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SOME BASIC ELEMENTS OF ELECTRONICS AND RADIOELECTRONICS

Teaching aid

2017

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B12

Посібник складається з текстів за фахом «Електроніка і радіоелектроніка», граматичних і лексичних вправ. У посібнику також є словник найважливіших термінів з транскрипцією.

Для студентів I-II курсів, що вивчають радіоелектронні апарати.

Reviewers: Doctor of Science V.I. Ogar,
Doctor of Science, professor V.A. Krasnobayev

Babakova, L. M.

B12 Teaching-aid on speciality "Electronic and radioelectronic equipment" [Text]: teaching-aid/ L. M. Babakova. – Kharkiv: National aerospace university «Kharkiv aviation instiyute», 2017. – 73 p.

The teaching-aid book includes texts for electronic and radioelectronic students, grammar and lexical exercises. There is also a terminological vocabulary aimed at better students'understanding of the subject.

For I-II year students of the 5-th faculty specializing on electronic and radioelectronic engineering.

Bibliogr. : 8 names.

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PREFACE

The present teaching-aid is aimed to those roho study or are interested in electronic anf radioelectronic engenering. It is an attempt to complile a stydy guide on the very basic elements of the subject. The teaching-aid book is recommended as an aid in mastering the techniqul of translation of protessional technical texts and in developing oral skills of radio-technical practice.

It is intended for the students possessing pre-intermediate level of general English.

The texts were closen according to the subjects the students deal orith during the course and may by studied irrespectively of each other by the students of different groaps of the faculty.

The texts were selected from orarions foreign books and journals.

The teaching-aid consists of 14 texts writh notes and exercises. There are also some illustration to the texts.

The vocabulary writh the transcription at the end of the book is considered to make students easier work and better understand the subject.

THE NATURE OF ELECTRICITY

It is well known that all substances are made up of small particles, called molecules. The molecule is so small that it is invisible through the ordinary microscope. More recently, the molecule has been found to be made up of much smaller particles called atoms. The atom itself is made up of protons and electrons, which are minute masses with positive and negative charges of electricity. The first laws of electrical charges are as follows: like charges repel each other. Unlike charges attract each other. It is the attraction between the protons of the nucleus of the atom and the rotating electrons that holds the electrons in their orbit.

The mass of the proton is much greater than that of electron. This is why we find the electron doing all the moving; the proton is so heavy it remains stationary.

Scientists have told us that an electron can leave its atom and move over to the next atom. The stream of electrons moving along from atom to atom is called an electric current. The unit of current is called the ampere. An atom or molecule that has lost or gained an electrical charge is called an ion.

A material in which the electrons are loosely bound so that they flow readily from one atom to another is a good conductor (copper, silver, aluminum). A material in which the electrons are tightly bound is an insulator or non-conductors (wood, rubber, glass).

Two things are necessary to cause an electric current to flow: 1. a complete circuit or electrical pathway, and 2. a driving force, called an electromotive force (emf).

In the first case any conductor may be used, an electromotive force is usually supplied by a battery. A battery has a surplus of negative (-) charges on one plate; if a copper wire is run from the (-) charged plate of a battery around to the other plate, a current flows. If a small light bulb is placed in the circuit, it will light, giving evidence of[1] a current flow.

If we substituted a generator for the battery we should have a typical lighting circuit.

The extent to which a material resists the flow of an electric current is called resistance and is measured in ohms. Copper wire has a very low resistance but such substances as porcelain have extremely high resistance.

If we could look inside a wire carrying a direct current, we should see electrons moving from atom to atom in continuous flow.

However, if we could examine a wire carrying an alternating current, this would not be the case[2]. The electrons move in one direction, stop, move in the other direction, stop, and then repeat the process.

A complete cycle consists of two alternations. The amplitude of the wave represents the strength of the current or the number of electrons moving.

Notes to the Text

1. ... giving evidence of - ... свидетельствуя
2. This would not be the case – это было бы не так

Obligatory Word and Expression List

to be invisible	loosely (tightly) bound
particle	circuit
positive (negative) charge	electromotive force
to repel	wire
to attract	to give evidence of
an electric current	to measure
insulator	resistance
cycle	

Exercises

I. Read, translate and study the text

II. Answer the following questions to the texts

1. What are all substances made up of?
2. What is atom? What are the first laws of electrical charges?
3. Why does the proton remain stationary?
4. What holds the electrons in their orbit?
5. What represents an electric current?
6. What is an ion?
7. What is the difference between a conductor and an insulator?
8. What is called resistance?
9. How many alternations does a complete cycle consist of?

III. Put six questions to the text

IV. Give antonyms to the following:

positive, like charge, to attract, to loose, tightly bound, conductor, to leave, low, to do all the moving

V. Give English equivalents to the following words and use them in your own sentences:

состоять из, быть невидимым, замкнутая цепь, поместить, свидетельствовать, представлять собой, заставлять, чрезвычайно большое сопротивление, это не так, заменить что-то

VI. Give Russian equivalents to the following words in everyday life and in this text:

like, to attract, current, to supply, a plate, direct, wire, to gain

VII. Give other words of the same root and state what parts of speech they are:

to attract, to move, to loose, to flow, to resist, to alternate, electric

VII. Give the three forms of the following:

to repel, to find, to leave, to loose, to bind, to run, to attract

VIII. Translate from Russian into English:

1. Известно, что молекулы состоят из мельчайших частиц-атомов.
2. Каждый атом состоит из ядра и нескольких электронов.
3. Электрон представляет собой мельчайшую частицу с отрицательным зарядом.
4. Электроны вращаются вокруг ядра с большой скоростью.
5. Когда атом приобретает один или более электронов, он становится отрицательно заряженным ионом.

IX. Fill in the words omitted

1. All substances are known to be made up of small particles, called ...
2. The atom is made up of ... and ..., which are minute masses with positive and negative charges of electricity.
3. The proton is so heavy it remains ... .
4. The stream of electrons moving along from atom to atom is called an ... .
5. The only way to charge an atom positively is to take an .. away from it.
6. A material in which the electrons are tightly bound is
7. An electromotive force is usually supplied by a ... .
8. The abbreviation emf represents ... .

9. The resistance is measured in ... .

10. In a wire carrying a ... current electrons move from atom to atom in continuous flow.

XI. Insert prepositions:

1. All substances are known to be made up ... molecules. They are invisible... the ordinary microscope.
2. The nucleus consists... a number protons, each with a single positive charge and (except for hydrogen) one or more neutrons which have no charge.
3. Proton is minute mass ... positive charge.
4. An electric current represents the stream of electrons which move along... atom ... atom.
5. An electromotive force is usually supplied ... a battery.
6. If a small light bulb, placed in the circuit lights, it gives evidence ... a current flow.

XII. Choose the appropriate word from the brackets:

1. The electrons are minute masses with (positive, negative) charges.
2. Like charges (repel, attract) each other.
3. (the proton, the electron) does all the moving.
4. In a good conductor the electrons are (loosely, tightly) bound.
5. Rubber is a good (conductor, insulator).
6. Porcelain has extremely (high, low) resistance.
7. In a wire carrying a (direct, alternating) current electrons move in one direction, stop, move in the other direction, stop and then repeat the process.

XIII. Retell the text, using the new words from the text

IRCUITS

In an Electric Current, Electrons Do the Moving.

An electric current has been defined as a flow of electrons in a conductor. It is the electron which does the moving because it is only times as heavy as[1] the proton. Early experimenters in electricity thought the proton, or (+) charge, did the moving. In radio, however, and especially in the study of the vacuum tube, it is desirable to think of electric current in terms of electron flow. Therefore when we speak of (electron flow as electric current, we mean a flow of electrons from (-) to (+).

Ohm's Law. The two requirements for an electric current are an electromotive force, or driving force, and a. complete circuit. Let us make an experiment with an electric lamp. If we adjust[2] resistor so that there is more resistance in the circuit, the lamp becomes dimmer, showing that the current is smaller. The electromotive force of the battery has not been changed. Thus we see there is a relationship between current and resistance. This is not hard to understand; for when the resistance is increased, it is more difficult to push a current through it. If there is no more electromotive force available, then the current will of course become smaller. However, if two dry cells are used instead of one, the electromotive force will be increased, causing a large current again to flow.

Therefore we conclude that there is a relationship between current, resistance, and electromotive force. This relationship is known as Ohm's law.

Series Circuits. When a resistance is connected in series[3] with a lamp and battery, the lamp burns dimly because of the resistance. If we add another resistance, the lamp bums even more dimly, which tells us that in order to find resistance, the total resistance, we must add resistance to the resistance. When resistances follow one another as they do in our example, they are said to be in series. When resistances are connected in series in a circuit, the total resistance is found by adding the separate resistors. The total resistance $R = R_l + R_2$. Since the total resistance is greater than R_l, it is to be expected, according to Ohm's law, that the current should become smaller and the lamp burn more dimly.

Parallel Circuits. In radio circuits[4],we frequently find resistances connected in parallel[5], or running side by side[6].In such cases it is often necessary to find the total resistance Since the current will now have two paths to travel at the same time, it will require less electromotive force to cause the current to flow than it would if there were only one resistance. This circuit may be compared with two highways running side by side, which carry more traffic than one highway, Likewise, when two resistors are connected in parallel, the total resistance is always less than the resistance of the smaller of the resistors. To make computations, it is necessary to work out[7] a formula mathematically.

Sometimes we wish to know how easy it is for a current to flow through a circuit. This property of a circuit is called conductance and opposite, or reciprocal, of resistance. Thus I/R gives conductance, and the unit of measurement is the mho, which is ohm spelled backward.

A useful form of parallel resistors is the Wheatstone bridge[8], an important electrical instrument used for measuring resistance.

Notes to the Text

1. To be 1/1845 times as heavy as ... - быть в 1845 раз легче, чем
2. To adjust - устанавливать
3. To connect in series - соединять последовательно
4. Radio circuit - высокочастотный контур
5. To connect in parallel - соединять параллельно
6. Side by side - рядом

7. To work out - решить
8. Wheatstone bridge - мост сопротивления, мост Уитстона

Obligatory Word and Expression List

vacuum tube
electromotive force
complete circuit
resistor
to increase
to cause
to connect in series
dry
to connect in parallel
conductance
available
to make an experiment
to enable
property
to do the moving
to flow
computation
cell

Exercises

I. Read and study the text

II. Answer the following questions:

1. What is electric current?
2. Why does the electron do the moving?
3. How do electrons flow?
4. What are the requirements for an electric current?
5. What is a relationship between current, resistance and electromotive force?
6. What is a series circuit?
7. What is the total resistance equal to in series circuits?
8. When are resistances connected in parallel?
9. Where are resistances connected in parallel used?
10. What is the total resistance equal to in parallel circuits?
11. What is conductance?
12. What is the unit of resistance?
13. What is the unit of conductance?
14. For what purposes do we use the Wheatstone bridge?

III. Insert prepositions and adverbs:

1. Electrons flow …(«) ... (+) in a conductor.
2. If we take two dry cells instead … one we shall increase the electromotive force.

3. If resistors are connected ... series, ... order to find the total resistance we must add the separate resistors.
4. According ... Ohm's law the increasing of resistance causes the decreasing of the current.
5. If we have three resistors of different sizes, connected in series, we find that the electromotive force required to push the current .., each of the three resistances is proportional to the size ... each resistance.
6. In radio circuits resistances are connected ... parallel that is they run side ...side.
7. The unit of measurement of conductivity is Mho, that is Ohm spelled ... .
8. Sometimes it is desirable to know how easy it is ... a current to flow ... a circuit.
9. This property is exact opposite ... resistance.
10. The Wheatstone bridge is used ... measuring resistance.

IV. Give English equivalents to the following:

электрический ток, сопротивление, электродвижущая сила, делать вычисления, проводить опыт, обратная величина, единица измерения, соединить последовательно (параллельно), взаимосвязь, вызывать (быть причиной), проводимость, свойство

V. Make up sentences using the above words and expressions

VI. Identify the following symbols and terms: - , +, emf, ohm, mho

VII. Give the degrees of comparison of the following adjectives:

little	great
small	difficult
dim	hard

VIII. Give three forms of the following verbs: to think to find

to know	to call
to increase	to spell
to connect	to use
to say	to become

IX. Which choice or choices in the parentheses or brackets are correct for the following?

1. An electric current is the motion of (electrons, protons, atoms) through a conductor.
2. Speaking of electric flow as electric current, we mean a flow of electrons from (+) to (-) or from (-) to (+).
3. If we increase the resistance in a complete circuit the current becomes (smaller, larger).
4. If we use two dry cells instead of one, electromotive force will be (decreased, increased).
5. If we add another resistance to the series circuit the lamp burns (brightly, dimly).
6. In order to find the total resistance in series circuit we must (add, subtract, multiply, divide) the separate resistors.
7. The total resistance in parallel circuit is (less, more) than in separate resistor.
8. The unit of resistance is (mho,ohm).

X. Make two diagrams of electric circuits (in series, in parallel) and explain their use

XI. Give derivatives to the following: to desire electric to conduct dim

to resist relation
to computeto require

XII. Put 10 questions to the text

XIII. Retell the text, using words and expressions from the Obligatory Word List

XIV. Translate from Russian into English:

1. Электрический ток представляет собой поток электронов в проводнике.
2. Вначале экспериментаторы считали, что именно протон совершает движение.
3. Для возникновения электрического тока необходимы два условия: электродвижущая сила и замкнутая цепь.
4. Известно, что между электрическим током, сопротивлением и электродвижущей силой существует взаимосвязь.
5. Если мы увеличим сопротивление в цепи, то ток уменьшится.
6. При последовательном соединении сопротивления следуют одно за другим.
7. Общее сопротивление в последовательной цепи равно сумме отдельных сопротивлений, входящих в эту цепь.

8. В радиоконтурах часто используются сопротивления, соединенные параллельно.

9. Общее сопротивление в параллельной цепи всегда меньше самого меньшего сопротивления, входящего в эту цепь.

10. Величина, обратная сопротивлению, называется проводимостью.

11. Мост Уитстона представляет собой электрический прибор для измерения сопротивления.

WAVES

If we could look inside a wire carrying a direct current, we should see electrons moving from one atom to another in a continuous flow[1]. However, if we could examine a wire carrying 60-cycle alternating current, this would not be the case[2]. The electrons move in one direction, stop, move in the other direction, stop, and then repeat the pro-cess. They make no progress but merely move backward and forward, backward and forward, sixty round trips per second.

