Recommendation T/R 61-02 (Chester 1990, revised in Nicosia 1994 and The Hague 2001)

HARMONISED AMATEUR RADIO EXAMINATION CERTIFICATES

Recommendation proposed by the Working Group "Radio Regulatory" (RR)

Text of the Recommendation adopted by the "European Radiocommunications Committee" (ERC):

INTRODUCTION

The Recommendation as approved in 1990 makes it possible for CEPT Administrations to issue a Harmonised Amateur Radio Examination Certificate (HAREC). The HAREC document shows proof of successfully passing an amateur radio examination which complies with the Examination Syllabus for HAREC level A or B. It facilitates the issuing of an individual licence to radio amateurs who stay in a country for a longer term than that mentioned in CEPT Recommendation T/R 61-01 (revision 1992). It also facilitates the issuing of an individual licence to a radio amateur returning to his native country showing the HAREC certificate issued by a foreign Administration.

The Recommendation as revised in 1994 has the aim to make it possible for non-CEPT countries to participate in this system. This revision is comparable to the extension of Recommendation T/R 61-01 to non-CEPT countries. The provisions for this extension are found in the new Annexes 3 and 4.

The original Recommendation had to be adapted slightly, but retains the applicability with CEPT as before. Annexes 3 and 4 of the original Recommendation are renumbered as resp. Annexes 5 and 6.

The revision of 2001 lowered the requirements for sending and receiving Morse code signals from 12 words per minute to 5 words per minute.

“The European Conference of Postal and Telecommunications Administrations,

considering

a) that the Radio Amateur Service is a service according to the ITU Radio Regulations article 1 and governed by the ITU Radio Regulations and national regulations,

b) that Administrations are responsible, in accordance with article 32 of the ITU Radio Regulations, for taking such measures as they judge necessary to verify the operational and technical qualifications of radio amateurs. Additionally radio amateurs shall not operate on frequencies below 30 MHz, unless they have proved their ability to send correctly by hand and to receive correctly by ear texts in Morse code signals,

c) that significant differences between the existing national regulations and licence conditions impede the radiocommunication activities by licensed radio amateurs outside their own country,

d) that in an international context the International Amateur Radio Union has supported the concept of the harmonisation of examination levels concerning the radio amateur service,

e) that CEPT Recommendation T/R 61-01 concerns only temporary use of portable and mobile radio stations in CEPT and non-CEPT countries,

f) that CEPT countries and non-CEPT countries are mutually seeking to harmonise regulations and matters also concerning non commercial and recreational activities of their citizens,

noting

a) that it is highly desirable to establish a common arrangement for radio amateurs who wish to use amateur radio stations in another country in which they are taking resident,

b) that a common approach can be found in spite of the great variety of classes of amateur licenses and examinations prevailing in the different CEPT countries and non-CEPT countries,

c) that on the basis of this commonality it is possible to designate which national classes of amateur licences and examinations are of a similar nature,

d) that in general good experience has been gained by the introduction of Recommendation T/R 61-01 although the classification of the various national licence classes into the two CEPT licence classes causes some difficulties regarding the minimum examination standard,

e) that despite the procedures of this Recommendation, Administrations have the right to require separate bilateral agreements when recognising the radio amateur certificates issued by foreign Administrations,

recommends

a) that CEPT Administrations issue a mutually recognised Harmonised Amateur Radio Examination Certificate to those passing the relevant national examinations corresponding to CEPT examination levels A or B (see Annex 1),

b) that Administrations, not being members of CEPT, accepting the provisions of this Recommendation, may apply for participation in accordance with the conditions laid down in Annexes 3 and 4,

c) that Administrations participating in this system agree, subject to their national laws and regulations to issue national licences corresponding to CEPT examination level A or B to foreign nationals who possesses a Harmonised Amateur Radio Examination Certificate issued by an Administration participating in this system and who stay in their country for a period longer than three months,

d) that licenses issued under c) will be renewed by the issuing Administration,

e) that any person who has obtained a Harmonised Amateur Radio Examination Certificate in any country participating in this system, has the right on return to his own country to obtain a licence there without having to pass a further examination,

f) that licences granted under this Recommendation shall cover the operation of fixed, mobile and portable radio amateur stations,

g) that the provisions of Recommendation T/R 61-01 shall continue to apply to radio amateurs making short stays in other CEPT countries and non-CEPT countries participating in the T/R 61-01 system."

