XVII A.P.
DÜSSELDORF
21.5-1.6 1990
CCIR

XVIIth PLENARY ASSEMBLY
DÜSSELDORF, 1990

INTERNATIONAL TELECOMMUNICATION UNION

QUESTIONS OF THE CCIR, 1990

VOLUME XV–4

SG 4	FIXED-SATELLITE SERVICE
SG 9	FIXED SERVICE

CCIR INTERNATIONAL RADIO CONSULTATIVE COMMITTEE

Geneva, 1990

CCIR

1. The International Radio Consultative Committee (CCIR) is the permanent organ of the International Telecommunication Union responsible under the International Telecommunication Convention "... to study technical and operating questions relating specifically to radiocommunications without limit of frequency range, and to issue recommendations on them..." (International Telecommunication Convention, Nairobi 1982, First Part, Chapter I, Art. 11, No. 83).*

2. The objectives of the CCIR are in particular:

a) to provide the technical bases for use by administrative radio conferences and radiocommunication services for efficient utilization of the radio-frequency spectrum and the geostationary-satellite orbit, bearing in mind the needs of the various radio services;

b) to recommend performance standards for radio systems and technical arrangements which assure their effective and compatible interworking in international telecommunications;

c) to collect, exchange, analyze and disseminate technical information resulting from studies by the CCIR, and other information available, for the development, planning and operation of radio systems, including any necessary special measures required to facilitate the use of such information in developing countries.

* *See also the Constitution of the ITU, Nice, 1989, Chapter 1, Art. 11, No. 84.*

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STUDY GROUPS 4, 9

CCIR INTERNATIONAL RADIO CONSULTATIVE COMMITTEE

92-61-04361-5

Geneva, 1990

PLAN OF VOLUMES I TO XV
XVIIth PLENARY ASSEMBLY OF THE CCIR

(Düsseldorf, 1990)

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All references within the texts to CCIR Recommendations, Reports, Resolutions, Opinions, Decisions and Questions refer to the 1990 edition, unless otherwise noted; i.e., only the basic number is shown.

1990
Printed in Belgium

DISTRIBUTION OF TEXTS OF THE XVIIth PLENARY ASSEMBLY OF THE CCIR IN VOLUMES I TO XV

Volumes and Annexes I to XV, XVIIth Plenary Assembly, contain all the valid texts of the CCIR and succeed those of the XVIth Plenary Assembly, Dubrovnik, 1986.

1. Recommendations, Resolutions, Opinions are given in Volumes I-XIV and Reports, Decisions in the Annexes to Volumes I-XII.

1.1 *Numbering of texts*

When a Recommendation, Report, Resolution or Opinion is modified, it retains its number to which is added a dash and a figure indicating how many revisions have been made. Within the text of Recommendations, Reports, Resolutions, Opinions and Decisions, however, reference is made only to the basic number (for example Recommendation 253). Such a reference should be interpreted as a reference to the latest version of the text, unless otherwise indicated.

The tables which follow show only the original numbering of the current texts, without any indication of successive modifications that may have occurred. For further information about this numbering scheme, please refer to Volume XIV.

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* Not reprinted, see Dubrovnik, 1986.

(1) Published separately.

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* Not reprinted, see Dubrovnik, 1986.

(1) Published separately.

1.3.1 *Note concerning Reports*

The individual footnote "Adopted unanimously" has been dropped from each Report. Reports in Annexes to Volumes have been adopted unanimously except in cases where reservations have been made which will appear as individual footnotes.

1.4 *Resolutions*

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2. **Questions** (Vols. XV-1, XV-2, XV-3, XV-4)

2.1 *Numbering of texts*

Questions are numbered in a different series for each Study Group: where applicable a dash and a figure added after the number of the Question indicate successive modifications. The number of a Question is completed by an *Arabic figure indicating the relevant Study Group.* For example:

- Question 1/10 would indicate a Question of Study Group 10 with its text in the original state;
- Question 1-1/10 would indicate a Question of Study Group 10, whose text has been once modified from the original; Question 1-2/10 would be a Question of Study Group 10, whose text has had two successive modifications.

Note – The numbers of the Questions of Study Groups 7, 9 and 12 start from 101. In the case of Study Groups 7 and 9, this was caused by the need to merge the Questions of former Study Groups 2 and 7 and Study Groups 3 and 9, respectively. In the case of Study Group 12, the renumbering was due to the requirement to transfer Questions from other Study Groups.

2.2 *Assignment of Questions*

In the plan shown on page II, the relevant Volume XV in which Questions of each Study Group can be found is indicated. A summary table of all Questions, with their titles, former and new numbers is to be found in Volume XIV.

2.3 *References to Questions*

As detailed in Resolution 109, the Plenary Assembly approved the Questions and assigned them to the Study Groups for consideration. The Plenary Assembly also decided to discontinue Study Programmes. Resolution 109 therefore identifies those Study Programmes which were approved for conversion into new Questions or for amalgamation with existing Questions. It should be noted that references to Questions and Study Programmes contained in the texts of Recommendations and Reports of Volumes I to XIII are still those which were in force during the study period 1986-1990.

Where appropriate, the Questions give references to the former Study Programmes or Questions from which they have been derived. New numbers have been given to those Questions which have been derived from Study Programmes or transferred to a different Study Group.

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VOLUME XV-4

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QUESTION 7-2/4

BASEBAND TRANSMISSION VARIABILITY, DELAY, ECHOES AND SWITCHING DISCONTINUITIES IN SYSTEMS IN THE FIXED-SATELLITE SERVICE

(1962-1963-1970-1974-1986)

The CCIR,

CONSIDERING

(a) that satellites at various altitudes may be used for communication purposes;

(b) that, due to the distances to be traversed by the signals and the finite velocity of radio waves, the use of satellites for communication purposes will introduce transmission delay;

(c) that echoes, e.g. due to impedance mismatch at 4-wire/2-wire terminations external to the satellite link, may also be present;

(d) that transmission discontinuities, due to the switching of signals from satellite to satellite in non-synchronous satellite systems, may cause difficulties for the transmission of telephony, telegraphy, television and other signals, if the discontinuities are excessive or too frequent;

(e) that the permissible overall transmission delays, levels of echoes, switching discontinuities, attenuation variations, frequency variations arising from Doppler and other effects, are matters for the CCITT (in the case of television, for the CMTT) to decide;

(f) that the permissible values of transmission delay may have a marked effect on the costs of establishing and maintaining fixed-satellite systems;

(g) that, whereas high altitude satellites offer increased coverage with fewer satellites, the transmission delay would be greater than if low altitude satellites were used;

(h) that future fixed-satellite systems may utilize signal processing or on-board signal regeneration where delay may be encountered;

(j) that some digital services may be unaffected by satellite delay and further study may be required,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what transmission delays and switching discontinuities are to be expected in the various types of fixed-satellite system;

2. what methods, within the satellite system itself, could be used to minimize or avoid transmission-delay variations and switching discontinuities in non-synchronous satellite systems;

3. what attenuation variations and residual frequency variations are to be expected in the baseband for various types of systems in the fixed-satellite service;

4. which orbits are most suitable for fixed-satellite systems, as regards the maximum permissible values of the transmission delay, level of echo signals and switching discontinuities for telephony, telegraphy, television and other signals, taking account of the views of the CCITT and CMTT, as appropriate;

5. what additional transmission delays are to be expected in satellite systems utilizing on-board signal processing and regeneration;

6. which digital services may be unaffected by transmission delay?

Note – See Report 214.

QUESTION 23-1/4

LOW CAPACITY EARTH STATIONS AND ASSOCIATED SATELLITE SYSTEMS

(1974-1986)

The CCIR,

CONSIDERING

(a) Resolution No. 27 of the Plenipotentiary Conference, Nairobi, 1982;

(b) the urgent needs of developing countries and the needs of various administrations for the use of low capacity earth stations and associated systems;

(c) the need to incorporate low capacity systems in the international telecommunication network;

(d) that more information on technical and operational matters is necessary to assist in the development of economical low capacity earth stations and associated systems;

(e) that such systems may operate in the frequency bands allocated to the fixed-satellite service,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the preferred frequency bands, modulation, access and coding methods for low capacity systems;

2. what are the preferred performance characteristics of earth stations and space stations for such systems;

3. what systems criteria must be defined to ensure compatibility between low capacity systems and between future low capacity systems and existing systems in the fixed-satellite service, including those for:

- facilitating interconnection in the international telecommunication network,
- frequency sharing and making most effective use of the geostationary-satellite orbit?

Note – See Report 869.

QUESTION 25-1/4*

UNWANTED EMISSIONS RADIATED FROM AND RECEIVED BY EARTH STATIONS AND SPACE STATIONS OF THE FIXED-SATELLITE SERVICE

(1976-1982)

The CCIR,

CONSIDERING

(a) that the radiation of unwanted emissions by space stations or earth stations of the fixed-satellite service could cause interference to other services;

(b) that the radiation of unwanted emissions by other services could cause interference to the space stations and/or earth stations of the fixed-satellite service;

(c) that unwanted emissions by space stations or earth stations of the fixed-satellite service could cause interference to other stations of the fixed-satellite service;

(d) that suppression of unwanted emissions to very low levels, in particular from space stations, may involve major technical problems;

(e) that the various radio services differ greatly in the sensitivity of their stations to interference;

(f) that Appendix 8 to the Radio Regulations specifies the maximum permitted levels of spurious emissions for frequency bands below 17.7 GHz;

(g) that the CCIR has not yet furnished adequate Recommendations pertaining to unwanted emissions at frequencies above 960 MHz;

(h) that no information is available regarding unwanted emissions from stations employing digital modulation techniques in frequency bands above 960 MHz;

(j) that Recommendation No. 66 of the WARC-79 calls for the continued intensive study of maximum permitted levels of spurious emissions for all frequency bands, services and modulation methods not currently covered by Appendix 8 to the Radio Regulations, and specifically for the space services;

(k) that Recommendation No. 507 of the WARC-79 calls for the study of the specific problem of interference which may be caused by spurious emissions from stations in the broadcasting-satellite service to services with adjacent-frequency allocations;

(l) the invitation to the CCIR of Recommendation No. 61 of the WARC-79 to continue to study technical standards for the assessment of harmful interference and to recommend technical criteria for the frequency bands above 28 MHz, allocated to space radiocommunication, radio astronomy, and the terrestrial radiocommunication services concerned, in order to enable the IFRB and administrations to apply such criteria for these bands,

UNANIMOUSLY DECIDES that the following question should be studied as a matter of urgency:

1. what limit should be placed upon the power of unwanted emissions radiated by space stations and earth stations of the fixed-satellite service in the various frequency bands in order to protect this service and other services taking into account § 1 and 3 of Recommendation No. 66 of the WARC-79;

2. what level of power flux-densities resulting from unwanted emissions of stations of other services is acceptable at space and earth stations of the fixed-satellite service and what are the technical and operational aspects deriving from the presence of unwanted emissions from stations of other services, notably space stations of the broadcasting-satellite service, taking account of Recommendation No. 507 of the WARC-79?

Note – See Reports 712 and 713.

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* This Question should be brought to the attention of Study Groups 1, 7, 8, 9, 10 and 11.

QUESTION 30/4*

PROVISION OF FEEDER LINKS** BETWEEN FIXED-EARTH STATIONS AND SPACE STATIONS OF VARIOUS SERVICES IN FREQUENCY BANDS ALLOCATED TO THE FIXED-SATELLITE SERVICE

(1986)

The CCIR,

CONSIDERING

(a) that at present feeder links between fixed-earth stations and space stations of any space radiocommunication service may be provided in frequency bands allocated to the fixed-satellite service (Radio Regulations No. 22 regarding feeder links);

(b) that certain Earth-to-space allocations to the fixed-satellite service have been designated for the exclusive provision of feeder links to space stations in the broadcasting-satellite service;

(c) that except for *(b)* above, frequency allocations for the fixed-satellite service, in general, provide no differentiation between the various applications to which these bands may be put;

(d) that some feeder link applications are unidirectional requirements, which may make inefficient use of the bi-directional frequency allocations to the fixed-satellite service;

(e) that in planning space services adequate provision should be made for the feeder links;

(f) that the technical characteristics of feeder links may be quite different from those of links entirely in the fixed-satellite service and may give rise to inhomogeneity in some fixed-satellite service bands;

(g) that it may be technically and operationally desirable for all satellites of a system to use particular frequency bands for feeder links, regardless of orbital position or date of entry into service;

(h) that the deployment of large integrated multiple-service space stations may emerge in the future as an attractive option for the utilization of spectrum allocated to the space services;

(j) the invitation to the CCIR of Recommendation No. 61 of the WARC-79 to continue to study technical standards for the assessment of harmful interference and to recommend technical criteria for the frequency bands above 28 MHz, allocated to space radiocommunication, radio astronomy, and the terrestrial radiocommunication services concerned, in order to enable the IFRB and administrations to apply such criteria for these bands,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the technical characteristics of systems of the various space services affecting the bandwidth requirements and the choice of frequency bands for feeder links, and what are the desirable technical characteristics of such links;

2. what are the technical advantages and disadvantages associated with providing feeder links in bands allocated to the fixed-satellite service, and what special provisions would enhance the utility of feeder links when using allocations of the fixed-satellite service;

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* This Question should be brought to the attention of Study Groups 7, 8, 9, 10 and 11.

** A feeder link may include an up link or a down link or both, depending on the requirement of the particular space service (see No. 109 of the Radio Regulations for the full definition).

3. what other provisions for feeder links may be desirable or necessary, and which technical factors could help influence a decision on the suitability of the frequency spectrum for feeder links to satellites of any particular service, for example:

3.1 sharing difficulties,

3.2 adjacent band interference,

3.3 propagation constraints;

4. what are the technical and operational problems and advantages regarding the provision of feeder links in relation to the coexistence of sub-systems in various services on board the same space station;

5. what other technical or operational factors would affect, or would be affected by, the specific provision of feeder links in the various space services?

QUESTION 32-1/4

FREQUENCY SHARING BETWEEN SYSTEMS IN THE FIXED-SATELLITE SERVICE AND TERRESTRIAL SERVICES

(1986-1990)

The CCIR,

CONSIDERING

(a) that, in the interest of spectrum conservation, many frequency bands have been allocated on a shared basis to the fixed-satellite service and terrestrial services;

(b) that it should be feasible in most cases for these services to share frequency bands effectively;

(c) that the scope for development and future applications of systems in both kinds of service depends to a great extent upon the manner in which they share frequency bands;

(d) that the use of systems in the fixed-satellite service which may include inter-satellite links and feeder links to satellites in other radiocommunication services, will require extensive use of the radio-frequency spectrum allocated;

(e) that the conditions for effective frequency sharing between radio-relay systems and the fixed-satellite service should be investigated;

(f) that attention should be paid to the conditions for frequency sharing between inter-satellite links in the fixed-satellite service and terrestrial services;

(g) that Resolution No. 101 of the WARC-79 requests the CCIR to study and to determine, as a matter of urgency, suitable criteria applicable to sharing between the fixed and mobile services and feeder links to broadcasting satellites,

UNANIMOUSLY DECIDES that the following question should be studied:

1. under what conditions and to what extent can systems in the fixed-satellite service share frequency bands with terrestrial services;

2. what are the preferred technical characteristics of transmitting and receiving antennas for earth stations at fixed locations, from the standpoint of frequency sharing with terrestrial radio services;

3. what are the factors that determine the maximum power, or power density which may be radiated towards the horizon by an earth station;

4. what are the factors that determine the minimum antenna beam elevation angle which should be employed by earth stations;

5. what criteria are appropriate for frequency sharing between inter-satellite links in the fixed-satellite service and terrestrial services;

6. what criteria are appropriate for frequency sharing between terrestrial fixed and mobile services and feeder links to broadcasting satellites?

Note – See Recommendations 355, 357, 406, 615 and 675, and Reports 209, 386, 388, 393, 448, 449, 709, 791, 792, 876 and 877.

QUESTION 34/4*

PHYSICAL INTERFERENCE IN THE GEOSTATIONARY-SATELLITE ORBIT

(1986)

The CCIR,

CONSIDERING

(a) that continuity of traffic on established geostationary-satellite links may be interrupted by collision or by the physical blocking of satellite antenna beams due to the uncontrolled drifting of inactive satellites;

(b) that it is desirable that the probability of physical interference due to inactive satellites remain low;

(c) that the numbers of uncontrolled objects in or intersecting the geostationary-satellite orbit are likely to continue to increase;

(d) that the size of satellites in the geostationary-satellite orbit is likely to increase;

(e) that some concerned organizations have already developed policies, in respect of their own satellites, to reduce the probability of physical interference;

(f) that it would benefit all users and potential users of the geostationary-satellite orbit to ensure that unnecessary hazards are minimized,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what is the probability of physical interference under the assumptions that inactive satellites are left to drift in geostationary orbits; that inactive satellites are removed to orbits not intersecting the geostationary orbit; and that other means to minimize physical interference in the GSO might be used;

2. what is the probability of satellites losing normal control ability prior to or during the intended removal from the geostationary orbit;

3. what are the best means to minimize unnecessary physical interference in the geostationary orbit;

4. what are the practical difficulties, including any reduction in operational life, associated with the removal of satellites from the geostationary orbit;

5. what conditions would have to exist for physical interference to adversely affect geostationary-satellite operations;

6. what are the effects of a collision in the geostationary orbit including the effect on the probability of physical interference?

Note – See Report 1004.

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* This Question should be brought to the attention of Study Groups 7, 8, 10 and 11.

QUESTION 36/4

USE OF STEERABLE SPOT BEAMS BY SPACE STATIONS IN THE GEOSTATIONARY-SATELLITE ORBIT

(1987)

The International Frequency Registration Board (IFRB),

CONSIDERING

(a) the provisions of No. 326 of the International Telecommunication Convention (Nairobi, 1982);

(b) the inadequacy of suitable technical guidance to consider the interference potential created by the use of steerable spot beams from a space station on a geostationary-satellite orbit;

(c) the urgent need of the IFRB to have such a guidance to enable it to treat cases of steerable spot beams used by such space stations within the framework of Appendix 29 to the Radio Regulations,

REQUESTS THE CCIR:

urgently to study the method to be used to calculate interference between satellite networks in which the space stations on the geostationary-satellite orbit use steerable spot beams.

QUESTION 39/4*

TECHNICAL CRITERIA TO BE USED IN THE BOARD'S EXAMINATIONS OF THE PROBABILITY OF HARMFUL INTERFERENCE REQUIRED BY PROVISIONS Nos. 1354, 1506 AND 1509 OF THE RADIO REGULATIONS

(1989)

The International Frequency Registration Board (IFRB),

CONSIDERING

(a) the provisions of No. 326 of the International Telecommunication Convention, Nairobi, 1982;

(b) that the Radio Regulations, in Articles 12 and 13, request the IFRB to carry out examinations, *inter alia*, of the probability of harmful interference between terrestrial stations and earth stations (Nos. 1354 and 1509) as well as examinations of the probability of harmful interference between stations of geostationary-satellite networks (No. 1506);

(c) that it is necessary for the Board, when developing its Technical Standards, to have the required information through appropriate Recommendations of the CCIR (see Nos. 1001, 1454 and 1582 of the Radio Regulations);

(d) that the Radio Regulations distinguish the harmful interference (No. 163) from the permissible interference (No. 161);

(e) that in Question 45/1 the CCIR decided to study the terms "acceptable interference" and "harmful interference" as well as the problems related to the maximum permissible values of interference and the associated time percentages in a general way, applicable to all radiocommunication services;

(f) that the present CCIR Recommendations and Reports contain criteria for different sharing situations between terrestrial and space services, but there exists no CCIR Recommendation or Report establishing the limits of harmful interference which the Board could consider when developing its Technical Standards to be used for the above mentioned examinations of the probability of harmful interference,

REQUESTS THE CCIR to study the following question:

what criteria for levels of harmful interference are to be recommended to the IFRB for use in its examinations of the probability of harmful interference, in particular in examinations foreseen by provisions Nos. 1354, 1506 and 1509 of the Radio Regulations, and under what conditions and for what associated percentage of time do they apply?

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* Elements of this Question concerning criteria for levels of harmful interference are studied separately by Study Group 4 and Study Group 9 (see Question 141/9). The elements concerning under what conditions and for what associated percentage of time they apply are studied jointly by Working Party 4-9S.

QUESTION 40/4*

REFERENCE RADIATION DIAGRAM OF ANTENNAS AT EARTH STATIONS IN THE FIXED-SATELLITE SERVICE**

(1990)

The CCIR,

CONSIDERING

(a) that the side-lobe characteristics of antennas for earth stations will affect the level of interference between the fixed-satellite services and terrestrial systems in shared frequency bands and also the efficiency of utilization of the geostationary-satellite orbit;

(b) that the majority of earth stations in the existing satellite services employ antennas of large diameter to wavelength ratio (D/λ) and that important but incomplete data concerning such antenna radiation patterns are already available;

(c) that in the future earth stations in the fixed-satellite service systems may employ antennas of relatively small D/λ,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what is the reference radiation pattern for coordination studies and the calculation of interference between fixed-satellite systems, and between earth stations of such systems and stations of other services (Note 1);

2. what is the design objective for new antennas with side-lobe levels as low as practicable (Note 2)?

Note 1 – To do this in a statistically significant and convincing manner a great deal of information on antenna far field side-lobes is needed. This information should cover a representative range of antenna types over a wide range of D/λ and operating frequencies. Measurement conditions and uncertainties should be stated.

Note 2 – Since one of the main aims is to improve utilization of the geostationary-satellite orbit a high degree of suppression of radiation a few degrees off-beam is of particular importance. The design objective should be based on:

- the analysis of measurements of the side-lobe peaks of new earth-station antennas, where these show a high degree of side-lobe suppression; these measurements should be made in the far field with adequate ground clearance. The uncertainty associated with the measurements should be stated;
- the analysis of available studies for proposed antenna types where these aim at a high degree of side-lobe suppression.

Note 3 – See Recommendations 465, 580 and Reports 391, 998.

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* Previously Study Programme 1A/4.

** Special attention is to be paid to very small aperture antennas (e.g. VSAT antennas).

QUESTION 41/4*

RADIATION CHARACTERISTICS OF SATELLITE ANTENNAS IN THE FIXED-SATELLITE SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that the efficient utilization of the frequency spectrum and the geostationary-satellite orbit is dependent on the performance of the antenna system;

(b) that antenna systems capable of the simultaneous utilization of the same frequencies twice or more at the same location or from the same service area are necessary for frequency re-use;

(c) that multi-beam antennas may be utilized for different service areas and may also involve frequency re-use;

(d) that frequency re-use might be achieved with orthogonally polarized signals;

(e) that more effective utilization of satellite power can be made if beam shaping is employed;

(f) that the performance of such antenna systems should be evaluated by practical means prior to their use,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what is the orthogonal polarization performance in all angular regions, with particular regard to the antenna type;

2. what is the coupling between antennas in close proximity and between beams of multi-beam antennas;

3. what are the techniques for beam shaping both along the axis of propagation and perpendicular to that axis;

4. what is the minimum achievable beamwidth, taking into account factors such as, physical size, realizable geometrical antenna tolerances in orbit and spacecraft antenna orientation accuracy;

5. what is the minimum usable beamwidth, taking into account the environmental effects in orbit, such as heating and atmosphere effects in the transmission path;

6. what are the techniques for evaluation of these antenna characteristics;

7. what pointing accuracy is reasonably attainable wih antennas of various sizes and types?

Note – See Recommendation 672 and Reports 555, 558 and 1141.

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* Previously Study Programme 1B/4.

QUESTION ITU-R 42-1/4*

CHARACTERISTICS OF ANTENNAS AT EARTH STATIONS IN THE FIXED-SATELLITE SERVICE

(1990-1993)

The ITU Radiocommunication Assembly,

considering

a) that the radiation fields close to antennas will affect the level of coupling between earth-station antennas in the fixed-satellite service (FSS) and nearby antennas using the same frequency bands;

b) that the radiation fields of antennas may also be affected by the use of pit shielding;

c) that earth-station antennas with more than one beam are feasible, and that the use of such antennas may be preferable to employing several single-beam antennas at an earth station;

d) that frequency re-use might be achieved with orthogonally polarized signals;

e) that the precision of satellite station-keeping and attitude control may improve as a result of the development of more advanced control techniques in the satellite sub-systems;

f) that at higher frequency bands (i.e. 20-30 GHz) phased array antennas are also likely to be used,

decides that the following Question should be studied

1. What is the relationship between near and far field patterns of earth stations in the FSS and other stations using the same frequency bands?

2. What is the coupling between antennas close to one another?

3. What is the effectiveness of pits or other devices for providing shieldings?

4. What are the radiation characteristics of each beam of multi-beam antennas?

5. What are the limitations on the number of beams that can be generated by a single antenna, and what is the minimum achievable angular separation between the beams?

6. What is the polarization discrimination performance of antenna systems in all angular regions with particular regard to the antenna type?

7. What are the desirable limits of steerability of earth-station antennas for geostationary satellites?

8. What are the radiation characteristics of phased array antennas?

Note 1 - The results of these studies should lead to the formulation of appropriate Recommendations within three years.

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* New version of CCIR Question 42/4

QUESTION 43/4*

USE OF SMALL EARTH STATIONS IN THE FIXED-SATELLITE SERVICE IN THE EVENT OF NATURAL DISASTERS, EPIDEMICS, FAMINES AND SIMILAR EMERGENCIES FOR WARNING AND RELIEF OPERATIONS

(1990)

The CCIR,

CONSIDERING

(a) that rapid and reliable telecommunications are essential for relief operations in the event of natural disasters, epidemics, famines and similar emergencies;

(b) that geostationary-satellite systems can provide telecommunication services to help minimize losses resulting from these emergencies;

(c) that, through damage or from other causes, the normal telecommunications facilities in disaster areas are often inadequate for relief operations and cannot be restored or supplemented quickly through local resources;

(d) that the World Administrative Radio Conference, Geneva, 1979, has adopted Recommendation No. 1;

(e) that use of space radiocommunication systems is one of the means by which rapid and reliable telecommunications could be provided for relief operations;

(f) that the cost of the equipment needed for this purpose should be minimal, but that the equipment might perform a variety of functions including voice disaster warning, field reporting, data collection and co-ordination of relief operations,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what factors affect the choice of suitable frequency bands for transportable earth stations in the fixed-satellite service to provide relief telecommunications;

2. what are the preferred technical characteristics for transportable earth stations in the fixed-satellite service to provide relief telecommunications?

