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March 22, 1995

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FEDERAL COMMUNICATIONS COMMISSION
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Via Hand Delivery

Mr. William F. Caton, Secretary
Federal Communications Commission
1919 M Street, N.W. Room 222
Washington, D.C. 20554

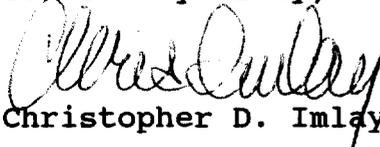
Re: Comments of the American Radio
Relay League, Incorporated; ET Docket
No. 94-32; Submission of Corrected
Copies

Dear Mr. Secretary:

On March 20, 1995, this office filed an original and the requisite number of copies of comments in the above-referenced proceeding. Unfortunately, through inadvertence of the undersigned, all were filed without exhibits referred to in the comments. Corrected copies and a corrected original are attached hereto for filing, together with the exhibits. These should be substituted for the copies originally filed Monday, March 20.

Should any question arise concerning these corrected copies, kindly notify the undersigned. We apologize for any inconvenience this may have caused.

Yours very truly,


Christopher D. Imlay

enc.

cc: David Sumner

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MAR 22 1995

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of)
)
Allocation of Spectrum Below) ET Docket No. 94-32
5 GHz Transferred From)
Federal Government Use)

To: The Commission

DOCKET FILE COPY ORIGINAL

COMMENTS OF THE AMERICAN RADIO RELAY LEAGUE, INCORPORATED
IN RESPONSE TO SECOND NOTICE OF PROPOSED RULE MAKING

THE AMERICAN RADIO
RELAY LEAGUE, INCORPORATED

Christopher D. Imlay
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March 20, 1995

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SUMMARY

The American Radio Relay League, Incorporated (the League), the national association of amateur radio operators in the United States, submits its comments in response to a portion of the Second Notice of Proposed Rule Making (the Second Notice), FCC 95-47, 60 Fed. Reg. 13102, released March 20, 1995.

The Second Notice proposes certain rules to govern frequency assignment and use of the first 50 MHz of spectrum transferred from Federal Government use. Principally aimed at establishing rules governing assignment and use of the 4660-4685 MHz band by Fixed and Mobile services, the Second Notice offers no specific proposed rule changes relative to the 2390-2417 MHz segments. It simply asks whether the changes made in the Table of Allocations, which elevated the Amateur Service to Primary status at 2390-2400 MHz and 2402-2417 MHz, and permitted asynchronous data-PCS at 2390-2400 MHz, require additional rule changes in either Part 97 or Part 15, to facilitate sharing between the Amateur Services and Part 15 devices in the subject bands. It is reasonable for the Commission to ask the question at this point, following the allocation decision, but there appears no need for any additional service rule changes to implement the allocation decision, save for a single "housekeeping" change in Part 97 discussed herein. There appears to be minimal potential for interference as between asynchronous data-PCS on the one hand and amateur stations on the other hand. Neither is there a need to reregulate either amateurs or Part 15 devices to facilitate their operation at 2402-2417 MHz.

Therefore, the League requests that the Commission refrain from making any further sharing or coordination rules for either the 2390-2400 MHz, or the 2402-2417 MHz bands, as none are required to accommodate full use by both the Amateur Service and by asynchronous data-PCS in the 2390-2400 MHz band, and by other Part 15 users in the 2402-2417 MHz band. Further, the League requests that the Commission commence an additional proceeding at an early date looking toward the allocation of the 2300-2310 MHz, 2400-2402 MHz, and 2417-2450 MHz bands to the Amateur Service on a Primary basis.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
DEPUTY SECRETARY

In the Matter of)
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To: The Commission

