City & Guilds
Multiple choice question paper

Paper number	Examination	Monday
7650-003/004	**Radio Amateurs**	**11 May 1998**
Series	Paper	**18 30 - 20 45**
May 1998	**Written**	**2¼ hours**

You should have the following for this examination

this question book
two answer sheets
an HB pencil

use the attached Schedule to answer any appropriate questions

MC

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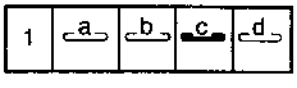
Read the following notes BEFORE you answer any questions.

- You MUST use an HB PENCIL to complete ALL parts of the answer sheet.
- Each question shows FOUR possible answers (lettered 'a', 'b', 'c', and 'd'), only ONE is correct.

  Decide which one is correct and mark your answer on the ANSWER SHEET with your HB pencil.

  For example if you decide 'c' is correct, mark your answer like this



  If you want to change your answer, cancel your first choice by filling in the lower half of the box like this

  Then mark the answer which you have now decided is correct.

- Any calculations or rough work can be done in this question book.
- Attempt all questions; if you find a question difficult, leave it and return to it later.

This paper contains 80 questions; answer them using the 'boxes' numbered 1 to 25 and 26 to 80 on separate answer sheets.

See next page

Part A

Licensing Conditions and Operating Procedures

Answer questions 1 to 25 on a separate answer sheet

PART A
LICENSING CONDITIONS AND OPERATING PROCEDURES

1 What are the necessary qualifications for obtaining an Amateur Radio Licence (A)?

a A pass in the Radio Amateurs Examination at any time.
b A pass in the Radio Amateurs Examination within the last year.
c A pass in the Radio Amateurs Examination and a pass in the Amateur Morse Test within the last year.
d A pass in the Radio Amateurs Examination and a pass in the Amateur Morse Test at any time.

2 The Amateur Radio Licence (A) states that the Station shall be used for the purpose of

a self-training in communication by wireless telegraphy, which use includes technical investigations
b sending or receiving news or messages of, or on behalf of, any social organisation
c sending messages in which the Licensee has no more than an indirect pecuniary interest
d communication only with other licensed users on the frequency bands specified in the first column of the Schedule.

3 If an Amateur Radio Licence (A) or (B) is held on behalf of a club, greetings messages may be sent by non-licensed persons provided that

a these messages are sent and received to and from stations in countries which have implemented CEPT Recommendation T/R 61-01
b each person sends only one such message to each station with which the station is in contact
c each greetings message does not exceed four minutes
d it is under the direct supervision of any holder of an Amateur Radio Licence (A) or (B).

4 In the 'Amateur Radio Licence (A) or (B) Terms, Provisions and Limitations Booklet BR68', wireless telegraphy means

a any permitted type of transmission
b Morse and data only
c Morse, RTTY, data, facsimile, SSTV only
d all types of transmission except telephony.

5 In an amateur call sign the Regional Secondary Locator U refers to

a Guernsey
b Isle of Man
c Wales
d Scotland.

6 The class of emission F1D refers to

a telephony using frequency modulation (f.m.)
b telephony using phase modulation (p.m.)
c packet/data using direct frequency shift keying of the carrier
d packet/data using frequency shift keyed audio tone.

7 The Amateur Radio Licence (A) authorises the Licensee to receive

a broadcasting stations of the classes of emission for which the station is licensed to transmit
b messages on police frequencies during a genuine emergency
c commercial stations using shared amateur bands
d transmissions in the Standard Frequency Service.

8 The Amateur Radio Licence states that to avoid causing interference the Licensee should conduct tests

a every 28 days
b every 30 minutes
c from time to time
d when instructed by authorised representatives of the Secretary of State.

9 If an amateur station is situated within 1 km of the boundary of an aerodrome, the height above ground level of the antenna and supporting mast must not exceed

a 15 m
b 20 m
c 25 m
d 30 m.