Note – See Report 554.

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* Previously Study Programme 22A/4.

QUESTION 44/4*

USE OF TRANSPORTABLE TRANSMITTING EARTH STATIONS IN THE FIXED-SATELLITE SERVICE INCLUDING USE FOR FEEDER LINKS TO BROADCASTING SATELLITES

(1990)

The CCIR,

CONSIDERING

(a) that the introduction of transportable transmitting earth stations is essential for television operation and provides a satisfactory technical solution for problems of outside television broadcasting;

(b) that in the case of using of transportable transmitting earth stations for feeder links to broadcasting satellites the results of WARC ORB-88 should be taken into account;

(c) that it would be desirable to review the link budgets of up links and down links in view of constraints due to the small size of transportable transmitting earth-station antennas;

(d) that it may be necessary to provide for the simultaneous accommodation of auxiliary signals required for the operation of transportable transmitting earth-station and that these auxiliary signals may have an effect on interference problems,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what overall design of links using transportable transmitting earth stations is appropriate for various uses in the fixed-satellite service including outside television broadcasts and feeder links to broadcasting satellites;

2. what characteristics and operational procedures are recommended for transportable transmitting earth stations;

3. what interference problems need to be considered due to the transmission of auxiliary signals that may be necessary for the operation of transportable earth stations;

4. what factors affect the choice of suitable frequency bands for the operation of transportable transmitting earth stations, taking into account that many bands are shared with terrestrial services;

5. to what extent would it be feasible and desirable to reduce radiation outside the main beam for small-diameter antennas (D/λ below 150)?

Note – See also Question 32/CMTT.

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* Previously Study Programme 22B/4. This Question should be brought to the attention of the CMTT and Study Groups 10 and 11.

QUESTION 45/4*

INTERRUPTIONS TO TRAFFIC ON DIGITAL PATHS OR CIRCUITS IN THE FIXED-SATELLITE SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that continuity of traffic on established satellite links may be interrupted by equipment failure or by natural phenomena (i.e. solar interference, attenuation due to hydrometeors);

(b) that the interruptions may be divided into self-restoring interruptions (i.e. protection switching, hydrometeors) and interruptions which include repair time;

(c) that site diversity and protection switching converts longer interruptions into either very brief ones or prevents complete interruptions of the link;

(d) that existing Recommendations 353, 354, 522 and 614 permit a high noise level or a high bit error ratio during very short periods for a very small percentage of the time; that digital path or circuit availability is affected by interruptions of 10 consecutive seconds or more and that digital path or circuit quality is affected by momentary interruptions of traffic of less than 10 s according to the availability objectives given in Recommendation 579;

(e) that the CCITT is being asked for advice on the level of noise and its duration which it regards as equivalent to a total interruption, and is studying the duration and frequency of occurrence of short breaks in transmission and of sudden level variations on an international telephone circuit;

(f) that interruptions to traffic may be manifested by sudden baseband level variations, by complete loss of the wanted signal or by high noise level; or in the case of digital transmission systems, by bursts of errors;

(g) that there is a need for further study concerning bursts of errors;

(h) that the CCITT in its Recommendation G.221, § (*c*), has pointed out the malfunctioning which can arise due to noise in fault conditions, which may then be transferred to subsequent systems and that earth-station equipment may contain devices which mute receivers under conditions of extreme noise;

(j) that, in planning a satellite link, decisions must be taken on receive signal margins, provision of site diversity and protection switching, etc., which have a major impact on the link availability and the cost of its provision;

(k) that different service applications may have different availability requirements (i.e. demand assigned telephony, data transmission, television);

(l) that the duration of some interruptions may depend on the configuration of the satellite network; they may also depend on whether earth stations are always attended or unattended at the onset of an interruption, and on whether or not the earth-station antennas are readily steerable to point from one satellite to another;

(m) that terms and definitions that are required in connection with this Question should, as far as possible, be based on internationally accepted expressions,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what is the rate of incidence and the duration of self-restoring and other interruptions to be expected in modern satellite systems between points defined by the hypothetical reference digital path or circuit;

2. for satellite links with and without site diversity protection, what is the proportion (in frequency and in duration) of interruptions due to propagation effects which would contribute to the availability and unavailability objectives;

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* Previously Study Programme 24A/4.

3. what are the preferred characteristics (i.e. switching time) for equipment protection arrangements;

4. for satellite links with protection arrangements and/or diversity site switching, what is the proportion (in frequency and in duration) of short breaks in transmission due to protection and diversity switching;

5. what is the proportion of interruptions due to maintenance including human error;

6. what are the preferred characteristics of devices which would prevent malfunctioning of other systems connected in tandem at baseband;

7. what terms and definitions now available in the documents of several international bodies interested in terminology are applicable for these studies and what additional terms and definitions, if any, are required?

Note 1 – In carrying out studies of interruptions as they concern availability, it may be useful to distinguish between satellite networks where the earth stations are always attended and the antennas are readily steerable and other satellite networks where these conditions do not apply.

Note 2 – See Recommendations 353, 354, 522, 579 and 614, and Reports 706 and 997.

QUESTION ITU-R 46-1/4*

PREFERRED MULTIPLE-ACCESS CHARACTERISTICS IN THE FIXED-SATELLITE SERVICE

(1990-1993)

The ITU Radiocommunication Assembly,

considering

a) that satellites in the fixed-satellite service (FSS) are simultaneously used by many earth stations at different locations;

b) that various multiple access methods including time division-multiple access (TDMA) and spread spectrum (or code division) Multiple Access (SSMA or CDMA) are already used or planned by various administrations;

c) that, in order to ensure the efficient use of frequency spectrum and orbits, it may be desirable to determine the optimum multiple-access characteristics;

d) that recommendation of certain system characteristics may be desirable;

e) that the transmission characteristics of multiple-access systems, especially TDMA systems, may be of importance in their interaction with one another;

f) that increases in interference on SSMA signals can be accommodated by reducing system capacity,

decides that the following Question should be studied

1. What are the preferred multiple-access methods taking into account in particular the nature of the network, the modulation methods and the different system characteristics used in the FSS?

2. What characteristics of multiple-access systems might usefully be recommended as preferred and, if appropriate, what operational characteristics should be selected for their application?

3. What is the effect of interference on networks using SSMA techniques?

4. What is the appropriate interference criterion to be applied for coordination among SSMA systems?

5. What is the appropriate interference criterion to be applied for coordination with systems using other modulation and/or access techniques?

Note 1 - The results of these studies should lead to the formulation of appropriate Recommendations within three years.

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* New version of CCIR Question 46/4.

QUESTION 47/4*

USE OF FREQUENCY BANDS ABOVE 10 GHz IN THE FIXED-SATELLITE SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that wide frequency bands are needed for systems in the fixed-satellite service, for both regional and global use;

(b) that the technical feasibility of using frequency bands above 10 GHz for systems in the fixed-satellite service should be considered;

(c) that the use of frequency bands above 10 GHz for these systems would introduce special technical problems, such as the effects of cloud and precipitation, on system performance and reliability,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the technical characteristics associated with the use of frequency bands above 10 GHz for systems in the fixed-satellite service;

2. what special techniques (such as diversity and adaptive** transmission techniques) could be used to overcome these special technical problems;

3. under what conditions would the use of these techniques be appropriate;

4. under what conditions would it be feasible for systems in the fixed-satellite service to share frequency bands above 10 GHz with terrestrial services, and what is the extent to which such sharing might be possible;

5. what criteria affect the determination of the coordination area of earth stations which use special techniques such as site diversity and transmit power control?

Note – See Reports 552 and 710.

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* Previously Study Programme 27C/4.

** "Adaptive", in this sense, means changing the information rate or radiated power over a transmission link to compensate for changes in path attenuation.

QUESTION 48/4*

TECHNICAL FACTORS INFLUENCING THE EFFICIENCY OF USE OF THE GEOSTATIONARY-SATELLITE ORBIT BY RADIOCOMMUNICATION SATELLITE NETWORKS SHARING FREQUENCY BANDS ALLOCATED TO THE FIXED-SATELLITE SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that most of the recent radiocommunication satellite systems use the geostationary-satellite orbit;

(b) that the number of satellites on the geostationary-satellite orbit is increasing rapidly;

(c) that the spacing between such satellites is determined by the need to control interference and that, where the characteristics of the satellites are different, the number that can be accommodated in a given arc depends also on how they are arranged;

(d) that interference can arise in both the up and down links and in direct links between satellites and is dependent on a number of technical factors;

(e) that the factors involved are interrelated and it is necessary to define the relationship between them so as to establish appropriate criteria providing for the orderly development and most effective use of the geostationary-satellite orbit;

(f) that the effectiveness of use of the geostationary-satellite orbit will be further improved to the extent that it may be possible to use the same frequencies more than once within a single radiocommunication satellite, or from the same orbit location by different satellites;

(g) that the effectiveness of use of the geostationary-satellite orbit and the frequency spectrum may also be improved if up-link and down-link frequency bands are used in satellite networks systematically in pairs;

(h) that the ability to operate satellites at small angular separations may be limited by earth-station antenna main beam characteristics;

(j) that Recommendation No. 708 of the WARC-79 recommends that the CCIR study or, as appropriate, continue to study topics which are included in this Question,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the technical characteristics of radiocommunication satellite systems using fixed-satellite frequency bands which affect the utilization of the geostationary-satellite orbit, and the interrelationships between them, some of which are as follows:

1.1 the preferred technical characteristics of transmitting and receiving antennas for earth and space stations, including the purity of polarization (circular and linear) attainable in all relevant parts of the radiation patterns, and the direction of the planes of polarization in the case of linear polarization, from the standpoint of frequency sharing within the same satellite network and with other networks, taking into account both main beam and side-lobe characteristics;

1.2 the optimum range of powers or power densities to be employed by satellite and by earth-station transmitters, to facilitate frequency sharing among networks;

1.3 the effects of modulation characteristics and energy dispersal on frequency sharing among networks;

1.4 the extent to which it is feasible and useful to reduce errors in satellite station-keeping and the pointing direction of satellite antenna beams;

1.5 what are the technical means by which the service arc of a satellite can be maximized;

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* Previously Study Programme 28A/4.

2. what technical criteria should be used to ensure an orderly development aiming at the most efficient and effective use of the geostationary-satellite orbit;

3. under what conditions and to what extent would it be feasible for space stations in the fixed-satellite service, operating in the same system or operating in different systems, to share these preferred frequency bands;

4. to what extent would it be feasible and desirable to adopt preferred technical characteristics for different geostationary radiocommunication satellites and earth stations, to improve the overall effectiveness of the use of the orbit, and what technical methods should be adopted for the adjustment of satellite antenna coverage areas;

5. what technical characteristics and utilization principles should be recommended for application to single geostationary satellites such as providing for up links and down links in more than one pair of frequency bands (including the case of satellites used for multiple services) to improve the efficiency of use of the geostationary-satellite orbit;

6. to what extent is it desirable to pair the frequency bands allocated for Earth-to-space and space-to-Earth links for the fixed-satellite service and, if found desirable, what preferred pairing should be recommended to improve the overall effectiveness of use of both the frequency spectrum and the geostationary orbit, taking into account the various applications and the different frequency allocations in the three ITU Regions;

7. what are the ways in which it would be feasible to increase the efficiency of use of the geostationary-satellite orbit and of the frequency spectrum, by permitting a total interference-noise contribution from other satellite networks substantially in excess of the values recommended in Recommendation 466. Account should be taken of the possibility that a higher total interference-noise contribution might, if necessary, be limited to networks using satellites in congested parts of the orbit. The feasibility of overcoming problems of interference which result from inhomogeneous network parameters and the impact of external interference on satellite networks in which frequency re-use is practised should also be studied;

8. what are the factors affecting the multiple use of the same frequencies within a radiocommunication satellite;

9. what sharing criteria will permit the operation of networks using geostationary and non-geostationary satellites without unacceptable interference?

Note 1 – See Recommendations 465, 466, 483, 484, 524 and 670 and Reports 453, 556, 557, 558, 710, 867, 875, 1000, 1001, 1002, 1136, 1137, 1140 and 1141.

Note 2 – As indicated in Note 6 of Recommendation 524, important studies are needed for possible modification of RECOMMENDS 2 of Recommendation 524.

QUESTION 49/4*

TECHNICAL COORDINATION METHODS FOR SYSTEMS IN THE FIXED-SATELLITE SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that in the development of communication-satellite systems difficulties arise in placing new satellites on certain sectors of the geostationary-satellite orbit owing to the increasing probability of mutual interference;

(b) that the Radio Regulations do not specify any technical procedure for the coordination of communication-satellite systems;

(c) that numerous technical and organizational methods are currently being developed for increasing the use of the geostationary-satellite orbit;

(d) that there are no standard procedures for the technical coordination of communication-satellite systems;

(e) that the WARC-79 adopted Resolution No. 3 "relating to the use of the geostationary-satellite orbit and to the planning of space services utilizing it",

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the methods which should be used for the technical coordination of communication-satellite systems with various combinations of multiple access, modulation and energy dispersal;

2. what are the preferred procedures for the technical coordination of communication-satellite systems on a bilateral and multilateral basis?

Note – See Reports 454, 870, 999, 1003 and 1135.

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* Previously Study Programme 28B/4.

QUESTION 50/4*

INTERFERENCE CRITERIA AND CALCULATION METHODS FOR NETWORKS IN THE FIXED-SATELLITE SERVICE USING DIGITAL MODULATION

(1990)

The CCIR,

CONSIDERING

(a) that sharing of frequency bands between the fixed-satellite service and other co-equal primary space services, requires the availability of appropriate interference criteria;

(b) that coordination of networks within the fixed-satellite service requires the availability of appropriate interference criteria;

(c) that the calculation of interference requires the determination of the interfering signal levels prior to demodulation;

(d) that the total interference effect may be a complex function of the characteristics and power levels of pre-demodulation interfering signals, the demodulator characteristics, and the performance in the absence of interference;

(e) that some systems could use FEC (Forward Error Correction) coding which may pose special problems with respect to interference;

(f) that the criteria of Recommendation 523 are provisional and relate to the protection of a specific digital system (8-bit PCM telephony), although more generalized criteria to include many other digital signals (e.g. 32 kbit/s ADPCM, data) and digital transmission schemes (e.g. on-board signal regeneration) are required;

(g) that it is desirable that CCIR texts offer simple procedures for the conversion between interference or interference criteria and the levels of interfering signals,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the methods by which pre-demodulation levels of interfering signals may be converted to interference effects or interference criteria, recognizing that the total interference will depend on the characteristics and number of interfering signals and the bandwidth within which they are measured and that interference criteria are usually specified for various percentages of time;

2. what are the methods by which the effects of individual interfering signals can be assessed, for the purpose of establishing and applying appropriate single entry criteria;

3. what are the methods by which the effects of single entry and aggregate interference signals on digital carriers with FEC coding can be assessed;

4. what are the methods for characterizing pre-demodulation disturbances other than thermal noise (e.g., inter-symbol interference, non-linearities) which may affect the conversion of interfering signal levels to post-demodulation interference effects;

5. what interference criteria could be used to protect one satellite network which utilizes a wideband carrier from another satellite network which utilizes a number of carriers employing different modulation techniques within the same bandwidth?**

Note – See Recommendations 523 and 671 and Reports 455, 710 and 867.

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* Previously Study Programme 28C/4.

** This Decides was approved by the XVII Plenary Assembly (see PLEN/99).

QUESTION 51/4*

OPERATION, FREQUENCY SHARING AND COORDINATION OF FIXED SATELLITE SERVICE NETWORKS USING SATELLITES IN SLIGHTLY INCLINED GEOSTATIONARY ORBITS

(1990)

The CCIR,

CONSIDERING

(a) that North-South station-keeping consumes up to 90% or possibly more of a geostationary satellite's total station-keeping fuel, makes claim to a major fraction of a satellite's in-orbit mass, and is a dominant factor in limiting the in-orbit life of a geostationary satellite;

(b) that circumstances may make it necessary for an administration to seek to extend the operation of a satellite beyond its anticipated life through the timely cessation of North-South station-keeping;

(c) that it may be desirable and feasible for an administration to plan the operation of a network without or with only part-time North-South station-keeping of its satellite;

(d) that the cessation or absence of North-South station-keeping results in a continual change of a satellite's orbital inclination at a rate not exceeding about 0.85° per year, with the total inclination never exceeding about 15°;

(e) that the diurnal cyclic variations caused by an orbital inclination may affect the probability of mutual interference between the stations of a network not exercising North-South station-keeping and the stations of another network;

(f) that administrations intending to operate a network without or with only part-time North-South station-keeping, as well as those administrations whose services may thereby be affected, should be able to assess the consequences of and determine the practical limits, if any, for such operation,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what extension of operational life may be achieved, and the associated potential spacecraft payload trade-offs;

2. what are the effects of the absence or only part-time use of North-South station-keeping on:

2.1 the operation, reliability and performance of a network;

2.2 the interference between networks, and

2.3 the efficiency of use of the geostationary-satellite orbit;

3. what is the feasibility of operating a number of co-frequency satellites at the same nominal longitude;

4. what are the consequences of time-variant transmission paths, including Doppler shift, propagation delay, and polarization angle variation;

5. what new operating procedures, operational constraints, and/or operating requirements are necessary;

6. what new interference calculation methods and criteria are necessary;

7. what new sharing constraints and criteria are necessary;

8. what new methods for determining the need for coordination between networks are necessary?

Note – See Report 1138.

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* Previously Study Programme 28D/4.

QUESTION 52/4*

CHARACTERISTICS FOR INTERNATIONAL DIGITAL TRANSMISSION LINKS IN THE FIXED-SATELLITE SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that the CCITT suggests a demarcation line between the study of CCITT Study Group XVIII and CCIR Study Group 4 concerning international digital links;

(b) that the CCITT has established a series of interface parameters for primary and higher order multiplex systems;

(c) that digital satellite links will be part of a plesiochronous international digital network as well as the ISDN;

(d) that satellite ISDN connections can form all, or part, of the high grade, medium grade or local grade connections, or combinations thereof;

(e) that satellite systems will interface with digital networks at the earth station;

(f) that digital speech interpolation and low rate encoding techniques (e.g. CCITT Recommendation G.721) are becoming an increasingly important feature of digital satellite communications;

(g) that, for a geostationary satellite, the transmission time from end-to-end of the hypothetical reference digital path may vary significantly due to the movement of the satellite relative to the Earth;

(h) that satellite links may be required for the transmission of digital television signals;

(j) that on-board switching and on-board signal processing techniques may be employed in the future,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what is the impact that low rate encoding and digital speech interpolation (either separately or combined) might have on the characteristics of voice and data communications in digital satellite systems;

2. what is the best way of introducing low rate encoding and digital speech interpolation techniques;

3. what are the factors which affect the determination of the various alternative architectures, corresponding reference digital paths, link control protocols and user requirements;

4. what are the appropriate availability and performance criteria (e.g. phase jitter, slips, bunched digital errors) at the relevant interfaces; and what coding/decoding techniques for error correction, if any, may be needed to meet the performance criteria;

5. what energy dispersal (i.e. scrambling) and/or encryption methods are appropriate for different services;

6. what are the factors which affect the determination of how best to accommodate elastic buffering to compensate for time delay variations due to satellite movement;

7. what is the impact, if any, of ISDN services on satellite system design.

8. what are the factors which affect the appropriate allocation of impairments for different satellite reference digital paths, where satellite systems are interconnected with the ISDN;

9. what are the factors which characterize digital satellite networks when they form part of the public switched network or the ISDN;

10. what is the impact of the requirements for these networks on the characteristics of the earth stations;

11. what is the appropriate definition of the user/network digital interface characteristics?

Note – See Recommendations 521, 522 and 614, Reports 997 and 1139 and Opinion 56.

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* Previously Study Programme 29A/4.

QUESTION 53/4*

DIGITAL SATELLITE COMMUNICATION SYSTEMS FOR DEDICATED/USER ORIENTED NETWORKS**

(1990)

The CCIR,

CONSIDERING

a) that dedicated/user-oriented networks external to the ISDN using capacity on international, regional and national satellite systems are being established;

b) that these networks carry business and other traffic;

c) that there are various alternative architectures and corresponding reference digital paths and user requirements for these networks;

d) that more information and criteria on technical and operational matters associated with such systems would be useful in the development of economical satellite systems;

e) that these networks may include the use of very small aperture terminals (VSAT) in the earth segment, which may be dedicated to a single user,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the fundamental technical characteristics of dedicated digital satellite networks based on a survey of existing systems;

2. what are the preferred user requirements for performance and availability on the satellite link;

3. what are the factors which characterize alternative network topologies, system architectures and link control protocols;

4. what is the impact of the network requirements on the characteristics of the earth stations;

5. what is the appropriate definition of dedicated user/network digital interface characteristics?

Note – See Report 1134.

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* Previously Study Programme 29C/4.

** Special attention is to be paid to VSAT systems.

QUESTION 54/4*

FEEDER LINKS FOR THE SPACE STATIONS IN THE BROADCASTING-SATELLITE SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that under the Radio Regulations the Earth-to-space links used as feeder links to satellites in the broadcasting-satellite service are part of the fixed-satellite service;

(b) that the frequency and technical characteristics of such feeder links may depend on the technical characteristics of the broadcasting satellite, but that risks of interference with satellites in the fixed-satellite service providing links between specified points on the Earth should also be taken into account;

(c) that certain frequency bands are allocated to the fixed-satellite service in both the Earth-to-space and the space-to-Earth directions;

(d) that the system constraints of the broadcasting-satellite service may affect the efficiency with which the fixed-satellite service frequency bands are used for links between earth stations;

(e) that the frequency bands 14.5-14.8 GHz and 17.3-18.1 GHz (Earth-to-space, Regions 1 and 3) and 17.3-18.1 GHz (Earth-to-space, Region 2) are limited to feeder links for the broadcasting-satellite services;

(f) that the Earth-to-space frequency band 17.7-18.1 GHz designated for feeder links to the broadcasting-satellite service are shared with the fixed, the mobile, and the fixed-satellite (space-to-Earth) services;

(g) that large integrated multiple-service space stations may be deployed in the future as an attractive option for the utilization of spectrum allocated to space services;

(h) that further study of this topic is called for under Resolutions Nos. 3, 101, 701 and Recommendation No. 64 of the WARC-79;

(j) that specific study of this topic is called for under Recommendation No. 101 of the WARC-79,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what is the technical and operational suitability of the frequency bands allocated to the fixed-satellite service (Earth-to-space) other than those identified under CONSIDERING *(e)* above for the use as feeder links to broadcasting satellites;

2. what are the technical characteristics, e.g. frequency deviation and pre-emphasis and utilization principles to be recommended for implementation of such feeder links, taking into account the special requirements of the broadcasting-satellite service. (The special requirements of the broadcasting-satellite service are covered by Question 98/11);

3. what conditions and criteria are necessary for the shared use of frequency bands between feeder links for broadcasting-satellites and other Earth-to-space or space-to-Earth links of the fixed-satellite service, or with terrestrial services taking into account the requirements and constraints arising in the various types of systems;

4. what technical characteristics and other aspects for feeder links would facilitate the coexistence or integration of broadcasting-satellite sub-systems using them with other space services sub-systems, notably the fixed-satellite service sub-systems, on board the same space station?

Note – See Reports 561 and 1006.

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* Previously Study Programme 30A/4. This Question is brought to the attention of Study Groups 1, 8, 9, 10 and 11, and the results of any such studies should also be presented to these Study Groups.

QUESTION 55-1/4*

USE OF THE FIXED-SATELLITE SERVICE FOR FEEDER LINKS IN THE MOBILE-SATELLITE SERVICE

(1990-1992)

The CCIR,

considering

a) that up until now the spectrum requirements in the FSS allocations for MSS feeder links have not been significant, and such feeder links have been successfully accommodated in the FSS allocations through technical coordination;

b) that many FSS allocated frequency bands, below 15 GHz, are being utilized extensively in certain parts of the GSO;

c) that MSS feeder-link requirements are, in the future, expected to increase significantly following probable additional allocations in the 1 to 3 GHz range to the MSS at the World Administrative Radio Conference (Malaga-Torremolinos, 1992);

d) the constraints of the FSS Allotment Plan on the utilization of some 4/6 GHz and 11/13 GHz FSS allocations;

e) that there is increasing interest in providing multiple satellite services (including MSS) from a single satellite platform;

f) that technical coordination of MSS feeder-link networks with FSS networks may have conflicting technical characteristics and is expected to become increasingly difficult;

g) that the spectrum and orbit efficiency of the FSS allocations should be maximized taking into account the above factors relating to the MSS feeder link usage of these bands;

h) that frequency coordination between narrow-band carriers in the mobile satellite feeder links and analogue FM-TV signals in the FSS, in general, is difficult;

j) that the system constraints of a particular mobile-satellite service may affect the efficiency with which the fixed-satellite frequency bands are used for communication between fixed stations,

decides that the following Question should be studied

1. What are the sharing criteria for MSS feeder links and other links in the FSS?

2. What types of FSS networks are the most technically suitable for sharing with feeder links to satellites in the MSS?

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* This Question should be brought to the attention of Study Group 8.

3. What, if any, technical advantage is there for feeder links to use any specific FSS frequency band?

4. What technical measures can be developed to facilitate sharing between MSS feeder links and FSS networks?

Note 1 - The results of the studies relating to § 1 and 2 above should lead to a Recommendation within two years.

