AUG. 1978

A.M. - F.M. V.H.F. SIGNAL GENERATOR

TYPE 1525

ISSUE 4

CONTENTS

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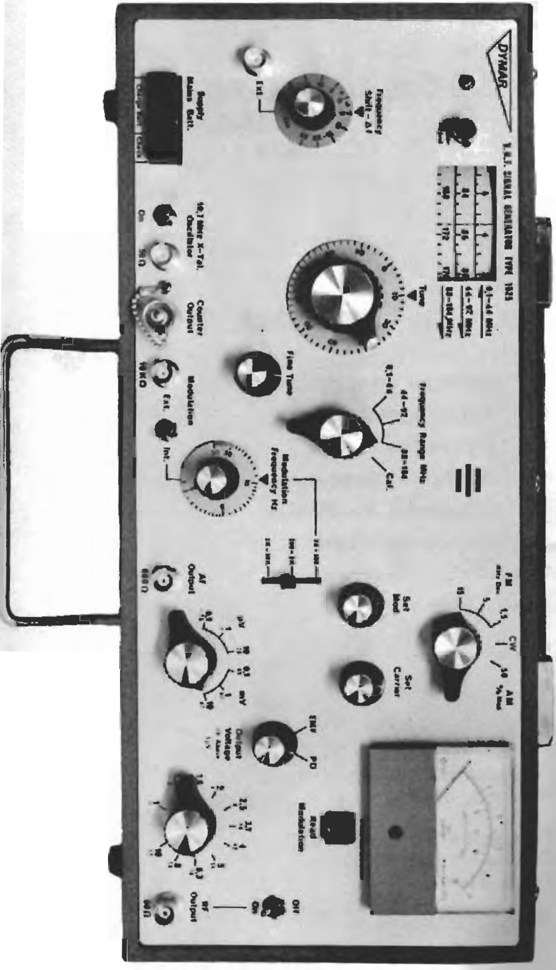


Signal Generator Type 1525

1. GENERAL DESCRIPTION.

The Dymar V.H.F. Signal Generator Type 1525 is a solid state, high-performance instrument designed primarily for the testing of narrow-band receivers of modern V.H.F. radiotelephone equipment to today's exacting specification.

Frequency coverage is from 100 kHz to 184 MHz in three bands, and a high degree of setting accuracy can be achieved by means of a drum scale 50 cm in length, with virtually linear MHz interval points.

The RF output can be unmodulated, or it can be modulated either in Amplitude or Frequency.

The internal modulating oscillator covers the range 30 Hz to 30 kHz, and its output is also available from a 600 ohm source impedance for external use. Alternatively, modulation can be applied from an external source.

A 1 MHz crystal calibrator is incorporated with its own loudspeaker, and this allows the scale cursor to be adjusted at the "cal" points. Alternatively, a counter output socket is provided, which allows precise frequency setting using a digital counter.

A calibrated frequency shift control adjusts the carrier ± 25 kHz from its reference point.

The output level is set by means of a 120 dB attenuator which operates in 2 dB steps, while the interpolation between these steps can be done on the meter. Output voltage is from 100 mV to 0.1 μV across a matched load of 50 ohm (P.D.). Alternatively an additional 6 dB pad can be switched in, which calibrates the attenuator setting in terms

External Shift:	± 6 Volts D.C., relative to a potential of -6 Volts D.C. will shift frequency approximately ± 25 kHz.

MODULATION

AMPLITUDE MODULATION:	Continuously variable 0 - 50%.
Modulation Setting Accuracy:	5% of f.s.d.
Frequency Range:	30 Hz to 10 kHz
Frequency Setting Accuracy:	5% + 3Hz. Counter Output available for precise setting of modulation frequency.
Envelope Distortion:	Better than 3% at 1 kHz and 30% depth of modulation.
FREQUENCY MODULATION:	Continuously variable. 3 ranges giving full-scale deviations of 1.5 kHz, 5 kHz and 15 kHz.
Modulation Setting Accuracy:	10% of f.s.d.
Frequency Range:	30 Hz to 15 kHz
Frequency Setting Accuracy:	As in A.M.
Modulation Distortion:	Better than 3% at 3 kHz deviation.

External Modulation AM and FM:	Approximately 3 volts input into 10k ohm will modulate the carrier externally with waveforms not available internally, such as square waves, pulses, etc.

R.F. OUTPUT

Level:	100mV to 0.1μV e.m.f. or p.d. into 50 ohm adjustable in steps of 2dB. Interpolation from -1dB to +1dB continuously on meter.
Accuracy:	± 1dB at 1 μVolt and above.
Output Impedance:	50 ohm with a V.S.W.R. of 1.25 to 1.
Leakage:	Less than 1 μV in a 2-inch loop search coil anywhere outside the instrument and 6" away from it.
Counter Output:	Approx. 50 mV into 50 ohm, irrespective of attenuator setting.

AUXILIARY OUTPUTS

A.F. Oscillator:	30 Hz to 30 kHz in 3 ranges.
Frequency Calibration:	3%
Output Voltage:	Continuously variable 0 - 1.5 volts into 600 ohm measured on meter.
Setting Accuracy:	5% of f.s.d.

I. F. Oscillator:	10.7 MHz Crystal controlled.
Frequency Accuracy:	0.001%. 10^{o} - 30^{o}C
Output Voltage:	Approx. 0.4 Volts into 50 ohm
External Power Supply:	190 - 260 Volts 95 - 130 Volts 50 - 60 Hz OR 22 - 32 Volts DC at 90 mA
Internal Battery:	24 Volt (nominal) Nickel Cadmium rechargeable battery of 400 mAh capacity giving a typical operating time of 4½ hours between recharging. Batteries are recharged in situ by means of an internal charging circuit in 14 hours from a fully discharged condition (22 Volts).
Meter:	2½" movement calibrated 0 - 5 and 0 - 15 plus a scale of -1, 0 and + 1dB for carrier setting. A "Check Battery" push button connects meter across battery to read voltage directly.

Dimensions and Weight:

Width	Height	Depth	Weight
16.5"	7"	10"	22 lb
42 cm	17.5 cm	25 cm	10kg

Accessories: Rack Mounting Adaptor Kit Type 1801.

Protective Front Panel Cover Type 1802.

Typical figures based on normal operating conditions.

Dymar policy is one of continuous improvement, therefore the right is reserved to change specifications without notice.

3. OPERATION.

3.1. Power Supply.

The instrument is normally despatched from the factory set for 230 volts operation, and no further tap changes or adjustments are necessary, provided the supply voltage is between 190 and 260 volts A.C. If the mains voltage is in the range 95 to 130 volts A.C. then the primary windings on the transformer have to be connected in parallel instead of in series. To do this, remove the top cover from the instrument and make the following adjustment on the power supply board which is situated on the right-hand side behind the meter. Remove the link which connects the two pins marked 230V, and substitute two links across pins marked 115V. Also, replace the 150 mA fuse with an equivalent type rated for 300 mA.

To operate the instrument from the mains supply, push the red button marked "Mains", which will then light up.

To operate the instrument from its own internal battery, first check the battery voltage by depressing the green button "Check", when a reading of not less than 22 volts (red arrow on the meter) should be obtained. To switch on the battery supply, depress the blue button marked "Batt". In the interest of prolonging battery life, this button does not light up, but the instrument is nevertheless operational. If the battery voltage is less than 22 volts, the batteries require recharging. This is done by depressing the red and blue buttons ("Charge Batt"), when the instrument will be operational from the mains and charging its own batteries. A discharged battery of 22 volts or less will need 14 hours of charging to obtain its full charge.

To operate the instrument from an external battery, connect it to the two sockets on the back panel, push the slider switch to "External Battery", and then proceed as before. The battery should have a nominal voltage of 24 volts, and the instrument will operate satisfactorily between 22 and 32 volts D.C.

3.2. Frequency Tuning

Set the Function Switch to "CW" and the "Frequency Range" Switch to the required range. Set the "Fine Tune" control to mid-position and the "Frequency Shift-Δf" control to zero. Using the main tuning knob, set the generator to the required frequency.

If more accurate frequency setting is required, it is necessary to check the frequency calibration of the main tuning scale. To do this, set the range switch to "Cal" and turn the main tuning knob until a whistle is heard in the loudspeaker. Loosen the "Adjust Cursor" knob and set the cursor to coincide with a 1 MHz point (2 MHz point on the 88 - 184 MHz range). Lock the cursor in position. The logging scale on the main tuning knob can be used for interpolation between two calibration points.