An alternating current is usually represented as the loop rising above the line representing the motion to the right, crossing the line representing no motion at all, falling below the line representing motion to the left. This is often called a sine curve[3] One loop[4] of the curve is called alternation[5]; a complete cycle[6] represents two alternations, i.e. a return to the starting point of the electrons; the amplitude of the wave represents the strength of the current or the number of electrons actually moving. The frequency of the alternating current is the number of complete cycles per second.

It is well known that in order to keep a current flowing, one must have an electromotive force[7]. This electremotive force (emf) also changes with the frequency exactly the same as the current does.

Sometimes, as when an alternating current is flowing through a coil of wire, the current is held back[8] while the voltage is allowed to surge ahead[9] In this case, the current is said to lag behind[10] the voltage or is out of phase[11] with the voltage. If a condenser is connected in a circuit, the current will be found to get ahead[12] of the voltage, or will lead the voltage, by a certain amount. The difference between the voltage and current at any particular instant in the circuit is called the phase angle[13].

This phase relationship[14] depends upon power factor[15]. The power is the product of voltage times amperage[16]. It is measured in watts. When the power is maximum the current and voltage are in phase, hut when the power is not a maximum, they are out of phase. So it is necessary to keep the power factor as high as possible.

SOUND WAVES

Sounds are produced by vibrations and are carried through the air by the bumping of molecules against each other. The motion of molecules is carried from one group to another so that the sound wave, or compression of molecules, travels through the air at about 340 m.per second[17].

Sound waves travel much faster in water, iron and steel.

The problem of measuring the velocity of sound is not a difficult one. But the intensity of a sound is a relative quantity[18] . For example, if the sound in an institute hall is ten times as great as the sound in a home, it is said that the institute hall sound is I bel louder than the sound in the home. The unit of relative intensity, the bel, is named after Alexander Graham Bell. Since the bel is a very large unit, it has been divided into ten parts, called decibels(db). Thus a decibel is 1/10 bel.

There are three factors that control the character of the sound:

1) its amplitude, or loudness - the height of the waves;
2) its frequency, or pitch - the number of vibrations per second;
3) its quality, or the number and strength of the over tones20 or harmonics present. The radio operators are particularly interested in sound in its connection with radio, especially at two points:

1) where the sound waves are changed into electric waves in the transmitting station, and;
2) where the radio waves axe changed back into sound waves at the receiving end.

At the transmitting stations the sound waves are converted into electric waves by means of different microphones (carbon, crystal ,velocity, dynamic - type, etc).

At the receiving end of the radio system the radio waves are changed back into sound waves. It is done by means of different headphones[21] or loudspeakers.

Notes to the Text

1. In a continuous flow - непрерывным потоком
2. This would not be the case - это было бы не так (дело обстояло бы иначе)
3. A sine curve - синусоида, синусоидальная кривая
4. Loop - виток, петля
5. Alternation - половина периода
6. Complete cycle - полный период
7. An electromotive force (emf) - электродвижущая сила(э.д.с)
8. Is held back - задерживается, замедляется
9. To surge ahead - здесь - усиливать (напряжение)

10. To lag behind - отставать от
11. Out of phase - не совпадают по фазе
12. To get ahead - опережать
13. Phase angle - фазовый угол
14. Phase relationship - соотношение фаз
15. Power factor - фактор мощности
16. The product of voltage times amperage - произведение напряжения на силу тока в амперах
17. At about 340 m.per second - со скоростью примерно 340 м/с.
18. A relative quantity - относительная величина
19. Pitch - высота тона
20. Overtones - обертоны, высшие гармоники
21. Headphones - головной телефон (наушники)

Obligatory Word and Expression List

wave	amplitude	measure	quantity
flow	frequency	to time	quality
loop	electromotive force	power factor	pitch
sine curve	to lag behind	sound	overtone
alternation	to get ahead	motion	to convert
velocity	out of phase	by means of	cycle

Exercises

I. Read and study the text

II. Answer the following questions:

1. What Is a direct current?
2. Do the electrons make any progress in a wire carrying alternating current?
3. How is the alternating current represented?
4. What does the loop above (below) the line represent?
5. That is called a sine line?
6. How many alternations does a complete cycle represent?
7. Is the strength of the current represented as the amplitude of the wave?
8. What is the frequency of the alternating current?
9. What must we have to keep a current flowing?
10. How does an emf change?
11. Is it possible to hold back the current?
12. When do we say that the current is out of phase with the voltage?
13. When does the current lead the voltage?

14. What is called the phase angle?
15. What does the phase relationship depend upon?
16. How is the power measured?
17. When are the current and voltage in phase?
18. Why is it necessary to keep the power factor high?
19. How are sound waves produced?
20. What is the velocity of sound?
21. Where do sound waves travel faster: in air, water or in steel?
22. Why do we say that the intensity of a sound is a relative quantity?
23. What is the unit of sound intensity?
24. What factors control the character of the sound?
25. Where are sound waves changed Into electric waves? By means of what devices is it done?
26. Where are radio waves changed back into sound waves?

III. Insert prepositions and adverbs:

1. The electrons move ... one atom ... another ... a continuous direct current flow.
2. ... an alternating current flow the electrons only move ... and... ... any progress.
3. The loop raising ... the line represents motion ... the right, falling ... the line represents motion ... the left.
4. The frequency ... the alternating current is the number ... cycles ... second.
5. The electromotive force changes ... the frequency.
6. The current is flowing ... the wire.
7. When the current lags ... the voltage it is said to be ... ... phase ... the voltage.
8. The phase relationship depends ... the power factor.
9. The power factor should be kept ... high ... possible.
10. Sounds are carried ... the air ... bumping molecules ... each other.
11. The bel is divided ... ten parts, called decibels.
12. The pitch is the number ... vibrations ... second.
13. The sound waves may be changed ... electric waves.
14. The changing ... waves is done ... means ... different devices.

IV. Give English equivalents to the following:

проволока, постоянный тон, переменный ток, движение влево (вправо), синусоида, частота, э.д.с., отставать, опережать, сдвиг по фазе, фактор мощности, скорость звука, относительная величина, громкость, высота тона, качество звука, изменять(ся), с помощью

V. Make up sentences using the above words and expression

VI. Give antonyms:

move	to fall	great
backward	left	to return
above	to lag behind	direct

VII.Give synonyms:

trip	to get ahead	amount
loop	great	particular
change	intensity	amplitude

VIII. Spell the words given in phonetic transcriptions:

[΄O:ltWnertiN]	[ig΄zxmin]	[Tru:]
["LltW'nezSqn]	[kWv]	['sWkzt]
[΄fri:kwqnsi]	['meZqd]	['sWtn]
[feiz]	['kxrqktq]	['kwOliti]

IX. Choose the appropriate word from the brackets:

1. In the (direct, alternating) current flow the electrons move only in one direction.
2. The curve (above, below) the line represents the notion of electrons to the left.
3. One loop of the sine curve is called (cycle, alternation).
4. The strength of the current is represented by the (amplitude, frequency).
5. When the power factor is (high, low) the current and voltage are out of phase.
6. Sound waves travel faster in (air, water).
7. The (loudness, pitch) depends on the number of vibrations per second.
8 .The sound waves are changed into electric waves in the (transmitting, receiving) stations.
9. The radio waves are converted into sound waves by means of the (microphone, loudspeaker).

X. Put five questions to the text

X. Retell the text using words and expressions from the Obligatory Word List

XII. Translate into English:

1. Постоянный ток можно представить в виде непрерывного потока электронов.
2. При переходе значения синусоиды на отрицательной области в область положительных значений электроны двигаются вправо.
3. Полный период состоит из двух полупериодов.
4. Амплитуда волны дает представление о силе тока.
5. Для того чтобы заставить электроны двигаться, необходима электродвижущая сила.
6. Ток может либо отставать от напряжения, либо опережать его. Это явление называется сдвигом по фазе.
7. Соотношение фаз зависит от фактора мощности. Чем больше мощность, тем меньше сдвиг по фазе.
8. Звук создается в результате колебаний молекул воздуха или другого вещества.
9. Интенсивность звука является относительной величиной.
10. Громкость звука характеризуется амплитудой или высотой волны, а высота тона - ее частотой.
11. Качество звука определяется количеством и силой гармоник.
12. Радиоинженер должен знать многие вопросы, связанные с акустикой.
13. На передающих станциях звуковые волны превращаются в электрические с помощью различных микрофонов.
14. Репродуктор приемной станции преобразует электрические волны в звуковые.
15. Существует много различных типов приемников и передатчиков.

RADIO WAVES

Radio waves, or electromagnetic impulses, travel through space with the speed of light. They differ from other electromagnetic waves only in frequency.

Radio waves are said to occupy the band of frequencies[1] from 10,000 per second up to 3,000,000,000 or more per second. The velocity of the wave equals its frequency multiplied by[2] its wavelength. It is approximately 300,000,000 meters per second. Frequencies of long radio waves are expressed in kilocycles per second[3]; frequencies of short and ultra-short radio waves, in megacycles per second[4].

Radio waves are sent out in all directions from a transmitting antenna. The part of the wave remaining close to the earth is called the ground wave[5]. After it has travelled a few hundred miles or less, its energy is absorbed by the earth and it can be heard no longer. Broadcasting frequencies are not absorbed so quickly as the high and ultra-high frequencies; therefore, the ground wave from broadcasting stations[6] can be heard at a greater distance than the ground wave from high-frequency stations[7].

The high-frequency waves (the sky waves)[8] strike the ionosphere and turn back toward the earth again« After being returned to the earth the wave is reflected upward and so on. It is called a multi-hop. The distance between these reflected waves is called a skip distance[10].

If the ground and sky wave reunite in phase[11], the signal will be strengthened. If, however, they reunite out of phase, they will conceal each other and silence will result. Such a phenomenon is called fading[12]. It occurs periodically with changing the ionosphere.

RADIO WAVE MODULATION

All waves are represented graphically by the sine curve. The height gives the amplitude (or strength) of the radio wave; the distance between Identical places on the curve, one wavelength[13]; and the number of waves per second, the frequency.

Modulation is thought to be the combination of a sound wave (low frequency) with a radio wave (high frequency).

When the sound wave affects the height or amplitude of the radio wave, the effect is known as amplitude modulation (AM)[14]. Most broadcasting and phone communication stations[15] employ amplitude modulation.

Another type of modulation, in which the sound waves after being converted into electric waves are used to affect the frequency of the radio waves being transmitted, is called frequency modulation (FM)[16] Frequency modulation is widely employed by many modern radio communication and radio broadcasting systems. Thismethod of modulation has many advantages in comparison with the usual amplitude modulation

There are following ranges[17] of the radio waves according to their lengths:

1.Long waves – waves with wavelengths between 30,000 and 3,000 metres (the respective frequencies are 10 to 100 kc) . In its infancy radio communication was based exclusively on long waves* The advantage of long waves is that they offer constant communication distance at any time of day and year.

2.Medium waves – waves with wavelengths between 3,000 and 200 meters (their respective frequencies are from 100 to 1,500 kc). This range is of the greatest interest for radio broadcasting and for many marine, aircraft and military radio telegraph stations. SOS[19] signals are sent on this wave range (the 600-metre wave) by ships in distress.

3.Short waves – waves with the wavelengths between 200 and 10 meters (1.5 - 50 mc). Lower frequencies of this range (1.5 - 6 mc) are referred to as[20] intermediate waves and are used for government telegraph and telephone radio communication. Short waves offer vast communication distances in comparison with other waves and demand relatively low transmitter power

4. Ultrashort waves occupy the following ranges: metre waves –from 10 to 1 metre (30-300 mc); decimetre waves - from 100 to 10 cm (300-3,000 mc); centimetre waves - from 10 to 1 cm (3,000-30,000mc); millimetre waves – from 10 to 1 mm (30,000-300,000 mc) Waves shorter than 30 cm are sometimes referred to as microwaves.

In some countries the wavelengths are classified as follows:

V.H.F. – very high frequency (metre waves) U.H.F. – ultra-high frequency (decimetre waves) S.H.F. – scper-high frequency (centimetre waves) H.H.F. – hyper-high frequency (millimetre waves)

Microwaves are used in communication, radiolocation and navigation aids. A vast number of radio-stations can operate simultaneously in the ultra-short wave range without mutual interference[21]. These waves are the only suitable for the transmission of television programmes.

Notes to the Text

1. Band of frequencies – полоса частот, диапазон
2. Multiplied by – умноженный на
3. Kilocycles per second – килогерц
4. Megacycles per second – мегагерц, 10^6 герц
5. Ground waves - поверхностные волны, прямые волны
6. Broadcasting stations – радиовещательные станции
7. High-frequency stations – высокочастотные радиостанции
8. The sky-waves – пространственные волны, небесные (ионосферные) волны
9. Amultihop – многократное отражение волн от ионосферы
10. A hop - одно отражение (волны от ионосферы)
11. A skip – прыжок, скачок a skip distance - расстояние скачка
12. Reunite in phase - воссоединяется по фазе
13. reunite out of phase - не воссоединяются по фазе
14. Fading – затухание
15. Wavelength - длина волны
16. Amplitude modulation (AM) - амплитудная модуляция
17. Broadcasting and phone communication stations - станции радиовещания и телефонной связи
18. Frequency modulation (FM) - частотная модуляция
19. Range - зона, полоса, диапазон; дальность, расстояние
20. In its infancy - в первое время, на ранней стадии развития
21. SOS "транскрипция" - сигнал бедствия СОС
22. Are referred to as - здесь - называется
23. Without mutual interference - не мешая друг другу, без взаимной интерференции

24. Are the only ones - являются единственным видом волн

Obligatory Word and Expression List

band of frequencies
to multiply
kilocycle
megacycle
ground wave
sky waves
radio broadcasting
to strike
multihop
skip distance
to reunite in(out)of phase
wavelength
radio communication
as follows
range
medium waves
short waves
ultra-short wave
are referred to as
interference
long waves

Exercises

I. Read and study the text

II. Answer the following questions:

1. That is the speed of radio wave travel?
2. How do radio waves differ from the other e.m. waves?
3. What band of frequencies do radio waves occupy?
4. In what terms are frequencies of radio waves expressed?
5. What is the ground wave (the sky wave)?
6. What is called a multihop?
7. What distance do we call a skip distance?
8. When does fading occur?
9. How are waves represented graphically?
10. Is it possible to affect the height of the radio wave?
11. What is the difference between amplitude modulation and frequency modulation?
12. Where is frequency modulation employed?
13. How are radio waves classified?
14. What is the advantage of long waves?
15. Where is the medium waves range employed?
16. When is a SOS signal sent?
17. Where are frequencies of intermediate waves range used?
18. What waves are used in TV?

