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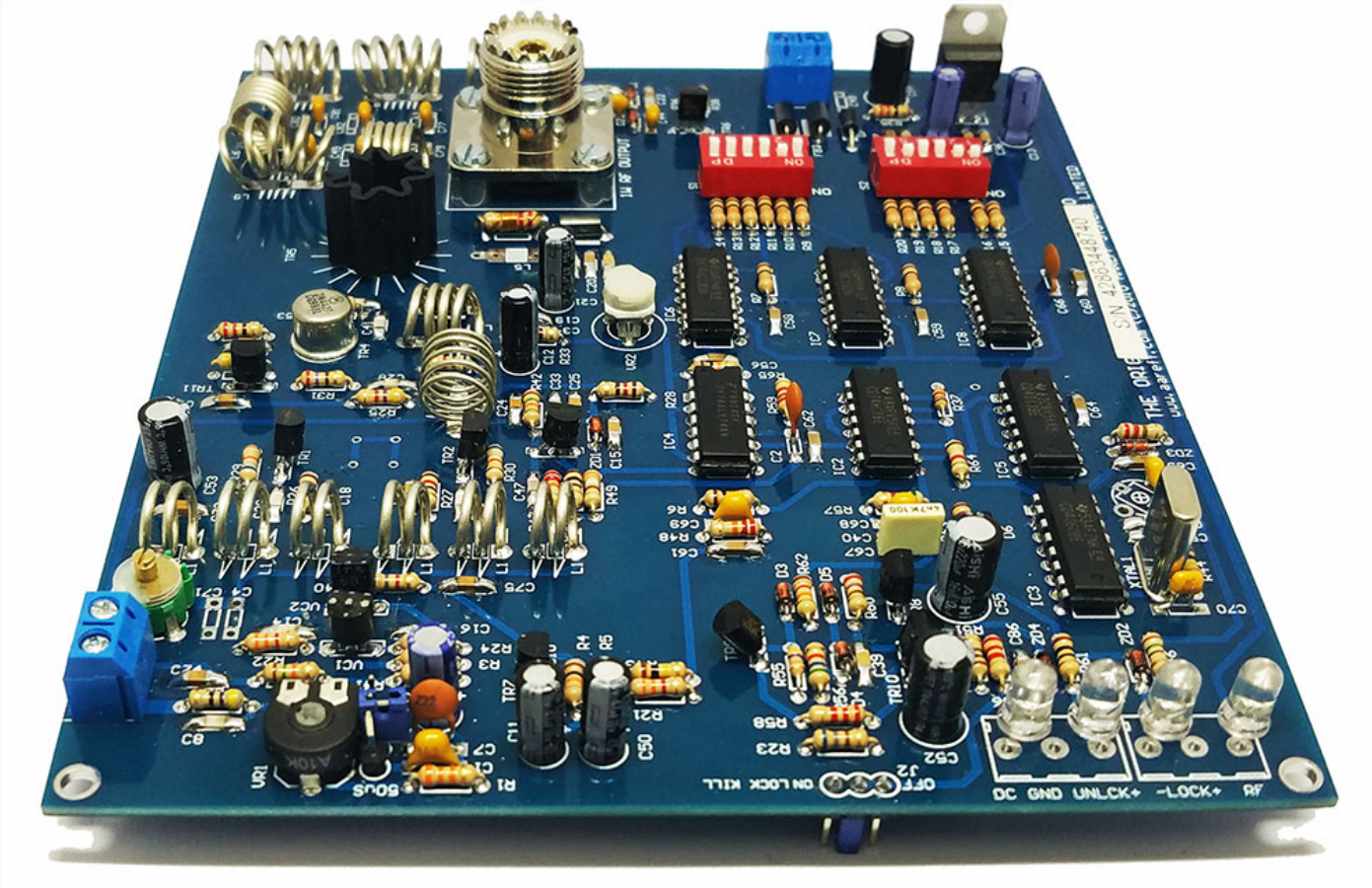
User Manual - User Manual - Original and Genuine Veronica® 1W PLL (1WPLLM)



INTENDED USE / LEGAL ADVICE

This product is not intended for use on a ‘stand alone’ basis, it is sold as spare part/module sub assembly and is intended as a component for use in a fully assembled transmitter and/or transmission system that as a whole complies with the engineering requirements of ETS 300 384 and ETS 300 447. Use of this product on a ‘stand alone’ basis will in most countries of the world contravene the EMC compatibility regulations. It is the customer’s responsibility to check relevant laws, directives and regulations before putting this product into service with an antenna system. You, the customer agree to defend, indemnify and hold harmless Aareff Systems Limited, it’s employees and agents, from and against any claims, actions or demands, including without limitation legal and accounting fees, alleging or resulting from improper or unlawful use of this product.

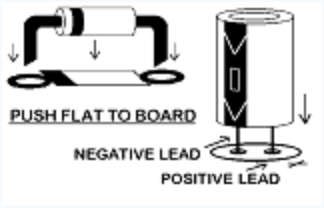
CONSTRUCTION DETAILS

Before attempting any construction, check all the components against the component list. If any of the components are missing or damaged, immediately contact Aareff or the supplier that you purchased this kit from before going any further. If you are unsure about soldering refer to Soldering Tips section.

The Circuit Board is printed with a legend showing the component shapes and reference numbers (R1, R2, R3, C1, C2, etc). Use the legend together with the component list to find the correct component for the PCB. Take extreme care when placing the components on the PCB. If a component is incorrectly placed, the circuit will not work properly and may even be damaged.

It's normal to assemble the PCB with the smaller components first, progressing through to the larger components. Using the PCB legend as a positioning aid, solder the components into the PCB and trim back the excess leads in the following

order.

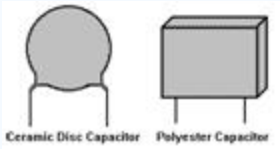


Diode and Electrolytic Capacitor connections to PCB

1. Resistors, LINKS, Diodes and Zener Diodes The zener diodes look almost identical to the 1N4148 diode, be sure to read the print on the glass carefully(you may need a magnifying glass for this) and not get them mixed up. It's important that you insert these into the correct positions. Line up diodes with legend for correct polarity (see diagram). All components flat to PCB with very short leads. Some resistors are very close together do not bridge the adjacent connections with solder

2. IC2, IC3, IC4, IC5, IC6, IC7, IC8, S1 and S2 CAUTION! SOME ICs ARE STATIC SENSITIVE DEVICES. (Soldering Iron must have good earth. Avoid touching the IC pins with your fingers). Gently bend the pins with small pliers to allow fit to PCB. Make sure all pins go into PCB and the component is flat down. Line up with legend for correct polarity. The component pins are close together, do not bridge the adjacent pins with solder

3. Variable Resistors VR1 and VR2, Ceramic Disc Capacitors and Ferrite Bead Chokes. Keep leads very short and components close to PCB. A 1 turn ferrite bead is simply a component lead cut off and passed through the empty ferrite bead.



4. TR4 and TR5. Push fully down so transistor case is firm against PCB, then solder. To achieve maximum power and prevent instability of the circuit, this condition is very important (see section 12 diagram).

5. The six coils that make up L1, and all other coils. Push coils fully down to the board when soldering, keeping leads very short.

6. Polyester Capacitors. Insert these in the correct positions. All flat to PCB with no leads showing.

7. TR1, TR2, TR3, TR6, TR7, TR8, TR9, TR10, VCD1, VCD2 and LEDs . Line up components with legend for correct polarity. LED polarity is shown by a flat section on one side of the plastic body. The Transistors and Varicap will not push flat to the PCB without damage. As a compromise to keep the leads short, push the components gently, slightly bending the leads until the black casing is 3 mm above the PCB.

