International Footnotes

(These footnotes come from the Radio Regulations, Geneva, 1959, the Final Acts of the Space EARC, Geneva, 1963, the Final Acts of the Maritime Mobile WARC, Geneva, 1967, or the Final Acts of the Space WARC, Geneva, 1971.)

354 In Albania, Bulgaria, Hungary, Poland, Roumania, Czechoslovakia and the U.S.S.R., the bands 1 660-1 690 MHz, 3 165-3 195 MHz, 4 800-4 810 MHz, 5 800-5 815 MHz and 8 680-8 700 MHz are also used for radio astronomy observations.

386 In Albania, Bulgaria, Hungary, Poland, Roumania, Czechoslovakia and the U.S.S.R., the band 5 470-5 650 MHz is also allocated to the aeronautical radionavigation service.

387 Between 5 600-5 650 MHz, ground-based radars used for meteorological purposes are authorized to operate on the basis of equality with stations of the maritime radionavigation service.

388 In the F. R. of Germany, the band 5 650-5 775 MHz is allocated to the amateur service and the band 5 775-5 850 MHz is allocated to the fixed service.

389 In China, India, Indonesia, Japan and Pakistan the band 5 650-5 850 MHz is also allocated to the fixed and mobile services.

389A In Bulgaria, Cuba, Hungary, Poland, Roumania, Czechoslovakia and the U.S.S.R., the space research service is a primary service in the band 5 670-5 725 MHz.

390 In Albania, Bulgaria, Hungary, Poland, Roumania, Czechoslovakia and the U.S.S.R., the band 5 800-5 850 MHz is allocated to the fixed, mobile and fixed-satellite services.

391 The frequency 5 800 MHz is designated for industrial, scientific and medical purposes. Emissions must be confined within the limits of ± 75 MHz of that frequency. Radiocommunication services operating within those limits must accept any harmful interference that may be experienced from the operation of industrial, scientific and medical equipment.

391A Radio astronomy observations are being carried out in the band 5 750-5 770 MHz and 36.458-36.488 GHz in a number of countries under national arrangements. Administrations are urged to take all practicable steps to protect radio astronomy observations in these bands from harmful interference.

3. The aeronautical radionavigation service is also allocated in Soviet Bloc countries (386).

4. In the band 5.6–5.65 GHz, the meteorological aids service is allocated on a co-equal basis with maritime radionavigation (387).

b. 5.65–5.725 GHz:

1. The radiolocation service is allocated on a primary basis worldwide.

2. The amateur service is allocated on a secondary basis worldwide.

3. The fixed and mobile services are also allocated in this band (389).

4. The space research service is allocated in the band 5.67–5.725 GHz, on a primary basis, in some Soviet Bloc countries (389A)

c. 5.725–5.85 GHz:

1. The radiolocation service is allocated on a primary basis worldwide.

2. The fixed-satellite service is allocated on a primary basis in Region 1.

3. The amateur service is allocated on a secondary basis worldwide.

4. The fixed and mobile services are also allocated in this band (388, 389, 390).

5. The frequency 5.8 GHz is designated for ISM purposes worldwide (391).

6. Radio astronomy observations are being carried out in a number of countries (354, 391A) in the bands 5.75–5.77 GHz and 5.8–5.815 GHz.

d. 5.85–5.925 GHz:

1. The radiolocation service is allocated on a primary basis in Region 2 and on a secondary basis in Region 3.

2. The fixed, mobile and fixed-satellite services are allocated on a primary basis in Regions 1 and 3.

3. The amateur service is allocated on a secondary basis in Region 2.

5.2 *Proposed Changes to the Present Allocation.* The 3rd NOI contained discussions proposing the addition of three services and an expansion of ISM equipment within the bands 5.625–5.925 GHz. A summary of these proposed allocations follows:

1. Addition of the Amateur Satellite service on a secondary basis. The frequency limits of allocation would be 5.65–5.67 GHz. This allocation was also proposed in the Table of Allocations.

2. Spectrum for use by the common carrier fixed service in the bands of 5.650–5.925 GHz was requested.

3. The request to obtain spectrum in the 5.625–5.925 GHz bands for use by the commercial fixed satellite service was discussed.

4. Footnote 357A has been proposed in the Table of Allocations to provide for wireless transmission of power. This footnote states:

"The frequencies 2450 MHz and 5800 MHz are designated for the wireless transmission of power. Emissions must be confined within ±50 MHz of the frequencies designated. This electrical energy transfer may be effected from space-to-earth, space-to-space, or point-to-point on the earth."

5.3 *Military Systems Operating in the Band.* The military has several developmental and operational radar systems with equipment capable of operating in the bands 5.6–5.925 GHz. Classified information concerning these systems has been made available to the FCC staff. A brief description of some of the military systems follows:

Air Force. The Air Force systems include the following systems.

The All Weather System (AWS) is an atmospheric environmental program that is a continuing acquisition and procurement program to improve and modernize the air weather service in support of military operations and command and control systems. The system is presently operational in the US.

Electronic warfare simulators are used in all types of aircraft. Bomb directed controls are also employed. This system is presently operational.

A part of the Air Defense Command and Control Network is a system which provides for surveillance, identification, command and control and interception of hostile airborne targets. With the phase-out of this system, a Joint Surveillance System (JSS) between the FAA, air Defense Command and Canada will be implemented to perform the U.S. surveillance and peacetime control missions of detection, identification and interception. The JSS will provide the means for rapid transition of the command, control and surveillance functions.

Navy. Navy systems include the Tarter/Terrier/Talos system. This system is a surface-to-air and surface-to-surface missile system. The primary role of this system is fleet air defense with a secondary role of anti-missile and anti-ship defense. These systems include search, acquisition, tracking, and navigation functions and are currently operational systems.

5.4 *Military Equipment Summary.* Information on military present and planned worldwide spectrum utilization of the 5.625–5.925 GHz bands is summarized in this section.

Air Force. A list of the Communictions-Electronic (C–E) equipment indicates that the Air Force has about 25 types of nomenclatured equipments capable of operating in this band. Approximately 75% of these nomenclatured equipments tune over the entire frequency band (5.60–5.925 GHz). These equipments are principally used as fixed and mobile ground radars and as pilotless carrier transponders or radars. Info[illegible]ation currently available indicates that th[illegible]omenclatured equipment represent t[illegible] equipment quantities in excess of 20[illegible]

Army. Information of A[illegible] equipments indicates about [illegible] nomenclatured equipments [illegible]erating or planned for operatio[illegible]d. Some of these nomenclatur[illegible]s will operate in the band belo[illegible]. The remainder may operate withi[illegible]ntire band (5.625–5.925 GHz). The op[illegible]onal availability extends to 1990 for a majority of the nomenclatured equipments.

The Army has indicated that the loss of the 5825–5925 MHz band for use by radars at military test ranges would severely reduce the capability of those ranges to support the weapons development programs. Such delays of the weapons development programs across the U.S. will have a serious effect upon the Defense Readiness posture.

Navy. The Navy has about 10 types of nomenclatured equipments, representing an equipment quantity of about 600, operating in the 5.625–5.925 GHz band. All of these equipments are shipboard radars and are capable of operating in the 5.625–5.700 GHz frequency range. Some of the radars use frequency agility techniques. Approximately 100 radars are capable of operating above 5.85 GHz. It is projected that equipment quantities will increase by approximately 26% by 1990.