Ill. Insert prepositions and adverbs:

1. Radio waves travel ... space ... the speed ... light.
2. Frequencies are expressed ... kilocycles and megacycles ... second.

3. The ground waves are close ... the earth.
4. The energy ... the wave is absorbed ... the ground.
5. Radio waves are sent ... broadcasting stations.
6. ... the ionosphere, the sky waves travel ... ... the earth and then they are reflected ... .
7. The skip distance lies ... reflected waves.
8. The ground and sky waves can reunite ... phase or ... ... phase.
9. Fading takes place ... changing the ionosphere.
10. The wavelength is a distance ... identical places ... the curve.
11. Sound waves may be converted ... electric waves.
12. Radio waves are classified ... ... their lengths.
13. Aircraft signals are mainly sent ... the medium wave range.
14. Many stations operate ... mutual Interference.
15. Ultra-short waves are used ... transmitting TV programs.

IV. Supply English equivalents for the following:

полоса частот, длина волны, УКВ, поверхностная волна, пространственная волна, станции ВЧ, ударять(ся), скачок. затухание,расстояние, в сравнении с, диапазон волн, промчастота, классифицируются следующим образом, одновременно, относительно малая (большая) энергия

V. Маке up sentences using the above words and expressions

VI. Speak about classifications of wavelengths in our country and in other countries

VII. Put ten questions to the text

VIII. Explain in English the meaning of the following: ground waves fading

sky waves	amplitude modulation
skip distance	frequency modulation
in (out) of phase	radio wave ranges
is (are) referred to	as

IX. Compose sentences using the words and phrases:

1. (frequency, radio waves, to express, kilocycles, in).
2. (electromagnetic waves, to sent, all, in, direction).
3. (modulation, of, with, to think, to be, the combination of, sound wave, radio wave).

4. (for, frequency modulation, to employ, in, broadcasting, radio communication).
5. (there, to be, some, of, ranges, wavelength).

X. Choose the appropriate word from the brackets:

1. Frequencies of (long, short) radio waves are expressed in kilocycles per second.
2. The electromagnetic waves are seat out from a (receiving, transmitting) antenna.
3. The broadcasting station signals can be heard at a (lesser, greater) distance than the high-frequency station signals.
4. The signal is strengthened when the ground and sky wave reunite (in phase, out of phase).
5. When the sound wave affects the (number, height) of radio waves, the effect is known as amplitude modulation.

XI. Retell the text using words and expressions from the Obligatory Word List

XII. Translate into English:

1. Известно, что радиоволны распространяются со скоростью света.
2. Существуют пространственные и поверхностные радиоволны.
3. При изменении структуры ионосферы часто возникает явление, называемое затуханием.
4. Частота радиоволн определяется количеством периодов в секунду.
5. Амплитудной модуляцией называется изменение силы радиоволн.
6. Оба вида модуляции широко используются в системах радиосвязи и радиовещания.
7. В соответствии с длиной радиоволны делятся на несколько диапазонов.
8. Преимущество длинных волн в том, что их можно использовать в любое время и при любой погоде.
9. Многие морские, авиационные и другие радиостанции работают на диапазоне средних волн.
10. На диапазоне УКВ могут работать одновременно несколько станций, не мешая друг другу.

PROPAGATION OF RADIO WAVES

Propagation Characteristics.

The, propagation characteristics of a radio wave depend primarily upon the frequency. The following paragraphs summarize the important v characteristics of each frequency band[1].

1.VLF - very low frequency (10 to 30 kc)[2] waves are characterized by very low ground attenuation[3] and very good reflection of sky-wave signals[4]. These frequencies are therefore useful for very long range communication systems. The antenna structures are usually very large and expensive The atmospheric absorption at these frequencies is very small. Propagation is affected by sunspots and magnetic storms. Daytime ranges[5] of thousands of miles are possible at these frequencies.

2. LF- low frequency (30 to 300 kc). In this region the ground-wave attenuation[6] is increased. At the high-frequency end of the band the sky absorption is greatly increased in the daytime. This results in a reduction in the daytime range to several hundred miles under unfavorable circumstances; however, longer-distance sky-wave transmission is possible. Low-frequency antenna structures can be more efficient than vlf antennas, which partially compensates for the increased ground-wave attenuation.

3. MF- medium frequencies (300 to 3 000 kc) include the broadcast range of 500 to 3500 kc. Antenna systems are usually designed to provide good ground-wave coverage[7] in the region of interest. Coverage can extend for a distance of approximately 100 miles from the antenna. Beyond this limit sky-wave coverage[8] is possible at night.

4. HF - high frequencies (3 to 30 mc)[9]. High-frequency propagation is characterized by very short ground-wave coverage. Sky-wave transmission is used exclusively long-range communication. To achieve the best sky-wave transmission between two points the frequency must be carefully selected. The optimum frequency will vary with time and ionosphere conditions.

5.VHF - very high frequencies (30 to 300 Mc). In general, frequencies above 30 MC are not reflected from the ionosphere and sky-wave transmission is not possible. Ground-wave coverage is affected by refraction and reflection in the troposphere. Atmospheric absorption is very small.

6. UHF - ultra high frequencies (300 to 3,000 Mc). In this frequency band atmospheric effects become important. In general, except for certain frequencies, the atmospheric absorption increases with frequency. The atmosphere refracts radio waves making "line of sight" transmission[10] beyond the optical horizon possible.

The maximum line of sight range[11] depends upon antenna height as follows: $D \cong \sqrt{2H_t} + \sqrt{2H_r}$[12] statue miles for $D \gg H_t, H_r$[13] . Where H_t, H_r = heights of transmitter antenna and receiving antenna, respectively, ft. Equation takes into consideration the effect of refraction in the earth's atmosphere increasing the line of sight transmission beyond the optical horizon.

7. S H F - superhigh frequencies (3,000 to 300,000 Mc) extend to the practical upper limit of reliable propagation over an appreciable distance. At frequencies in excess of[14] 10,000 Mc, attenuation due to [15] precipitation becomes very pronounced. Very directive antenna systems can be designed at these short wavelengths.

Scatter Propagation[16]. Recent investigations in the field of beyond-the-horizon propagation have shown that ionospheric scattering from the lower E layer permits the design of practical communication systems in the frequency range from 25 to approximately 60 Mc ever distances from 600 to 1,200 miles. In addition, tropospheric scattering permits the design of practical communication systems over the frequency band of 100 to 10,000 Mc at distances of up to a few hundred miles beyond the horizon.

Notes to the Text

1. Frequency band – зд. диапазон (полоса) частот
2. 30 Kc - 30 Kilo-cycles per second – 30 килогерц (кГц)
3. Ground attenuation – затухание поверхностной волны
4. Sky-wave signal – сигнал пространственной волны
5. Daytime range – расстояние передачи в дневное время
6. Ground-wave attenuation – затухание поверхностной волны
7. Ground-wave coverage – дальность передачи поверхностной волны
8. Sky-wave coverage – дальность передачи волны в пространстве
9. 30 MC - 30 mega-cycles per second – 30 мегагерц (МГц)
10. Line of sight transmission – передача в пределах прямой видимости
11. Line of sight range – дальность прямой видимости
12. $D \cong \sqrt{2H_t} + \sqrt{2H_r}$ – D is approximately equal to the square root of 2H sub t plus the square root of 2H sub r
13. $D \gg H_t, H_r$ – D is much greater than H_t, H_r
14. In excess of – більше, чем
15. Due to - благодаря (чему-либо)
16. Scatter propagation – рассеянное распространение радиоволн

Obligatory Word and Expression List

propagation	coverage
ground attenuation	low frequency
equation	to take into consideration
reflection	medium frequency
sky-wave signal	superhigh frequency
high frequency	scatter propagation
absorption	ultra high frequency
sky-wave transmission	refraction

Exercises

I. Read, translate and study the text

II. Put 5 questions to the text

III. Answer the following questions:

1. Upon what does the propagation of radio waves depend?
2. What frequencies are useful for very long-range communication systems?
3. What is the atmospheric absorption at very low frequency?
4. At what frequency is the propagation affected by sun-spots and magnetic storms?
5. How does the efficiency of antenna structures vary with the increasing of frequency?
6. Why is sky-wave transmission not possible at the frequencies above 30 Mc?
7. At what frequency do atmospheric effects become important?
8. Why is line of sight transmission possible beyond the optical horizon at ultra high frequencies?
9. What equation shows the dependence of the maximum line of sight range upon antenna height?
10. What effects are used for beyond-the-horizon propagation at very high frequencies?

IV. Insert prepositions:

1. The propagation ... a radio wave depends ... the frequency.
2. Very low frequency is characterized ... very low ground attenuation.
3. The atmospheric absorption is very small ... very low frequencies.
4. Propagation is affected ... sunspots and magnetic storms.

5. Coverage can extend ... a distance ... approximately 100 miles ... the antenna.

6. The atmospheric absorption increases frequency.

V. Fill in the words omitted:

1. Beyond the distance of approximately 100 miles sky-wave ... is possible at night.
2. ... of a radio wave depends primarily upon the frequency.
3. The best sky-wave transmission between two points is achieved when the ...
is carefully selected.
4. Ground-wave coverage is affected by ... and ... in the troposphere.
5. Very low frequency is characterized by very low ...
6. When we speak about ultra high frequencies, we must take into ...atmospheric effects.
7. This equation shows the dependence of the maximum line of sight upon … .
8. Practical communication systems are possible due to tropospheric … .

VI. Give English equivalents to the following and use them in sentences:

затухание, полоса частот, пространственная волна, радиус передачи, преломление, отражение, распространение, принимать во внимание

VII. Give a general description of propagation of radio waves at such frequencies:

a) very low frequency; b) low frequency, c) medium frequency, d) high frequencies, e) very high frequencies, f) ultra high frequencies,
g) superhigh frequencies.

VIII. Translate into English:

1. Радиоволны очень низких частот характеризуются малым коэффициентом затухания.
2. На распространение радиоволн очень низких частот влияют солнечные пятна и магнитные бури.
3. Поглощение пространственной волны увеличивается в дневное время.
4. Передача пространственной волны возможна на большое расстояние.

5. С увеличением частоты возрастает затухание поверхностной волны.

6. Оптимальная частота для передачи пространственной волны изменяется с изменением состояния ионосферы.

7. Обычно радиоволны с частотой выше 30 МГц не отражаются от ионосферы.

8. На передачу поверхностной волны влияет преломление в тропосфере.

9. Поглощение радиоволн в атмосфере возрастает с частотой.

10. На сверхвысоких частотах используются направленные антенные системы.

IX. Retell the text using words and expressions from obligatory word and expression list

ANTENNAS

Radiation from Antennas.

An antenna is a device used for the purpose of radiating or receiving radio waves. Alternatively, it may be considered as an arrangement for matching a transmission line or r-f generator to a propagation path. In the immediate vicinity of the antenna, the field configuration is called the induction field. It is made up of[1] complex local fields which die out very rapidly as the distance from the antenna increases. The only significant field component that exists outside the immediate vicinity of the antenna is the radiation field. The amplitude of this field decreases inversely as the range from the antenna.

Antenna Resistance.

In order that an antenna provides a match to a source of r-f energy it must present a resistive load of the proper value. This resistive load is called antenna resistance. The total resistance of an antenna is composed of factors resulting from ohmic loss in the conductors of the antenna, radiation loss, loss from corona, eddy currents, leakage, etc. For most practical purposes the ohmic and radiation resistances only need be considered.

Radiation Patterns, Directivity, Gain, and Effective Area.

Antenna systems are usually designed to have radiation characteristics which vary with the direction from the antenna. A graphical representation of the radiation of an antenna as a function of direction is called the radiation pattern. Radiation patterns may be specified in various planes through the center of the antenna, and such planes usually are chosen to include the maximum radiation.

A pattern in the horizontal plane is called an azimuth pastern, while a vertical-plane pattern is called an elevation pattern[2]. The plane of the pattern is sometimes related to[3] the polarization; for example, an E-plane pattern is one measured in a plane containing the electric field. Another classification of patterns depends on[4] the distance from the antenna.

If the distance is great enough the pattern is a so-called[5] Fraunhofer pattern and its shape is independent of the distance.

This distance is given by

$$1.\ \delta = \geq \frac{2D^2}{\lambda} \quad 6$$

where D - a longest dimension of the antenna system in units consistent with δ and λ.

For distance less than that given by Eq.(1), the shape of the pattern varies with the distance from the antenna. Such patterns are called Fresnel patterns. Since antennas are ordinarily used only for ranges greater than that given by Eq.(1), Fraunhofer patterns are the ones of most interest[7]. Equation (I) is useful in determining the minimum distance to use in measuring such patterns.

Two important properties of an antenna system are directivity and gain. Directivity is a function of the radiation pattern and is defined in Eq.(2).

$$2.\ D = \frac{P_\delta}{P_a} \quad 8$$

where P_δ – power radiated per unit solid angle in a given direction; P_a - average power radiated per unit solid angle[9].

Gain on the other hand[10] includes the losses in the antenna and is given in Eq.(3)

$$3.\ \Upsilon = 4\pi \frac{P_\delta}{P_t}$$

where P_t – total power delivered to antenna terminals. For an antenna with negligible losses, gain, and directivity are the same.

The effective area of an antenna system is defined as

$$4.\ a_c = \frac{\lambda^2 \Upsilon}{4\pi} \quad 11$$

This quantity is not readily related physically to many types of low-frequency antennas, but in the case of horns, reflectors, and lenses as used in the microwave region, the effective area and physical areas are nearly the same.

Reciprocity.

The properties of an antenna system are, in general, identical for transmission and reception in the tree space. In particular, the radiation pattern of an antenna is the same regardless of whether the antenna is used for transmission or reception. She power transferred between two antennas will be the same regardless of which is used for transmission or reception if the generator and load impedance are conjugates of the transmitting and receiving antenna impedances in each case.