The most accurate frequency setting can, of course, be obtained by using a suitable counter, e.g. the Dymar Type 1680, and connecting it to the "Counter Output" socket.

To obtain a known shift of frequency away from the set frequency, use the Δf knob which is calibrated directly in kHz. The sense of the shift is reversed when used on the 0.1 - 44 MHz range. A frequency shift can also be obtained by applying a D.C. potential between 0 and 12 volts from an external source. This can be used for synchronising the generator to an external standard via a phase-lock loop.

3.3. Output Voltage

For any given frequency setting, operate the "Set Carrier" control to set the meter at the 0dB mark, i.e. for half-scale deflection. The output voltage can then be read directly from the setting of the two attenuator switches, and is calibrated in terms of the open circuit voltage with a 50 ohm internal impedance (E.M.F.) or the terminated voltage delivered into a matched load of 50 ohm (P.D.), depending on the setting of the third attenuator switch, which gives 6 dB of attenuation.

The ON-OFF switch situated above the "RF Output" Socket, when put into the "OFF" position, will reduce the Carrier by between 20 and 40dB, depending on the frequency setting.

This is particularly useful when checking the quieting performance of F.M. receivers at sensitivity level. If this degree of attenuation is not sufficient, then putting the "Range Switch" to "Cal" will attenuate the residual carrier by another 50 - 70dB with the oscillator still running, and therefore not subject to drift when the carrier is switched on again.

3.4. Modulation

Set the Modulation External/Internal Switch to "Int" and select the modulation frequency by setting the dial and the 3-position range switch to the appropriate position. Set the main function switch to AM or one of the three FM ranges available, then depress the push-button "Read Modulation", and by operating the control "Set Mod" adjust the depth of modulation or frequency deviation as required. The "Read Modulation" switch is biased, and the meter reverts to reading carrier when the button is released. The modulating frequency is available at the "AF Output" socket at 600-ohm output impedance. The amplitude is controlled by the same "Set Mod" potentiometer, and is 1.5 volts into 600 ohm (3 volts E.M.F.) when the meter reads f.s.d.

3.5. 10.7 MHz Crystal Oscillator

This oscillator is used for receiver alignment in the radiotelephone sets which have a 10.7 MHz Intermediate Frequency, and it is put into operation by the adjacent switch marked "ON".

4. TECHNICAL DESCRIPTION.

4.1. General

The Equipment Type 1525 consists basically of the front panel assembly and its associated Audio Board, and three distinct sub-assemblies, namely:

1. The Oscillator Box
2. The Attenuator Box
3. The Power Supply Board

Reference will be made in the circuit description to the relevant circuit diagrams.

4.2. The Main Oscillator Box

4.2.1. Transistor VT 404 acts as the main oscillator in conjunction with the coil L400 and the variable capacitor C400A. It is used in the grounded base configuration, and the positive feedback employed to maintain oscillation is from a tap on L400 to the emitter via C411. The frequency range covered as C400A swings from max. to min. is 44 - 92 MHz. Zener diode D403 provides additional stabilisation against supply changes, and also sets a reference bias to the two varicap diodes D401 and D402 which act as variable reactance elements of the main resonant circuit to give frequency shift and modulation facility. The output from the oscillator is taken via the buffer stage VT405 to two separate buffer stages, one feeding the Low Band A.M. Modulator, and one feeding the frequency doubler, to obtain the High Band of 88 to 184 MHz.

4.2.2. The Low Band frequency of 44-92 MHz is applied to the base of the modulated transistor

VT414, which has the tuned circuit L401 and C400B in its collector tracking the input frequency. A.M. modulation is applied to this stage through the emitter follower VT412, and the modulated RF output is routed to the main output socket (and hence to the Attenuator) via switch S400B and S400E. The amplitude of the carrier is controlled from the "Set Carrier" potentiometer by the P-N-P emitter follower VT415.

4.2.3 The main oscillator output (44-92 MHz) is fed to the frequency doubler through the buffer stage VT406. This doubler is broadband balanced, and consists of the transistors VT416 and VT417 with a common collector load R162. Pre-set potentiometer RV403 is adjusted to give minimum output at the input frequency, and the doubled frequency (88-184 MHz) is amplified in the transistor stage VT423 before being applied to the High Band Modulator VT424.

4.2.4 The High Band Modulator VT424 is identical to the Low Band Modulator and has the tuned circuit L403 and C400C tracking the input frequency. VT422 acts as the modulating transistor, and the output is taken to the switch S400E. The amplitude of the carrier as adjusted by the "Set Carrier" is controlled by VT425 in the same manner as on the Low Band.

4.2.5 Range 1 of the Signal Generator, which covers the frequency band 0.1 MHz to 44 MHz, is obtained by mixing the output of the main oscillator in the range 46-89.9 MHz with a Crystal Oscillator operating at 90 MHz and extracting the difference frequency. The Crystal Oscillator consists of the transistors VT418 and VT419 connected in a "Butler" circuit with the overtone crystal between the emitters. The Mixer Circuit uses the two transistors VT420 and VT421 arranged in a double balanced configuration with the variable resistor RV404 adjusted for optimum balance. The 90 MHz signal from the oscillator is the high-level signal, whereas the variable frequency signal, which may already have amplitude modulation impressed upon it, is the low level or linear, signal. Therefore this signal is fed from switch S400E through the attenuating pad R491, R492 and R493 into the mixer. The output at R486 is taken to the Low Pass Filter which has two traps tuned to 90 MHz and 62MHz respectively. A Wideband Amplifier consisting of VT427, VT428 and VT429 raises the output before feeding it to the output switch S400E.

4.2.6. The output at the range switch S400E is taken via the "Carrier Off" relay contacts to the main output socket SK400, while the diode D404 monitors the carrier level, the DC component being fed to the meter on the front panel. Part of the output is taken through the buffer stage VT 426 to give the "Counter Output" at socket SK 401.

4.2.7. The 1 MHz Crystal Calibrator Circuit is also contained in the main oscillator box. In position four of the range switch marked "CAL", the main output at switch S400E becomes disconnected, and the Main Oscillator output at switch S400B is routed to the Mixer Transistor VT407.

The other input of this mixer is a spectrum of 1 MHz harmonics derived from the Crystal Oscillator VT400 and the Pulse Generator consisting of the Schmidt Trigger VT401 and VT402, and the differentiating circuit C418 and R422. The audible beat notes which occur at 1 MHz intervals are amplified by VT408 and the complementary Audio Amplifier VT409, VT410 and VT411. The output is taken to the Loudspeaker.

4.2.8. The FM modulating signal which is either audio frequency or the calibrated DC shift is fed through the switch S400A to the buffer stage VT403, either directly or on range 3, through a divide-by-two network to maintain constant deviation even though the frequency has been doubled. Since the L/C ratio of the Main Oscillator Circuit varies with frequency, a constant modulating waveform would produce higher deviation at higher carrier frequency. A complex attenuating network consisting of RV400A and RV400B is mechanically coupled through gears to the tuning capacitor C400A, so that as frequency of the oscillator rises, and the deviation sensitivity increases, the modulation voltage is decreased, thus keeping the deviation constant.

4.3. The Attenuator

The Attenuator is a constant impedance design with 50Ω Π section attenuating pads being switched either in or out of circuit by means of microswitches. The microswitches are operated by cams from the front panel controls. The following list gives the Switches and the corresponding pads.

Decade Switch	S300/301	- 20 dB
	S302/303	- 40 dB
	S304/305	- 40 dB
Unit Switch:	S308/309	- 2 dB
	S310/311	- 4 dB
	S312/313	- 4 dB
	S314/313	- 10 dB
PD/EMF Switch:	S306/307	- 6 dB

Therefore any attenuation between 0 and 126 dB in 2 dB increments is available from this attenuator. The 40 dB pads consist of two 20 dB pads in tandem with C301 or C300 compensating for some direct leakage through microswitch capacity at high frequencies.

