WILD GOOSE ASSOCIATION

16 January 1983

MINUTES OF THE 58th BOARD OF DIRECTORS MEETING

The 58th meeting of the Board was held as scheduled Wednesday, 26 January 1983, in Conference Room 8440, NASSIF Building, 400 Seventh St., S.W., Washington, DC. Capt. Bill Kohl arranged for the conference room.

The list of attendees is as follows:

Directors	Members
C. S. Andren	
E. L. McGann	D. C. Scull
L. F. Fehlner	
D. Carter	
B. Ambroseno	
V. L. Johnson	
V. I. Weihe	

The number of Directors present met the quorum requirement. The agenda is presented as Exhibit 1.

Item 1 - Call to Order

The meeting was called to order by President Carl Andren at 0950, 26 January 1983.

Item 2 - Secretary's Report

The minutes of the previous meeting were approved as distributed to the Board.

Fehlner reported on a communication on 14 January 1983 from Lester Brodeur of Sanders Associates, MIP-2, 95 Canal St., Nashua, NH 03060 (phone 603/424-5080 X455). Mr. Brodeur volunteered a paper on filters for presentation at the next WGA technical meeting.

Andren reported on a communication from member Joseph Zyda regarding tax refunds which may be owed to attendees at the WGA Convention held in San Diego. See Exhibit 2. It was suggested this item be included in the next news letter.

Item 3 - Treasurer's Report

Acting Treasurer Andren presented the Treasurer's report. See Exhibit 3. Treasurer's books will be transferred within the next few weeks to Treasurer Carter following an audit by the Audit Committee.

Item 4 - Standing Committee Reports

a. Awards - Andren reported on a communication received from John Illgen nominating Mike Eaton for the Medal of Merit in 1983. See Exhibit 4.

On an award related matter, the Board requested the Secretary to explore the procurement of additional Medals of Merit. Since the supply of lapel pins is also low, the request was extended to include additional pins.

b. Constitution - Johnson reported on an action item from the previous meeting regarding more effective management, in particular, management procedures which overcome the frequent lack of a quorum at Board meetings. See Exhibit 5. The Board agreed with the recommendations of Exhibit 5 and decided to make the subject an action item for the next Board meeting.

[Secretary's note: Board members please read Exhibit 5 and come to next meeting (or otherwise communicate) prepared to discuss inplementation of recommendations of Exhibit 5.]

c. Conventions -

1. 1982 - Chairman Carter reported on the financial status of the 1982 convention. See Exhibit 6. In summary, the Convention is expected to be self-supporting, including the publication of the proceedings. Proceedings are expected to be distributed in the next few months to Convention attendees. They will be available to others at a price yet to be established.

2. 1983 - Andren reported that Carter has agreed to co-chair the 1983 Convention provided it is held at the Capital Holiday Inn. McGann moved to appoint Carter as co-chairman, to select the Capital Holiday Inn as the location, and to authorize Carter to select a co-chairman. Johnson seconded. Motion carried.

d. Historical - no report

e. Journal - Ambroseno delivered copies of the 1982 Journal to Board members and reported $7235 from sales of advertising. Mailings to 82 overseas members were discussed and it was agreed that surface mail should

be used to reduce cost of mailing. An agenda item was suggested for the next meeting regarding possible increase in dues for non-U.S. members to cover communication costs.

f. Membership - The Board discussed the possibility of acquiring a small computer capable of handling WGA records and mailings and making it available to the membership chairman for his/her use in keeping membership records and eventually to support financial records. To this end, McGann moved that the Executive Committee purchase a small computer and suitable software to be used initially by the Membership Chairman for maintaining membership records at a cost not to exceed $3000. Carter seconded. Motion carried.

g. Newsletter - Andren reported a communication from Illgen to the effect that the newsletter would be distributed within 2 weeks.

h. Nominating and Election - No report

Item 5 - Special Committee Reports

a. Government Liaison - McGann suggested that certain members of Congress should be contacted to remind them of the 1974 decision to make Loran-C the national radionavigation system for use in coastal waters, and to publicize the large number of receivers in use and their favorable effect on business activity. McGann suggested further that WGA should spearhead a special event in 1984 to commemerate not only the 1974 Congressional decision, but also the 25th birthday of Loran-C. Johnson moved that the Executive Committee be empowered to engage in planning a celebration in 1984 to commemorate the 1974 decision and to celebrate the 25th birthday of Loran-C. McGann seconded. Motion carried.

Item 6 - New Business

a. CCIR - The Coast Guard has invited the WGA to participate in updating CCIR report 915 and Recommendation 589. See Exhibit 7. The Board agreed to establish a special committee to handle the details of WGA participation. The committee was named the "CCIR Interferance Protection Criteria Committee" and it will address the protection criteria required in the band 70 to 130 KHz.

b. FCC Draft Report - Andren brought Exhibit 8 to the attention of the Board. The Board engaged in much discussion of the impact of PLC (Power Line Carrier) on Loran-C and observed that Exhibit 8 highlights the views of the utilities while ignoring the comments submitted by DOT, USCG and WGA. McGann volunteered to call Sam Tropea (see page 8 of Exhibit 8). The Board suggested this item should be publicized in the Newsletter.

c. Mail Drop - Ambroseno moved to accept Megapulse's offer to use their address as the WGA mail drop. Weihe seconded. Motion carried. Megapulse will forward the WGA mail as appropriate. It will not be necessary to include "c/o Megapulse" in the address.

Item 7 - Adjourn - The meeting adjourned at 1240 on a motion by Weihe.

Leo F. Fehlner
Secretary

Distribution:

Directors
Chairmen

WILD GOOSE ASSOCIATION

January 21, 1983

TO: WGA Directors and Committee Chairmen

FROM: WGA President

SUBJECT: 58th Meeting of the Board of Directors

The next WGA Board of Directors meeting will be held Wednesday, January 26, 1983 at 9:30 A.M. in Conference Room 8440, NASSIF Building. 400 Seventh Street, S.W. Washington, D.C. Contact if needed is Capt Bill Kohl, telephone (202) 426-9520.

AGENDA

1. Call to order

2. Secretary's Report

3. Treasurer's Report

4. Standing Committee Reports

   a. Awards — Frank
   b. Constitution — Johnson
   c. Convention
      1. 1982 Proceeding — Carter
      2. 1983 — Andren
   d. Historical — Dean
   e. Journal 1982 — Ambroseno
   f. Membership — Andren
   g. Newsletter — Illgen
   h. Nominating and Election — Dean

5. Special Committee Reports

   a. Government Liaison

6. New Business

   a. WGA Input to US Study Group 8B (CCIR) U.S.C.G. Report
   b. FCC Draft Report and order to provide enchanced recognition of power line carrier (PLC) systems in the 10 to 490 KHz frequency bands - discussion

Carl S. Andren
President

Exhibit 2

International Telephone and Telegraph Corporation

Avionics Division

Telecommunications and Electronics Group-North America

Plant: *390 Washington Avenue*
Nutley, New Jersey 07110
Telephone (201) 284-0123

Sales Office: 7821 Orion Avenue
Van Nuys, CA 91409
Telephone: (213)780-0176, or
(213)988-2600, x316

7 October 1982

Wild Goose Association
P.O. Box 413A
Acton, MA 01720

Subject: San Diego Room Tax Refund

Gentlemen:

The attached article appeared in the October issue of "Sunset Magazine." Perhaps our members who attended the Bahia meeting in October 1981 may wish to apply for these refunds.

Very truly yours,

J. Zyda
Western Regional Manager

JZ/dm
attachment

Exhibit 2
Page 2

SAN DIEGO REFUND

Occupants of Hotels/Motels In City of San Diego from April 1, 1981 Through December 15, 1981.

The San Diego Superior Court has held that the Transient Occupancy Tax of eight percent (8%) of the rent collected by hotels/motels as required by the City of San Diego from April 1, 1981 through December 15, 1981 should have been at the rate of six percent (6%).

If you were a tenant of a hotel/motel in the City of San Diego on any date beginning on April 1, 1981 to and including December 15, 1981 and were charged the Transient Occupancy Tax at the rate of eight percent (8%) by the hotel/motel you may be entitled to a refund in the amount of two percent (2%) of the rent charged.

To receive a refund a written, signed request must be filed with the City of San Diego containing the following:

1. Name and address of claimant.
2. The hotel/motel bill (or a copy) evidencing payment of the eight percent (8%) tax during the period April 1, 1981 through December 15, 1981.

Where the hotel/motel bill is unavailable, include the name and address of the hotel/motel, dates of occupancy and amount of rent and tax paid. Include any documentation available. Claims without hotel/motel bill may not be honored without verification by the City which may cause substantial delay.

No claims for amounts less than one dollar ($1.00) will be refunded. Claims must be received by the City no later than July 27, 1983. All claims are subject to verification.

Send the claim and supporting documentation to: City Treasurer, Attn. Alberta Hall, P.O. Box 2289, San Diego, California 92112.