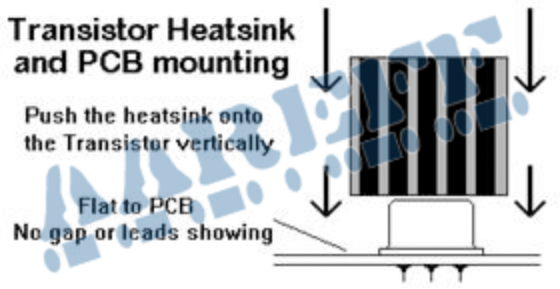
8. 3 Way Jumpers, Electrolytic Capacitors, and XTAL1. Line up Electrolytic Capacitors with legend for correct polarity (see diagram). All flat to PCB with no leads showing at all.

9. Phono Socket. 'MPX'.Flat to PCB

10. SO-239 (1W RF). Fix tight to PCB with nuts, bolts and washers (see diagram), then solder centre pin firmly.

11. IC1. Line up with legend for correct polarity Mount the component so that the black casing is about 3mm above the PCB.

12. TR5 Heatsink Gently push the heatsink onto the transistor with vertical force only. Any side ways force could easily damage the transistor (see diagram). Fit black heatsink to TR5



Before applying a power supply to the circuit, check and double check that all the components are in the correct position with the right polarisation. Check all the soldered joints, these should be shiny in appearance and all components should be rigid. When all the checks are complete and okay, test the circuit.

COMPONENT LIST

*** POLARISED COMPONENTS TAKE GREAT CARE TO INSERT THE COMPONENT LEADS INTO THE PCB THE CORRECT WAY**

R1	33K	orange orange orange gold B40
R2	47R	yellow purple black gold B8
R3	10K	brown black orange gold B35
R4	10K	brown black orange gold B35
R5	1K5	brown green red gold B25
R6	15K	brown green orange gold B37
R7	10K	brown black orange gold B35
R8	10K	brown black orange gold B35
R9	10K	brown black orange gold B35
R10	10K	brown black orange gold B35
R11	10K	brown black orange gold B35
R12	10K	brown black orange gold B35
R13	10K	brown black orange gold B35
R14	10K	brown black orange gold B35
R15	10K	brown black orange gold B35
R16	10K	brown black orange gold B35
R17	10K	brown black orange gold B35
R18	10K	brown black orange gold B35
R19	10K	brown black orange gold B35
R20	10K	brown black orange gold B35
R21	3K3	orange orange red gold B29
R22	3K3	orange orange red gold B29
R23	680R	blue, grey, brown, gold B21
R24	3K3	orange orange red gold B29
R25	4K7	yellow purple red gold B31
R26	120R	brown red brown gold B13
R27	120R	brown red brown gold B13

R28	120R	brown red brown gold B13
R29	68K	blue grey orange gold B44
R30	68K	blue grey orange gold B44
R31	27R	red purple black gold B5
R32	6K8	blue grey red gold B33
R33	120R	brown red brown gold B14
R34	22R	red red black gold B4
R35	22R	red red black gold B4
R36	1K5	brown green red gold B25
R37	1K5	brown green red gold B25
R38	150R	brown green brown gold B14
R39	15K	brown green orange gold B37
R40	6K8	blue grey red gold B33
R41	15K	brown green orange gold B37
R42	15K	brown green orange gold B37
R43	100K	brown black yellow gold B46
R44	100K	brown black yellow gold B46
R45	33R	orange orange black gold B6
R46	15R	brown green black gold B3
R47	22K	red red orange gold B38
R48	33K	orange orange orange gold B40
R49	390R	orange white brown gold B18
R50	100R	brown black brown gold B12
R51	100R	brown black brown gold B12
R52	4K7	yellow purple red gold B31
R53	47R	yellow purple black gold B8
R54	220R	red red brown gold B15
R55	47K	yellow purple orange gold B42
R56	5K6	green blue red gold B32
R57	5K6	green blue red gold B32
R58	2K2	red red red gold B27
R59	2K2	red red red gold B27
R60	270R	red purple brown gold B16
R61	10R	brown black black gold B2
R62	12K	brown red orange gold B36
R63	12K	brown red orange gold B36
R64	1K8	brown grey red gold B26
R65	10K	brown black orange gold B35
R66	2K2	red red red gold B27
C1	1.5n	152 B161

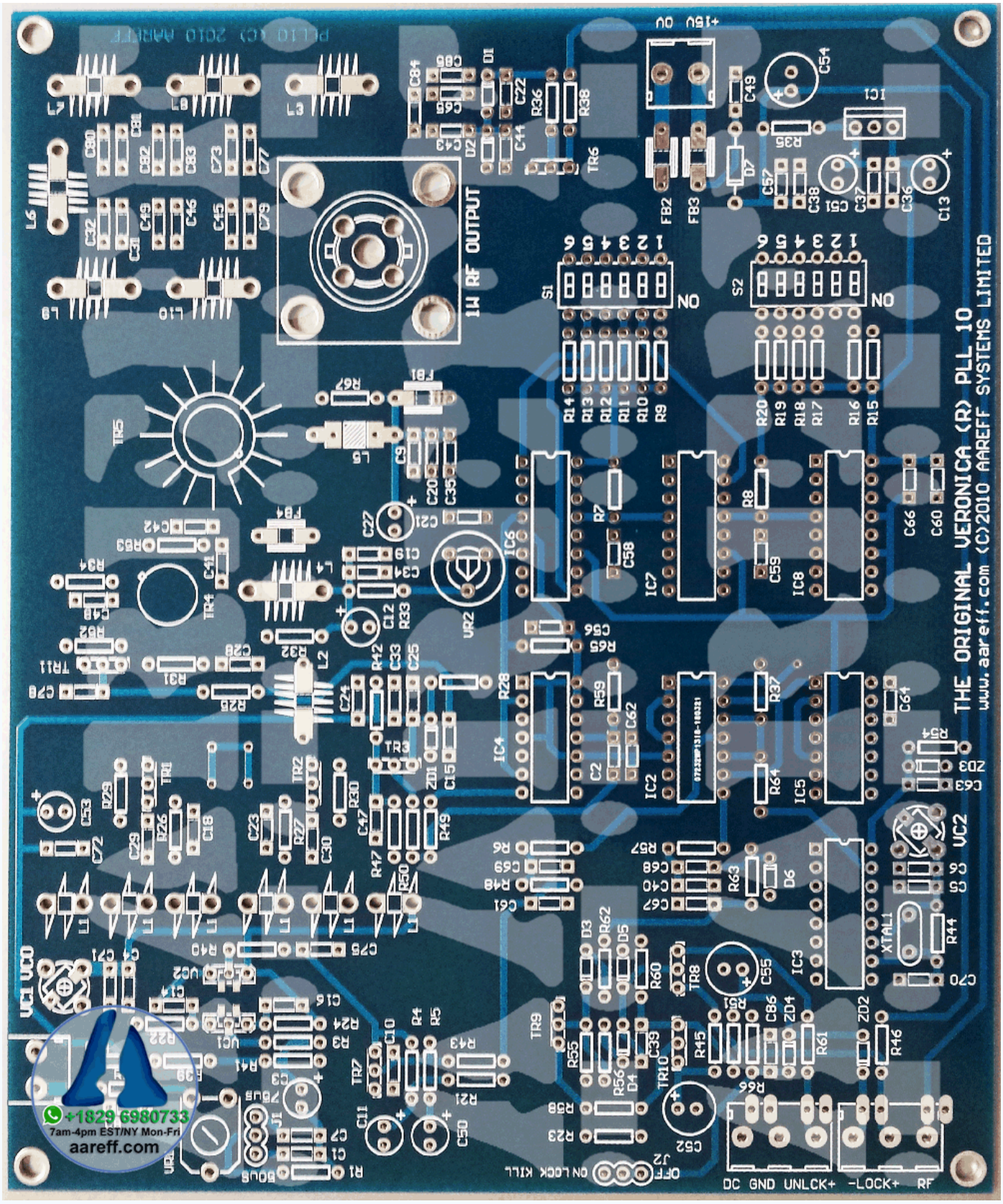
C2	2.2n	222 B164
C3*	220uF	220uF /=>16V B170
C4		NOT FITTED
C5	15p	15J B150
C6	15p	15J B150
C7	2.2n	222 B164
C8	100p	101 B158
C9	100p	101 B158
C10	100p	101 B158
C11*	47u	47uF /16V B171
C12*	47u	47uF /16V B171
C13*	1u	1uF /63V B168
C14	68p	68J B156
C15		NOT FITTED
C16	68p	68J B156
C17		NOT FITTED
C18	1n	102 B159
C19	1n	102 B159
C20	1n	102 B159
C21	1n	102 B159
C22	1n	102 B159
C23	1n	102 B159
C24	1n	102 B159
C25	1n	102 B159
C27	47u	47uF /16V B171
C28	10p	10J B149
C29	47p	47J B155
C30	47p	47J B155
C31	39p	39J B154
C32		NOT FITTED
C33	10n	103 B160
C34	10n	103 B160
C35	10n	103 B160
C36	10n	103 B160
C37	10n	103 B160
C38	10n	103 B160
C39	10n	103 B160
C40	10n	103/10n B196
C41	47p	47J B155
C42	47p	47J B155