4.4. Power Supply

The design of the power supply is conventional and consists of Transformer T100 and rectifying diodes D102 and D105 producing "raw" D.C. voltage across reservoir capacitor C102. This voltage is an unregulated D.C. voltage of approximately 24 volts relative to the -12.6 volt common output rail. Either this voltage or the battery voltage of 24 volt is applied to the series regulator, which then produces two regulated output voltages of +5.6 volts and -12.6 volts with respect to chassis. VT103 and VT104 comprise a difference amplifier which senses the magnitude of the -12.6 volt rail and compares it with the Zener voltage D103. VT101 and VT100 are the series elements of the regulator. The +5.6 volts rail is taken from the emitter follower VT102, whose base is held about 6.3 volts above ground by means of the Zener Diode D104. The internal battery can be recharged by the voltage doubling circuit C100, C101, D100 and D101 through the resistor R1. The pushbutton switch S3A, S3B connects the meter through resistor R4 to check the state of charge of the battery.

4.5. Main Assembly and Audio Board

4.5.1. 10.7 MHz Oscillator

This is a Crystal Oscillator which is activated by Switch S7 where transistor VT200 oscillates at the resonant frequency of the Crystal XL200. C200 adjusts for the cutting tolerance of the Crystal. The output is taken from a tap on L200 directly to the output socket on the front panel.

4.5.2. A.F. Oscillator

This is a conventional R.C. Oscillator of the "Wien Bridge" Type, with VT201 and VT202 comprising the maintaining amplifier. VT203 and VT204 are an augmented emitter follower which drives the Wien Bridge feedback network and also the negative feedback resistor R206 through thermistor TH200 to stabilise the amplitude of oscillation.
Potentiometers RV1A and RV1B vary the frequency continuously while S5A and S5B alter the range.

The Audio Frequency is picked off the slider of the "Set Mod" potentiometer RV4, and applied to a similar emitter follower VT205 and VT206. This output is now available at the front panel via the 600-ohm resistor R222 and through the modulation function switch S9A it can be routed to the main oscillator box to provide Amplitude or Frequency Modulation.

4.5.3. Frequency Shift and Modulation

For Frequency Modulation the A.F. Waveform is applied via the Emitter Follower VT207 to the summing junction (Pin 49) where the three Frequency shifting functions, namely Internal Frequency Shift Δf, External Shift and Fine Tune Control, are added together. These electrical voltages are then applied to the FM modulator in the Oscillator Box.

4.5.4. Meter Amplifier and Modulation Monitor

In the FM Mode the amount of deviation which is applied is proportional to the amplitude of the AF waveform and this amplitude is measured by the Meter Amplifier VT208 and VT209 which drives the detector diodes D200 and D201 connected in a feedback network. The meter is then directly calibrated in terms of kHz deviation.

In the AM mode, the depth of modulation is measured by extracting the AF waveform at the Carrier Monitor Diode and feeding it through a frequency correcting amplifier VT210 before applying it to the same Meter Amplifier. The Meter is then calibrated directly in terms of Amplitude Modulation Depth expressed as a percentage.

5. ALIGNMENT PROCEDURE

5.1 The following test gear is required:

1. U.H.F. Millivoltmeter (Dymar Type 2011)
2. AVO 8
3. Distortion Factor Meter (Dymar Type 2065)
4. Frequency Counter (Dymar Type 1680)
5. A.F. Millivoltmeter (Part of Dymar Type 1765)
6. Spectrum Analyser (Anritsu, Type MS62A)
7. Audio Signal Generator (Dymar, Type 2041)
8. Standard Attenuator (Texscan, Type 550)
9. Modulation Meter (Dymar Type 1785)
10. Receiver, 1 μV sensitivity up to 184 MHz.

5.2. Frequency Alignment of the Main Oscillator and Modulators

Connect the Frequency Counter to the "Counter Output" of the Signal Generator, and set the "Cursor" to its mid-position, and the "Frequency Range" switch to 44 - 92 MHz Range. Set the frequency dial to 45 MHz, and check that the frequency corresponds to the dial reading. Subsequently, turn the dial to 90 MHz, and check that this second tracking point corresponds to the dial reading. If the above two tracking points do not correspond to the output frequency, it is possible that the frequency scale drum may have moved with respect to the main tuning capacitor. In this case it is necessary to remove the top cover of the Signal Generator in order to gain access to the drum. It will now be possible to re-adjust the main tuning capacitor by holding on to the drum with one hand (set to one of the tracking points), and turning the handle knob.

If, however, this procedure will not remedy the fault, then the oscillator will require re-tracking. In order to do this, the whole oscillator box must be removed and reconnected on the out-side to the P.S.U. The bottom and top covers should be removed, in order to gain access to the coils and trimmers of the oscillator and the two modulators.

The following is the procedure:

Tune L400 to 45 MHz, and C401 to 90 MHz. Connect UHF Millivoltmeter to the socket SK400, and tune L401 at 44 MHz for maximum output and C402 at 92 MHz for maximum output.

Turn the "Frequency Range" switch to 88 - 184 MHz. Tune L403 for maximum output at 88 MHz and C403 at 184 MHz for maximum output.

To set the 90 MHz oscillator, connect the frequency counter to the counter output, socket SK401.

Set the "Tuning Control" to exactly 50 MHz. Turn the "Frequency Range" switch to the lowest range (0.1 - 44 MHz), and tune the coil L402 so as to get exactly 40 MHz on the frequency counter.

5.3. Alignment of the Low Pass Filter and Balanced Mixer.

Connect the output of the Signal Generator to the spectrum analyser. Set the frequency to 44 MHz on the lowest range (0,1 - 44 MHz).

Tune L406 and adjust RV404 for minimum 90 MHz output, at least 20dB below carrier output. Tune L407 for f.s.d. indication on the meter, with the the "Set Carrier" control fully clockwise.

Reconnect UHF Millivoltmeter to the R.F.

output and check that 100mV e.m.f. is obtainable over the whole frequency range with the carrier indicator on the meter set to "O" position.

5.4. Alignment of Doubler

With the spectrum analyser connected as under para 5.3., set the frequency to 184 MHz, and by means of pre-set RV403 adjust the fundamental 92 MHz for minimum amplitude.

5.5. Counter Output Check

Connect the U.H.F. Millivoltmeter to the socket SK401, and check that the output is at least 50 mV.

5.6. Calibration Adjustment

Set the "Frequency Range" switch to the "Cal" position and check that the calibration circuitry is operational.

Set the "Tuning Control" to any frequency on range two (44 - 92 MHz) and tune into any 1 MHz frequency step. Connect the frequency counter to the "Counter Output" socket SK401, reset "Range" switch to range 2 and check the frequency. It should be x MHz ± 0.01%.

If it is not, connect the frequency counter to the base of VT401 and set the 1 MHz oscillator to 1 MHz by means of the trimmer C405.

Turn the "Frequency Range" switch to the "Cal" position, and a whistle should be heard. (N.B. The volume of the whistle is a function of the position of the "Set Carrier" Potentiometer.)

Turn the "Frequency Dial" to get zero beat, and check on the counter if the calibration is within specified accuracy.

5.7. Initial Adjustment of F.M. Deviation

Connect the AVO meter between the emitter of VT403 and the -6.3V line, and set pre-set potentiometer RV401 for zero current.

Set the "Frequency Range" switch S400 to the 44 MHz - 92 MHz range. Tune into 45 MHz. Connect the Modulation Meter to SK400, and set it to 15 kHz deviation. Connect the A.F. Signal Generator to C494, and modulate the oscillator at about 1 kHz. Adjust the amplitude of the A.F. Generator so as to get 15 kHz deviation as read on the Modulation Meter.

Change the frequency of the oscillator to 90 MHz, and adjust pre-set potentiometer RV402 to get 15 kHz deviation, without changing either the amplitude or the frequency of the modulating A.F. Signal Generator.

Put on the bottom cover, and replace the Oscillator Box in its proper position, making the appropriate connections.

5.8. Alignment of Audio Board and Associated Circuitry

Remove the bottom cover of the Signal Generator and unhinge the board by unscrewing the two retaining screws.

5.9. Setting-up of the 10.7 MHz Crystal Oscillator

Connect the Frequency Counter to Socket SK1 and turn on the switch S7. Set the coil L200 to approximately 10.7 MHz. With the trimming capacitor C200, set the frequency to exactly 10.7 MHz. Disconnect the Counter and connect UHF Millivoltmeter. Check that the output level is about 400 mV into 50 ohms. Switch off the oscillator.