**COMMENTS OF THE AMERICAN RADIO RELAY LEAGUE, INCORPORATED
IN RESPONSE TO SECOND NOTICE OF PROPOSED RULE MAKING**

The American Radio Relay League, Incorporated (the League), the national association of amateur radio operators in the United States, by counsel and pursuant to Section 1.415 of the Commission's Rules, hereby respectfully submits its comments in response to a portion of the Second Notice of Proposed Rule Making (the Second Notice), FCC 95-47, 60 Fed. Reg. 13102, released March 20, 1995.¹ The Second Notice proposes certain rules to govern frequency assignment and use of the first 50 MHz of spectrum transferred from Federal Government use. Principally aimed at establishing rules governing assignment and use of the 4660-4685 MHz band by Fixed and Mobile services, the Second Notice also asks whether specific rules are necessary to accommodate sharing between the Amateur Service and unlicensed asynchronous data-PCS systems which will operate at 2390-2400 MHz under Part 15 rules. Further,

¹ The Second Notice was combined with the First Report and Order in this proceeding. The First Report and Order allocated the 2390-2400 MHz band, and the 2402-2417 MHz band to the Amateur Service on a primary basis, and permitted Part 15 data-PCS systems to operate in the 2390-2400 MHz band as well.

the Second Notice asks whether allowance should be made to combine the 2390-2400 MHz and 2400-2483.5 MHz bands for Part 15 operation. Finally, the Second Notice asks whether rules are necessary to facilitate coordination and shared operation between Part 15 users and Amateur stations in the 2402-2417 MHz band. In the interests of the Amateur Service in compatible sharing arrangements in these bands, the League states as follows:

I. Introduction

1. The Second Notice in this proceeding is not principally aimed at establishing any further specific rules for sharing between data-PCS systems and amateurs in the 2390-2400 MHz band, or between amateurs and traditional Part 15 devices in the 2402-2417 MHz band. Indeed, no specific rules or sharing criteria relative to those bands are proposed in the Second Notice or the Appendix thereto. Instead, the Commission seeks input on whether any such rules are necessary in the first place to facilitate the sharing arrangement established in the First Report and Order. In the opinion of the League, no additional rules are required. This is not to say that there should not be testing of interference potential between typical amateur station configurations and asynchronous data-PCS systems in the 2390-2400 MHz segment. There should be coordinated testing, and the League has been in contact with Apple Computer, Inc. before and since the issuance of the Report and Order in this proceeding to urge the desirability and means of doing so.

2. The First Report and Order held (and correctly so, in the League's view), as follows:

We will regulate these unlicensed PCS devices in accordance with Part 15 of our Rules. Devices operating under Part 15 have generally proven to be effective in operating in shared environments with other services, including in frequency bands shared with the Amateur service. We recognize the value of maintaining adequate spectrum for the Amateur service and we believe that the generally robust nature of PCS devices will make it feasible for unlicensed PCS devices and Amateur operations to operate on a shared basis in this band. In addition, both Apple and the ARRL believe that shared use of this band is possible. (footnote omitted). Accordingly, we are providing for the continued availability of the 2390-2400 MHz band for Amateur operations, and are increasing the status of the Amateur service in this band to primary. (footnote omitted). Considering past experience of Part 15 devices and Amateur service users operating in a shared environment, we do not believe that it is necessary to adopt specific provisions for protecting either of these operations.

Report and Order, at par. 17, page 12.

3. Based on information provided to the League from Apple Computer, Inc., the League determined that interaction between asynchronous data-PCS systems and amateur stations is likely to be minimal. Because the principal applications of data-PCS systems are indoors, and because the power and antenna gain of such systems are each strictly limited in accordance with §§15.319-15.321 of the Rules,² there appears not to be significant interference potential

² Asynchronous devices only are permitted in the 2390-2400 MHz band; minimum bandwidths permitted are 500 kHz, and devices of less than 2.5 MHz bandwidth are required to search for an available window in the band. All devices must have a mechanism for monitoring the spectrum before transmitting. Significant attenuation is required near the band edges. Peak transmit power must not exceed 100 uW multiplied by the square root of the emission bandwidth in hertz. (For example, a 100 kHz data signal would be permitted 32 mW, a 1 MHz signal 100 mW, and a 10 MHz signal 316 mW output). Power spectral density shall not exceed 3

to amateur operations in the band. Given the wide bandwidths and error-correction protocols used by asynchronous data-PCS systems, the League is informed that there does not appear much potential for interference from amateur stations to those unlicensed PCS systems. The League stated in an ex parte filing with the Commission that the two conditions under which it could support such a sharing arrangement at 2390-2400 MHz, however, were: 1) that the Amateur Service should receive a primary allocation in that band (and at 2402-2417 MHz), and 2) that Amateurs would not have to protect data-PCS systems against interference. The allocation plan for the band established by the Report and Order is entirely consistent with those conditions, and entirely consistent with the technical needs of both the Amateur Service and data-PCS systems.

