

INTERNATIONAL RADIO CONSULTATIVE COMMITTEE

C.C.I.R.

DOCUMENTS OF THE
Xth PLENARY ASSEMBLY

GENEVA, 1963

VOLUME IV

RADIO-RELAY SYSTEMS
SPACE SYSTEMS
RADIOASTRONOMY



INTERNATIONAL RADIO CONSULTATIVE COMMITTEE

C.C.I.R.

DOCUMENTS OF THE

Xth PLENARY ASSEMBLY

GENEVA, 1963

VOLUME IV

RADIO-RELAY SYSTEMS

SPACE SYSTEMS

RADIOASTRONOMY

Published by the

INTERNATIONAL TELECOMMUNICATION UNION

GENEVA, 1963



Recommendations of Section F (Radio-relay systems)

Reports of Section F (Radio-relay systems)

RADIO-RELAY SYSTEMS

Questions and Study Programmes allocated to Study Group IX (Radio-relay systems); Opinions and Resolutions of interest to this Study Group

List of documents of the Xth Plenary Assembly concerning Study Group IX

Recommendations of Section L (Space systems and radioastronomy)

Reports of Section L (Space systems and radioastronomy)

SPACE SYSTEMS AND RADIOASTRONOMY

Questions and Study Programmes allocated to Study Group IV (Space systems and Radioastronomy); Opinions and Resolutions of interest to this Study Group

List of documents of the Xth Plenary Assembly concerning Study Group IV

DISTRIBUTION OF THE TEXTS OF THE Xth PLENARY ASSEMBLY OF THE C.C.I.R. AMONG VOLUMES I—VI

1. Recommendations

Number	Volume	Number	Volume	Number	Volume
45	III	218, 219	III	289, 290	IV
48, 49	V	224	III	297-300	IV
75-77	III	237	I	302	IV
80	V	239	I	304-306	IV
100	III	240	III	310, 311	II
106	III	246	III	313	II
136	V	257, 258	III	314	IV
139, 140	V	259	IV	325-334	I
162	III	261, 262	V	335-349	III
166	III	264-266	V	350-367	IV
168	II	268	IV	368-373	II
182	III	270, 271	IV	374-379	III
205	V	275, 276	IV	380-406	IV
212	V	279	IV	407-421	V
214-216	V	281-283	IV	422-429	III
				430, 431	I

2. Reports

Number	Volume	Number	Volume	Number	Volume
19	III	107	III	195-203	III
32	V	109	III	204-226	IV
42	III	111	III	227-266	II
43	II	112	III	267-282	III
46	II	122	V	283-290	IV
77	V	130	IV	291-316	V
79	V	134	IV	317-320	III
93	III	137	IV	321	I
106	III	151	II	322	*
		175-194	I		

3. Resolutions

Number	Volume	Number	Volume	Number	Volume
1	III	14-16	III	19, 20	III
2-13	II	17, 18	IV	21, 22	I
				23-29	VI

* Published separately.

4. Opinions

Number	Volume	Number	Volume	Number	Volume
1, 2 3	I IV	4-10 11	II III	12-14 15-19 20, 21	IV V III

5. Questions

Number	Volume	Number	Volume	Number	Volume
3	III	163	III	221	IV
23	V	166	V	222	V
43	III	175-177	I	225	I
66	V	180-183	III	226	III
74	III	185	II	227-231	I
81	III	188	III	232, 233	III
95	III	191	III	234-245	IV
102	V	192-195	IV	246-248	II
118	V	197	IV	249-259	III
120, 121	V	199, 200	V	260, 261	IV
132, 133	III	205	V	262-270	V
140	III	206	III	271-275	III
152-154	V	207	I	276-279	IV
156, 157	V	219, 220	I	280-282	III

6. Study Programmes *

Number	Volume	Number	Volume	Number	Volume
36	V	127	I	176	II
57	II	139	II	177	V
102	III	148	II	180-185	I
110	V	153	II	186, 187	III
119	V	161, 162	V	188-206	II
		170	V	207	III

* This list includes only those Study Programmes which do not derive from Questions. A Study Programme derived from a Question carries the same serial number as this Question, followed by a letter (e.g. S.P. 102A (XII)). It is inserted in the book immediately after the text of the Question from which it is derived.