5.10. Setting-up of the A.F. Oscillator

Connect the Frequency Counter to "A.F. Output" socket SK2. Set the "Audio Frequency" switch S5 to the range 300 Hz to 3KHz. Check that the frequency is within ± 3% of the dial indication. Repeat the procedure with S5 set first to the low and then to the high range. Disconnect the frequency counter and connect the Distortion Factor Meter to SK2. Set RV200 so that the distortion is not more than 0.3% at 1 KHz. Connect A.F. Millivoltmeter to socket SK2. Set the function switch S9 to "C.W." position. At 1 KHz, press the "Read Modulation" button S4, and by means of "Set Mod" control RV4, set the meter for f.s.d.

Under these conditions, the A.F. output should be adjusted by means of RV201 to 1.5V R.M.S. into 600 ohm, or 3V R.M.S. open circuit.

5.11. Setting up of the "Carrier Level"

Connect U.H.F. Millivoltmeter to the R.F. output socket SK5. Set the attenuator switches to "No attenuation" positions (fully clockwise) and the P.D./E.M.F. to E.M.F. position. Also, set the function switch S400 to the C.W. position.

By means of the "Set Carrier" potentiometer RV5, adjust the output level to 100 mV E.M.F. as indicated on the Voltmeter (frequency immaterial). Adjust pre-set potentiometer RV208 for zero "Set Carrier" as indicated on the meter of the Signal Generator.

5.12. Adjustment of the A.M. Percentage Modulation

Connect the Modulation Meter to the R.F. output socket SK5, and tune it into any frequency between 44 MHz and 184 MHz. Set the function switch S9 to "A.M.% Mod." position, and the A.F. Oscillator to about 1 kHz. Operate the push-button switch, S4, marked "Read Modulation" and, by means of the "Set Mod." potentiometer RV4, adjust the modulation to adjust the pre-set potentiometer RV207 to read 50% on the meter (i.e. full-scale deflection).

5.13. Adjustment of F.M. Deviation

Set the "Function" switch to "Carrier" position, the "Frequency Shift" to zero, and the "Fine Frequency" control to its central position. Disconnect the wire from C494 and connect AVO meter in series between C494 and the wire, and set the potentiometer RV204 for zero current. Reconnect the wire.

Turn the "Function" switch S9 to 15kHz F.M. deviation, and set the "Set Mod." potentiometer RV4 to read f.s.d. on the meter. Connect Modulation Meter to the R.F. output and, by means of pre-set RV202, set the deviation to 15 kHz.

5.14. Setting Up "Frequency ShiftΔf"

Connect the frequency counter to socket SK6, and set "Freq. Shift" dial (potentiometer RV2) to zero shift. Set the R.F. output to some convenient frequency, say 100 MHz.

Turn the "Frequency Shift" RV2 to + 25 kHz and adjust RV205 for the counter to read the original frequency plus 25 kHz.

Turn the "Frequency Shift" dial to -25kHz a and adjust RV203 for the counter to read the original frequency less 25 kHz.

The above adjustments should be repeated several times, because controls RV205 and RV203 are interdependent.

Put the top cover on the Oscillator Box, making certain that all screws are properly tightened up. Screw on the Audio Board, and put on the bottom and top covers.

5.15. Leakage Test

Tune the Signal Generator to the receiver frequency, and check that in 2-inch loop search coil the leakage is less than 1 μV anywhere outside the instrument.

5.16. Stability Test

Connect the frequency counter to the socket SK6, and check that the stability of the main R. F. oscillator is within the specified accuracy.

5.17. Attenuator Alignment

Connect Signal Generator (frequency 10 MHz - 184 MHz) in series with the Standard Attenuator, which, in turn, should be connected with the Attenuator under test, to SK300. The UHF Millivoltmeter should be connected to SK301 via T-connector, and terminated into 50-ohm load. Select some convenient level at 10 MHz and check the attenuator pads in succession by operating the microswitches from inside the attenuator box and comparing the levels with the Standard, observing the reading on the UHF Millivoltmeter. The maximum allowable error is $\pm$ 2%.

N.B. Note that the attenuator switches must be fully clockwise so that, in fact, no attenuation is provided by the cams operating the microswitches.

Check first 40 dB pad by operating S304 and S305.

Check second 40 dB pad by operating S302 and S303.

Check 20 dB pad by operating S300 and S301

Check 10 dB pad by operating S314 and S315

Check first 4 dB pad by operating S312 and S313.

Check second 4 dB pad by operating S310 and S311.

Check 2 dB pad by operating S308 and S309.

Check 6 dB pad by operating S306 and S307.

Next, set the frequency of the Signal Generator to 184 MHz. As before, check the first 40 dB pad by operating S304 and S305, and if necessary correct the frequency response by means of trimmer C301. Again, check the second 40 dB pad by operating S302 and S303, and correct the frequency response by means of trimmer C300.

To check the insertion loss, connect the U.H.F. Millivoltmeter via the T-connector terminated with 50-ohm load directly to the Signal Generator, and take some convenient reading. Subsequently measure the level of the signal (184 MHz) via the attenuator, with the attenuator switches fully clockwise (no attenuation). The limit is $\pm$ 1dB maximum.

6. COMPONENTS LIST

NOTE: All resistors are in Ω and all capacitors are in μF, unless otherwise stated.

Circuit Ref.	Description	Value	Tol. %	Rating

6.1. Oscillator Box

Resistors

R400	Carbon	27k	5	$\frac{1}{4}$W
R401	Carbon	2.7k	5	$\frac{1}{4}$W
R402	Carbon	10k	5	$\frac{1}{4}$W
R403	Carbon	2.7k	5	$\frac{1}{4}$W
R404	Carbon	2.2k	5	$\frac{1}{4}$W
R405	Carbon	4.7k	5	$\frac{1}{4}$W
R406	Carbon	6.8k	5	$\frac{1}{4}$W
R409	Metal Film	2.2k	1	1/16W
R410	Carbon	18k	5	$\frac{1}{4}$W
R411	Carbon	3.3k	5	$\frac{1}{4}$W
R412	Carbon	1k	5	$\frac{1}{4}$W
R413	Carbon	12k	5	$\frac{1}{4}$W
R414	Carbon	3.3k	5	$\frac{1}{4}$W
R415	Carbon	10k	5	$\frac{1}{4}$W
R416	Carbon	33k	5	$\frac{1}{4}$W
R417	Carbon	1k	5	$\frac{1}{4}$W
R418	Carbon	1k	5	$\frac{1}{4}$W
R419	Carbon	1k	5	$\frac{1}{4}$W
R420	Carbon	4.7k	5	$\frac{1}{4}$W

Circuit Ref.	Description	Value	Tol. %	Rating
R421	Carbon	4.7k	5	$\frac{1}{4}$W
R422	Carbon	330	5	$\frac{1}{4}$W
R423	Carbon	10k	5	$\frac{1}{4}$W
R424	Carbon	100k	5	$\frac{1}{4}$W
R425	Carbon	6.8k	5	$\frac{1}{4}$W
R426	Carbon	33	5	$\frac{1}{4}$W
R427	Carbon	15	5	$\frac{1}{4}$W
R428	Carbon	47k	5	$\frac{1}{4}$W
R429	Carbon	6.8k	5	$\frac{1}{4}$W
R430	Carbon	330	5	$\frac{1}{4}$W
R431	Carbon	2.2k	5	$\frac{1}{4}$W
R432	Carbon	1k	5	$\frac{1}{4}$W
R433	Carbon	10k	5	$\frac{1}{4}$W
R434	Carbon	100	5	$\frac{1}{4}$W
R435	Carbon	1k	5	$\frac{1}{4}$W
R436	Carbon	2.2k	5	$\frac{1}{4}$W
R437	Carbon	2.2k	5	$\frac{1}{4}$W
R438	Carbon	330	5	$\frac{1}{4}$W
R439	Carbon	560	5	$\frac{1}{4}$W
R440	Carbon	560	5	$\frac{1}{4}$W
R441	Carbon	1.8k	5	$\frac{1}{4}$W
R442	Carbon	390	5	$\frac{1}{4}$W
R443	Carbon	6.8k	5	$\frac{1}{4}$W
R444	Carbon	100	5	$\frac{1}{4}$W
R445	Carbon	6.8k	5	$\frac{1}{4}$W