QUESTION 56/4*

FREQUENCY SHARING BETWEEN THE INTER-SATELLITE SERVICE WHEN USED FOR LINKS OF THE FIXED-SATELLITE SERVICE AND TERRESTRIAL RADIOCOMMUNICATION SERVICES

(1990)

The CCIR,

CONSIDERING

(a) that certain frequency bands are allocated on a shared basis to the inter-satellite service and certain terrestrial radiocommunication services;

(b) that the WARC-79 requested the CCIR in Recommendation No. 710 to study the criteria applicable to sharing between the radiolocation service and the inter-satellite service in the bands 59-64 GHz and 126-134 GHz, in which airborne radars in the radiolocation service may be operated subject to not causing harmful interference to the inter-satellite service;

(c) that the WARC-79 requested the CCIR in Recommendation No. 709 to study the criteria applicable to sharing between the aeronautical mobile service and the inter-satellite service in the bands 54.25-58.2 GHz, 59-64 GHz, 116-134 GHz, 170-182 GHz and 185-190 GHz, in which stations in the aeronautical mobile service may be operated subject to not causing harmful interference to the inter-satellite service;

(d) that the WARC-79 requested the CCIR in Recommendation No. 707 to study the criteria applicable to sharing between the radionavigation service and the inter-satellite service in the band 32-33 GHz,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the preferred technical characteristics of inter-satellite links that would facilitate the frequency sharing between the inter-satellite service when used for links of the FSS and terrestrial radiocommunication services;

2. what are the appropriate criteria for frequency sharing between the radiolocation service and the inter-satellite service in the bands 59-64 GHz and 126-134 GHz, when used for links of the fixed-satellite service;

3. what are the appropriate criteria for frequency sharing between the aeronautical mobile service and the inter-satellite service in the bands 54.25-58.2 GHz, 59-64 GHz, 116-134 GHz, 170-182 GHz and 185-190 GHz, when used for links of the fixed-satellite service;

4. what are the appropriate criteria for frequency sharing between the radionavigation service and the inter-satellite service in the band 32-33 GHz, when used for links of the fixed-satellite service?

Note – See Reports 791, 872 and 874.

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* Previously Study Programme 31A/4.

QUESTION 57/4*

PREFERRED TECHNICAL CHARACTERISTICS AND SELECTION OF SITES FOR EARTH STATIONS IN THE FIXED-SATELLITE SERVICE TO FACILITATE SHARING WITH TERRESTRIAL SERVICES

(1990)

The CCIR,

CONSIDERING

(a) that earth stations of the fixed-satellite service and terrestrial stations may be subject to mutual interference where they share a frequency band;

(b) that the required physical separation between the two kinds of station is an important factor in the effectiveness of sharing;

(c) that site shielding is an effective means to reduce the required physical separation between the two kinds of station;

(d) that the relative location and antenna beam pointing geometry of earth and terrestrial stations also affect the spacing between the two kinds of station;

(e) that terrestrial systems generally comprise a number of links in tandem or connected at nodes, and that their stations are generally located on prominent terrain,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what appropriate techniques and technical criteria should be used in the selection of earth-station site characteristics and what should be the nature of locations to minimize the physical spacing between such sites and stations of terrestrial services;

2. what appropriate techniques should be used to provide and evaluate man-made site shielding?

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* Previously Study Programme 32A/4.

QUESTION 58/4*

INTERFERENCE REDUCTION AND CANCELLATION TECHNIQUES FOR THE EARTH STATIONS IN THE FIXED-SATELLITE SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that interference from transmitting stations of terrestrial services to receiving earth stations in the fixed-satellite service affects the effectiveness of frequency sharing between the two types of service;

(b) that means to reduce interference could greatly improve the effectiveness of sharing,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the appropriate techniques by which interference received at an earth station could be reduced, eliminated or otherwise rendered less harmful;

2. under what conditions would such techniques be most effective, and what would be the magnitude of the expected improvement and the limitations?

Note – See Report 875.

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* Previously Study Programme 32B/4.

QUESTION 59/4*

PREFERRED TECHNICAL CHARACTERISTICS OF SPACE STATIONS IN THE FIXED-SATELLITE SERVICE TO FACILITATE SHARING WITH TERRESTRIAL SERVICES

(1990)

The CCIR,

CONSIDERING

(a) that emissions from space stations in the fixed-satellite service may produce interference in receiving stations of terrestrial services in frequency bands shared by the two kinds of service;

(b) that it is impractical to coordinate between the many terrestrial stations and the many space stations and that, therefore, sharing criteria should be such as to preclude the need for detailed coordination;

(c) that, in devising such sharing criteria, account needs to be taken of the operational and technical requirements of networks in the fixed-satellite service as well as of the requirements of terrstrial services and the measures available to them,

UNANIMOUSLY DECIDES that the following question should be studied:

what are the technical constraints on the pfd of space stations which comply with the sharing criteria, devised under Question 116/9 taking into account the technical and operational requirements for such space stations when they are part of networks?

Note 1 – These studies should be carried out in close collaboration with those of Question 116/9.

Note 2 – See Recommendation 358 and Report 387.

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* Previously Study Programme 32C/4.

QUESTION 60/4*

SHARING CRITERIA FOR PROTECTING RECEIVING SPACE STATIONS IN THE FIXED-SATELLITE SERVICE AGAINST INTERFERENCE FROM LINE-OF-SIGHT RADIO-RELAY TRANSMITTERS OPERATING IN SHARED FREQUENCY BANDS

(1990)

The CCIR,

CONSIDERING

(a) that emissions from line-of-sight radio-relay transmitters may produce interference in receiving space stations of the fixed-satellite service, in shared frequency band;

(b) that it is impractical to coordinate between the many terrestrial stations and the many space stations and that, therefore, sharing criteria should be such as to preclude the need for detailed coordination;

(c) that, in devising such sharing criteria, account needs to be taken of the operational and technical requirements of radio-relay systems and the options open to them to comply with such sharing criteria, as well as of the technical and operational characteristics of space stations,

UNANIMOUSLY DECIDES that the following question should be studied:

what are the sharing criteria by which receiving space stations in the fixed-satellite service can be adequately protected against interference from radio-relay transmitters without requiring detailed coordination?

Note 1 – These studies should be carried out in close collaboration with those of Question 114/9.

Note 2 – See Recommendations 356 and 558, and Reports 790, 793 and 1006.

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* Previously Study Programme 32D/4.

QUESTION 61/4*

CRITERIA FOR FREQUENCY SHARING BETWEEN THE FIXED SERVICE AND THE FIXED-SATELLITE SERVICE IN BIDIRECTIONALLY ALLOCATED FREQUENCY BANDS

(1990)

The CCIR,

CONSIDERING

(a) that the existing sharing criteria are based on fixed-satellite systems unidirectionally allocated frequency bands;

(b) that bidirectional operation on the fixed-satellite service introduces additional interference sources;

(c) that the coordination of earth stations in bidirectionally allocated frequency bands may require new coordination parameters which take into consideration interference sources from the down-link as well as the up-link direction;

(d) that the introduction of transmitting earth stations in a frequency band that currently is allocated for transmitting space stations may impose restrictions on both the fixed and fixed-satellite services;

(e) that both long-term and short-term interference mechanisms must be considered in establishing frequency sharing criteria,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the short-term and long-term sharing criteria which take into consideration down-link and up-link interference;

2. what are the new coordination parameters for the coordination of transmitting and receiving earth stations, taking into account the inclusion of these parameters in Report 382, and noting that earth-station coordination distances are determined by short-term anomalous propagation conditions;

3. what are the new pfd limits for the protection of terrestrial receivers, taking into account the inclusion of these limits in Report 387?

Note 1 – These studies should be carried out in close collaboration with those of Question 115/9.

Note 2 – See Report 1005.

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* Previously Study Programme 32E/4.

QUESTION 62/4*

FREQUENCY SHARING OF THE FIXED-SATELLITE SERVICE AND THE INTER-SATELLITE SERVICE WITH THE FIXED SERVICE UNDER PROVISIONS OF RR ARTICLE 14

(1990)

The CCIR,

CONSIDERING

(a) that allocations have been made in various frequency bands for space and terrestrial radio services on a primary basis subject to the seeking of agreement under Article 14 of the Radio Regulations;

(b) that allocations have been made in some frequency bands to the fixed-satellite service or the inter-satellite service on a primary basis subject to the Article 14 provisions of the Radio Regulations to seek agreement with other administrations using or planning to use other radio services in accordance with the Table of Allocations;

(c) that Article 14 does not prescribe any specific technical basis or methodology to determine affected administrations;

(d) that the Article 14 provisions do not prescribe the technical bases for seeking agreement with affected administrations;

(e) that the CCIR has already developed interference and sharing criteria for sharing FSS with some other radio services in various frequency bands;

(f) that it is desirable to develop sharing criteria for the FSS and radio relay services in particular frequency bands for which sharing criteria has not been established for facilitating the application of the Article 14 procedure;

(g) that this information would be useful to the IFRB in establishing its Rules of Procedures for the application of Article 14 in the different fixed satellite service frequency band allocations;

(h) that administrations need, in some cases, technical criteria to evaluate the effects on both a given assignment or a proposed system of a radio service subject to the Article 14 procedure,

CONSIDERING FURTHER

(a) that the World Administrative Radio Conference on the use of the geostationary satellite orbit and the planning of the space services utilizing it (Second Session, Geneva 1988) adopted Recommendation No. 15 (Orb-88) on the "Review of Article 14 of the radio regulations and further development of technical criteria for its application";

(b) that Recommendation No. 15 (Orb-88) invites the CCIR to continue studies of the development of sharing criteria for the different services which are involved in the application of Article 14;

c) that Recommendation No. 15 (Orb-88) also invites the CCIR to provide technical criteria permitting administrations to evaluate the effect on their services of the application of Article 14 with respect to a given assignment;

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the appropriate criteria for frequency sharing of the fixed-satellite service and the inter-satellite service with the fixed service for bands involved in the application of Article 14;

2. what are the appropriate technical criteria which could be used to determine the administrations affected according to Article 14;

3. what are the appropriate technical criteria permitting administrations to evaluate the effect on their services of the application of Article 14 with respect to a given assignment?

Note – See Recommendation 674 and Report 1143.

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* Previously Study Programme 32F/4.

QUESTION 63/4*

FREQUENCY SHARING OF THE FIXED-SATELLITE SERVICE AND THE INTER-SATELLITE SERVICE WITH TERRESTRIAL RADIO SERVICES OTHER THAN THE FIXED SERVICE UNDER PROVISIONS OF RR ARTICLE 14

(1990)

The CCIR,

CONSIDERING

(a) that allocations have been made in various frequency bands for space and terrestrial radio services on a primary basis subject to the seeking of agreement under Article 14 of the Radio Regulations;

(b) that allocations have been made in some frequency bands to the fixed-satellite service or the inter-satellite service on a primary basis subject to the Article 14 provisions of the Radio Regulations to seek agreement with other administrations using or planning to use other radio services in accordance with the Table of Allocations;

(c) that Article 14 does not prescribe any specific technical basis or methodology to determine affected administrations;

(d) that the Article 14 provisions do not prescribe the technical bases for seeking agreement with affected administrations;

(e) that the CCIR has already developed interference and sharing criteria for sharing FSS with some other radio services in various frequency bands;

(f) that it is desirable for facilitating the application of the Article 14 procedure to develop sharing criteria for the FSS and terrestrial radio services other than the fixed service in particular frequency bands for which sharing criteria has not been established;

(g) that this information would be useful to the IFRB in establishing its Rules of Procedures for the application of Article 14 in the different fixed-satellite service frequency band allocations;

(h) that administrations need, in some cases, technical criteria to evaluate the effects on both a given assignment or a proposed system of a radio service subject to the Article 14 procedure,

CONSIDERING FURTHER

(a) that the World Administrative Radio Conference on the use of the geostationary satellite orbit and the planning of the space services utilizing it (Second Session, Geneva 1988) adopted Recommendation No. 15 (Orb-88) on the "Review of Article 14 of the radio regulations and further development of technical criteria for its application";

(b) that Recommendation No. 15 (Orb-88) invites the CCIR to continue studies of the development of sharing criteria for the different services which are involved in the application of Article 14;

c) that Recommendation No. 15 (Orb-88) also invites the CCIR to provide technical criteria permitting administrations to evaluate the effect on their services of the application of Article 14 with respect to a given assignment;

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the appropriate criteria for frequency sharing of the fixed-satellite service and the inter-satellite service with terrestrial radio services other than the fixed service for bands involved in the application of Article 14;

2. what are the appropriate technical criteria which could be used to determine the administrations affected according to Article 14;

3. what are the appropriate technical criteria permitting administrations to evaluate the effect on their services of the application of Article 14 with respect to a given assignment?

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* Previously Study Programme 32G/4. This Question should be brought to the attention of Study Groups 1, 8, 10 and 11.

QUESTION 64/4*

PREFERRED TECHNICAL CHARACTERISTICS OF FIXED-SATELLITE SERVICE NETWORKS USING SATELLITES IN SLIGHTLY INCLINED GEOSTATIONARY ORBITS TO FACILITATE SHARING WITH THE FIXED SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that the application and technical characteristics of satellites in slightly inclined geostationary orbits are being studied for use in fixed-satellite service networks;

(b) that emissions from space stations in the fixed-satellite service may produce interference in receiving stations of the fixed service in frequency bands shared by the two kinds of service;

(c) that emissions from line-of-sight radio-relay transmitters may produce interference in receiving space stations of the fixed-satellite service, in shared frequency bands;

(d) that it is impractical to coordinate between the many space stations and the many terrestrial stations and that, therefore, sharing criteria should be such as to preclude the need for detailed coordination;

(e) that, in devising such sharing criteria, account needs to be taken of the operational and technical requirements of networks in the fixed-satellite service, as well as of the operational and technical requirements of radio-relay systems and the options open to them to comply with such sharing criteria;

(f) that the power flux-density limits specified in Article 28 have been developed assuming a specific scenario of space station distribution and associated angles of arrival above the horizontal plane;

(g) that the limits specified in Article 27 apply to the fixed service, with the aim of protecting regions around the geostationary satellite orbit;

(h) that sufficient technical information and interference studies are not available relating to space stations operating with slightly inclined geostationary orbits,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what potentional interference mechanisms can occur between satellites in slightly inclined geostationary orbits and the fixed service;

2. to what extent can existing constraints on spacecraft emissions for protecting the fixed service be applied to such satellite systems;

3. to what extent can existing constraints on the fixed service be applied to protect such satellite systems;

4. what are the coordination methods between terrestrial stations and earth stations operating with satellites in slightly inclined geostationary orbits;

5. what is the need to establish the constraints relating to north-south stations-keeping and their magnitude, with respect to their impact on sharing;

6. what are the technical means to aid in ameliorating this sharing situation;

7. what is the efficiency of use of the geostationary satellite orbit?

Note 1 – These studies should be carried out in close collaboration with those of Question 117/9.

Note 2 – See Report 1142.

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* Previously Study Programme 32H/4.

QUESTION 65/4*

FREQUENCY SHARING BETWEEN SYSTEMS IN THE FIXED-SATELLITE SERVICE AND THE FIXED SERVICE IN THE CASE OF RELIEF OPERATIONS AND OTHER TEMPORARY APPLICATIONS

(1990)

The CCIR,

CONSIDERING

(a) that the temporary use of transportable earth stations in the fixed-satellite service for various purposes including relief telecommunications is a desirable operating option;

(b) that the use of transportable earth stations at a specific location will be occasional and temporary;

(c) that the need to bring transportable earth stations into operation quickly is incompatible with the very long advance notice periods normally acceptable for the coordination of fixed earth stations;

(d) that it is necessary to study the impacts of transportable stations for relief telecommunications which might be provided by terrestrial radiocommunications sharing the frequency band with the fixed-satellite service,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what specific interference criteria relating to the use of transportable earth stations in the fixed-satellite service are necessary;

2. what are the appropriate criteria to ensure compatibility between stations in the fixed-satellite service and stations for relief telecommunications which might be provided by terrestrial radiocommunications?

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* Previously Study Programme 32J/4.

QUESTION 66/4*

FREQUENCY SHARING BETWEEN THE FIXED-SATELLITE SERVICE AND THE BROADCASTING-SATELLITE SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that the WARC-79 allocated common frequency bands to the fixed-satellite service and to the broadcasting-satellite service;

(b) that some of these allocations are for different Regions but that the geostationary-satellite orbit is a common resource for the benefit of all Regions;

(c) that the technical characteristics of networks in the two services may be quite different, in particular with regard to space station e.i.r.p.;

(d) that Resolutions Nos. 700 and 34 of the WARC-79 call for the urgent study of specific aspects of sharing the fixed-satellite service and the broadcasting-satellite service;

(e) that Recommendation No. 708 of the WARC-79 calls for study, or the continuation of study, of the conditions for frequency sharing in those bands allocated to the broadcasting-satellite service by the WARC-79,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what criteria affect frequency sharing and interference between systems in the fixed-satellite service and the broadcasting-satellite service;

2. what technical and operating characteristics of systems in the fixed-satellite service may facilitate sharing between the two services;

3. what technical and operational aspects relate specifically to the problem of frequency sharing between the two services where they serve different Regions?

Note – See Report 873.

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* Previously Study Programme 33A/4. This Question should be brought to the attention of Study Groups 10 and 11.

QUESTION 67/4*

FREQUENCY SHARING BETWEEN THE FIXED-SATELLITE SERVICE AND THE EARTH EXPLORATION-SATELLITE (PASSIVE) AND SPACE RESEARCH (PASSIVE) SERVICES

(1990)

The CCIR,

CONSIDERING

(a) that allocations have been made in various frequency bands to the earth exploration-satellite and space research services for the operation of passive sensors on board spacecraft;

(b) that the allocations made in the band 18.6-18.8 GHz are shared with the fixed, mobile (except aeronautical mobile), and fixed-satellite services;

(c) that application of the sharing criteria contained in Report 694 could restrict the development of the fixed, mobile (except aeronautical mobile), and fixed-satellite services,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the minimum restrictions which could be applied to the fixed-satellite (space-to-Earth) service in order to ensure the satisfactory operation of passive sensors;

2. what are the maximum restrictions which might be tolerated by the fixed-satellite services without jeopardizing the operating of this service?

Note 1 – The content of Report 694 needs to be reviewed by all the Study Groups concerned (particularly Study Groups 4 and 9).

Note 2 – Frequency sharing between the fixed service (radio-relay systems) and the earth exploration-satellite and the space research services is the subject of Question 113/9. The requirements of passive sensors in the frequency band 18.6-18.8 GHz are considered in the Note in § 8 of Recommendation 595, relating to the fixed service (digital radio-relay systems) operating in the band 17.7-19.7 GHz.

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* Previously Study Programme 33B/4.

QUESTION 68/4*

FREQUENCY SHARING OF THE FIXED-SATELLITE SERVICE AND THE INTER-SATELLITE SERVICE WITH OTHER SPACE RADIO SERVICES UNDER PROVISIONS OF RR ARTICLE 14

(1990)

The CCIR,

CONSIDERING

(a) that allocations have been made in various frequency bands for space radio services on a primary basis subject to the seeking of agreement under Article 14 of the Radio Regulations;

(b) that allocations have been made in some frequency bands to the fixed-satellite service or the inter-satellite service on a primary basis subject to the Article 14 provisions of the Radio Regulations to seek agreement with other administrations using or planning to use other radio services in accordance with the Table of Allocations;

(c) that Article 14 does not prescribe any specific technical basis or methodology to determine affected administrations;

(d) that Article 14 provisions do not prescribe the technical bases for seeking agreement with affected administrations;

(e) that the CCIR has already developed interference and sharing criteria for sharing FSS with some other radio services in various frequency bands;

(f) that it is desirable to develop sharing criteria for the FSS and other radio services in particular frequency bands for which sharing criteria has not been established for facilitating the application of the Article 14 procedure;

(g) that this information would be useful to the IFRB in establishing its Rules of Procedures for the application of Article 14 in the different fixed satellite service frequency band allocations;

(h) that administrations need, in some cases, technical criteria to evaluate the effects on both a given assignment or a proposed system of a radio service subject to the Article 14 procedure,

CONSIDERING FURTHER

a) that the World Administrative Radio Conference on the use of the geostationary satellite orbit and the planning of the space services utilizing it (Second Session, Geneva, 1988) adopted Recommendation No. 15 (Orb-88) on the "Review of Article 14 of the radio regulations and further development of technical criteria for its application";

(b) that Recommendation No. 15 (Orb-88) invites the CCIR to continue studies of the development of sharing criteria for the different services which are involved in the application of Article 14;

(c) that Recommendation No. 15 (Orb-88) also invites the CCIR to provide technical criteria permitting administrations to evaluate the effect on their services of the application of Article 14 with respect to a given assignment,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the appropriate criteria for frequency sharing of the fixed-satellite service and the inter-satellite service with other space radio services for bands involved in the application of Article 14;

2. what are the appropriate technical criteria which could be used to determine the administrations affected according to Article 14;

3. what are the appropriate technical criteria permitting administrations to evaluate the effect on their services of the application of Article 14 with respect to a given assignment?

Note – See Report 873.

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* Previously Study Programme 33C/4. This Question should be brought to the attention of Study Groups 7, 8, 10 and 11.

QUESTION 69/4

USE OF THE SATELLITE TRANSMISSION MEDIUM IN THE FRAMEWORK OF THE ISDN*

(1990)

The CCIR,

CONSIDERING

(a) that the ISDN and its framework are defined and standardized by the CCITT;

(b) that various Study Groups of the CCITT are involved in this work;

(c) that the satellite transmission medium can be used in the framework of the ISDN;

(d) that all efforts have to be made to ensure that a correct use is made of all transmission media in the ISDN;

(e) that the use of the satellite in the framework of the ISDN needs to be compatible with the network protocols and other specifications developed by the CCITT and this for all services to be carried by the ISDN;

(f) that incompatibilities between the network protocols and the satellite routes within the ISDN may reduce or preclude the international access to the ISDN by some countries, for which satellite links represent the main or the only way for such access,

and ALSO CONSIDERING

(a) that studies on the compatibility of the satellite transmission medium and the ISDN, should be performed jointly by the CCIR and the CCITT;

(b) that various Study Groups and other working entities in the CCITT and in the CCIR can provide expertise on these issues,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what network protocols and functions as well as terminal and service specifications may influence the use of the satellite medium in the ISDN and the public switched network;

2. what CCITT Recommendations and series of Recommendations deal with the parameters and functions which may influence the use of the satellite medium;

3. what modifications could be made to these Recommendations to allow for the maximum utilization of the satellite medium for all the services to be carried in the ISDN;

4. where amendment to a CCITT Recommendation is not considered practicable, what alternative steps can be taken to ensure that Satellites can play their full part in ISDN Communications?

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* This Question is allocated to an ad hoc CCIR/CCITT Expert Group on ISDN and satellite matters.

QUESTION 70/4

PROTECTION OF THE GEOSTATIONARY-SATELLITE ORBIT AGAINST UNACCEPTABLE INTERFERENCE FROM TRANSMITTING EARTH STATIONS IN THE FIXED-SATELLITE SERVICE AT FREQUENCIES ABOVE 10 GHz

(1990)

The CCIR,

CONSIDERING

(a) that some administrations use low levels of artificial energy dispersal on TV carriers which eases the coordination for some satellite networks;

(b) that the use of artificial energy dispersal may in some cases result in intra-network interference which adversely affects the attainment of the desired operating quality;

(c) that, where the operating frequencies of transmissions are known, their coordination may be facilitated when they are not subject to artificial energy dispersal;

(d) that the temporary increase of transmitted up-link power is an effective means of combating fading due to rain (up-link power control);

(e) that when up-link power in the direction of a wanted satellite is temporarily increased another satellite may be subject to an interference increase due to differential rain attenuation on the two transmission paths, the attenuation differential expected to increase with inter-satellite spacing;

(f) that the greater the angular spacing between a wanted and an interfered-with satellite the smaller will be the fraction of the total interference in the interfered-with satellite that is subject to the increase and the more tolerable will be the interference increase;

(g) that such an interference increase will persist only for a small percentage of the time;

(h) that these considerations may offer relief for earth station operators under certain circumstances at frequencies above 10 GHz;

(j) that Recommandation 524 only specifies the earth station emission levels while it is the received power levels at the interfered with satellite that is of concern;

(k) that while television carriers utilize energy dispersal to reduce the e.i.r.p. density levels, it also leads to a wider band of high density spectrum to be avoided by narrow-band carriers,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what is the appropriate format for criteria for the protection of geostationary space stations in the fixed-satellite service against unacceptable interference caused by earth station emissions above 10 GHz, given that it is the power received which causes interference, not the power transmitted, and that during small percentages of the time increases in interference may be tolerable;

2. what off-axis e.i.r.p. density criteria, including those in Recommendation 524 would be appropriate for earth stations transmitting television carriers utilizing various levels of energy dispersal;

3. what are the preferred values for such criteria that give due recognition to the efficiency of utilization of the geostationary-satellite orbit spectrum, intra-network interference and inter-network coordinability?

Note – See Recommendation 524.

QUESTION 71/4

PROTECTION OF GEOSTATIONARY-SATELLITE NETWORKS IN THE FIXED-SATELLITE SERVICE FROM UNACCEPTABLE INTERFERENCE FROM NON-GEOSTATIONARY SATELLITE SYSTEMS

(1992)

The CCIR,

considering

a) that non-GSO satellite systems are being planned for operation in the mobile-satellite service and other space services;

b) that such non-GSO systems may be using feeder links in the FSS bands;

c) that No. 2613 of the Radio Regulations states that non-GSO systems shall cease or reduce to a negligible level their emissions whenever there is unacceptable interference into GSO FSS systems;

d) that the CCIR has not yet established the level of unacceptable interference which is required to protect GSO FSS networks from non-GSO networks;

e) that sufficient geocentric angular separation may provide protection for GSO FSS satellites from unacceptable interference from non-GSO systems;

f) that angular avoidance techniques have not been studied,

decides that the following Question should be studied

1. What is the permissible level of interference from a non-GSO satellite system into a GSO satellite network in the fixed-satellite service?

2. What are the methods which can be used to determine the necessary angular separation to prevent unacceptable levels of interference from non-GSO systems into GSO FSS networks?

3. What are the techniques for ensuring the necessary angular avoidance determined in § 2?

Note 1 - The results of these studies should lead to an appropriate Recommendation within two years.

QUESTION 72/4

PROPORTION OF SATELLITES IN FSS BANDS LIKELY TO OPERATE IN SLIGHTLY INCLINED GEOSTATIONARY ORBITS

(1992)

The CCIR,

considering

a) that a considerable proportion of the radio spectrum allocated to the fixed-satellite (FSS) is allocated also to terrestrial services;

b) that, if slightly inclined orbits are used in shared bands, for certain relative pointing directions of satellite earth-station antennas and terrestrial radio-relay antennas, the interference from the former to the latter will increase relative to the truly geostationary case for half of each orbital period;

c) that, if slightly inclined orbits are used in shared bands, the portion of the sky which terrestrial terminals should avoid in order to minimize interference, will be increased relative to the truly geostationary case;

d) that the proportion of terrestrial radio-relay terminals adversely affected as indicated in § b) and c) will depend on the proportion of satellites in the FSS which employ slightly inclined orbits;

e) that considerations regarding the limit of inclination within which an orbit may be generally regarded as geostationary will thus be influenced by considering d);

f) that orbit inclination has certain disavantages for some "geostationary" satellite networks - e.g. the need for earth stations to have tracking antennas, reduction of net spot-beam coverage, etc.,

decides that the following Question should be studied

1. What proportions of nominally geostationary satellites using frequencies shared by the FSS and terrestrial radio services are likely in future to be operated within the following ranges of orbit inclination:

- $< 1°$,
- $1°$ to $5°$,
- $5°$ to $10°$,
- $10°$ to the natural limit?