ANNEX 1

CONDITIONS FOR ISSUE OF HARMONISED AMATEUR RADIO EXAMINATION CERTIFICATE (HAREC)

1.a A Harmonised Amateur Radio Examination Certificate will be issued by CEPT Administrations to persons who have passed a national examination for radio amateurs that meets the criteria set out in paragraph 2 below. (The national classes corresponding to such examinations are set out in Column 3 of Annex 2).

1.b A Harmonised Amateur Radio Examination Certificate will be issued by non-CEPT Administrations to persons who have passed a national examination for radio amateurs that meets the criteria set out in paragraph 2 below. (The national licences corresponding to such examinations are set out in Column 3 of Annex 4).

1.c A Harmonised Amateur Radio Examination Certificate will be issued, on request, by CEPT Administrations to radio amateurs who have passed the relevant national examination prior to the introduction of the harmonised examination syllabus.

2. **Criteria for national examinations**

National examinations which qualify the examinee for a CEPT examination level A certificate shall cover the subjects that a radio amateur may encounter in conducting tests with an amateur station and with its operation.
They must include at least:

i) ***Technical, operational and regulatory matters***
(see the examination syllabus Annex 6)

a) TECHNICAL CONTENT
1. Electrical, Magnetic and Radio Theory
2. Components
3. Circuits
4. Receivers
5. Transmitters
6. Antennas and Transmission Lines
7. Propagation
8. Measurements
9. Interference and Immunity
10. Safety

b) NATIONAL AND INTERNATIONAL OPERATING RULES AND PROCEDURES
1. Phonetic Alphabet
2. Q-code (as far as radio amateur traffic is concerned)
3. Operational Abbreviations
4. International Distress Signs, Amateur emergency traffic and natural disaster communications
5. The use and composition of call signs
6. The principles and purposes of the IARU band plans

c) NATIONAL AND INTERNATIONAL REGULATIONS RELEVANT TO THE RADIO AMATEUR AND RADIO AMATEUR SATELLITE SERVICE
1. ITU Radio Regulations
2. CEPT Regulations
3. National Laws and Regulations
3.1 Demonstrate knowledge of maintaining a log

ii) ***Sending and receiving Morse code signals***

a) CEPT examination level A
The examinee is required to demonstrate his ability to send and transcribe in Morse code, plain texts, number groups, punctuation and other signs:
- at a speed not less than 5 words per minute
- for a duration of at least 3 minutes
- with a maximum of 4 errors in reception
- with a maximum of 1 uncorrected and 4 corrected errors in transmission
- using a non-automatic Morse key

CEPT examination level A
A licence based on CEPT examination level A allows the use of all frequency bands allocated to the radio amateur service and authorised in the country where the amateur station is to be operated.

CEPT examination level B
A licence based on CEPT examination level B, not including the requirements for sending and receiving Morse code signals, allows the use of amateur stations in the frequency bands above 30 MHz which have been allocated to the amateur radio service and authorised in the country where the amateur station is to be operated.

National licences corresponding to CEPT examination levels
National licences corresponding to CEPT examination levels A and B are shown in Column 3 of Annex 2 and Annex 4.
Column 4 of Annex 2 and Annex 4 show the licences Administrations will issue to holders of the HAREC from other countries.

3. The HAREC document

The Harmonised Amateur Radio Examination Certificate shall contain at least the following information in the language of the country of issue as well as in English, French and German:

a) a statement to the effect that the holder has passed an examination, meeting the requirements for a CEPT examination level A or B certificate
b) the holder's name and date of birth
c) the CEPT examination level of certificate
d) the date of issue
e) the issuing authority.

This document should be in the form set out in Annex 5.