Circuit Ref.	Description	Value	Tol. %	Rating
R446	Carbon	47	5	$\frac{1}{4}$W
R447	Carbon	39k	5	$\frac{1}{4}$W
R448	Carbon	1k	5	$\frac{1}{4}$W
R449	Carbon	4.7k	5	$\frac{1}{4}$W
R450	Carbon	27k	5	$\frac{1}{4}$W
R452	Carbon	27k	5	$\frac{1}{4}$W
R453	Carbon	1.2k	5	$\frac{1}{4}$W
R454	Carbon	1k	5	$\frac{1}{4}$W
R455	Carbon	10k	5	$\frac{1}{4}$W
R456	Carbon	680	5	$\frac{1}{4}$W
R457	Carbon	10k	5	$\frac{1}{4}$W
R458	Carbon	680	5	$\frac{1}{4}$W
R459	Carbon	330	5	$\frac{1}{4}$W
R460	Carbon	15k	5	$\frac{1}{4}$W
R461	Carbon	15k	5	$\frac{1}{4}$W
R462	Carbon	100	5	$\frac{1}{4}$W
R463	Carbon	10k	5	$\frac{1}{4}$W
R464	Carbon	680	5	$\frac{1}{4}$W
R465	Carbon	56	5	$\frac{1}{4}$W
R466	Carbon	56	5	$\frac{1}{4}$W
R467	Carbon	6.8k	5	$\frac{1}{4}$W
R468	Carbon	1k	5	$\frac{1}{4}$W
R469	Carbon	6.8k	5	$\frac{1}{4}$W
R470	Carbon	56	5	$\frac{1}{4}$W
R471	Carbon	330	5	$\frac{1}{4}$W

Circuit Ref.	Description	Value	Tol. %	Rating
R472	Carbon	5.6k	5	$\frac{1}{4}$W
R473	Carbon	390	5	$\frac{1}{4}$W
R474	Carbon	1.8k	5	$\frac{1}{4}$W
R475	Carbon	150	5	$\frac{1}{4}$W
R477	Carbon	1k	5	$\frac{1}{4}$W
R478	Carbon	330	5	$\frac{1}{4}$W
R479	Carbon	6.8k	5	$\frac{1}{4}$W
R480	Carbon	1k	5	$\frac{1}{4}$W
R481	Carbon	6.8k	5	$\frac{1}{4}$W
R482	Carbon	56	5	$\frac{1}{4}$W
R483	Carbon	56	5	$\frac{1}{4}$W
R484	Carbon	15k	5	$\frac{1}{4}$W
R485	Carbon	15k	5	$\frac{1}{4}$W
R486	Carbon	100	5	$\frac{1}{4}$W
R487	Carbon	100	5	$\frac{1}{4}$W
R488	Carbon	1.5k	5	$\frac{1}{4}$W
R489	Carbon	680	5	$\frac{1}{4}$W
R490	Carbon	680	5	$\frac{1}{4}$W
R491	Carbon	270	5	$\frac{1}{4}$W
R492	Carbon	68	5	$\frac{1}{4}$W
R493	Carbon	68	5	$\frac{1}{4}$W
R494	Carbon	1k	5	$\frac{1}{4}$W
R495	Carbon	2.7k	5	$\frac{1}{4}$W
R496	Carbon	100	5	$\frac{1}{4}$W
R497	Carbon	33	5	$\frac{1}{4}$W
R498	Carbon	820	5	$\frac{1}{4}$W
R499	Carbon	270	5	$\frac{1}{4}$W

Circuit Ref.	Description	Value	Tol. %	Rating
R500	Carbon	33	5	$\frac{1}{4}$W
R501	Carbon	47	5	$\frac{1}{4}$W
R502	Carbon	105	5	$\frac{1}{4}$W
R503	Carbon	47	5	$\frac{1}{4}$W
R504	Carbon	39	5	$\frac{1}{4}$W
R505	Metal Film	150	1	1/16W
R506	Metal Film	36.5	1	1/16W
R507	Carbon	12k	5	$\frac{1}{4}$W
R508	Carbon	1.2k	5	$\frac{1}{4}$W
R509	Carbon	330	5	$\frac{1}{4}$W
R510	Carbon	68	5	$\frac{1}{4}$W
R511	Carbon	6.8k	5	$\frac{1}{4}$W
R512	Carbon	10k	5	$\frac{1}{4}$W
R513	Carbon	22	5	$\frac{1}{4}$W
R514	Carbon	27	5	$\frac{1}{4}$W
R515	Carbon	4.7k	5	$\frac{1}{4}$W
RV400	Dual gang Pot.	2x50k		
RV401	Pre-set Linear	5k		
RV402	Pre-set Linear	2.5k		
RV403	Pre-set Linear	1k		
RV404	Pre-set Linear	1k		
RV405	Pre-set Linear	20K		

Circuit Ref.	Description	Value	Tol. %	Rating
Capacitors				
C400	Tuning	3 x 56p		
C401	P.T.F.E. Trimmer	5p		
C402	Variable Capacitor	6p		
C403	Variable Capacitor	6p		
C404	Ceramic	15p	5	
C405	Variable Capacitor	10-40p		
C406	Ceramic	560p	10	
C407	Ceramic	270p	5	
C408	Ceramic	100p	10	
C409	Ceramic	0.1		
C410	Ceramic	0.03		
C411	Ceramic	100p	10	
C412	Ceramic	470p	10	
C413	Ceramic	0.033		
C414	Ceramic	100p	10	
C415	Ceramic	0.033		
C416	Ceramic	100p	10	
C417	Ceramic	100p	10	
C418	Ceramic	100p	10	
C419	Ceramic	0.01		
C420	Electrolytic	2.2		63V
C421	Electrolytic	10		25V

Circuit Ref.	Description	Value	Tol. %	Rating
C422	Electrolytic	150		16V
C423	Electrolytic	150		16V
C424	Electrolytic	150		16V
C425	Electrolytic	150		16V
C426	Ceramic	100p	10	
C427	Ceramic	0.001	20	
C428	Ceramic	0.003		
C429	Ceramic	0.001	20	
C430	Ceramic	0.001	20	
C431	Ceramic	0.001	20	
C432	Ceramic	0.003		
C433	Ceramic	0.033		
C434	Ceramic	0.033		
C435	Ceramic	0.033		
C436	Ceramic	0.033		
C437	Ceramic	0.033		
C438	Ceramic	0.033		
C439	Ceramic	0.001	20	
C440	Ceramic	0.033		
C441	Ceramic	0.033		
C442	Ceramic	100p	10	
C443	Ceramic	12p	5	
C444	Ceramic	0.033		
C445	Ceramic	0.033		
C446	Ceramic	0.033		

Circuit Ref.	Description	Value	Tol. %	Rating
C447	Ceramic	0.033		
C448	Ceramic	0.033		
C449	Ceramic	0.033		
C450	Ceramic	0.003		
C451	Ceramic	0.033		
C452	Ceramic	0.001	20	
C453	Ceramic	0.003		
C454	Ceramic	0.001	20	
C455	Ceramic	0.003		
C456	Ceramic	0.003		
C457	Ceramic	0.001	20	
C458	Ceramic	0.033		
C459	Ceramic	0.033		
C460	Ceramic	0.033		
C461	Electrolytic	10		25V
C462	Ceramic	0.003		
C463	Ceramic	0.033		
C464	Ceramic	0.001	20	
C465	Ceramic	0.033		
C466	Ceramic	0.033		
C467	Ceramic	46p	5	
C468	Ceramic	8p	5	
C469	Ceramic	63p	5	
C470	Ceramic	23p	5	
C471	Ceramic	35p	5	

Circuit Ref.	Description	Value	Tol. %	Rating
C472	Ceramic	0.033		
C473	Ceramic	0.033		
C474	Ceramic	0.003		
C475	Electrolytic	10		25V
C476	Ceramic	0.1		
C477	Electrolytic	10		25V
C478	Ceramic	0.1		
C479	Ceramic	0.033		
C480	Ceramic	0.033		
C481	Feed-Thro'	500p	20	
C482	Feed-Thro'	500p	20	
C483	Feed-Thro'	500p	20	
C484	Feed-Thro'	500p	20	
C485	Feed-Thro'	500p	20	
C486	Feed-Thro'	500p	20	
C487	Feed-Thro'	500p	20	
C488	Feed-Thro'	500p	20	
C489	Feed-Thro'	500p	20	
C490	Feed-Thro'	500p	20	
C491	Feed-Thro'	500p	20	
C492	Feed-Thro'	500p	20	
C493	Feed-Thro'	500p	20	
C494	Feed-Thro'	500p	20	
C495	Feed-Thro'	500p	20	
C496	Feed-Thro'	500p	20	