Exhibit 3

WILD GOOSE ASSOCIATION

TREASURER'S REPORT
Jan. 26, 1983

Previous Balance			$4,559.76
	Transactions		
Receipts			
Dues	$ 519.50		
Proceedings Sales	10.00		
Hospitality - 1982 Convention	1,400.00		
		$1,929.50	
			$6,489.26
Expenditures			
1982 Convention Chairman's Advance Hotel Deposit	2,000.00		
1982 Convention Awards	215.11		
1982 Journal Expense	3,227.00		
		$5,442.11	
Balance as of 1/26/83			$1,047.15

Submitted 1/26/83

Carl S. Andren
President
for D. Carter, Treasurer

Approved by Board of Directors

L.F. Fehlner
Secretary

Exhibit 4

Kaman Tempo

A DIVISION OF KAMAN SCIENCES CORPORATION

816 State St., P.O. Drawer QQ
Santa Barbara, California 93102
Telephone (805) 965-0551

8 November 1982

Mr. Robert L. Frank
30785 River Crossing
Birmingham, MI 48010

Dear Bob:

I believe the awards committee should strongly consider Mike Eaton (Canadian Hydrographic Service) for the Medal of Merit next year. Mike has been involved in Loran-C System Engineering, experiments, tests, and has provided unique findings associated with Loran-C propagation and operation in the Northern latitude. He has been a staunch supporter of Loran-C for many years and is largely responsible for Loran-C expansion in Canada. Mike has authored numerous papers covering all aspects of Loran-C.

In the past the WGA has not (to my knowledge) considered citizens from other countries. I believe the time has come for an exception.

Best Regards,

John

John D. Illgen
Manager, Field
Testing and Technology
Member, Board of Directors,
Wild Goose Association

cc: WGA Board of Directors
Carl Andren, President
Edward McGann, VP

Exhibit 5

TO: Mr. Leo F. Fehlner, Secretary WGA

FROM: V. L. Johnson, Chairman Constitution Committee

DATE: 25 January 1983

SUBJECT: Review of Board and Executive Committee Powers

The following is in response to request by the Board of Directors at the meeting of October 15, 1982 that review of the Constitution and By Laws be made in regard to the powers of the Board of Directors and Executive Committee with the view to recommending operating procedures to overcome the frequent absence of a quorum at Board meetings and the consequent inability to take binding actions.

The following sections of Article VII of the Constitution are pertinent to this matter:

Section 2. Board Powers
Section 3. Executive Committee
Section 4. Executive Committee Powers
Section 6. Powers of the President

The following sections of Article II of the By-Laws are also pertinent:

Section 1. Board Meetings
Section 2. Quorum
Section 3. Executive Committee Meetings
Section 4. Alternates and Proxy
Section 5. Absentee Ballot

First, in regard to Quorum, attention is invited to Article II, Sections 4 and 5, of the By-Laws which make provisions for Directors unable to attend a meeting to appoint an alternate to attend or to vote by absentee ballot. Our experience, however, is that these provisions are seldom used. Why this is so deserves some thought and consideration as to actions that would encourage the use of these important provisions. It is suggested that this question be presented to the Board for consideration as soon as it can be entered into the meeting agenda.

Attention is also invited to Article II, Section 2, which makes provision for Board meetings to be conducted without a quorum present, but with binding actions of the Board to be ratified by a majority of the Board by written ballot.

Next, in regard to powers of the Board and the Executive Committee, attention is invited to Article VII, Sections 2 and 4, of the Constitution. Here it seems clear that the Board is "responsible for the general management of the affairs of the Association" which would usually be exercised by issuing policies, resolutions, and directives or by the enactment of By-Laws; and that the Executive Committee is "empowered to administer the affairs of the Association in accordance with the policies, resolutions and directives of the Board." Our experience, however, is that the Board spends much time at its meetings tending to matters that could be viewed as administrative affairs and do not need the attention of the Board - provided that the Board has issued the appropriate policies, resolutions, and directives. More attention by the Board to these "general management" actions should allow the Executive Committee to assume more of the administrative load and allow more attention by the Board to overall and long-range concerns of the Association. To insure that the Board maintains an overview of the affairs of the Association, it is recommended that the Executive Committee provide a report of its actions at each Board meeting, in accordance with the intent of the last sentence of Section 4.

Finally, in considering all the above, it appears that enough flexibility has already been provided in the Constitution and By-Laws to allow the Board to act without a quorum being present at each meeting and to allow the Board and the Executive Committee to interact properly. No changes appear to be needed or desirable. It is recommended that the Board give specific attention to unloading itself and that the President increase the attention of the Executive Committee to the administrative affairs of the Association. As this develops, the Board will be able to plan more specific meeting agendas and allow longer notice of meetings, which will allow and perhaps encourage better attendance and more use of the absentee voting provisions of the By-Laws.

Respectively submitted,

VERNON L. JOHNSON

VJ/mm

cc: C. Andren, President

Exhibit 6

January 26, 1983

1982 CONVENTION - PRELIMINARY REPORT

Attendance

66	Advance Registrations
53	On-site Registrations
119	Total Registrations
85	at the Thursday Luncheon
77	at the Friday Luncheon
85	at the Banquet

Receipts (to date)

$11,570	Registrations, Functions, Miscellaneous
500	Advance from WGA Treasury
$12,070	Total Receipts

Expenditures (to date)

$ 8,499.30	Convention Expenses

Balance in Convention Account

$ 3,570.70

Anticipated Expenses

$ 2,000	Proceedings Printing & Binding

Notes:

(1) Hospitality contributions made directly to WGA Treasury not included above. Estimate over $2000.

(2) Direct payment WGA Treasury to Holiday Inn of $2000 not included above.

David A. Carter
1982 Convention Chairman

U.S. Department of Transportation
United States Coast Guard

Commandant
United States Coast Guard

Washington, DC 20593
Staff Symbol: (G-TPP-3)
Phone: (202) 426-1231

Exhibit 7

16562
Serial 157-3
18 JAN 1983

Mr. Carl Andren
President, Wild Goose Association
8841 Monard Drive
Silver Spring, MD 20910

Dear Mr. Andren:

The CCIR (International Radio Consultative Committee of the International Communications Union) in Question 33-1/8 asked those operating radionavigation systems in the band 70-130 kHz what interference protection criteria would be necessary to protect their system from other systems operating in the same band. In response to this question, the UK submitted specific protection criteria (15 dB) required for the DECCA NAVIGATOR System, and the US submitted a description of the types (but not specific amount) of interference which could harm LORAN-C reception. From these responses, the CCIR IV Plenary Assembly in Geneva in February 1982 adopted Report 915 and Recommendation 589, which essentially describes the types of interference harmful to both DECCA and LORAN-C, includes a specific protection criteria for DECCA systems, and recommends that administrations coordinate technical characteristics.

Since Question 33-1/8 will remain open through the next four-year CCIR cycle (1982-1986), I would like to invite the Wild Goose Association to participate in the updating of CCIR Report 915 and Recommendation 589. The Coast Guard LORAN-C Program Manager has also asked the DOT Transportation Systems Center to review previous studies performed on non-pulsed interference (CWI, etc.) to LORAN, and draft a report to the CCIR. Neither TSC nor the Coast Guard plan to actually measure specific interference protection criteria required by typical LORAN receivers. Obtaining specific interference protection criteria for different types of interference is necessary, but will be difficult to do.

US Study Group 8B to the CCIR meets monthly in Washington, DC (usually at the FAA building on Independence Avenue) to discuss maritime, aeronautical and land mobile issues, and prepare a U.S. position for the CCIR. Discussions of Question 33-1/8 may begin as early as June when TSC completes their study, and will continue until agreement is reached on a final paper. The deadline for getting a final paper approved will be early to mid fall of 1983. WGA and its members are encouraged to participate in the study group. Information

16562
Serial 157-3
18 JAN 1983

regarding this issue or the CCIR US study group can be obtained from either Mr. Hersey of my staff, or Mr. R. Dupre, Secretary of USSG 8B (telephone (201) 426-3994).

Sincerely,

W. A. PAPPAS
Chief, Marine Radio Policy Branch
By direction of the Commandant

Encl: (1) CCIR Question 33-1/8
(2) Recommendation 589
(3) Report 915

Copy to: DOT/TSC, Cambridge, MA (J. Lovecchio)
COMLANTAREA (Ao)
G-NRN
G-TES

QUESTION 33-1/8

INTERFERENCE TO RADIONAVIGATION SERVICES FROM OTHER SERVICES IN THE BANDS BETWEEN 70 kHz AND 130 kHz

(1976–1978)

The CCIR,

CONSIDERING

(a) that the Radio Regulations authorize radionavigation, fixed and maritime mobile services in various combinations in the bands between 70 and 130 kHz depending on region;

(b) that radionavigation systems are either operational or being implemented to provide coverage in all regions;

(c) that since radionavigation is a safety service, it is essential that there be no harmful interference to any system of the service;

(d) that both pulse and continuous wave radionavigation systems are used in the separately allocated bands between 70 kHz and 130 kHz;

(e) that separation in time domain of radionavigation signals of one system enables several stations of that system to overlap the same geographic area,

UNANIMOUSLY DECIDES that the following question should be studied:

1. what system parameters must be defined to assure compatibility and to avoid harmful interference between the different systems of the radionavigation service and/or other services authorized in the bands between 70 and 130 kHz;

2. what system factors may cause interference between the same and different types of radionavigation systems where the former operate in the same band and the latter operate in one or more of the other bands between 70 and 130 kHz;

3. what operational characteristics should be recommended to avoid mutual interference between stations providing the same type of radionavigation service?

Note. – See Recommendation 589 and Report 915.