ANNEX 2

NATIONAL LICENCE CLASSES EQUIVALENT TO CEPT EXAMINATION LEVELS A AND B

2	3 National Licences equivalent to:		4 National Licences to be issued to holders of a HAREC issued by other Administrations	
Country	LEVEL A	LEVEL B	LEVEL A	LEVEL B
Albania				
Austria	1	2	1	2
Andorra				
Belgium	C	B	C	B
Bosnia and Herzegovina	A, B, C	D	A, B, C	D
Bulgaria	1	2	1	2
Croatia	A	B, C	A	C
Cyprus				
Czech Republic				
Denmark	A	C	A	C
Estonia	A[1], B[2]	C	A	C
Finland	Y	T	Y	T
France	E	C	E	C
Germany	1	2	1	2
Greece				
Hungary	RHB, RHC	URHB, URHB	RHB, RHC	URHB, URHC
Iceland	A, B, C	T	A, B, C	T
Ireland	A	B	A	B
Italy	general	limited	general	Limited
Latvia				
Liechtenstein	1, 2	3, 4	1, 2	3, 4
Lithuania	A	B	A	B
Luxembourg	A	B	A	B
Malta				
Moldova				
Monaco				
Netherlands	A	C	A	C
Norway	A	–	A	–
Poland	1	2	1	2
Portugal	A, B[3]	B[4]	A	B[4]
Romania				
Russian Federation				
San Marino				
Slovak Republic				
Slovenia	1	2, 3	1	3
Spain	A	B	A	B
Sweden	1	2	1	2
Switzerland	1, 2	3, 4	1, 2	3, 4
Turkey	A	B, C	A	B, C
Ukraine	1, 2	3	1, 2	3
United Kingdom	A	B	A	B
Vatican City				
former Yugoslav Republic of Macedonia	A	B	C	D

[1] Sending and receiving Morse code signals at a speed not less than 12 words per minute.
[2] Sending and receiving Morse code signals at a speed not less than 5 words per minute.
[3] With examination in Morse code telegraphy, manual transmission and reception.
[4] Without examination in Morse code telegraphy.

ANNEX 3

PARTICIPATION OF NON-CEPT ADMINISTRATIONS IN THE CEPT RADIO AMATEUR CERTIFICATE ACCORDING TO THIS RECOMMENDATION

1. APPLICATION

1.1. Administrations, not being members of CEPT, may apply for participation in the CEPT arrangements for Harmonised Amateur Radio Examination Certificates regulated by this Recommendation. Applications shall be sent to CEPT European Radiocommunications Office (ERO) in Copenhagen (address: Midtermolen 1, DK-2100 Copenhagen, Denmark).

The information needed to support an application shall include: a list of certificate classes in the country concerned; their privileges and the proposed CEPT examination level equivalents. Details of national examination syllabuses or documents describing the requirements of the national certificate classes and their privileges shall be enclosed with the application.

All the details mentioned above must be submitted in one of the official languages of the CEPT (English, French or German).

2 . PROCEDURES OF APPLICATIONS

2.1 The CEPT ERC shall check, based on this Recommendation, each application to determine the equivalence of the national licence classes to the harmonised CEPT classes and to assess the acceptability of any deviations from this Recommendation.

2.2 When the ERC has agreed to accept the participation of a non-CEPT country it notifies the applying Administration and arranges for the ERO to include the relevant details in Annex 4.

2.3 A CEPT Administration requiring a separate bilateral agreement to apply this Recommendation with a non-CEPT Administration, shall indicate this in a footnote in Annex 2.

2.4 A non-CEPT Administration requiring a separate bilateral agreement to apply this Recommendation with a CEPT Administration, shall include this in a footnote in Annex 4.

ANNEX 4

TABLE OF EQUIVALENCE BETWEEN NATIONAL CLASSES OF NON-CEPT COUNTRIES AND CEPT EXAMINATION LEVELS A and B

2	3 National Licences equivalent to:		4 National Licences to be issued to holders of a HAREC issued by other Administrations	
Country	**LEVEL A**	**LEVEL B**	**LEVEL A**	**LEVEL B**
Australia	Unrestricted	Intermediate Limited	Unrestricted	Limited
Israel	A, B	T, C	B	T
South Africa	A Unrestricted	A Restricted	A Unrestricted	A Restricted

ANNEX 5

HARMONISED AMATEUR RADIO EXAMINATION CERTIFICATE (HAREC)
based on CEPT Recommendation T/R 61-02

1. The issuing Administration or responsible issuing Authority

   _____

   of the country _____

   declares herewith that the holder of this certificate has successfully passed an amateur radio examination which fulfils the requirements laid down by the International Telecommunication Union (ITU). The passed examination is comparable with level ____ [1)], as indicated in CEPT Recommendation T/R 61-02 (HAREC). According to the amateur radio regulations of the country _____, the holder of this certificate is entitled to receive the national licence class ____ [1)].