5.5 *Government Usage of Bands Within the U.S.* There are over 600 frequency assignments in the 5.6–5.925 GHz band. Approximately 83% of the total assignments are military (DOD) and of these, about 75% are used as land and mobile radiolocation radars and weather radars. The remaining 25% of the assignments are used as radionavigation, mobile and experimental stations.

The eight Government agencies with frequency assignments in this band and the approximate percentage for each of these agencies are:

Agency:	*Percent of total*
Air Force	55
Army	15
Commerce	11
ERDA	2
Interior	1
Navy	13
NASA	2
NS	>1

A frequency assignment distribution for four sub-bands of the overall band (5.6–5.925) is given in table 5.2. The total for the 4 sub-bands cannot be equated to the total, since approximately 70% of these assignments tune across multiple sub-bands, i.e., in the 5.825–5.925, only 12 assignments are fixed tuned.

Table 5.3 Frequency Assignment Distribution for the 5.6-5.925 GHz Bands

AGENCY	FREQUENCY SUB-BAND, GHz			
	5.6-5.65	5.65-5.725	5.725-5.825	5.825-5.925
AF	184	139	141	83
AR	35	47	56	24
C	74	0	0	0
ERDA	1	10	7	1
I	3	0	0	0
N	42	40	54	32
NS	0	0	0	1
NASA	4	6	5	4
Total	343	242	263	145

A summary of the usage within the U.S. for each Governmental agency follows:

Air Force. The Air Force uses this band principally for radiolocation and meteorological radar functions. The remaining assignments are used for radionavigation, telecommand land and experimental stations.

The radiolocation land stations are located throughout the U.S. and its possessions. Most of these stations are used for various air defense operations and missile testing.

The radiolocation mobile stations are deployed throughout the 50 states and in the Pacific. Primarily, the equipment is used as: aircraft radar transponders, for operational and pre-flight testing missiles, for tracking or reentry vehicles or as command/telemetry transceivers.

Many of the radiolocation stations are capable of operating in all of the sub-bands (5.6–5.925 GHz).

The weather radars are located in the continental U.S. and are used in the Weather Forecasting and Observing System. The weather radars have the capability of tuning from 5.45 to 5.65 GHz.

Army. The Army's principal use of this band is for radiolocation and radionavigation. The remaining assignments are used for experimental purposes. Some of these experimental assignments are used for missile system tests.

Most of the radiolocation land stations are located in Alabama, Arizona, California, New Mexico and Utah. The equipment is used for range safety and precision tracking in support of airborne testing, missile testing and tactical and/or training operations. It should be noted that as a result of operational constraints, the precision tracking radars and associated transponders must operate in the upper portions of the overall band.

The radiolocation mobile equipment is deployed in about six states. The equipments are transponders used during missile and airborne tests.

The radionavigation, surveillance and mobile stations employ airborne transponders for operation of a test range radionavigation system.

Commerce. Commerce uses the 5.6–5.65 GHz frequency sub-band for operation of weather radars (meteorological aids service) and for radiolocation purposes.

The weather radars are located throughout the U.S. and are capable of operating in the sub-band 5.6–5.65 GHz. Currently, there are 71 assignments for Commerce weather radars. These assignments include the future equipments as well as the present. The equipment growth can be approximated by assuming a linear growth of 20% per year between 1975 through 1980. Therefore, the estimate of the number of radars operating by the beginning of 1977 is 28 stations. The radars, the WSR-74C, are used by the National Weather Service as part of the Weather Station Radar network. The overall investment cost by Commerce for this Network is in excess of 24 million dollars.

The three radiolocation stations are located in Colorado and Florida and are used to track weather balloons and obtain convection current information.

Energy Research and Development Administration (ERDA). ERDA uses this band for the radiolocation service. There is one radiolocation land station located in Nevada. This station is a portable tracking radar that is capable of operating between 5.4 to 5.9 GHz. ERDA also uses radiolocation mobile stations which are deployed in California, Hawaii, Johnston Islands, Nevada, New Mexico and Virginia. These stations are air-deployed transceivers that operate in the two sub-bands between 5.625–5.825 GHz.

Interior. Interior has three assignments in the sub-band 5.6–5.65 GHz. Two of the assignments are radiolocation land stations used to gather weather information. One of these stations is portable that may be used anywhere in the U.S., and the second is located in California. The third assignment is a weather radar used for storm detection in Alaska.

Navy. The Navy's principal use of this band is for radiolocation purposes with approximately 30% of the assignments used as weather radars or as experimental stations.

The majority of the radiolocation assignments are radiolocation land stations. These stations are located in California, Florida, Hawaii, Louisiana, Maryland, New Jersey, North Carolina, Pennsylvania, South Carolina, Texas, Virginia, Washington, Puerto Rico and Johnston Islands. Certain radiolocation assignments are used as radiolocation mobile stations. A limited number of assignments are "U.S. and Possessions" assignments with large numbers fields. These assignments represent the shipboard tunable radars operating in this band.

NASA. NASA uses this band for radiolocation land stations, radiolocation mobile stations, and experimental stations.

The radiolocation land stations are located in California, Nevada and Virginia and are probably used for instrumentation and test purposes.

The radiolocation mobile stations are airborne transponders located in Virginia.

Presently, NASA is studying the feasibility of using the 2.45 and 5.8 GHz band (see proposed international footnote 357A) for wireless transmission of power (WTP). The WTP system is in the conceptual stage. Presently, the 2.45 GHz ISM allocation is receiving the most consideration; however, footnote 357A would also provide for operation at 5.8 GHz.

SECTION 6.—EMC CONSIDERATIONS

6.1 *Introduction.* This section considers the EMC of non-Government proposed fixed and fixed satellite services and Government existing and proposed services operating in the bands 3.3–3.7 GHz, 4.4–4.9 GHz and 5.625–5.925 GHz. The non-Government and military have performed previous work in this area; however, there are many potential interactions not addressed in these analyses.

The non-Government Fixed Satellite Advisory Committee has investigated the following interactions.

(a) Shipboard radars and fixed satellite in the bands 3.4–3.7 GHz.

(b) Troposcatter system and fixed satellite in the band 4.4–4.9 GHz.

(c) Radiolocation and fixed satellite.

Additional non-Government analysis of radiolocation was sharing with the fixed satellite service in the 3.4–3.7 GHz bands was submitted to a GWARC Ad Hoc committee in January 1977 (GRC 798–III). It is assumed that GRC–798–III supersedes all applicable analysis previously made by the Fixed Satellite Advisory Committee.

The Navy is also investigating the compatability between the proposed fixed satellite and fixed services and Navy radars operating in the bands 3.3–3.7 GHz and 5.625–5.925 GHz. The Navy study is a Phase I (preliminary) study currently in the review stage. Based upon the initial results of the Phase I report, sharing between the fixed satellite and fixed services and the radiolocation service may not be possible without restrictions. Phase II (more detailed) sharing analyses efforts have been initiated by the Navy.

Previous studies by the non-Government and the Navy have been used wherever possible. In the cases where previous analysis information was not available, preliminary additional Federal Government sharing analyses were made. These cases and the associated frequency bands are:

(a) 3.3–3.7 GHz:

1. Aeronautical radionavigation (ASR's) and fixed satellite.

2. Airborne radars and fixed satellite.

3. Airborne radars and fixed.

(b) 4.4–4.9 GHz.

1. Mobile stations that are air deployed, and fixed satellite.

2. Radio astronomy and fixed satellite.

(c) 5.625–5.925 GHz:

1. Weather radars and fixed satellite.

2. Wireless transmission of power and fixed satellite.

Although the additional Government analyses are preliminary and are not all inclusive, these analyses provide insight that can be used for preliminary evaluation of the compatibility of various services. Due to the development activity in the frequency bands being considered, further analysis; particularly of military equipments may be appropriate.