RECOMMENDATION 589 *

INTERFERENCE TO RADIONAVIGATION SERVICES FROM OTHER SERVICES IN THE BANDS BETWEEN 70 kHz AND 130 kHz

(Question 33/8)

(1982)

The CCIR,

CONSIDERING

(a) that radionavigation systems exist or are being implemented in the three Regions;

(b) that various services, including radionavigation systems, operate in frequency bands between 70 kHz and 130 kHz;

(c) that radionavigation being a safety service, all practical means consistent with the Radio Regulations should be taken to prevent harmful interference to any radionavigation system;

(d) that users of phased pulsed radionavigation systems in the band 90-110 kHz receive no protection outside that band, yet may receive benefit from their signals outside the occupied bandwidth;

(e) that in the band 90-110 kHz, different phased pulsed radionavigation systems may operate in adjacent areas, on the same assigned frequency and within the same occupied bandwidth,

UNANIMOUSLY RECOMMENDS

1. that for CW-radionavigation systems in the frequency bands 70-90 kHz and 110-130 kHz the parameter to be used in planning, to avoid harmful interference, should be the protection ratio in terms of wanted to unwanted signals;

* The Director, CCIR, is requested to bring this Recommendation to the attention of the Inter-Governmental Maritime Consultative Organization (IMCO), the International Civil Aviation Organization (ICAO), the International Association of Lighthouse Authorities (IALA) and Study Group 7.

2. that the protection ratio, for (...-radionavigation systems with characteristic ...ush as an existing system (see Report 915) that presently operates in the same bands, should be 15 dB within the receiver passband of ± 7 Hz at 3 dB;

3. that information be exchanged between the authorities operating radionavigation systems in the band 90-110 kHz with those operating other systems outside the band employing highly stable (atomic reference) transmissions;

4. that administrations operating radionavigation systems in the band 90-110 kHz in adjacent areas coordinate the technical characteristics of their individual systems in accordance with the Radio Regulations.

REPORT 915 *

INTERFERENCE BETWEEN FIXED AND MARITIME MOBILE AND RADIONAVIGATION SERVICES IN THE BANDS BETWEEN 70 kHz AND 130 kHz

(Questions 1/8 and 33/8)

(1982)

1. Introduction

In each of the separate allocation bands between 70 kHz and 130 kHz, a number of different services have been approved for transmission to be made on specific frequencies.

It is necessary to recognise that safety aspects of these radionavigation services make it essential that they are able to operate free from harmful interference.

This Report is concerned with the particular case of the Decca Navigator system and the Loran system and gives detailed guidance on the protection necessary in order to operate satisfactorily.

2. Protection of Systems

2.1 *Decca Navigator (DN) system*

2.1.1 *A description of the system*

The DN system uses low power CW transmissions from groups of three or four transmitting stations (termed a Decca chain) that are switched according to a fixed sequence which cycles around the three or four stations every 20 s.

Five frequencies are used for each chain, all frequencies bearing a strict harmonic relation to the other four, and each lying in one of five sub-bands allocated in the Radio Regulations as follows (f = fundamental frequency):

$5f$	in band 70- 72	kHz
$6f$	in band 84- 86	kHz
$8f$	in band 112-115	kHz
$9f$	in band 126-129	kHz
$8.2f$	in band 115-117.6	kHz

The five frequencies transmitted from all stations of each chain are phase locked to each other. The stability of transmission from each station is at least one to three parts in 10^6, although in certain cases (approximately 10% of the DN chains operational today) stabilities of the order of 1 part in 10^{11} will be found due to the use of rubidium frequency standards in the transmitting equipment.

The higher standard of frequency accuracy is sometimes required in certain areas because, during night time when strong sky-wave signals may give rise to poor phase lock, it may be necessary to allow a slave station to run free and to substitute the normal master/slave phase lock by rubidium standards at both master and slave stations.

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* This Report should be brought to the attention of Study Group 7, the Inter-Governmental Maritime Consultative Organization (IMCO) and the International Association of Lighthouse Authorities (IALA).

In this way the necessary degree of effective phase lock between master and slave transmissions is maintained during the night periods.

Currently produced receivers have very narrow band for all frequencies, being approximately 10 Hz at −6 dB points.

2.1.2 *Sources of interference*

The described system is liable to suffer interference from the carrier or side bands, including any spot line frequency in the spectrum, of a transmitter using any of the following types of transmission:

2.1.2.1 CW – continuous wave;

2.1.2.2 modulated CW and/or frequency shift keying;

2.1.2.3 pulsed.

Generally the frequency stabilities of the three sources of interference will be:

(a) Of the order required by the Radio Regulations or as used by some quartz controlled stations (about 10^{-4} to 10^{-8}).

(b) Highly stable as accepted for modern standard frequency and timing purposes which is achieved by use of high stability standards e.g. caesium, rubidium (about 10^{-11} to 10^{-12}).

The effects of the two types of stability (*(a)* and *(b)* above) can be different depending on the spacing between the wanted (DN) carrier and the unwanted (interfering) carrier frequencies, and the degree of stability of the DN carrier.

2.1.3 *Results of interference*

The DN system could be prone to the following four forms of interference from one or more of the six sources identified above (being a combination of those given in §§ 2.1.2.1, 2.1.2.2 or 2.1.2.3.

2.1.3.1 *Co-channel interference* *

Co-channel interference is that experienced in a DN receiver channel from another transmission whose carrier or line frequencies fall within ±5 Hz (but more than ±1 Hz, see § 2.1.3.3 below) of a DN transmission frequency. Interference arises because the DN receiver offers little or no rejection to the interfering signal, which if it is strong enough and is sufficiently phase stable will beat with the wanted DN transmission, and will at a level of the order of +12 dB (wanted/unwanted) signals show considerable distortion in the accuracy of the phase output of the affected channel. Further at +15 dB (wanted/unwanted), triggering of the lane identification signal will be affected if the interference is on the $6f$ or $8.2f$ channels.

2.1.3.2 *Adjacent channel interference* *

Adjacent channel interference is that experienced in a DN receiver from another transmission near to but differing by more than ± 5 Hz from a DN transmission frequency. The interference created by the unwanted signal, being incoherent with respect to the wanted signal, is treated by the DN receiver as if it were noise. The accepted level of interference to the $5f$, $8f$ and $9f$ channels at the input to the DN receiver is +8 dB (wanted/unwanted) while the $6f$ and $8.2f$ triggering remains as in § 2.1.3.1 at +15 dB(wanted/unwanted). Typical DN receiver selectivity characteristics are as follows:

± 10 Hz separation: −6 dB
± 20 Hz separation: −10 dB
± 50 Hz separation: −25 dB
± 100 Hz separation: −37 dB
± 200 Hz separation: −48 dB
± 500 Hz and greater separation: better than −60 dB

In practice the true degree of DN receiver rejection to an interfering signal does depend on the bandwidth of the signal, especially as the wanted DN frequency is closely approached. Signals that are, by their nature (intentionally or otherwise), wideband may not be subject to the degree of rejection expected. Transmission spectrum analysis and local geographical knowledge of the interfering transmitter are therefore all-important for an accurate assessment of the degree of interference to a particular DN chain.

* The expression "wanted-to-unwanted signal ratio" when used in conjunction with an interfering pulsed transmission must be interpreted as "wanted CW to unwanted peak-signal-ratio".

2.1.3.3 *Synchronous interference* *

Synchronous interference will be experienced in a DN receiver from another transmission on a frequency very close (less than +1 Hz) to the DN frequency, especially when the interfering transmission frequency and the DN frequency are each separately stabilised by their own high stability standards.

This is clearly a special, and very serious, case of "co-channel" interference. It can arise if the interfering signal is CW in nature with an effect similar to that caused by co-channel interference with the difference that the DN phase information will in general tend to drift possibly in a slow oscillating manner or at worst (and most dangerous) could be nearly static over long periods of time with large phase errors and/or poor signal/noise characteristic.

The effects very much depend on the wanted-to-unwanted ratio of signal strengths but a +15 dB (wanted/unwanted) figure would keep the phase excursions within acceptable limits.

As regards the lane identification triggering requirement, the (wanted/unwanted) figure for CW interference and sideband interference would be similar to § 2.1.3.1 but if the interference was due to pulse energy (which would not be in existence long enough to cause persistent phase errors but could blank out triggering information for long periods) then this would be "time interference" which is covered in the next paragraph.

The side band or pulse spectral line energy although not in existence long enough as previously stated, to cause persistent phase errors, can upset the channel, causing hunting of the oscillators. A factor of 12 dB (wanted/unwanted) is required.

2.1.3.4 *Time interference*

2.1.3.4.1 *Time interference I*

Time interference will in general only be experienced in the $6f$ or $8.2f$ channels of a DN receiver in the presence of a pulsed interfering transmission. A persistent effect will only be experienced:

- if the interfering transmission is of significantly long duration with respect to the shortest switching period of the DN system (i.e. lane identification triggering – 0.05 s);
- if the pulsed transmission is time coincident with the DN lane identification switching period;
- if the peak spectral line power of the pulsed transmission is strong enough; and
- if it is stable enough.

The effect on the DN receiver is a loss of triggering and the +15 dB (wanted/unwanted) protection factor is required.

2.1.3.4.2 *Time interference II* *

A pulsed transmission can, in specific conditions, cause different interference effects in a DN receiver. If the peak spectral line power of the pulse transmission at a particular location is very much greater than the power of the DN $6f$ or $8.2f$ transmission then the pulsed transmission will shock excite the DN lane identification $6f$ or $8.2f$ triggering. The effect is that the DN receiver will be made to produce false triggers with associated false phase indications. The degree of effect depends on the closeness of the spectral line frequency of the interference transmission to the DN frequency and the pulse repetition rate.