Notes to the Text

1. It is made up of – оно (поле) состоит из ...
2. Elevation pattern – вертикальная диаграмма
3. ... is related to ... – относится к ...
4. To depend on-to depend – относится к …
5. So-called – так называемый
6. $\delta = \geq \frac{2D^2}{\lambda}$ – δ is greater than or equal to 2 D to the second power divided λ (lambda)
7. Fannhoper patterns are the ones of most interest – диаграммы Фраунгофера представляют наибольший интерес
8. $D = \frac{P_\delta}{P_a}$ – D is equal to equals P sub δ divided by P sub a
9. P_a – averge power radiated per unit solid angle – P_a является средней мщьностью изулучаемой на единицу телесного угла
10. On the othes hand – с другой стороны
11. $a_c = \frac{\lambda^2 \Upsilon}{4\pi}$ – a sub c equals the ratio of the product square Υ divided by 4π

Obligatory Word and Expression List

radiation
gain
leakage
field configuration
inversely
azimuth pattern
radiation field
dimension
directivity
loss
reciprocity
eddy currents
matching
effective area
radiation pattern
Induction field
equation
elevation pattern
resistive load
average power
solid angle
radiation loss

Exercises

I.Read, translate and study the text

II. Put 5 questions to the text

III. Anever the following questions:

1. What are antennas used for?
2. How do we call the field configuration which is in the immediate vicinity of the antenna?
3. Of what is the induction field made up?
4. What are the factors of which the total resistance of an antenna is composed?
5. What characteristics of the radiation has usually an antenna?
6. What do we call the radiation pattern?
7. How do we call a pattern in the horizontal plane?
8. How is a pattern in the vertical plane called?
9. What is the equation which determines the minimum distance of the Fraunhofer pattern?
10. What equation determines gain?
11. What types of antennas are used in the microwave region?
12. Will the power transferred between two antennas vary if the antennas replace each other?

IV. Insert preposition:

1. An antenna is used ... the purpose ... radiating or receiving radio waves
2. The plane ... the pattern is sometimes related ... the polarization
3. The classification patterns depends ... the distance ... the antenna
4. P_a is equal ... average power radiated ... unit solid angle
5. a_c equals lambda ... the second power multiplied ... Y divided ... 4π

V. Give the opposites of:

to increase, outside, inversely, to receive, longest low-frequency

VI. Give English equivalents to the following words and used them in sentences:

вихревые токи, конфигурация поля, поле индукции, резистивная нагрузка, потери, утечка, направленность, сопротивление излучения.

VII. Fill in the words omitted:

1. An antenna is a ... used for radiating or receiving radio waves.

2. The field configuration which is in the immediate vicinity of the antenna is called ... .

3. The field which exists outside the immediate vicinity of the antenna is called the ... .

4. The resistive load which provides a match to a source of r-f energy is called ... .

5. The radiation characteristics usually vary with the ... from an antenna.

6. A pattern in the vertical plane is called an ... .

7. An antenna has properties which are identical for and ...

8. ... is a function of the radiation pattern.

9. In the equation which defines directivity is power radiated per ... .

10. Classification of patterns ... upon the distance from the antenna.

VIII. Give derivations of the following:

radiate, receive, resist, classify transmit

XI. Translate into English:

1. Поле в непосредственной близости от антенны называется полем индукции.
2. Поле вдали от антенны называется полем излучения.
3. Амплитуда поля излучения уменьшается с увеличением расстояния от антенны.
4. Двумя важнейшими характеристиками антенны являются направленность и усиление.
5. Антенна представляет омическую нагрузку, которая называется сопротивлением антенны.
6. Графическое представление излучения антенны в функции направления называется диаграммой направленности.
7. Диаграмма направленности в горизонтальной плоскости называется азимутальной диаграммой.
8. Форма диаграммы в зоне Фраунгофера не зависит от расстояния.
9. Направленность является функцией диаграммы направленности.
10. Эффективная площадь антенны определяется по формуле

$$a_c = \frac{\lambda^2 \Upsilon}{4\pi}.$$

X. Give a general description of: antenna resistance, radiation patterns, directivity, gain, effective area.

XI. Retell the text using words and expression from the Obligatory Word and Expression List

SEMICONDUCTOR[1] DIODES

An electric current is simply another name for a flow of electrons. Electricity flows when electrons move from one atom of a substance to the next.

In some materials - copper, silver, aluminum, and many other metals - the electrons can move easily. These substances are called conductors.

In other materials - glass, porcelain, hard rubber, and many plastics the electrons can move only with great difficulty. In fact, only a very few electrons can move in these substances, even under great electrical pressure. We call these substances insulators.

Between conductors and insulators are many materials which are neither good conductors nor acceptable insulators. The electrons of their atoms are free to move[2], but not so free as in a conductor. These substances are known as semiconductors.

Although many semiconductors exist, only a few are used in electronics. Those most widely used are germanium, silicon, selenium, and copper oxide.

These particular semiconductors have a strange property[3]. Under certain special conduction, electrons can flow out of them easier than in[4]. Under other condition, the situation is reversed: electrons come in freely, but have difficulty getting out.

This property is evident only when electrons enter or leave the semiconductor material, i.e. when the semiconductor is in contact[5] with a conductor.This contact may be made in two ways: by point contact[6], in which the semiconductor and the conductor make contact at only a single point; and by surface contact[7], in which they meet over a broad area.

An early example of point contact use is the old-fashioned crystal set. It consisted of a small piece of galena[8] crystal and a spring-wire "catwhisker"[9]. The user moved the catwhisker over the surface of the crystal until a sensitive spot was located.

An example of surface-contact application is the copper-oxide stack[10] widely used in both test equipment and[11] in telephone engineering.

Such a device consist of alternate discs of lead and copper oxide stacked face-to-face and held together by an insulated bolt through the center. It is called a semiconductor diode.

Older than radio itself, semiconductor diodes today are the workhorses of the electronics industry. They form the heart of nearly all digital computers[12] - the giant electronic brains. They make radar[13] possible. Without them television could not function. Within a giant missile hundreds of tiny semiconductor diodes control it’s every movement.

One of the main characteristic of the semiconductor diode is as follows: it is a one-way street for electric currents. It will allow the current to flow freely in one direction, but it will block it almost completely in the other. This property is of great importance for many electronic devices. A great advantage of the semiconductor diode over its vacuum-tube cousins is that the first does not require heat to move its electrons. Another advantage is the smaller size possible with semiconductors.

Current. In the semiconductor diode, current flows more easily in one direction (forward current)[14] than in the other (reverse current). Forward current,
i.e. current going in the easy direction, is always the larger of the two.

Resistance. The semiconductor diodes have an unusual resistance characteristic. Their resistance varies in accordance with[15] the voltage you apply to them. At low voltages, forward resistance is high; at higher voltages, it drops. Reverse, on the contrary[16], is extremely high at low voltages, but drops as voltage increases. Different diodes operate at different voltages.

Bias[17]. This term is often used when you are dealing with semiconductor diodes. Bias consists of voltage applied to a diodes to make it operate at the desired point. If voltage applied causes forward current to flow, its called forward bias. If its applied in the reverse direction the term is reverse bias. A diode to which such a voltage is applied is said to be biased.

Temperature. Up to certain point, heat has little effect on a semiconductor diode. At the certain temperature, however, the crystal structure breaks down and current flows freely in either directions. Some diodes recover when they are cooled, while others are ruined.

Capacitance. It is also one of the major characteristic of semiconductor diode. A capacitor[19] its made up of two conductors separated by a dielectric. Here the semiconductor is used as the dielectric. The capacitance of a semiconductor diode changes with the voltage in manner similar to the diodes resistance. The capacitance has a little effect on a forward resistance or forward current. It becomes important, however, when the diode is not conducting, since the capacitance will allow very-high-frequency alternating current to pass.

The semiconductor diodes are used as rectifiers[20] for changing alternating current into direct current in receivers, as detectors[21] of r.f. power in radio and TV sets. They are widely used in the circuits of computers. We use semiconductor diodes in many ham-type radio receivers[22] as automatic noise limiters[23]. Semiconductor diodes are also used in mixers[24] in extremely high frequency superhet[25] receivers for mixing signals coming from antenna with those from the local oscillator[26].

Thus, the semiconductor diode began to perform the variety of jobs.

Besides, there are very many "special" diodes, such as the tunnel diode[27], which operates at speeds near that light, the Zener diode [28], which can regulate voltages, and many others.

From the primitive crystal set discovered about a century ago and crude copper-oxide stacks, through the sealed-unit microwave mixers and into the era of the junction diode (announced in 1948) it has become one of the most basic, most useful and least understood of our electronic servants.

Notes to the Text

1. semiconductor – полупроводник
2. are free to move – могут свободно перемещаться
3. have a strange property –обладать удивительным свойством
4. Under certain special condition, electrons can flow out of them easier than in – при определенных условиях поток электронов легче выходит из полупроводников, чем попадает в них
5. Is in contact – соприкасается, находится в контакте с
6. Point contact – точечный контакт
7. Surface contact – плоскостной контакт, контакт по плоскости
8. Galena [transcriptions] – гален, сернистый свинец, галенит
9. "Catwhisker" – «усик», «волосок», контактная пружина
10. Copper-oxide stack – столбик окиси меди из нанизанных друг на друга дисков
11. In both ... and ... – как в …, так и в ...
12. Digital computers – цифровые вычислительные мамины
13. Radar – радиолокация (от radio detection and ranging)
14. Forward current прямой ток, reverse current – обратный ток
15. Varies in accordance with – изменяется в соответствии с
16. On the contrary – наоборот
17. Bias – смещение
18. When you are dealing with – когда имеют дело с
19. Capacitor – конденсатор
20. Capacitance – емкость
21. Rectifiers – выпрямители
22. Detector – детектор, детекторное устройство
23. Ham-type receivers – приемники радиолюбителей

23.Noise limiter – ограничитель шумов, помех

24. Mixers – смесители, микшеры
25. Superhet (superheterodyne) – супергетеродинный приемник
26. Local oscillator – гетеродин, местный генератор

oscillator – генератор колебаний, осциллятор

27. Tunnel diode – туннельный диод
28. The Zener diode – диод Ценкера

Obligatory Word and Expression List

semiconductor	point (surface)contact	crystal set
conductor	forward (reverse) current	resistance
Insulator	digital computer	bias
germanium	radar	rectifier
silicon	missile	noise limiter
property	device	mixer
galena	reverse direction	oscillator

Exercises

I. Read and translate the text

II. Answer the following questions:

1. What is an electric current?
2. In what materials can the electrons move easily?
3. Where can they move with difficulty?
4. Can the electrons move in insulators?
5. What substances are called semiconductors?
6. What semiconductors are used in electronics?
7. Why do we say that semiconductors have a strange property?
8. How many the contact of the semiconductor with a conductor be made?
9. How was a sensitive spot of the crystal set located?
10. Where is surfaces-contact applied?
11. What is a semiconductor diode?
12. Are semiconductor diodes used in electronics?
13. Could TV function without semiconductors?
14. Where are semiconductor diodes used?
15. What are the main characteristics of the semiconductor diode?
16. Which current is named forward (reverse)?
17. When is forward resistance high?
18. Does reverse resistance rise as voltage increases?
19. What does bias consist of?
20. What diode is said to be biased?
21. In what way does temperature effect on semiconductors?
22. How is a capacitor made up?
23. When has the capacitance much effect on forward resistance?
24. What are rectifiers used for?
25. Where are mixers applied?
26. What are the characteristics of the tunnel diode?

III. Insert prepositions and adverbs:

1. The electrons move ... one atom ... the other ... a continuous flow.
2. Only ... great electrical pressure can a very few electrons move ... the insulators.
3. The substances ... conductors and insulators are known ... semiconductors.
4. ... certain conditions the electrons can flow ... ... semiconductors easier than ... them.
5. She semiconductor is often ... contact ... a conductor.
6. The semiconductor diode consists ... two pieces of different substances.
7. Television could not function ... semiconductor diodes.
8. The characteristics ... semiconductors are ... great importance ... many electronic devices.
9. One ... the advantages ... semiconductors ... vacuum tubes is their little size.
10. The resistance of semiconductor diodes varies ... ... the voltage applied ... them.
11. ... low voltage reverse resistance is very high.
12. Rectifiers are used ... changing alternating current ... direct current.
13. Mixers are designed ... mixing signals ... the antenna ... those ... the oscillator.
14. The tunnel diode operates ... speeds ... that ... light.

IV. Give English equivalents to the following?

полупроводник, изолятор, свойство(качество), в определенных условиях, точечный (поверхностный) контакт, цифровая счетная машина, обратный (прямой) ток, прямое (обратное) сопротивление, смещение, конденсатор, емкость, выпрямитель, ограничитель шума, смеситель

V. Make up sentences using the above words and expression

VI. Give opposite to the following?

conductor	tiny	similar
easily	forward	cool
to get out	high	few
to enter	to increase	to move

VII. Spell the words given in phonetic transcription

VIII. Choose the appropriate word from the brackets:

1. In copper and silver the electrons can move (with difficulty, easily)
2. (glass, aluminum, silicon) is known as a semiconductor
3. The copper-oxide stack used in the test equipment is an example of (point contact, surface contact) application
4. (semiconductor diodes, vacuum tubes) do not need heat to move their electrons
5. The current going in the easy direction is called (forward, reverse) current
6. Reverse resistance is high at (high, low) voltage
7. Bias consists of a (voltage,resistance) applied to a diode to make it operate at the desired point
8. When the crystal structure breaks down the current (can, cannot) flow easily in both directions
9. Alternating current is changed into direct current by means of (detectors,rectitiers)
10. Semiconductor diodes are often used as mixers in (high frequency, low frequency) receivers

IX. Put ten questions to the text

X. Retell the text using words and expressions from the Obligatory Word List

XI. Speak about characteristics of conductors, insulators and semiconductors

XII. Using the text make up some flashes of conversation

XIII. Compose the sentences using the words and phrases:

1. (more, the electrons, a substance, from, the other, to, one atom, of).
2. (these, a, strange, have, particular, property, semiconductors).
3. (come in, certain, under, freely, condition, the electrons, have, but, difficulty, getting out).
4. (galena crystal, it, a small piece, consists, and, of, a spring-wire).
5. (control, every, semiconductor, movement, of, diodes, missiles).
6. (applied, in accordance with, the resistance, the voltage, of, varies, the semiconductor diodes).
7. (the voltage, with, the capacitance, changes, similar, in a manner, to, the resistance).
8. (semiconductors, perform, jobs, the variety, can, of).

XIV. Translate into Russian:

While the semiconductor diode is like a one-way street for electrons, the vacuum diode is more like a subway turn stile. You can go to the wrong way on a one-way street; you can't go the wrong way through a turnstile.