6.2 *Analysis Parameters.* All of the analysis discussed within this report are based upon achievement of a specific interference to noise power ratio criteria.

Generally, the non-Government analyses relied upon existing CCIR reports to evaluate the compatibility between services. Normally, an overall interference probability criteria of 0.01 percent was used. Coordination distances between ground based systems were based upon C.C.I.R. report 382.2. This report has previously been used to establish coordination area requirements between earth stations and terrestrial radiocommunications services. In addition to determination of coordination distance by use of great circle propagation mechanisms, a rain scatter propagation model is also used. Based upon report 382–2, the propagation model requiring the greatest coordination distance is the mode to be taken into account.

The Phase I Navy and additional Government analyses are based upon a median (50%) probability criteria. The Federal Government analyses may be divided into two categories:

(a) Determination of a coordination distance between ground and/or air deployed systems.

(b) Whether or not a given INR criteria is exceeded for cases involving satellite interactions.

The coordination distance developed by the Federal Government analyses where based upon an automated smooth earth propagation model. This model provides the long-term median value of propagation loss and includes the combined effects of diffraction and troposcatter. This model does not determine the coordination distance associated with rain scatter or other low probability phenomenon, which may exceed the distanuce calculated by the smooth earth model.

Development of Coordination Distances. The median value of propagation loss was calculated in accordance with the following equation:

$$L=P_T+G_T+G_R-KTB-INR+DC-BW \qquad (6.1)$$

where

P_T=peak output power in dBw.

G_T=Transmitter antenna gain in the direction of the receiver in dBi.

G_R=receiver antenna gain in the direction of the transmitter in dBi.

KTB=receiver noise level, Boltzmann's constant (K) times effective system noise temperature (T) times receiver bandwidth, BW_R in dBw.

INR=interference to noise power ratio, dB.

DC=duty cycle of interference emission in dB.

BW=ratio of the receiver 3-dB filter bandwidth BW_R and the 3-dB emission bandwidth BW_T of the interferer in dB.

$$BW=10\log\frac{BW_T}{BW_R},\ BW_T>BW_R$$

$$BW=0,\ BW_T\leq BW_R$$

The coordination distance was then established by use of the smooth earth propagation model.

Satellite Interactions. The satellite is stationary, thus interactions between the satellite and other services are evaluated by:

$$KNR=I-KTB \qquad (6.6)$$

Where

INR and KTB are as previously defined. I is the interference receive power in a reference bandwidth, dBw

A test of equality can then be made to determine if the INR ratio exceeds the criteria.

Equipment Characteristics. The equipment characteristics used for the additional Federal Government analyses are given in table 6.1. The characteristics of the Government equipments (item No. 1 through 4) were obtained from C–E or assignment record information. The characteristics of the wireless transmisisons of power (WTP) system (item No. 5) was provided via telecom. with NASA representatives. The fixed microwave equipment (Farinon SS4000W) characteristics were provided by a brochure. The earth station characteristics were obtained by using measured characteristics of an INTELSAT ground station. The satellite receive characteristics were extracted from the HS333 Canadian domestic satellite characteristics.

The INR criteria used in this report were obtained by using the values assumed in the non-Government analyses, Navy analysis and other previous Government analysis. The INR values used were:

(a) 0 dB for all radars.

(b) −10 dB[2] for fixed and fixed satellite services.

(c) −5 dB for mobile (air deployed) services.

[2] For the cases where pulsed systems are the interferer, an average interference power criteria was used. The criteria will not be valid for some conditions involving high data rate digital reception.

TABLE 6.1

Equipment Characteristics

ITEM	NOMENCLATURE	TRANSMIT POWER, dBw	PRF, PPS	PULSE WIDTH, µsec	3 dB EMISSION BANDWIDTH, MHz	ANTENNA MB	GAIN SL	RCVR NOISE FIGURE, dB OR (TEMPERATURE), °K	3 dB IF BANDWIDTH, MHz	AVERAGE ANTENNA HEIGHT ASSUMED, FT
1	ASR[1]	50	1000	0.6	1.8	32	10^2	5 dB	2.3	50
2	Airborne Rdr	33	3000	0.25	4.0	3	0	27 dB	5.0	30,000
3	Airborne System-Classified	20	NA	NA	5.0	3	0	30 dB	6.5	60,000
4	WSR-74C	54	266	3	0.5	40	NOT REQ.	NOT REQ.	NOT REQ.	50
5	WTP-NASA PROPOSED SYSTEM	100	NA	NA	UNKNOWN BASICALLY CW	87	NOTE 3	NOT REQ.	NOT REQ.	SYNCHRONOUS ORBIT
6	FARINON MICROWAVE (SS 4000W)	7	NA	NA	20.0	38	-10	9 dB	20.0	250
7	SATELLITE EARTH STATION	NOT REQ.	NA	NA	NOT REQ.	59	NOTE 4	(80 °K)	1 to 36 ASSUMED	50
8	SATELLITE	NOTE 5	NA	NA	NOTE 5	18	0	8 dB	1 to 36 ASSUMED	SYNCHRONOUS ORBIT

NOTES:

1. These characteristics were extrapolated from ASR 8 and existing FAA data.
2. The ASR antenna pattern will be a modified CSC² pattern. Gain of 32 dBi @ 5° and 10 dB at 0° and 30° elevation was assumed.
3. An extremely large array is used in this system. Gain of 10 dBi was assumed for 10 degrees off-axis and -10 dBi for 90 degrees off-axis.
4. Off-axis gain levels were calculated by using CCIR Report 391-2.
5. Power flux density limits were used for the calculation.

Satellite Parameters. The Radio Regulations specifies the maximum allowable power flux density (PFD) at the earth's surface produced by the fixed-satellite downlink. In the bands between 3.4–7.75 GHz, RR470NM Spa 2 states: "The power flux density at the Earth's surface produced by emissions from a space station or reflected from a passive satellite for all conditions and for all methods of modulation shall not exceed the following values;"

$152+\frac{\delta-5}{2}$ dBW/m² in any 4 kHz band for angles of arrival δ (in degrees) between 5 and 25 degrees above the horizontal plane;

142 dBW/m² in any 4 kHz band for angles of arrival between 25 and 90 degrees above the horizontal plane.

These limits relate to the power flux density which would be obtained under assumed free-space propagation conditions.

Satellite system design is governed by an overall performance criteria, i.e. achievement of a particular signal-to-noise ratio for the entire link. In some cases, like FM TV video transmissions where energy dispersal waveforms are employed, the limits given in RR470NM might be experienced. It is realized that the maximum *PFD* limit may be reduced by more than 20 dB for some links; however, the maximum level has been used for the initial OT analysis.

The conversion from *PFD* to interference power in a receive bandwidth may be expressed in logmetric form as:

$$I=PFD(\delta)+G_R+10\log\left(\frac{\lambda 2}{4\pi}\right)+10\log\left(\frac{BW_R}{4\text{ kHz}}\right) \quad (6.3)$$

where

I=maximum power in BW_R, dBW.
G_R=receive antenna gain, dBi.
λ=wavelength, meters.

6.3 *EMC Analysis of the 3.3–3.7 GHz Bands.* The results of previous sharing studies considering the EMC between radiolocation and the fixed satellite and fixed services are discussed in this section. These results are followed by additional Federal Government analyses of the following interactions:

(a) Aeronautical radionavigation (ASR's) and fixed satellite,

(b) Airborne Radars and fixed satellite stations,

(c) Airborne Radars and fixed stations (Farinon SS4000W).