II. No Additional Rules are Necessary for Sharing Between Amateurs and Data-PCS Systems at 2390-2400 MHz

4. Given that there is little or no predicted interference between Amateur Radio Service stations and data-PCS systems in either direction, the League recommends that there be no mandated regulations governing coordination or interference protection aside from the normal presumptions inherent in the relationship between a radio service allocation and Part 15 devices. As noted above, the League is ready, willing and able to conduct joint or separate testing of data-PCS systems, and to exchange empirical and

milliwatts in any 3 kHz bandwidth. Peak transmitter power shall be reduced by the amount in decibels that the directional gain of the antenna exceeds 3 dBi.

hypothetical reference circuit information for field test and theoretical calculations.³ It is of course difficult to conduct in-place coordination with any Part 15 device, since they are unlicensed and portable/mobile systems. Amateur stations are often portable or mobile as well. However, coordination would not seem to be necessary.

5. The Second Notice, at Paragraph 57, reiterates the Commission's finding that unlicensed asynchronous data-PCS and Amateur Service use of 2390-2400 MHz is generally compatible, and that it is unnecessary to propose any formal standards for sharing between the two services. Nonetheless, it asks whether that conclusion is appropriate or whether there is a need to restrict certain uses by amateurs; whether certain unlicensed data-PCS devices might be particularly disruptive; or whether the Commission should coordinate Amateur/PCS use. The coordination issue is difficult, as discussed above. Real-time coordination between and among users is not realistic, given the nature of the two services. Neither can the League, at present, identify any particular data-PCS use that would be unusually disruptive of amateur communications. This is because only asynchronous PCS systems are

³ Attached hereto as Exhibit A, for example, are hypothetical reference circuits for some of the amateur modes used or anticipated in the bands around 2.4 GHz. These were prepared for ITU-R study group purposes, but have application in informal coordination discussions with Apple Computer and other data-PCS providers. This type of information exchange is likely to lead to far more effective interference avoidance at the outset than would be achieved by specific regulations, even if there were significant interaction potential anticipated, which there is not.

allowed in the band (isynchronous PCS systems are not to be accommodated there).⁴ Indeed, the rules governing power, bandwidth and antenna gain for asynchronous PCS operation appear to be compatible with most amateur applications in the band.

6. It is recognized that some data-PCS proponents, such as Compaq, in comments in response to the first Notice of Proposed Rule Making in this proceeding, expressed a general desire that the 2390-2400 MHz band be made available for unlicensed PCS exclusively. However, there was no indication that it, or any other data-PCS proponent, could not provide asynchronous data-PCS service on a compatible sharing basis with the Amateur Service. The contrary conclusion having been conclusively reached by Apple Computer, the Commission is wise to require in the Second Notice, at paragraph 57, that commenters addressing the compatibility issue should be specific as to what uses might be particularly disruptive and as to how shared use of the band could be enhanced.

**III. Combined Part 15 Use of 2390-2400 MHz and 2400-2483.5 MHz
Should Be Addressed in a Separate Proceeding**

7. The Second Notice, at Paragraph 55 thereof, asks whether any changes should be made to the operational Part 15 rules to permit combination of the 2390-2400 MHz band and the 2400-2483.5 MHz band for use as a single, large Part 15 band. There has not been, in the previous rounds of comments in this proceeding, any

⁴ The Report and Order held that there were no comments in response to the first Notice of Proposed Rule Making which indicated any need for isynchronous PCS in the 2390-2400 MHz band. See the Report and Order, footnote 50, page 11.