C43	1.8p	1.8C B70
C44	1.8p	1.8C B70
C45	5.6p	5.6 B148
C46	39p	39J B154
C47	33p	33J B153
C48	1n	102 B159
C49		NOT FITTED
C50*	10u	10uF =>16V B169
C51*	1u	1uF/ 63V B168
C52*	220u	220uF/ 16V /220uF 25V B170
C53*	220u	220uF/ 16V /220uF 25V B170
C54*	220u	220uF/ 16V /220uF 25V B170
C55*	220u	220uF/ 16V /220uF 25V B170
C56	100n	100nK/0.1 63- / u1K63/ B197
C57	100n	100nK/0.1 63- / u1K63/ B197
C58	100n	100nK/0.1 63- / u1K63/ B197
C59	100n	100nK/0.1 63- / u1K63/ B197
C60	100n	100nK/0.1 63- / u1K63/ B197
C61	100n	100nK/0.1 63- / u1K63/ B197
C62	100n	100nK/0.1 63- / u1K63/ B197
C63	100n	100nK/0.1 63- / u1K63/ B197
C64	100n	100nK/0.1 63- / u1K63/ B197
C65		NOT FITTED
C66	150p	151 B69
C67	4n7	4n7K / 2A472K B195
C68	220n	.22J 63/ u22K/ 1J224K B198
C69	220n	.22J 63/ u22K/ 1J224K B198
C70	82p	82J B157
C71		NOT FITTED
C72	1n	102 B159
C73		NOT FITTED
C74	1n	102 B159
C75	1n	102 B159
C76		NOT FITTED
C77	39p	39J B154
C78	1n	102 B159
C79	27p	27J B152
C80		NOT FITTED
C81	39p	39J B154
C82		NOT FITTED

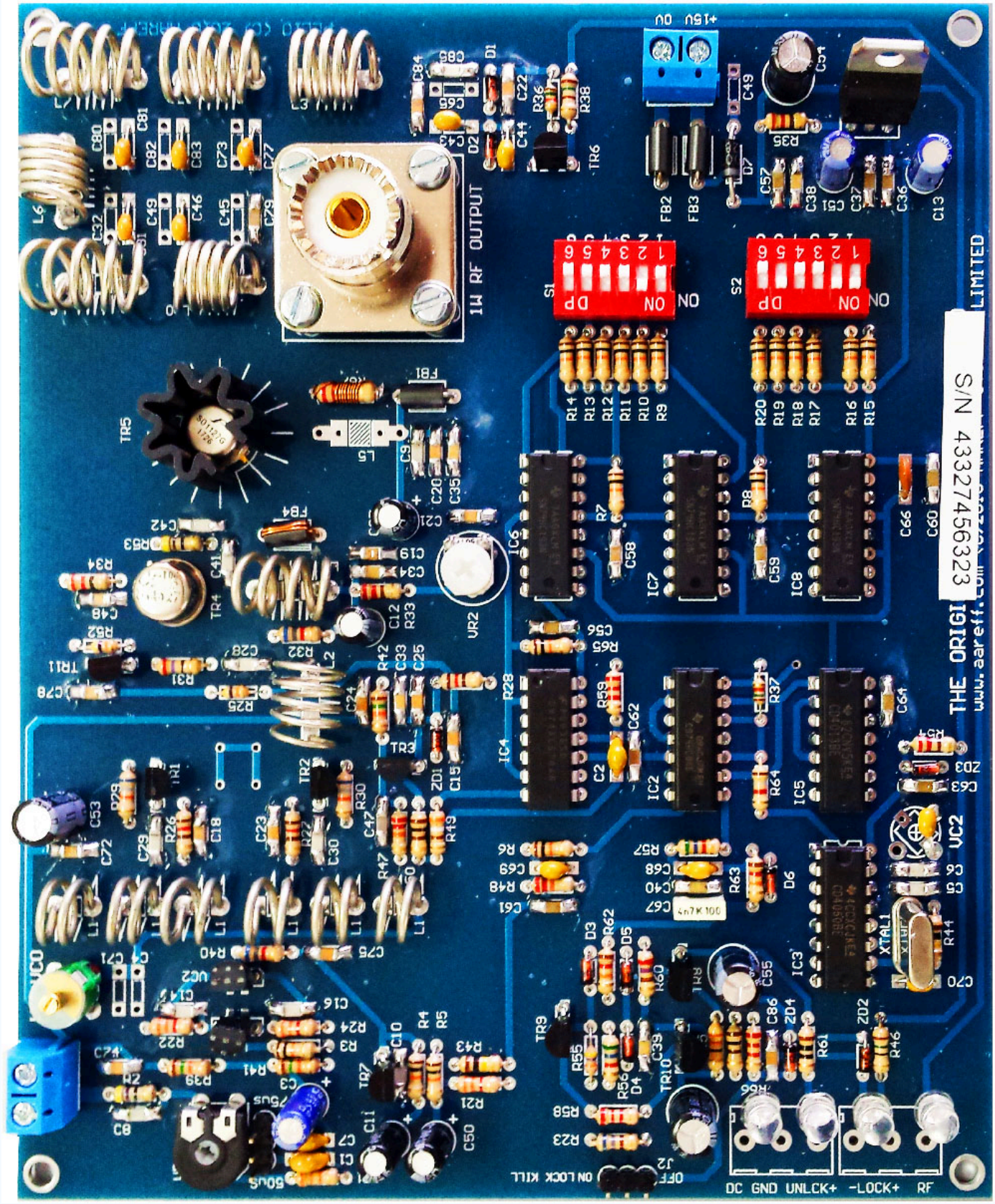
C83	39p	39J B154
C84	1n	102 B159
C85	22p	22J B154
C86	1n	102 B159
TR1*	BF494	BF494 B97
TR2*	BF494	BF494 B97
TR3*	BF494	BF494 B97
TR4*	2N4427	2N4427 B76
TR5*	SD1127	SD1127 B75
TR6*	BC549	C549 B97
TR7*	BC558	C558B B96
TR8*	BC549	C549 B97
TR9*	BC549	C549 B97
TR10*	BC558	C558B B96
TR11*	BC549	C549 B97
VC1	22p	Green Var Capacitor B89
VC2	10p	Yellow Var Capacitor B93
VR1	10K	10K Variable Res. Pot. B94
VR2	500R	502 Variable Res. Pot B91
VCD1	BB304	BB304 B98
VCD2	BB304	BB304 B98
IC1*	7805CT	7805CT B118
IC2*	74HCT86	74HCT86 B85
IC3*	HCF4060	HCF4060BE B84
IC4*	74ALS74	74ALS74 B83
IC5*	74HC76	74HC76 B82
IC6*	74HCT193	74HCT193 B79
IC7*	74HCT193	74HCT193 B79
IC8*	74HCT193	74HCT193 B79
D1*	1N4148	4148 B58
D2*	1N4148	4148 B58
D3*	1N4148	4148 B58
D4*	1N4148	4148 B58
D5*	1N4148	4148 B58
D6*	1N4148	4148 B58
D7*	1N4004	4004 B64
ZD1*	7V5	7V5 B61
ZD2*	7V5	7V5 B61
ZD3*	11V	11V B62
ZD4*	5V1	5V1 B60