**ARRANGEMENT OF VOLUMES I TO VII OF THE DOCUMENTS
OF THE Xth PLENARY ASSEMBLY OF THE C.C.I.R.**

(Geneva, 1963)

- VOLUME I** Emission. Reception. Vocabulary (Sections A, B and K and Study Groups I, II and XIV).
- VOLUME II** Propagation (Section G and Study Groups V and VI).
- VOLUME III** Fixed and mobile services. Standard frequencies and time signals. International monitoring (Sections C, D, H and J and Study Groups III, XIII, VII and VIII).
- VOLUME IV** Radio-relay systems. Space systems. Radioastronomy (Sections F and L and Study Groups IX and IV).
- VOLUME V** Sound broadcasting and television (Section E and Study Groups X, XI, XII and the C.M.T.T.).
- VOLUME VI** Resolutions of a general nature.
Reports to the Plenary Assembly.
List of participants.
List of documents in numerical order.
- VOLUME VII** Minutes of the Plenary Meetings.

Note 1. — To facilitate references, the pagination in the English and French texts is the same.

Note 2. — At the beginning of Volume VI will be found information concerning the Xth Plenary Assembly of the C.C.I.R. and the participation at this meeting, the presentation of texts (Definitions, origins, numbering, complete lists, etc.) together with general information on the organization of the C.C.I.R.

TABLE OF CONTENTS OF VOLUME IV

	Page
Distribution of the texts of the Xth Plenary Assembly of the C.C.I.R. among Volumes I–VI . . .	4
Arrangement of Volumes I to VII of the Xth Plenary Assembly of the C.C.I.R.	6
Table of contents of Volume IV	7

RECOMMENDATIONS OF SECTION F (RADIO-RELAY SYSTEMS)

F. 1—Interconnection

Rec. 268	Radio-relay systems for telephony using frequency-division multiplex. <i>Interconnection at audio frequencies</i>	17
Rec. 270	Radio-relay systems for television. <i>Interconnection at video signal frequencies</i>	17
Rec. 297	Radio-relay systems for telephony using time-division multiplex. <i>Interconnection at audio frequencies</i>	18
Rec. 299	Radio-relay systems for telephony using time-division multiplex. <i>Agreement on major characteristics</i>	19
Rec. 304	Radio-relay systems for telephony. <i>Interconnection of different systems of multiplexing</i>	19
Rec. 306	Radio-relay systems for television and telephony. <i>Procedure for the international connection of systems with different characteristics</i>	20
Rec. 380	Radio-relay systems for telephony using frequency-division multiplex. <i>Interconnection at baseband frequencies</i>	21
Rec. 381	Interconnection of radio-relay and line systems. <i>Line regulating and other pilots. Limits for the residues of signals outside the baseband</i>	25

F. 2—Radio-frequency channel arrangements

Rec. 279	Radio-relay systems for telephony using frequency-division multiplex. <i>Radio-frequency channel arrangements for 300-channel systems operating in the 2 and 4 Gc/s bands</i>	28
Rec. 281	Radio-relay systems for television and telephony. <i>Preferred radio-frequency channel arrangements for television</i>	29
Rec. 282	Radio-relay systems for television and telephony. <i>Use of special radio-frequency channel arrangements</i>	29
Rec. 283	Radio-relay systems for telephony using frequency-division multiplex. <i>Radio-frequency channel arrangements for 60- and 120-channel telephony systems operating in the 2 Gc/s band</i>	30
Rec. 382	Radio-relay systems for television and telephony. <i>Radio-frequency channel arrangements for systems for 600 to 1800 telephone channels, or the equivalent, operating in the 2 and 4 Gc/s bands</i>	32