indication that the 2390-2400 MHz band should in any way be combined with the traditional Part 15 segment at 2400-2483.5 MHz. The record in this proceeding is replete with indications of the limitations on use of the 2400-2483.5 MHz segment resulting from Part 18 operation there. The Commission has facilitated development of both the Amateur Service and asynchronous data-PCS as compatible users in the 2390-2400 MHz segment. It would be detrimental to both amateurs and data-PCS users to permit any coupling of the two band segments that would encourage the entire panoply of Part 15 users to migrate downward from the 2400-2483.5 MHz segment to the 2390-2400 MHz segment, in an effort to minimize or avoid interference from Part 18 devices in the upper segment. The League therefore recommends that no such coupling be permitted at this time.

8. Recent events also dictate that no decision be made in this Second Notice proceeding with respect to Part 15 coupling of 2390-2400 MHz and 2400-2483.5 MHz allocations. On Wednesday, March 15, 1995, NTIA issued its Spectrum Reallocation Final Report in response to Title VI of the Omnibus Budget Reconciliation Act of 1993, NTIA Special Publication 95-32. This document modified the NTIA Preliminary Report in several important respects. Among these was the decision by NTIA to reallocate the 2400-2402 MHz segment and the 2417-2450 MHz segment for private sector use. This was done, according to the Final Reallocation Report, in order to provide FCC with the opportunity to develop a "long term regulatory framework and strategy that meets the needs of the Amateur Service and addresses the requirements of a robust and growing Part 15

industry." It would be useful for the Commission to address the relationship of the 2390-2400 MHz band and the 2400-2483.5 MHz band only in light of this recent decision to reallocate the entire 2400-2450 MHz band from government use, which facilitates increased use of the 2400-2450 MHz band for Part 15 devices. There will have to be a further allocation proceeding to address the Part 2 status of the 2400-2402 MHz and 2417-2450 MHz bands,⁵ which will affect any need to couple the 2390-2400 MHz band with the higher, general Part 15 segment. Under any circumstances, the League sees no benefit in combining the Part 15 uses in the 2390-2400 MHz segment with those in the 2400-2450 MHz segment.

IV. Potential Interference to Radio Astronomy Operations

9. The Second Notice asks about the sufficiency of protection for space research operations, such as those conducted by the National Research Council (NRC) and Cornell University. Those entities have requested that there be no aeronautical use of 2390-2400 MHz in order to protect space research operations at 2380 MHz. Also, it is requested that terrestrial use of 2390-2400 MHz be

⁵ There will also have to be a proceeding in the near term to plan the allocation status of the 2300-2310 MHz band. This segment has extensive current use, especially around 2304 MHz. The Commission did not address this band in the First Report and Order, suggesting instead (at footnote 52, page 12) that the matter should await a further proceeding. The Commission stated that it would "carefully consider the benefits of continued Amateur Service access to 2300-2310 MHz in future decisions." However, the NTIA Final Report accelerated the availability of this band to August of this year, to provide for pairing with the 2390-2400 MHz band (see the Final Report, at pages vi and 4-15, and Appendix B thereof). Because the latter has been allocated to the Amateur Service on a Primary basis, the Commission is urged to allocate the 2300-2310 MHz band to the Amateur Service on a Primary basis as well.

prohibited within 100 miles of the Arecibo, Puerto Rico National Astronomy and Ionospheric Center (NAIC). The Commission agreed to prohibit aeronautical use of unlicensed PCS devices, but asks for further comment on the degree of protection from terrestrial unlicensed PCS systems necessary in Arecibo.

10. The League offers no specific comment on the compatibility between unlicensed asynchronous data-PCS at 2390-2400 MHz and the NAIC at Arecibo. There is no proposal to restrict amateur operation in that band, however, and there are no current restrictions in the Part 97 rules. Current rules do not permit Amateur-Satellite Service use of the 2390-2400 MHz band, but only Amateur Service use. While aeronautical mobile use of the band is permitted in the Amateur Service, it is extremely rare in practice, and the League is not aware of any reported incident of interference to the observatory from amateur operation on any frequency band at this time. There is a great deal of local coordination between amateur groups in Puerto Rico and the Arecibo Observatory generally, and there are licensed radio amateurs working at the NAIC. There is every reason to believe that this cooperative arrangement will continue, and there does not appear any reason to restrict any amateur operation in the vicinity of the Arecibo Observatory. If there are any local interference problems, (and the League is aware of no interaction between amateurs and the NAIC in the 2390-2400 MHz band at all), it is apparent to the League that they can and will be resolved easily and quickly on a local coordination basis.