LED1	5mm LED BLUE DC IND. B177
LED2	5mm LED RED UNLOCK IND. B174
LED3	5mm LED BLUE LOCK IND. B177
LED4	5mm LED BLUE RF IND. B177
L1	6 x 2 turn coil 6mm i.d.
L2	7mm x 5 turn thin wire
L3	5 turn coil 7mm i.d..
L4	4 turn coil 5mm i.d
L5	RF choke 2K2 B55
L6	5 turn coil 7mm i.d..
L7	5 turn coil 7mm i.d.
L8	5 turn coil 7mm i.d.
L9	5 turn coil 7mm i.d.
L10	5 turn coil 7mm i.d.
XTAL1	6.4MHz Xtal 6.40000 B71
S1*	6 Way DIP Switch B81
S2*	6 Way DIP Switch B81
FB1	1 turn ferrite bead B216
FB2	1 turn ferrite bead B216
FB3	1 turn ferrite bead B216
FB4	2 turn ferrite bead B216
MPX	PCB Phono Socket
2 x Straight 3 PIN Headers B87	
1 x Push-On Black Heatsink B109	
1 x THE ORIGINAL VERONICA PLL9 PCB	
2 x Jumper handbags B88	
2 x 2 way PCB terminal blocks B116	
2 x 3 way PCB terminal blocks B147	

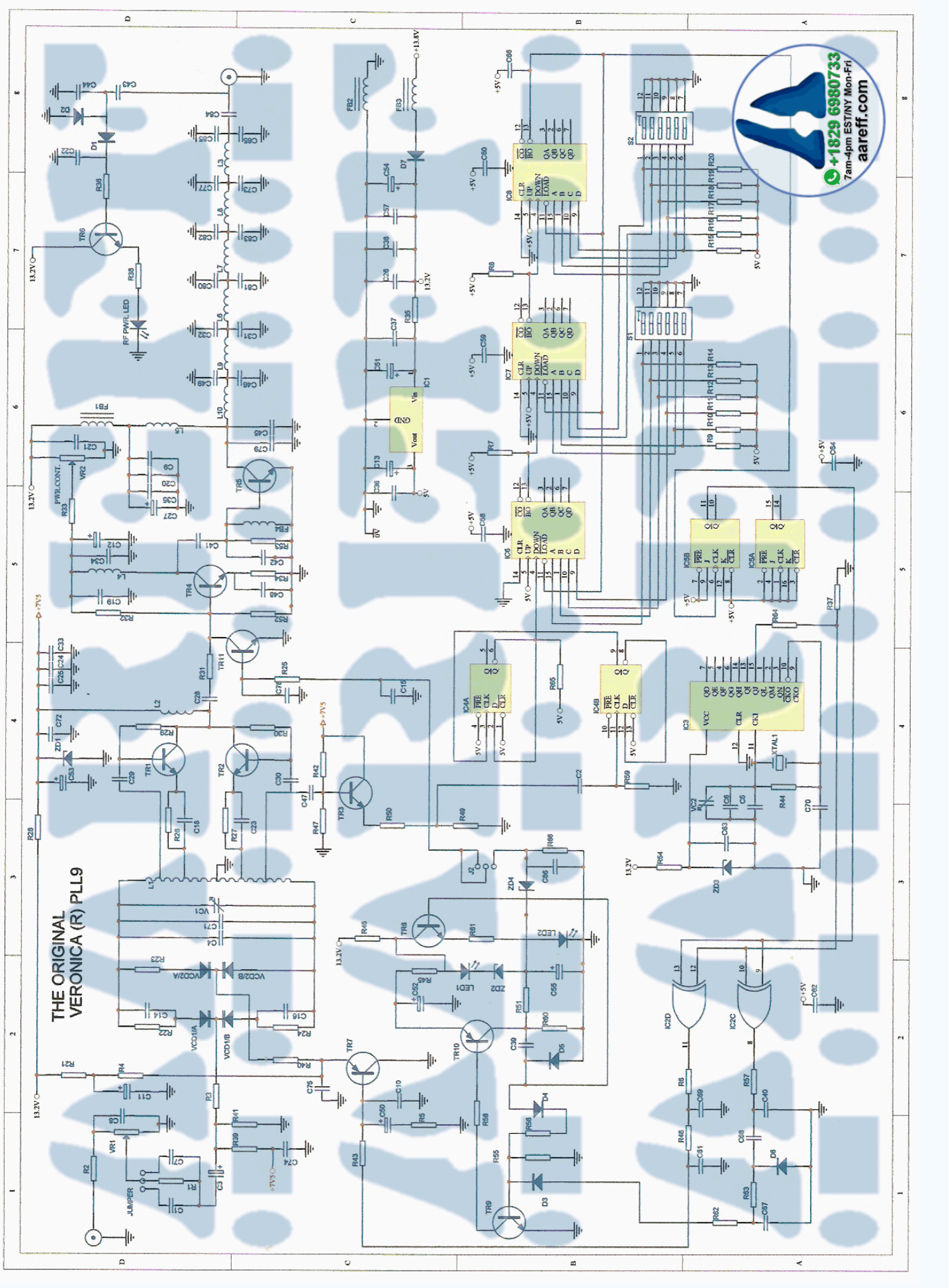
PCB LAYOUT – BLANK, NO COMPONENTS FITTED



PCB LAYOUT – COMPONENTS FITTED



SCHEMATIC (PLL9)



CIRCUIT TESTING

If the 1 watt PLL is connected to a Veronica / Aareff Limiter Compressor or a Stereo Coder, pre-emphasis is not required. To disable the pre-emphasis, do not select 50uS or 75uS and remove the jumper completely. Store the jumper in a safe place just in case you need to restore the pre-emph for another application at a later date.

The 1W PLL features out of lock shutdown, this is a required for use in the EU. The diagram above shows how to set the jumper to activate it.>

1. Plug in 50 ohm dummy load (resistors soldered inside PL-259) DO NOT POWER THE CIRCUIT WITHOUT A 50 ohm LOAD CONNECTED TO THE SO-239.

2. Apply between 12 and 16 volts to the PCB position marked +15V (+) and 0V (-). DO NOT EXCEED 16V DC.

3. Choose a frequency from the attached LOOK-UP table and select the appropriate code on the transmitter DIP switches.

4. Adjust VC1 slowly until the RED LED starts to dim. Continue adjusting VC1 even more slowly, the RED LED will dim further or flicker, then the BLUE LED will illuminate. The BLUE LED indicates a locked condition.