Note 1 - The results of this study should lead to the formulation of an appropriate Recommendation within two years.

QUESTION 73/4

AVAILABILITY AND INTERRUPTIONS TO TRAFFIC ON DIGITAL PATHS OR CIRCUITS IN THE FIXED-SATELLITE SERVICE

(1992)

The CCIR,

considering

a) that circuits or digital paths in the fixed-satellite service may be interrupted for long or short periods, these interruptions typically taking the form of high circuit noise level, low wanted signal level, bursts of bit errors in digital systems or the presence of unwanted signals;

b) that interruptions of 10 consecutive seconds duration or more are treated as a loss of circuit or digital path availability, whereas interruptions of less duration are treated as short breaks in the circuit;

c) that the degree of circuit or digital path availability and the objectives for short breaks have a major bearing on the design of a system and the cost of its provision, operation and maintenance;

d) that short breaks in transmission and burst of errors may cause loss of synchronization in digital transmission systems;

e) that existing Recommendations 353, 354, 522 and 614 permit a high noise level or a high bit error ratio during very short periods for a very small percentage of the time;

f) that earth-station equipment may contain devices which mute receivers under conditions of high noise or a significant drop in received carrier power;

g) that the CCITT is being asked for advice on the level of noise and its duration which it regards as equivalent to a total interruption, and is studying the duration and frequency of occurrence of short breaks in transmission and of sudden level variations on international telephone circuits;

h) that different systems or service applications may have different availability requirements (i.e. demand assigned telephony, data transmission, television);

j) that the duration of some interruptions may depend on the configuration of the satellite network; they may also depend on whether earth-stations are always attended or unattended at the onset of an interruption, and on whether or not the earth-station antennas are readily steerable to point from one satellite to another;

k) that terms and definitions that are required in connection with this Question should, as far as possible, be based on internationally accepted expressions,

decides that the following Question should be studied

1. What should be the objectives for circuit or digital path availability for systems or services which are not included under Recommendation 579?

2. What should be the objectives for the duration and frequency of occurrence of short breaks in transmission, of short duration bursts of errors and sudden baseband level variations, for current and future systems, between points defined by the hypothetical reference circuit or the hypothetical reference digital path?

3. What are the important factors affecting circuit or digital path availability and short interruptions such as breaks in transmission, bursts of bit errors and baseband level variations?

4. What terms and definitions now available in the documents of several international bodies interested in terminology are applicable for these studies and what additional terms and definitions, if any, are required?

Note 1 - The results of these studies should lead to the formulation of an appropriate Recommendation within four years.

Note 2 - See CCIR Recommendation 579 and CCITT Recommendations I.35A and G.82x.

QUESTION 74/4

NETWORK ARCHITECTURES FOR DIGITAL TRANSMISSION LINKS IN THE FIXED-SATELLITE SERVICE

(1992)

The CCIR,

considering

a) that digital satellite links will continue to form part of evolving digital networks carrying a variety of services including those of the ISDN;

b) that satellite connections can form all or parts of the high grade, medium grade or local grade connections, or combinations thereof;

c) that satellite connections can also form part of the user access portion for connecting with a public switched network;

d) that it would be desirable to establish various network architectures for digital satellite links to provide designers of equipment and systems with guidance for their implementation;

e) that these network architectures may help designers in allocating impairment for digital transmission links,

decides that the following Question should be studied

1. What network architectures are conceivable and preferable to facilitate the design and construction of actual systems for digital transmission?

2. What network architectures are preferable from overall cost efficiency, taking § 1 into account?

3. What are the requirements for the connection of satellite based networks with public switched networks?

Note 1 - The results of these studies should lead to the formulation of appropriate Recommendations within two years.

QUESTION 75/4

PERFORMANCE OBJECTIVES OF INTERNATIONAL DIGITAL TRANSMISSION LINKS IN THE FIXED-SATELLITE SERVICE

(1992)

The CCIR,

considering

a) that the CCITT suggested a demarcation line between the study of CCITT Study Group XVIII and CCIR Study Group 4 concerning international digital links;

b) that the CCITT has established and/or has been establishing a number of Recommendations on the performance objectives for PCM telephony (see CCITT Recommendation G.711), 64 kbit/s ISDN (see CCITT Recommendation G.821) and primary rate and higher order ISDN (see CCITT Recommendation G.82x);

c) that digital satellite links will continue to form part of evolving digital networks carrying a variety of services including those of the ISDN;

d) that satellite connections can form all or parts of the high grade, medium grade or local grade connections, or combinations thereof;

e) that the performance objectives of the satellite part of the international digital transmission may depend on a particular network architecture selected for providing specific services;

f) that satellite links may be required for the transmission of analogue and video signals;

g) that the effect of precipitation may be significant particularly in frequency bands above 10 GHz,

decides that the following Question should be studied

1. What availability and performance criteria (e.g., phase jitter, slips, bunched digital errors) are required for a particular network architecture?

2. What encoding/decoding techniques for error correction, if any, may be needed to meet the performance criteria?

3. What allocation of impairments is, if any, appropriate for different satellite reference digital paths, where satellite systems are part of the international ISDN connection?

Note 1 - The results of these studies should lead to the formulation of an appropriate Recommendation within two years.

QUESTION 76/4

VOICE AND DATA SIGNAL PROCESSING FOR INTERNATIONAL DIGITAL TRANSMISSION LINKS IN THE FIXED-SATELLITE SERVICE

(1992)

The CCIR,

considering

a) that digital satellite links will continue to form part of evolving digital networks carrying a variety of services including those of the ISDN;

b) that satellite systems will interface with terrestrial digital networks at the earth station;

c) that the CCITT has established and/or has been establishing a series of interface parameters for multiplex systems such as SDH;

d) that digital speech interpolation (DSI) and low rate encoding (LRE) techniques (e.g. CCITT Recommendation G.721) are prevalent techniques in digital satellite systems and more efficient techniques are being studied in the CCITT;

e) that on-board switching and on-board signal processing techniques may be employed in the future,

decides that the following Question should be studied

1. What impact LRE and DSI (either separately or combined) might have on the characteristics of voice and data communications in digital satellite systems?

2. What is, if any, the best way to introduce LRE and DSI techniques?

3. Which scrambling (i.e. energy dispersal) and/or encryption methods are appropriate for different applications?

4. What are the characteristics of the user/network digital interfaces?

5. How can channel processing techniques in satellite based SDH transport sub-networks, be accommodated?

6. What impact the voice/data signal processing functions may have on the characteristics of the earth stations?

7. What on-board signal processing should be employed for voice/data transmission in future digital satellite systems?

Note 1 - The results of these studies should lead to the formulation of an appropriate Recommendation within two years.

QUESTION 77/4

VIDEO SIGNAL PROCESSING FOR INTERNATIONAL DIGITAL TRANSMISSION LINKS IN THE FIXED-SATELLITE SERVICE

(1992)

The CCIR,

considering

a) that digital satellite links will continue to form part of evolving digital networks carrying a variety of services including those of the ISDN;

b) that satellite systems will interface with terrestrial digital networks at the earth station;

c) that the CCITT has established and/or has been establishing a series of interface parameters for multiplex systems such as SDH;

d) that the coding algorithm and associated FEC code (e.g. CCIR Recommendation 723) are stipulated and more efficient methodologies are being studied in the CCIR for digital satellite systems;

e) that on-board switching and on-board signal processing techniques may be employed in the future,

decides that the following Question should be studied

1. What impact does the transmission via satellite have on digital TV using bandwidth compression techniques taking into account error statistics incurred in digital satellite systems?

2. What are the characteristics of the user/network digital interfaces?

3. Which scrambling (i.e. energy dispersal) and/or encryption methods are appropriate for different video applications?

4. How to accommodate channel processing techniques in satellite-based SDH transport sub-networks?

5. What impact the video signal processing functions may have on the characteristics of the earth station?

6. What on-board signal processing should be employed for video transmission in future digital satellite systems?

Note 1 - The results of these studies should lead to the formulation of an appropriate Recommendation within two years.

QUESTION 78/4

USE OF SATELLITE COMMUNICATION SYSTEMS IN THE B-ISDN

(1992)

The CCIR,

considering

a) that satellite communication systems can be used in the framework of the B-ISDN;

b) that the use of a satellite in the framework of the B-ISDN needs to be compatible with the protocols and other specifications related to B-ISDN services;

c) that CCITT Recommendations on B-ISDN deal with the parameters and functions which may influence the use of satellite communication systems,

decides that the following Question should be studied

1. What are the fundamental technical characteristics of satellite communication systems for B-ISDN services?

2. What are the preferred network architectures, protocols and functions including terminal and service specifications for B-ISDN applications that are affected by satellite transmission?

3. What are the appropriate availability and performance criteria (e.g. cell loss ratio, cell delay, delay variation)?

Note 1 - The results of these studies should lead to the formulation of an appropriate Recommendation within four years.

QUESTION 79/4*

EXAMINATION OF CRITERIA FOR FREQUENCY SHARING BETWEEN THE FIXED-SATELLITE SERVICE AND THE RADIOLOCATION AND RADIONAVIGATION SERVICES IN THE BAND 13.75-14 GHZ

(1992)

The CCIR,

recognizing

a) that the World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum (Malaga-Torremolinos) (WARC-92) added an allocation to the fixed-satellite service in the band 13.75-14 GHz;

b) that this band is shared on a co-primary basis between the fixed-satellite service and the radiolocation service (and radionavigation service by Radio Regulation (RR) No. 855 (WARC-92)) with certain limitations placed on these services by RR No. 855A (WARC-92);

c) that in accordance with RR No. 855A (WARC-92), and until changed by a future competent WARC: "the e.i.r.p. of any emission from an earth station in the fixed-satellite service shall be at least 68 dBW, and should not exceed 85 dBW, with a minimum antenna diameter of 4.5 metres. In addition, the e.i.r.p. averaged over one second, radiated by a station in the radiolocation and radionavigation services toward the geostationary-satellite orbit shall not exceed 59 dBW";

d) that *resolves* 1 of Resolution No. 112 of WARC-92 invites the CCIR to conduct the necessary studies, prior to 31 January 1994, with respect to the values given in RR No. 855A (WARC-92) relating to allocations in the band 13.75-14 GHz and to report the outcome at least one year before the next competent conference, and

considering

a) that the values in *recognizing* c) are intended to allow these services to share the band without the need for coordination;

b) that Study Group 4 is in the best position to undertake the urgent study of the values given in RR No. 855A (WARC-92) in view of the work that has already progressed in Working Party 4A on this subject;

c) that the assistance and cooperation of Study Group 8, in terms of providing the technical characteristics of the radiolocation and radionavigation services, is needed,

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* Study Group 8, Study Group 7 and Task Group 7/3 should be informed of this Question.

undertakes studies of the following Question as a matter of urgency (see *recognizing* d))

1. Are the constraints to the fixed-satellite service, provided in RR No. 855A (WARC-92) , appropriate to allow sharing of the 13.75-14 GHz band with the radiolocation and radionavigation services?

2. Are the constraints to the fixed-satellite service, provided in RR No. 855A (WARC-92), appropriate for the operation of the fixed-satellite service?

3. Is 59 dBW the maximum e.i.r.p., averaged over 1s, which could be radiated in the band 13.75-14 GHz by a station in the radiolocation and radionavigation services towards the geostationary-satellite orbit, appropriate to ensure compatibility with the fixed-satellite service operating in accordance with RR No. 855A (WARC-92)?

4. Is 59 dBW an appropriate maximum e.i.r.p. for the radiolocation and radionavigation services?

Note 1 - The results of these studies should lead to a draft CCIR Report to the next competent Conference in accordance with Resolution No. 112 (WARC-92), and further to a CCIR Recommendation in two years time.

QUESTION 80/4

TECHNICAL COMPATIBILITY BETWEEN THE PRIMARY ALLOCATION TO THE FIXED-SATELLITE SERVICE AND THE SECONDARY ALLOCATIONS TO THE SPACE RESEARCH SERVICE AND THE EARTH EXPLORATION-SATELLITE SERVICE IN THE BAND 13.75-14 GHz

(1992)

The CCIR,

recognizing

a) that the World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum (Malaga-Torremolinos) (WARC-92) allocated the band 13.75-14 GHz to the fixed-satellite service on a co-primary basis;

b) that the space research and Earth exploration-satellite services have secondary allocations in the band 13.75-14 GHz;

c) that *resolves* 2 of Resolution No. 112 (WARC-92) invites the CCIR to conduct the necessary studies with regard to the technical compatibility between the fixed-satellite service and the allocations to the space research and Earth exploration-satellite services in the band 13.75-14 GHz;

d) that Radio Regulation (RR) No. 855B (WARC-92) states:

- that geostationary space stations in the space research service whose advance publication information has been received prior to 31 January 1992 shall operate on an equal basis with stations in the fixed-satellite service;

- that until 1 January 2000, stations in the fixed-satellite service shall not cause harmful interference to non-geostationary space stations in the space research and Earth exploration-satellite services;

e) that *resolves* 1 of Resolution No. 112 (WARC-92) calls for studies with respect to RR No. 855A (WARC-92) involving the sharing between the fixed-satellite service and the radiolocation and radionavigation services (see Question 79/4),

undertakes studies of the following Question

1. What are the technical characteristics of the fixed-satellite service that should be used in analyzing the compatibility with the secondary allocations to the space research and Earth exploration-satellite services in the band 13.75-14 GHz?

2. What, if any, measures may need to be taken by the fixed satellite-service to share on an equal basis the band 13.75-14 GHz with those geostationary space stations in the space research service that have been advance published prior to 31 January 1992?

3. What, if any, measures may need to be taken by the fixed satellite-service to prevent harmful interference to non-geostationary space stations of the space research and Earth exploration-satellite services prior to 1 January 2000?

The results of these studies should be forwarded, in a timely manner, to the Study Group responsible for the studies dealing with *resolves* 2 of Resolution No. 112 (WARC-92).

QUESTION 81/4*

FREQUENCY SHARING AMONG NETWORKS IN THE FIXED-SATELLITE SERVICE, THE MOBILE-SATELLITE SERVICE AND THOSE OF MULTISERVICE SATELLITES IN THE GEOSTATIONARY SATELLITE ORBIT

(1992)

The CCIR,

considering

a) that the World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum (Malaga-Torremolinas) (WARC-92) has made frequency allocations for the mobile-satellite service shared co-primary with the fixed-satellite service;

b) that in the WARC-92 Final Acts the following footnotes, *inter alia*, apply in these bands: 873, 873A, 873B, 873C, 873D, 873E, 882A and 882D;

c) that WARC-92 in its Recommendation No. 719 (WARC-92) invites the CCIR "to study as a matter of urgency technical characteristics, including pointing techniques, of multiservice-satellite networks using the geostationary-satellite networks encompassing mobile-satellite and fixed-satellite applications, and the sharing criteria necessary for compatibility with the fixed-satellite service in the frequency bands referred to above";

d) that the carrier parameters for the mobile-satellite service and those of multiservice satellites may be quite different from those for the fixed-satellite service due to the difference in user terminal equipment;

e) that a number of different modulation/multiple access techniques are employed in these networks;

f) that this Study Group and Study Group 8 are studying technical and operational aspects of multiservice satellites operating in the frequency bands referred to above;

g) that studies of technical and operational aspects for the mobile-satellite service in the frequency bands referred to above are being studied in Study Group 8;

h) that RR 873E (WARC-92) limits use of the bands 19.7-20.1 GHz and 29.5-29.9 GHz by the mobile-satellite service in Region 2 to dual-service (MSS and FSS) networks;

j) that in the bands 20.1-20.2 GHz and 29.9-30 GHz sharing between dual-service (MSS and FSS) networks, fixed-satellite service networks and mobile-satellite service networks is not precluded,

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* Study Group 8 should be informed of this Question.

decides that the following Question should be studied as a matter of urgency

1. What are the technical characteristics likely to be used in multiservice-satellite networks, encompassing mobile-satellite and fixed-satellite applications, which use the geostationary orbit in the bands 19.7-20.2 GHz (space-to-Earth) and 29.5-30 GHz (Earth-to-space)?

2. What are the technical characteristics of fixed-satellite networks using the geostationary orbit in these bands?

3. What are the advantages and disadvantages regarding the flexibility and efficiency of orbit and spectrum use, made feasible by the use of single purpose satellites as compared with multiservice systems?

4. What are the sharing criteria for fixed-satellite networks, mobile-satellite networks and fixed/mobile multiservice-satellite networks necessary for mutual compatibility within these bands?

Note 1 - The results of these studies should lead to the formulation of an appropriate Recommendation within two years.

QUESTION ITU-R 201/4

DIGITAL SATELLITE SYSTEMS IN THE FIXED-SATELLITE SERVICE IN SYNCHRONOUS TRANSPORT NETWORKS BASED ON THE SDH

(1993)

The ITU Radiocommunication Assembly,

considering

a) that Telecommunication Standardization Study Groups have defined

- a Synchronous Digital Hierarchy (SDH) contained in Recommendations ITU-T G.707*, ITU-T G.708* and ITU-T G.709*;
- the general characteristics and functions of synchronous multiplexing equipment contained in Recommendations ITU-T G.781*, ITU-T G.782* and ITU-T G.783*;
- the physical parameters of the electrical and optical interfaces of SDH equipment contained in Recommendations ITU-T G.703* and ITU-T G.958*;
- the architectures, performance and management capabilities of transport networks based on the SDH contained in Recommendations ITU-T G.803* and ITU-T G.831*;
- the management of SDH equipment and transport networks contained in Recommendations ITU-T G.784*, ITU-T Q.811* and ITU-T Q.812*;
- the all encompassing Telecommunications Management Network (TMN) principle defined in Recommendation ITU-T M.30*, which will also make use of SDH network management facilities;

b) that digital satellite systems in the fixed-satellite service (FSS) have been in operational use interconnecting telecommunication networks on a global basis;

c) the need for digital satellite systems to be adapted in line with the technical and operational enhancements of the networks they interconnect;

d) that digital satellite systems have to also provide interconnection and interworking between plesiochronous and synchronous networks to accommodate regional differences in planning and deployment of new technology;

e) that digital satellite systems will be integral parts of managed digital transmission networks utilizing SDH transmission technologies;

f) that digital satellite systems as parts of the SDH transport networks should be compatible with the Network Node Interface (NNI) specified in ITU-T Recommendations;

g) that digital satellite systems should as much as possible use standard SDH multiplexers, multiplexing concepts and management features to meet its FSS specific operational needs which include multipoint/multidestination connection configurations;

h) that the use of SDH standard features in the design and for enhanced operation of satellite systems should be a trade-off with the continued need of efficient use of FSS spectrum and orbital resource utilization;

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* Former CCITT Recommendations, e.g., G.707, G.708, G.709, G.781, G.782, G.783, G.703, G.958, G.803, G.831, G.784, Q.811, Q.812 and M.30.

j) that digital satellite systems for SDH traffic handling should be designed to provide adequate channel performance in order to comply with Recommendation ITU-T G.826*;

k) that the implications of the SDH concepts, functional requirements and characteristics on satellite systems, including their typical statistical error distributions, have to be analysed, and incompatibilities with satellite long transmission delay and Doppler effects be either removed or compensated for,

decides that the following Question should be studied

1. What are the most appropriate digital satellite systems network architectures to use as sub-networks or network functional elements in an SDH-based transport networks, with respect to:

- their functions and functional block diagrams conforming to the concepts and interfacing requirements of the ITU-T SDH Recommendations;
- the optimum bit rates of the satellite links from operational traffic and spectrum efficiency perspective?

2. What are the system requirements in terms of network synchronization, timing distribution, buffer requirements to ensure proper integration in SDH-based transport networks?

3. Within the broader transport SDH networks, what are the FSS-SDH sub-network specific needs in terms of network management and OAM, which should be satisfied using standard SDH facilities (e.g. for enhanced operation, configuration control, traffic handling including multipoint networking, performance monitoring)?

4. Which SDH standard protocols or part thereof need to be adapted for proper operation over satellite links with the inherent satellite propagation delay?

5. What are the functional requirements of FSS-SDH terrestrial digital interface equipment to be satisfied using standard SDH multiplex equipment and interfaces, including means and interfaces for accommodating the future TMN, and what modifications to these standards are necessary when used for FSS-SDH?

6. What are the satellite transmission system specific functional requirements that are to be accommodated either in the SDH Section Overhead (SOH) or in a suitable satellite frame overhead capacity and functions?

7. What are the transmission characteristics of satellite links and/or the required upgrading in the SDH frame structure in these SDH sub-networks to ensure conformance with relevant ITU-T performance requirements, to ensure unimpaired operation of the standard digital functions of the SDH multiplex and transport, and to achieve an efficient utilization of satellite radio frequency and orbital allocations?

Note 1 - The results of these studies should lead to the formulation of appropriate Recommendations within three years.

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* Former CCITT Recommendation G.826.

QUESTION ITU-R 202/4

INTERFERENCE CRITERIA IN THE FIXED-SATELLITE SERVICE FOR THE OPTIMUM INHOMOGENEOUS USE OF THE AVAILABLE CAPACITY OF THE GEOSTATIONARY ORBIT

(1993)

The ITU Radiocommunication Assembly,

considering

a) that in today's environment the use of orbit and spectrum tends to be rather inhomogeneous in terms of satellite spacings and frequency re-use;

b) that in particular the usage of the frequency band allocated to the FSS in the geostationary-satellite orbit (GSO) tends to be non-uniform;

c) that the spacing between GSO satellites using the same frequencies for co-coverage and non co-coverage applications is non-uniform;

d) that carriers with very different characteristics (such as power, occupied bandwidth, modulation type, access type, etc.) can be accommodated in an inhomogeneous manner in transponders of GSO satellites;

e) that the flexible accommodation of carriers in satellite transponders is a major factor in the optimum use of the GSO capacity, in particular in commercial applications;

f) that the non-uniform use of the orbit/spectrum resource creates a number of different interference scenarios;

g) that the effects of interference into a given carrier in the fixed-satellite service (FSS) depend on the specific characteristics of the interfering carrier and also of the wanted carrier;

h) that in some cases interference cannot be treated as an equivalent amount of thermal noise;

j) that narrow-band carriers are more susceptible than wideband carriers to interference from high spectral peaks falling into their occupied bandwidth,

decides that the following Question should be studied

1. What are the reference scenarios which best reflect the current and expected future utilization of the orbit/spectrum resources available for use in the FSS?

2. How can the efficient use of the available GSO capacity be assessed and the optimum use of it be determined?

3. What interference criteria can be adopted to optimize the use of the GSO capacity and allow for the most flexible access to it?

Note 1 - The results of these studies should lead to the formulation of appropriate Recommendations within four years.

QUESTION ITU-R 203/4

THE IMPACT OF USING SMALL TVRO DISHES ON THE EFFICIENT USE OF THE GEOSTATIONARY-SATELLITE ORBIT

(1993)

The ITU Radiocommunication Assembly,

considering

a) that in recent years a growing number of direct to home (DTH) satellite TV services have developed in the fixed-satellite service (FSS) bands;

b) that for cost and environmental reasons the DTH system providers wish to implement small dishes for home reception;

c) that the ability to operate satellites at small angular separations may be limited by the main beam characteristics of small dishes;

d) that the density of satellites using the FSS bands in critical parts of the geostationary-satellite orbit (GSO) is already high and is increasing;

e) that FSS satellite separation in the geostationary orbit is typically 3° but in parts of Region 2, 2° spacing is extensively operated,

decides that the following Question should be studied as a matter of urgency

1. What are the potential levels of interference between DTH services and other telecommunications services in the FSS bands?

2. What is the impact on the efficient use of the GSO in the FSS bands from the proliferation of small earth station dishes?

3. What steps might be taken to meet the needs of the DTH TV services in FSS bands with minimum impact on the efficiency of use of the GSO by all other fixed-satellite services?

Note 1 - The results of these studies should lead to the formulation of appropriate Recommendations within two years.

QUESTION ITU-R 204/4

INTERFERENCE OF UNDETERMINED ORIGIN ON EARTH-TO-SATELLITE LINKS

(1993)

The ITU Radiocommunication Assembly,

considering

a) that interference of undetermined origin to satellite telecommunication systems may occur on the satellite-to-Earth and/or on the Earth-to-satellite link;

b) that such interference may be caused by the operation of satellite, earth and terrestrial radio stations in conditions not in conformity with the Radio Regulations or with their notified parameters;

c) that on Earth-to-satellite links such interference may also arise as a result of equipment faults and/or of incorrect operations of earth stations, terrestrial radio-relay networks and/or satellite control stations;

d) that the probability of occurrence of such interference is greater on the up link on account of the large number of transmitting earth stations and stations of terrestrial services and the fairly wide antenna patterns usually associated with the receiving antennas of telecommunication satellites;

e) that the number of earth stations for satellite communications, in particular small stations (VSATs), is growing rapidly, thereby increasing the probability of such interference,

decides that the following Question should be studied

Taking into account the presence and character of interference of undetermined origin on the up link:

1. To what extent have satellites suffered interference of undetermined origin on the up link, and thereby impairing the performance of telecommunication channels; and if so:

a) In what frequency band has this interference been observed?

b) What is the duration and frequency of occurrence of such interference?

c) What is the spectral structure of such interference and its relative level?

d) Does such interference have a significant impact on the performance of telecommunication channels?

2. What possibilities or techniques exist, or which could be developed, to determine the origin of such interference and to overcome problems arising in connection with this type of interference?

Note 1 - The results of these studies should lead to the formulation of appropriate Recommendations within three years.