10 The Amateur Radio Licence (A) states that the apparatus comprised in the station should be designed, and constructed, and maintained and used so that its use does not cause any

a out of band emissions
b harmonics
c spurious emissions
d undue interference.

See next page

11 The Amateur Radio Licence (A) states that when operating under the Licence in countries which have implemented CEPT Recommendation T/R 61-01 the Licensee shall

a be a temporary visitor and non-resident in the host country
b be a permanent resident in the host country
c have been a resident in the host country for at least 2 months
d be a visitor to the host country for not more than 2 months.

12 When the station is operated at a Temporary Location the Licensee may use which one of the following suffixes?

a /A.
b /T.
c /MM.
d /P.

13 Which one of the following need NOT be recorded in the Log (except when the Station is in an Unattended Operation)?

a Dates of transmission.
b Specific frequencies.
c Initial calls.
d Power.

14 An amateur station may NOT be established in a

a vessel on an inland waterway
b motorised caravan
c public transport vehicle
d private light aeroplane.

15 In the case of a prolonged contact, an amateur in the United Kingdom should transmit the call sign at intervals not exceeding

a 10 minutes
b 15 minutes
c 20 minutes
d 30 minutes.

16 An absorption wavemeter for checking spurious emissions must

a have a dial calibrated to an accuracy of ± 1%
b have a frequency coverage extending up to at least the second harmonic
c always be checked against a crystal calibrator
d have a built-in amplifier to detect any very weak emissions.

17 Amateur Radio Licence holders may operate in the band 70.00–70.50 MHz at power levels not exceeding

a 26 dBW
b 22 dBW
c 20 dBW
d 15 dBW.

18 Which one of the following secondary allocations may only be used with the written consent of the Secretary of State?

a 24050–24150 MHz.
b 47000–47200 MHz.
c 75500–76000 MHz.
d 142000–144000 MHz.

19 Maximum power should be used only when

a transmitting Morse
b making a CQ call
c taking part in a contest
d communication is difficult.

20 The log of an amateur radio station

a must be kept securely away from any unauthorised person
b must only contain those details specifically called for in the licence
c can be a valuable aid to the operation of the station by logging all communications and observations in full
d must be retained at the station for at least one year.

21 The MAIN use of v.h.f. and u.h.f. repeaters is to

a increase the communications range of fixed stations
b provide emergency communications for user services
c increase the communications range of mobile stations
d provide a focal point for amateur communications.

22 What is the Q-code for 'I have nothing for you'?

a QSB.
b QRU.
c QSL.
d QSK.

23 Ignoring band plans may result in

a unnecessary interference between stations using different modes
b a letter from the Secretary of State
c confiscation of equipment
d a letter from the Secretary of the IARU.

24 The callsign G2UFO in phonetics is

a Germany 2 uncle fox oboe
b Germany 2 uncle foxtrot oscar
c golf 2 uniform fox oboe
d golf 2 uniform foxtrot oscar.

25 During a thunderstorm it is advisable to

a disconnect the antennas and unplug the radio and computing equipment
b inform other amateurs via the local repeater of the storm
c switch from the mains supply to a standby battery supply
d change to a higher frequency band to avoid the interference caused by the lightning.

See next page

Part B

Principles and Practice

Answer questions 26 to 80 on a separate answer sheet

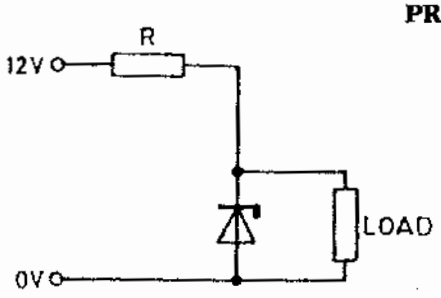


FIG. 2601

26 Refer to Fig. 2601. The maximum permitted current through the Zener diode is 50 mA, and through the load is 10 mA.
6 V are dropped across R.
What is a suitable value of R?

a 60 Ω.
b 100 Ω.
c 120 Ω.
d 1.2 kΩ.