5. Experiment with the adjustment of VC1 to find centre lock repeating step 4.

6. Apply audio at line level to the phono socket. Adjust the VR1 for correct FM deviation.

7. Switch off and remove dummy load. You are now ready to install the 1W PLL into your transmission system.

SPECIFICATIONS

The following tests were taken at 15V DC and the worst case measurement was recorded over the range -20 to +50 deg C.

Frequency	100KHz steps from 87.5 to 108MHz
RF Power Output	1000mW to 1400mW into 50 Ohm load
Deviation Sensitivity Stability	+/-2% max
Spurious Emissions	>75dB rtc
Harmonic Emissions	>63dB rtc
Out of Lock RF Muting	>63dB rtc
Freq Stability	+/- 1 KHz max., typ. +/-300Hz
Freq Fine Adj (VC2)	> +/- 1000Hz
RF Output Connector	SO239
Audio Input Sensitivity	0.775 V rms for +/- 75 KHz
Signal To Noise Ratio	80 dBu
Frequency Response	Flat from 30 Hz to 76 KHz
Pre-emphasis	(50uS/ 75uS/ None) Selectable

Audio Distortion	Better than 0.02 % THD
Audio Input Connector	Phono/ RCA type unbalanced sockets
Power Supply	13.8V DC Regulated 650mA max.

TROUBLE SHOOTING

No LEDs illuminated

1. Power supply is working and polarity

No or poor audio

1. Check audio source is connected to circuit properly

2. Set VR1 to mid position

3. Check joints, polarity and for shorts around components

‘Buzz’ on the audio

1. In the presence of a strong RF signal ‘Buzz’ may be generated in audio source. Unplug the audio source to establish whether that is the cause. If this cures the problem, try another audio source or move the audio source further away from the transmitter

2. Strong RF often generates a ‘buzz’ on some receivers. Try a receiver at a further distance away from the transmitter.

3. Is the power supply regulated

RF Unstable.

1. Is TR4 and TR5 flat down to PCB as shown in the construction details diagram of section 13

2. Is the SO-239 connected to a 50 ohm load

3. Are the coils soldered properly and fully down to the PCB

4. Check nuts and bolts are tight and soldered joint is okay on S0-239

5. Check joints, polarity and for shorts on all of the components around TR4 and TR5.

Due to the complexity of the circuit, other faults are more difficult to locate without test equipment. All of the components in the kit are high quality and brand new, it's very likely that a fault is down to the construction. Using the PCB legend and Component List, check that all components are in the correct positions and have the correct polarity.

Carefully check the PCB soldering. Excessive soldering may have shorted out adjacent tracks on the PCB. Solder splashing from the iron could have shorted out adjacent tracks. A magnifying glass or multimeter may help to find any small hairline short circuits not visible to the naked eye. All soldered joints should be shiny in appearance. Any dull looking soldering may be a ‘dry joint’, causing the circuit to malfunction. Re-solder dull looking joints.

If the circuit still has a fault after double checking everything, contact your supplier or Aareff via Post or Email. Describe in writing or with a diagram the exact problem and we will take steps to get you working

SOLDERING TIPS

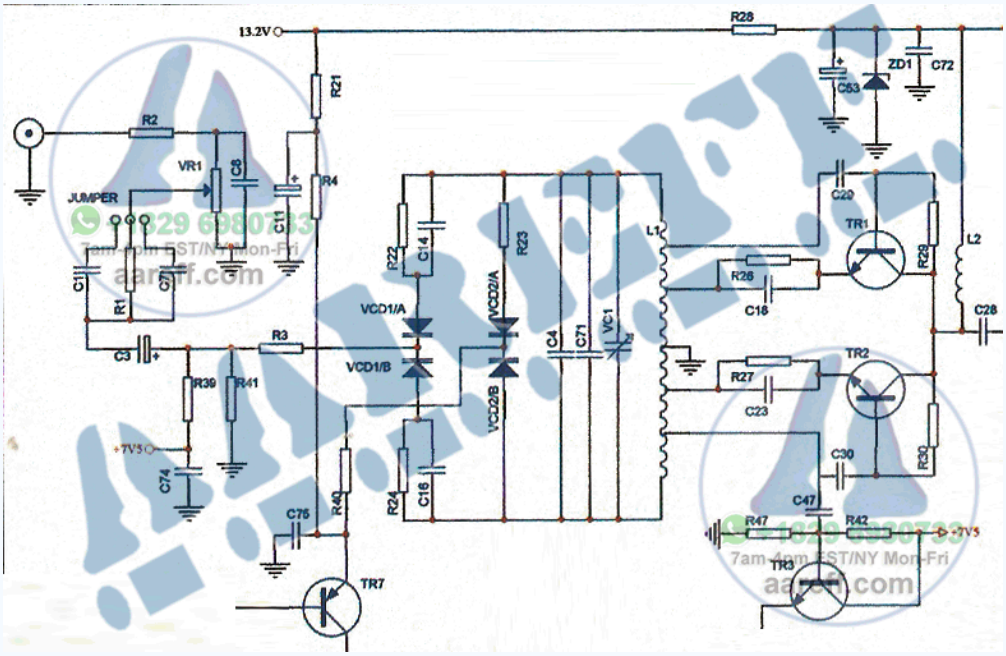
For good soldered joints it is vital that the circuit board is clean and free of grease. If the board has become dirty or greasy, clean it down with meths or some other suitable electrical cleaning solvent before starting construction.

Keep everything clean, that’s the answer to successful soldering. The iron tip always needs be clean and shiny, if the iron looks all grey, black and burnt, the solder will not flow properly. A small piece of sponge dampened with water is ideal for cleaning the iron. After a few soldered joints, wipe the tip of the iron on the damp sponge to remove the dirt build up.

Always apply the iron to the joint first, this heats the joint up, then apply the solder. This will give the joint a shiny and cone shaped appearance, which is correct. Never put a blob of solder on the iron and then apply this blob of solder to the joint. This will not work because the blob of solder will not bond to the cold joint

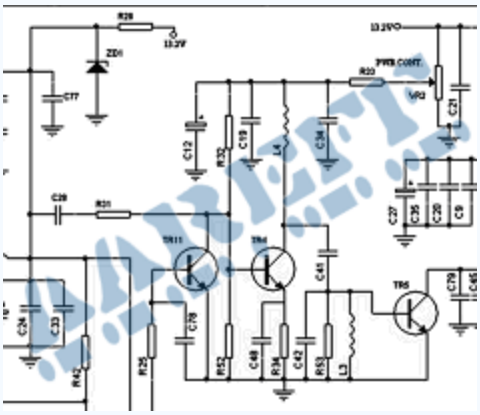
CIRCUIT OPERATION

Section 1 - Voltage controlled oscillator



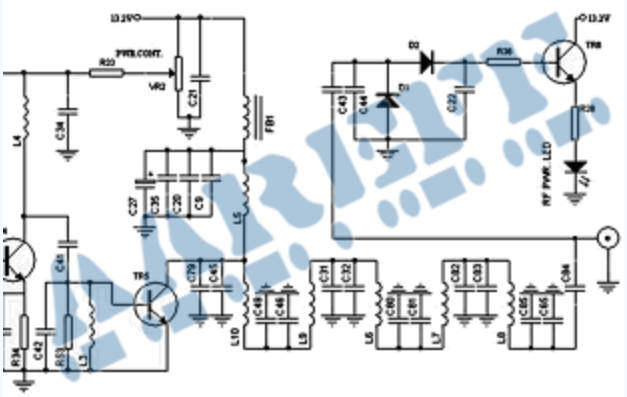
The main VHF voltage controlled oscillator or VCO is the heart of the transmitter and it is where the radio signal that will finally find it's way to antenna is generated. This VCO is a Hartley type configured to operate in push pull mode at half the final frequency. Two sets of back to back varicap diodes are connected across the main LC tank. One of the varicap diodes is used for frequency correction and the other is used for direct FM modulation. The varicap diode used for the modulation is DC biased to give optimum deviation linearity. The collector current from each one of the VCO transistors is drawn from the same point. At this point the combined current pulses are at double the VCO frequency. The current pulses are resonated into a sine wave across the DC feed inductor. Providing the VCO transistors are matched, the fundamental frequency cancels leaving the doubled frequency at a level of about +10dBm.