		Page
Rec. 383	Radio-relay systems for television and telephony. <i>Radio-frequency channel arrangements for systems for 600 to 1800 telephone channels, or the equivalent, operating in the 6 Gc/s band</i>	35
Rec. 384	Radio-relay systems for television and telephony. <i>Radio-frequency channel arrangements for systems with a capacity of either 2700 telephone channels or 960 telephone channels, or the equivalent, operating in the 6 Gc/s band</i>	37
Rec. 385	Radio-relay systems for telephony using frequency-division multiplex. <i>Radio-frequency channel arrangements for 60-, 120- and 300-channel telephony systems operating in the 7 Gc/s band</i>	41
Rec. 386	Radio-relay systems for television and telephony. <i>Radio-frequency channel arrangements for systems with a capacity of 960 telephone channels, or the equivalent, operating in the 8 Gc/s band</i>	43
Rec. 387	Radio-relay systems for television and telephony. <i>Radio-frequency channel arrangements for systems with a capacity of 960 channels, or the equivalent, operating in the 11 Gc/s band</i>	44
Rec. 388	Tropospheric-scatter radio-relay systems. <i>Radio-frequency channel arrangements</i>	47
Rec. 389	Radio-relay systems for television and telephony. <i>Preferred characteristics of auxiliary radio-relay systems operating in the 2, 4, 6 or 11 Gc/s bands</i>	48

F. 3—Hypothetical reference circuits and noise

Rec. 289	Radio-relay systems for monochrome television. <i>Permissible noise in the hypothetical reference circuit</i>	51
Rec. 300	Radio-relay systems for telephony using time-division multiplex. <i>Hypothetical reference circuit for radio-relay systems with a capacity of 60 telephone channels or less</i>	53
Rec. 302	Tropospheric-scatter radio-relay systems. <i>Limitation of interference</i>	54
Rec. 303	Tropospheric-scatter radio-relay systems. <i>Radio-frequency channel arrangements</i>	54
Rec. 390	Definitions of hypothetical reference circuits	55
Rec. 391	Radio-relay systems for telephony using frequency-division multiplex. <i>Hypothetical reference circuit for radio-relay systems with a capacity of 12 to 60 telephone channels</i>	57
Rec. 392	Radio-relay systems for telephony using frequency-division multiplex. <i>Hypothetical reference circuit for radio-relay systems with a capacity of more than 60 telephone channels</i>	58
Rec. 393	Radio-relay systems for telephony using frequency-division multiplex. <i>Allowable noise power in the hypothetical reference circuit</i>	60
Rec. 394	Radio-relay systems for telephony using time-division multiplex. <i>Allowable noise power in the hypothetical reference circuit</i>	62
Rec. 395	Radio-relay systems for telephony using frequency-division multiplex. <i>Noise in real circuits</i>	63

		Page
Rec. 396	Tropospheric-scatter radio-relay systems. <i>Hypothetical reference circuit for radio-relay systems for telephony using frequency-division multiplex</i>	65
Rec. 397	Tropospheric-scatter radio-relay systems. <i>Allowable noise power in the hypothetical reference circuit for telephony transmission using frequency-division multiplex</i>	66

F. 4—Maintenance

Rec. 290	Maintenance procedure for radio-relay systems for telephony using frequency-division multiplex. <i>Measurements to be made</i>	68
Rec. 305	Radio-relay systems for television and telephony. <i>Stand-by arrangements</i> .	68
Rec. 398	Radio-relay systems for telephony using frequency-division multiplex. <i>Maintenance measurements in actual traffic</i>	69
Rec. 399	Radio-relay systems for telephony using frequency-division multiplex. <i>Measurement of performance with the help of a signal consisting of a continuous uniform spectrum</i>	71
Rec. 400	Service channels for radio-relay systems. <i>Types of service channel to be provided</i>	73
Rec. 401	Radio-relay systems for television and telephony. <i>Frequencies and deviations of continuity pilots</i>	75