27 A parallel resonant circuit is MOST selective if the coil has

a high resistance
b low resistance
c a resistance of $\sqrt{\frac{L}{C}}$
d a resistance of $\frac{L}{C}$.

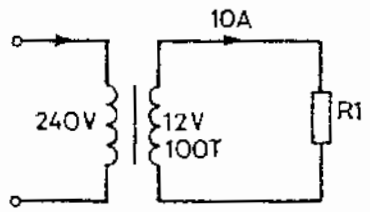


FIG. 0454

28 In Fig. 0454, if the current through the resistor R1 is 10 A, the current in the primary is

a 50 mA
b 500 mA
c 1 A
d 5 A.

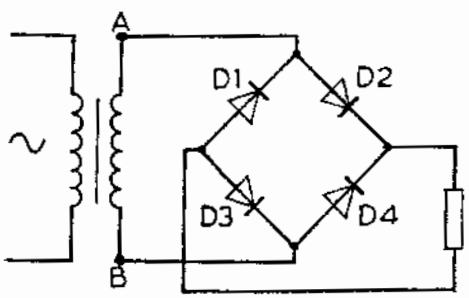


FIG. 2363

29 Refer to Fig. 2363. When point B is at peak positive voltage with respect to point A, the current is flowing through

a D4 and D1
b D3 and D2
c D2 and D1
d D1 and D3.

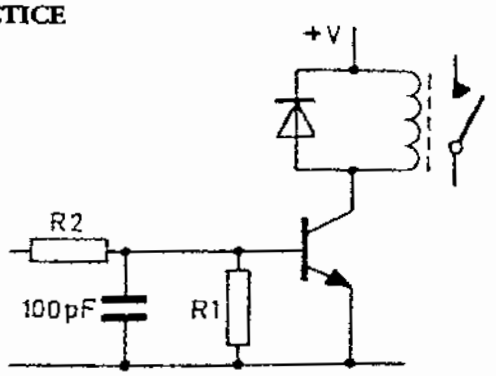


FIG. 2588

30 In Fig. 2588 the purpose of the resistor R1 is to

a increase the speed of the relay switching ON time
b reduce the current being drawn by the relay coil
c ensure the emitter voltage stays below the base voltage
d ensure the relay stays OFF with no input signal.

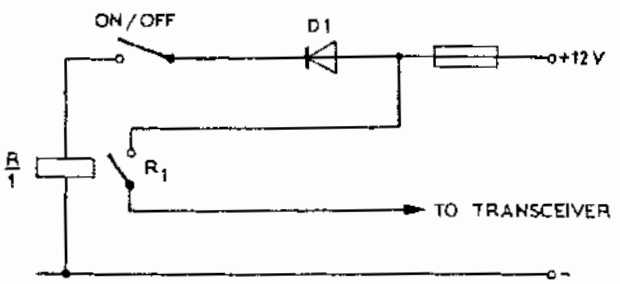


FIG. 0869

31 The purpose of the diode D1 in Fig. 0869 is to

a smooth the supply to the relay
b introduce a time delay into the operation of the relay
c prevent reverse polarity being applied
d discharge the relay coil when switched off.

32 The purpose of a pre-selector in a superheterodyne receiver is to

a match the antenna to the input of the mixer
b reduce radiation of the signal from the v.f.o.
c reduce the amplitude of out of band signals reaching the mixer
d select the frequency range of the v.f.o.

33 A superheterodyne receiver tuned to a c.w. signal at 3530 kHz with the local oscillator tuned to 3980 kHz and the b.f.o. tuned to 449.2 kHz produces an audio beat note of

a 449.2 Hz
b 530.0 Hz
c 800.0 Hz
d 980.0 Hz.

See next page

34 In an f.m. receiver, the audio signal is recovered from the r.f. envelope by

a a discriminator
b an integrator
c a differentiator
d a low pass filter.