   For the purpose of CEPT Recommendation T/R 61-01 this national licence class is classified as being CEPT licence class ____ [1)], as listed in Columns 4 respectively 5 of Appendix II of Recommendation T/R 61-01.

2. L'Administration ou l'Autorité compétente

   _____

   du pays _____

   certifie que le titulaire du présent certificat a réussi un examen de radioamateur conformément au règlement de l'Union internationale des télécommunications (UIT). L'épreuve en question correspond à la classification ____ [1)] de la Recommandation CEPT T/R 61-02 (HAREC). Conformément à la réglementation régissant les radioamateurs du pays _____, le titulaire du présent certificat est en droit d'obtenir la licence nationale de la catégorie ____ [1)].

   En application de la Recommandation CEPT T/R 61-01, la licence nationale de cette catégorie correspond à la classification ____ [1)], comme défini dans les colonnes 4 respectivement 5 de l'Annexe II de la Recommandation CEPT T/R 61-01.

3. Die ausstellende Verwaltung oder zuständige Behörde

   _____

   des Landes _____

   erklärt hiermit, dass der Inhaber dieser Bescheinigung eine Amateurfunkprüfung erfolgreich abgelegt hat, welche den Erfordernissen entspricht, wie sie von der Internationalen Fernmeldeunion (ITU) festgelegt sind. Die abgelegte Prüfung entspricht nach CEPT-Empfehlung T/R 61-02 (HAREC) der Stufe ____ [1)]. Gemäß Amateurfunkbe-stimmungen des Landes _____ hat der Inhaber dieser Bescheinigung Anspruch auf eine nationale Amateurfunkgenehmigung der Klasse ____ [1)].

   In Anwendung der CEPT-Empfehlung T/R 61-01 ist diese nationale Genehmigungsklasse als CEPT-Genehmigungsklasse ____ [1)] eingestuft, wie dies in Spalten 4 bzw. 5 von Anhang II der CEPT-Empfehlung T/R 61-01 aufgeführt ist.

4. Officials requiring information about this certificate should address their enquiries to the issuing national Authority or the issuing Administration as indicated above.

   Les autorités officielles désirant des informations sur ce document devront adresser leurs demandes à l'Autorité nationale compétente mentionnée ci-dessous.

   Behörden, die Auskünfte über diese Bescheinigung erhalten möchten, sollten ihre Anfragen an die genannte ausstellende nationale Behörde oder die ausstellende Verwaltung richten.

[1)] To fill in HAREC Level A, B

Address/Adresse/Anschrift

_____

_____

_____

_____

Telephone/Téléphone/Telefon: _____

Telex/Télex/Telex:_____

Telefax/Téléfax/Telefax: _____

Signature/
Signature/
Unterschrift/

Official stamp
Cachet officiel
Offizieller Stempel

ANNEX 6

EXAMINATION SYLLABUS FOR HAREC LEVEL A AND/OR B

INTRODUCTION

This syllabus has been produced for the guidance of the Administrations so that they may prepare their national [amateur radio] examinations for the CEPT Harmonised Amateur Radio Examination Certificate (HAREC).

The scope of the examination is limited to subjects relevant to tests and experiments with amateur stations conducted by radio amateurs. These include circuits and their diagrams; questions may relate to circuits using both integrated circuits and discreet components.

a) Where quantities are referred to, candidates should know the units in which these quantities are expressed, as well as the generally used multiples and sub-multiples of these units.

b) Candidates must be familiar with the compound of the symbols.

c) Candidates must know the following mathematical concepts and operations:
   - adding, subtracting, multiplying and dividing
   - fractions
   - powers of ten, exponentials
   - squaring
   - square roots
   - inverse values
   - interpretation of linear and non-linear graphs

d) Candidates must be familiar with the formulae used in this syllabus and be able to transpose them.