F. 5—Characteristics

Rec. 271	Radio-relay systems for television and telephony. <i>Simultaneous transmission by the same radio-frequency carrier. Baseband arrangements</i>	77
Rec. 275	Radio-relay systems for telephony using frequency-division multiplex. <i>Pre-emphasis characteristic for frequency modulation systems</i>	78
Rec. 276	Radio-relay systems for television. <i>Frequency deviation and the sense of modulation</i>	81
Rec. 298	Radio-relay systems for telephony using time-division multiplex. <i>Preferred characteristics</i>	82
Rec. 402	Radio-relay systems for television. <i>Simultaneous transmission of a monochrome television signal and a single sound channel. Preferred characteristics of the sound channel</i>	83
Rec. 403	Radio-relay systems for television and telephony. <i>Intermediate frequency characteristics</i>	84
Rec. 404	Radio-relay systems for telephony using frequency-division multiplex. <i>Frequency deviation</i>	85
Rec. 405	Radio-relay systems for television. <i>Pre-emphasis characteristics for frequency modulation systems</i>	86
Rec. 406	Line-of-sight radio-relay systems sharing the same frequency bands as the satellite receivers of active earth-satellite communication systems. <i>Maximum effective radiated powers of line-of-sight radio-relay system transmitters</i>	90

REPORTS OF SECTION F (RADIO-RELAY SYSTEMS)

Page

F. 1—Interconnection

Report 134	Radio-relay systems for telephony using time-division multiplex. <i>Technical characteristics to be specified to enable interconnection between any two systems.</i>	91
Report 283	Radio-relay systems for telephony using frequency-division multiplex. <i>Technical characteristics to be specified to enable interconnection between any two systems</i>	94
Report 284	Interconnection of auxiliary radio-relay systems at radio frequencies	97
Report 285	Tropospheric-scatter radio-relay systems. <i>Transmission, interference and interconnection</i>	98

F. 2—Radio-frequency channel arrangements

Report 286	Tropospheric-scatter systems. <i>Radio-frequency channel arrangements for systems using frequency modulation</i>	104
Report 287	Radio-relay systems for telephony and television. <i>Systems of capacity greater than 1800 telephone channels, or the equivalent</i>	106

F. 3—Hypothetical reference circuits and noise

Report 130	Radio-relay systems for telephony. <i>Noise tolerable during very short periods of time on line-of-sight systems</i>	110
Report 288	Noise in circuits longer than 2500 km	113

F. 4—Maintenance

Report 137	Duration of interruptions on radio links when switching from normal to stand-by equipment	114
------------	---	-----

F. 5—Characteristics

Report 289	Radio-relay systems for television and telephony. <i>Preferred characteristics for the transmission of more than one sound channel. Simultaneous transmission of television and a maximum of four sound channels</i>	117
Report 290	Radio-relay systems for television and telephony. <i>Preferred characteristics for the transmission of more than one sound channel. Transmission of up to six sound channels</i>	119

QUESTIONS AND STUDY PROGRAMMES ASSIGNED TO STUDY GROUP IX
(RADIO-RELAY SYSTEMS): OPINIONS AND RESOLUTIONS OF INTEREST
TO THIS STUDY GROUP