35 An incoming signal suddenly increases in signal strength. The automatic gain control (a.g.c.) of a receiver will

a reduce the amplification of the receiver
b increase the amplification of the receiver
c produce positive feedback in the audio output stage
d increase the i.f. bandwidth.

36 Which stage of a receiver affects its frequency stability?

a Product detector.
b R.F. amplifier.
c Local oscillator.
d Ratio detector.

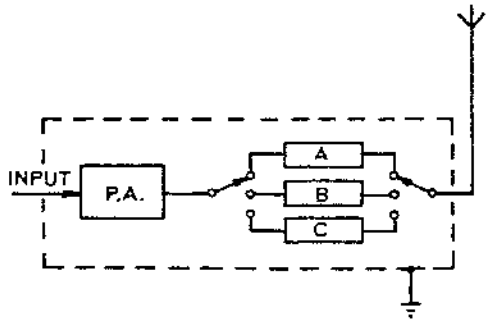


FIG. 1798

37 Fig. 1798 shows the power amplifier stage of an h.f. transmitter, for use on 3.5, 7 and 14 MHz. The p.a. output circuit consists of broadband transformers, followed by three switched units A, B and C. The purpose of A, B and C is to

a match the antenna to the feeder
b match the feeder to the transceiver
c tune the p.a.
d attenuate harmonics and spurious emissions.

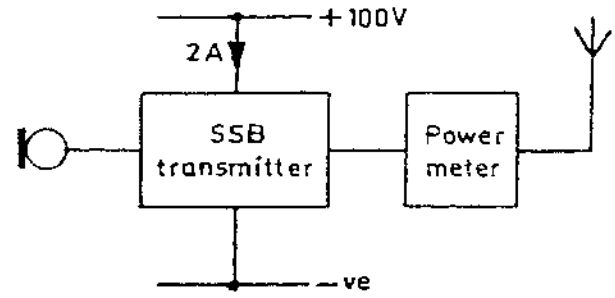


FIG. 2521

38 Refer to Fig. 2521. An s.s.b. (J3E) transmitter has a power meter connected in the antenna feeder. What will the meter indicate when the transmitter is keyed with no modulation applied?

a 200 W p.e.p.
b 100 W p.e.p.
c Full scale deflection.
d No deflection.

39 The purpose of the IF Shift control on an h.f. transceiver is to

a vary the frequency response of the microphone amplifier
b vary the frequency response of the receiver audio amplifier
c minimise interference from a station on an adjacent frequency
d adjust the gain of the i.f. amplifier stages.

40 A c.w. transmitter operating on 7 MHz causes interference on the 14 MHz band. The probable cause is

a wrongly adjusted frequency multiplier
b use of unbalanced feeder to a dipole antenna
c a high s.w.r.
d poor frequency stability of the oscillator.

41 Amplitude modulation of a c.w. carrier by frequencies in the range 300 to 15 000 Hz would

a provide high power output from the transmitter
b produce sidebands liable to cause interference
c cause distortion of the radiated signal
d cause harmonics in the transmitter r.f. output.

42 If the power amplifier of a transmitter is generating parasitic oscillations, these are likely to be

a harmonics of the oscillator frequency
b sub-harmonics of the oscillator frequency
c grouped around the oscillator frequency
d frequencies unconnected with the oscillator frequency.

43 If a transmitter is producing key clicks, these may be suppressed by

a screening the lead from the key to the transmitter
b inserting resistors
c connecting a resistor and capacitor in series across the key contacts
d connecting the key to the transmitter via a keying relay.

44 Overmodulation is undesirable because it

a reduces transmitter output power
b causes the power amplifier to exceed its maximum ratings
c results in the generation of spurious sidebands
d causes the signal to be less easily readable.

45 The purpose of a two-tone test is to

a check access to a repeater station
b occupy a free channel before transmission
c provide station identification
d check the operation of s.s.b. linear amplifiers.

46 Frequency chirp in a c.w. transmitter is often due to

a fast rise time of carrier envelope
b poor power supply regulation
c radio frequency feedback
d thermal expansion.