2.1.4 *DN field strength*

As a guide in assessing the degree of interference that a DN receiver can tolerate in any part of a DN chain coverage, Annex I tabulates the following data, together with an example of a calculation of acceptable interference:

Table I : Typical station radiated powers.

Table II-a and II-b : Ground-wave field strengths assuming 100 W radiated power for 70 kHz and 127 kHz for various ground conductivities.

Table III : Typical ground conductivities for various types of terrain.

A safety factor of 6 dB in favour of DN is required for sky-wave effects at night. This effect can cause a decrease in the wanted DN (ground-wave) field and additionally this effect can cause an increase in the strength of the interfering signal if the unwanted signal sky-wave is in phase with its own ground-wave component.

* The expression "wanted-to-unwanted signal ratio" when used in conjunction with an interfering pulsed transmission must be interpreted as "wanted CW to unwanted peak-signal-ratio".

2.1.5 *Quality of data*

The interference protection ratios for DN systems will only be realistic in the solution of problems where there is full knowledge of the characteristics of the interfering transmissions.

2.1.6 *Conclusions*

The Decca Navigator system, in spite of its narrow band design, can suffer a degree of interference from transmission both in its own allocated bands and also from transmissions located in adjacent bands but radiating significant spectral power ('overspill') outside those bands. Care should always be taken to assign frequencies which tend to conform to those outlined in this Report in order to reduce interference to permissible levels. For general planning purposes a wanted/unwanted protection ratio of +15 dB should be adopted with the proviso that, in the decision-making, special care be taken when the transmitted centre frequency, the shift frequency or the spectral line frequency are within close limits of the particular Decca Navigator frequency involved. For the reasons stated in § 2.1.4 it is necessary to include the 6 dB safety factor.

2.1.7 *Interference measurements*

One administration has carried out laboratory interference measurements with Decca Navigator receivers. The description of the measurements and the results are given in Annex II.

The receivers used for these tests were manufactured by that administration and were licenced for use only in the domestic waters of that administration.

2.2 *Loran system*

2.2.1 *Introduction*

The users of phase pulsed hyperbolic radionavigation systems, also identified as Loran, place reliance upon its normal navigational role. When harmful radio interference occurs, the navigational information display ceases and appropriate warning signals appear. The user, however, is neither able to identify the interfering source nor able in many cases to retune filter traps. This is because the receiver output is designed for navigational displays and provides no audible outputs to monitor the interfering signal as is possible in communication services. Even if provided, the navigational user is unqualified to identify the harmful interference. For these reasons and the significance of navigational failures, it is essential that administrations support measures to prevent harmful interference through technical monitoring and cooperative approaches.

Present receivers have significant technical design improvements over early Loran radionavigation receivers. Similarly, considerable effort is devoted to transmitter design and continuous monitoring of spectral output. The reduced costs of radionavigational receivers for Loran in no way reflect any reduced technical design. In fact, present receivers surpass all performance specifications of early generations including selectivity and processing as can be easily verified.

Regardless of technological advances, certain types of signals in the time-domain and in relative amplitude relationships can seriously impact upon safe radionavigational use including transmissions outside but in proximity to the radionavigation band. In addition, operation of radionavigation systems within the authorized band must be coordinated among operating administrations. These are described generally herein.

2.2.2 *Highlights of the radionavigation service as affects interference considerations*

Pulsed hyperbolic radionavigation systems utilize a chain of three to five transmitting stations in which the master and secondary stations transmit synchronized pulses at precise time intervals. In all Loran stations, the transmissions are controlled in absolute time by atomic clock. The time difference as received is measured in millionths of a second and displayed for either plotting a line-of-position on nautical charts or, in some equipment, is further processed by microprocessor to display latitude and longitude. For technical accuracy, receiver processing tracks the envelope and the third zero-crossing of each pulsed train of eight or nine for the secondary or master respectively.

The Loran signal is an amplitude modulated burst of energy which rises to a peak in 60 μs and decays to zero in approximately 300 μs. The signal contains 99% of its energy between 90 and 110 kHz. Stations in each chain are assigned specific group repetition intervals (GRI) and by which the receivers servo loops identify the transmitters being tracked. The frequency modulated on the analog pulse is related to the GRI assigned as:

$$f = \frac{1}{2\,(GRI)}$$

This product is a precise value for any chain in the neighbourhood of 5000 Hz, atomic clock controlled.

In order to control skywave contamination or confusion between skywave and the desired groundwave, system design for any coverage area ensures that all processing information is within 40 μs. This is because the first reflection skywave typically arrives 30 to 50 μs after the groundwave. Unfortunately, as the receivers band limiting filter is configured to reject energy beyond the 90-110 kHz band, the filter disperses the pulse in time which makes it more difficult to separate the time differences.

The receiver performance accordingly may be viewed in simplification as susceptible to two forms of interference. It is first susceptible to any amplitude form that masks the ability to faithfully track the zero-crossing of the radionavigation signal or the amplitude modulation of the envelope. It is secondly highly susceptible in the time domain to any signal which is precisely synchronous or near synchronous. In order to control the effects of strong signals in amplitude, slot filters are included in receivers. However, if too close to the amplitude modulated radionavigation signal band, slot filters degrade the faithful reproduction of the necessary envelope.

Lastly, it is the responsibility of the operating administration to ensure proper transmitted signals. This is accomplished by continuous monitoring, both in time as well as spectrum, by a radionavigation system monitoring station in the region of coverage. It is this station which is capable of identification, as least by frequency, of interfering sources to the radionavigation service. The lack of user interference reports may be misleading since only the monitoring station has the necessary equipment and records. In fact, the monitoring station advises the users of necessary slot filter adjustment.

2.2.3 *Amplitude signal impacts*

This form of interference results in masking or desensitizing of receiver input, within the radionavigation band approximately 10 to 15 kHz bordering the radionavigation band limits. The degree of this problem is related conventionally to spectral-geographical considerations based upon the relative signal densities.

The most common form of this interference is from communication services. The keying rate or modulation is not significant, but the relative power ratios are when sufficient to offset the time systems. Slot filters provide narrowband rejection in most cases, provided that no more than approximately four separate cases exist.

The worst case interference of this nature stems from bandwidth of the transmitted signal where the signal, such as multiplexed printers, exceed the rejection band of conventional slot filters.

The other type of communications interference stems from daily or hourly changes in the center of emissions as an example. A backup communications system which is activated at random is extremely difficult to cope with. That is, it is on or off faster than users can adjust its rejection as notified by monitoring stations.

2.2.4 *Time domain, navigation-to-navigation system*

This type of interference is related to the provisions of Radio Regulation No. 453, and applies to radionavigation systems operating in the band 90-110 kHz. All administrations operating radionavigation systems in the band are urged to coordinate technical and operating characteristics so as to avoid system-to-system interference. This is accomplished by GRI and timing since all stations are on the same center frequency (100 kHz).

Analytical techniques using computers are available to designate the necessary time-domain characteristics of phase pulsed systems and confirm accurate coverage of the required service area. The United States, as one of several administrations operating Loran, is prepared to provide advice for any planned system or recommend suitable timing characteristics to the mutual benefit of all users.

Although a formal coordinating mechanism is not established pursuant to the intent of Radio Regulation No. 453, direct coordination has been accomplished on an ad hoc basis among several administrations concerned. Representatives of the United States and of the Soviet Union met in June and December of 1980 in regard to coordination of overlapping systems. Ad hoc meetings have also been conducted with representatives of the United States and the United Kingdom.

2.2.5 *Time domain, frequency and time standard broadcasts*

This interference is most severe from atomic clock controlled emissions outside of the radionavigation band where the signals in absolute time are either in precise or near synchronous with the Loran signal. The extreme sensitivity through coherent processing in the radionavigation receiver makes it susceptible to precise time emissions at frequencies greatly beyond those adjacent to the radionavigation band. Any emission which generates 5000 Hz in absolute time disrupts the proper functioning of the tracking loops.

An example is the transmission of standard frequencies in the United States (Boulder, Colorado) on 60 kHz which requires special filters in all radionavigation receivers utilized near U.S. waters. In laboratory controlled tests, an interfering signal on 85 kHz caused receiver (100 kHz) malfunction within 0.02 Hz of precisely 85 000 Hz. Degrees of moving interference existed in all cases approaching 5000 Hz multiples. All emissions of a precise time structure should consider using odd multiples of 2.5 kHz insofar as low frequency time and frequency standard services may be broadcast near maritime regions., The availability of phase locked loops and synthesizers provide inexpensive means to convert such transmissions to any standard frequency desired by the user.

A form of precise frequency interference in the time domain has been observed in the case of major radio transmitting complexes where a precise clock is used to synthesize all transmit frequencies for communication transmitters. In all cases investigated, the interference was corrected by careful tuning of the synthesizer outputs. These investigations continue and may result in recommendations as to tuning procedures or offsets of a major degree.

ANNEX I

DATA AND EXAMPLE

TABLE I

Frequency	Radiated power (W)	
	100 m single mast	50 m 3-mast T
5*f*	93.8	43.0
6*f*	97.9	49.5
8*f*	116.8	58.0
8.2*f*	122.0	62.5
9*f*	131.5	66.5

TABLE IIa – *Ground-wave field strength at 70 kHz (dB(μV/m)) for radiated power of 100 W, for 6 conductivity values*

Conductivity (S/m)		5	10^{-2}	2×10^{-3}	10^{-3}	5×10^{-4}	10^{-4}
Range (km)	(NM)	Field strength (dB(μV/m))					
50	(27)	65	65	64	63	62	56
100	(54)	59	59	58	57	56	48
150	(81)	55	55	54	53	51	41
200	(108)	52	52	51	49	46	34
250	(135)	50	50	48	46	43	30
300	(162)	48	48	46	44	39	25
350	(189)	46	46	44	41	36	21
400	(216)	44	44	42	39	33	18
450	(243)	43	43	40	37	30	15

NM: nautical miles.