QUESTION ITU-R 205/4

FREQUENCY SHARING BETWEEN NON-GEOSTATIONARY SATELLITE FEEDER LINKS IN THE FIXED-SATELLITE SERVICE USED BY THE MOBILE-SATELLITE SERVICE

(1993)

The ITU Radiocommunication Assembly,

considering

a) that the World Administrative Radio Conference For Dealing With Frequency Allocations in Certain Parts of the Spectrum (Malaga-Torremolinos, 1992) (WARC-92) adopted primary mobile-satellite service (MSS) allocations in the 1 to 3 GHz frequency range on a shared primary basis with other radio services subject to coordination in accordance with Resolution No. 46;

b) that non-geostationary satellite (non-GSO) networks implementing these MSS allocations may use the fixed-satellite service (FSS) allocations for feeder links;

c) that the feeder links for these MSS non-GSO networks are considered part of the FSS;

d) that these FSS feeder links must operate in accordance with No. 2613 of the Radio Regulations (RR) and are only subject to the advance publication and notification procedures of Articles 11 and 13 of the RR;

e) that the frequency and technical characteristics of such feeder links for the non-GSO MSS networks may depend on the technical characteristics of such systems using the MSS frequency bands;

f) that several of these non-GSO MSS networks may use the same FSS frequency band for their feeder links;

g) that studies of interference mechanisms between non-GSO networks in the respective MSS and the FSS allocated bands have commenced but are not complete;

h) that the permissible interference criteria used for geostationary FSS networks may not be applicable to the FSS feeder links for non-GSO MSS networks,

decides that the following Question should be studied

1. What are the technical characteristics of the FSS feeder link used by the non-GSO MSS networks?

2. What are the permissible interference criteria between FSS feeder links used by the non-GSO MSS networks taking into account the impact on the MSS?

3. What are the interference calculation methods needed to analyse the potential interference between FSS feeder links used by non-GSO MSS networks?

4. What are the spectrum sharing possibilities and technical solutions that are available to permit the sharing of frequencies between FSS feeder links used by non-GSO MSS networks while satisfying RR No. 2613?

Note 1 - The results of these studies should lead to the formulation of appropriate Recommendations within two years.

QUESTION ITU-R 206/4

SHARING BETWEEN NON-GEOSTATIONARY SATELLITE FEEDER LINKS IN THE FIXED-SATELLITE SERVICE USED BY THE MOBILE-SATELLITE SERVICE AND NETWORKS OF THE FIXED-SATELLITE SERVICE USING GEOSTATIONARY SATELLITES

(1993)

The ITU Radiocommunication Assembly,

considering

a) that the World Administrative Radio Conference For Dealing With Frequency Allocations in Certain Parts of the Spectrum (Malaga-Torremolinos, 1992) (WARC-92) adopted primary mobile-satellite service (MSS) allocations in the 1 to 3 GHz frequency range on a shared primary basis with other radio services subject to coordination in accordance with Resolution No. 46;

b) that non-geostationary satellite (non-GSO) networks implementing these MSS allocations may use the fixed-satellite service (FSS) allocations for feeder links;

c) that the feeder links for these MSS non-GSO networks are considered part of the FSS;

d) that these FSS feeder links must operate in accordance with No. 2613 of the Radio Regulations (RR) and are only subject to the advance publication and notification procedures of Articles 11 and 13 of the RR;

e) that the frequency and technical characteristics of such feeder links for the non-GSO MSS networks may depend on the technical characteristics of such systems using the MSS frequency bands;

f) that several of these non-GSO MSS networks may use the same FSS frequency band for their feeder links;

g) that studies of interference mechanisms between non-GSO network feeder links and GSO networks of the FSS using the same frequency bands have commenced but are not complete;

h) that the permissible interference criteria used for interference between geostationary FSS networks may not be applicable to interference from (and to) non GSO networks to (and from) GSO FSS networks,

decides that the following Question should be studied

1. What are the technical characteristics of the FSS feeder links used by the non-GSO MSS networks?

2. What are the permissible interference criteria for interference from (and to) non-GSO MSS feeder links to (and from) GSO FSS networks using the same frequency bands?

3. What are the interference calculation methods needed to analyse the potential interference from (and to) non-GSO MSS feeder links to (and from) GSO FSS networks using the same frequency bands?

4. What are the spectrum-sharing possibilities and technical solutions that are available to permit the sharing of frequencies by GSO FSS networks and FSS feeder links used by non-GSO MSS networks subject to RR No. 2613?

Note 1 - The results of these studies should lead to the formulation of appropriate Recommendations within two years.

QUESTIONS OF STUDY GROUP 9

FIXED SERVICE

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QUESTION 101/9*

ANALOGUE RADIO-RELAY SYSTEMS USING AMPLITUDE OR FREQUENCY MODULATION

(1990)

The CCIR,

CONSIDERING

(a) that it is sometimes desirable to be able to interconnect systems of different types particularly on international circuits;

(b) that there may be economic and operational advantages in the use of radio-relay systems using amplitude or frequency modulation for the transmission of telephony and/or television signals and having a capacity greater than that described in the current Recommendations;

(c) that it is preferable for the major intermediate-frequency and radio-frequency characteristics of radio-relay systems for analogue sound programme and television signals to conform, as far as possible, with those for multi-channel telephony,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the radio, baseband or intermediate-frequency characteristics of analogue radio-relay systems, using amplitude or frequency modulation, which it is essential to specify to enable two such systems to be interconnected;

2. what are the optimum values for the system characteristics (including the baseband intermediate-frequency and radio-frequency characteristics) for enabling the maximum capacity of each radio channel to be achieved;

3. what are the preferred characteristics of international radio-relay systems for the transmission of signals for analogue sound programme and television when they differ from those for telephony?

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* Previously Question 1/9.

QUESTION 102/9*

AVAILABILITY OF RADIO-RELAY SYSTEMS

(1990)

The CCIR,

CONSIDERING

(a) that all interruptions to traffic are factors affecting availability;

(b) that the degree of availability required of a system, has a major bearing on system design and on the cost of its provision and operation;

(c) that protection arrangements are frequently used to improve system availability;

(d) that information on the availability of radio-relay systems between the points shown as R' and R of Fig. 1, Recommendation 380 for analogue systems and between the points T and T' according to Recommendation 596 for digital systems, will assist the CCITT to define reliability and availability objectives for overall analogue and digital connections,

UNANIMOUSLY DECIDES that the following question should be studied:

1. how should the concept of system availability be applied to radio-relay systems;

2. what standards of availability are the objectives when providing radio-relay systems;

3. what standards of availability are now achieved by radio-relay systems of current design;

4. what standards of availability should be the objective for future radio-relay systems having a length equal to that:

- of a hypothetical reference circuit, when measured between the points shown as R' and R of Fig. 1 of Recommendation 380;
- of a hypothetical reference digital path, when measured between T and T' of Fig. 1 in Report 938 according to Recommendation 596;

5. what is the contribution of protection switching to system availability?

Note – See Recommendation 557 and Reports 137, 443, 445, 1052 and 1053.

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* Previously Question 5/9.

QUESTION 103/9*

TRANS-HORIZON RADIO-RELAY SYSTEMS

(1990)

The CCIR,

CONSIDERING

(a) that trans-horizon radio-relay systems have received acceptance and are increasingly being used operationally in many parts of the world;

(b) that it is desirable to determine the preferred characteristics of such systems needed to facilitate their international connection;

(c) that the frequency bands used by trans-horizon radio-relay systems are often shared with line-of-sight radio-relay systems, other fixed and mobile, or broadcasting services;

(d) that there are technical and operational difficulties in sharing frequency bands between tropospheric-scatter systems and space systems (see Recommendation Spa2 – 2);

(e) that the prediction of path antenna gain cannot be determined precisely,

(f) the digital trans-horizon network or links may be required for particular applications;

(g) that the hypothetical reference digital path in Recommendation 556 may be suitable for trans-horizon systems;

(h) that the allowable bit error ratios of Recommendation 594 may also be applicable to the design of trans-horizon systems;

(j) that nevertheless, the complete achievement of these objectives could result in uneconomic systems,

UNANIMOUSLY DECIDES that the following question should be studied:

1. how do the characteristics of tropospheric-scatter propagation affect the design of radio-relay systems for telephony and television;

2. to what extent are systems, employing this mode of propagation and operating on the same or on neighbouring frequencies, liable to interfere with each other, with systems employing different modes of propagation as well as with other services;

3. on what basis should radio-frequency channel arrangements for trans-horizon systems be established;

4. what are the technical criteria affecting the choice of radio-frequency bands for trans-horizon systems (whether by tropospheric scatter mode or by diffraction propagation, using comparable equipment, with high power transmitters and/or very sensitive receivers);

5. what are the methods to be used for measuring the noise and the stability of the net loss in trans-horizon systems designed on the basis of meeting the objectives in Recommendation 397;

6. what are the relationships between system design parameters and path antenna gain;

7. what are the hypothetical reference digital paths and performance objectives for digital trans-horizon radio networks;

8. what is the manner in which such networks may be accommodated within the hypothetical reference connection of CCITT Recommendation G.821;

9. whether the performance criteria discussed in Report 930 are applicable to trans-horizon systems?

Note – See Recommendations 302, 388 and 698 and Reports 285 and 1191.

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* This Question merges Question 7/9 and Study Programme 7G/9.

QUESTION 104/9*

RADIO-RELAY SYSTEMS OPERATING IN BANDS 8 AND 9 FOR THE PROVISION OF TELEPHONE TRUNK CONNECTIONS IN RURAL AREAS

(1990)

The CCIR,

CONSIDERING

(a) that it is most important to extend telecommunication media in rural areas and especially in the developing countries, particularly with a view to connecting small rural exchanges to the national network and, through it, where possible, to the international network;

(b) that in many cases, in view of the extent of these countries, nature of the terrain, climatic conditions, low density of rural population, etc., it is advisable for technical and economic reasons to use radio-relay systems;

(c) that it is necessary to define the technical characteristics of the equipment used for this purpose;

(d) that the performance standards of such systems should be determined;

(e) that radio-frequency channel arrangements are required,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the general characteristics and standards to be adopted for simple, economic radio equipments which will provide trunk connections:

– in band 8, and

– in band 9,

and which meet the following basic requirements:

1.1 exclusive use of solid state components;

1.2 capacity:

1.2.1 up to 6, 12, 24 or 30 telephone channels;

1.2.2 48 or 60 telephone channels;

1.2.3 6 voice-frequency telegraph channels in the sub-baseband for both systems under § 1.2.1 and 1.2.2;

1.3 use of an appropriate type of modulation and optimization of its characteristics;

1.4 small power consumption;

1.5 ease of installation;

1.6 simple maintenance, i.e. it should be possible for the equipment to operate with periodic maintenance at long intervals and to entrust these operations to semi-skilled staff;

1.7 simple auxiliary equipment for measurements and tests;

2. what are appropriate availability objectives for radio-relay systems operating in rural areas;

3. what are appropriate noise power objectives in radio links operating in rural areas;

4. what are the preferred radio-frequency channel arrangements?

Note 1 – Some flexibility may be required in connection with § 1.1 (use of solid-state components exclusively) and § 1.4 (small power consumption), particularly when geographical conditions justify the use of trans-horizon paths.

Note 2 – See Report 379.

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* This Question merges Question 9/9 and Study Programmes 9A/9 and 9B/9.

QUESTION 105/9*

RADIO SYSTEMS OPERATING IN BANDS 8 AND 9 FOR THE PROVISION OF SUBSCRIBER TELEPHONE CONNECTIONS IN RURAL AREAS

(1990)

The CCIR,

CONSIDERING

(a) that it is most important to make telecommunication media available to subscribers in rural areas and in particular to such subscribers in the developing countries;

(b) that the Regional Plan Committee for Asia has drawn the attention of the CCIR to this need;

(c) that single-channel and multiple access (e.g. radio concentrator) equipment appear to offer suitable solutions for this purpose;

(d) that with such systems, subscribers would have access to the national network and, through that, to the international network;

(e) that such subscribers must enjoy the same conditions, as far as the quality of calls is concerned, as do urban subscribers,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what should be the performance criteria applicable to radiotelephone circuits for rural subscribers, and how should they be specified;

2. what should be the general characteristics of subscriber radio equipment operating in bands above 30 MHz to ensure:

2.1 that several rural subscribers, for economic reasons, may share the same radio terminal (party line);

2.2 that the privacy of calls is safeguarded;

2.3 that such rural subscribers may communicate with each other;

2.4 that such subscribers may be connected to a manual or an automatic exchange;

2.5 that to obtain a greater efficiency in the use of the frequency spectrum and for reasons of economy without appreciably reducing the grade of service, a number of rural subscribers should have access to a smaller number of telephone circuits (e.g. radio concentrators);

2.6 that signals other than voice-frequency should be able to be transmitted (charge information, public phone signalling, etc.);

3. what should be the characteristics of simple subscriber radio equipment operating in bands above 30 MHz which meet the following basic requirements:

3.1 a transmitter-receiver mounted on a mast or housed in a special case;

3.2 low power consumption, with solid state components;

3.3 independence from the mains supply;

3.4 possibility of connection to the nearest main station, which may be some distance away;

3.5 use of a very simple type of antenna and an inexpensive antenna support structure;

3.6 equipment not requiring skilled staff;

3.7 minimum maintenance;

3.8 a design that is easily adaptable to various configurations and service facilities;

3.9 that for some applications the transmitter-receiver sets be able to operate at different frequencies or be allocated different time slots and thereby have multiple access to a number of telephone circuits?

Note 1 – The Director, CCIR, is requested to inform the Chairman, Special Autonomous Study Groups 3 (GAS 3) and 7 (GAS 7), of the setting of this Question and to transmit to him the results of the studies.

Note 2 – See Report 380.

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* Previously Question 10/9.

QUESTION 106/9*

DIVERSITY TECHNIQUES FOR RADIO-RELAY SYSTEMS

(1990)

The CCIR,

CONSIDERING

(a) that, in a radio-relay system, fading may lower the signal-to-noise ratio and impair the reliability of the system;

(b) that these effects can, to a large extent, be mitigated by employing techniques of diversity reception;

(c) that the optimum values of the various diversity parameters may be different for line-of-sight, diffraction, or trans-horizon radio-relay systems;

(d) that the expression "diversity reception" should be taken in its widest sense,

UNANIMOUSLY DECIDES that the following question should be studied:

1. under typical conditions of fading encountered in radio-relay systems, whether line-of-sight, diffraction or trans-horizon systems, what are the relative advantages of the various types of diversity;

2. what is the optimum value of the chosen parameter for each type of diversity (antenna-spacing, frequency-spacing, time-difference, etc.);

3. in what way must the received signals be utilized to obtain the best possible resulting signal, due account being taken of the mechanism of propagation, the nature of the transmitted signal, the characteristics of available antennas, including adaptive arrays, the bandwidth occupied by the spectrum of the modulated wave, the complexity of the requisite equipment and its ease of operation;

4. what influence does the use of diversity have on the transmission bandwidth and quality;

5. what influence does the use of diversity have on interference that may be caused or suffered by the systems?

Note – See Report 376.

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* Previously Question 13/9.

QUESTION 107/9*

CHARACTERISTICS OF RADIO-RELAY SYSTEMS OPERATING IN FREQUENCY BANDS ABOVE ABOUT 17 GHz

(1990)

The CCIR,

CONSIDERING

(a) that radio-relay systems may make use of the fixed service frequency allocations above 17 GHz;

(b) that techniques for the use of these frequencies are being considered by various administrations;

(c) that the radio-wave propagation characteristics at these frequencies are known to differ in some respects from those of lower frequencies and that some of these differences might be exploited to advantage;

(d) that the equipment techniques might differ from those used in the lower frequency bands,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the characteristics of radio-relay systems and equipment best suited for the exploitation of radio-frequency bands above about 17 GHz;

2. what are the preferred methods that can be used to offset the effects of propagation on radio-relay systems operating above about 17 GHz;

3. what are the preferred modulation techniques for use at frequencies above about 17 GHz for radio-relay systems;

4. what is the susceptibility of these systems to interference and what is their potential for causing interference to other systems?

Note – See Report 783.

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* Previously Study Programme 16A/9.

QUESTION 108/9*

CHANNEL SPACINGS AND ARRANGEMENTS FOR RADIO-RELAY SYSTEMS OPERATING IN FREQUENCY BANDS ABOVE ABOUT 17 GHz

(1990)

The CCIR,

CONSIDERING

(a) that radio-relay systems may make use of the fixed service frequency allocations above about 17 GHz;

(b) that radio frequency channel arrangements may be required in the new frequency bands where the use of both analogue and digital radio-relay systems is foreseen;

(c) that radio-wave propagation characteristics at these frequencies are known to differ in some respects from those of lower frequencies;

(d) that there may be a frequency limit beyond which Recommendations on radio-frequency channel arrangements are not necessary,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the preferred radio-frequency channel arrangements for the frequency bands above about 17 GHz, available for use by radio-relay systems;

2. what is the preferred channel spacing and what features of the system will affect the channel spacing;

3. is there any frequency limit beyond which Recommendations on radio-frequency channel arrangements are not necessary and, if so, what is the frequency limit;

4. what guidelines should be established governing the contents of Recommendations and Reports as regards radio-frequency channel arrangements and utilization above about 17 GHz and above any frequency identified in DECIDES 3?

Note – See Recommendations 595, 637 and Report 936.

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* Previously Study Programme 16B/9.

QUESTION 109/9*

CRITERIA FOR FREQUENCY SHARING BETWEEN RADIO-RELAY SYSTEMS AND SYSTEMS IN THE FIXED-SATELLITE SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that radio-relay systems are now widely employed throughout the world and make extensive use of the radio-frequency spectrum;

(b) that the use of radio-relay systems is expected to continue to expand and that new systems are expected to operate with improved performance and make more efficient use of the radio-frequency spectrum;

(c) that the use of systems in the fixed-satellite service in shared frequency bands is expected to continue to expand;

(d) that the continued development of terrestrial and space services is desirable;

(e) that control of mutual interference between stations of the various services is necessary,

UNANIMOUSLY DECIDES that the following question should be studied:

1. under what conditions and to what extent can radio-relay systems share frequency bands with systems in the fixed-satellite service;

2. to what degree can electromagnetic shielding between earth stations and stations in the fixed service be used or provided by artificial means;

3. what are the appropriate criteria to determine the minimum practicable separation between the locations of radio-relay stations and earth stations in space radiocommunication services, where either kind of station may transmit and receive, and use any type of modulation;

4. what criteria are appropriate for frequency sharing between inter-satellite links in the fixed-satellite service and the fixed-service;

5. what criteria are appropriate for frequency sharing between the fixed service and feeder links to broadcasting satellites?

Note 1 – The allowable values of performance and availability degradations of radio-relay systems, caused by the aggregate of all emissions from other radio services are studied under Question 127/9.

Note 2 – See Recommendations 355 and 359, and Reports 209, 382, 448, 709, 791 and 876.

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* Previously Question 17/9.

QUESTION 110/9*

ANTENNA RADIATION DIAGRAMS OF RADIO-RELAY STATIONS FOR USE IN SHARING STUDIES

(1990)

The CCIR,

CONSIDERING

(a) that determination of criteria for frequency sharing between radio-relay systems and systems in the Space Radiocommunication Service requires a knowledge of the antenna gains of the radio-relay stations along all possible interfering paths;

(b) that the reference diagrams for large earth station antennas may not be applicable for antennas of line-of-sight radio-relay systems;

(c) that the use of reference radiation patterns for line-of-sight radio-relay antennas would facilitate interference calculations;

(d) that different reference radiation patterns may be required for the various types of antennas in use,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the measured radiation patterns in the vertical and horizontal planes for both polarizations of typical antennas used in line-of-sight radio-relay systems, including passive reflector (i.e. periscope) antennas, and passive repeaters;

2. what reference radiation patterns can be defined for the different types of antennas?

Note – See Recommendation 1037 and Report 614.

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* Previously Study Programme 17A/9.

QUESTION 111/9*

PROTECTION CRITERIA BETWEEN THE BROADCASTING-SATELLITE SERVICE AND THE FIXED SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that Resolution No. 34 of the WARC-79 resolves that the CCIR shall study the technical provisions which may be appropriate for sharing in the band 12.5 to 12.75 GHz between stations in the broadcasting-satellite service in Region 3 and terrestrial stations in Regions 1 and 2;

(b) that Recommendation PLEN/B of the WARC ORB-85 invites the CCIR to include in its report to the Second Session of the WARC ORB the results of its studies relevant to, *inter alia*, sharing between high definition television (HDTV) in the broadcasting-satellite service and the fixed service,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the technical provisions appropriate for sharing in the band 12.5 to 12.75 GHz between stations in the broadcasting-satellite service in Region 3 and terrestrial stations in the fixed service in Regions 1 and 2;

2. what are the technical provisions appropriate for sharing between HDTV in the broadcasting-satellite service and the fixed service?

Note – See Reports 789 and 1189.

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* Previously Study Programme 17B/9. This Question should be brought to the attention of Study Groups 10 and 11.

QUESTION 112/9*

FREQUENCY SHARING BETWEEN THE BROADCASTING-SATELLITE SERVICE (SOUND) AND THE FIXED SERVICE IN THE BAND 0.5 TO 3 GHz

(1990)

The CCIR,

CONSIDERING

(a) that radio-relay systems are widely employed throughout the world and make extensive and increasing use of much of the spectrum below 3 GHz;

(b) that studies to date have shown that accommodation of the broadcasting-satellite service (sound) in the frequency range 0.5 to 2 GHz or nearby, will cause considerable sharing difficulties with many services;

(c) that Resolution No. COM5/1 of the World Administrative Radio Conference, Geneva, 1988, resolves that a band (or bands) of frequencies in the range 0.5 to 3 GHz be sought with a view to a possible allocation to the broadcasting-satellite service (sound);

(d) that the Plenipotentiary Conference, Nice, 1989, has resolved that a world administrative radio conference will be held in 1992 in order to provide, if possible, for the necessary allocation to the broadcasting-satellite service (sound) within the frequency range 0.5 to 3 GHz,

UNANIMOUSLY DECIDES that the following question should be studied:

what is the feasibility of the sharing of frequencies between the broadcasting-satellite service (sound) and the fixed service in the band 0.5 to 3 GHz, with special consideration to geographic sharing?

Note – See Report 941.

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* Previously Study Programme 17C/9. This Question should be brought to the attention of Study Groups 10 and 11.

QUESTION 113/9*

FREQUENCY SHARING BETWEEN RADIO-RELAY SYSTEMS AND SYSTEMS OF THE EARTH EXPLORATION-SATELLITE SERVICE AND THE SPACE RESEARCH SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that radio-relay systems are widely employed throughout the world and make extensive and increasing use of several frequency bands;

(b) that there is potential for interference between radio-relay systems and both geostationary and non-geostationary statellite radiocommunication systems;

(c) that special consideration must be made of the unique characteristics of systems in space radiocommunication services other than the traditional fixed-satellite service;

(d) that Study Group 2 has undertaken some preliminary studies with regard to radio-relay systems sharing with the earth exploration-satellite service and the space research service;

(e) that the WARC-79 allocated these services to share additional frequency bands and at the same time requested the CCIR via Recommendation No. 706 to study certain aspects of the sharing criteria between radio-relay systems and passive sensors for the earth exploration-satellite service and the space research service operating in the band 18.6 to 18.8 GHz;

(f) that administrations will require agreed sharing criteria to carry out compatibility analysis under the Radio Regulations, such as Article 14,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the levels of interference from the earth exploration-satellite service and the space research service acceptable to radio-relay systems, including percentage of time considerations;

2. what are the constraints on the services which would be necessary and acceptable to facilitate sharing;

3. what special considerations of sharing are required when non-geostationary satellites are used by these space services;

4. what are the feasibility and constraints on sharing these services when the space services employ passive or active microwave sensors?

Note – See Reports 942 and 1197.

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* Previously Study Programme 17D/9. This Question should be brought to the attention of Study Group 7.

QUESTION 114/9*

MAXIMUM e.i.r.p. FOR LINE-OF-SIGHT RADIO-RELAY TRANSMITTERS OPERATING IN FREQUENCY BANDS SHARED WITH THE FIXED-SATELLITE SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that emissions from line-of-sight radio-relay transmitters may produce interference in receiving space stations of the fixed-satellite service, in shared frequency bands;

(b) that it is impractical to coordinate between the many terrestrial stations and the many space stations and that, therefore, sharing criteria should be such as to preclude the need for detailed coordination;

(c) that, in devising such sharing criteria, account needs to be taken of the operational and technical requirements of radio-relay systems and the options open to them to comply with such sharing criteria, as well as of the technical and operational characteristics of space stations,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the acceptable constraints, if any, on the e.i.r.p. of radio-relay transmitters, which may have to be adopted to protect adequately the receiving space stations in the fixed-satellite service, without requiring detailed coordination?

Note 1 – These studies should be carried out in close collaboration with those of Question 60/4.

Note 2 – See Recommendation 406 and Reports 393, 790 and 1006.

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* Previously Study Programme 17E/9.

QUESTION 115/9*

CRITERIA FOR FREQUENCY SHARING BETWEEN THE FIXED SERVICE AND THE FIXED-SATELLITE SERVICE IN BIDIRECTIONALLY ALLOCATED FREQUENCY BANDS

(1990)

The CCIR,

CONSIDERING

(a) that the existing sharing criteria are based on fixed-satellite systems in unidirectionally allocated frequency bands;

(b) that bidirectional operation on the fixed-satellite service introduces additional interference sources;

(c) that the coordination of earth stations in bidirectionally allocated frequency bands may require new coordination parameters which take into consideration interference sources from the down link as well as the up-link direction;

(d) that the introduction of transmitting earth stations in a frequency band that currently is allocated for transmitting space stations may also impose restrictions on both the fixed and fixed-satellite services;

(e) that both long-term and short-term interference mechanisms must be considered in establishing frequency sharing criteria,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the preferred short-term and long-term sharing criteria that take into consideration down-link and up-link interference;

2. what limitations are acceptable to radio-relay systems that will allow for the development and growth of the fixed service in frequency bands with new allocations for bidirectional satellite transmissions?

Note 1 – These studies should be carried out in close collaboration with those of Question 61/4.

Note 2 – See Report 1005.

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* Previously Study Programme 17F/9.