Section 2 - 100mW RF amplifier



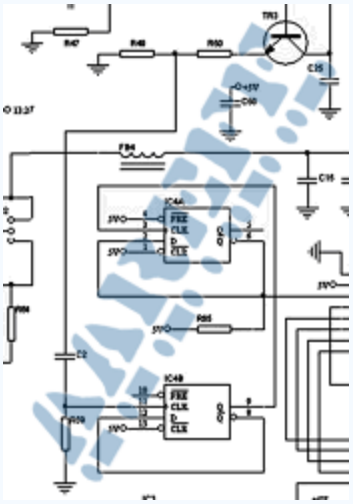
Using a class A biased and stabilised common emitter amplifier the +10dBm is amplified up to +20dBm. The VCO is loosely coupled to the amplifier input with a small value of capacitance. The small capacitor across the amplifier emitter resistor increases the amplifier gain at the higher frequencies compensating for high frequency losses in the amplifier transistor. The DC feed inductor works with input capacitance to the next amplifier to form a good impedance match and some slight broad tuning from 88 to 108 MHz.

Section 3 - 1W RF amplifier



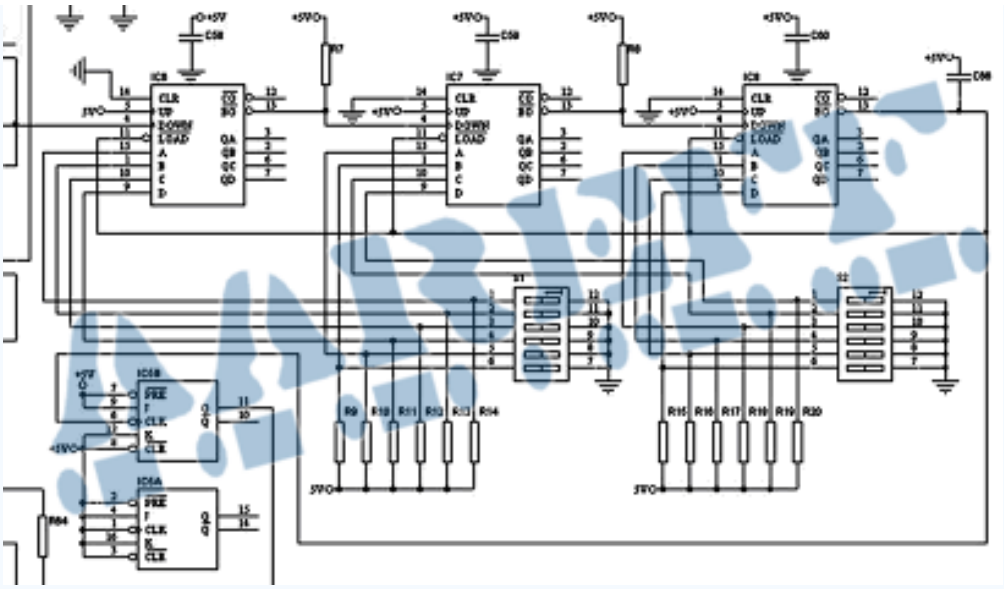
The final 1W amplifier is a common emitter transistor operated in single ended class B mode. The amplifier input is +20dBm and is derived from the output of the 100mW amplifier. The transistor collector develops the RF voltage over the DC feed choke. This point is then matched and filtered through a 10 pole of LC filter to produce 1W when terminated with 50 ohm resistance at the output socket. A small amount of the RF from the output socket is rectified through two high frequency diodes, then buffered with a small transistor to drive an LED to indicated power. The RF harmonics at the output are at -65 dB rtc.

Section 4 - VHF fixed divider



A low power high impedance emitter follower transistor takes a small amount of RF signal from half frequency side of VCO. This signal is interfaced to the first divider IC 74ALS74. The IC is a high speed dual flip-flop. The flip flops are cascaded to make a divide by four stage. If the transmitter operating frequency is 100 MHz, the VCO is 50 MHz and this results in a divided output of 12.5 MHz.

Section 5 - Count by N

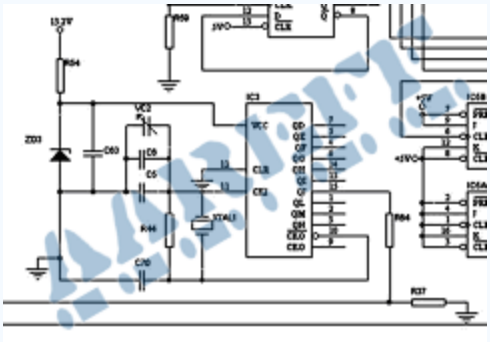


The main counter clock input is the 12.5 MHz signal from the VHF fixed divider. Three 74LS193 ICs are cascaded to form a count down arrangement. A 12 bit input is momentarily latched into the ICs from two 6 way dil switch banks. The 12 bit number is decrement by one for every 12.5 MHz clock pulse. If the dil switches are set to give a 12 bit number of 1000 in decimal, the 12 bit number will reach zero following a count of 1000 of the 12.5 MHz clock pulses, at this point the last IC in the chain signals the zero with an output pulse. This output pulse sends a signal back to the three counter ICs to once again momentarily latch the 12 bit input from the dip switches into the ICs and starts the whole countdown process again, then again and again and so on. The repetition of the output pulse is 12.5 KHz.

Section 6 - Pulse to square conversion

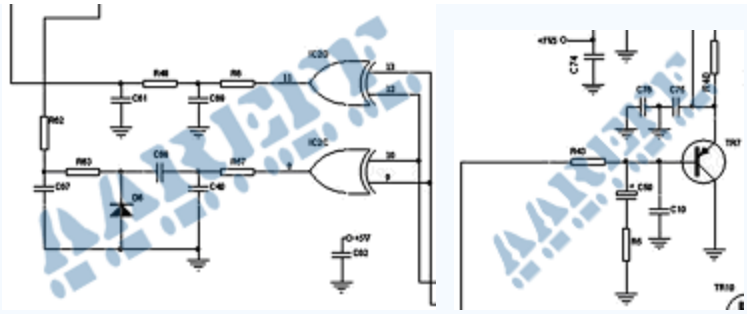
It is the 12.5 KHz count by N output pulse that will ultimately be compared to the quartz crystal oscillator in a later circuit stage. Unfortunately the the 12.5 KHz pulse is very narrow with a mark space ratio of about 1000:1, this is interfaced to a 74LS76 flip flop IC . The IC output results in a clean 1:1 mark space ratio square wave at 6.25 KHz. This square wave is the final output of the divider chain.