**V. There is No Need for Further Rules Governing Amateur
and Part 15 Operation at 2402-2417 MHz**

11. The Commission finally notes that Part 15 devices and Amateur Stations operating at 2402-2417 MHz continue to be governed by current applicable technical and operational rules for each service. Comment is solicited on whether there are any changes necessary to facilitate use of the band by the Amateur Service and by Part 15 devices. The Utilities Telecommunications Council had urged earlier that the Commission "increase the status" of Part 15 devices in that segment.⁶ Such a proposal is, especially in that band, pointless. There is, as the record in this proceeding clearly shows, significant noise in this band from Part 18 devices. The only devices that can operate there, assuming that the Commission is not inclined to alter the status of Part 18 devices in the band, are Part 15 devices that are not particularly susceptible to noise, and certain Amateur and Amateur-Satellite applications. There are no technical or operational rule modifications that could be made, short of restrictions on Part 18 operation, that are likely to improve this situation. Interactions between Amateur stations and Part 15 devices in this band have not been reported to the League, if any exist (though the use of the band by new spread spectrum

⁶ The UTC suggestion was yet another example of a conceptual error repeatedly noted lately: Part 15 devices have no allocation status; they are by definition permitted to operate at sufferance to licensed radio services. The point is not to denigrate the importance of such devices to the American Public whatsoever, but to avoid equating unlicensed intentional radiating devices with licensed radio services when making spectrum allocations decisions involving licensed radio services in shared bands.

Part 15 devices is presently at low levels), and significant use can be made by both of the entire 2400-2450 MHz band.⁷ The League is aware of no justification for any additional Part 15 or 97 regulation above 2400 MHz.

**VI. The Part 97 Rules Require Modification to Implement
The First Report and Order**

12. Though the Second Notice does not make any reference to it, the First Report and Order did not modify the Part 97 Rules in order to implement in those Service rules the change in the Amateur allocation status at 2390-2400 MHz and 2402-2417 MHz from Secondary to Primary. This should be done by modification of 47 C.F.R. §97.303(b), to eliminate reference to the avoidance of interference to, and the non-protection from interference from, the Government radiolocation service in the 13 cm band, and modification of the table at 47 C.F.R. §97.301 to eliminate reference to that condition. In view of the recent decision by NTIA in the Spectrum Reallocation Final Report to reallocate the entire 2390-2450 MHz band for private sector use, to provide for a secure developmental future for the Amateur Service and Part 15 devices, the rule change might best be addressed all at once in a subsequent proceeding.

⁷ Apple Computer, Inc., in pleadings filed earlier in this proceeding, had urged the Commission to create a primary allocation for the Amateur Service in the entire 2390-2483.5 MHz band. This proposal is, given the circumstances inherent in the allocation status of this band, most reasonable. The League requests that the Commission, in view of the recent action by NTIA, propose a contiguous primary amateur allocation at 2390-2483.5 MHz.

VII. Conclusions

13. This Second Notice offers no specific proposed rule changes relative to the 2390-2417 MHz segments. It simply asks whether the changes made in the Table of Allocations, which elevated the Amateur Service to Primary status at 2390-2400 MHz and 2402-2417 MHz, and permitted asynchronous data-PCS at 2390-2400 MHz, require additional rule changes in either Part 97 or Part 15, to facilitate sharing between the Amateur Services and Part 15 devices in the subject bands. It is reasonable for the Commission to ask the question at this point, following the allocation decision, but there appears no need for any additional service rule changes to implement the allocation decision, save for the single "housekeeping" change in Part 97 discussed above. There appears to be minimal potential for interference as between asynchronous data-PCS on the one hand and amateur stations on the other hand. Neither is there a need to reregulate either amateurs or Part 15 devices to facilitate their operation at 2402-2417 MHz. There is good reason at the present time to extend the primary amateur allocation from 2390 MHz to 2483.5 MHz, however, consistent with the allocation plan for the entire band, and consistent with the Final Reallocation Report recently released by NTIA.