QUESTION 116/9*

SHARING CRITERIA FOR PROTECTING THE FIXED SERVICE FROM EMISSIONS OF SPACE STATIONS IN THE FIXED-SATELLITE SERVICE IN SHARED FREQUENCY BANDS

(1990)

The CCIR,

CONSIDERING

(a) that emissions from the space stations in the fixed-satellite service may produce interference in receiving stations of the fixed service in frequency bands shared by the two services;

(b) that it is impractical to coordinate between the many terrestrial stations and the many space stations and that, therefore, sharing criteria should be such as to preclude the need for detailed coordination;

(c) that, in devising such sharing criteria, account needs to be taken of the operational and technical requirements of networks in the fixed-satellite service as well as of the requirements of the fixed service and measures available to them,

UNANIMOUSLY DECIDES that the following question should be studied:

what are the preferred sharing criteria by which the fixed service could be adequately protected against unacceptable interference due to emissions from space stations of the fixed-satellite service in shared frequency bands in such a way as not to require detailed coordination between space and terrestrial stations?

Note 1 – These studies should be carried out in close collaboration with those of Question 59/4.

Note 2 – See Recommendations 357, 615 and 674, and Reports 387, 877 and 1143.

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* Previously Study Programme 17G/9.

QUESTION 117/9*

CRITERIA FOR FREQUENCY SHARING BETWEEN THE FIXED SERVICE AND FSS NETWORKS USING SATELLITES IN SLIGHTLY INCLINED GEOSTATIONARY ORBITS

(1990)

The CCIR,

CONSIDERING

(a) that emissions from space stations in the fixed-satellite service may produce interference in receiving stations of terrestrial services in frequency bands shared by the two kinds of service;

(b) that emissions from line-of-sight radio-relay transmitters may produce interference in receiving space stations of the fixed-satellite service, in shared frequency bands;

(c) that it is impractical to coordinate between the many terrestrial stations and the many space stations and that, therefore, sharing criteria should be such as to preclude the need for detailed coordination;

(d) that, in devising such sharing criteria, account needs to be taken of the operational and technical requirements of radio-relay systems, as well as of the operational and technical requirements of networks in the fixed-satellite service, and the options open to them to comply with such sharing criteria;

(e) that the application and technical characteristics of satellites in slightly inclined geostationary orbits are being studied for use in fixed-satellite service networks and that the use of such satellites may impose additional sharing constraints over those applicable to conventional geostationary satellite networks;

(f) that the limits specified in Article 27 of the Radio Regulations apply to terrestrial services, with the aim of protecting regions around the geostationary satellite orbit;

(g) that the power flux-density limits specified in Article 28 have been developed assuming a specific scenario of space station distribution and associated angles of arrival above the horizontal plane;

(h) that sufficient technical information is not available concerning the applicability of existing sharing criteria to the case of terrestrial services and fixed-satellite service networks using slightly inclined geostationary orbits and which share the same frequency bands;

(j) that the coordination of terrestrial stations with earth stations operating to satellites in slightly inclined geostationary orbits and sharing the same frequency bands may require new coordination parameters, due in part to new earth station pointing requirements,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the potential interference mechanisms which can occur between the fixed service and satellite networks using slightly inclined geostationary orbits;

2. to what extent can existing constraints on spacecraft emissions for the protection of terrestrial systems, be applied to satellite systems operating with slightly inclined orbits;

3. to what extent can existing contraints on the fixed service be applied to protect such satellite systems;

4. what is the need to establish constraints on north-south station-keeping and their magnitude with reference to their impact on sharing;

5. what are the coordination methods required between terrestrial stations and earth stations operating with satellite systems using satellites in slightly inclined geostationary orbits;

6. what technical means can be used to ameliorate this sharing situation?

Note – These studies should be carried out in close collaboration with those of Question 64/4.

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* Previously Study Programme 17H/9.

QUESTION 118/9*

PROTECTION CRITERIA BETWEEN THE MOBILE SATELLITE SERVICES AND THE FIXED SERVICE IN THE BAND 1 TO 3 GHz

(1990)

The CCIR,

CONSIDERING

that Resolution 208 of WARC MOB-87 has recommended that the next competent WARC should consider designating spectrum in the band 1 to 3 GHz for international use by mobile-satellite services,

UNANIMOUSLY DECIDES that the following question should be studied:

what are the technical criteria for sharing and ensuring protection between the fixed and mobile-satellite services in the band 1 to 3 GHz?

Note – See Report 1195.

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* Previously Study Programme 17J/9. This Question should be brought to the attention of Study Group 8.

QUESTION 119/9*

LIMITATION OF UNWANTED EMISSIONS FROM RADIO-RELAY SYSTEMS

(1990)

The CCIR,

CONSIDERING

(a) the definition in the Radio Regulations that unwanted emissions consist of spurious emissions and out-of-band emissions;

(b) that the definition in Article 1, No. 139 of the Radio Regulations states that spurious emission is an emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information and that spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out-of-band emissions;

(c) that the radiation of spurious emissions by radio-relay systems could cause interference to other radio services and other radio-relay systems, and that it is necessary to define limits for these emissions;

(d) that Appendix 8 of the Radio Regulations applies only to the mean power of a transmitter and spurious emissions, and that there are a variety of emissions where the interpretation of the term "mean power" and its consequential measurement is difficult;

(e) that Recommendation No. 66 of the WARC-79 calls for the continued intensive study of the maximum permitted levels of spurious emissions from radio-relay systems not currently covered by Appendix 8 to the Radio Regulations and especially for digital systems;

(f) that the definition in Article 1, No. 138 of the Radio Regulations states that out-of-band emission is an emission on a frequency or frequencies immediatly outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions;

(g) that out-of-band emissions from radio-relay systems can introduce interference into other radio-relay systems or other radio services and it is necessary to define limits for these emissions;

(h) that techniques to suppress out-of-band emissions may differ from those to suppress spurious emissions;

(j) that the Radio Regulations do not define the limitations on the out-of-band emissions by radio-relay systems,

UNANIMOUSLY DECIDES that the following question should be studied:

1. with regard to spurious emission,

1.1 what kind of spurious emission, generated by radio-relay systems should be considered;

1.2 what are the limits applicable to spurious emissions;

1.3 what are the appropriate reference points in the radio-relay system, at which these values should be defined;

1.4 what are the appropriate measurement techniques and reference measurement bandwidths for spurious emissions;

1.5 how the term "mean power" of Appendix 8 of the Radio Regulations should be interpreted for spurious emission from radio-relay systems;

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* This Question merges Question 19/9 and Study Programmes 19A/9 and 19B/9.

2. with regard to out-of-band emission,

2.1 what kind of out-of-band emissions generated by radio-relay systems should be considered;

2.2 what are the limits applicable to out-of-band emissions;

2.3 what are the appropriate reference points in the radio-relay system, at which these values should be defined;

2.4 what are the appropriate measurement techniques and reference measurement bandwidth for out-of-band emissions;

2.5 how the term "mean power" of Appendix 8 of the Radio Regulations should be interpreted for out-of-band emissions from radio-relay systems?

Note 1 – The results of these studies are to be communicated to Study Group 1.

Note 2 – See Report 937.

QUESTION 120/9*

FREQUENCY TOLERANCES OF RADIO-RELAY SYSTEMS

(1990)

The CCIR,

CONSIDERING

(a) that the frequency tolerances of radio-relay systems influence interference and efficient frequency band utilization;

(b) that the recent advances in technology may make possible the adoption of tighter limitations on the frequency tolerances of radio-relay systems;

(c) that account must be taken of the transmitter spectral distribution of the radio-relay system and of the total frequency difference between the wanted and any interfering signal;

(d) that Recommendation No. 69 of the WARC-79 calls for the study of frequency tolerances and for the determination of the ultimate values of the tolerances,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the factors which affect the frequency tolerances of radio-relay systems, taking into account the recent advances in technology;

2. what are the preferred limits for frequency tolerances of radio-relay systems.

Note – See Report 785.

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* Previously Study Programme 19C/9. The results of these studies are to be communicated to Study Group 1.

QUESTION 121/9*

TRANSPORTABLE FIXED-SERVICE RADIOCOMMUNICATION EQUIPMENT FOR RELIEF OPERATIONS

(1990)

The CCIR,

CONSIDERING

(a) that rapid and reliable telecommunications are essential for relief operations in the event of natural disasters, epidemics, famines and similar emergencies;

(b) that, through damage or from other causes, the normal telecommunications facilities in disaster areas are often inadequate for relief operations and cannot be restored or supplemented quickly through local resources;

(c) that the World Administrative Radio Conference (WARC), Geneva, 1979, has adopted Recommendation No. 1,

UNANIMOUSLY DECIDES that the following question should be studied:

what are the preferred characteristics and frequency bands for transportable radio-relay equipment to provide relief telecommunication when:

- the equipment is used to establish terrestrial access to a transportable earth station;
- only terrestrial relief telecommunication facilities are involved?

Note – See Report 615.

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* Previously Question 20/9. See also Questions 148/9 and 43/4

QUESTION 122/9*

EFFECTS OF PROPAGATION ON THE DESIGN AND OPERATION OF RADIO-RELAY SYSTEMS

(1990)

The CCIR,

CONSIDERING

(a) that the performance of analogue radio-relay systems or of digital systems operating in the plesiochronous or synchronous modes can be seriously affected by multipath propagation;

(b) that rain attenuation is also a significant impairment at frequencies above about 10 GHz;

(c) that cross-polarization techniques are of interest for a more efficient use of the radio-frequency spectrum;

(d) that absorption bands in the atmosphere due to oxygen and water vapour exist at various frequencies above about 20 GHz;

(e) that special propagation conditions may be encountered in desert and jungle terrain, especially ducting**;

(f) that there are frequently technical and economic advantages in using relatively long paths for microwave radio-relay systems, particularly where natural terrain facilitates the use of high antenna sites**,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what is the degradation of radio-relay system performance due to multipath fading, particularly for high capacity systems, analogue systems or digital systems operating in the plesiochronous or synchronous transmission modes;

2. what are the effects of rain attenuation on radio-relay system performance, on the choice of optimum hop length and on system availability;

3. what cross-polarization decoupling can be achieved, both in faded and non-faded conditions;

4. what are the possible advantages in the use of the absorption bands for particular situations, when considerable additional propagation attenuation is required;

5. what would be the effects of the propagation conditions on the optimum characteristics for microwave radio-relay systems operating over desert and jungle terrain***;

6. what technical methods could be used to reduce the harmful effects of adverse propagation conditions and what relationship exists between outage probability and various characteristics of digital radio-relay systems?

Note – See Report 784, and also Report 338 (Volume V).

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* Previously Question 25/9.

** This has been brought to the attention of the CCIR by the World Plan Committee with reference to the African Continent following its meeting in April 1980 (Paris).

*** Administrations of the African countries are urged to participate in these studies and the urgent need for propagation data relevant to the African Continent is brought to the attention of Study Group 5.

QUESTION 123/9*

RADIO-RELAY SYSTEMS FOR THE SIMULTANEOUS TRANSMISSION OF ANALOGUE AND DIGITAL SIGNALS

(1990)

The CCIR,

CONSIDERING

(a) that simultaneous transmission of analogue and digital signals on radio-relay systems may be important from the point of view of baseband frequency occupancy;

(b) that specific applications of radio-relay systems carrying simultaneously analogue telephone or television signals and digital signals are under development;

(c) that radio-relay systems with a capacity of 960, 1260 and 1800 frequency division multiplexed telephone channels as described in Recommendation 380 may be used for transmission of digital signals below or above the baseband;

(d) that radio-relay systems with a capacity of 1260 or 1800 FDM telephone channels may be used for transmission of an analogue colour television signal as given in Recommendation 270, as well as digital signals above the baseband;

(e) that no characteristics of radio-relay systems carrying both analogue baseband signals and digital signals simultaneously, exist,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the preferred transmission characteristics and values of the critical system parameters of radio-relay systems which carry simultaneously both analogue and digital signals;

2. in particular, what are the preferred transmission characteristics and the most critical system parameters for the provision of simultaneous transmission of analogue and digital signals under the following conditions:

- if the radio-relay system is to carry both FDM telephone channels and digital signals;
- if the radio-relay system is to carry an analogue colour television signal and digital signals?

Note – See Report 786.

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* This Question merges Question 26/9 and Study Programme 26A/9.

QUESTION 124/9*

NEW TECHNIQUES FOR SPECTRUM SHARING AND BAND UTILIZATION FOR RADIO-RELAY SYSTEMS

(1990)

The CCIR,

CONSIDERING

(a) that advances in technology and new encoding, modulation and access schemes, are making practicable new sharing schemes that offer economical as well as technological advances for increasing the efficiency of spectrum sharing and band utilization;

(b) that rapid advances are being made in packet radiocommunication, multi-function techniques, circuit assignment techniques, and point-to-multipoint systems;

(c) that these techniques are used both on terrestrial fixed and mobile systems as well as by satellite schemes;

(d) that Recommendation No. 65 of the World Administrative Radio Conference, Geneva, 1979, invites the CCIR to carry out studies on these matters,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the new encoding and modulation techniques and access schemes that would lead to better sharing and utilization of the spectrum;

2. what are the technical and performance criteria for ensuring compatibility with existing radiocommunication systems?

Note 1 – Radio-frequency channel arrangements for systems covered by this Question other than those operating in bands 8 and 9 are studied under Questions 101/9 and 136/9.

Note 2 – Point-to-multipoint systems are studied under Question 125/9.

Note 3 – See Reports 940.

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* Previously Question 27/9. This Question should be brought to the attention of Study Group 1.

QUESTION 125/9*

POINT-TO-MULTIPOINT SYSTEMS FOR TELEPHONY, DATA OR VIDEO APPLICATIONS USING NEW TECHNIQUES FOR SPECTRUM SHARING AND BAND UTILIZATION

(1990)

The CCIR,

CONSIDERING

(a) that the expansion of point-to-point terrestrial radio-relay services and advances in technology have stimulated the introduction of related point-to-multipoint systems;

(b) that point-to-multipoint applications may be implemented for either analogue or digital transmission techniques and may offer service advantages such as the rapid provision of connections;

(c) that point-to-multipoint systems for telephony, data and video applications may form part of other systems such as integrated services digital network (ISDN);

(d) that point-to-multipoint systems may operate in frequency bands where chanelling plans have been recommended by the CCIR for point-to-point systems;

(e) that point-to-multipoint systems may share frequency bands with other services and new frequency coordination techniques may be appropriate;

(f) that criteria different from those adopted for point-to-point systems may be required to assess the spectrum efficiency of point-to-multipoint systems,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the appropriate modulation and baseband multiplexing techniques for point-to-multipoint radio systems for different types of transmitted signal and service requirements;

2. what factors are to be considered in assessing performance and availability criteria for point-to-multipoint systems and the necessity to set objectives;

3. what are the preferred interface parameters at the points of interconnection with other systems;

4. what are the characteristics of point-to-multipoint systems that influence their coordination with other systems sharing the same frequency band, and coordination techniques that might be adopted;

5. what are the factors which influence the spectrum efficiency and band utilization of point-to-multipoint systems compared with conventional point-to-point links, especially when specialized service requirements are considered such as the rapid and effective provision of connections in urban and rural environments;

6. what frequency bands allocated to the fixed service are most appropriate to point-to-multipoint systems;

7. is it necessary to specify alternative frequency channelling plans for point-to-multipoint systems and what are the most appropriate plans for systems operating in bands 8 and 9;

8. what are the criteria for determining the boundaries of point-to-multipoint service areas;

9. what are the parameters and calculation procedures suitable for determining the various effects of interference?

Note – See Recommendation 701 and Reports 940 and 1057.

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* Previously Study Programme 27A/9.

QUESTION 126/9*

REQUIREMENTS FOR POINT-TO-MULTIPOINT SYSTEMS USED IN THE LOCAL GRADE PORTION OF AN ISDN CONNECTION

(1990)

The CCIR,

CONSIDERING

(a) the study on the ISDN has been carried out, and I-Series Recommendations have been developed by the CCITT;

(b) point-to-multipoint systems may contribute to rapid construction of the ISDN, because of their easy and low cost installation even if the number of subscribers is small;

(c) point-to-multipoint systems have advantages for ISDN service expansion because of their portability,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the preferred system architectures in the circuit switching mode and the packet switching mode;

2. what are the methods which are suitable for circuit activation/deactivation of radio channels, especially when the point-to-multipoint system operates under the demand-assignment multiple access scheme;

3. what are the preferred protocols or procedures between the point-to-multipoint system and the exchange or terminal equipment when such phenomena, as lost calls, connection delays, or short interruptions occur;

4. what are the preferred objectives for the proportion of lost calls and connection delays?

Note – See Report 1193.

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* Previously Study Programme 27B/9.

QUESTION 127/9*

MAXIMUM ALLOWABLE PERFORMANCE AND AVAILABILITY DEGRADATIONS OF RADIO-RELAY SYSTEMS DUE TO VARIOUS SOURCES OF INTERFERENCE

(1990)

The CCIR,

CONSIDERING

(a) that in order to evaluate the overall system performance and availability of radio-relay systems, all sources of interference must be considered;

(b) that interference could be caused by emissions from other radio-relay systems and systems in other radio services, and by radiations from sources other than radio services;

(c) that criteria to limit interference from services which share with the fixed service on a non-primary basis may differ from the criteria which apply to services sharing frequency bands on a primary basis;

(d) that interferences due to radiations from sources other that radio services, e.g. ISM equipment should also be studied,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the allowable values of performance and availability degradations of analogue and digital radio-relay systems, caused by the aggregate of all emissions from other radio-relay systems, from other radio services both in shared and non-shared environments, including radiations from sources other than radio services;

2. what are the allowable values of performance and availability degradations of analogue and digital radio-relay systems, caused by interference from other radio-relay systems;

3. what are the allowable values of performance and availability degradations of analogue and digital radio-relay systems, caused by the interference from other radio services allocated in the same frequency bands as the fixed service on a primary basis;

4. what are the allowable values of performance and availability degradations of analogue and digital radio-relay systems, caused by the interference from radio services allocated in the same frequency bands as the fixed service on a non-primary basis;

5. what are the allowable values of performance and availability degradations of analogue and digital radio-relay systems, caused by unwanted emissions from other radio services in the non-shared environment;

6. what are the allowable values of performance and availability degradations of analogue and digital radio-relay systems, caused by radiations from sources other than radio services both in the shared and non-shared environments;

7. what are the principles of apportioning these degradations over the length of the radio-relay system;

8. what are the principles of apportioning these degradations to each exposure;

9. what are the acceptable and practical means open to radio-relay systems to effectively limit these degradations?

Note — See Report 1187.

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* Previously Question 28/9.

ANNEX I

GENERAL METHODS FOR DETERMINING FREQUENCY SHARING BETWEEN RADIO-RELAY SYSTEMS AND OTHER SERVICES

The CCIR,

CONSIDERING

a) that there is increasing pressure to use spectrum more efficiently by greater frequency sharing with other services;

b) that when new sharing situations are under study, the technical characteristics of each service need to be understood in order to derive sharing criteria which ensure that performance degradations to radio-relay systems are adequately controlled,

DECIDES that the following studies should be carried out:

1. general methodology to be used for deriving frequency sharing criteria between radio-relay systems and other services;

2. determination of the allowable values of degradation to the performance and availability of radio-relay systems caused by aggregate interference sources from other radio services in shared frequency bands;

3. determination of the principles of apportioning this degradation over the length of a radio-relay system;

4. determination of the principles of apportioning this degradation to each interference source;

5. determination of the characteristics of radio-relay systems which are sensitive to these signals, and the limit values of interference into radio-relay systems which give rise to the allowable degradation in performance and availability.

Note – See Report 1196.

QUESTION 128/9*

MAXIMUM ALLOWABLE DEGRADATION OF RADIO-RELAY SYSTEMS DUE TO ENERGY SPREAD FROM SERVICES IN THE ADJACENT BANDS

(1990)

The CCIR,

CONSIDERING

(a) that limited filtering of modulated signals at the band edges may cause mutual interference even though the frequency stability of both the wanted and interfering signals is well controlled;

(b) that the interference criteria for the coexistence of services within a frequency band may differ from that of services in adjacent bands,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the allowable values of long-term and short-term increases of radio channel noise or error ratio in radio-relay systems caused by the aggregate interference sources in the adjacent band;

2. what are the principles of apportioning this degradation over the length of a radio-relay system;

3. what are the principles of apportioning this degradation to each exposure;

4. what is the RF interference power at the input to the receiver which will generate the allowable amount of channel noise, error ratio, or reduction in availability;

5. what are the acceptable and practical means open to radio-relay systems to effectively limit degradation due to interference from services in adjacent bands?

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* Previously Study Programme 28A/9. This Question should be brought to the attention of Study Group 1.

QUESTION 129/9*

EVALUATION OF INTERFERENCE AMONG LINE-OF-SIGHT RADIO-RELAY SYSTEMS

(1990)

Le CCIR,

CONSIDERING

(a) that interference problems are of primary importance in the planning of radio-relay systems, in order to make efficient use of the radio frequency spectrum;

(b) that the interference effects depend upon the characteristics both of the interfering signals (power level, carrier frequency, modulation system, etc.) and of the disturbed system (antennas, receiving filters, etc.);

(c) that the determination of interference criteria requires the definition of analysis and calculation techniques to relate the characteristics of signals interfering with radio-relay links, with their effects on transmission quality;

(d) that it is highly desirable to standardize the use of parameters suitable to define the interference effects in analogue and digital modulated radio-relay systems,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the interference sources which may affect radio-relay system quality and the system parameters (e.g. antenna diagrams) that are relevant to the determination of the power level of the interfering signals in fading or non-fading conditions of the interfered signal;

2. what parameters are suitable to represent the effects of interference on the transmission quality of analogue and digital modulated radio-relay systems;

3. what analysis and calculation techniques are useful for evaluating the interference effects when the power level of the received signal is at its normal value as well as when it is near the receiver threshold level;

4. what methods are appropriate for calculation and measurement of interference effects on the transmission quality of analogue and digital modulated radio-relay systems, in order to provide the necessary information for system planning and equipment design?

Note – See Reports 779, 780 and 1054.

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* Previously Study Programme 28C/9.

QUESTION 130/9*

POSSIBLE LIMITS FOR REDUCING TRANSMITTER POWER AND REPEATER DISTANCE OF RADIO-RELAY SYSTEMS OPERATING IN THE BAND 1 TO ABOUT 10 GHz

(1990)

The CCIR,

CONSIDERING

(a) that with the present design of terrestrial radio-relay systems operating in the band 1 to about 10 GHz, the distances between stations amounts to 30 to 70 km and more;

(b) that with such distances between stations, the signal fading depth can be great and a considerable effective radiated power is required to offset drops in signal level due to fading with a view to ensuring the required operating stability of the circuit and channel performance;

(c) that this radiated power creates an unfavourable interference environment for other radio systems operating in shared frequency bands;

(d) that one solution is to reduce the transmitter power, the energy consumption, and the interference potential, by shortening the repeater distance;

(e) that a shortening of the repeater distances in radio-relay circuits reduces the fading depth and required antenna mast heights;

(f) that due to a lower fading depth, it is possible to reduce the transmitter power provided that the long-term performance objectives are met;

(g) that a lower effective radiated transmitter power reduces the primary energy consumption to such an extent that this requirement can be met by simple independent power sources;

(h) that lower transmitter power in radio-relay stations considerably reduces the interference caused to satellite and earth-station receivers, and also mitigates mutual interference between terrestrial radio-relay circuits,

UNANIMOUSLY DECIDES that the following question should be studied:

what are the appropriate limits for the reduction of the effective radiated power of transmitters of radio-relay circuits operating in the range 1 to about 10 GHz (combined with reduced repeater distances), taking account of all technical and economic factors; improved electromagnetic compatibility conditions, the scientific and technical prospects for improving the technological possibilities for the development of radio-relay equipment and also improved means of transmission of various types of information on radio-relay circuits?

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* Previously Question 29/9. This Question should be brought to the attention of Study Groups 1 and 5.

QUESTION 131/9*

CRITERIA FOR FREQUENCY SHARING BETWEEN THE FIXED AND BROADCASTING SERVICES

(1990)

The CCIR,

CONSIDERING

(a) that systems in the fixed service are now widely employed throughout the world and make extensive use of the radio-frequency spectrum;

(b) that the use of such systems is expected to continue to expand and that new systems are expected to operate with improved performance and make more efficient use of the radio-frequency spectrum;

(c) that the use of systems of the broadcasting service in shared frequency bands is expected to continue to expand;

(d) that the continued development of fixed and other services is desirable;

(e) that control of mutual interference between stations of the various services is necessary;

(f) that Resolution 510 of the World Administrative Radio Conference, 1979 (WARC-79) requests the CCIR to study the determination of protection criteria between stations in the sound broadcasting service and stations in the fixed and mobile (except aeronautical mobile (R)) services, especially in the band 87.5 to 108 MHz for Region 1 and certain countries concerned in Region 3,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what levels of interference are acceptable and under what conditions do they apply to fixed service systems in order to facilitate sharing with systems in the broadcasting service;

2. what sharing criteria are appropriate for fixed service systems to facilitate the operation with the broadcasting service in a shared environment?

Note – See Report 1194.

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* This Question, which merges Question 30/9 and Study Programme 30B/9, should be brought to the attention of Study Groups 10 and 11.

QUESTION 132/9*

THE USE OF FREQUENCIES IN THE BAND 0.5 TO 3 GHz FOR RADIO-RELAY SYSTEMS

(1990)

The CCIR,

CONSIDERING

(a) that radio-relay systems are widely employed throughout the world and make extensive and increasing use of much of the spectrum below 3 GHz;

(b) that the propagation characteristics in this band permit the design of economical radio-relay systems;

(c) that Recommendation No. 205 of WARC MOB-87 has recommended that the next competent WARC should consider designating a suitable band or bands for international use by mobile services,

UNANIMOUSLY DECIDES that the following question should be studied:

what are the technical and operational advantages to the fixed service of spectrum in the range 0.5 to 3 GHz?

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* Previously Study Programme 30A/9. This Question should be brought to the attention of Study Group 8.