Section 7 - Crystal reference oscillator



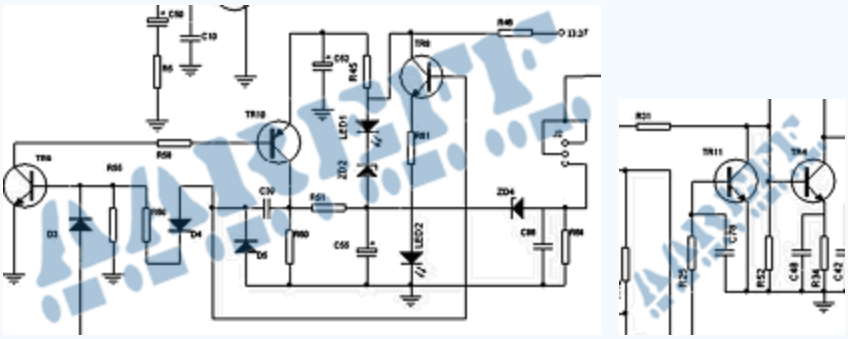
The crystal reference oscillator is based around the cmos IC 4060. This IC features 14 cascaded flip flops, also know as a 14 bit ripple counter. It also features a built in amplifier to resonate the crystal across. A 6.4 MHz crystal is connected to the IC. A small adjustable capacitor is placed in parallel with the crystal load capacitance. This allows the crystal frequency to fine adjusted. The output of Q10 or cascaded flip flop number 10 is used. This divides the crystal frequency of 6.4 MHz by 1024 resulting in a clean square wave of 6.25 KHz. This square wave is the final output of the crystal reference.

Section 8 - XOR phase detector



The 6.25 KHz final divider output and the 6.25 KHz final crystal reference are applied to a 2 input XOR gate. This gate compares the two frequencies. If the two frequencies are exactly the same with a 90 degree phase shift between them, the output of the gate is a 1:1 mark space ratio square wave at 12.5 KHz. If the transmitter VCO frequency starts to drift, usually due to temperature variations, the 6.25 KHz final divider output will also drift. The XOR gate detects this as a phase change compared to the 6.25 KHz crystal reference and the mark space ratio at output of the XOR gate changes. Using an RC integrator on the output of the XOR gate results in a DC voltage from 0 to 5 V representing the transmitter frequency drift. This DC voltage is fed through a second RC integrator to produce the phase correction voltage and remove any further residual 12.5 KHz. The phase correction voltage is applied to the frequency correction varicap diode in the VCO forming a phase locked loop. A simple RC snubber circuit is also connected to ground from the phase correction voltage to prevent the loop hunting or bouncing up and down.

Section 9 - Lock indications



The output from the XOR gate is also taken to a second RC integrator to convert the changing mark space ratio into a DC voltage. If the transmitter is completely unlocked the DC voltage rises up an down continuously. This signal is passed through an RC high pass filter to leave only the AC component. The AC signal is rectified back to DC and passed through some buffering and inverting transistors to indicate unlocked and locked on two LEDs. This DC voltage representing an unlocked condition is also taken to the base of a small RF transistor that is across the input of the 100mW RF amplifier and ground. In the unlocked condition the RF is completely shunted or crow barred to ground. Shunting the RF to ground at this point provides more than -60 dBc of RF suppression.

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DIL SWITCH (S2 and S1)

MHz	1	2	3	4	5	6		1	2	3	4	5	6
87.5	ON	ON	OFF	OFF	ON	OFF		OFF	ON	OFF	ON	OFF	ON
87.6	ON	ON	OFF	OFF	ON	OFF		OFF	ON	OFF	ON	OFF	OFF
87.7	ON	ON	OFF	OFF	ON	OFF		OFF	ON	OFF	OFF	ON	ON
87.8	ON	ON	OFF	OFF	ON	OFF		OFF	ON	OFF	OFF	ON	OFF

MHz	1	2	3	4	5	6		1	2	3	4	5	6
87.9	ON	ON	OFF	OFF	ON	OFF		OFF	ON	OFF	OFF	OFF	ON
88	ON	ON	OFF	OFF	ON	OFF		OFF	ON	OFF	OFF	OFF	OFF
88.1	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	ON	ON	ON
88.2	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	ON	ON	OFF
88.3	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	ON	OFF	ON
88.4	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	ON	OFF	OFF
88.5	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	OFF	ON	ON
88.6	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	OFF	ON	OFF
88.7	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	OFF	OFF	ON
88.8	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	ON	OFF	OFF	OFF
88.9	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	ON	ON	ON
89	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	ON	ON	OFF
89.1	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	ON	OFF	ON
89.2	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	ON	OFF	OFF
89.3	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	OFF	ON	ON
89.4	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	OFF	ON	OFF
89.5	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	OFF	OFF	ON
89.6	ON	ON	OFF	OFF	ON	OFF		OFF	OFF	OFF	OFF	OFF	OFF
89.7	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	ON	ON	ON
89.8	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	ON	ON	OFF
89.9	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	ON	OFF	ON
90	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	ON	OFF	OFF
90.1	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	OFF	ON	ON
90.2	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	OFF	ON	OFF
90.3	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	OFF	OFF	ON
90.4	ON	ON	OFF	OFF	OFF	ON		ON	ON	ON	OFF	OFF	OFF
90.5	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	ON	ON	ON
90.6	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	ON	ON	OFF
90.7	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	ON	OFF	ON
90.8	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	ON	OFF	OFF
90.9	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	OFF	ON	ON
91	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	OFF	ON	OFF
91.1	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	OFF	OFF	ON
91.2	ON	ON	OFF	OFF	OFF	ON		ON	ON	OFF	OFF	OFF	OFF
91.3	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	ON	ON	ON
91.4	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	ON	ON	OFF
91.5	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	ON	OFF	ON
91.6	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	ON	OFF	OFF

MHz	1	2	3	4	5	6		1	2	3	4	5	6
91.7	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	OFF	ON	ON
91.8	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	OFF	ON	OFF
91.9	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	OFF	OFF	ON
92	ON	ON	OFF	OFF	OFF	ON		ON	OFF	ON	OFF	OFF	OFF
92.1	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	ON	ON	ON
92.2	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	ON	ON	OFF
92.3	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	ON	OFF	ON
92.4	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	ON	OFF	OFF
92.5	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	OFF	ON	ON
92.6	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	OFF	ON	OFF
92.7	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	OFF	OFF	ON
92.8	ON	ON	OFF	OFF	OFF	ON		ON	OFF	OFF	OFF	OFF	OFF
92.9	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	ON	ON	ON
93	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	ON	ON	OFF
93.1	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	ON	OFF	ON
93.2	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	ON	OFF	OFF
93.3	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	OFF	ON	ON
93.4	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	OFF	ON	OFF
93.5	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	OFF	OFF	ON
93.6	ON	ON	OFF	OFF	OFF	ON		OFF	ON	ON	OFF	OFF	OFF
93.7	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	ON	ON	ON
93.8	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	ON	ON	OFF
93.9	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	ON	OFF	ON
94	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	ON	OFF	OFF
94.1	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	OFF	ON	ON
94.2	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	OFF	ON	OFF
94.3	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	OFF	OFF	ON
94.4	ON	ON	OFF	OFF	OFF	ON		OFF	ON	OFF	OFF	OFF	OFF
94.5	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	ON	ON	ON
94.6	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	ON	ON	OFF
94.7	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	ON	OFF	ON
94.8	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	ON	OFF	OFF
94.9	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	OFF	ON	ON
95	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	OFF	ON	OFF
95.1	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	OFF	OFF	ON
95.2	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	ON	OFF	OFF	OFF
95.3	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	ON	ON	ON
95.4	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	ON	ON	OFF