Therefore, the foregoing considered, the American Radio Relay League, Incorporated respectfully requests that the Commission refrain from making any further sharing or coordination rules for either the 2390-2400 MHz, or the 2402-2417 MHz bands, as none are required to accommodate full use by both the Amateur Service and by

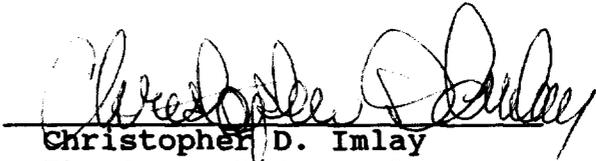
asynchronous data-PCS in the 2390-2400 MHz band, and by other Part 15 users in the 2402-2417 MHz band. Further, the League requests that the Commission commence an additional proceeding at an early date, looking toward the allocation of the 2300-2310 MHz, 2400-2402 MHz, and 2417-2483.5 MHz bands to the Amateur Service on a Primary basis.

Respectfully submitted,

**THE AMERICAN RADIO RELAY
LEAGUE, INCORPORATED**

225 Main Street
Newington, CT 06111

By


Christopher D. Imlay
Its General Counsel

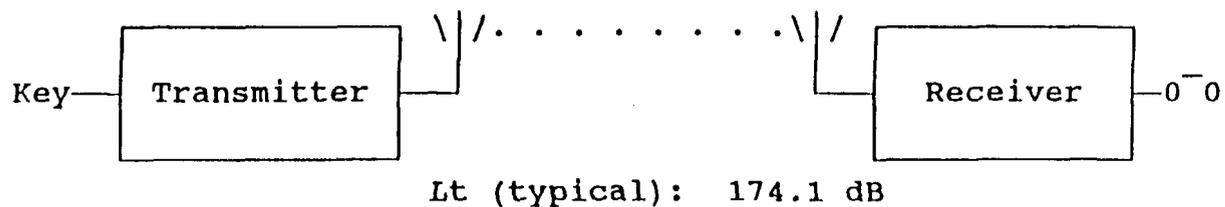
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March 20, 1995

ANNEX 1/1

FIGURE 1

HYPOTHETICAL REFERENCE CIRCUIT FOR
AMATEUR WEAK SIGNAL MORSE TELEGRAPHY
2300 - 2400 MHz



PX : 2 - 48.1 dBW
(typical) : 32.0 dBW

Antenna : Yagi array
Polarization: H
Git : 20 - 30 dBi
(typical) : 25.0 dBi

Lft : 3.0 dB

Pt : 0 - 31.7 dBW
(typical) : 10.0 dBW

Emission : 150HA1A

Pr : -142.1 dBW

Antenna : Yagi array
Polarization: H
Gir : 20 - 30 dBi
(typical) : 25.0 dBi

Lfr : 3.0 dB

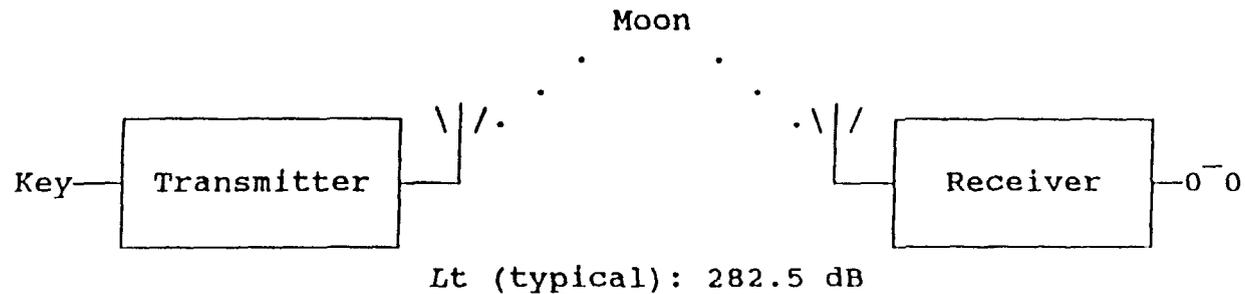
Pa : -170.1 dBW
SNR : 6.0 dB
N : -176.1 dBW