TABLE IIb – *Ground-wave field strength at 127 kHz (dB(μV/m)) for radiated power of 100 W, for 6 conductivity values*

Conductivity (S/m)		5	10^{-2}	2×10^{-3}	10^{-3}	5×10^{-4}	10^{-4}
Range (km)	(NM)	Field strength (dB(μV/m))					
50	(27)	64	64	63	61	58	49
100	(54)	58	58	57	55	52	36
150	(81)	55	55	52	50	45	28
200	(108)	51	51	49	45	38	21
250	(135)	49	49	46	41	33	16
300	(162)	47	47	43	38	28	12
350	(189)	45	44	40	34	24	8
400	(216)	44	43	38	31	19	4
450	(243)	42	41	35	28	16	0

NM: nautical miles.

TABLE III – *Typical conductivity data*

Quality	Example of medium	Value (S/m)
Best	Sea water	5
Good	Land of South England, East Anglia	1×10^{-2}
Average	Approaches to Pennines	2×10^{-3}
Poor	Pennines, Exmoor, sandy desert	1×10^{-3}
Bad	Scottish Highlands, parts of Scandinavia	5×10^{-4}
Very bad	Parts of Norway, North Canada (Laurentian Shield), Greenland	$\leqslant 1 \times 10^{-4}$

EXAMPLE

Question

What CW (0.1 A1) interference level is tolerable at 170 nautical miles over poor terrain if the Decca Navigator station 6*f* transmission is 50 W (from a 50m, 3-mast T antenna)?

Answer

Conductivity (see Table III)	= 10^{-3}
Ground-wave field strength: 100 W (see Tables II-a and II-b)	= 38 dB(μV/m)
Correction for 50 W transmitted power	= −3 dB
Correction for sky-wave (see § 2.1.4)	= −6 dB
Protection requirement	= −15 dB
Therefore:	
If no DN receiver circuit rejection	= +14 dB(μV/m) tolerable (upper limit)
If CW interfering signal frequency 500 Hz removed from DN signal frequency (see § 2.1.3.2)	= +60 dB
Therefore if full DN receiver circuit rejection	= +74 dB(μV/m) tolerable (upper limit)

ANNEX II

INTERFERENCE TO DECCA NAVIGATOR SYSTEM – LABORATORY MEASUREMENTS (JAPAN)

1. Test outline

1.1 *Instrumental configuration*

Figure 1 shows the block schematic where a Decca signal generator and an interference signal generator feed wanted and unwanted signals to the test receiver, respectively. Simulating various interference conditions with this instrumentation, the Decometer and the LI indications were taken to determine the wanted/unwanted signal ratio.

1.2 *Test signal*

The unwanted CW frequency was varied around the wanted Decca frequency to monitor close interference. The point frequencies were chosen as the ones being separated by 0.4 Hz, 1.0 Hz, 5.0 Hz, 20.0 Hz and 100.0 Hz from the wanted. (For some tests, the unwanted frequencies were set at the points over 100 Hz from the wanted.)

To examine the influence of keyed signals, the unwanted input signals at the frequency of each CW above were keyed to have a 100 ms-period and synchronized to the LI signal.

2. Test results

The results are summarized in Fig. 2 to Fig. 6.

Figures 2, 3 and 4 present the influence of the unwanted signals on the Decometer indication.

Where:

in Fig. 2 – parameter, lane error, test receiver; MS-5A, wanted level; 40 dBμV, unwanted mode; CW;

in Fig. 3 – parameter; lane error, test receiver; MS-3A, wanted level; 40 dBμV, unwanted mode; CW;

in Fig. 4 – lane error; constant (0.01 lanes), test receiver; MS-3A, wanted level; 40 dBμV, unwanted mode; CW.

Figures 5 and 6 display the influence of the unwanted signals on the Decca lane values.

Where:

in Fig. 5 – parameter; lane identification probability, test receiver; MS-5A, wanted level; 40 dBμV, unwanted mode; CW,

in Fig. 6 – parameter, lane identification probability, test receiver; MS-5A, wanted level; 40 dBμV, unwanted mode; keyed.

3. Summary

In this Report it is concluded that for general planning purposes there should be a wanted/unwanted protection ratio of 15 dB, and an additional 6 dB for safety factor on account of the skywave at night.

The test result indicated that, if a Decometer indication error of 0.01 lanes is considered to be acceptable, the value 0.01 lanes is always retained when the wanted/unwanted ratio was 15 dB or more.

Additionally, from Fig. 5 which shows the results at a specific test condition for the given receiver, it is shown that for example, an 80% probability of lane identification requires approximately 19 dB of the wanted/unwanted ratio when skywave contamination is not taken into account.

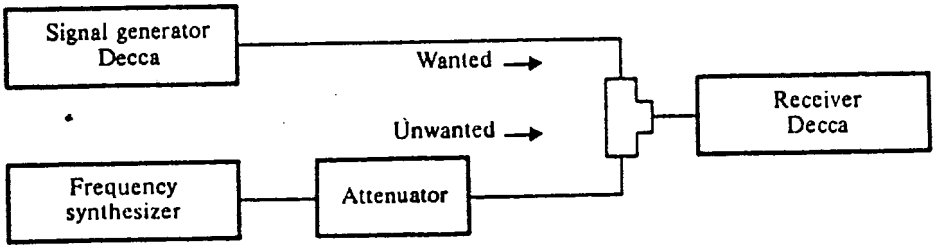
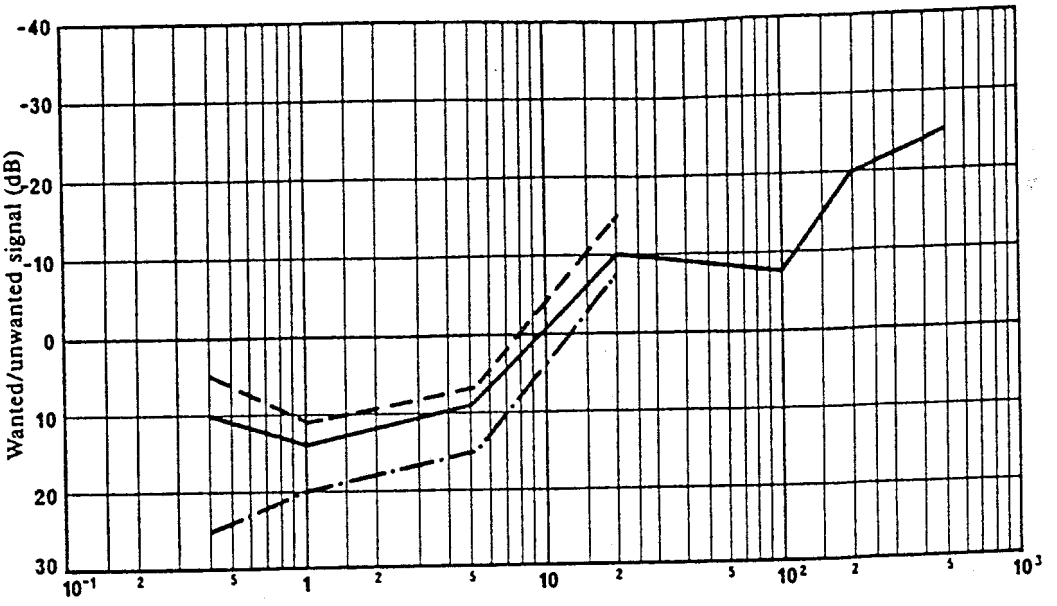


FIGURE 1 – *Test configuration block diagram*



Deviation of unwanted frequency from wanted (Hz)

FIGURE 2 – *Interference to Decometer indication*

— — — — : lane error ± 0.02

———— : lane error ± 0.01

—·—·—· : lane error ± 0

Center frequency: 85.005 kHz
Chain code: 5C
Wanted level: 40 dB(μV)
Decca pattern: red
Unwanted mode: CW
Frequency code: 6*f*