EMC of Radiolocation and Fixed Satellite. The initial analysis made by the Fixed Satellite Advisory Committee concluded that sharing between the radiolocation and fixed satellite services is possible if the satellite PFD is limited to −122 dBw/m² in 2.5 MHz.

On January 28, 1977, a new document, GRC–798–III, addressing this subject was introduced to members of the Ad Hoc committee. The conclusions of this analysis were:

a. "The earth station coordination aspects do not appear to involve greater difficulties than that associated with the fixed service."

b. "It would appear that the present PFD limit would be tolerable in that actual interference cases would involve a maximum penalty of 1% on the radar coverage capability."

A brief discussion of these general conclusions is required in order to fully understand the impact of these statements.

The coordination distance required between radiolocation stations and satellite earth stations are approximately 100 miles for normal propagation modes. However, consideration of rain scatter coordination distance extends this required separation to about 280 miles.

Limitation of the coverage area by 1 percent would have little impact upon radars used for training. However, if radars are used for air defense purposes, the restriction of 1 percent would weaken the overall function of these systems. An alternative discussed in GRC 798–III would be to restrict the maximum PRD limit to a level of −165 to 173 dBW/m²/4KHz which would result in an overall INR of 0 dB.

EMC of Radiolocation (Shipboard Radars and Fixed). The proposed fixed stations would be used to provide line-of-sight communications for common carrier users (inferred by 3rd NOI). Currently, the fixed service is proposed on a secondary basis in the sub-band 3.3–3.4 GHz. Under a secondary allocation, the fixed service must accept interference from the radiolocation service. Normally, common carrier users desire highly reliable links. Achievement of this goal may require that the proposed fixed service be allocated on a primary basis. Consequently, sharing between radiolocation and the fixed services was addressed within this report.

The calculations provided by the Phase I

Navy study generally indicates that distance separation between the radiolocation (shipboard radars) and fixed stations of less than 210 miles will preclude interference in the 3.3–3.4 GHz sub-band. This assumes worst case mainbeam-to-mainbeam coupling. Under less extreme conditions, mainbeam-to-sidelobe, a distance separation of less than 85 miles is required.

EMC of Aeronautical Radionavigation and Fixed Satellite. The FAA ASR is planned to be used by aeronautical radionavigation service, i.e., is considered as a safety-of-life service.

Satellite Interference into ASR. The interference-to-noise power ratio may be calculated by using equation 6.2 and 6.3 in conjunction with the ASR characteristics given in table 6.2. The INR in 2.3 MHz for the mainbeam coupling case is about 12 dB. The elevation angle within CONUS for mainbeam coupling to the satellite will vary as a function of ground station locations and satellite orbital position. The minimum angle is about 5 degrees and the maximum angle is about 55 degrees. Assuming that the existing ASR–8 antenna characteristics will be similar to the proposed ASR, the approximate antenna characteristics are:

3 dB azimuth beamwidth of 1.35 degrees
one antenna rotation in 4.8 seconds.

As the ASR sweeps in azimuth, the receiver may see as many as 35 interfering stationary sources (assuming orbital spacing of 3°) with various levels of interference. Conceivably, all of the interference levels could be above the noise if maximum PFD limits are used. The 3 dB beamwidth dwell time is $\frac{(1.35)}{360}$ 4.8 seconds or about 18 milliseconds.

Thus, interference may be experienced for about 630 pulses/scan.

The only acceptable alternative to the FAA would be to lower the PFD limit for this band. Generally, a reduction of 15 dB would probably be ample. However, establishment of an INR specification level requires further analysis and coordination with the FAA.

ASR Interference into Satellite Earth Station. The loss required to preclude interference between the earth station and ASR (eq. 6.1) by using the parameters provided in table 6.1 are:

$$L=(174.7+G_R+G_T) \text{ dB}$$

assuming an ASR tilt angle of 4° and an earth station elevation angle of 5°, the required loss is

$$L\simeq(174.7+10+14.5) \text{ dB}=199.2 \text{ dB}$$

Based upon a smooth earth propagation prediction model, the required distance separation is 60 miles.

EMC of Airborne Radar and Fixed Satellite. The airborne radars are used for navigation station keeping on cargo-type aircraft. Due to the large number of these equipments, it is assumed that the airborne radars may be used in the U.S. during flight between bases. Also, there are new airborne radars being developed for use in portions of the band.

Satellite Interference into the Airborne Radar. The airborne radars have a very high noise figure (over 20 dB above the ASR) and a low antenna gain; therefore, it is evident that the satellite will not interfere with this system.

The Airborne Radar Interference into Satellite Earth Stations. The loss required to preclude interference, as calculated by equation 6.1, and using the equipment parameters defined in table 6–1 is:

$$L=155.4+G_R+G_T$$

Assuming 5 degrees off axis for the earth station and mainbeam coupling from the airborne radar (3 dBi gain)

$$L\simeq173 \text{ dbB}$$

The aircraft may fly at an altitude of 30,000 feet. Consequently, the required slant range is 250 miles. This distance is in the diffraction region; thus, small increases in loss will have negligible effects upon the distance.

EMC of Airborne Radars and Fixed. Airborne radars may fly at an altitude of 30,000 feet or greater. Effectively, this will increase the line-of-sight distance to about 250 miles. Consequently, the additional loss advantage of diffraction, as experienced by ground based equipments, is not realized.

Airborne Radar Interference into Fixed Stations. The Farinon SS4000W microwave equipment is a 600 channel system and has been assumed to be typical of fixed service equipment proposed for operation in the 3.3–3.4 GHz sub-band. The medium propagation loss as calculated by parameters given in table 6.1 and equation 6.1 is:

$$L=134.4+G_R+G_T \text{ in dB}$$

The loss is 175.4 dB for mainbeam to mainbeam couping (low probability of occurrance), and the corresponding slant range is about 250 miles.

The loss is 127 dB for airborne mainbeam and fixed station sidelobe antenna coupling. The corresponding slant range is 10 miles.

Fixed Service (SS400W) Interference into the Airborne Radar. This calculation is not required since the constraining system is the fixed station. This is evident by the high noise figure given in table 6.1.

6.4 *EMC Analysis of the 4.4–4.9 GHz Band.* The results of the Fixed Satellite Advisory Committee have been summarized to portray the EMC between high powered fixed stations (troposcatter) and the proposed fixed satellite service. This summary is followed by a preliminary Federal Government analysis of airborne mobile stations, and the fixed satellite service. Also, the impact of satellite emission upon the radio astronomy is discussed.

EMC of Troposcatter Systems and Fixed Satellite. The Fixed Satellite Advisory Committee sharing analysis concluded that sharing between troposcatter systems and earth stations require large coordination distances (308 miles). This analysis concludes that sharing of fixed satellite and troposcatter systems should be able to be accommodated.

Troposcatter Interference into Earth Stations. The coordination distances developed by the advisory committee, assuming 10° horizontal angle, are:

(a) About 154 miles (250 Km) separation between the troposcatter system and earth station is required, based upon great circle propagation mechanisms for 0.01% of the time.

(b) About 308 miles, worst case, based upon rain scatter.

Satellite Interference into Troposcatter. The Fixed Satellite Committee calculations showed that the troposcatter antenna could not point closer than ±4 degrees of the satellite geostationary orbit without exceeding an INR criteria of −10 dB. This calculation assumes maximum PFD of −152 dBw/m²/4 Kz. If the PFD was reduced to −160 dBw/m², the troposcatter antenna may look up to ±2 degrees of the geostationary orbit and receive adequate protection. A PFD of −173 dBw/m²/4 KHz is required to achieve an INR of −10 dB.