QUESTION 133/9*

SHARING CRITERIA BETWEEN THE FIXED AND MOBILE SERVICES IN THE FREQUENCY BANDS BETWEEN ABOUT 0.5 AND 3 GHz

(1990)

The CCIR,

CONSIDERING

(a) that due to the growing demand on the radio frequency spectrum, there is a need to improve frequency sharing between different services;

(b) that there is a particularly strong need for mobile and fixed services to share frequencies between about 0.5 and 3 GHz;

(c) that the use of mobile services is mainly centred in and around urban areas;

(d) that with appropriate sharing criteria, the fixed service can use spectrum required in urban areas for mobile purposes;

(e) that criteria for fixed/mobile sharing have not been determined;

(f) that the necessary technical characteristics relevant to sharing are not known;

(g) that there is a need to develop sharing criteria on a world-wide basis, considering the special requirements for all regions,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the types of situations which would be favourable to sharing between fixed and mobile services;

2. what are the principles which need to be developed to allow sharing criteria to be determined;

3. what are the relevant sharing criteria for fixed and mobile services;

4. what are the types of coordination mechanisms which might be appropriate between the two services;

5. what are the areas which require further study?

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* Previously Study Programme 30C/9. This Question should be brought to the attention of Study Groups 1 and 8.

QUESTION 134-1/9

HYPOTHETICAL REFERENCE DIGITAL PATHS AND PERFORMANCE OBJECTIVES FOR DIGITAL RADIO-RELAY SYSTEMS

(1990-1992)

The CCIR,

considering

a) that digital radio-relay systems of low, medium and high capacity are being designed;

b) that it is desirable for planning purposes to specify hypothetical reference digital paths (HRDP);

c) that there is a need to specify the performance objectives for these reference paths;

d) that acceptable levels of interference into digital radio-relay systems operating in shared bands need to be determined;

e) that digital radio-relay systems are used without restriction in the high, medium and local grade portions of the hypothetical reference digital connection, and that criteria need to be established to ensure that the overall severely errored second allowance for adverse propagation within the HRX (see CCITT Recommendation G.821) is not exceeded;

f) that the CCITT is considering a draft Recommendation entitled G.826 to identify performance objectives for end-to-end connections at or above the primary rate within PDH (plesiochronous digital hierarchy) and SDH (synchronous digital hierarchy) telecommunication networks,

decides that the following Question should be studied

1. What are suitable hypothetical reference digital paths and what are the characteristic elements of such paths?

2. What performance objectives are suitable for digital radio-relay systems operating in the local, medium and high grade portions of an ISDN?

3. What are suitable periods of time for the expression of these performance objectives?

4. How should the performance objectives be divided amongst the characteristic elements of the HRDP for various periods of time?

5. What is the mathematical basis for summing the severely errored second contributions due to adverse propagation from geographically diverse radio-relay systems, and satellite systems, so as to derive the overall performance of the HRX in any month?

6. What, if any, impact will there be on CCIR radio-relay system standards from the introduction of CCITT draft Recommendation G.826?

Note 1 - See Recommendations 556, 594, 634, 696 and 697.

QUESTION 135/9*

CHARACTERISTICS OF DIGITAL RADIO-RELAY SYSTEMS BELOW ABOUT 17 GHz

(1990)

The CCIR,

CONSIDERING

(a) that the CCITT is carrying out digital transmission studies taking into account all types of transmission media;

(b) that specific problems of radio-relay digital transmission in plesiochronous and synchronous modes need to be studied in order to satisfy performance objectives and achieve efficient spectrum utilization;

(c) that digital radio-relay system characteristics are determined by the gross bit rate, modulation method, spectrum shaping, interference susceptibility and other relevant factors;

(d) that adaptive techniques offer effective counter-measures to adverse propagation conditions and, for example, by the use of dynamic transmitter output power control, a means of reducing interference;

(e) that in certain applications multi-state modulation is an effective method for increasing spectrum utilization efficiency;

(f) that technological studies for establishing multi-state modulation are being pursued;

(g) that suitable counter-measures against the consequences of multipath fading for multi-state modulation are required;

(h) that coexistence of multi-state modulation systems with other radio systems is required,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the preferred characteristics of radio-relay systems for plesiochronous and synchronous digital transmission operating in frequency bands below about 17 GHz;

2. with regard to multi-state modulation;

2.1 what is the effect of multi-state modulation on spectrum utilization;

2.2 what is the relationship between multi-state modulation, modulation rate and required outage probability;

2.3 what is the performance of different signal processing techniques in the presence of interference and linear and/or non-linear inter-symbol interference;

2.4 what is the performance of multi-state modulation during multipath fading;

2.5 what is the relationship between multi-state modulation and repeater spacing in digital radio-relay systems?

Note – See Report 378.

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* This Question merges Question 34/9 and Study Programme 34A/9.

QUESTION 136/9*

RADIO-FREQUENCY CHANNEL ARRANGEMENTS FOR DIGITAL RADIO-RELAY SYSTEMS BELOW ABOUT 17 GHz

(1990)

The CCIR,

CONSIDERING

(a) that digital radio-relay systems are already in service and that systems of this type will be used more extensively in the future;

(b) that as far as applicable digital radio-relay systems should be compatible with the Network Node Interface (NNI) recommended by the CCITT for synchronous digital hierarchy;

(c) that existing Recommendations for frequency channel arrangements are used by various administrations for analogue radio-relay systems and attention should be paid to coexistence with such systems;

(d) that these existing frequency channel arrangements may not be appropriate for the optimum design of digital radio-relay systems;

(e) that frequency channel arrangements are required in frequency bands, where the use of digital radio-relay systems is foreseen;

(f) that the efficient use of the spectrum should be studied;

(g) that some administrations may wish to establish digital systems utilizing their existing radio-relay stations;

(h) that additional information is needed to establish those characteristics of digital systems which are relevant to the optimization of frequency channel arrangements;

(j) that interference, both between and within digital radio-relay systems, could be minimized by the coordination of radio-frequency channel arrangements over a large geographical area;

(k) that interference between digital and analogue radio-relay systems could be minimized by the coordination of radio-frequency channel arrangements over a large geographical area,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the preferred radio-frequency channel arrangements for digital radio-relay systems below about 17 GHz;

2. what guidelines should be established governing the contents of Recommendations and Reports as regards radio-frequency channel arrangements;

3. whith regard to channel spacings for digital radio-relay systems below about 17 GHz;

3.1 what is the preferred channel spacing on the basis of the type of modulation and the permissible amount of interference;

3.2 how can cross-polarization be used to enhance the use of the frequency spectrum;

3.3 what are other features of the system that will affect the channel spacing;

3.4 what is the influence of the choice of channelling arrangements on the overall capacity of a practical radio network?

Note 1 – Radio-frequency channel arrangements for radio-relay systems operating in bands 8 and 9 for the provision of telephone trunk connections in rural areas are studied under Question 104/9.

Note 2 – See Recommendations 382, 383, 384, 387, 595, 635, 636 and 637 and Reports 607, 779, 782, 934, 936 and 1055.

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* This Question merges Question 35/9 and Study Programme 35A/9.

QUESTION 137/9*

INTERCONNECTION AT BASEBAND AND INTERMEDIATE FREQUENCIES FOR DIGITAL RADIO-RELAY SYSTEMS

(1990)

The CCIR,

CONSIDERING

(a) that the characteristics at the interface of digital sections will be determined by CCITT Study Group XVIII;

(b) that *TT'* may also be used for interconnection of digital radio-relay systems instead of *RR'* shown in Fig. 1 of Report 938;

(c) that there may be a need to interconnect at baseband frequencies within digital radio-relay systems, e.g., between transmitters, receivers, protection switching equipment, test equipment, etc. (points *ZZ'* and *YY'* shown in Fig. 1 of Report 938);

(d) that baseband interconnection should preferably be made only at digital rates corresponding to levels in a digital hierarchy or at simple multiples of such rates;

(e) that the format of the signal may influence the radiated spectrum;

(f) that radio systems should not use a signal format with a redundant level, since this is wasteful of radio spectrum, and therefore output line codes, such as those specified by CCITT Study Group XVIII, are inappropriate for use with digital radio-relay systems;

(g) that the format of the signal at a point of interconnection must be such as to ensure the recovery of a timing signal, including the case where the clock signal may be provided separately from the information signal;

(h) that the response to jitter is a fundamental characteristic of a digital transmission system and that it must be compatible with any jitter present on the input signal within limits to be specified;

(j) that the permissible jitter on a signal fed into a digital multiplexer at point *TT'* is limited by the characteristics of the digital multiplexer, as may be determined by CCITT Study Group XVIII;

(k) that, in general, it is unlikely that a radio-relay system will be able to exploit the format of the signal at the source (multiplexers and codecs) in order to satisfy the needs of timing recovery, spectrum control and error-ratio measurement;

(l) that intermediate frequency interconnection may offer technical advantages;

(m) that synchronous digital hierarchy signals at, for example, STM-1 level, conforming to standards developed by the CCITT, will be carried on digital radio-relay systems and interconnected within and between such systems at baseband frequencies,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the preferred characteristics including jitter at the interconnection point between digital radio-relay system for each interconnecting system capacity;

2. what are the characteristics including jitter at interconnection points *YY'* and *ZZ'* (see Fig. 1 of Report 938) for each system capacity;

3. what are the features of the signal necessary for timing-signal recovery, spectrum economy and error-ratio measurement;

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* Previously Question 36/9.

4. is it desirable to scramble all digital inputs to a radio-relay system and, if so, what are the preferred characteristics of the scrambler;

5. is it necessary to add redundancy to the signal and, if so, what is the form of such redundancy;

6. how the removal or propagation of code format violations at the point of interconnection should be treated;

7. what other features of the signal format are necessary to ensure satisfactory operation of a digital radio-relay system when such a system forms part of a telecommunications network;

8. what are the desirable characteristics of intermediate frequencies for digital radio-relay systems;

9. what are the features of the synchronous digital hierarchy signal developed by the CCITT which must be taken into account to ensure satisfactory interconnection at baseband frequencies of synchronous digital radio-relay systems, and how should relevant overheads be treated at points of interconnection?

Note – See Report 788.

QUESTION 138/9*

PREFERRED METHODS AND CHARACTERISTICS FOR THE SUPERVISION AND PROTECTION OF DIGITAL RADIO-RELAY SYSTEMS

(1990)

The CCIR

CONSIDERING

(a) that supervision of digital radio-relay systems is necessary;

(b) that stand-by switching arrangements to increase the availability of digital radio-relay systems and to facilitate maintenance are under study;

(c) that supervision and protection techniques may extend across international borders;

(d) that the principles of supervision for digital radio-relay systems should take account of overall maintenance considerations for digital networks;

(e) that overall performance and availability are affected by the methods used for supervision and protection,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the preferred supervisory principles for digital radio-relay systems;

2. what are the preferred arrangements, characteristics and applications of stand-by switching at baseband and intermediate frequencies;

3. what is the effectiveness of special protection techniques for specific applications;

4. what is the effect of protection principles on overall performance and on availability of digital systems;

5. is it desirable to include a service channel in the transmitted bit stream and, if so, what is the preferred form of such a service channel?

Note – See Report 787.

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* Previously Question 37/9.

QUESTION 139-1/9

MEASUREMENT OF DIGITAL RADIO-RELAY SYSTEMS

(1990-1992)

The CCIR,

considering

a) that the development of digital radio-relay systems and techniques will be enhanced by the use of standard test procedures;

b) that the installation, operation and maintenance procedures for radio-relay systems will be simplified by the use of standard test procedures;

c) that the performance of actual radio-relay links has to be measured initially before being brought into service and at subsequent intervals for maintenance purposes;

d) that the International Electrotechnical Commission (IEC) is studying methods and conditions of measurement for simulated systems;

e) that Opinion 50 proposes coordination between the work of the IEC and the CCIR,

decides that the following Question should be studied

1. What are the measurement techniques that would lead to a better characterization of in-service and out-of-service equipment and system performance?

2. What are the channel models that are best suited for evaluating equipment performance?

3. What are the applications of measured equipment parameters to system performance?

4. What are the preferred test procedures for bringing into service and maintenance of digital radio-relay systems and links?

5. What methods and/or algorithms are appropriate for measurements on an in-service basis using PDH (plesiochronous digital hierarchy) and SDH (synchronous digital hierarchy) fabrics, in order to verify the digital radio-relay error performance objectives?

QUESTION 140/9*

APPLICATION OF CELLULAR TYPE MOBILE RADIOCOMMUNICATION SYSTEMS FOR USE AS FIXED SYSTEMS

(1990)

The CCIR,

CONSIDERING

(a) the Questions submitted by the Plan Committee for Latin America at its meeting in Paramaribo, December, 1985, in accordance with provision No. 93 of the International Telecommunication Convention (Nairobi, 1982);

(b) the Questions submitted by the Plan Committee for Asia and Oceania at its meeting in Bali, October, 1986;

(c) that it is technically feasible and in some cases may be desirable to apply cellular type mobile radiocommunication systems for use as fixed systems;

(d) that basic system requirements (e.g., performance objectives and frequency bands) for such application should be developed by Study Group 9 which is responsible for the fixed service;

(e) that for efficiency of the study of the various technical characteristics necessary for meeting the above basic system requirements should be preferably developed by Study Group 8;

(f) that a close collaboration should be established between Study Groups 8 and 9 on this matter,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the basic system requirements such as performance objectives and frequency bands for the application of cellular type mobile radiocommunication systems for use as fixed systems;

2. taking into account Questions 105/9 and 124/9, how should mobile cellular radiocommunication systems used in fixed services be compared with optimized fixed systems offering similar services?

Note 1 – The results of the studies should be communicated to Study Group 8 by Study Group 9.

Note 2 – Study Group 8 is expected to communicate its finding on the relevant studies to Study Group 9.

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* Previously Question 38/9. This Question should be brought to the attention of Study Group 8 and the CCITT.

QUESTION 141/9*

TECHNICAL CRITERIA TO BE USED IN THE BOARD'S EXAMINATIONS OF THE PROBABILITY OF HARMFUL INTERFERENCE REQUIRED BY PROVISIONS Nos. 1354, 1506 AND 1509 OF THE RADIO REGULATIONS

(1990)

The International Frequency Registration Board (IFRB),

CONSIDERING

(a) the provisions of No. 326 of the International Telecommunication Convention, Nairobi, 1982;

(b) that the Radio Regulations, in Articles 12 and 13, request the IFRB to carry out examinations, *inter alia*, of the probability of harmful interference between terrestrial stations and earth stations (Nos. 1354 and 1509) as well as examinations of the probability of harmful interference between stations of geostationary satellite networks (No. 1506);

(c) that it is necessary for the Board, when developing its Technical Standards, to have the required information through appropriate Recommendations of the CCIR (see Nos. 1001, 1454 and 1582 of the Radio Regulations);

(d) that the Radio Regulations distinguish the harmful interference (No. 163) from the permissible interference (No. 161);

(e) that in Question 45/1 the CCIR decided to study the terms "acceptable interference" and "harmful interference" as well as the problems related to the maximum permissible values of interference and the associated time percentages in a general way, applicable to all radiocommunication services;

(f) that the present CCIR Recommendations and Reports contain criteria for different sharing situations between terrestrial and space services, but there exists no CCIR Recommendation or Report establishing the limits of harmful interference which the Board could consider when developing its Technical Standards to be used for the above mentioned examinations of the probability of harmful interference,

REQUESTS THE CCIR to study the following question:

what criteria for levels of harmful interference are to be recommended to the IFRB for use in its examinations of the probability of harmful interference, in particular in examinations foreseen by provisions Nos. 1354, 1506 and 1509 of the Radio Regulations, and under what conditions and for what associated percentage of time do they apply?

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* Elements of this Question concerning criteria for levels of harmful interference are studied separately by Study Group 4 and Study Group 9 (see Question 39/4). The elements concerning under what conditions and for what associated percentage of time they apply are studied jointly by Working Party 4-9S.

QUESTION 142/9*

RADIO LOCAL AREA NETWORKS (RLANs)

(1990)

The CCIR,

CONSIDERING

(a) that there is a need to provide effective communication for mobile, moveable and fixed computer based equipment within the workplace;

(b) that there is a high level of interest in radio local area networks (RLANs), as demonstrated by existing products and intense research activities;

(c) there is a need for more practical experience on the performance of RLANs;

(d) that it is desirable to establish RLAN standards which are compatible with wireless or wired telecommunication systems;

(e) that standardization of RLAN system architecture and technical features may lead to economic design;

(f) that there may be a need to allocate frequency spectrum and/or establish operating guidelines to allow the orderly development of RLANs,

UNANIMOUSLY DECIDES that the following question should be studied:

1. how can RLANs be designed to minimize the amount of planning required for their installation and operation;

2. what system architectures are best suited to RLANs;

3. what data rates are required for RLANs;

4. what performance objectives are suitable for RLANs;

5. how can RLANs develop and migrate to become an integral part of a personal communications network;

6. what media access control techniques are best suited for RLANs to allow multiple system operation and mobility;

7. which frequency bands are suitable for RLANs operation;

8. what level of intelligence and adaptability is to be expected from the RLAN units in order to maximize efficient spectrum usage and minimize interference potential;

9. can low power RLAN systems share frequencies already allocated to and being used by other services at the same location;

10. can the low-power requirement be combined with modulation techniques to allow RLANs to share frequencies already being used by other services at the same location;

11. what appropriate modulation, spread spectrum or other techniques and error detection or correction techniques are best suited to RLANs;

12. what type of antenna distribution systems provide reliable local area coverage while minimizing wide area emissions;

13. what is the level of interference tolerated by the RLANs and what is the level of interference caused by RLANs to other spectrum users, in particular within frequency bands that are allocated to and in use by others?

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* This Question should be brought to the attention of Study Group 8.

QUESTION 143/9*

SIGNAL-TO-NOISE RATIOS AND PROTECTION RATIOS; BANDWIDTH, ADJACENT CHANNEL SPACING AND FREQUENCY STABILITY

(1990)

The CCIR,

CONSIDERING

(a) that the conditions for satisfactory performance of a system must take account of the need to receive signals propagated via the ionosphere, which are subject to fading and multipath effects and are accompanied by radio noise and interference;

(b) that studies requiring signal-to-noise ratios and protection ratios are closely related and that determination of necessary adjacent channel spacings requires, in addition, consideration of frequency stability and bandwidth of the systems;

(c) that there are a number of different techniques and systems in use in the radiotelegraph and radiotelephone services and, while it is essential to consider the most advanced state of the radio art, it is also necessary to give special study to conventional systems, either affecting integration of landline and radio services, or of concern to the IFRB;

(d) that the WARC-79, in its Recommendation No. 64, invites the CCIR to continue to study the protection ratios, the signal-to-noise ratios and the fading allowances and, in its Recommendation No. 60, urges the CCIR to expedite all phases of the programme of studies which will assist the IFRB in the further refinement of its Technical Standards,

UNANIMOUSLY DECIDES that the following question should be studied:

1. Classes of emission

The studies concern the following classes of emission in regular use in the fixed service but should also give due regard to new techniques and systems, including those under development, for application to the fixed service:

1.1 *Radiotelephony*

Classes of emission: A3E, R3E, B8E, J3E, H3E, F3E (above 30 MHz only, with reference to ionospheric-scatter applications).

1.2 *Radiotelegraphy*

1.2.1 Classes of emission: A1B, A2B, A7B, F1B, F7B.

1.2.2 Modulation rates:

- A1B, A2B, machine telegraphy: 50 and 120 bauds;
- A7B multi-channel VF telegraphy: 50 to 200 bauds per channel;
- F1B: 50 to 600 bauds.

1.2.3 Codes:

- 5-unit start-stop;
- synchronous error-detecting and correcting systems using two-condition signalling codes other than the International Telegraph Alphabet No. 2;
- other systems.

1.3 *Facsimile, phototelegraphy*

Classes of emission: R3C, F3C.

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* Previously Study Programme 1A/3.

2. what are the minimum conditions required for satisfactory service, with regard to:

2.1 *Acceptable criteria and values for:*

2.1.1 intelligibility over radiotelephone circuits, for the various grades:
- just usable, operator-to-operator (order wire),
- marginally commercial,
- good commercial;

2.1.2 the quality of radiotelegraph circuits (telegraph distortion; character error rate; efficiency factor for ARQ circuits);

2.1.3 legibility of copy over facsimile (phototelegraphy) circuits;
- the maximum duration and percentage of the time during which performance inferior to the standard values can be tolerated.

2.2 *Performance of the system as a function of:*

2.2.1 signal-to-noise ratios and co-channel protection ratios;

2.2.2 required signal-to-noise ratios and co-channel protection ratios for the acceptable standard values of intelligibility, error rate (efficiency factor on ARQ circuits), or legibility for the various services * and of the frequency of operation; considering:

2.2.2.1 signal fading, taking account not only of the amplitude distribution, but also of the autocorrelation function and the distribution of duration of the fades;

2.2.2.2 diversity (space, frequency or time) techniques: noise reducers, coding including the use of error-correcting codes or ARQ, use of more than two signalling conditions and optimum modulation and detection techniques;

Note – It would be useful to compare the systems using the various telegraph codes, including those of § 1.2.3, in terms of undetected or uncorrected error rate for a given power and signalling speed, in words per minute, and operating under the same conditions. A 5-unit start-stop system may be used as the reference system by regarding each mutilated character as an error only. It is provisionally suggested that the ratio of error rates should be expressed for two-circuit conditions only; namely, when the system under test is subjected to an average of one undetected or uncorrected error per 1000 characters, and per 10 000 characters.

2.2.2.3 multipath effects;

2.2.2.4 interference effects of the predominant sources of radio noise such as atmospheric, or man-made noise:
- as described by the waveform and amplitude distribution of the instantaneous values of the noise;
- the effects as actually received, taking account of the method of detection, and of filtering prior to and following detection;

2.2.2.5 interference effects of co-channel signals representing the various classes of emission, taking account of the spectral and statistical (fading) characteristics of the interfering signal;

2.2.2.6 monthly mean signal-to-noise ratios and co-channel protection ratios, required for circuits of various lengths and directions, to meet the acceptable standard values of circuit performance (§ 2.1) during the specified percentage of the time, taking into account:
- the distribution within an hour of the mean values of the short-term (fading) distributions of signals and noise;
- the distribution, within a month or season, for a given hour of the hourly mean values of the signal strengths and atmospheric noise levels (Report 322, published separately);

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* For radiotelephone services, the signal-to-noise ratio required in the audio band must be specified, and from this the signal-to-noise ratio required in the radio-frequency band is established.

2.2.2.7 the total fading allowance derived from the day-to-day intensity fluctuations of signals and noise and short-term fading of signals.

Note – The monthly mean values of atmospheric noise for various time blocks, and information on the distribution of values within the month, is given in Report 322; with regard to monthly mean values of signal strength, and distribution of hourly values within the month, Report 252-2 + supplement (published separately) gives a method for computation.

This study is intended to lead to revisions or replacement of Recommendations 240-2 (Kyoto, 1978) and 339-3 (Geneva, 1974).

2.3 Minimum bandwidth required for satisfactory transmission and reception of the intelligence in a complete system.

2.4 Overall frequency stability of a complete system, and the parts of a system, required for satisfactory transmission and reception of information, with particular reference to the performance criteria of frequency synthesizers.

3. what are the adjacent channel protection ratios, and frequency separations required between various classes of emission, considering:

3.1 the use of effective receiving band-pass filters no wider than necessary for satisfactory reception (see § 2.3 above, and Recommendations 237 (New Delhi, 1970), 330 (Geneva, 1963) and 331);

3.2 the dynamic range of the receiver input circuits;

3.3 the bandwidth occupied by the interfering signal;

3.4 the spectral distribution of the interfering signal in relation to the receiver bandwidth;

3.5 the frequency tolerance and stability of the wanted and unwanted signals;

3.6 the studies of § 2.2 above relating to co-channel protection ratios.

Note 1 – The result of this study should be presented in the form indicated in the Table annexed to Recommendation 240.

Note 2 – See Reports 183, 195, 197, 200, 203, 436, 550, 704, 989, 990 and 991 and Recommendations 240, 338, 339, 343, 344, 345, 349 and 612 and Decision 45.

QUESTION 144/9*

EFFICIENCY FACTOR AND TELEGRAPH DISTORTION ON ARQ CIRCUITS

(1990)

The CCIR,

CONSIDERING

(a) that the efficiency factor as defined in the "List of Definitions of Essential Telecommunication Terms" (Part I, 1961, No. 33.23; see also Recommendation 345) is very useful for defining and determining the quality of a communication circuit using error correction by automatic repetition;

(b) that the value of the efficiency factor of an ARQ circuit depends on the telegraph distortion in both directions of the radio circuit;

(c) that a continuous measurement of the efficiency factor is required by the CCITT for radiotelegraph circuits incorporating ARQ equipment, and operating in the fully automatic telex network (see Recommendation U.23, CCITT, Fascicle VII.1),

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the preferred methods for measuring the efficiency factor used to analyse and predict the performance of systems with error correction by automatic repetition, especially at the commencement and finish of the operating period using one frequency;

2. how the efficiency factor depends on the telegraph distortion measured at the incoming end (receiver) of the ARQ terminals at either end.

Note 1 – Measurements should preferably be carried out in successive periods of 20 seconds for detailed analysis and over a number of such periods for long-period evaluation.

Note 2 – Attention is especially drawn to § 9 of Recommendation U.23 of the CCITT with regard to the monitoring of ARQ circuits, which reads:

"9. *Precautions to be taken before incorporating circuits with ARQ equipment in automatic switching networks*

In spite of these precautions, fully-automatic operation on a radiotelegraph circuit incorporating ARQ equipment can be considered only if this circuit possesses adequate stability.

Before incorporating a circuit with ARQ equipment in the fully-automatic switching network, the administrations must carry out extended trials. These trials should be made under normal traffic conditions, over a minimum period of three consecutive hours chosen from the busy period (or periods), when heavy traffic is foreseen to occur on the route under consideration (allowing for the traffic, whether terminal or transit, that prevails on the route according to the season). The condition that must be fulfilled before a circuit can be accepted for use in the fully-automatic network is that its mean efficiency factor, measured over periods of 20 consecutive seconds each, shall not fall below 80% for more than 10% of the total time involved in the measurements. The measurements must be repeated as often as will be necessary for the administration to have an assessment of the suitability of the circuit.

The attention of administrations is drawn to the fact that, before offering fully-automatic transit working on a radio route incorporating ARQ equipment, the grade of service on the route under consideration must be in accordance with that proposed in Recommendation F.68, [2], i.e. only one call lost in 50.

If these conditions are not complied with, it would be better to retain semi-automatic operation.

Reference

[2] CCITT Recommendation *Establishment of the automatic intercontinental telex network*, Vol. II, Fascicle II.4, Rec. F.68."

Note 3 – See Report 437.

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* Previously Study Programme 1C/3.