HARMONISED AMATEUR RADIO EXAMINATION CERTIFICATE (HAREC)

i) ***Technical, operational and regulatory matters***

a) TECHNICAL CONTENT

1. **ELECTRICAL, ELECTRO-MAGNETIC AND RADIO THEORY**
1.1 **Conductivity**
1.2 **Sources of electricity**
1.3 **Electric field**
1.4 **Magnetic field**
1.5 **Electromagnetic field**
1.6 **Sinusoidal signals**
1.7 **Non-sinusoidal signals**
1.8 **Modulated signals**
1.9 **Power and energy**

2. **COMPONENTS**
2.1 **Resistor**
2.2 **Capacitor**
2.3 **Coil**
2.4 **Transformers application and use**
2.5 **Diode**
2.6 **Transistor**
2.7 **Heat dissipation**
2.8 **Miscellaneous**

3. **CIRCUITS**
3.1 **Combination of components**
3.2 **Filter**
3.3 **Power supply**
3.4 **Amplifier**
3.5 **Detector**
3.6 **Oscillator**
3.7 **Phase Locked Loop [PLL]**

4. **RECEIVERS**
4.1 **Types**
4.2 **Block diagrams**
4.3 **Operation and function of the following stages**
4.4 **Receiver characteristics**

5. **TRANSMITTERS**
5.1 **Types**
5.2 **Block diagrams**
5.3 **Operation and function of the following stages**
5.4 **Transmitter characteristics**

6. **ANTENNAS AND TRANSMISSION LINES**
6.1 **Antenna types**
6.2 **Antenna characteristics**
6.3 **Transmission lines**

7. **PROPAGATION**

8. **MEASUREMENTS**
8.1 **Making measurements**
8.2 **Measuring instruments**

9. **INTERFERENCE AND IMMUNITY**
9.1 **Interference in electronic equipment**
9.2 **Cause of interference in electronic equipment**
9.3 **Measures against interference**

10. **ELECTRICAL SAFETY**

b) NATIONAL AND INTERNATIONAL OPERATING RULES AND PROCEDURES

1. **Phonetic Alphabet**
2. **Q-Code**
3. **Operational Abbreviations**
4. **International Distress Signs, Emergency traffic and natural disaster communication**
5. **Call signs**
6. **IARU band plans**

c) NATIONAL AND INTERNATIONAL REGULATIONS RELEVANT TO THE AMATEUR RADIO AND RADIO AMATEUR SATELLITE SERVICE

1. **ITU Radio Regulations**
2. **CEPT Regulations**
3. **National Laws, Regulations and Licence conditions**

ii) ***Sending and receiving Morse code signals***

a) TECHNICAL CONTENT

CHAPTER 1

1. ELECTRICAL, ELECTRO-MAGNETIC AND RADIO THEORY

1.1 Conductivity

- Conductor, semiconductor and insulator
- Current, voltage and resistance
- The units ampere, volt and ohm
- Ohm's Law [E=I.R]
- Kirchhoff's Laws
- Electric power [P=E.I]
- The unit watt
- Electric energy [W=P.t]
- The capacity of a battery [ampere-hour]

1.2 Sources of electricity

- Voltage source, source voltage [EMF], short circuit current, internal resistance and terminal voltage
- Series and parallel connection of voltage sources

1.3 Electric field

- Electric field strength
- The unit volt/metre
- Shielding of electric fields

1.4 Magnetic field

- Magnetic field surrounding live conductor
- Shielding of magnetic fields

1.5 Electromagnetic field

- Radio waves as electromagnetic waves
- Propagation velocity and its relation with frequency and wavelength $[\ v = f \cdot \lambda\ ]$
- Polarisation

1.6 Sinusoidal signals

- The graphic representation in time
- Instantaneous value, amplitude [E_{max}], effective [RMS] value $\left[U_{eff} = \frac{U_{max}}{\sqrt{2}} \right]$ and average value
- Period and duration of period
- Frequency
- The unit hertz
- Phase difference

1.7 Non-sinusoidal signals

- Audio signals
- Square wave
- The graphic representation in time
- D.C. voltage component, fundamental wave and higher harmonics

1.8 Modulated signals

- Amplitude modulation
- Phase modulation, frequency modulation and single-sideband modulation
- Frequency deviation and modulation index $\left[m = \frac{\Delta F}{f_{mod}} \right]$
- Carrier, sidebands and bandwidth
- Waveform

1.9 **Power and energy**

– The power of sinusoidal signals $\left[P = i^2 \cdot R \; ; \; P = \frac{u^2}{R} \; ; \; u = U_{eff} \; ; \; i = I_{eff} \right]$

– Power ratios corresponding to the following dB values: 0 dB, 3 dB, 6 dB, 10 dB and 20 dB [both positive and negative]

– The input/output power ratio in dB of series-connected amplifiers and/or attenuators

– Matching [maximum power transfer]

– The relation between power input and output and efficiency $\left[\eta = \frac{P_{uit}}{P_{in}} \cdot 100 \;\; \% \right]$

– Peak Envelope Power [p.e.p.]