47 Transmitter outputs at 2 or 3 times the wanted frequency are called

a harmonics
b key clicks
c splatter
d spurious oscillations.

48 Splatter from a single sideband transmitter can often be minimised by reducing the

a microphone gain
b output standing wave ratio
c standing current in the power amplifier
d single sideband filter bandwidth.

49 A low pass filter following the power amplifier in a single sideband transmitter is designed to prevent

a distorted audio
b frequency drift
c splatter
d transmitter harmonics.

50 Which one of the following is an advantage of transistorised broadband linear PA stages in transmitters?

a Good harmonic suppression.
b Narrow bandwidth.
c Operator convenience.
d Good matching to all antennas.

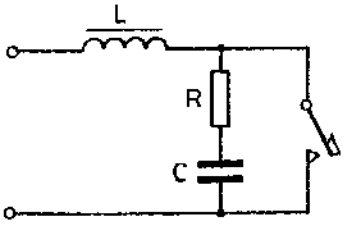


FIG. 0186

51 Fig. 0186 shows a filter used in the keying circuit of a low power c.w. transmitter. The purpose of the resistor in the circuit is to

a suppress the click when depressing the key
b stabilise the current so as to prevent chirp
c limit the discharge current from the capacitor
d suppress the click when the key is released.

52 Which one of the following may be used to measure accurately the frequency of a home-built transmitter that covers the whole of the 3.5 to 3.8 MHz band?

a S.W.R. meter.
b Digital frequency meter.
c Absorption-type frequency meter.
d Dip oscillator.

53 When using a crystal oscillator in conjunction with a receiver to ensure that a transmitter is operating within the limits of the 28.0 to 29.7 MHz band, the frequency of the crystal should be

a 10 kHz
b 100 kHz
c 500 kHz
d 1000 kHz.

54 Which one of the following actions is most likely to cause interference to electronic equipment?

a Operating with the minimum power to maintain contact.
b Using frequency modulation in preference to s.s.b.
c Using a coaxial cable to the antenna which is located as far from the electronic equipment as possible.
d Using a whip antenna to keep the signal as close as possible to the amateur station.

See next page

55 An amateur operator should

a only use class C linear amplifiers at their maximum rated power for s.s.b. operation
b maintain power levels at approximately 35 dBW in urban areas
c use full legal power at all times
d use only the power necessary to maintain reliable communication.

56 Digital circuitry containing a crystal clock oscillator is likely to generate

a an infinite number of harmonics of the fundamental clock frequency
b a very narrow band of interference
c sub-harmonic interference
d no interference.

57 A severe burst of interference lasting a few seconds disrupts reception on a radio station receiver every 10 to 15 minutes. Which one of the following is the most likely cause?

a A dummy load of the wrong resistance.
b A thermostat in a tropical fish tank.
c An electric induction motor in a hair dryer.
d A light dimmer switch.

58 A television receiver is experiencing interference on sound from a nearby amateur transmitter. With the volume control turned fully off, the breakthrough is still heard. Which stage of a receiver is being affected?

a Audio detector.
b I.F. amplifier.
c Audio output.
d R.F. tuner.

59 Which one of the following modes of emission is least likely to cause audio breakthrough to nearby audio equipment?

a Single sideband reduced carrier.
b Double sideband full carrier.
c Continuous wave telegraphy.
d Narrow band frequency modulation.

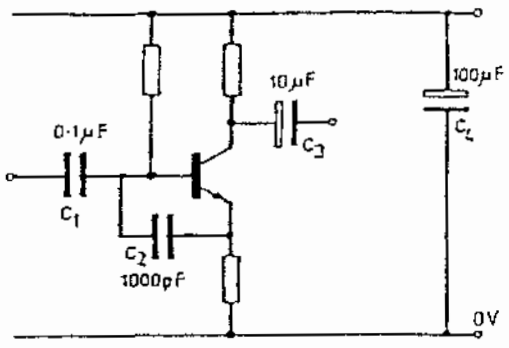


FIG. 1653

60 Fig. 1653 shows the pre-amplifier stage of an audio amplifier. Which capacitor is used as r.f. decoupling?

a C_1.
b C_2.
c C_3.
d C_4.