Circuit Ref.	Description	Value	Tol. %	Rating
C497	Ceramic	100p	10	
C498	Ceramic	2.2pA.O.T.		
C499	Ceramic	0.033		
Semiconductors				
D400	Mullard	OA91		
D401	I.T.T.	BB121B		
D402	I.T.T.	BB121B		
D403	Mullard	BZY88/C6V2		
D404	Transitron	AA112		
VT400	R.C.A.	2N5180		
VT401	R.C.A.	2N5180		
VT402	R.C.A.	2N5180		
VT403	Texas	BC 213		
VT404	Telefunken	BFX 89		
VT405	R.C.A.	2N5180		
VT406	R.C.A.	2N5180		
VT407	R.C.A.	2N5180		
VT408	Texas	BC 183LA		
VT409	Texas	BC 183LA		
VT410	Texas	BC 213		
VT411	Texas	BC 183LA		
VT412	Texas	BC 183LA		
VT413	R.C.A.	2N5180		
VT414	R.C.A.	2N5180		

Circuit Ref.	Description	Value	Tol. %	Rating
VT415	Texas	BC 213		
VT416	R. C. A.	2N5180		
VT417	R. C. A.	2N5180		
VT418	R. C. A.	2N5180		
VT419	R. C. A.	2N5180		
VT420	R. C. A.	2N5180		
VT421	R. C. A.	2N5180		
VT422	Texas	BC 183LA		
VT423	R. C. A.	2N5180		
VT424	R. C. A.	2N5180		
VT425	Texas	BC213		
VT426	R. C. A.	2N5180		
VT427	R. C. A.	2N5180		
VT428	R. C. A.	2N5180		
VT429	R. C. A.	2N4427		
Coils				
L400	A4-101797			
L401	A3-101795			
L402	A3-101798			
L403	A3-101796			
L404	R. F. Choke			
L405	R. F. Choke			
L406	A3-101799			
L407	A3-101800			
L408	R. F. Choke	220 μH	10	

Circuit Ref.	Description	Value	Tol. %	Rating
L409	R.F. Choke	220 μH	10	
L410	R.F. Choke	220 μH	10	
L411	R.F. Choke	220 μH	10	
L412	R.F. Choke	22 μH	10	
L413	R.F. Choke	220 μH	10	
L414	R.F. Choke	220 μH	10	
L415	R.F. Choke	220 μH	10	
Miscellaneous				
RL400	Relay	RS 12		
XL400	Crystal Unit	1000 kHz		
XL401	Crystal Unit	90000 kHz		
SK400	BNC Bulkhead Socket			
SK401	BNC Bulkhead Socket			
S400	Switch	A2-101162		

6.2. AUDIO BOARD AND ASSOCIATED CIRCUITRY

Circuit Ref.	Description	Value	Tol.%	Rating
Resistors				
R2	Metal Oxide	52.3k	1	$\frac{1}{4}$W
R3	Metal Oxide	15k	1	$\frac{1}{4}$W
R200	Carbon	27k	5	$\frac{1}{4}$W
R201	Carbon	10k	5	$\frac{1}{4}$W
R202	Carbon	330	5	$\frac{1}{4}$W
R203	Carbon	2.2k	5	$\frac{1}{4}$W
R204	Carbon	68k	5	$\frac{1}{4}$W
R205	Carbon	3.3k	5	$\frac{1}{4}$W
R206	Carbon	680 A.O.T.	5	$\frac{1}{4}$W
R207	Metal Oxide	4.22k	1	$\frac{1}{4}$W
R208	Metal Oxide	1.5k	1	$\frac{1}{4}$W
R209	Metal Oxide	1.5k	1	$\frac{1}{4}$W
R210	Carbon	10k	5	$\frac{1}{4}$W
R211	Carbon	560	5	$\frac{1}{4}$W
R212	Carbon	68k	5	$\frac{1}{4}$W
R213	Carbon	10k	5	$\frac{1}{4}$W
R214	Carbon	270	5	$\frac{1}{4}$W
R215	Carbon	33k	5	$\frac{1}{4}$W
R216	Carbon	100k	5	$\frac{1}{4}$W
R217	Carbon	2.2k	5	$\frac{1}{4}$W
R218	Carbon	15k	5	$\frac{1}{4}$W
R219	Carbon	180	5	$\frac{1}{4}$W

Circuit Ref.	Description	Value	Tol. %	Rating
R220	Carbon	100	5	$\frac{1}{4}$W
R221	Carbon	100	5	$\frac{1}{4}$W
R222	Carbon	620	5	$\frac{1}{4}$W
R223	Carbon	100k	5	$\frac{1}{4}$W
R224	Metal Oxide	7.5k	1	$\frac{1}{4}$W
R225	Carbon	330k	5	$\frac{1}{4}$W
R226	Carbon	1k	5	$\frac{1}{4}$W
R227	Carbon	680	5	$\frac{1}{4}$W
R228	Carbon	18k	5	$\frac{1}{4}$W
R229	Carbon	22kA.O.T.	5	$\frac{1}{4}$W
R230	Carbon	1k	5	$\frac{1}{4}$W
R231	Carbon	33kA.O.T.	5	$\frac{1}{4}$W
R232	Carbon	22k A.O.T.	5	$\frac{1}{4}$W
R233	Carbon	18k	5	$\frac{1}{4}$W
R234	Carbon	39k	5	$\frac{1}{4}$W
R235	Carbon	330	5	$\frac{1}{4}$W
R236	Carbon	4.7k	5	$\frac{1}{4}$W
R237	Carbon	180	5	$\frac{1}{4}$W
R238	Carbon	15k	5	$\frac{1}{4}$W
R239	Carbon	3.9k	5	$\frac{1}{4}$W
R240	Carbon	100	5	$\frac{1}{4}$W
R241	Carbon	10k	5	$\frac{1}{4}$W
R242	Carbon	3.9k	5	$\frac{1}{4}$W
R243	Carbon	2.2k	5	$\frac{1}{4}$W
R244	Carbon	15kA.O.T.	5	$\frac{1}{4}$W
R245	Carbon	15k	5	$\frac{1}{4}$W

Circuit Ref.	Description	Value	Tol. %	Rating
R246	Carbon	220k	5	$\frac{1}{4}$W
R247	Carbon	2.7k	5	$\frac{1}{4}$W
R248	Carbon	3.9k	5	$\frac{1}{4}$W
R249	Carbon	100k	5	$\frac{1}{4}$W
R250	Carbon	100	5	$\frac{1}{4}$W
R251	Carbon	39k	5	$\frac{1}{4}$W
R252	Carbon	6.8k A.O.T.	5	$\frac{1}{4}$W
R253	Carbon	470 A.O.T.	5	$\frac{1}{4}$W
R254	Metal Oxide	4.99k	1	$\frac{1}{4}$W
R256	Carbon	100k	5	$\frac{1}{4}$W
R257	Carbon	470	5	$\frac{1}{4}$W
RV1	Dual Gang Pot.	50k	2	
RV2	Pot. Linear	10k	2	
RV3	Pot. Linear	10k	10	
RV4	Pot. Linear	10k	10	
RV5	Pot. Linear	25k	10	
RV200	Pre-set Linear	1k		
RV201	Pre-set Linear	500		
RV202	Pre-set Linear	5k		
RV203	Pre-set Linear	2.5k		
RV204	Pre-set Linear	1k		

Circuit Ref.	Description	Value	Tol. %	Rating
RV205	Pre-set Linear	2.5k		
RV206	Pre-set Linear	5k		
RV207	Pre-set Linear	10k		
RV208	Pre-set Linear	1k		

Capacitors

C200	Trimmer	10-40p		
C201	Ceramic	15p	5	
C202	Ceramic	0.033		
C203	Ceramic	100p	10	
C204	Ceramic	200p	10	
C205	Ceramic	100p	10	
C206	Polystyrene	920p	1	30V
C207	Polystyrene	0.01	1	30V
C208	Polystyrene	0.1	1	30V
C209	Polystyrene	920p	1	30V
C210	Polystyrene	0.01	1	30V
C211	Polystyrene	0.1	1	30V
C212	Ceramic	10p	5	
C213	Electrolytic	10		25V
C214	Electrolytic	10		25V
C215	Electrolytic	10		25V
C216	Electrolytic	10		25V