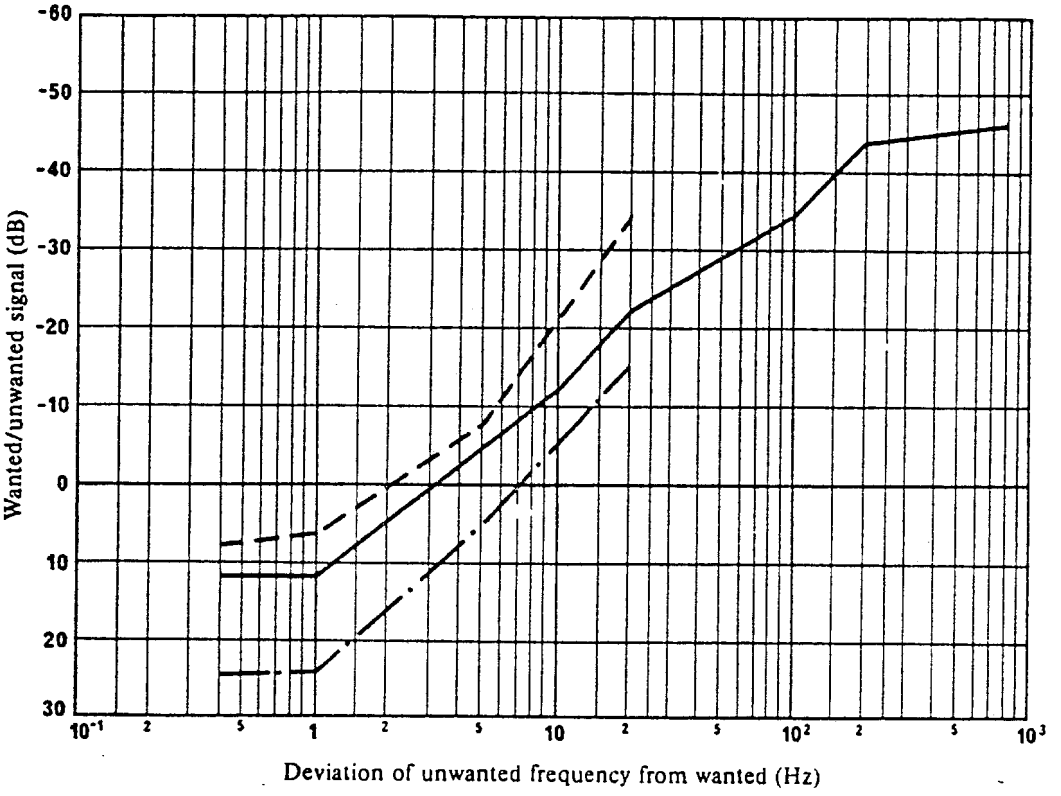


FIGURE 3 – *Interference to Decometer indication*

– – – – – : lane error ± 0.02

——————— : lane error ± 0.01

—·—·— : lane error ± 0

Center frequency: 85.005 kHz
Chain code: 5C
Wanted level: 40 dB(μV)
Decca pattern: red
Unwanted mode: CW
Frequency code: 6*f*

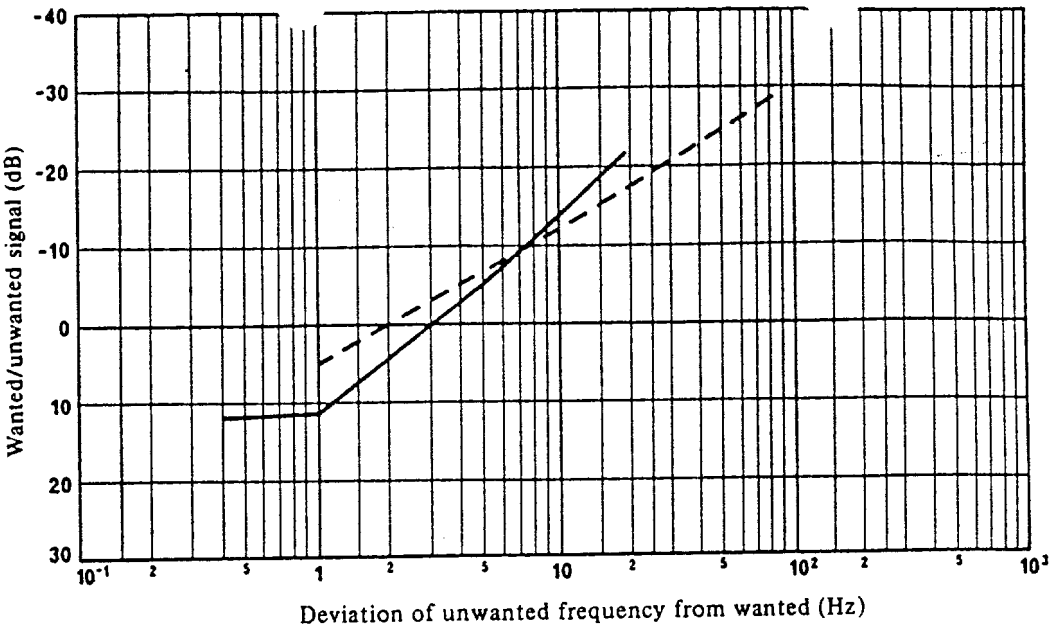


FIGURE 4 – *Interference to Decometer indication*

– – – – – : unwanted 100 ms keying

——— : unwanted CW

Center frequency: 85.005 kHz
Chain code: 5C
Wanted level: 40 dB(μV)
Indication lane error: 0.01
Frequency code: 6*f*

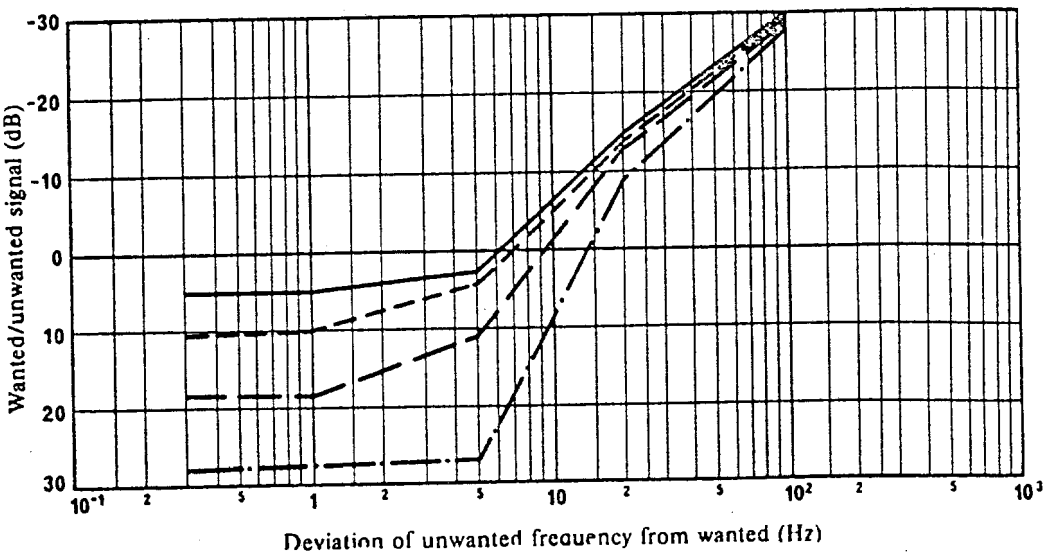


FIGURE 5 – *Interference to lane identification*

Parameter: lane identification probability

——— : 0%

– – – – – : 50%

— — — — : 80%

—·—·— : 100%

Center frequency: 85.005 kHz
Chain code: 5C
Wanted level: 40 dB(μV)
Unwanted mode: CW
Frequency code: 6*f*

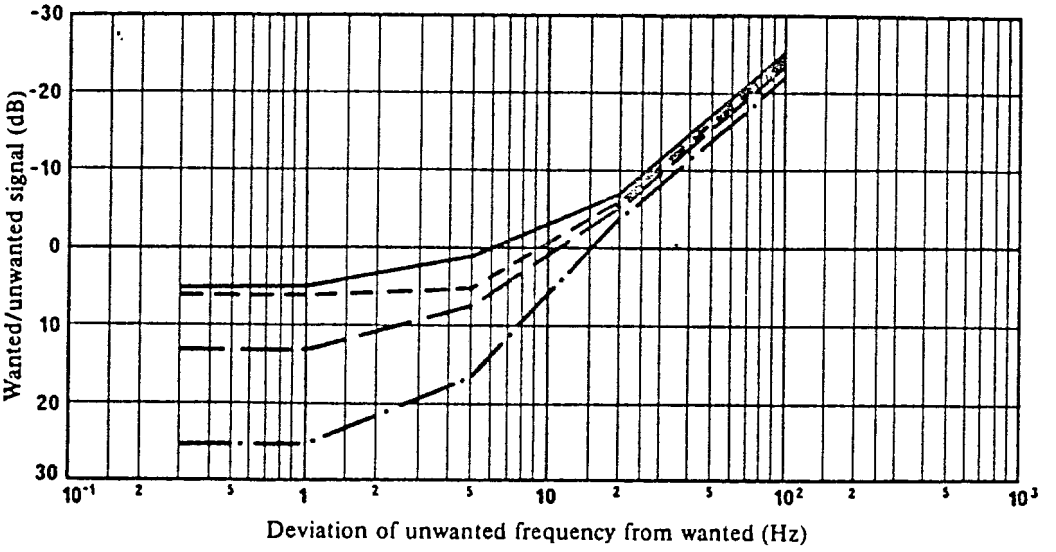


FIGURE 6 – *Interference to lane identification*

Parameter: lane identification probability

——————— : 0%

— — — — — : 50%

— — — — - : 80%

— — - — — : 100%

Center frequency: 85.005 kHz
Chain code: 5C
Wanted level: 40 dB(μV)
Unwanted mode: pulse
Frequency code: 6*f*

FOR AGENDA

Doc. 22942/2-2.8.2.1/1.9.162/4.24
Ref: Doc. 22507/1-2.8.2.1/1.9.162/4.24

Exhibit 8

TO: Mr. Andrew
FYI per direction of
(ABL)
FWD BY: [illegible]
DATE: 1-3-83

To be considered by FCC Commissioners JAN 83

Note for Joe Hussey G-TPP-3, 202-426-1231

THIS IS BAD NEWS

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

In the Matter of	)	
	)	
Amendment of Parts 2, 15, and 90 of the Commission's Rules to provide recognition for power line carrier operations of electric utilities in the bands 10-490 kHz.	)	Gen. Docket No. 82-9 RM-3747

REPORT AND ORDER

Adopted: Released:

By the Commission:

SUMMARY

1. This action amends the Commission's Rules to implement a new U.S. Footnote to provide enhanced recognition of electric power utility Power Line Carrier (PLC) systems in the 10 to 490 kHz frequency band. Rules establishing a notification procedure, a notification activity, and a data base are also adopted so that band occupants can cooperate in minimizing or eliminating mutual interference. 1/

BACKGROUND

2. On January 13, 1982, the Commission adopted a Notice of Proposed Rulemaking (47 FR 3799, January 27, 1982) in the above captioned matter in response to a petition filed by the Utilities Telecommunications Council (hereinafter UTC) 2/. The Notice proposed the possible amendment of Part 2 of the Commission's Rules to include a U.S. Footnote governing PLC operations, the inclusion of a new Section in Part 15 to cover PLC operations, and the amendment of Part 90 to provide for the notification and data base requirements applicable to PLC systems. Two footnote versions, one suggested by UTC and one by the Interdepartment Radio Advisory Committee were released for comment. Also, the Notice requested comments regarding the need and effects of continued use of the 10-14 kHz and 90-110 kHz band segments by PLC users.