B (500 Hz) : 26.9 dB

F : 1 dB
Fe : NA
Fr : 1 dB

kT₀B : -204 dBW

HYPOTHETICAL REFERENCE MODEL FOR
AMATEUR EARTH-MOON-EARTH MORSE TELEGRAPHY
2300 - 2400 MHz



PX : 50 - 65 dBW
(typical) : 63.0 dBW

Antenna : Parabolic
Polarization: Linear
Git : 35 - 45 dBi
(typical) : 40 dBi

Lft : 1 dB

Pt : 20 - 31.7 dBW
(typical) : 24.0 dBW

Emission : 50HA1A

Pr : -219.5 dBW

Antenna : Parabolic
Polarization: Linear
Gir : 35 - 45 dBi
(typical) : 40 dBi

Lfr : 1 dB

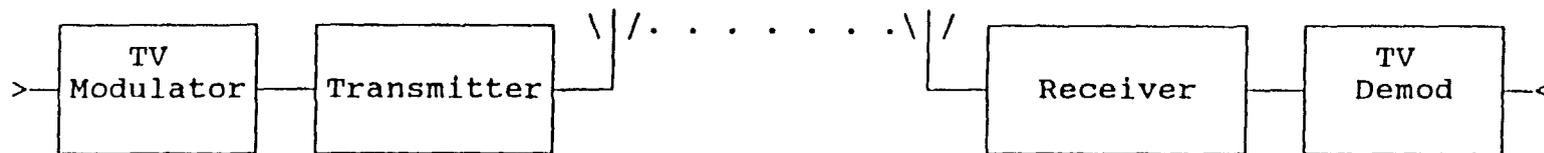
Pa : -180.5 dBW
SNR : 6 dB
N : -186.5 dBW