Circuit Ref.	Description	Value	Tol. %	Rating
C217	Electrolytic	10		25V
C218	Electrolytic	10		25V
C219	Ceramic	100p	10	
C220	Electrolytic	10		25V
C221	Electrolytic	470		25V
C222	Electrolytic	150		16V
C223	Ceramic	0.003		
C224	Electrolytic	10		25V
C225	Electrolytic	10		25V
C226	Electrolytic	150		16V
C227	Electrolytic	22		25V
C228	Polyester	1	10	100V
C229	Polyester	1	10	100V
C230	Electrolytic	150		16V
C232	Electrolytic	10		25V
C233	Ceramic	0.001	20	

Semiconductors

D200	Mullard	OA91
D201	Mullard	OA91
VT200 to VT210	Texas	BC 183LA

Miscellaneous

XL200	Crystal Unit	10700 kHz

Circuit Ref	Description	Value	Tol. %	Rating
TH200	Thermistor	RA54		
TH201	Thermistor	VA1066S		
TH202	Thermistor	VA1066S		
TH203	Thermistor	VA1056S		
L200	Coil	A4-101490		
S5	Lever Switch	A4-104085		
S7	Toggle Switch			
S8	Toggle Switch			
S9	Function Switch	A3-101163		
S10	Toggle Switch			
LS	Speaker	75Ω		
SK1	BNC Bulkhead Socket			
SK2	BNC Bulkhead Socket			
SK3	BNC Bulkhead Socket			
SK4	BNC Bulkhead Socket			
SK5	BNC Bulkhead Jack			
SK6	BNC Bulkhead Jack			

6.3. ATTENUATOR

Circuit Ref.	Description	Value	Tol.%	Rating
Resistors				
R300	Metal Oxide	61.9	1	$\frac{1}{2}$W
R301	Metal Oxide	249	1	$\frac{1}{2}$W
R302	Metal Oxide	61.9	1	$\frac{1}{2}$W
R303	Metal Oxide	61.9	1	$\frac{1}{2}$W
R304	Metal Oxide	249	1	$\frac{1}{2}$W
R305	Metal Oxide	30.9	1	$\frac{1}{2}$W
R306	Metal Oxide	249	1	$\frac{1}{2}$W
R307	Metal Oxide	61.9	1	$\frac{1}{2}$W
R308	Metal Oxide	61.9	1	$\frac{1}{2}$W
R309	Metal Oxide	249	1	$\frac{1}{2}$W
R310	Metal Oxide	30.9	1	$\frac{1}{2}$W
R311	Metal Oxide	249	1	$\frac{1}{2}$W
R312	Metal Oxide	61.9	1	$\frac{1}{2}$W
R313	Metal Oxide	150	1	$\frac{1}{2}$W
R314	Metal Oxide	37.4	1	$\frac{1}{2}$W
R315	Metal Oxide	150	1	$\frac{1}{2}$W
R316	Metal Oxide	432	1	$\frac{1}{2}$W
R317	Metal Oxide	11.5	1	$\frac{1}{2}$W
R318	Metal Oxide	432	1	$\frac{1}{2}$W
R319	Metal Oxide	221	1	$\frac{1}{2}$W
R320	Metal Oxide	23.7	1	$\frac{1}{2}$W
R321	Metal Oxide	221	1	$\frac{1}{2}$W
R322	Metal Oxide	221	1	$\frac{1}{2}$W

Circuit Ref.	Description	Value	Tol. %	Rating
R323	Metal Oxide	23.7	1	$\frac{1}{2}$W
R324	Metal Oxide	221	1	$\frac{1}{2}$W
R325	Metal Oxide	95.3	1	$\frac{1}{2}$W
R326	Metal Oxide	71.5	1	$\frac{1}{2}$W
R327	Metal Oxide	95.3	1	$\frac{1}{2}$W

Capacitors

C300	Variable	3-12p
C301	Variable	3-12p

Miscellaneous

S300 to S315	Micro-switch Burgess V4T7/GP
or	
S300 to S315	Micro-switch Cherry ES63-10A
SK300	BNC Bulkhead Socket
SK301	BNC Bulkhead Socket

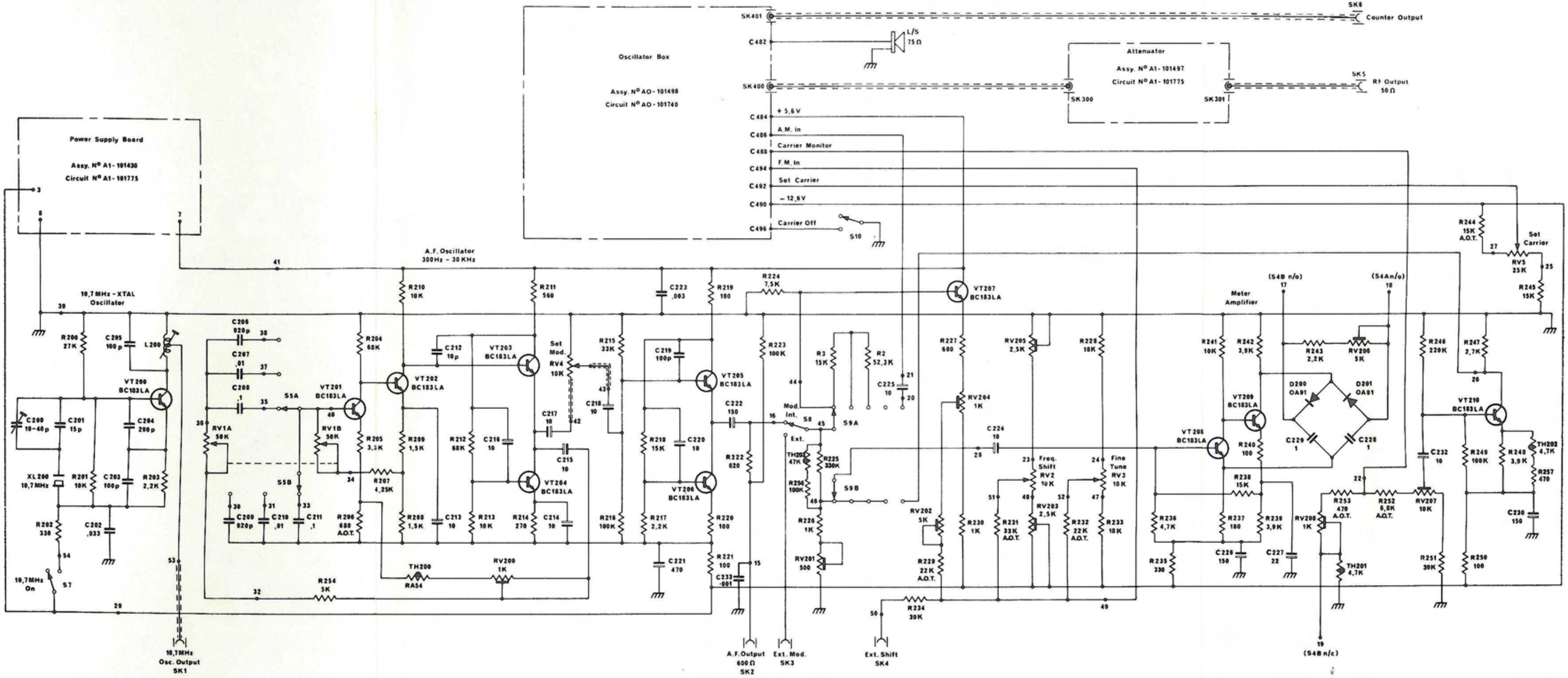
6.4 POWER SUPPLY BOARD AND ASSOCIATED CIRCUITRY