EMC of Mobile (Airborne) System and Fixed Satellite. As of this date, interactions between airborne mobile systems and the proposed fixed satellite service in the 4.4–4.9 GHz band have not been investigated. As indicated in Section 4, there are several airborne systems capable of operating in the 4.4–4.9 GHz band.

Satellite Interference into Mobile Stations. The calculated value of the interference-to-noise ratio (eq. 6.2 and 6.3) shows the interference is 39 dB below the noise in a 6.5 MHz bandwidth. Therefore, it appears that this link is compatible.

Mobile Station Interference into Earth Stations. Some of the airborne systems are designed to fly at low altitudes; others at high altitudes. One of the high altitude systems was chosen for this analysis, thus, an altitude of 60,000 feet was used.

The loss, L, is:

$$L=172.6+G_R+G_T$$

if G_R=3 dB
G_T=17 dB (4 degrees off-axis)
L=192.6 dB

Based upon smooth earth prediction models, the slant range is 360 miles.

The required loss is about 163 dB for G_T=0 and G_R=−10. The corresponding distance for this condition is about 340 miles.

EMC of Radio Astronomy and Fixed Satellite. CCIR report 224.3 contains the power flux density for typical line measurements. The level of signal causing harmful interference is a PFD of −196 dBw/m²/4 KHz (isotropic antenna). Due to the sensitivity of these systems, it is apparent that the two services are not compatible. A portion of the satellite downlink spectrum could be "notched out" by employing multi-section filters. This approach would decrease the performance and increase the cost of satellite systems.

6.5 *EMC Analysis of the 5.625–5.925 GHz bands.* Previous EMC analyses between the radiolocation and proposed fixed satellite service have been made by the Fixed Satellite Advisory Committee and by the Navy. Summaries of these analyses are provided in this section. Also, sharing between the following services have also considered:

a. Weather radars and fixed satellite.
b. WTP and fixed satellite.

EMC of Radiolocation and Fixed Satellite. The Fixed Satellite Advisory Committee concluded that sharing between the radiolocation and fixed satellite (uplink) services is not feasible. This analysis found that the interference from a radiolocation device into the satellite is over 30 dB greater than the maximum permissible interference into the satellite.

The Phase I Navy study has also concluded that Navy radiolocation and the proposed fixed satellite service may be incompatible for operation in this band.

EMC of Weather Radars and Fixed Satellite. U.S. Department of Commerce/National Weather Service uses the 5.6–5.65 GMz band for operation of weather radars. Weather (WXD) radars are used to detect, locate, track and measure meteorological phenomena. In order to perform these functions, the coverage volume of Weather radars cannot be restricted. The INR (Eq 6.2) during periods of mainbeam coupling (assuming global coverage of satellite antenna) is about 20 dB. This exceeds the acceptable criteria of −10 dB by 30 dB; consequently, inband sharing between these services is not feasible. The present allocation provides for 50 MHz of spectrum for operation of this service. If the WXD radar spectrum was reduced to 25 MHz (5.6–5.625 GHz) intrasystem interference is anticipated.

WTP Interference to Satellite. The Proposed WTP system will require an extremely narrow beam width antenna (0.008 degrees)

Vol. 42
1977

in order to provide efficient transfer of energy. The conceptual system characteristics have been estimated as:

Transmit power—10 Giga Watts.
Type antenna—Phase Array.
Antenna Gain—87 dBi (approximate).
Modulation—non essentially CW.

The proposed system will be located on a geostationary satellite platform. Assuming a maximum transmit and receive total gain coupling (G_T+G_R) of −10 dBi, the amount of CW power at a satellite receiver spaced 10 degrees away is approximately −94 dBw.

The other extreme is a satellite spaced approximately 160 degrees away in synchronous orbit. Under these conditions, the total coupling gain will be higher or approximately 20 dBi (10 dBi+10 dBi) and the amount of CE power at the satellite is approximately −84 dBw.

For a 36 MHz channel, the satellite noise power is −121 dBw. Clearly, the WTP CW signal will cause interference to the fixed satellite.

JOINT STATEMENT OF CHAIRMAN RICHARD E WILEY AND COMMISSIONER MARGITA E. WHITE

In Re: Fifth Notice of Inquiry in Docket 20271, Preparation for the 1979 World Administrative Radio Conference (WARC).

Dissenting only with respect to the majority's decision to limit future flexibility in the international arena in the 512–608 MHz and the 614–806 MHz portion of the spectrum.

We wholeheartedly agree with a great portion of the Commission's decision that provides for a flexible approach in establishing our recommendations for the 1979 WARC. However, the majority has not seen fit to extend flexibility to the 512–608 MHz and 614–806 MHz portions of the spectrum.

It must be empahsized that this proceeding is another step in the development of the U.S. position for the upcoming 1979 WARC and should reflect this country's best interests in international radio rules and regulations over the next twenty year time period. As a result of the inherent difficulties in accurately forecasting long-term future service by service spectrum demands, the theme of the preparatory effort to date in all areas, including allocation proposals, has been flexibility—flexibility to account for unpredictable changes in technology, economics, or national interest. We disagree that the information developed in the record at this stage of the proceeding is sufficient to warrant decisive and inflexible long-term allocation proposals in these bands. If the majority's decision today becomes the final U.S. position, it may make it impossible for a later Commission—faced with concrete facts and possible new technologies—to meet its responsibility under the Communications Act to "encourage the larger and more effective use of radio in the public interest."

It would seem that the Commission is making a decision that it need not make in 1977. This is an international proceeding, not a domestic rule making. Establishing the entire band as broadcasting and mobile internationally would not dictate or even suggest a change in our domestic allocations. (Indeed, the international VHF band is allocated to fixed, mobile and broadcasting services while our national allocations permits only television broadcasting in this band.)

Our dissent on this matter should not be construed in any way as a deviation from our joint commitment to fostering the fullest practical development of UHF television. We fully understand that the future course of UHF depends very fundamentally on the continued availability of ample spectrum space. It was for this reason that we supported initiation of the UHF Task Force to carefully study the future needs of UHF

future welfare of television in the UHF band. Indeed, one might reasonably infer that the majority has already weighed the complex and problematical projections of competing spectrum need for the remainder of this century and found all but those of UHF television lacking in credibility and consequence. The record of UHF television development to date, however, instills little confidence in the majority's clairvoyance. At present, there are 371 comercial and noncommercial UHF–TV stations on the air, less than one-third (30 percent) of the total 1269 current allocations. Although UHF–TV growth increased 300 percent between 1960 and 1975, UHF–TV total allocation usage has remained constant for the last five years. Whether this indicates a "plateau" of UHF–TV growth or merely a temporary lag is unclear at this point. While we all have high hopes for UHF television development in both the commercial and noncommercial sectors, a more convincing demonstration of actual future need is required, I think, before we reserve the lion's share of the 470–890 MHz band exclusively for UHF broadcasting.

Even if the majority's crystal ball assessment of UHF television needs to the end of the century were supported by reasonable ing for shared access to the 470–890 MHz band, such action would not reallocate a single frequency currently designated by the existing domestic table. Implementation by the United States of an international reallocation of UHF spectrum would be subject to a separate rule making in which all interested parties would have the opportunity to comment and the Commission would have the opportunity, also, to weigh competing spectrum needs. In advancing a WARC proposal which would freeze the current UHF domestic allocation, the Commission unnecessarily prejudges competing future needs and forecloses the opportunity to meet our mandate of promoting the larger and more effective use of radio in the public interest.