CHAPTER 2

2. COMPONENTS

2.1 Resistor

– The unit ohm

– Resistance

– Current/voltage characteristic

– Power dissipation

– Positive and negative temperature coefficients [PTC and NTC]

2.2 Capacitor

– Capacitance

– The unit farad

– The relation between capacitance, dimensions and dielectric. (Qualitative treatment only)

– The reactance $\left[X_c = \frac{1}{2\pi f \cdot C} \right]$

– Phase relation between voltage and current

– Characteristics of fixed and variable capacitors: air, mica, plastic, ceramic and electrolytic capacitors

– Temperature coefficient

– Leakage current

2.3 Coil

– Self-inductance

– The unit henry

– The effect of number of turns, diameter, length and core material on inductance. (Qualitative treatment only)

– The reactance

– Phase relation [$X_L = 2\pi f \cdot L$] between current and voltage

– Q-factor

– Skin effect

– Losses in core materials

2.4 Transformers application and use

– Ideal transformer [$P_{prim} = P_{sec}$]

– The relation between turn ratio and:

  – voltage ratio $\left[\frac{u_{sec}}{u_{prim}} = \frac{n_{sec}}{n_{prim}} \right]$

  – current ratio $\left[\frac{i_{sec}}{i_{prim}} = \frac{n_{prim}}{n_{sec}} \right]$

  – impedance ratio. (Qualitative treatment only)

– Transformers

2.5 **Diode**

- Use and application of diodes:
  - Rectifier diode, zener diode, LED [light-emitting diode], voltage-variable and capacitor [varicap]
  - Reverse voltage and leakage current

2.6 **Transistor**

- PNP- and NPN-transistor
- Amplification factor
- Field-effect transistor [N channel and P channel, j-FET]
- The resistance between gate and source
- The transistor in the:
  - common emitter [source] circuit
  - common base [gate] circuit
  - common collector [drain] circuit
  - input and output impedances of the above circuits
  - method of biasing

2.7 **Miscellaneous**

- Simple thermionic device [valve]
- Simple digital circuits

CHAPTER 3

3. CIRCUITS

3.1 **Combination of components**

- Series and parallel circuits of resistors, coils, capacitors, transformers and diodes
- Current and voltage in these circuits
- Impedance of these circuits

3.2 **Filter**

- Series-tuned and parallel-tuned circuit:
  - Impedance
  - Frequency characteristic
  - Resonant frequency $\left[f = \frac{1}{2\pi \sqrt{L \cdot C}} \right]$
  - Quality factor of a tuned circuit $\left[Q = \frac{2\pi f \cdot L}{R_s} \; ; \; Q = \frac{R_p}{2\pi f \cdot L} \; ; \; Q = \frac{f_{res}}{B} \right]$
- Bandwidth
- Band-pass filter
- Low-pass, high-pass, band-pass and band-stop filters composed of passive elements
- Frequency response
- Pi filter and T filter
- Quartz crystal

3.3 **Power supply**

- Circuits for half-wave and full-wave rectification and the Bridge rectifier
- Smoothing circuits
- Stabilisation circuits in low voltage supplies

3.4 **Amplifier**

- Lf and hf amplifiers
- Amplification factor
- Amplitude/frequency characteristic and bandwidth
- Class A, A/B, B and C biasing
- Harmonics [non-linear distortion]

3.5 **Detector**
- AM detectors
- Diode detector
- Product detector
- FM detectors
- Slope detector
- Foster-Seeley discriminator
- CW/SSB detectors

3.6 **Oscillator**
- Factors affecting frequency and frequency stability conditions necessary for oscillation
- LC oscillator
- Crystal oscillator, overtone oscillator

3.7 **Phase Locked Loop [PLL]**
- Control loop with phase comparator circuit

CHAPTER 4

4. RECEIVERS

4.1 **Types**
- Single and double superheterodyne receiver

4.2 **Block diagrams**
- CW receiver [A1A]
- AM receiver [A3E]
- SSB receiver for suppressed carrier telephony [J3E]
- FM receiver [F3E]