Introduction by the Chairman, Study Group IX	125
Opinion 12 Radio-relay systems for television. <i>Maintenance procedures</i>	127
Opinion 13 Radio-relay systems for telephony. <i>C.C.I.T.T./C.C.I.R. Joint Working Party on circuit noise</i>	127
Opinion 14 Radio-relay systems for television and telephony. <i>Preferred frequency bands and centre frequencies for radio-relay links for international connections</i> . .	128
Resolution 17 Signal amplitudes in individual channels of multi-channel telephone systems .	130
Resolution 18 Information required on the transmission characteristics of line systems for use in the design of radio-relay systems	130
Question 192 (IX) Radio-relay systems for telephony using frequency-division multiplex . . .	131
Study Programme 192A (IX) Radio-relay systems for television and telephony. <i>Systems of a capacity greater than 1800 telephone channels, or the equivalent</i>	131
Question 193 (IX) Radio-relay systems for television and telephony. <i>Hypothetical reference circuits and circuit noise</i>	132
Study Programme 193A (IX) Radio-relay systems for television and telephony. <i>Noise tolerable during very short periods of time.</i>	132
Question 194 (IX) Radio-relay systems for television. <i>Preferred characteristics for the transmis- sion of monochrome television</i>	133
Study Programme 194A (IX) Radio-relay systems for television and telephony <i>Preferred characteristics for the transmission of more than one sound channel</i>	133
Question 195 (IX) Radio-relay systems for television and telephony. <i>Service channels</i>	134
Study Programme 195A (IX) Radio-relay systems for television and telephony. <i>Preferred characteristics for auxiliary radio-relay systems for the provision of service channels</i>	135
Question 197 (IX) Radio-relay systems for television and telephony. <i>Transmission interruptions.</i>	136
Question 221 (IX) Protection ratios for the operation of communication services within the channels of a broadcasting service	136
Question 260 (IX) Tropospheric-scatter radio-relay systems	137
Study Programme 260A (IX) Tropospheric-scatter radio-relay systems. <i>Radio-frequency channel arrangements</i>	137
Study Programme 260B (IX) Tropospheric-scatter radio-relay systems. <i>Diversity techniques.</i>	139
Question 261 (IX) Radio-relay systems for television and telephony. <i>Preferred characteristics for the transmission of colour television and the simultaneous transmission of colour television and other signals</i>	139
Question 276 (IX) Characteristics of simple VHF or UHF radio equipment for use on trunk connections in the new and developing countries	140
Question 277 (IX) Simple single-channel radiotelephony equipment	141
Question 278 (IX) Two-channel time-diversity telegraph systems for use on radio-relay links .	142
Question 279 (IX) Transmission planning for radio-relay systems in the new and developing countries	142
List of documents of the Xth Plenary Assembly of the C.C.I.R. concerning Study Group IX	143

The following texts, which are not contained in this Volume, also concern radio-relay systems:

Text	Title	Volume
Reports 241, 242	Propagation data required for radio-relay systems	II
Report 243	Tropospheric-wave propagation curves for application to interference problems in the range from 1 to 10 Gc/s	II
Report 244	Estimation of tropospheric-wave transmission loss	II
Rec. 335	Intercontinental radiotelephone systems	III
Rec. 421	Requirements for the transmission of monochrome television signals over long distances	V
Report 316	Requirements for the transmission of colour television signals over long distances	V

Page

RECOMMENDATIONS OF SECTION L (SPACE-SYSTEMS AND RADIO-ASTRONOMY)

L. 1—General

Rec. 259	Selection of frequencies used in telecommunication with and between artificial earth-satellites and other spacecraft	153
Rec. 350	Identification of radio emissions from spacecraft	154
Rec. 351	Cessation of radio emissions from spacecraft	154

L. 2—Communication satellites

Rec. 352	Active communication-satellite systems for multiplex telephony and/or monochrome television. <i>Hypothetical reference circuit for intercontinental systems.</i>	156
Rec. 353	Active communication-satellite systems for frequency-division multiplex telephony. <i>Allowable noise power in the basic hypothetical reference circuit .</i>	157
Rec. 354	Active communication-satellite systems for monochrome television. <i>Video bandwidth and permissible noise in the hypothetical reference circuit</i>	158
Rec. 355	Active communication-satellite systems. <i>Feasibility of sharing frequency bands with terrestrial radio services</i>	159
Rec. 356	Communication-satellite systems sharing the same frequency bands as line-of-sight radio-relay systems. <i>Maximum allowable values of interference in a telephone channel of a communication-satellite system</i>	160
Rec. 357	Communication-satellite systems sharing frequency bands with line-of-sight radio-relay systems. <i>Maximum allowable values of interference in a telephone channel of a radio-relay system</i>	161
Rec. 358	Communication-satellite systems sharing the same frequency bands as line-of-sight radio-relay systems. <i>Maximum allowable values of power flux density at the surface of the earth produced by communication satellites</i>	162
Rec. 359	Communication-satellite systems. <i>Avoidance of interference between earth stations and terrestrial radio stations sharing the same frequency bands. Determination of the coordination distance</i>	164