XV. Translate into English:

1. Электричеством зазывается направленный поток электронов.
2. Электроны передвигаются легко в таких веществах, как алюминий и серебро.
3. Полупроводники не являются ни хорошими проводниками, ни хорошими изоляторами.
4. Существует два типа соединения проводника с полупроводником: точечный контакт и контакт по плоскости.
5. Двигая контактную пружинку по поверхности кристалла, можно определить наиболее чувствительную точку.
6. Полупроводники широко используются в электронной промышленности, радиолокации и вычислительной технике.
7. Телевидение не могло бы работать без полупроводниковых диодов.
8. Преимущество полупроводникового диода над вакуумной лампой в том, что он гораздо меньшего размера и не требует накала (подогревателя).
9. В полупроводниковом диоде прямой ток всегда больше обратного.
10. При малом напряжении обратное сопротивление увеличивается.
11. В различных диодах применяется различное напряжение.
12. Смещением называется напряжение, приложенное к диоду и вызывающее ток в необходимом направлении.
13. Одним из основных параметров диода является емкость.
14. Конденсатор состоит из двух проводников, разделенных диэлектриком.
15. Полупроводниковые диоды используются как выпрямители и детекторы в радио и телевидении.
16. Радиолюбители часто используют полупроводниковые диоды в качестве автоматических ограничителей помех.
17. В супергетеродинном приёмнике используются смесители для смешения сигналов от антенны и от генератора.
18. Существует много различных диодов, используемых в радиотехнике: шумовой диод, кремниевый диод, туннельный диод и многие другие.

VOLTAGE AMPLIFIERS

Classes of Operation[1] and Types of Coupling.

In general, the use of an amplifier is necessitated by[2] the requirement for reproducing a given signal at either a higher voltage level or[3] a higher power level. Although in many cases both results accomplished, are separated for design considerations into 1.voltage amplifiers and 2. power amplifiers.

Amplifier Classifications.

The tube used as either a voltage or power amplifier can be employed in any one of the following classes of operation:
Class A Amplifier. The grid bias and alternating grid voltages are such that plate current in a specific tube flows at all times.
Class AB Amplifier. The grid bias and alternating grid voltages are such that plate current in a specific tube flows for more than half but less than the entire electrical cycle
Class B Amplifier. The gird bias is approximately equal to[4] the cutoff value[5] so that the plate current is approximately zero when no exciting grid voltage is applied and so that plate current in a specific tube flows for approximately one-half of each cycle when an alternating grid voltage is applied.
Class C Amplifier. The grid bias is appreciably greater than the cutoff value so that the plate current in each tube is zero when no alternating grid voltage is applied and so that plate current in a specific tube flows for appreciably less than one-half of each cycle when alternating grid voltage is applied

To denote that grid current does not flow during any part of the input cycle, the suffix 1. can be added to the letter or letters of the class identification, e.g.[6], class ABI. The suffix 2 can be used to denote that grid current flows during some part of the cycle.

Types of Coupling.

A tube used for voltage amplification is usually operated class A and at low to moderate plate supply voltages[7] and plate currents. The types of amplifiers, denoted by the types of coupling employed, fall into four general categories:

The resistance- coupled amplified is characterized by the resistive plate load R_b, grid resistor R_c, and coupling capacitor C_c. This form of voltage amplifier is the most widely-used because of the ease with which broad frequency coverage[8] can be achieved and economy in the cost, size, and weight of the components required.

The transformer-coupled amplifier can provide much more gain tube[9] than the corresponding resistance-coupled amplifier since a voltage gain can be derived from a step-up ratio[10] in the transformer. Amplification of very low and very high frequencies is difficult because of inherned limitations of transformer.

The impedance-coupled amplifier provides a method of obtaining a high value of plate-load impedance with a low d-c voltage[11] drop. With the exception that there is no transformation ratio, most of its operating characteristic are the same as those of the transformer-coupled stage.

The direct-coupled amplifier is the only type that has a frequency response without lower limit.

Notes to the Text

1. Classes of operation – классы по видам работы
2. Is necessitated by – вызывается необходимостью
3. Either... or – или … или, либо ..., либо
4. Is equal to – равняется
5. Cutoff value – величина отсечки
6. E.g. - exempli gratia (лат.) – аналог for example – например
7. Plate supply voltage – анодное питающее напряжение
8. Broad frequency coverage – широкий диапазон частот
9. Gain per tube – усиление на каждую лампу
10. Step-up ratio in the transformer – повышающий трансформатор
11. D-c voltage drop-direct current voltage drop – падение напряжения постоянного тока

Obligatory Word and Expression List

voltage amplifier	coupling
power amplifier	resistive plate load
resistance-coupled amplifier	grid resistor
transformer-coupled amplifier	coupling capacitor
impedance-coupled amplifier	frequency coverage
direct-coupled amplifier	frequency response
grid bias	gain
alternating grid voltages	plate-load impedance
grid current	transformation ratio
plate current	cutoff value.

Exercises

I. Read, translate and study the text

II. Put five questions to the text

III. Answer the following questions:

1. What do we use, amplifiers for?
2. How can we divide amplifiers according to their purpose?
3. What are the main classes of operation of amplifiers?
4. How can we classify voltage amplifiers according to the types of coupling?
5. In what class of amplifiers does plate current in a specific tube flow at all times?
6. In what class of amplifiers does plate current in a specific tube flow for more than half but less than the entire electrical cycle?
7. In what class of amplifiers is the grid bias approximately equal to the cutoff value?
8. When is the grid bias appreciably greater than the cutoff value?
9. What do we denote by adding the suffix I to the letters of the class identification?
10. What do we denote by adding the suffix 2?
11. How can we classify the amplifiers according to coupling employed?
12. What form of voltage amplifier is the most widely used?
13. In what type of voltage amplifier can broad frequency coverage be achieved easily?
14. What type of amplifier can provide much more gain per tube than others?
15. What type of amplifiers has a frequency response without lower limit?

IV. Give a general description of the following classes of amplifiers:

a) class A amplifier
b) class AB amplifier
c) class B amplifier
d) class C amplifier

Give a general description of the following types of amplifiers:

a) resistance-coupled amplifier
b) transfomer-coupled amplifier
c) impedance-coupled amplifier
d) direct-coupled amplifier

V. Insert prepositions:

1. Plate current ... a specific tube flows ... approximately one-half ... each cycle.
2. The suffix I can be added ... the letter or letters ... the class identification, in order to denote that grid current does not flow during any part ... the input cycle.
3. The use ... an amplifier is necessitated the requirement for reproducing a given signal ... either a higher voltage level or a higher power level. The grid bias is approximately equal ... the cutoff value 5. The direct-coupled amplifier is the only type that has a frequency response ... lower limit.

VI. Fill in the words omitted:

1. The types of..., denoted by the types of ... employed, may be divided into four groups.
2. The resistance-coupled amplifier is characterized by the ..., grid resistor, and ... .
3. In the resistance-coupled amplifier ... can be achieved easily.
4. ... and alternating grid voltages are such that ... in a specific tube flows at all times.
5. In class AB amplifier ... in a specific tube flows for more than half but less than the entire ... .
6. The impedance-coupled amplifier provides a low ... .
7. In class B amplifier the plate current is approximately zero when no ... is applied.
8. A method of obtaining a high value of ... is used in the impedance-coupled amplifier.
9. In class C amplifier the grid bias is appreciably greater than the ... .
10. The transformer-coupled amplifier can provide much more ... per tube than the corresponding ... amplifier.

VII. Give English equivalents to the following:

усиление, коэффициент усиления по напряжению, коэффициент трансформации, усилитель с непосредственной связью, усилитель с дроссельной связью, диапазон частот, сеточное сопротивление, сеточное смещение, переменное сеточное напряжение, величина отсечки, возбуждающее сеточное напряжение, реостатный усилитель, сеточный ток

VIII. Translate into English:

1. Усилитель напряжения воспроизводит данный сигнал на более высоком уровне напряжения.
2. Имеется 4 класса работы усилителей напряжения.
3. В усилителе класса А анодный ток лампы всегда больше нуля.
4. Усилители используются для воспроизведения данного сигнала либо на более высоком уровне напряжения, либо на более высоком уровне мощности.
5. В зависимости от этого усилители делятся на усилители напряжения и усилители мощности.
6. В усилителе класса В сеточное смещение приблизительно равно величине отсечки.
7. В усилителе класса С сеточное смещение значительно больше, чем величина отсечки.
8. По типам связи усилители напряжения могут быть разделены на усилители на сопротивлениях, трансформаторные усилители, усилители с импедансной связью и усилители с непосредственной связью.
9. В реостатном усилителе можно легко получить широкий диапазон частот.
10. Усилитель с дроссельной связью отличается от трансформаторного усилителя тем, что он не имеет коэффициента трансформации.

IX. Retell the text using words and expressions from the Obligatory Word and Expression List

RECEIVERS

The design requirements of receivers depend upon the intended application. The suitability of a particular type to a specific application is measured by its ability to meet the performance requirements[1], i.e.[2], sensitivity, noise figure, selectivity, gain, bandwidth, phase and amplitude linearity, image v rejection, etc[3].

Classification of Receivers. A receiver is any device which accepts and demodulates r-f signals[4] to obtain the information or intelligence contained in the signal. In the most applications it is necessary to amplify the demodulated signal to a level suitable for use. Since the amplitudes of the signals at the input to receiver are ordinary extremely small, a typical receiver must amplify the receiver signal by a factor of several thousand before the signal is of sufficient amplitude to be of use. This amplification may be accomplished before and after the signal has been demodulated.

The intelligence contained in the r-f signal may be in the form of continuous-wave (c-w) amplitude modulation, frequency modulation, pulse-amplitude modulation, pulse-length modulation, pulse-time modulation, etc.

Receivers are divided into the following types: superheterodyne, tuned r-f (t.r.f), regenerative and super-regenerative, crystal video and frequency modulation (f-m).

In the superheterodyne the r-f signal is covered to an intermediate frequency where it is amplified and demodulated.

The t.r.f. receiver is one in which the r-f signal is amplified to a relatively high level by turned amplifiers resonant at the frequency of the incoming signal and then demodulated. In regenerative and superregenerative receivers amplifications is increased by the use of a control amount of positive feedback. In the regenerative receiver the greatest amplification (sencetivity) is obtained when the amount of feedback is slightly less than required for oscillation.

In the superregenerative receiver a r-f amplifier or plate detector having sufficient positive feedback to cause oscillation is made nonoscillatory periodically[5] by the application of a quench signal which may be developed from the oscillating stage or be obtained from an external source. Superregeneration provides considerably more amplification in a stage than does regeneration.

The crystal video receiver is one in which the r-f signal is demodulated by a crystal diode detector at a low signal level prior to amplification. The demodulated signal is then amplified to a usable level by audio-frequency or video-frequency amplifiers.

Frequency-modulation receivers are capable of accepting a frequency-modulated signal and converting the frequency variations into amplitude variations and may be of superheterodyne, t.r.f., or superregenerative type.

Notes to the Text

1. To meet the performance requirements – удовлетворять требуемым характеристикам

2. I.e. - id est (лат.) - that is (англ) – то есть 3. etc. - etcetera (лат.) - so on (англ) – и так далее

4. R-f signals-radio-frequency signals – радиочастотные сигналы

5. ... is made nonoscillatory periodically – становиться периодически негенерирующим

Obligatory Word and Expression List

receiver
device
sensitivity
noise figure
continuous-wave amplitude modulation
frequency modulation
to accept
to receive

to demodulate	pulse-amplitude modulation
selectivity	to amplify
gain	pulse-length modulation
amplitude	pulse-time modulation
bandwidth	incoming signal
superheterodyne	receiver phase linearity
feedback	tuned radio-frequency receiver
plate detector	oscillation
regenerative receiver	to convert
crystal diode detector	tuned amplifier
superregenerative receiver	crystal video receiver
frequency-modulation receiver	intermediate frequency

Exercises

I. Read, translate and study the text

II. Put five questions to the text

III. Answer the following questions

1. What performance requirements must a receiver meet?
2. What is a receiver?
3. What does a receiver do with an accepted signal before it becomes suitable for use?
4. Why is it necessary to amplify signals which are accepted by a receiver?
5. In what form may the intelligence contained in the r-f signals be?
6. What are the main types of receivers?
7. When is the greatest amplification obtained in the regenerative receiver?
8. In what type of receivers is the r-f signal converted to an intermediate frequency?
9. How is a frequency-modulated signal converted in the frequency-modulation receiver?
10. How is amplification increased in regenerative and superregenerative receivers?

IV. Insert prepositions:

1. Usually the amplitudes ... the signals ... the input the receiver are extremely small.
2. The demodulated signal is amplified ... a level suitable ... use.

3. The performance requirements of a receiver depend the intended application.
4. Receivers are divided ... six types.
5. In the superheterodyne receiver the r-f signal is converted ... an intermediate frequency.
6. In regenerative and superregenerative receivers amplification is increased ... the use ... a controlled amount ... positive feedback.

V. Give English equivalents to the following and use them in sentences:

частота, усиление, супергетеродинный приемник, приемник прямого усиления, амплитудно-импульсная модуляция, демодулировать, приходящий сигнал, сверхрегенеративный приемник

VI. Give derivatives of the following:

require, receive, apply, suit, classify, amplify, modulate,oscillate.

VII. Fill in the words omitted:

1. Frequency-modulation receivers accept ... signals and convert them to the amplitude-modulated signals.
2. The r-f signal is converted to an ... in the superheterodyne receiver.
3. A receiver accepts and ... r-f signals.
4. In the tuned r-f receiver the r-f signal is amplified to a relatively high level by ... resonant at the frequency of the ... and then demodulated.
5. The demodulated signals must be ... .
6. In the regenerative receiver, the greatest amplification is obtained when the amount of ... is less than it is necessary for ... .

VIII. Give a general description of the following types of receivers:

superheterodyne; turned r-f; regenerative; superregenerative; crystal video; frequency-modulation

IX. Translate into English:

1. Приемник - это прибор, который принимает и демодулирует радиочастотные сигналы.
2. Обычно амплитуды сигналов на входе приемника очень малы, поэтому приемник должен усилить полученный сигнал.
3. Имеется 6 типов приемников: супергетеродинный, приемник прямого усиления, регенеративный, сверхрегенеративный, кристаллический видеоприемник и частотномодулированный.

4. В супергетеродинном приемнике радиочастотный сигнал превращается в сигнал промежуточной частоты.

5. В регенеративном приемнике используется положительная обратная связь.

6. В супергетеродинном приемнике используются усилитель высокой частоты, усилитель промежуточной частоты и усилитель низкой частоты.

7. Тип используемого приемника зависит от применения.

8. Приемники характеризуются чувствительностью, коэффициентом шума, избирательностью, усилением и шириной полосы частот.

9. В частотномодулированном приемнике частотномодулированные сигналы преобразуются в амплитудномодулированные сигналы.

10. В сверхрегенеративном приемнике анодный детектор периодически не генерирует.