I want to answer one final argument which has been raised in support of the position of inflexibility taken by the majority. It has been argued that if a proposal calling for shared access throughout the 470–890 MHz band were adopted, it would have a "devastating psychological impact" upon the broadcast industry. This would occur, so the prophets contend, because any such allocation proposal would be seen by the industry as an "abandonment" of UHF–TV and by the other radio service industries as an "open mission to ascertain and meet future spectrum needs as they become more clearly evident and put the interested industries to the proof in the implementing rulemakings for allocating a scarce spectrum resource. The paramount public interest in a rational, far-sighted allocations policy demands no less, and competing industry interests are entitled to no more.

If this statement of purpose will not allay the "psychological" concerns of the broadcast industry, then I would seriously question the rationality of those concerns and not the wisdom of a policy favoring flexibility in future allocations. In this regard, while I recognize and remain committed to the Commission's policies for fostering the continued development of UHF television, I doubt that our mandate in this area includes assuming the role of psychiatrist for that industry. If, however, our mandate does require us to play that role, I think that the patient's mental health—and economic and technological well-being as well—would be better served by a confrontation with reality, rather than by reinforcing any delusions of grandeur or paranoia.

I hope that the majority's decision on this matter is not irreversible, and that a more

Vol. 42
1977

Navy study generally indicates that distance separation between the radiolocation (shipboard radars) and fixed stations of less than 210 miles will preclude interference in the 3.3-3.4 GHz sub-band. This assumes worst case mainbeam-to-mainbeam coupling. Under less extreme conditions, mainbeam-to-sidelobe, a distance separation of less than 85 miles is required.

EMC of Aeronautical Radionavigation and Fixed Satellite. The FAA ASR is planned to be used by aeronautical radionavigation service, i.e., is considered as a safety-of-life service.

Satellite Interference into ASR. The interference-to-noise power ratio may be calculated by using equation 6.2 and 6.3 in conjunction with the ASR characteristics given in table 6.2. The INR in 2.3 MHz for the mainbeam coupling case is about 12 dB. The elevation angle within CONUS for mainbeam coupling to the satellite will vary as a function of ground station locations and satellite orbital position. The minimum angle is about 5 degrees and the maximum angle is about 55 degrees. Assuming that the existing ASR-8 antenna characteristics will be similar to the proposed ASR, the approximate antenna characteristics are:

3 dB azimuth beamwidth of 1.35 degrees
one antenna rotation in 4.8 seconds.

As the ASR sweeps in azimuth, the receiver may see as many as 35 interfering stationary sources (assuming orbital spacing of 3°) with various levels of interference. Conceivably, all of the interference levels could be above the noise if maximum PFD limits are used. The 3 dB beamwidth dwell time is $\frac{(1.35)}{360}$ 4.8 seconds or about 18 milliseconds.

Thus, interference may be experienced for about 630 pulses/scan.

The only acceptable alternative to the FAA would be to lower the PFD limit for this band. Generally, a reduction of 15 dB would probably be ample. However, establishment of an INR specification level requires further analysis and coordination with the FAA.

ASR Interference into Satellite Earth Station. The loss required to preclude interference between the earth station and ASR (eq. 6.1) by using the parameters provided in table 6.1 are:

$$L=(174.7+G_R+G_T)\ \text{dB}$$

assuming an ASR tilt angle of 4° and an earth station elevation angle of 5°, the required loss is

$$L\simeq(174.7+10+14.5)\ \text{dB}=199.2\ \text{dB}$$

Based upon a smooth earth propagation prediction model, the required distance separation is 60 miles.

EMC of Airborne Radar and Fixed Satellite. The airborne radars are used for navigation station keeping on cargo-type aircraft. Due to the large number of these equipments, it is assumed that the airborne radars may be used in the U.S. during flight between bases. Also, there are new airborne radars being developed for use in portions of the band.

Satellite Interference into the Airborne Radar. The airborne radars have a very high noise figure (over 20 dB above the ASR) and a low antenna gain; therefore, it is evident that the satellite will not interfere with this system.

The Airborne Radar Interference into Satellite Earth Stations. The loss required to preclude interference, as calculated by equation 6.1, and using the equipment parameters defined in table 6-1 is:

$$L=155.4+G_R+G_T$$

Assuming 5 degrees off axis for the earth station and mainbeam coupling from the airborne radar (3 dBi gain)

$$L\simeq173\ \text{dbB}$$

The aircraft may fly at an altitude of 30,000 feet. Consequently, the required slant range is 250 miles. This distance is in the diffraction region; thus, small increases in loss will have negligible effects upon the distance.

EMC of Airborne Radars and Fixed. Airborne radars may fly at an altitude of 30,000 feet or greater. Effectively, this will increase the line-of-sight distance to about 250 miles. Consequently, the additional loss advantage of diffraction, as experienced by ground based equipments, is not realized.

Airborne Radar Interference into Fixed Stations. The Farinon SS4000W microwave equipment is a 600 channel system and has been assumed to be typical of fixed service equipment proposed for operation in the 3.3-3.4 GHz sub-band. The medium propagation loss as calculated by parameters given in table 6.1 and equation 6.1 is:

$$L=134.4+G_R+G_T\ \text{in dB}$$

The loss is 175.4 dB for mainbeam to mainbeam couping (low probability of occurrence), and the corresponding slant range is about 250 miles.

The loss is 127 dB for airborne mainbeam and fixed station sidelobe antenna coupling. The corresponding slant range is 10 miles.

Fixed Service (SS400W) Interference into the Airborne Radar. This calculation is not required since the constraining system is the fixed station. This is evident by the high noise figure given in table 6.1.

6.4 *EMC Analysis of the 4.4-4.9 GHz Band.* The results of the Fixed Satellite Advisory Committee have been summarized to portray the EMC between high powered fixed stations (troposcatter) and the proposed fixed satellite service. This summary is followed by a preliminary Federal Government analysis of airborne mobile stations, and the fixed satellite service. Also, the impact of satellite emission upon the radio astronomy is discussed.

EMC of Troposcatter Systems and Fixed Satellite. The Fixed Satellite Advisory Committee sharing analysis concluded that sharing between troposcatter systems and earth stations require large coordination distances (308 miles). This analysis concludes that sharing of fixed satellite and troposcatter systems should be able to be accommodated.

Troposcatter Interference into Earth Stations. The coordination distances developed by the advisory committee, assuming 10° horizontal angle, are:

(a) About 154 miles (250 Km) separation between the troposcatter system and earth station is required, based upon great circle propagation mechanisms for 0.01% of the time.

(b) About 308 miles, worst case, based upon rain scatter.

Satellite Interference into Troposcatter. The Fixed Satellite Committee calculations showed that the troposcatter antenna could not point closer than ±4 degrees of the satellite geostationary orbit without exceeding an INR criteria of −10 dB. This calculation assumes maximum PFD of −152 dBw/m²/4 Kz. If the PFD was reduced to −160 dBw/m², the troposcatter antenna may look up to ±2 degrees of the geostationary orbit and receive adequate protection. A PFD of −173 dBw/m²/4 KHz is required to achieve an INR of −10 dB.

EMC of Mobile (Airborne) System and Fixed Satellite. As of this date, interactions between airborne mobile systems and the proposed fixed satellite service in the 4.4-4.9 GHz band have not been investigated. As indicated in Section 4, there are several airborne systems capable of operating in the 4.4-4.9 GHz band.