3. Power Line Carrier is a telecommunications technique used by the electric power utility entities for protective relaying, general supervision of their power systems and voice communications. The technique uses the power

1/ The term notification as used herein should not be confused with the "notification" procedure for equipment authorization which is the subject of Docket No. 82-242.

2/ UTC is the national representative on telecommunications matters for the nation's electric, gas, water and steam utilities.

transmission lines as the propagation medium for the radio frequency signals with the PLC transmitters and receivers being coupled to the power transmission lines by means of matching networks. PLC systems operate between 10 and 490 KHz using low power transmitters. Both Government and non-Government PLC systems operate in this band and there are more than 2000 electrical utility entities using approximately 20,000 PLC terminals. PLC systems operate on an unlicensed basis as restricted radiation devices under Part 15 of the Rules. As a consequence, PLC systems can operate as they have for 40 years only on an unprotected, noninterference basis to authorized stations and receive no protection from authorized radio stations. This rulemaking merely provides the means to make PLC Systems occupants aware of the presence of radio systems so that interference situations can be anticipated and avoided whenever possible and so that PLCs can continue to fulfill the important function they serve in providing the nation's power utility needs.

SUMMARY OF COMMENTS AND REPLY COMMENTS

4. Thirty parties submitted comments in the proceeding, twenty-four of which were filed by utility companies or their representatives. The other six commentors included Aeronautical Radio, Inc. (ARINC), The American Telephone & Telegraph Co. (AT&T), The Department of Energy (DOE), The Electronic Industries Assoc. (EIA), The Manufacturers Radio Frequency Advisory Council (MRFAC), and the Tennessee Valley Authority (TVA). Reply Comments were filed by the Utilities Telecommunication Council. All comments were generally favorable to the rulemaking and a list of all commentors in the proceeding is contained in Appendix A.

5. Comments filed by the utility companies reflected three areas of agreement considered important to power line carriers using the 10-490 kHz band. These areas of agreement are summarized as follows:

(a) Adopt a U.S. Footnote in the National Table of Frequency Allocations to set forth the basis for PLC recognition.

(b) Allow continued access to the entire 10-490 kHz band for PLC operations.

(c) Provide a notification procedure designed to anticipate and to avoid most interference situations involving PLCs.

6. The comments of the utilities unanimously supported the proposal to adopt a U.S. Footnote in the frequency table. UTC commented that since the major radio and radionavigation users of the 10-490 KHz band are Government administered, a U.S. Footnote would be the most beneficial to alert the principal users. Florida Power and Light added that a U.S. Footnote would place all users, both Federal Government and non-Government, on notice of the existence of PLC systems in the band. DOE and TVA also supported the adoption of a U.S. Footnote. Further, DOE and the National Electrical Manufacturers Association (NEMA) stated that the U.S. Footnote proposed by UTC which would "require cooperation" is considered preferable to the National Telecommunications and Information Administration version which "urges cooperation" in preventing interference situations. ARINC, on the other hand, supports the NTIA suggested footnote which, it says, sets forth more clearly the basis under which PLC systems must operate.

Exhibit 8

7. Commenting parties also oppossed restricting the use of any segment of the 10-490 kHz band by PLCs and denied that PLCs cause harmful interference to OMEGA and LORAN-C radionavigation systems that operate in the 10-14 kHz and 90-110 kHz bands, respectively. UTC argued that there are over 2500 PLC users between 90-110 kHz and that exclusion of PLC operations from the 10-14 kHz band and the 90-110 kHz bands is unwarranted in view of the absence of documented interference from PLCs. General Electric commented that the 90-110 kHz band is an optimum band for PLC use based on the relative cost of installation and its good, low-loss transmission characteristics. Rochester Gas and Electric Corp. stated that excluding PLCs from segments of the band would have a substantial economic and technical impact due to the high cost to relocate and the already congested usage of microwave frequencies. Atlantic City Electric Co. submitted that compatibility of PLC systems with OMEGA and LORAN-C, would be bolstered by implementing the proposed notification procedure. DOE commented that there are no alternate frequencies available if PLC operation is excluded from the OMEGA and LORAN-C bands and also referenced a General Accounting Office report which considered terminating the use of LORAN-C in favor of radio positioning by satellite.

What BS!

8. The proposals for establishing a notification procedure and data base were also widely accepted by the comments filed. UTC supported the two-way notification procedure whereby use of frequencies by PLC systems would be revealed to radio users in advance of such use and FCC and NTIA frequency assignment would be made known to PLC users in advance also. To implement the procedure UTC agreed that it is ready, willing and able to incur the expense and burden of establishing a centralized PLC data base and to serve as, or work with, an approved industry-operated entity. DOE agreed that the notification procedure should be as simple as possible and that the data base include only such information as is necessary to alert the users of potential problems. ARINC suggested that because the FAA coordinates and assigns non-directional beacon frequencies and maintains the data base for aeronautical radionavigation facilities that perhaps the FAA should handle the notification procedure and not the FCC. AT&T's comments on the notification procedure suggest that the data base contain the route and location of the energized power line. It further suggested that access to data base information be made available on request to interested parties. ARINC, AT&T and MRFAC agreed in their comments that the notification action should not afford any change in status to unlicensed PLC operation.

9. Other comments in the proceeding suggested modifications to the proposed Parts 15 and 90 Rules that would govern PLC operation. AT&T and EIA suggest that the definition of PLC be clarified to show its application only to the transmission system, that is, exclusive of those lines which connect the distribution substation to the customer. They stated that using the nomenclature "transmisssion power line carrier" would clearly distinguish it from distribution power line carrier or building power line carrier systems. DOE suggested that Section 15.7(e) be modified to show that the PLCs excepted in the Note concern only those used by electric utilities and not all carrier current systems. ARINC, on the other hand, stated that PLCs should not be excepted from compliance under Section 15.7 of the rules which provides objective standards for operation. ARINC argued that the proposed new Section 15.8 does not propose any technical standards to govern PLCs. GE and NEMA suggested that Section 15.8 be modified to state that interference should not be caused to "authorized stations". NEMA added that this modification would

help maintain the existing status of PLCs relative to other incidental and restricted radiation devices. Finally, UTC commented that Sections 15.8 and 90.63 should be clarified to show that the data base information should apply to existing, additions to existing, and changes to existing systems. UTC also requested that Section 15.8(c) be modified to specify that "harmful" interference should not be caused to an authorized or licensed radio service.

10. The single Reply Comment in the proceeding was filed by UTC. UTC stressed that none of the comments opposed the implementation of a U.S. Footnote and that, in fact, most comments vigorously supported this approach and a U.S. Footnote should be adopted. UTC also replied that the North American Electric Reliability Council (NERC) had agreed to undertake the compilation and operation of the PLC data base and that UTC would work with NERC in this effort if the Commission and NTIA approved them to act as the notification activity. It further pointed out that none of the comments filed gave any support for restricting PLC from the use of any portion of the 10-490 kHz band. In addition, UTC opposed ARINC's suggestions that the FAA, and not the FCC, oversee the notification process on the basis that the FAA does not regulate all users of the 10-490 kHz band. UTC also objected to ARINC's recommendation that PLCs remain subject to Section 15.7 of the Rules. UTC stated that the proposed language of the new Section 15.8 clearly places the burden of noninterference on PLC users without imposing arbitrary radiation levels. Further, UTC's replies supported the comments of AT&T and others regarding clarification of the PLC definition to specify the transmission aspects. However, UTC opposed AT&T's suggestion that Section 90.63(h) 3/ be modified to require the submission of PLC routing information on the basis that such a requirement would present a monumental task and cost to the utilities to gather and store all the necessary data. In addition, UTC opposed AT&T's suggestion to make the data base information available to other interested parties unless they were bona-fide users of the band. Finally, UTC replied to MRFAC and reiterated that the proposed rules would not elevate PLC operation from unlicensed to licensed status. UTC also suggested that MRFAC members could benefit from the information in the data base since they could check the frequency selected for the operation of their remote control devices against that used by local PLC systems.