	Page
Rec. 360	Criteria for selection of preferred reference frequencies for communication-satellite systems sharing frequency bands with line-of-sight radio-relay systems. 165

L. 3—Direct broadcasting from satellites

No Recommendations in this sub-section

L. 4—Radionavigation by satellite

Rec. 361	Frequency requirements of radionavigation-satellite systems 167
----------	---

L. 5—Meteorological satellites

Rec. 362	Frequencies technically suitable for meteorological satellites 169
----------	--

L. 6—Maintenance telemetering, tracking and telecommand

Rec. 363	Preferred frequency bands for use in maintenance telemetering, tracking and telecommand of developmental and operational satellites 170
----------	---

L. 7—Space research

Rec. 364	Tele communication links for near-earth research stations. <i>Frequencies, bandwidths and interference criteria</i> 171
Rec. 365	Telecommunication links for deep-space research. <i>Frequencies, bandwidths and interference criteria</i> 173
Rec. 366	Telecommunication links for manned research spacecraft 175
Rec. 367	Frequency bands for re-entry communications 177

L. 8—Radioastronomy

Rec. 314	Protection of frequencies used for radioastronomical measurements 178
----------	---

L. 9—Radar astronomy

No Recommendations in this sub-section

REPORTS OF SECTION L (SPACE-SYSTEMS AND RADIOASTRONOMY)

L. 1—General

Report 204	Terms and definitions relating to space radiocommunication 181
Report 205	Factors affecting the selection of frequencies for telecommunications with and between spacecraft 185

L. 2—Communication satellites

Report 206	Communication-satellite systems. <i>General considerations relating to the choice of orbit, satellite and type of system</i> 206
Report 207	Active communication-satellite experiments. <i>Preliminary results of tests and demonstrations</i> 216
Report 208	Active communication-satellite systems for frequency-division multiplex telephony and monochrome television. <i>Form of the basic hypothetical reference circuit and allowable noise standards; video bandwidth and sound channel for television</i> 218

		Page
Report 209	Communication-satellite systems. <i>Frequency sharing between communication-satellite systems and terrestrial services</i>	221
Report 210	Frequency sharing within and between communication-satellite systems . .	232
Report 211	Active communication-satellite systems. <i>A comparative study of possible methods of modulation</i>	233
Report 212	Communication-satellite systems for frequency-division multiplex telephony and monochrome television. <i>Use of pre-emphasis by frequency modulation systems</i>	249
Report 213	Factors affecting multi-station access in communication-satellite systems .	250
Report 214	Communication-satellite systems. <i>The effects of Doppler frequency-shifts, transmission time delays and switching discontinuities</i>	252

L. 3—Direct broadcasting from satellites

Report 215	Feasibility of direct sound and television broadcasting from satellites . . .	262
------------	---	-----

L. 4—Radionavigation by satellites

Report 216	Use of satellites for terrestrial radionavigation	267
------------	---	-----

L. 5—Meteorological satellites

Report 217	Radiocommunications for meteorological satellite systems	270
------------	--	-----

L. 6—Maintenance telemetering, tracking and telecommand

No Reports in this sub-section

L. 7—Space research

Report 218	Technical characteristics of telecommunication links between earth stations and spacecraft for research purposes	272
Report 219	Interference considerations for near-earth research satellite telecommunication links	288
Report 220	Interference considerations for telecommunication links used for deep-space research	294
Report 221	Telecommunication links for manned research spacecraft. <i>Frequencies, bandwidths and interference criteria</i>	300
Report 222	Factors affecting the selection of frequencies for telecommunications with spacecraft re-entering the earth's atmosphere	302