Circuit Ref.	Description	Value	Tol. %	Rating
Resistors				
R1	Wirewound	820	5	10W
R4	Metal Film	1M	1	$\frac{1}{4}$W
R100	Carbon	2.2k	10	$\frac{1}{2}$W
R101	Carbon	4.7k	10	$\frac{1}{2}$W
R102	Carbon	10k	10	$\frac{1}{2}$W
R103	Carbon	10k	10	$\frac{1}{2}$W
R104	Carbon	22k	10	$\frac{1}{2}$W
R105	Carbon	10k	10	$\frac{1}{2}$W
R106	Carbon	2.2k	10	$\frac{1}{2}$W
RV100	Pre-set Pot.	5k		
Capacitors				
C100	Electrolytic	150		100V
C101	Electrolytic	150		100V
C102	Electrolytic	1000		40V
C103	Electrolytic	100		25V
C104	Electrolytic	10		25V
C105	Ceramic	0.033		25V
C106	Electrolytic	100		40V
Semiconductors				
D100	Westinghouse S2M1			
D101	Westinghouse S2M1			
D102	Westinghouse S2M1			

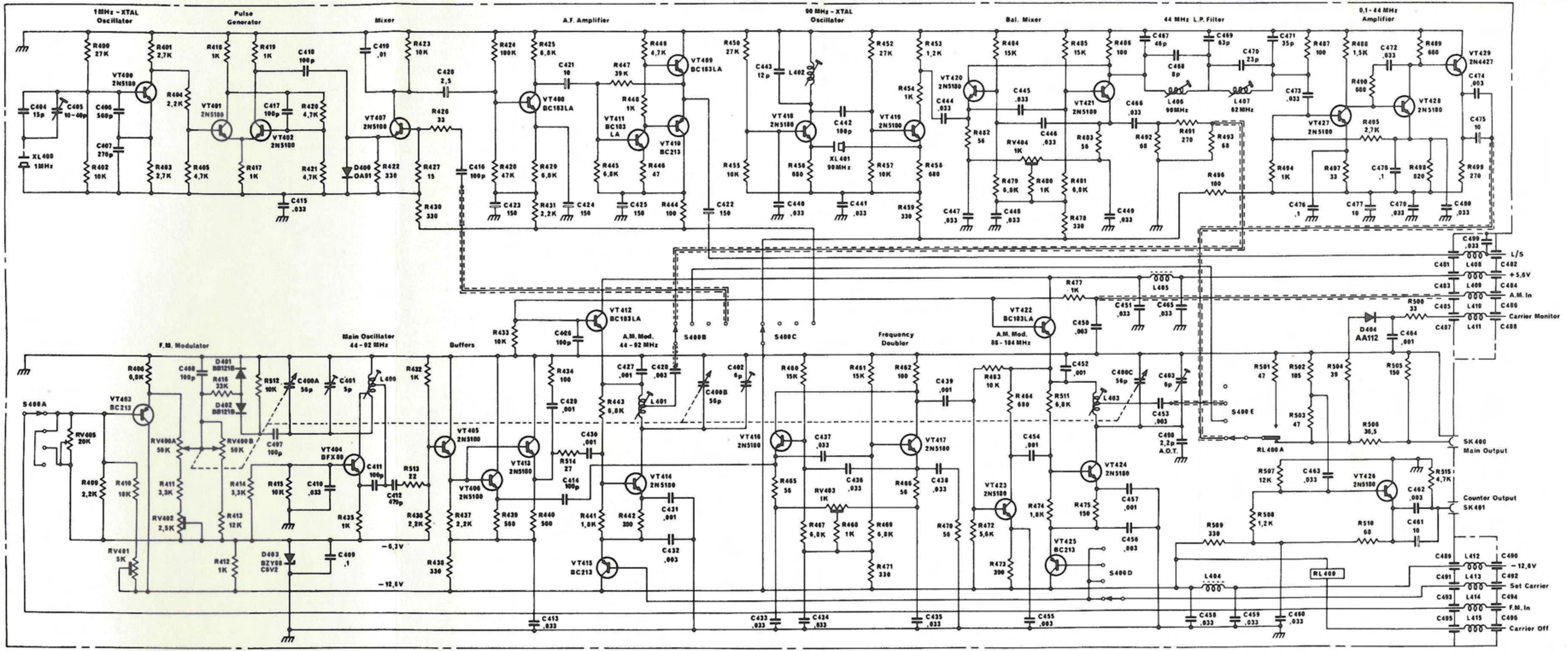
Circuit Ref.	Description	Value	Tol. %	Rating
D103	Mullard	BZY88-C6V2		
D104	Mullard	BZY88-C6V2		
C105	Westinghouse	S2M1		
VT100	R.C.A.	2N5296		
VT101	Texas	BC 183LA		
VT102	I.T.T.	BSY90		
VT103	Texas	BC183LA		
VT104	Texas	BC183LA		

Miscellaneous

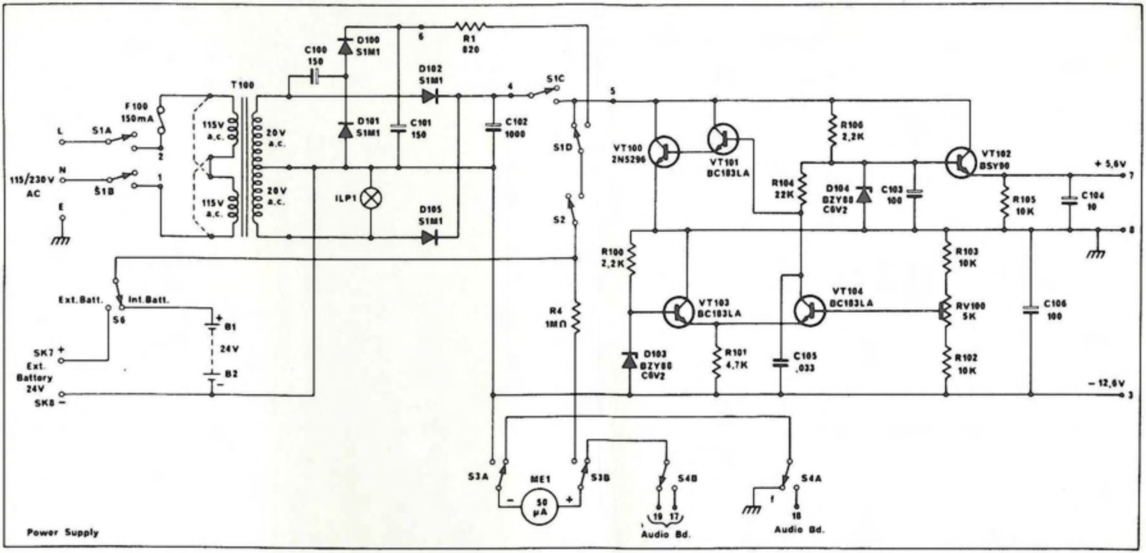
T100	Transformer	40/1024		
F100	Fuse	F286 150mA		
S1)	Combined Push-			
S2)	Button Switch			
S3)	Special.			
S4	Push-Button Switch			
S6	Slider Switch			
SK7	Terminal	L1726/1/Red		
SK8	Terminal	L1726/1/Black		
ME1	Meter	A4-101177		
B1	Battery Stack	10/400DK		
B2	Battery Stack	10/400DK		

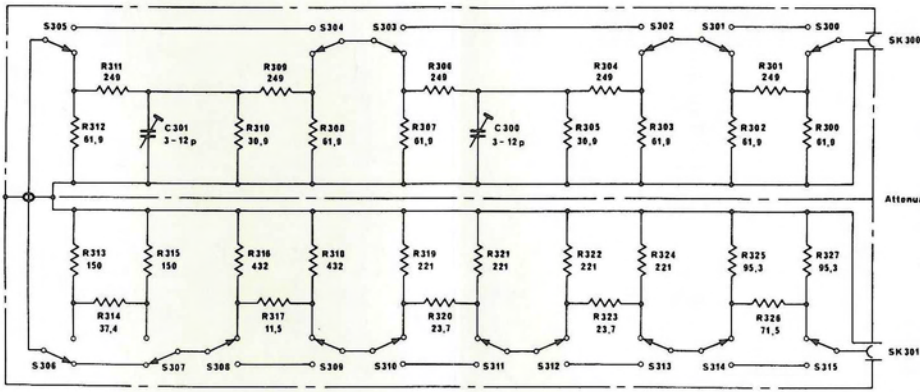


Circuit Diagram - Signal Generator type 1525
AO - 101682 - 07



Circuit Diagram – Oscillator Box
AO - 101740 - 05





Circuit Diagram – Attenuator and Power Supply Board

A1 - 101775 - 02