

Preface

Automated radio monitoring (ARM) technology obtained wide distribution as a tool for problem-solving in various areas, beginning from radio frequency spectrum usage control to the use of radio environment checks to search for illegal radio transmitters. Radio monitoring equipment serves as the basis of technical measures for counteracting unapproved information pick-up, including the all-important investigation of compromising emanations.

The list of problems solved with the help of ARM equipment includes:

- Revelation and analysis of radio emissions, for the identification of signal and interference sources,
- Measurement of radio emission parameters, and the estimation of their danger or value for the user,
- Electromagnetic field strength, or the power flow density measurement,
- Radio signals and interference direction-finding in the terrain.

In particular, ARM equipment allows radio engineering facilities and computer hardware to be checked for the presence and level of incidental emanations. As such, the main functions of ARM equipment are the permanent or periodic observations of airwaves in the wide frequency range, the effective detection, analysis and localization of potential or specially-organized channels of information drain.

Based on the authors' development experience, fundamental information concerning the described ARM systems, reference data, and recommendations on the best methods and approaches for obtaining solutions to the above-mentioned problems are included in the book, together with the classification and detailed description of modern high-efficient hardware-software ARM equipment, including equipment for detection, radio direction-finding, parameters measurement and their analysis, and the identification and localization of electromagnetic field sources. Examples of ARM equipment structure and application, within the complicated interference environments found in industrial centers, inside of buildings, and in the open terrain, are included, together with the software required for such applications.

The book is prepared on the basis of Russian and foreign publications and as a result of various research and implementation activities of IRCOS¹ company experts, under the supervision and direct participation of the authors.

The book contains 12 chapters.

In Chapter 2, the list of problems solved by ARM systems is discussed in detail. An analysis of the nomenclature, structure, functions and parameters of ARM equipment is performed, and the system hierarchy of the facilities is developed. The composition, the functions, and the main technical characteristics for each class of equipment are determined.

Chapter 3 is devoted to the basic parameters of up-to-date radio receivers affecting ARM problem fulfillment. The peculiarities of the digital receiver structure for the 9 kHz – 18 GHz frequency range are shown. Design examples and the characteristics of single-channel and double-channel digital receivers are discussed.

Chapter 4 is dedicated to the mathematical aspects of narrow-band signal detection, as well as the signals with dynamic frequency-time distribution (with frequency hopping) for single- and double-channel radio equipment.

ARM problem-solving via multi-channel panoramic digital receivers is analyzed in Chapter 5, together with the hardware and software structure peculiarities of these receivers and their main technical data.

Chapters 6 and 7 are devoted to the radio signals used in communication, broadcasting, TV and data transmission systems, and to the technical analysis and parameter measurement of modulated and non-modulated signals. Examples of radio signal parameter measurement are discussed and recommendations for software applications are given.

A review of and the theoretical bases for direction-finding methods are presented in Chapter 8, and the main parameters of radio direction finders are explained. Examples of multifunctional radio monitoring and direction-finding equipment in VHF, UHF, and microwave ranges are described. The affect of used digital receivers on direction-finding effectiveness is shown.

Chapter 9 is devoted to the development of geographically-distributed radio monitoring systems and to direction-finding systems for radio emission sources. The application of stationary, mobile, portable and hand-held ARM equipment is considered. Moreover, the problems related to ARM station system equipment, organization of data transmission through the communication, navigation and power supply channels, are considered in this chapter as well. The possible uses of software for signal detection, their parameter measurement, and direction-finding of radio emission sources – with positions indicated on an electronic map – are discussed.

Chapter 10 includes information on determining the position of radio emission sources by mobile radio monitoring stations, and estimation of field strength distribution, taking into account terrain relief and area reclamation, to obtain covering zones of broadcasting and communication. Solutions to the problems of

¹IRCOS means: Investigations on **R**adio **C**ontrol and **S**ystem design

electromagnetic compatibility and the parameters testing of radio electronic equipment are discussed also.

Chapter 11 describes the structural peculiarities of radio monitoring equipment inside the premises and the revelation of technical channels of information leakage and unapproved radio emission sources. Revelation methods are discussed, together with these source localization methods on checked objects. Implementation examples for hardware-software facilities for technical channel leakage revelation, used both inside the premises and on the boundary of the checked zone, are presented.

In Chapter 12, the problems of radio system structure in performing compromising emanations investigation are considered. The theoretical aspects and the practical approaches for the revelation of the informative components are discussed, with calculation of the checked area and object immunity radii. The equipment and the software examples for these investigations are given.

The authors are confident that the materials offered in the book will be useful to experts in the area of radio monitoring, to operators and leaders of civil and military radio-checking services, and to security service employees of both state and commercial structures. The book can be recommended to the students of technical universities and colleges, studying in the appropriate fields.

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Problems, Methods and Equipment

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