Satellite Interference into Mobile Stations. The calculated value of the interference-to-noise ratio (eq. 6.2 and 6.3) shows the interference is 39 dB below the noise in a 6.5 MHz bandwidth. Therefore, it appears that this link is compatible.

Mobile Station Interference into Earth Stations. Some of the airborne systems are designed to fly at low altitudes: others at high altitudes. One of the high altitude systems was chosen for this analysis, thus, an altitude of 60,000 feet was used.

The loss, L, is:

$$L=172.6+G_R+G_T$$

if $G_R=3$ dB
$G_T=17$ dB (4 degrees off-axis)
$L=192.6$ dB

Based upon smooth earth prediction models, the slant range is 360 miles.

The required loss is about 163 dB for $G_T=0$ and $G_R=-10$. The corresponding distance for this condition is about 340 miles.

EMC of Radio Astronomy and Fixed Satellite. CCIR report 224.3 contains the power flux density for typical line measurements. The level of signal causing harmful interference is a PFD of −196 dBw/m²/4 KHz (isotropic antenna). Due to the sensitivity of these systems, it is apparent that the two services are not compatible. A portion of the satellite downlink spectrum could be "notched out" by employing multi-section filters. This approach would decrease the performance and increase the cost of satellite systems.

6.5 *EMC Analysis of the 5.625-5.925 GHz bands.* Previous EMC analyses between the radiolocation and proposed fixed satellite service have been made by the Fixed Satellite Advisory Committee and by the Navy. Summaries of these analyses are provided in this section. Also, sharing between the following services have also considered:

a. Weather radars and fixed satellite.
b. WTP and fixed satellite.

EMC of Radiolocation and Fixed Satellite. The Fixed Satellite Advisory Committee concluded that sharing between the radiolocation and fixed satellite (uplink) services is not feesible. This analysis found that the interference from a radiolocation device into the satellite is over 30 dB greater than the maximum permissible interference into the satellite.

The Phase I Navy study has also concluded that Navy radiolocation and the proposed fixed satellite service may be incompatible for operation in this band.

EMC of Weather Radars and Fixed Satellite. U.S. Department of Commerce/N[illegible]onal Weather Service uses the 5.6-5.65 G[illegible]band for operation of weather radars. [illegible]ather (WXD) radars are used to d[illegible]ocate, track and measure meteorolo[illegible]enomena. In order to perfo[illegible]ctions, the coverage volume of [illegible]ars cannot be restricted. The [illegible]4) during periods of mainbe[illegible] (assuming global coverage of [illegible]nna) is about 20 dB. This excee[illegible]s [illegible]cceptable criteria of −10 dB by 30 [illegible] consequently, inband sharing between these services is not feasible. The present allocation provides for 50 MHz of spectrum for operation of this service. If the WXD radar spectrum was reduced to 25 MHz (5.6-5.025 GHz) intrasystem interference is anticipated.

WTP Interference to Satellite. The Proposed WTP system will require an extremely narrow beam width antenna (0.008 degrees) in order to provide efficient transfer of energy. The conceptual system characteristics have been estimated as:

Transmit power—10 Giga Watts.
Type antenna—Phase Array.
Antenna Gain—87 dBi (approximate).
Modulation—non essentially CW.

The proposed system will be located on a geostationary satellite platform. Assuming a maximum transmit and receive total gain coupling (G_T+G_R) of −10 dBi, the amount of CW power at a satellite receiver spaced 10 degrees away is approximately −94 dBw.

The other extreme is a satellite spaced approximately 160 degrees away in synchronous orbit. Under these conditions, the total coupling gain will be higher or approximately 20 dBi (10 dBi+10 dBi) and the amount of CE power at the satellite is approximately −84 dBw.

For a 36 MHz channel, the satellite noise power is −121 dBw. Clearly, the WTP CW signal will cause interference to the fixed satellite.

JOINT STATEMENT OF CHAIRMAN RICHARD E. WILEY AND COMMISSIONER MARGITA E. WHITE

In Re: Fifth Notice of Inquiry in Docket 20271, Preparation for the 1979 World Administrative Radio Conference (WARC).

Dissenting only with respect to the majority's decision to limit future flexibility in the international arena in the 512–608 MHz and the 614–806 MHz portion of the spectrum.

We wholeheartedly agree with a great portion of the Commission's decision that provides for a flexible approach in establishing our recommendations for the 1979 WARC. However, the majority has not seen fit to extend flexibility to the 512–608 MHz and 614–806 MHz portions of the spectrum.

It must be empahsized that this proceeding is another step in the development of the U.S. position for the upcoming 1979 WARC and should reflect this country's best interests in international radio rules and regulations over the next twenty year time period. As a result of the inherent difficulties in accurately forecasting long-term future service by service spectrum demands, the theme of the preparatory effort to date in all areas, including allocation proposals, has been flexibility—flexibility to account for unpredictable changes in technology, economics, or national interest. We disagree that the information developed in the record at this stage of the proceeding is sufficient to warrant decisive and inflexible long-term allocation proposals in these bands. If the majority's decision today becomes the final U.S. position, it may make it impossible for a later Commission—faced with concrete facts and possible new technologies—to meet its responsibility under the Communications Act to "encourage the larger and more effective use of radio in the public interest."

It would seem that the Commission is making a decision that it need not make in 1977. This is an international proceeding, not a domestic rule making. Establishing the entire band as broadcasting and mobile internationally would not dictate or even suggest a change in our domestic allocations. (Indeed, the international VHF band is allocated to fixed, mobile and broadcasting services while our national allocations permits only television broadcasting in this band.)

Our dissent on this matter should not be construed in any way as a deviation from our joint commitment to fostering the fullest practical development of UHF television. We fully understand that the future course of UHF depends very fundamentally on the continued availability of ample spectrum space. It was for this reason that we supported initiation of the UHF Task Force to carefully study the future needs of UHF broadcasting and to develop a plan to preserve the spectrum required to meet those needs. This task is a complex one, and even preliminary results cannot be expected until the advanced stages of the proceeding. Without attempting to prejudge future domestic findings, the uncertainty at this point suggests that the best direction to follow internationally should be to preserve our fullest degree of flexibility.

We are encouraged by the fact that this is not the Commission's final recommendation but rather the Fifth Notice of Inquiry. Fortunately, the Commission will have additional opportunities to reconsider this point as the formal proceeding advances. We trust that the majority will approach future decisions on flexibility with an open mind. Those who feel that the majority decision today is incorrect are invited to provide the most accurate and comprehensive information possible in response to this Inquiry. They may have lost this battle, but perhaps not the WARC.

STATEMENT OF COMMISSIONER JOSEPH R. FOGARTY

In Re: Fifth Notice of Inquiry in Docket 20271, Preparation for the 1979 World Administrative Radio Conference (WARC).

CONCURRING IN PART; DISSENTING IN PART

While I concour in the bulk of the proposals adopted in this Fifth Notice of Inquiry, I dissent from the proposal of the Commission majority that the international allocation for the 470–890 MHz (UHF) band be made to conform with our existing domestic allocation, except for the 806–890 MHz band where Mobile Services are proposed to be primary and broadcasting services secondary. In my judgment, this proposal fails to recognize the imperative need for flexibility in meeting future domestic spectrum requirements. I think that this Notice should have set forth the following proposal for the 470–890 MHz band:

470–608 MHz Broadcasting/Mobile; 608–614 MHz Broadcasting/Mobile/Radio Astronomy; and 614–890 MHz Broadcasting/Mobile.