X. Retell the text using words and expressions from the Obligatory Word and Expression List

OSCILLATORS

Several performance characteristics must be considered in selecting the best oscillator circuit for a particular application. These characteristics are 1) frequency; 2) frequency stability; 3) amplitude stability, and 4) power output.

Frequency of Operation[1]. At frequencies below 100 kc, RC oscillators have the advantages of good frequency stability, a wide tuning range since frequency varies inversely with capacitance instead of inversely as the square root as in LC oscillators constant power output over wide tuning ranges, and no bulky inductors.

Oscillators of the LC type are used extensively at frequencies from 100 kc to 500 Mc. Low-power LC oscillators can be constructed which will operate satisfactorily, with special tubes, at frequencies as high as 10,000 mc.

However, the effects of electron transit time, tube capacitances, and lead inductances severely limit the power output at frequencies above about 1,000 mc. At frequencies above 100 to 200 mc, the use of mutually coupled coils[3] becomes very difficult, and the Colpitts[4] and tuned-plate tuned-grid circuits5 are used almost exclusively.

At frequencies above 1,000 mc, magnetron and klystron oscillators are used extensively. The present upper frequency limit of magnetron and klystron operation is approximately 200,000 mc.

Frequency Stability. The frequency of oscillation is dependent upon6 the parameters of the tube, the Q of the resonant circuit, and the load impedance in addition to the values of L and C in the resonant circuit. The stability of the frequency of the oscillator to variations in tube characteristics is dependent upon the loaded Q of the oscillator resonant circuit. Circuit resistance due to coil loss, grid input loading, or resonant load resistance causes the frequency of oscillation to be dependent upon tube plate resistance. Since plate resistance varies with tube plate voltage and plate current, the frequency of an oscillator is dependent upon supply voltages.

At frequencies above approximately 50 mc the grid-cathode capacitance Cgk[7] is also sensitive to plate current changes because the transit-time input capacitance[8] is a function of the tube transconductance. As a result, the frequency of an oscillator will vary with changes in plate current. The frequency change caused by this effect will depend upon the per cent of the total grid-cathode capacitance that the transit-time capacitance represents.

Frequency stability is also a function of the stability of the components used in the oscillator circuit. Temperature-compensated components[9] should be used whenever variations in such components with changes in temperature will result in undesirable frequency variations.

Power Output. The required power output will determine in large part the type of tube to be used[10], and, in certain cases, it may restrict the oscillator circuits which can be used; e.g., the crystal-controlled oscillator and the reflex-klystron oscillator are capable of only relatively small power output.

The proper operating conditions for maximum efficiency and power output for an oscillator are determined in exactly the same manner as for the same tube operated as an amplifier with the single additional factor that the power output as an oscillator is less than the power output as an amplifier by the amount that must be fed back to the grid circuit to sustain oscillation. Power oscillators are normally operated class C.

Notes to the Text

1. Frequency of operation - рабочая частота
2. ... instead of inversely as the square root as in LC oscillators – вместо того, чтобы изменяться обратно
3. Mutually coupled coils – взаимно связанные катушки
4. Colpitts circuits – схемы Колпитса
5. Tuned-plate tuned-grid circuits – схемы с настроенным анодом и настроенной сеткой
6. ... is dependent upon, depends upon – зависит от
7. The transit-time Input capacitance – входная емкость за счет времени пролета электрона
8. Temperature-compensated components – температурно-компенсированные элементы
9. ... the type of tube to be used – тип лампы, который должен быть использован

Obligatory Word and Expression List

oscillate	tube capacitance
oscillator	electron-transit time
oscillation	lead inductance
oscillator circuit	tuned anode
frequency stability	tuned grid
amplitude stability	Klystron oscillator
power output	magnetron oscillator
tuning range	supply voltage
capacitance	

Exercises

I. Read, translate and study the text

II. Put 10 questions to the text

III. Answer the following questions:

1. What are the main performance characteristics of oscillators?
2. At what frequencies have EC oscillators the advantages of good frequency stability?
3. At what frequencies are the LC type oscillators used?
4. At what frequencies are magnetron and klystron oscillators used?
5. Upon what parameters does the frequency of oscillation depend?
6. Why is the frequency of an oscillator dependent upon supply voltages?
7. In what class are usually power oscillators operated?
8. Is frequency stability a function of the stability of the components?
9. How does the required power output determine the type of tube to be used?
10. How are the proper operating conditions for maximum efficiency and power output for an oscillator determined?

IV. Give English equivalents to the following words and шве them in sentences:

частота генерации, зависеть от, емкость сетка-катод, питающее напряжение, анодный ток, стабильность частоты, выходная мощность, диапазон настройки

V. Give derivatives of the following:

to oscillate, to depend, to tune, to induce, capacity, to resist.

VI. Fill in the words omitted:

1. RC oscillators have the advantages of good ... at frequencies below 100 kc.
2. RC oscillators have a wide tuning ... since frequency varies inversely with ...
instead of Inversely as the square as in LC oscillators.
3. ... LC oscillators can operate satisfactorily at frequencies as high as 10,000 mc.
4.The effects of electron transit time, tube ... and lead ... severely limit the ... at frequencies above about 1,000 mc.
5. The use of Mutually ... becomes very difficult at frequencies above 100 to 200 mc.
6. At frequencies above 100 to 200 mc the Colpitts and ... circuits are used almost exclusively.
7. At frequencies above 1,000 mc, and ... oscillators are used extensively.
8. The frequency of oscillation is ... upon the parameters of the tube, the Q of the ..., and the ... .
9. The frequency change depends upon the per cent of the total ... that the transit-time capacitance represents.

VII. Translate into English:

1. Одной из основных характеристик генератора является рабочая частота.
2. RC-генератор имеет хорошую стабильность частоты.
3. Генераторы типа LC используются до частоты 500 МГц. Магнетронный и клистронный генераторы используются при частотах свыше 1000 МГц,
5. Частота генерации зависит от параметров ламп и параметров контура.
6. Стабильность частоты зависит от Q - резонансного контура.
7. Анодное сопротивление лампы изменяется при изменении анодного напряжения и тока.
8. Стабильность частоты зависит от стабильности элементов. использованных в схеме генератора.

VIII. Give general characteristics of a)frequency of operation, b) frequency stability, c) power output

IX. Retell the text using words and expressions from the Obligatory Word and Expression List

RADIO TRANSMITTERS

A radio transmitter is a device for producing radio-frequency energy that is controlled by the intelligence to be transmitted[1]. Radio transmitters may be divided into two main classes: radio-telephone transmitters and radio-telegraph transmitters. Radio-telephone transmitters may be amplitude-modulated and frequency modulated.

Amplitude-modulated transmitters may be used at all frequency bands, while frequency-modulated transmitters find extensive use at frequencies above 40 MC. Radio-telephone transmitters may be classified as:

a) broadcast transmitters
b) short-wave and ultra-high-frequency transmitters
c) single-side-band[2] and asymmetric-side-band[3] transmitters

Radio-telegraph transmitters may be amplitude-keyed (on-off) and frequency-shift keyed.

An amplitude-keyed radio telegraph. transmitter differs from the corresponding amplitude-modulated transmitter in that instead of being modulated in accordance with a continuously varying signal, such as an audio-frequency signal, the transmitter output is turned on and off in accordance with the dots and dashes of the telegraph code.

An alternative to on-off keying[4] is to use one frequency for the mark intervals[5] and another for the spacing intervals[6].

Such frequency-shift keying can be obtained in many ways.

Radiotelephone Transmitters

Broadcast Transmitters.

Broadcast transmitters represent the highest development of radio-telephone transmitters with respect to[7] stability of carrier frequency, band width, low distortion and noise, etc. Such transmitters normally consist of a crystal oscillator followed by several buffer amplifier stages, a modulated amplifier, audio-frequency modulating system, etc. plus accessories such as protection equipment, monitoring facilities etc.

The crystal oscillator of a broadcast transmitter is operated at the carrier frequency, and normally employs a zero-temperature-coefficient crystal[8] operating at low-power level and under conditions such that the very greatest in frequency stability will be realized. The buffer amplifiers are for the purpose of isolating the crystal from the modulated amplifier, and employ screen-grid pentode, or neutralized triode tubes. Power amplifiers (including buffer stages) operating at lower power levels than the modulated stage are of the Class C type, while all power amplifiers following the modulated stage must be linear amplifiers.

Modulation may be accomplished either in the last stage of radio-frequency amplification or at a lower power level. The former is termed high-level modulation; the latter, low - level modulation. In low-level systems, the radio-frequency amplifiers following the modulated stage are linear amplifiers, vand are usually of the high-efficiency type when appreciable energy is involved.

High-level modulation usually takes the form of plate modulation with a Class B audio amplifier.

A variety of modulation methods are in use for low-level modulation, including plate, conventional control-grid and suppressor-grid modulation, in this order of popularity. Almost any system that gives complete modulation can be employed, since it is possible to take care of distortion with the aid of negative feedback.

Short-wave and ultra-high-frequency Radio-telephone Transmitters.

The only essential difference between broadcast and the short-wave telephone transmitters is that in the latter case the crystal oscillator operates at a subharmonic of the desired frequency, and harmonic generators as required are used between the crystal oscillator and the modulated stage. In many applications of short waves, it is not necessary to meet the same standards of performance[9] as in broadcast work, with the result that buffer amplifiers are sometimes reduced in number, or even eliminated, and other simplifications are permitted that result in reduced band width, more distortion, and greater noise than would be tolerable in broadcast work. Transmitters for short waves, unlike these[10] used in the ordinary broadcast band, are nearly always designed for operation at a number of frequencies, with facilities provided for relatively rapid frequency change.

Transmitters for use at ultra-high frequencies frequently employ resonant-line oscillators instead of crystal control. Such oscillators are sometimes used to generate directly the required power output, but in other cases a power amplifier, and sometimes a buffer amplifier and power amplifier, are employed in association with the resonant-line oscillator to provide isolation.

Notes to the Text

1. The intelligence to be transmitted – сообщение, которое должно быть передано
2. Single-side-band transmitters – передатчик с одной боковой полосой
3. Asymmetric-side band transmitter – передатчик о асимметричными боковыми полосами
4. On-oft keying – манипуляция выключениям
5. Mark intervals – интервалы знаков
6. Spacing intervals – интервалы промежутков
7. With respect to ... – относительно (что касается)

8. A zero-temperature-coefficient crystal – кристалл с нулевым температурным коэффициентом
9. To meet the same standards of performance - удовлетворять тем же самым стандартам на рабочих характеристик
10. Transmitters for short waves, unlike those – передатчики для коротких волн в отличие от ...

Obligatory Words and Expressions List

radio-telephone transmitters
radio-telegraph transmitters
broadcast transmitters
short-wave transmitters
ultra-high-frequency transm.
single-side-band transmitters
asymmetric-side-band transm.
amplitude-keyed transmitters
carrier frequency
buffer amplifier
protection equipment
monitoring facility
screen grid
pentode
neutralized triode tube
facilities
frequency change

Exercises

I. Read, translate and study the text

II. Put ten questions to the text

III. Answer the following questions:

1. What is a transmitter?
2. What are the main classes of transmitters?
3. What are the main types of m dulation of radio-telephone transmitters?
4. At what frequency bands may the amplitude-modulated transmitters be used?
5. At what frequencies are the frequency-modulated transmitters used?
6. What is the classification of radio-telephone transmitters?
7. How can we classify radio-telegraph transmitters?
8. What is the difference between amplitude-keyed radio-telegraph transmitters and the amplitude modulated transmitters?
9. Why do broadcast transmitters represent the highest development of radio-telephone transmitters?
10. What do broadcast transmitters consist of?
11. At what frequency is the crystal oscillator of a broadcast transmitter operated?
12. For what purposes are the buffer amplifiers used?
13. What do the buffer amplifiers employ?

14. Where may modulation be accomplished?
15. What do we call high-level modulation?
16. What do we call low-level modulation?
17. What is the difference between broadcast and short-wave telephone transmitters?

IV. Insert prepositions:

1. It is possible to take care ... distortion ... the aid... negative feedback.
2. Broadcast transmitters consist ... a crystal oscillator followed ... several buffer amplifiers, a modulated amplifier, etc.
3. The crystal oscillator operates ... the carrier frequency.
4. Modulation may be accomplished ... a lower power level.
5. Radio transmitters may be divided ... two main classes.
6. Amplitude-modulated transmitters may be used ... all frequencies.
7. Frequency-modulated transmitters may be used ... frequencies above 40 MC.
8. The transmitter output is turned ... and ... in accordance ... the dots and dashes ... the telegraph code.
9. There is the only essential difference ... broadcast and short-wave telephone transmitters.
10. High-level modulation usually takes the form ... plate modulation.

V. Give English equivalents to the following and use them in sentences:

прибор, амплитудно-модулированный передатчик, передатчик с частотной манипуляцией, радиотелеграфный передатчик с амплитудной манипуляцией, кристаллический генератор, несущая частота, буферный усилитель

VI. Fill in the words omitted:

1. ... transmitters may be used at all frequencies.
2. ... transmitters are usually used at frequencies above 40 MC.
3. An ... radio-telegraph transmitter differs from the amplitude-modulated transmitter.
4. In amplitude-keyed radio telegraph transmitters, the output is ... on and off in ... with the dots and dashes of the telegraph ... .
5. Instead of using on-off keying it is possible to use one frequency for the ...intervals and another for the ... intervals.
6. Broadcast transmitters are highly developed radio-telephone transmitters with respect to stability of ... ... , low ... , etc.
7. In broadcast transmitters a crystal oscillator is followed by several ... stages, a ... amplifier, etc.

8. The buffer amplifiers are used for isolating the crystal from the ... .
9. The ... employ screen grid, pentode, or neutralized triode tubes.
10. All ... ... which follow the modulated stage must be linear amplifiers.
11. Power amplifiers which operate at lower power levels than the ... stage are of the Class C type.
12. Modulation which is accomplished in the last stage of radio-frequency amplification is called ... .
13. Modulation which is accomplished at a lower power level is called ...
14. In short-wave telephone transmitters the ... operates at a subharmonic of the desired frequency.
15. The short-wave transmitters are usually provided with facilities for rapid ....

VII. Give derivatives to the following:

to transmit, to modulate, to classify, key, to carry, to equip, stable, to perform, cast.

VIII. Give the opposites:

to transmit, output, to turn on, highest, plus, to isolate, amplification, it is possible, negative feedback, to reduce latter.

IX. Give the synonyms:

employ, gain, it is termed ..., to reduce, plate, with the aid of, essential.