L. 8—Radioastronomy

Report 223	Line frequencies or bands, of interest to radioastronomy and related sciences, in the 30 to 300 Gc/s range arising from natural phenomena	304
Report 224	Radioastronomy	307
Report 225	The possibility of frequency sharing between radioastronomy and other services	326

L. 9—Radar astronomy

Report 226	Factors affecting the possibility of frequency sharing between radar astronomy and other services	338
------------	---	-----

QUESTIONS AND STUDY PROGRAMMES ASSIGNED TO STUDY GROUP IV (SPACE SYSTEMS AND RADIOASTRONOMY); OPINIONS AND RESOLUTIONS OF INTEREST TO THIS STUDY GROUP

Introduction by the Chairman, Study Group IV	343
Opinion 3	
Data on traffic loading and routing for use in developing communication-satellite system facilities	346
Question 234 (IV)	
Antennae for space systems	346
Question 235 (IV)	
Technical characteristics of communication-satellite systems	347
Study Programme 235A (IV)	
Feasibility of frequency sharing between communication-satellite systems and terrestrial radio services	348
Study Programme 235B (IV)	
Frequency sharing between communication-satellite systems and terrestrial radio services. <i>Wanted-to-unwanted signal ratios</i>	349
Study Programme 235C (IV)	
Communication-satellite systems. <i>Feasibility of frequency sharing among communication-satellite systems</i>	349
Study Programme 235D (IV)	
Study of preferred modulation characteristics for communication-satellite systems	350
Study Programme 235E (IV)	
Factors affecting freedom of access in communication-satellite systems	351
Question 236 (IV)	
Sharing of radio-frequency bands by links between earth stations and spacecraft	351
Question 237 (IV)	
Technical characteristics of links between earth stations and spacecraft	352
Question 238 (IV)	
Active communication-satellite systems for frequency-division multiplex telephony. <i>Transmission characteristics of audio channels</i>	353
Question 239 (IV)	
Effects of plasma on communications with spacecraft	354
Study Programme 239A (IV)	
Frequency bands for re-entry communications	354
Question 240 (IV)	
Time delay, echoes and switching discontinuities in communication-satellite systems	355
Question 241 (IV)	
Feasibility of direct sound and television broadcasting from satellites	356
Question 242 (IV)	
Technical characteristics of radionavigation satellite systems	356
Question 243 (IV)	
Radiocommunication for meteorological-satellite systems	357
Study Programme 243A (IV)	
Radiocommunication aspects of meteorological-satellite systems.	357
Question 244 (IV)	
Radioastronomy	358
Question 245 (IV)	
Radar astronomy	359

List of documents of the Xth Plenary Assembly of the C.C.I.R. concerning Study Group IV .361

The following texts, which are not contained in this Volume, also concern space-systems and radioastronomy:

Text	Title	Volume
Opinion 5	Influence of the troposphere on frequencies used for telecommunication with and between spacecraft	II
Study Programme 190 (V)	Tropospheric propagation factors affecting the sharing of the radio-frequency spectrum between radio-relay systems, including space and terrestrial telecommunications systems	II
Resolution 2	Tropospheric propagation data for broadcasting, space and point-to-point communications	II
Study Programme 191 (V)	Tropospheric absorption and refraction in relation to space telecommunication systems	II
Report 263	Factors affecting propagation in communications with spacecraft	II
Resolution 6	Use of satellite-borne ionosondes in orbits above the F2 peak (topside sounders) for the study of ionospheric propagation	II
Study Programme 204 (VI)	Characteristics of the ionosphere affecting space telecommunication systems	II
Study Programme 205 (VI)	Effects of radio noise in space on communications with spacecraft	II
Opinion 9	Effects of the ionosphere on radio waves used for telecommunication with and between spacecraft beyond the lower atmosphere	II
Study Programme 249A (VII)	Standard-frequency and time signal emissions from artificial earth satellites	III
Report 276	Monitoring at fixed monitoring stations of radio emissions from spacecraft	III
Question 188 (VIII)	Monitoring at fixed monitoring stations of radio emissions from spacecraft	III