61 Which one of the circuits below represents a low pass filter?

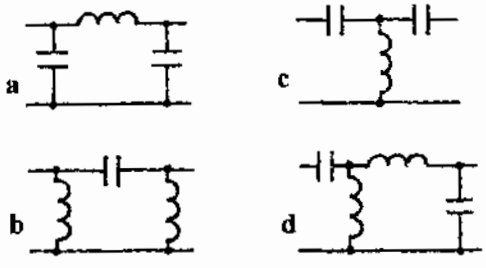


FIG. 1990

62 An amateur h.f. transmission is induced into the mains supply. What is the most likely cause?

a The antenna feeder is situated too close to the mains wiring.
b Incorrect mains fuses fitted at the transmitter input.
c The mains supply line impedance is too low.
d The transmitter is using a transformer with a copper screen between primary and secondary.

63 The earth connection for an amateur radio station should be to a copper earth spike using a cable which is

a made of a braided material
b a quarter of a wavelength long
c as short as possible
d routed alongside the mains supply lead.

64 A dipole antenna of an amateur transmitter fed with coaxial cable has been fitted with 1:1 balun at its centre. What advantage would this have?

a The transmitter signal would be boosted.
b Reception would be improved.
c The impedance match between the antenna and the transmitter would be improved.
d The prevention of r.f. currents flowing on the outer of the coaxial cable.

65 When investigating interference to a local television receiver what should be checked?

a The current rating of the receiver mains cable.
b The braid connection at the coaxial plug.
c The fuse rating of the mains plug for the receiver.
d The diagonal length across the receiver screen.

66 A neighbour has complained and logged the interference which he alleges to be from an amateur transmitter. What should be the first action taken by the amateur to establish the likely cause?

a Compare the amateur log with that of the complainant for any likely correlation.
b Ask the local office of the Radiocommunications Agency to investigate.
c Reduce transmitter power on all amateur bands.
d Fit filters to neighbour's equipment.

67 When installing an amateur radio transceiver in a car the 12 V supply should be

a connected directly to the battery with fuses in positive and negative wires
b plugged into the cigar lighter socket on the dashboard
c connected to the interior light circuit
d supplied from the engine management system.

68 Polarisation of a radio wave is defined by the

a angle at which a radio wave leaves an antenna
b degree to which a signal will be reflected from the D, E or F layers
c direction of the magnetic field
d direction of the electric field.

69 The troposphere is the region between the

a earth and the F2 layer
b earth and the D layer
c E layer and the F2 layer
d E layer and the F1 layer.

70 Which one of the following is mainly responsible for signal fading in h.f. radio communications?

a Cloud cover.
b Multi-path reception.
c A hole in the ozone layer.
d Mismatch in the antenna system.

71 The length of a quarter wave antenna for use on the 430–440 MHz band is approximately

a 140 cms
b 70 cms
c 35 cms
d 17.5 cms.

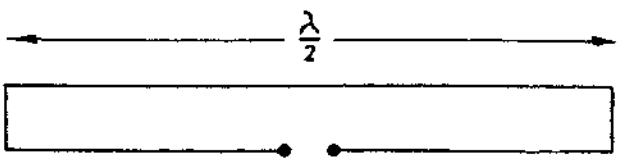


FIG. 2534

72 The most satisfactory feed arrangement for the antenna in Fig. 2534 is

a 50 Ω coaxial cable with 4:1 balun
b 75 Ω coaxial cable with 1:1 balun
c 300 Ω ribbon feeder
d 600 Ω open wire line.

73 The type of cable to be used when connecting a transmitter, a standing wave ratio meter, a low pass filter, and an antenna tuning unit is

a flat feeder
b single screened
c twin screened
d coaxial.