These are my reasons in support of both the dissent and the substitute proposal:

At the outset, it should be emphasized that the WARC meets to determine international allocation of the spectrum approximately once every 20 years. Thus, if sufficient flexibility is not incorporated into the international regulations prescribed by the 1979 WARC, U.S. telecommunications requirements may be restricted severely through the year 2000. On the other hand, adoption of principles favoring maximum flexibility at the 1979 WARC would permit and facilitate changes in the U.S. domestic allocation table which may be required to meet future spectrum needs for the expansion of existing services and the development of new communications systems.

A brief summary of the various radio service working group projections of future UHF spectrum requirements serves to illustrate the need for a U.S. position of maximum flexibility at the 1979 WARC. Broadcast interests have predicted that by the year 2000 a full complement of frequencies between 470 and 806 MHz will be required for commercial and noncommercial UHF television. The industry foresees public television station growth from the present 160 to more than 420 stations by the year 2000 and expects similar growth and spectrum saturation for commercial UHF–TV.

Beyond Commission decisions taken in Dockets 18261 and 18262, non-government non-television interests have predicted requirements, particularly for short range mobile communications, which, by the year 2000, could amount to approximately [illegible] MHz of the 470–806 MHz band. Based on projections from dramatic recent growth, particularly in the nation's major urbanized areas, and Commission licensing records, land mobile interests predict that by the end of this century there will be 2.1 million base station transmitters or 5.5 times the number existing in 1975. From these predictions, it is argued that in addition to the recent allocations in Dockets 18261 and 18262, between 102 and 174 MHz will be needed from the remaining UHF bands between 512 and 806 MHz.

International mobile service interests have also asserted the need for additional UHF spectrum to meet projected service requirements to the year 2000. The maritime community submits that by the end of the century an increased allocation of 15 to 18 MHz will be required if current traffic and demand trends continue. The aeronautical service has likewise advanced a projected need for 30 MHz of the UHF spectrum to allow for the development of new communications systems to keep pace with the introduction of more high capacity, high performance aircraft and related service requirements.

Government agencies, in addition, have expressed the need for access to 100 MHz in the 470–806 MHz band.

The only certain conclusion to be drawn from these industry working group projections is that there are significantly more demands for UHF spectrum than there is spectrum to allocate. Of course, each working group prediction tends to "maximize" its vision of future spectrum need to the virtual exclusion of competing service requirement projections. Due to the lack of sufficient information to confirm or modify these competing projections of spectrum need, it must be conceded that we are now in no position to formulate a rational plan for future UHF allocations which will enjoy any certainty of being in the overall national interest.

This conclusion is compelled not only by the paucity of reliable information as to future needs, but also by the rapidly changing nature of communications technologies applicable to the use of UHF frequencies. The Commission is currently engaged in an investigation of the future needs of television in the UHF band. Preliminary study suggests a great likelihood that technology improvements in TV receiver design will permit substantial reduction of the UHF-TV "taboos" thereby allowing many more TV stations to operate in the available spectrum than are currently permitted. With respect to the future needs of the land mobile community, there are complex, unresolved questions as to the actual load and usage of the spectrum currently allocated and whether advanced cellular and other technology may result in optimal utilization and conservation of spectrum. The several service working groups have not included in their reports any assessment of the impact of new technology on their projected spectrum needs. This deficiency further underscores the likelihood of miscalculation inherent in any attempt to establish future UHF spectrum retrum requirements now for the period contemplated by the 1979 WARC regulations.

Given this certainty of future uncertainty, reason and common sense clearly dictate that a proposal of maximum flexibility in UHF allocations would best serve this nation's overall telecommunications interests at the 1979 WARC. A majority of the Commission, however, takes a contrary position that it is imperative to freeze the existing domestic allocation internationally. I am frankly at a loss to understand why.

The majority's proposal is premised ostensibly on an overwhelming solicitude for the future welfare of television in the UHF band. Indeed, one might reasonably infer that the majority has already weighed the complex and problematical projections of competing spectrum need for the remainder of this century and found all but those of UHF television lacking in credibility and consequence. The record of UHF television development to date, however, instills little confidence in the majority's clairvoyance. At present, there are 371 comercial and noncommercial UHF-TV stations on the air, less than one-third (30 percent) of the total 1269 current allocations. Although UHF-TV growth increased 300 percent between 1960 and 1975, UHF-TV total allocation usage has remained constant for the last five years. Whether this indicates a "plateau" of UHF-TV growth or merely a temporary lag is unclear at this point. While we all have high hopes for UHF television development in both the commercial and noncommercial sectors, a more convincing demonstration of actual future need is required, I think, before we reserve the lion's share of the 470-890 MHz band exclusively for UHF broadcasting.

Even if the majority's crystal ball assessment of UHF television needs to the end of the century were supported by reasonable arguments, the wisdom of the Commission's proposed WARC position would still be less than self-evident. If the only choice were between exclusive UHF allocations for television or non-television services, I could understand a Commission decision opting for TV broadcasting. The majority's decision, however, appears to assume a need for such exclusivity which, I do not believe exists. Were the United States to adopt and gain international acceptance of a position calling for shared access to the 470-890 MHz band, such action would not reallocate a single frequency currently designated by the existing domestic table. Implementation by the United States of an international reallocation of UHF spectrum would be subject to a separate rule making in which all interested parties would have the opportunity to comment and the Commission would have the opportunity, also, to weigh competing spectrum needs In advancing a WARC proposal which would freeze the current UHF domestic allocation, the Commission unnecessarily prejudges competing future needs and forecloses the opportunity to meet our mandate of promoting the larger and more effective use of radio in the public interest.

I want to answer one final argument which has been raised in support of the position of inflexibility taken by the majority. It has been argued that if a proposal calling for shared access throughout the 470-890 MHz band were adopted, it would have a "devastating psychological impact" upon the broadcast industry. This would occur, so the prophets contend, because any such allocation proposal would be seen by the industry as an "abandonment" of UHF-TV and by the other radio service industries as an "open invitation to raid" the UHF spectrum heretofore reserved exclusively for broadcasting.

As I have emphasized already, adoption of a flexibility approach and principle at the 1979 WARC would not reallocate any domestic UHF frequency away from television to non-television use. It would preordain neither an "abandonment" of UHF television nor an apocalyptic "raid" on UHF spectrum by the non-television services. Such an approach, however, would allow this Commission to ascertain and meet future spectrum needs as they become more clearly evident and put the interested industries to the proof in the implementing rulemakings for allocating a scarce spectrum resource. The paramount public interest in a rational, far-sighted allocations policy demands no less, and competing industry interests are entitled to no more.

If this statement of purpose will not allay the "psychological" concerns of the broadcast industry, then I would seriously question the rationality of those concerns and not the wisdom of a policy favoring flexibility in future allocations. In this regard, while I recognize and remain committed to the Commission's policies for fostering the continued development of UHF television, I doubt that our mandate in this area includes assuming the role of psychiatrist for that industry. If, however, our mandate does require us to play that role, I think that the patient's mental health—and economic and technological well-being as well—would be better served by a confrontation with reality, rather than by reinforcing any delusions of grandeur or paranoia.

I hope that the majority's decision on this matter is not irreversible, and that a more objective analysis of the comments to be received in response to this Fifth Notice of Inquiry will lead to a modification of the Commission's proposal. To the extent that this initial proposal would limit use of the UHF band to the detriment of this Commission's ability to meet future U.S. telecommunications requirements, I dissent.

[FR Doc.77-15050 Filed 5-27-77;8:45 am]