X. Give a general description of the following types of transmitters:

a) radio-telephone transmitters;
b) radio-telegraph transmitters.

XI. Translate into English:

1. Радиопередатчик - это устройство, создающее радиочастотную энергию, промодулированную сообщением.
2. Существуют радиотелефонные и радиотелеграфные передатчики.
3. В радиотелефонных передатчиках применяют амплитудную и частотную модуляцию.
4. В радиотелеграфных передатчиках применяются амплитудная и частотная манипуляции.
5. В амплитудно-манипулированных телеграфных передатчиках выходной сигнал включается и выключается в соответствии с точками и тире телеграфного кода.

6. Широковещательные передатчики имеют высокостабильную несущую частоту.

7. Широковещательные передатчики обычно состоят из кристаллического генератора, нескольких каскадов буферных усилителей, модулируемого усилителя, модулирующей системы звуковой частоты и вспомогательных элементов.

8. В кристаллическом генераторе используется кварцевый кристалл с нулевым температурным коэффициентом, работающий на низком уровне мощности.

9. Буферные усилители применяются для изолирования кристаллического генератора от модулируемого усилителя.

10. В буферных усилителях используются лампы с экранирующей сеткой, пентоды или нейтрализованные триоды.

11. Усилители мощности передатчиков работают в классе С.

12. Усилители низкой частоты должны иметь малые нелинейные искажения (быть линейными).

13. В коротковолновых передатчиках кристаллический генератор работает на субгармонике желаемой частоты.

XII. Retell the text using words and expression from Obligatory Words and Expression List

AIRCRAFT RADIO EQUIPMENT

All the radio aids to navigation[1] are of no use to the pilot unless his airplane is radio-equipped. The most essential radio-equipment consists of a receiver. When operating under instrument condition (instrument flight)[2], the airplane is required to have a radio transmitter. More elaborate installations include a direction-finding radio loop[3] or a radio compass.

Radio Receivers. Aircraft radio receivers must be light in weight, economical in operation, and extremely sensitive. The long wave band[4] extending from 200 to 400 kilocycles has often been set inside for radio-range operation, and aircraft radio receivers are designed to cover this band.

The aircraft receiver is very similar in appearance and in operation to a small home radio. It is provided with a switch to turn it on and off[5], a volume control[6], a tuning knob[7]. It is always provided with earphones, as a loudspeaker would be impractical because of the noise of the engine.

When the pilot wishes to use his radio, he puts on[8] his earphones, turns on the radio, allows it a short time to warm up, and then tunes it to the frequency of the desired station. The volume control is then adjusted to bring the signal in[9] clearly but not loud enough to cause discomfort.

The receiver is generally mounted in the cockpit within easy reach of the pilot. The same storage battery that supplies current for the lights and starter can be used to operate the receiver. The antenna may be located beneath the fuselage. It may extend from the top of the cabin to the top of the fin[10] or it may extend from one wing tip back to the fin and then forward to the opposite wing tip.

Sometimes an auxiliary mast antenna is mounted beneath the fuselage. With this type of antenna, the cone of silence[11] can be detected more easily,

but it is not suitable for long-range reception. The pilot switches to the mast antenna when he is within a few miles of the station.

Many of the more recent radio receivers are designed for push-button tuning[12]. This arrangement can be adjusted so that any two selected frequencies may be tuned in by merely pushing the appropriate buttons.

The air transports usually carry at least three radio receivers, two of them designed to receive the radio-range signals while the third receiver is tuned to the frequency of the fan markers[13] along the airways.

Transmitters. All airplanes are now equipped with a transmitter in addition to a receiver. This equipment is referred to as two-way radio[14].
A transmitter is installed as an addition to the receiver, since obviously the transmitter alone would be practically useless. With two-way equipment, the pilot can carry on a conversation with the various ground stations and control towers. One type of installation consists of a transmitter mounted under the rear seat or in the baggage compartment, the receiver mounted in the instrument panel[15] and the reel[16] located in the cockpit for letting out the trailing antenna[17].

The transmitter requires a much longer antenna than the receiving set. Several types of trailing antenna are in common use.

Unlike the receiving set, the transmitter is tuned to operate with an antenna of a definite length. Some reels are equipped with a small electric motor to wind in[18] the antenna. An indicator may be provided to tell the length of antenna that has been unwound.

The addition of a microphone competes the two-way radio installation. Microphones designed specially for aircraft are usually referred to as communication type microphones[19]. The latest types are designed to exclude engine or other distant noises.

When the pilot wishes to broadcast[20], he brings the microphone close to his lip and presses the button that completes the circuit and starts the transmitter functioning. As soon as[21] he has finished talking, he releases the button to save the battery.

Operating the transmitter is almost as simple as operating a receiver. The set is turned on and allowed to warn up for several minutes. The antenna is let out to the correct length by counting the number of turns or watching the indicator.

Pressing the button on the microphone starts the set in operation ready to broadcast. As soon as the pilot is through talking[22], the set should be turned off and the antenna wound in.

Notes to the Text

1. Radio aids to navigation – радионавигационное устройство, навигационное радиосредство
2. Instrument flight – полет по приборам, слепой полет
3. Direction-finding radio loop – радиопеленгаторная антенна
4. Long wave band – длинноволновый диапазон
5. Turn on (off) – включить (выключить)
6. Volume control – регулятор громкости
7. Tuning knob – ручка (кнопка) настройки
8. Put on – надеть
9. Bring the signal in – здесь – принимать сигнал
10. Fin – киль, вертикальный стабилизатор
11. Cone of silence – мертвый конус, зона молчания
12. Push-button tuning – кнопочная настройка to tune in – настраиваться на(станцию)
13. Fan marker – веерный радиомаркер (факельный радиомаяк)
14. Is referred to as two-way radio – называется (считается) приемопередающей радиосистемой, т. е. системой, обеспечивающей двустороннюю связь
15. Instrument panel – приборная доска
16. Reel – здесь – рулетка
17. Trailing antenna(aerial) – свисающая (выпускная) антенна
18. To wind – наматывать, подтягивать
19. Communication type microphone – микрофон связного типа
20. To broadcast – вести радиопередачу
21. As soon as ... – как только
22. ... is through talking – заканчивает разговор

Obligatory Word and Expression List

equipment	to turn on (off)	cone of silence
receiver	volume control	fan marker
transmitter	to tune	airway
aircraft	cockpit	two-way radio
band	storage battery	instrument panel
to broadcast		

Exercises

I. Read and translate the text

II. Answer the following questions:

1. Are the airplanes radio-equipped now?
2. When must the pilot use the transmitter?
3. Where is directions-finding used?
4. What are radio receivers provided with?
5. Why would a loudspeaker be Impractical in the aircraft?
6. What does the pilot do when he wants to use the radio?
7. Where may the antenna be placed?
8. When does the pilot use the mast antenna?
9. How many receivers are there at the plane?
10. What is the fan marker?
11. What is two-way radio?
12. Where is the transmitter usually mounted?
13. What is the reel used for?
14. Does the receiver require a trailing antenna?
15. How does the transmitter operate?

III. Insert prepositions:

1. Aircraft receivers are light ... weight and economical ... operation.
2. The aircraft receiver is similar ... a home radio.
3. It is provided ... a switch to turn it and ... .
4. The operator tunes the radio ... the frequency ... the desired station.
5. The antenna nay he located ... the fuselage.
6. The mast antenna is not suitable ... long-range reception.
7. The pilot switches the mast antenna when he is ... a few miles ... the station.
8. The selected frequency may be tuned ... pushing the button.
9. The fan markers are situated ... the airways.
10. The two-way radio has a transmitter ... addition ... a receiver.
11. The transmitter is usually mounted ... the rear seat or ... the baggage compartment.
12. The reel is used ... letting ... the trailing antenna.
13. The transmitter operates ... an antenna ... a definite length.
14. The receiver is turned … and allowed to worm ... ... several minutes.
15. Pressing the button ... the microphone starts the set ... operation.
16. When the operator is ... talking, the set should be turned ... .

IV.Put some questions to each of the following sentences:

1.The aircraft radio receivers are designed to operate the long wave band from 200 to 400 kilocycles.

2.The storage battery supplies current for the lights and starter and can be used for receivers.

3. The pilot switches to the mast antenna when the airplane is near the station.

4. When the equipment consists of receiving and transmitting sets we say it is a two-way radio.

5. The operator presses the button for completing the circuit of the transmitter.

V. Give synonyms to the words:

operation	impractical	brine
installation	cabin	start
allow	broadcast	beneath
mount	button	adjust

VI. Give English equivalents to the following:

авиационный полет по приборам (слепой полет), радиопеленгатор, приемник, передатчик, регулятор громкости, настройка, кабина пилота, вспомогательный, мертвая зона, приемопередющая радиоустановка, приборная доска, радиовещание

VII. Make up sentences using the above words and expressions

VIII. Retell the text using words and expressions from the Obligatory Word List

IX. Name essential parts of the aircraft radio installation and describe their operation

X. Fill in the words emitted:

1. The radio-range signals are received by the ... .
2. She airplane requires a ... when operating under instrument ... .
3. The ... ... is adjusted to bring the signal in clearly.
4. The ... battery is used to operate the receiver.
5. The pilot can carry on a conversation with ground stations when he has ... radio equipment.
6. Aircraft microphones are referred to as ... type microphones.
7. When the operator is through talking, he ... the button to save battery.

XI. Form ten questions on the text

XII. Make up a dialogue and practice it with your comrade

XIII. Translate into English

1. Каждый самолет сейчас оборудован системой двусторонней радиосвязи.
2. Авиационный радиоприемник обычно помещается в кабине пилота.
3. Для определения мертвой зоны пилот использует штыревую антенну.
4. Веерные маркеры располагаются вдоль воздушных: трасс
5. С помощью рулетки можно увеличить или уменьшить длину антенны радиопередатчика.
6. В радиопеленгаторных установках часто применяют рамочную антенну.
7. Для ведения радиопередачи пилот использует микрофон связного типа.
8. Одев наушники, пилот включает радиоприёмник и настраивает его на частоту необходимой станции.

RADIO NAVIGATION

Radio constitutes one of the most valuable aids to air navigation. Without it no scheduled air transportation in any weather would be possible.

Dead reckoning[1] consists of planning the flight in advance[2] and estimating the heading[3], groundspeed[4], and the time required to complete the flight. Radio-navigation aids enable the pilot to follow the airways without visual reference to the ground. Radio fixes[5] located at frequent intervals along the airways help him to establish his exact position.

The signal of a conventional radio-broadcasting station[6] is sent out with approximately the same intensity in all directions. Such stations often use a mast or vertical antenna[7].

It is possible to control the direction of the signals of a radio station by varying the design of the transmitting antenna. If a loop antenna[8] instead of a mast is used the maximum radiation is sent out in line with[9] the ends of the loop. This means that all localities in line with the ends of the loop will receive a strong signal, whereas only a very weak signal will be picked up[10] by receivers at right angles to the loop.

The directional properties of a radio-rage station[11] represent an application of this principle. Two loop antennas are placed at right angle to each other. One of them transmits the letter "a" in code (`-), while the other antenna sends out signal "n" (-`). The tone of these signals closely resembles the dial tone[12] of a dial telephone[13].The same type of pattern[14] can be obtained
by using fine vertical antennas called Adcock vertical radiators[15]. Usually

there are four directions away from the range station in which the "n" and "a" signals overlap[16].These overlapping areas called beams or legs[17] form a narrow band widening outward from the station at the angle of about 3°, The pattern of each range station consists of four beams and four regions called quadrants[18] between the beams.

When a pilot is flying within the limits of one of the beams, he receives a steady buzz. Between the beams he will receive either the "a" or the "n" signal, depending on which quadrant he is in. The steady buzz is achieved by overlapping the "n" and "a" signals.

A narrow band known as the twilight zone[19] extends along the edges of each beam. In this zone both the on-course signal[20] or steady buzz and[21] the "n" or "a" quadrant signal can be heard simultaneously.

When a pilot is proceeding along a beam toward a radiorange station the intensity of the signal gradually increases, bonding up quite rapidly as the station is approached. Directly over the station, the signal dies down and practically disappears. This area over the station where the signal fades out is known as the cone of silence[22]. The cone of silence plays a very Important part in radio navigation, as it enables the pilot to enables a definite fix along the airway.

When the pilot wishes to tune in a radio-range station, he turns his receiver to the frequency of the station and then listens for the station identifications. Bach station broadcasts on an assigned frequency.

When flying along the airways, a pilot can tell from the beam signal v whether or not he is on his course. However, the beam does not tell him how near he is to the range station. Radio markers[23] are located along the airways for this purpose. These are low-powered radio stations placed along the airways to serve as radio fixes. Their frequency is generally the same as the beam along which they are located, but they can be heard for only a few miles. Each marker station has its own identification signal.

Another type of radio fix is known as the fan marker[24]. These markers operate on an ultra-high frequency (UHF) and send out a vertical fan-shaped beam. The signal can be received only when the airplane is almost directly in line with the station, and a special receiver is required. Fan markers are located along the principal airways about 30 miles away from the terminal airports.

Notes to the Text

1. Dead reckoning – счисление координат местоположения
2. In advance – заранее, наперед
3. Heading – курс, направление (полета)
4. Groundspeed – путевая скорость, скорость относительно земли
5. Radio fix – радиоориентир
6. Radio-broadcasting station – радиовещательная станция
7. Mast or vertical antenna – штыревая или вертикальная антенна

8. Loop antenna – рамочная антенна
9. In line with – в соответствии с
10. Pick up – здесь – принимать сообщения (сигналы)
11. Radio-range station – радионавигационная станция
12. Dial tone – сигнал (зуммер) ответа станции, сигнал готовности к набору номера
13. Dial telephone – автоматический телефон, телефонный аппарат АТС
14. Pattern – образец, шаблон, модель
15. Adcock vertical radiator – вертикальный излучатель Эдкока
16. Overlap – перекрывать
17. Beams or legs – здесь – зоны равной слышимости, линии курса
18. Quadrant – квадрант, четверть круга
19. Twilight zone – равносигнальная зона
20. On-course signal – направление сигнала по курсу (off-course - направление в сторону от принятого курса полета)
21. both ... and ... – как ..., так и ...
22. cone of silence (cone of nulls) – конус (зона) молчания, мертвый конус
23. marker station – маркерная станция, маркерный радиомаяк
24. fan marker – веерный радиомаркер

Obligatory Word and Expression list

navigation
dead reckoning
heading
airway
radio fix
radio-broadcasting station
loop antenna
to pick up signals
radio-range station
pattern
to overlap
beam
twilight zone
on (off) course signal
radio marker
fan marker
terminal
airport

Exercises

I. Read and study the text

II. Answer the following questions:

1. Is radio necessary for air navigation?
2. What is dead reckoning?
3. Why does the pilot use radio-navigation aids?
4. Where are radio-fixes located?