MHz	1	2	3	4	5	6		1	2	3	4	5	6
95.5	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	ON	OFF	ON
95.6	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	ON	OFF	OFF
95.7	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	OFF	ON	ON
95.8	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	OFF	ON	OFF
95.9	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	OFF	OFF	ON
96	ON	ON	OFF	OFF	OFF	ON		OFF	OFF	OFF	OFF	OFF	OFF
96.1	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	ON	ON	ON
96.2	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	ON	ON	OFF
96.3	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	ON	OFF	ON
96.4	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	ON	OFF	OFF
96.5	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	OFF	ON	ON
96.6	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	OFF	ON	OFF
96.7	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	OFF	OFF	ON
96.8	ON	ON	OFF	OFF	OFF	OFF		ON	ON	ON	OFF	OFF	OFF
96.9	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	ON	ON	ON
97	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	ON	ON	OFF
97.1	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	ON	OFF	ON
97.2	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	ON	OFF	OFF
97.3	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	OFF	ON	ON
97.4	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	OFF	ON	OFF
97.5	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	OFF	OFF	ON
97.6	ON	ON	OFF	OFF	OFF	OFF		ON	ON	OFF	OFF	OFF	OFF
97.7	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	ON	ON	ON
97.8	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	ON	ON	OFF
97.9	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	ON	OFF	ON
98	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	ON	OFF	OFF
98.1	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	OFF	ON	ON
98.2	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	OFF	ON	OFF
98.3	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	OFF	OFF	ON
98.4	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	ON	OFF	OFF	OFF
98.5	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	ON	ON	ON
98.6	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	ON	ON	OFF
98.7	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	ON	OFF	ON
98.8	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	ON	OFF	OFF
98.9	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	OFF	ON	ON
99	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	OFF	ON	OFF
99.1	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	OFF	OFF	ON
99.2	ON	ON	OFF	OFF	OFF	OFF		ON	OFF	OFF	OFF	OFF	OFF

MHz	1	2	3	4	5	6		1	2	3	4	5	6
99.3	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	ON	ON	ON
99.4	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	ON	ON	OFF
99.5	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	ON	OFF	ON
99.6	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	ON	OFF	OFF
99.7	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	OFF	ON	ON
99.8	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	OFF	ON	OFF
99.9	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	OFF	OFF	ON
100	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	ON	OFF	OFF	OFF
100.1	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	ON	ON	ON
100.2	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	ON	ON	OFF
100.3	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	ON	OFF	ON
100.4	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	ON	OFF	OFF
100.5	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	OFF	ON	ON
100.6	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	OFF	ON	OFF
100.7	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	OFF	OFF	ON
100.8	ON	ON	OFF	OFF	OFF	OFF		OFF	ON	OFF	OFF	OFF	OFF
100.9	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	ON	ON	ON
101	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	ON	ON	OFF
101.1	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	ON	OFF	ON
101.2	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	ON	OFF	OFF
101.3	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	OFF	ON	ON
101.4	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	OFF	ON	OFF
101.5	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	OFF	OFF	ON
101.6	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	ON	OFF	OFF	OFF
101.7	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	ON	ON	ON
101.8	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	ON	ON	OFF
101.9	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	ON	OFF	ON
102	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	ON	OFF	OFF
102.1	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	ON	ON
102.2	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	ON	OFF
102.3	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	ON
102.4	ON	ON	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF
102.5	ON	OFF	ON	ON	ON	ON		ON	ON	ON	ON	ON	ON
102.6	ON	OFF	ON	ON	ON	ON		ON	ON	ON	ON	ON	OFF
102.7	ON	OFF	ON	ON	ON	ON		ON	ON	ON	ON	OFF	ON
102.8	ON	OFF	ON	ON	ON	ON		ON	ON	ON	ON	OFF	OFF
102.9	ON	OFF	ON	ON	ON	ON		ON	ON	ON	OFF	ON	ON
103	ON	OFF	ON	ON	ON	ON		ON	ON	ON	OFF	ON	OFF

MHz	1	2	3	4	5	6		1	2	3	4	5	6
103.1	ON	OFF	ON	ON	ON	ON		ON	ON	ON	OFF	OFF	ON
103.2	ON	OFF	ON	ON	ON	ON		ON	ON	ON	OFF	OFF	OFF
103.3	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	ON	ON	ON
103.4	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	ON	ON	OFF
103.5	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	ON	OFF	ON
103.6	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	ON	OFF	OFF
103.7	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	OFF	ON	ON
103.8	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	OFF	ON	OFF
103.9	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	OFF	OFF	ON
104	ON	OFF	ON	ON	ON	ON		ON	ON	OFF	OFF	OFF	OFF
104.1	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	ON	ON	ON
104.2	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	ON	ON	OFF
104.3	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	ON	OFF	ON
104.4	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	ON	OFF	OFF
104.5	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	OFF	ON	ON
104.6	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	OFF	ON	OFF
104.7	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	OFF	OFF	ON
104.8	ON	OFF	ON	ON	ON	ON		ON	OFF	ON	OFF	OFF	OFF
104.9	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	ON	ON	ON
105	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	ON	ON	OFF
105.1	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	ON	OFF	ON
105.2	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	ON	OFF	OFF
105.3	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	OFF	ON	ON
105.4	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	OFF	ON	OFF
105.5	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	OFF	OFF	ON
105.6	ON	OFF	ON	ON	ON	ON		ON	OFF	OFF	OFF	OFF	OFF
105.7	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	ON	ON	ON
105.8	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	ON	ON	OFF
105.9	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	ON	OFF	ON
106	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	ON	OFF	OFF
106.1	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	OFF	ON	ON
106.2	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	OFF	ON	OFF
106.3	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	OFF	OFF	ON
106.4	ON	OFF	ON	ON	ON	ON		OFF	ON	ON	OFF	OFF	OFF
106.5	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	ON	ON	ON
106.6	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	ON	ON	OFF
106.7	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	ON	OFF	ON
106.8	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	ON	OFF	OFF

MHz	1	2	3	4	5	6		1	2	3	4	5	6
106.9	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	OFF	ON	ON
107	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	OFF	ON	OFF
107.1	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	OFF	OFF	ON
107.2	ON	OFF	ON	ON	ON	ON		OFF	ON	OFF	OFF	OFF	OFF
107.3	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	ON	ON	ON
107.4	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	ON	ON	OFF
107.5	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	ON	OFF	ON
107.6	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	ON	OFF	OFF
107.7	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	OFF	ON	ON
107.8	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	OFF	ON	OFF
107.9	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	OFF	OFF	ON
108	ON	OFF	ON	ON	ON	ON		OFF	OFF	ON	OFF	OFF	OFF

ROHS

All components used in this apparatus are RoHS compliant and do not contain above the specified limits in any of the following restricted substances:

- Lead
- Hexavalent Chromium
- Mercury
- Cadmium
- Polybrominated Biphenyls (PBB's)
- Polybrominated Diphenylethers (PBDE's)

PRODUCT END OF LIFE

This apparatus must NOT be disposed of with other domestic waste.

We are fully committed to maintaining our responsibilities to the environment. Owners of apparatus that has reached the end of it's useful life can return it to us for recycling, recondition, reuse or proper disposal. You will be required to pay lowest cost postal service available to ship the apparatus to us. Before shipping please contact us for more important information.

DECLARATION OF CONFORMITY

AAREFF TRANSMISSION SYSTEMS SL
AVDA ANDALUCIA 1
LA ALFOQUIA-ZURGENA
04661
ALMERIA
ESPANA.

Paul Hollings

In Zurgena, Almería, Spain on 01 of November 2008, the equipment:

Original and Genuine Veronica® 1W PLL (1WPLLM) meets the essential requirements of the R&TTE directive

ETS 300 384/A1 ed.1 (1997-2002) Broadcasting Systems Transmitters FM sound broadcasting in very high frequency (VHF)

It should be noted that this cannot be legally used as a standalone unit. This sub assembly is designed and intended to be installed in a fully screened EMC enclosure with or without other sub assemblies. Any final design should be further tested to verify it meets the essential requirements of:

EN 301 489-11 V1.3.1 (2006-05) Electromagnetic compatibility and Radio Spectrum Matters (EMC) for radio equipment and services. Part 11: Specific conditions for transmitting the terrestrial sound broadcasting service.

2006/95/EC DIRECTIVE 2006/95/EC of 12 December 2006 on electrical equipment designed for use within certain voltage limits.

0.279218912125