4.3 **Operation and function of the following stages (Block diagram treatment only)**
- HF amplifier
- Oscillator [fixed and variable]
- Mixer
- Intermediate frequency amplifier
- Limiter
- Detector
- Beat frequency oscillator
- Crystal calibrator
- LF amplifier
- Automatic gain control
- S meter
- Squelch

4.4 **Receiver characteristics (simple description treatment)**
- Adjacent-channel
- Selectivity
- Sensitivity
- Stability
- Image frequency
- Intermodulation; cross modulation

CHAPTER 5

5. TRANSMITTERS

5.1 Types

- Transmitter with or without frequency translation
- Frequency multiplication

5.2 Block diagrams

- CW transmitter [A1A]
- SSB transmitter with suppressed carrier telephony [J3E]
- FM transmitter [F3E]

5.3 Operation and functions of the following stages (Block diagram treatment only)

- Mixer
- Oscillator
- Buffer
- Driver
- Frequency multiplier
- Power amplifier
- Output filter [pi-filter]
- Frequency modulator
- SSB modulator
- Phase modulator
- Crystal filter

5.4 Transmitter characteristics (simple description)

- Frequency stability
- RF-bandwidth
- Sidebands
- Audio-frequency range
- Non-linearity
- Output impedance
- Output power
- Efficiency
- Frequency deviation
- Modulation index
- CW key clicks and chirps
- Spurious hf radiations
- Cabinet radiations

CHAPTER 6

6. ANTENNAS AND TRANSMISSION LINES

6.1 Antenna types

- Centre fed half-wave antenna
- End fed half-wave antenna
- Folded dipole
- Quarter-wave vertical antenna [ground plane]
- Antenna with parasitic elements [Yagi]
- Parabolic antenna
- Trap dipole

6.2 **Antenna characteristics**

- Distribution of the current and voltage
- Impedance at the feed point
- Capacitive or inductive impedance of a non-resonant antenna
- Polarisation
- Antenna gain
- Effective radiated power [e.r.p.]
- Front-to-back ratio
- Horizontal and vertical radiation diagrams

6.3 **Transmission lines**

- Parallel conductor line
- Coaxial cable
- Waveguide
- Characteristic impedance [Z_0]
- Velocity factor
- Standing-wave ratio
- Losses
- Balun
- Quarter-wave line as impedance transformer [$Z_0^2=Z_{in}.Z_{out}$]
- Open and short-circuited lines as tuned circuits
- Antenna tuning units

CHAPTER 7

7. PROPAGATION

- Ionospheric layers
- Critical frequency
- Influence of the sun on the ionosphere
- Maximum Usable Frequency
- Ground wave and sky wave, angle of radiation and skip distance
- Fading
- Troposphere
- The influence of the height of antennas on the distance that can be covered [radio horizon]
- Temperature inversion
- Sporadic E-reflection
- Auroral reflection

CHAPTER 8

8. MEASUREMENTS

8.1 **Making measurements**

- Measurement of:
  - DC and AC voltages and currents
  - Measuring errors:
  - Influence of frequency
  - Influence of waveform
  - Influence of internal resistance of meters
- Resistance
- DC and RF power [average power, Peak Envelope Power]
- Voltage standing-wave ratio
- Waveform of the envelope of an RF signal
- Frequency
- Resonant frequency

8.2 **Measuring instruments**

Making measurements using:
- Moving-coil meter
- Multi-range meter
- Reflectometer bridge
- Frequency counter
- Absorption frequency meter
- Dip meter
- Oscilloscope

CHAPTER 9

9. INTERFERENCE AND IMMUNITY

9.1 **Interference in electronic equipment**
- Blocking
- Interference with the desired signal
- Intermodulation
- Detection in audio circuits

9.2 **Cause of interference in electronic equipment**
- Field strength of the transmitter
- Spurious radiation of the transmitter [parasitic radiation, harmonics]
- Undesired influence on the equipment:
  - via the antenna input [aerial voltage, input selectivity]
  - via other connected lines
  - by direct radiation

9.3 **Measures against interference**

Measures to prevent and eliminate interference effects:
- Filtering
- Decoupling
- Shielding