74 Which one of the following feeders introduces the lowest losses?

a 50 Ω coaxial cable.
b 75 Ω coaxial cable.
c 300 Ω ribbon feeder.
d 600 Ω open wire feeder.

See next page

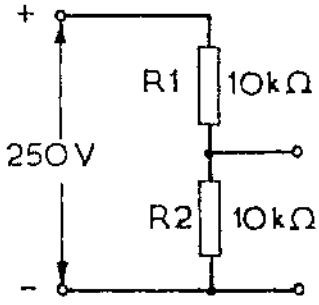


FIG. 0799

75 Refer to Fig. 0799. When using a multi-range meter to measure the voltage across R2, the most suitable range would be

a 0–100 V (a.c.)
b 0–100 V (d.c.)
c 0–250 V (a.c.)
d 0–250 V (d.c.).

76 A transmitter r.f. output power of 10 W is equivalent to

a 5 dBW
b 10 dBW
c 50 dBW
d 100 dBW.

77 The d.c. power input to the final stage in a transmitter is correctly measured by

a multiplying the applied voltage by the collector current
b multiplying the base current by the applied voltage
c multiplying the load impedance by the square of the collector current
d dividing the square of the applied voltage by the load impedance.

78 A digital frequency meter, whose internal crystal bas an accuracy of 2 parts in 10^6, is used to measure the frequency of a transmitter operating in the 14 MHz band. Which one of the following frequencies for the measured frequency is the most meaningful?

a 14.086 MHz.
b 14.0864 MHz.
c 14.08643 MHz.
d 14.086432 MHz.

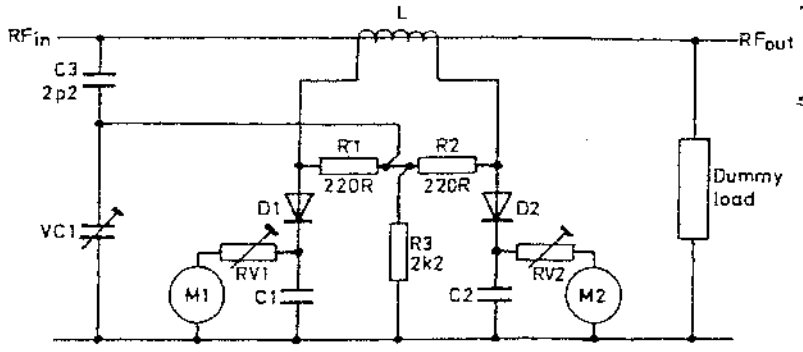


FIG. 2547

79 The function of the coil L in the circuit of the s.w.r. bridge shown in Fig. 2547 is to

a cancel the effect of any capacitance in the load circuit
b provide a sample of the output voltage
c provide a sample of the output current
d cancel the effect of any inductance in the load circuit.

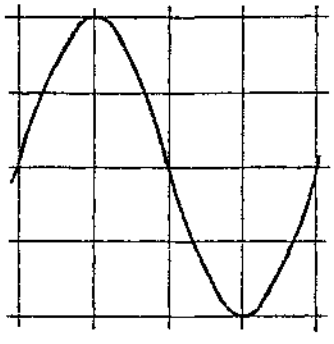


FIG. 2428

80 The oscilloscope trace of Fig. 2428 is obtained at the antenna socket of a transmitter operating into a 50 Ω dummy load. The oscilloscope amplitude control is set to 10 V per division. The peak r.f. output power from the transmitter is

a 2.5 W
b 4 W
c 8 W
d 14 W.

NOW GO BACK AND CHECK YOUR WORK BEFORE HANDING IN BOTH ANSWER SHEETS TO THE INVIGILATOR

● IMPORTANT —

Have you filled in your candidate number in PENCIL in the appropriate box on the answer sheets?

Have you filled in your answers in PENCIL in the appropriate boxes on the answer sheets?