5. What kinds of antennas are used by radio-broadcasting stations?
6. How is the direction of radio-signal controlled?
7. What signals does the loop antenna transmit?
8. What is the beam?
9. How is the steady buzz achieved?
10. What is the cone of silence?
11. What does the cone of silence enable the pilot?
12. Do all the stations have the same identifications?
13. What is the purpose of radio markers?
14. What frequency do fan markers operate on?
15. When can the airplane receive the fan marker signal?

III. Insert prepositions:

1. Radio enables the pilot to fly ... visual reference ... the ground.
2. Radio fixes are located ... frequent intervals ... the airways.
3. The signal is sent ... all directions.
4. The direction ... a signal is controlled ... varying the design ... the antenna.
5. All localities ... line ... the ends ... the loop will receive strong signals.
6. The aircraft receiver can pick ... very weak signals too.
7. Two antennas are located ... right angles ... each other.
8. Four regions ... the beams are called quadrants.
9. The buzz is achieved ... overlapping the "n" and "a" signals.
10. The cone ... silence is very important ... radio navigation.
11. The pilot turns the receiver ... the frequency ... the station and listens ... the identification signals.
12. Radio markers are placed ... the airways.
13. The broadcasting sends ... a vertical fan-shaped beam.

IV. Give English equivalents to the following:

график, счисление координат местоположения, направление полета, путевая скорость, точный, радиовещательная станция, рамочная антенна, в соответствии с, радионавигационная станция, перекрывать, зона равной слышимости, настраивать, маркерная станция

V. Make up sentences using the above words and expressions

VI. Give antonyms to the words:

possible	strong	on-course
to complete	transmitting	narrow
exact	the same	disappear

VII. Fill in the words omitted:

1.The broadcasting station ... signals in all directions.
2. … air transportation would be impossible without radio aids.
3. The exact position of the plane is established by means of ... .
4. The … areas are called beams or ... .
5. The pilot receives either the "a" or the "n" signal depending on which ... he is in.
6. Along the edges of each beam the ... ... extends.
7. The area over station is known, as the ... ...
8. Radio fan markers ... on an ultra-high ... .

VIII. Put ten questions to the text

IX. Retell the text using words and expressions from the Obligatory Word List

X. Translate into English:

1. Радио является одним из важнейших средств аэронавигации.
2. Пользуясь радиосредствами, пилот может лететь без визуального наблюдения за землей.
3. Радиоориентиры помогают пилоту определить его точное местоположение.
4. Специальные радиостанции посылают во всех направлениях опознавательные сигналы.
5. Изменяя положение передающей антенны, можно менять направление излучения сигналов.
6. Обычно в курсовых радиомаяках рамочные антенны устанавливаются под прямым углом друг к другу.
7. Те области, где сигналы радионавигационных станций "a" и "n" перекрываются, называются равносигнальными зонами.
8. Когда самолет летит вдоль луча, пилот слышит устойчивый зуммерный сигнал.
9. При приближении к передающей станции интенсивность сигналов увеличивается, но над станцией этот сигнал исчезает и начинается зона молчания.
10. Известно, что каждая станция передает сигналы на определённой частоте.
11. При помощи сигналов радиолуча летчик всегда может определить, придерживается ли он правильного курса в полёте.
12. Радиомаркеры расположены вдоль воздушных трасс.

XI. Without consulting the dictionary read the following text and give a short summary of it in English?

Types of Range Stations

Radio-range stations are divided into three general classes, as follows:

1. Full-power stations, Adcock vertical radiators (RA) or loop radiators (RL).
2. Medium-power stations, Adcock vertical radiators (MRA) or loop radiators (MRL).
3. Low-power stations, loop-type marker stations (ML).

The full-power stations are located along the airways and at the principal terminal airports. The medium-power stations are usually located at airports between the principal airway stations. The low-power stations can be heard for only a few miles and are provided for instrument approaches to intermediate airports.

RADIO IN OUTER SPACE

A new age has begun in the history of mankind an age in which man is free to travel through the space. At first he will find this new freedom dangerous and hostile, but as his knowledge increases, the freedom to travel will become safe and friendly. v In the exploration of space the role of radio is very important. Astronomy was one of the first branches of science to make use of radio equipment. The Sun and many other heavenly bodies are known to emit radio signals. Having learned to pick these up, people have discovered cosmic bodies situated at distances of several thousands of millions of light years[1] from the Earth. Now scientists widely use radio telescopes. In fact they are huge antenna constantly tuned in[2] to the "emissions" from our distant neighbors in the Universe. Giant radio telescopes were built in the Soviet Union, Great Britain, the USA and other countries.

Then it was the turn of radar to venture into outer space. The first radio signal to be reflected from the surface of the Moon was received in 1946. Soviet scientists have carried out[3] radar soundings of Venus, Mars, and Mercury.

In November 1962, the first interplanetary telegram in history, consisting of cue words "Lenin, USSR, Peace" travelled through Billions of kilometers of outer space. The radio signals were reflected from the surface of Venus and came back to the Earth.

At the end of 1963 Soviet science, registered another outstanding achievement. The first-ever radar probe of the planet Jupiter took place[4]. The aim of the experiment was to study the reflecting properties of Jupiter's surface and the propagation of radio waves over super-long distances. Observations were conducted with the help of a powerful transmitter and a high-directional antenna. It took the radio signals 1 hour 6 minutes[5] to get from the Earth to Jupiter and back again, that is to cover about 1,200 million kilometres. At the end of this time the transmitter was switched off and a second antenna with a highly sensitive receiver picked up the reflected signals.

Radar soundings of planets have made it possible to determine with greater accuracy the magnitude of the astronomical unit and the distance between the planets and the Earth and to learn more about the nature of their surfaces.

October 4, 1957 marked a new stage in space research. Scientists carried their experiments into space and get valuable scientific information therefrom. The world's first artificial earth satellite was equipped with radio transmitters to send back scientific data. Since then all spaceships launched into near-Earth space as well as to the Moon and the planets have been equipped with all sorts of radio technical devices.

Without them the launching would be fruitless from the scientific point of view. Thus during any space flight with a man on board or without him there is always a two-way communication channel: Earth-Space and Space-Earth. Control commands are transmitted to the spaceship along the first and a stream of information is sent back to the Earth along the second.

Radiotechnical apparatus makes it possible to measure the elements of the orbits of artificial earth satellites and the trajectories of the automatic interplanetary stations.

The two-way communication with the "Mars I" interplanetary station was a feat of modern radio-engineering. During one of the last sessions "Mars I" was over 106,000,000 kilometres away from the Earth. The scientists now have information on space routes which will in time be travelled by manned spaceships[6].

New information on interplanetary and solar plasma, the outermost magnetic belt around the Earth, solar wind in outer space was obtained. New data on the intensity of the magnetic field and on the presence of the meteoric matter in the space between the Earth and Mars was received. And all this due to[7] radio signals transmitted by the station. The launching[8] of sputniks equipped with special apparatus will make it possible to investigate the upper strata of the Earth atmosphere where clouds are formed. These meteorological sputniks ana later on whole meteorological stations, will enable us to make more accurate weather forecasts. Further improvements in the design of carrier-rockets and spaceships will make it possible to launch observatories equipped with telescopes and other optical devices beyond the Earthr-atmosphere.

Radioelectronics is marching into space. The limits of man's knowledge are widening all the time, and scientist are sending up their radio equipment into the unknown reaches of the Universe.

Notes to the Text

1. light year (the distance that light travels in one year) is a little less than 9,5 million million kilometres
2. to tune in – настраивать
3. to carry out – выполнять, проводить
4. to take place – иметь место, происходить
5. It took the radio signal 1 hour 6 minutes ... – радиосигнал за 1 час 6 мин (дословно это заняло 1 час 6 мин)
6. manned spaceship – космический корабль с человеком на борту
7. due to – благодаря
8. launching – запуск

Obligatory Word and Expression List

radio equipment	to carry out	to pick up
to emit radio signals	probe	accuracy
antenna	propagation of radio waves	
emission	transmitter	
radar high	sensitive receiver	
magnitude	unit	
manned spaceship	carrier-rocket	

Exercises

I. Read, translate and study the text

II. Put 10 questions to the text

III. Answer the following questions:

1. What age has begun in the history of mankind?
2. How have people discovered the most distant cosmic bodies?
3. What are radio telescopes?
4. What was the aim of the first radar probe of the planet Jupiter?
5. How was the probe of the planet Jupiter conducted?
6. What have radar soundings of planets given?
7. Why did October 4,1957 mark a new stage in space research?
8. Are all spaceships equipped with radiotechnical devices?
9. How is a two-way radio communication with spaceships organized?
10. What new scientific data was received by the "Mars-I" interplanetary station?
11. What do you know about meteorological sputniks?

IV. Give English equivalents to the following words and use them in your own sentences:

использовать, радиооборудование, проникнуть в космос, проводить наблюдение, распространение радиоволн, проводить зондирование планеты, направленная антенна, высокочувствительный приемник, величина астрономической единицы, запускать в космос, двусторонняя радиосвязь, ракетоноситель

V. Give synonyms to the following:

cosmos, hostile, dangerous, aid, sounding, research, artificial earth satellite, device, information, to obtain, to use, to conduct, to send up.

VI. Give nouns corresponding to the following verbs and adjectives:

free	to equip	to investigate
distant	to emit	to explore
cosmic	to transmit	to propagate
accurate	to measure	to observe
to improve		

VII. Memorize plural of the following nouns:

Singular		Plural
antenna	-	antennae, antennas
datum	-	data
apparatus	-	apparatus, apparatuses
stratum	-	strata

VIII. Insert prepositions:

1. ... May 15, 1958 a third Soviet sputnik was launched ... the upper strata of the atmosphere.
2. It was equipped with radio transmitters to send back scientific data.
3. Due ... the great weight ... the satellite it has been possible to install (установить) powerful transmitters in it.
4. ... the help ... sputnik's radio transmitter "Mayak" short-wave amatours throughout the world could listen in to sputnik III ... super-long distances.
5. ... any space flight ... a man ... board or ... him there is always a two-way communication channel: Earth-Space and Space-Earth.

IX. Translate into English:

1. В исследовании космоса радио играет важную роль.

2. Известно, что Солнце, Луна и другие небесные тела излучают радиоволны.

3. Благодаря радиосигналам, излучаемым небесными телами, ученые открыли самые отдаленные небесные светила.

4. В конце 1963 г. с помощью радара Советский Союз провел зондирование Юпитера - самой большой планеты солнечной системы.

5. Все космические корабли с человеком на борту или без него оснащены различными радиотехническими приборами.

6. Во время любого космического полета всегда осуществляется двусторонняя радиосвязь Земля – Космос, Космос – Земля.

7. Запуск спутников со специальным оборудованием в высшие слои атмосферы позволит сделать более точными предсказания погоды.

8. Первым человеком, который проник в космос, был советский человек.

9. 12 апреля 1961 года Юрий Гагарин совершил первый космический полет на борту корабля-спутника "Восток". Гагарин за 108 мин. облетел вокруг Земли. «Восток» был запущен с космодрома (cosmodrome) Байконур.

10. Полет человека в космос открыл новую эпоху в истории человечества - эпоху межпланетных путешествий.

X. Retell the text using as many new words and expressions as possible

XI. Fill in the blanks with the following words and phrases from the text:

data, to carry out, probe, layer, emissions, radio waves, satellite, matter, increase.

Deep Moon Probes

In recent years the Soviet Union has been investigating the ... emitted by the Moon on frequencies in the 0.13 to 3,5 cm range, which is equivalent to "Inspecting" the Moon's surface layers from 5 cm and 20 m down.

At present Soviet astronomers V.Troitsky, V.Krotikov and N.Tseitlin have done another ... an even deeper one, of our natural ... Measurements of radio-wave ... from the Moon were ... ... in the 70 cm frequency range.

The scientists expected to receive ... from a depth of 40 m. It was thought that if the density of lunar ... remained uniform throughout as depth increased, then the temperature at 40 m would be 20-50° more than at a depth of 20 m. However, the temperature ... proved to be much less. This is evidence that at a depth of about 30 m. there is a ... of rather dense matter, maybe even rock-like in character.

XII. Give a short summery of the previous text in English

XIII. Translate from English into Russian

On January 30, for the first time ever, two scientific stations - "Elektron-I" and "Elektron-2" - were launched in the Soviet Union.

Considerable technical difficulties were overcome in the simultaneous orbiting of two satellites by means of one carrier. A special system ensured the separation of the Electron I station from the last stage of the carrier rocket at a strictly set speed. The separation took place practically without any disturbing effect on the further movement of the last stage. In addition, the Elektron I station was designed in such a way that it was most compact in the period of separation, had no large protruding parts and did not fall in the zone of action of the jet stream of the final-stage engine.

On the external surface of the craft are the solar cells, aerial systems, some of the instruments, and the solar orientation sensors. On the cylindrical section of the body are located the rotating shutters of the heat regulating system. Elektron I carries collapsible aerials and solar-cell panels were extended after the separation of the spacecraft from the carrier rocket at a signal from a programmed timer. On Elektron 2 the solar-cell panels are fixed.

REFERENCES

1. Чечель, Е. Г. Учебник английского языка для технических вузов/ Е. Г.Чечель, Е. М. Андренко, П. К.Королев. – Киев: Вища шк., 1988. – 300 с.
2. Адаменко, М. Секреты ламповых усилителей низкой частоты/ М. Адаменко – НТ Пресс. ISBN 978-5-477-00155-2, 2007. – 384 с.
3. Technical Journal of Engineering and Applie Sciences. Global Impact Factor: 0.601 2012, ICV : 457.
4. Electronics Now, USA, 1992 – 1997.
5. Popular Electronics, USA, 2000 – 2001.
6. Радиоприемники, Радиософт, ISBN 5-93037-143-1, 2005.
7. Зайцева, Л. П. Микроэлектроника – настоящее и будущее: пособие по обучению чтению на английском языке/ Л. П. Зайцева, М. А. Бух – М.: Высш шк., 1990. – 159 с.
8. Лисовский, Ф. В. Англо-русский словарь по радиоэлектронике/ Ф. В. Лмсовский, И. Н. Кулагин. – М.: Русский язык, 1987. – 753 с.

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