QUESTION 145/9*

CHARACTERISTICS REQUIRED FOR SINGLE-SIDEBAND AND INDEPENDENT-SIDEBAND SYSTEMS USED FOR HIGH-SPEED DATA TRANSMISSION OVER HF RADIO CIRCUITS

(1990)

The CCIR,

CONSIDERING

(a) that an increasing demand is noted for high-speed data transmission over HF radio circuits and further increase in such demand may be expected;

(b) that recent developments are leading to systems having greatly improved bandwidth efficiency, i.e. a larger capacity in bits per second per unit bandwidth;

(c) that it is desirable that the effects of the random variations and disturbances in the propagation medium be the ultimate factors governing the performance obtainable with such systems;

(d) that the characteristics of a "3 kHz channel" have largely been derived from the use of such a channel for telephony,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what performance characteristics are required for data transmission by HF radio systems;

2. what is the maximum achievable data rate in the HF radio channel for the desired bit error ratio;

3. how can error-correction coding, time interleaving, in-band frequency diversity and other techniques be used to achieve the desired error probability;

4. what are the possibilities for the use of independent sidebands for data transmission;

5. what improvement in data transmission characteristics can be achieved by using a voice frequency channel bandwidth of 250-3000 Hz or 300-3400 Hz;

6. in evaluating high-speed data transmission systems, what statistical parameters should be used to describe the radio propagation medium and what values should be considered?

Note – See Reports 703, 864 and 995 and Recommendation 456.

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* Previously Question 12/3. This Question should be brought to the attention of Study Group 8.

QUESTION 146/9*

IMPROVEMENTS IN THE PERFORMANCE AND EFFICIENCY OF HF RADIOTELEPHONE CIRCUITS

(1990)

The CCIR,

CONSIDERING

(a) that there is a need to improve the quality of transmission of HF radiotelephone circuits;

(b) that the use of diversity techniques may offer the prospect of such improvements;

(c) that other methods of improvement, for example, the adaptation of compandor principles, might become available;

(d) that the efficiency of HF radiotelephone circuits can be enhanced by converting from manual to semi-automatic operation;

(e) that these techniques might be used either separately or in combination;

(f) that Recommendation No. 65 of WARC-79 invites studies of new and developing techniques which are making practicable improved spectrum sharing and band utilization schemes,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the various methods whereby diversity can be obtained on HF radiotelephone circuits;

2. what other methods including new developments, are available for obtaining such improvements;

3. what devices are most suitable for semi-automatic operation on HF radiotelephone circuits;

4. what improvement in performance and efficiency can be expected with these methods?

Note – See Reports 354, 355, 701 and 862 and Recommendations 335, 336, 455 and 480.

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* Previously Question 13/3.

QUESTION 147/9*

AUTOMATICALLY CONTROLLED RADIO SYSTEMS IN THE HF FIXED SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that successful development of fully automatic transmitting and receiving terminals may offer important improvements in efficiency, reliability and economy of operation in the fixed service;

(b) that certain features of automatic control may require cooperation and exchange of information between transmitters and receivers as, for example, for change of frequency and power,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what features of automatically controlled radio systems in the HF fixed service require cooperation between Administrations;

2. what are the preferred methods of exchanging and utilizing such information?

Note – See Report 551 and Decision 63.

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* Previously Question 14/3.

QUESTION 148/9*

TRANSPORTABLE FIXED SERVICE RADIOCOMMUNICATION EQUIPMENT FOR RELIEF OPERATIONS

(1990)

The CCIR,

CONSIDERING

(a) that rapid and reliable telecommunications are essential for relief operations in the event of natural disasters, epidemics, famines and similar emergencies;

(b) that, through damage or from other causes, the normal telecommunications facilities in disaster areas are often inadequate for relief operations and cannot be restored or supplemented quickly through local resources;

(c) that the WARC-79 has adopted Recommendation No. 1,

UNANIMOUSLY DECIDES that the following question should be studied:

what are the preferred characteristics and frequency bands for transportable fixed service equipment, operating at frequencies below approximately 30 MHz, for the provision of relief telecommunications when:

- the equipment is used in liaison with a transportable earth station;
- only terrestrial relief telecommunication facilities are involved?

Note – See Report 992 and Decision 63.

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* Previously Question 22/3. See also Questions 43/4 and 121/9.

QUESTION 149/9*

REMOTELY CONTROLLED HF RECEIVING AND TRANSMITTING STATIONS

(1990)

The CCIR,

CONSIDERING

(a) that HF receiving stations should be sited in locations practically free of man-made noise;

(b) that there exists a general trend to encourage automation and so to reduce the technical personnel required;

(c) that reduction of the interference level and introduction of automation could result in a better operation of the receiving stations and so could improve the quality and reliability of HF communications;

(d) that several administrations are studying the problems involved in applying remote control to HF receiving and transmitting stations and are encountering certain difficulties,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the problems raised by the remote control of HF receiving and transmitting stations;

2. what are the special characteristics of HF receivers and transmitters designed to be installed in remote-controlled stations;

3. what are the required characteristics of the controlling system, taking into account reliability of control and economy of circuits and equipment?

Note – See Reports 857, 993 and 994.

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* Previously Question 24/3.

QUESTION 150/9*

USE OF DIRECTIONAL ANTENNAS IN THE BANDS 4 TO 27.5 MHz

Limitation of radiation outside the direction necessary for the service

(1990)

THE INTERNATIONAL FREQUENCY REGISTRATION BOARD,

IN VIEW OF

the request of the PANEL OF EXPERTS in Recommendation No. 38 of its Final Report, Geneva, 1963,

CONSIDERING

(a) that there is serious congestion in the frequency bands between 4 and 27.5 MHz;

(b) that there is a need to adopt methods and regulations for the solution of the frequency problems with which administrations are confronted in the use of these bands;

(c) that occupation of the radio-frequency spectrum is represented, not only in time and bandwidth, but also in the spatial distribution of the radiated power;

(d) that this latter distribution can be effectively controlled by the use of directional antennas;

(e) that the intent of Articles 5 and 18 of the Radio Regulations, would seem to justify further explicit requirements for the use of directional antennas in the bands between 4 and 27.5 MHz, as well as for quantitative limitation of the intensity of radiation in directions other than that required for the service,

AND IN VIEW OF

No. 308 of the International Telecommunication Convention, Málaga-Torremolinos, 1973,

UNANIMOUSLY DECIDES to submit the following urgent question to the CCIR:

what are reasonable standards for the directivity of antennas in the various types of radio services, and for various distances, in the bands between 4 and 27.5 MHz, including the width of the main beam and the allowable intensity of radiation (effective radiated power) in directions of azimuth outside the main beam (such standards should reflect due regard for practical considerations of construction and cost)?

Note – See Report 356 and Recommendation 162.

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* Previously Question 29/3.

QUESTION 151/9*

USE OF DIRECTIONAL ANTENNAS IN THE BANDS BELOW 30 MHz IN THE FIXED SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that Question 150/9 was submitted by the IFRB in response to a recommendation of the Panel of Experts in 1963;

(b) that the Question refers mainly to transmitting antennas and also covers all services;

(c) that in the fixed service below 30 MHz directional antennas are useful both for transmission and reception for efficient use of the spectrum;

UNANIMOUSLY DECIDES that the following question should be studied:

what are the methods which can be used for the improvement of the performance standards of transmitting and receiving antennas in the fixed service in frequency bands below 30 MHz?

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* Previously Study Programme 29A/3. This Question should be brought to the attention of Study Groups 6 and 10.

QUESTION 152/9*

FREQUENCY TOLERANCE OF TRANSMITTERS FOR THE FIXED SERVICE AT FREQUENCIES BELOW ABOUT 30 MHz

(1990)

The CCIR,

CONSIDERING

(a) Recommendation No. 69 of WARC-79;

(b) that Appendix 7 to the Radio Regulations specifies the frequency tolerances for transmitters;

(c) that the principal objective of Appendix 7 has been the reduction of frequency space required per channel by means of the tightening of frequency tolerances;

(d) that it will be of considerable assistance to administrations, in the future planning of services and provision of equipment, to know those frequency tolerances which can be considered to be the ultimate useful minimum value for stations when using existing techniques and methods of operation;

(e) that Recommendations from CCIR on the matter of frequency tolerances may be of assistance to future Administrative Radio Conferences,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the desirable frequency tolerances of transmitters with a view to the reduction of the amount of spectrum required for the fixed service below 30 MHz;

2. where is it not necessary to make these tolerances more stringent under currently known conditions of operation, whether or not in certain cases it is possible to predict ultimate values of tolerances, and to recommend what these tolerance values might be;

3. which, if any, of the tolerances specified in Appendix 7 have already attained these ultimate values?

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* Previously Question 30/3.

QUESTION 153/9*

PROTECTION OF RADIO STATIONS AGAINST LIGHTNING AND OTHER ELECTROMAGNETIC DISTURBANCES

(1990)

The CCIR,

CONSIDERING

(a) that the WARC-79, in Resolution No. 64, invited the CCIR, in consultation with the CCITT, to provide Recommendations related to the protection of telecommunications equipment from lightning discharges;

(b) that there are areas in the world where, although protective devices against lightning have been installed, equipments constantly deteriorate, often very seriously, following discharges produced during electrical or violent storms;

(c) that radio transmitting and receiving stations may have large antennas often covering large areas and are therefore particularly susceptible to lightning damages;

(d) that modern radiocommunication systems, especially unattended radio stations requiring high reliability, are becoming increasingly more vulnerable than conventional stations;

(e) that other electromagnetic disturbances, e.g. auroral effects, may also result in deterioration of performances of all equipments,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the mechanisms by which lightning generated fields introduce destructive energy into radiocommunication equipments;

2. what protective techniques and devices are necessary for the efficient and economic use of radiocommunication equipments;

3. what measures are necessary for the protection of equipments against other electromagnetic disturbances such as auroral effects?

Note 1 – The attention of administrations is drawn to the CCITT publication "The protection of telecommunication lines and equipment against lightning discharges", which contains much valuable and relevant information on this subject.

Administrations are also encouraged to keep themselves informed of the ongoing work of CCITT Study Group V relevant to this matter.

Note 2 – The attention of Study Group 1 is directed to the need to also study the levels and other characteristics of the near electric and magnetic fields produced by electromagnetic disturbances other than lightning, such as auroral effects.

Note 3 – See Report 861.

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* Previously Question 31/3.

QUESTION 154/9*

CRITERIA TO BE USED IN DIFFERENTIATING BETWEEN CLASSES OF OPERATION

(1990)

The CCIR,

CONSIDERING

(a) Recommendations Nos. 60 and 64 of the WARC-79;

(b) that the WARC-79 has recognized the need to identify the class of operation of the fixed service assignments as follows (see Resolution No. 9 of the WARC-79):

Symbol A – assignment for regular operational use which is not provided by another satisfactory means of telecommunication,

Symbol B – assignment for use as a stand-by to some other means of telecommunication,

Symbol C – assignment for occasional use on a reserve basis and not requiring internationally recognized protection from harmful interference;

(c) that for the conduct of technical examination of such frequency assignments, the WARC-79 has decided that (see Article 12 of the Radio Regulations):

- the IFRB shall apply protection criteria for class of operation A higher than for class of operation B,
- the IFRB shall disregard the probability of interference to frequency assignments of class of operation C, and
- the different protection criteria to be applied by the IFRB for classes of operation A and B shall be published in the Technical Standards of the IFRB,

UNANIMOUSLY DECIDES that the following question should be studied:

what are the protection ratios and other technical parameters that are required for classes of operation A and B?

Note – See Report 860.

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* Previously Question 33/3.

QUESTION 155/9*

THE PERFORMANCE OVER REAL GROUND OF ANTENNAS OPERATING AT FREQUENCIES BELOW ABOUT 30 MHz IN THE FIXED SERVICE

(1990)

The CCIR,

CONSIDERING

(a) that in some countries flat ground is scarce;

(b) that considerations other than technical can determine the choice of antenna site;

(c) that antenna directivity is an important factor in controlling interference between systems;

(d) that gain and efficiency are important antenna parameters affecting both the capital and operational costs of providing a given service;

(e) that existing CCIR data deals primarily with horizontally polarized antennas,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the radiation patterns of various commonly used antennas over real ground (as compared to perfectly conducting ground);

2. what are the effects of ground slope and irregularities on antennas patterns and performance;

3. what type of antennas are most suited to operation in restricted areas which may have rough and/or sloping ground;

4. what effect do the mechanical parameters of the antenna have on its pattern and performance?

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* This Question should be brought to the attention of Study Groups 6, 8 and 10.

QUESTION 156/9*

NON-IONIZING RADIATION HAZARDS DUE TO TRANSMITTING SYSTEMS OPERATING AT FREQUENCIES BELOW ABOUT 30 MHz

(1990)

The CCIR,

CONSIDERING

(a) that radio frequency energy is known to have harmful effects on the human body when absorbed in a certain quantity;

(b) that radio frequency energy may induce harmful electric potentials in conducting material;

(c) that radio frequency energy is known to have harmful effects on apparatus (such as radiocommunication apparatus, navigation instruments, cardiac pacemakers, scientific or medical equipment, etc.);

(d) that radio frequency energy may lead to inadvertent ignition of inflammable or explosive material;

(e) that determinations of hazardous radiation levels and electric potentials are being made by competent authorities;

(f) that persons not associated with such systems may be exposed inadvertently to such radiation (including travellers by air) or to such electric potentials;

(g) that persons operating and maintaining radio transmitting systems may be required to work in close proximity to sources of such radiation;

(h) that the subject is partially treated in Reports 543, 671 and 682,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the radio frequency power flux densities and/or electric and magnetic field strengths to be expected from radio transmitting systems operating at frequencies below about 30 GHz;

2. what method should be used for calculating the power flux densities and/or the electric and magnetic field strengths, especially in the near field zone;

3. what methods are suitable for measuring the power flux densities and/or the electric and magnetic field strengths, especially in the near field zone;

4. what design precautions and technical operational procedures at transmitting stations and what precautions within areas in the vicinity of such stations, in which hazardous radio frequency may occur, are necessary to prevent the hazardous exposure of human beings, apparatus and inflammable or explosive materials to radio frequency radiation?

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* This Question should be brought to the attention of Study Groups 1, 8 and 10.

QUESTION 157/9*

RADIO SYSTEMS EMPLOYING METEOR-BURST PROPAGATION

(1990)

The CCIR,

CONSIDERING

(a) that the characteristics of meteor-burst propagation are given in Report 251;

(b) that experiments have already shown the practicability of utilizing frequencies above 30 MHz for transmission by meteor-burst propagation to distances well beyond the horizon;

(c) that systems using this mode of propagation are already in service;

(d) that it is desirable to determine the preferred characteristics of such systems needed to facilitate their international connection;

(e) that the frequency bands which might be used for such systems are already intensively used by other services,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what are the radio-frequency and baseband characteristics of such systems, which it is essential to specify for the transmission of data to enable two systems to be interconnected, and what values should be specified;

2. to what extent are systems employing this mode of propagation liable to interfere with each other and other services operating on the same or neighbouring frequencies;

3. to what extent are these systems susceptible to noise, particularly man made, and what can be done to mitigate such effects;

4. how does the design and use of meteor-burst systems vary with frequency?

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* This Question should be brought to the attention of Study Group 6.

QUESTION 158/9*

PACKET DATA TRANSMISSION PROTOCOLS FOR SYSTEMS OPERATING BELOW ABOUT 30 MHz

(1990)

The CCIR,

CONSIDERING

(a) that there is an increasing demand for the transfer of large amounts of information over HF radio circuits;

(b) that there is a need to provide a virtually error free digital data service over HF radio systems;

(c) that there is a demand for interfacing these systems between the supplier and users of information so as to provide automatic utilization of data;

(d) that the results of a study into packet transmission protocols may enable improvements to be made in the efficiency of the HF radio channel,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what type of packet protocol is best suited for HF radio systems;

2. what method of error detection, correction and packet size should be used;

3. what design precautions and technical operational procedures should be studied;

4. what type of synchronization should be used for bit timing and packet framing;

5. what should be the packet structure for interfacing to existing data packet networks?

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* This Question should be brought to the attention of Study Group 8.

QUESTION 159/9

EFFECTS OF UNWANTED EMISSIONS FROM RADAR SYSTEMS IN THE RADIODETERMINATION SERVICE ON SYSTEMS IN THE FIXED SERVICE

(1991)

The CCIR,

CONSIDERING

(a) that both fixed and mobile radar systems in the radiodetermination service are widely implemented in bands adjacent to or in harmonic relationship with the fixed service;

(b) that digital radio-relay systems in the fixed service are vulnerable to interference from services in different bands having spurious and out-of-band signals (unwanted emissions) such as those emitted by radar systems having high peak envelope power;

(c) that Study Group 1 has been studying the question of what are the appropriate technical criteria for frequency sharing (Question 45/1) including interference from radar systems into analogue radio-relay systems;

(d) that Study Group 8 has been studying the question of efficient use of the radio spectrum by radar systems including interference suppression techniques (Question 35/8);

(e) that Study Group 9 has been studying the question of maximum allowable performance and availability degradations of systems in the fixed service due to various sources of interference including those from non-shared environments (Question 127/9) e.g., radar interference;

(f) that the Questions referred to in *(c)*, *(d)* and *(e)* do not specifically deal with effects of unwanted emissions from radar systems on systems in the fixed service;

(g) that Article 5 of the Radio Regulations specifies the maximum values of spurious emissions from radio transmitters in terms of both relative mean power and absolute mean power but these limits are not always applicable to the radiodetermination service until acceptable methods of measurement exist;

(h) that Article 1 of the Radio Regulations defines the value of emission level beyond the occupied bandwidth, but does not clearly specify the maximum value of out-of-band emission beyond the necessary bandwidth;

(j) that, under the conditions stated in *(g)* and *(h)*, unwanted emissions from radar systems may in some cases cause unacceptable interference to systems in the fixed service;

(k) that studies carried out so far within Study Group 9 have shown that the installation of additional filtering in selected radar transmitters has been effective for suppression of the unwanted emissions;

(l) that it is desirable that as far as possible Recommendations will be established within the study period 1990-1994,

DECIDES that the following question should be studied:

1. what are the operational experiences of interference from radar systems into systems in the fixed service;

2. what means might be used to protect systems in the fixed service from unwanted emissions of radar systems and what operational results might be achieved;

3. what means might be used to control different levels of unwanted emissions from radar systems into systems in the fixed service;

4. what are the appropriate methods and criteria for ensuring compatibility between radar systems and systems in the fixed service?

QUESTION 160/9*

RADIO-RELAY SYSTEMS IN A SYNCHRONOUS DIGITAL NETWORK

(1991)

The CCIR,

CONSIDERING

(a) that the CCITT has defined:

- a synchronous digital hierarchy (SDH) contained in CCITT Recommendations G.707, G.708, G.709;
- the general characteristics and functions of synchronous multiplexing equipment contained in CCITT Recommendations G.781, G.782, G.783;
- the management of SDH equipment and networks contained in CCITT Recommendation G.784;
- the architectures, the performance and management capabilities of transport networks based on the SDH contained in draft CCITT Recommendations G.sna1 and G.sna2;
- the physical parameters of the electrical and optical interfaces of SDH equipment contained respectively in CCITT Recommendations G.703 and G.958;

(b) that digital radio-relay systems (DRRs) will be constituent elements of SDH-based transmission networks;

(c) that DRRs may provide interconnections between plesiochronous and synchronous network elements;

(d) that synchronous DRRs should be compatible with the network node interface (NNI) specified in the CCITT Recommendations;

(e) that synchronous DRRs should be operationally integrated into an SDH based network;

(f) that specific aspects of the synchronous DRRs need to be studied in regard to performance objectives and achieve efficient spectrum utilization;

(g) that synchronous DRRs at bit rates below STM-1 can provide in certain applications necessary savings of radio spectrum and/or reductions of modulation complexity;

(h) that the implications of the synchronization requirements in an SDH network on the DRRs design have to be analyzed;

(j) that the coexistence of synchronous DRRs with the existing radio-relay systems is required in the present radio channelling schemes;

DECIDES that the following question should be studied:

1. what are the architectures, the functions and the functional block diagrams of synchronous DRRs conforming to the concepts and the interfaces of CCITT Recommendations, for their operational integration in an SDH based network;

2. what are the features of DRRs required to allow the use of DRRs for the interconnection between plesiochronous and synchronous network elements;

3. what uses pertaining to the DRRs have to be proposed for the SOH bytes reserved for future standardization and for the SOH bytes reserved for national use;

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* This Question gathers the issues, related to radio-relay systems in a synchronous digital network, formerly included in Questions 135/9, 136/9 and 137/9. The new Question is proposed to supersede and replace the relevant items in the above-mentioned Questions.

4. what are the transmission characteristics of synchronous DRRs needed to meet the performance requirements and achieve efficient spectrum utilization;

5. what are the architectures, functions, functional block diagrams and transmission characteristics of synchronous DRRs able to transport partially filled STM-1 while maintaining the functionalities of the SDH based network;

6. what are the synchronization features of the synchronous DRRs;

7. what are the provisions needed for synchronous DRRs to be compatible with the existing radio systems within the present radio channelling schemes,

FURTHER DECIDES that:

draft Recommendations should be developed on the above-mentioned questions and submitted to the Interim Meeting of Study Group 9 (November, 1991) for approval.

QUESTION 161/9

PERFORMANCE LIMITS FOR BRINGING INTO SERVICE AND MAINTENANCE OF DIGITAL RADIO-RELAY SYSTEMS

(1992)

The CCIR,

considering

a) that digital radio-relay systems for use in the local, medium and high grade portion of an ISDN connection are being designed;

b) that performance objectives for planning of radio-relay systems are specified separately for hypothetical reference digital paths and real digital paths;

c) that there is a need to specify "Bringing into Service" (BIS) performance limits for digital radio-relay systems;

d) that there is a need to specify "Maintenance" performance limits for digital radio-relay systems;

e) that the CCITT has prepared BIS and Maintenance performance limits for digital transmission systems in Recommendations M.2100, M.2110 and M.2120,

decides that the following Question should be studied:

1. What are the principles for allocation of performance limits for "Bringing into Service" and "Maintenance" of digital radio-relay systems?

2. What are suitable performance limits for the "Bringing into Service" (BIS) of digital radio-relay systems?

3. What are suitable performance limits for the "Maintenance" of digital radio-relay systems?

QUESTION 162/9

MAXIMUM ALLOWABLE PERFORMANCE AND AVAILABILITY DEGRADATIONS OF RADIO-RELAY SYSTEMS DUE TO INTERFERENCE FROM OTHER RADIO SERVICES ALLOCATED IN THE SAME FREQUENCY BANDS

(1992)

The CCIR,

considering

a) that there is increasing pressure to use spectrum more efficiently by greater frequency sharing with other services;

b) that when new sharing situations are under study, the technical characteristics of each service need to be understood in order to derive sharing criteria which ensure that performance degradations to radio-relay systems are adequately controlled,

decides that the following Question should be studied

1. What are the allowable values of degradation to the performance and availability of radio-relay systems caused by aggregate interference sources from other radio services in shared frequency bands?

2. What are the principles of apportioning this degradation over the length of a radio-relay system?

3. What are the principles of apportioning this degradation to each interference source?

4. What are the characteristics of radio-relay systems which are sensitive to these signals, and the limit values of interference into radio-relay systems which give rise to the allowable degradation in performance and availability?

QUESTION 163/9*

CRITERIA FOR FREQUENCY SHARING BETWEEN THE FIXED SERVICE AND THE INTER-SATELLITE SERVICE OPERATING IN BANDS ABOVE ABOUT 20 GHz

(1992)

The CCIR,

considering

a) that systems in the terrestrial fixed service are now widely employed throughout the world and make extensive use of the radio-frequency spectrum;

b) that above 20 GHz, the fixed service and the inter-satellite service operate in shared bands;

c) that some allocations to the inter-satellite service are used, *inter alia*, to provide radiocommunication services in data relay satellite networks;

d) that there could be a relatively small number of data relay satellite networks;

e) that there could be forward links in the 23 GHz band from geostationary data relay satellites to low earth orbiting application satellites;

f) that there could be return links in the vicinity of 26 GHz from low earth orbiting application satellites to geostationary data relay satellites;

g) that there could be space-to-space links in the vicinity of 26 GHz between co-orbiting spacecraft in low earth orbit;

h) that control of mutual interference between stations of the two services is necessary,

decides that the following Question should be studied

1. What levels of interference are acceptable to the fixed service, for what percentages of time and under what conditions do they apply, in order to facilitate sharing with data relay satellite networks and space-to-space communication systems in low earth orbit operating in the inter-satellite service?

2. What sharing criteria are appropriate to the fixed service to facilitate sharing with data relay satellite networks and space-to-space communication systems operating in the inter-satellite service?

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* This Question should be brought to the attention of Study Group 7.

QUESTION 164/9

DIGITIZED SPEECH TRANSMISSIONS FOR SYSTEMS OPERATING BELOW ABOUT 30 MHz

(1992)

The CCIR,

considering

a) that voice communications in the HF band generally use 3 kHz channels;

b) that there is an increasing demand for voice security;

c) that voice security can be achieved through the use of digitized speech;

d) that vocoders (voice coders) are the only means to obtain digitized speech at low bit rates,

decides that the following Question should be studied

1. What digital speech signal methods are most suitable for HF radio links:

1.1 orthogonal channels;

1.2 linear prediction;

1.3 multi-impulse excitation;

1.4 sub-band coding;

1.5 other?

2. What are the preferred bit rates for each voice coding technique:

2.1 the quality of the transmission channel;

2.2 the level of interference;

2.3 the level of bit error ratio;

2.4 introduced delay;

2.5 speech intelligibility;

2.6 voice recognition;

2.7 other factors?

3. What are the preferred methods of error detection and correction for use with voice coders over HF links, with regard to:

3.1 overall bit rate;

3.2 speech intelligibility;

3.3 voice recognition;

3.4 introduced delay;

3.5 other factors,

as a function of bit error ratio?

4. What are the preferred characteristics of the modulator and demodulator for use with voice coders over HF links, with regard to:

4.1 bit rate;

4.2 interleaving;

4.3 in-band diversity;

4.4 the quality of the transmission channel;

4.5 introduced delay;

4.6 other factors,

as a function of:

4.7 speech intelligibility;

4.8 voice recognition;

4.9 other factors?