CHAPTER 10

10. SAFETY
- The human body
- Mains power supply
- High voltages
- Lightning

b) NATIONAL AND INTERNATIONAL OPERATING RULES AND PROCEDURES

CHAPTER 1

1. PHONETIC ALPHABET

A = Alpha	J = Juliet	S = Sierra
B = Bravo	K = Kilo	T = Tango
C = Charlie	L = Lima	U = Uniform
D = Delta	M = Mike	V = Victor
E = Echo	N = November	W = Whiskey
F = Foxtrot	O = Oscar	X = X-ray
G = Golf	P = Papa	Y = Yankee
H = Hotel	Q = Quebec	Z = Zulu
I = India	R = Romeo	

CHAPTER 2

2. Q-CODE

Code	Question	Answer
QRK	What is the readability of my signals?	The readability of your signals is ...
QRM	Are you being interfered with?	I am being interfered with
QRN	Are you troubled by static?	I am troubled by static
QRO	Shall I increase transmitter power?	Increase transmitter power
QRP	Shall I decrease transmitter power?	Decrease transmitter power
QRS	Shall I send more slowly?	Send more slowly
QRT	Shall I stop sending?	Stop sending
QRZ	Who is calling me?	You are being called by ...
QRV	Are you ready?	I am ready
QSB	Are my signals fading?	Your signals are fading.
QSL	Can you acknowledge receipt?	I am acknowledging receipt.
QSO	Can you communicate with ... direct?	I can communicate ... direct
QSY	Shall I change to transmission on another frequency?	Change transmission to another frequency
QRX	When will you call again?	I will call you again at ... hours on ... kHz (or MHz)
QTH	What is your position in latitude and longitude (or according to any other indication)?	My position is ... latitude, ... longitude (or according to any other indication)

CHAPTER 3

3. OPERATIONAL ABBREVIATIONS AS USED IN THE AMATEUR SERVICE

AR *) End of transmission
BK Signal used to interrupt a transmission in progress
CQ General call to all stations
CW Continuous wave
DE From, used to separate the call sign of the station called from that of the calling station
K Invitation to transmit
MSG Message
PSE Please
RST Readability, signal-strength, tone-report
R Received
RX Receiver
TX Transmitter
UR Your
VA *) End of work

*) In Morse transmitted as one coherent character.

CHAPTER 4

4. INTERNATIONAL DISTRESS SIGNS, EMERGENCY TRAFFIC AND NATURAL DISASTER COMMUNICATION

Distress signs:
- radiotelegraph ...---... [SOS]
- radiotelephone "MAYDAY"
- Resolution No. 640 of the Radio Regulations [ITU]
- International use of the amateur station in the event of national disasters

Frequency bands allocated to the amateur service

CHAPTER 5

5. **CALL SIGNS**
- Identification of the amateur station
- Use of the call signs
- Composition of call signs
- National prefixes

CHAPTER 6

6. **IARU BAND PLANS**
- IARU band plans
- Purposes

c) NATIONAL AND INTERNATIONAL REGULATIONS RELEVANT TO THE AMATEUR RADIO AND RADIO AMATEUR SATELLITE SERVICE

CHAPTER 1

1. **ITU RADIO REGULATIONS**
- Definition Amateur Service and Amateur Satellite Service
- Definition Amateur station
- Article 32 Radio Regulations
  - Status Amateur Service and Amateur Satellite Service
  - ITU Radio Regions

CHAPTER 2

2. **CEPT REGULATIONS**
- Recommendation T/R 61-01
- Temporary use of amateur stations in CEPT countries
- Temporary use of amateur stations in NON-CEPT countries which participate in the T/R 61-01 system

CHAPTER 3

3. **NATIONAL LAWS, REGULATIONS AND LICENCE CONDITIONS**
- National laws
- Regulations and licence conditions
- Demonstrate knowledge of maintaining a log
  - log keeping
  - purpose
  - recorded data

ii) ***Sending and receiving MORSE code signals***

The examinee is required to demonstrate his ability to send and transcribe in Morse code, plain texts, figure groups, punctuation and other signs:
- At a speed not less than 5 words per minute
- For a duration of at least 3 minutes
- With a maximum of 4 errors in reception
- With a maximum of 1 uncorrected and 4 corrected errors in transmission
- Using a non automatic Morse key