B (50 Hz) : 17 dB

F : 0.5 dB
Fe : NA
Fr : 0.5 dB

kT₀B : -204 dBW

HYPOTHETICAL REFERENCE CIRCUIT FOR
AMATEUR FAST SCAN TELEVISION
2300 - 2400 MHz



L_t (typical): 142 dB

P_X : 2 - 48.1 dBW
(typical) : 27.0 dBW

Antenna : Parabolic
Polarization: H
 G_{it} : 15 - 25 dBi
(typical) : 20.0 dBi

L_{ft} : 3.0 dB

P_t : 0 - 31.7 dBW
(typical) : 10.0 dBW

Emission : 16M0F3F

P_r : -115 dBW

Antenna : Parabolic
Polarization: H
 G_{ir} : 14 - 22 dBi
(typical) : 20.0 dBi

L_{fr} : 3.0 dB

P_a : -98 dBW
 SNR : 33 dB
 N : -131 dBW

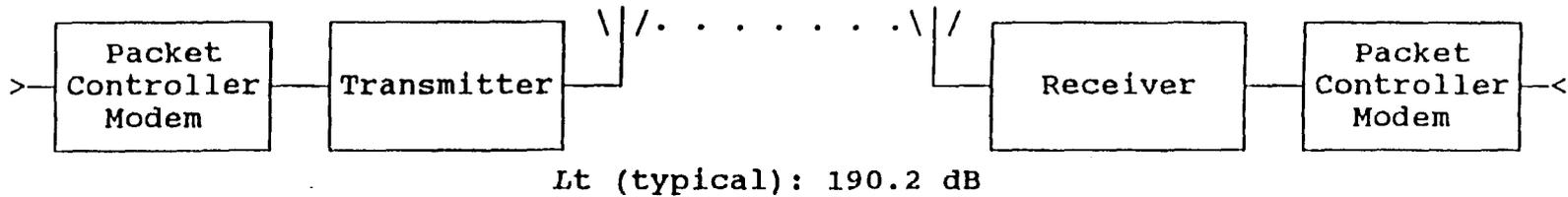
B (16 MHz) : 72 dB

F : 1 dB
 F_e : NA
 F_r : 1 dB

kT_0B : -204 dBW

FIGURE 4

**HYPOTHETICAL REFERENCE CIRCUIT FOR
AMATEUR HIGH SPEED PACKET RADIO
2300 - 2400 MHz**



PX : 2 - 48.1 dBW
(typical) : 18.0 dBW

Antenna : Yagi array
Polarization: H
G_{it} : 14 - 22 dBi
(typical) : 18.0 dBi

L_{ft} : 3.0 dB

P_t : 0 - 31.7 dBW
(typical) : 3.0 dBW

Emission : 1M00D1D

P_r : -172.2 dBW

Antenna : Yagi array
Polarization: H
G_{ir} : 14 - 22 dBi
(typical) : 18.0 dBi

L_{fr} : 3.0 dB

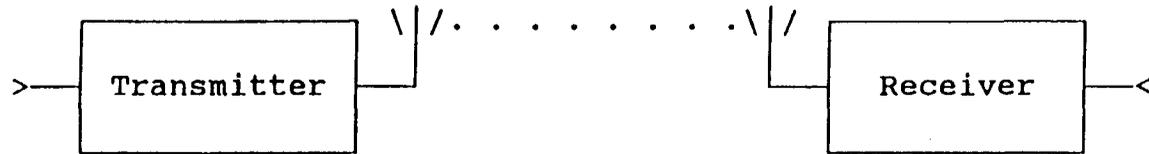
P_a : -154.2 dBW
SNR : 15.0 dB
N : -169.2 dBW

B (1 MHz) : 33.8 dB

F : 1 dB
F_e : NA
F_r : 1 dB

kT₀B : -204 dBW

**HYPOTHETICAL REFERENCE CIRCUIT FOR
AMATEUR WEAK SIGNAL SSB TELEPHONY
2300 - 2400 MHz**



Lt (typical): 211.2 dB

PX : 2 - 48.1 dBW
(typical) : 32.0 dBW

Antenna : Yagi array
Polarization: H
Git : 20 - 30 dBi
(typical) : 25.0 dBi

Lft : 3.0 dB

Pt : 0 - 31.7 dBW
(typical) : 10.0 dBW

Emission : 2K40J3E

Pr : -179.2 dBW

Antenna : Yagi array
Polarization: H
Gir : 14 - 22 dBi
(typical) : 25.0 dBi

Lfr : 3.0 dB

Pa : -157.2 dBW
SNR : 12 dB
N : -169.2 dBW

B (2.4 kHz) : 33.8 dB

F : 1 dB
Fe : NA
Fr : 1 dB

kT₀B : -204 dBW

LEGEND FOR FIGURES 1 TO 5:

- B* : 10 Log receiver post-detection bandwidth
- F* : noise power in dB above kT_0B , $10 \text{ Log } (\text{antilog } (F_r/10) + \text{antilog } (F_e/10) - 1)$
- F_e* : external noise figure, $76.8 - 27.7 \text{ Log } F$ (MHz) for residential areas
- F_r* : receiver noise figure
- G_{ir}* : gain of receiving antenna referenced to an isotropic antenna
- G_{it}* : gain of transmitting antenna referenced to an isotropic antenna
- kT_0B : noise power in 1 Hz at 290 kelvins
- L_b* : basic transmission loss
- L_{fr}* : receiving feeder loss
- L_{ft}* : transmitting feeder loss
- L_s* : system loss
- L_t* : transmission loss
- N_r* : noise power in dBW in the receiver passband
- P_X* : equivalent isotropically radiated power (e.i.r.p.) in dBW peak envelope power in the direction of the receiving station
- P_a* : resultant radio frequency signal power in dBW available at the terminals of the receiving antenna
- P_r* : power in dBW available from an isotropic antenna
- P_t* : radio frequency power in dBW input to the terminals of the transmitting antenna
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