DISCUSSION

11. The Commission in its NPRM in this proceeding recognized the importance of PLC operation in monitoring and protecting the electrical transmission systems that supply energy to the nation's homes and businesses. The Commission also agreed that because of the importance of the nationwide functions performed by PLC systems, enhanced recognition of its importance is desirable and in the public interest. The Commission further stated that because PLCs operate under the unlicensed provisions of Part 15, our first concern is that any recognition of PLC systems not be interpreted as the promotion of PLC at the expense of other users. Based on several comments in the proceeding which incorrectly speak of coordination rather than notification and of maintaining existing status of PLC relative to other Part

3/ Section 90.63(h) is redesignated, Section 90.63(g) hereinafter due to Section renumbering.

15 users, the Commission seeks to dispel any misunderstanding concerning the intent of this proceeding. Accordingly, the Commission wants to reaffirm its position that this proceeding does not elevate the status of PLCs in any way and that their operation in the band must be on an unprotected, noninterference basis to authorized users and at the same time on a coequal basis to other unlicensed users operating under Part 15 provisions. Cooperation between parties to the extent practicable is expected but, in any event, the PLC users must realize that in the event conflicts on spectrum usage cannot be resolved on a cooperative basis, their operation on a nonallocated basis must adjust to meet the requirements of the authorized radio users.

Footnote Implementation

12. The Commission in its Notice requested comments regarding the following three alternative footnote approaches:

(a) Establish a US Footnote to afford recognition to PLCs 4/.

(b) Establish an NG Footnote 5/ to afford recognition to PLCs with similar language in the NTIA manual.

(c) Establish no footnote but incorporate the language and necessary elements of the footnote into Parts 15 and 90 of the Commission's rules and into the NTIA manual.

Strong support was received from commentors for alternative (a) to establish a U.S. Footnote to afford recognition for PLCs. At the same time, no public support was expressed for alternatives b or c. The Commission agrees with the commentors who stated that, since the major radio users of the 10-490 kHz band are administered by the Federal government, a U.S. Footnote in the FCC and NTIA allocation tables would be most appropriate. A U.S. Footnote provides clear recognition of PLC systems and alerts frequency managers and table users to the presence of PLC systems while clearly setting forth the basis for PLC usage of the band. Further, the U.S. Footnote approach provides the most abbreviated and least cumbersome means of informing government and non-government users of the band of PLCs systems operation. Regarding the selection of the UTC or Interdepartment Radio Advisory Committee (IRAC) model for the U.S. footnote, the Commission favors the IRAC version which is the more concise of the two. In addition, the IRAC version clearly stresses that the notification process will be determined by the FCC and NTIA Rules. Furthermore, the IRAC language which "urges" users to minimize potential interference is believed to be more in keeping with the nature of a notification action. On the other hand, the stricter UTC language could be misinterpreted to convey that Commission or NTIA intervention for enforcement purposes is expected if parties will not cooperate, a situation which would implicitly elevate the status of PLC operators in an unintended manner.

4/ A US footnote denotes a stipulation the application of which is a matter of agreement between the Commission and other appropriate Government agencies.

5/ An NG Footnote denotes a stipulation applicable to non-Government stations.

Full Usage of the 10-490 kHz Band by PLCs

13. The Commission's request for comments regarding the need and effect of restricting PLC operation from the 10-14 kHz and 90-110 kHz band segments generated considerable negative response. As noted earlier, there were no comments that favored restricting PLC operation in the 10-14 kHz and the 90-110 kHz band segments. Moreover the PLC findings of the IRAC AD HOC 162 REPORT on PLC 6/ affirms the Commission's belief that PLCs can, at least for the time being, continue to operate compatibly in the entire 10-490 kHz band on a noninterference basis. In addition, compatibility should be further served by implementing the notification procedure designed to anticipate and avoid interference situations before they arise. Further, the notification procedure will allow authorized users, upon receipt of notification of a proposed PLC installation, an opportunity to object to the use of a frequency if interference is anticipated.

Notification Procedures

14. The Commission is pleased by the support expressed for the establishment of a notification procedure for PLC operations. It is also helpful that NERC has agreed to serve as the industry-operated entity to oversee the compilation and operation of the data base. Also, the Commission agrees with the comments that the notification procedure be kept as simple as possible and believes that listing the PLC transmitter and receiver locations and the other parameters set forth in Section 90.63(g) will be adequate information for the data base for PLC operations. To attempt to compile routing information for every PLC line involved as suggested by AT&T would be a monumental task and would be of little more benefit than knowing the transmitter and receiver locations from where the PLC signal originated. Regarding the ARINC request that FAA and not the FCC be responsible for the notification procedure, Commission involvement is considered quite appropriate since it administers the non-Government allocations for the band and is engaged in frequency coordination with NTIA. The FAA will not, however, be excluded from this activity particularly when operation involving radio beacon frequencies is contemplated.

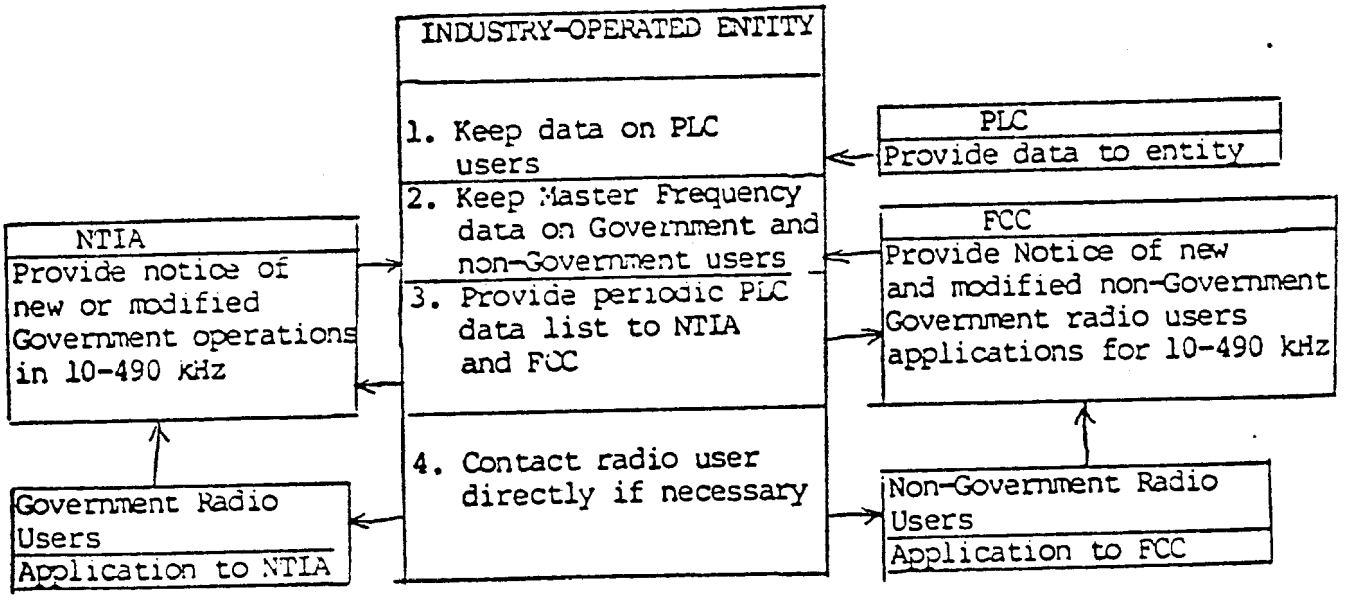
15. The industry-operated group, or NERC, will have a two-fold responsibility keeping the necessary data on PLC users and obtaining data on Government and non-Government users in the 10-490 kHz band from the Government and non-Government Master Frequency Files. The initial Master File data can be obtained by NERC from the FCC and the NTIA. Thereafter notices of new or modified station data will be provided to NERC to update the files. By comparing the data compiled on PLC and authorized radio users, NERC can determine the proximity of operations and anticipate interference situations. If NERC perceives that a potential problem exists between a PLC location and an applicant or authorized user, it can contact the user directly to determine if any adjustments can be made to the operation and if so, whether the user is willing to make such changes. However, it must be

6/ AD HOC COMMITTEE 162 REPORT TO IRAC, April 7, 1981. A copy of this report is contained in the Docket file. While some members of the Committee did not support full usage of the band by PLC's, the Reports findings did not recommend exclusion of PLC's from the 10-14 kHz and 90-110 kHz band segments.

remembered that because PLC operation is on an unallocated, noninterference basis, the notification process shall not preempt authorized users from having access to a frequency at a later time. NERC shall also provide the Commission and NTIA with monthly or periodic lists with supplements of PLC operations in microfiche form (number of copies to be determined) for information purposes. NERC may, of course, make arrangement for the release of its data on PLC operations to parties that have a need for the information.

16. One important requirement for the industry-operated entity to qualify to receive information on Government stations is that necessary security clearance be obtained to handle any classified data involving Government operations and to protect against the unauthorized disclosure of classified information. While the entity may discuss individual frequency problems with users, it shall not release data concerning Government stations to any entity. The Commission and NTIA agree on the selection of the North American Electric Reliability Council to serve as the designated entity subject to the attainment of the proper security clearances. Changes to the entity serving in this manner or to the details necessary for the functioning of the entity may be approved by the Commission and NTIA by written correspondence. To summarize, the following diagram illustrates the functions of the notification activity and the notification procedure authorized for PLC operations:

PLC NOTIFICATION PROCEDURE



Rule Modifications

17. The Commission agrees to implement some of the changes suggested to the rules governing PLC operation. As stated in the NPRM, the proceeding applies only to those PLC systems performing the transmission function between the power plant and the electrical substation. Accordingly, our rules will be modified so that the definition will clearly exclude those operations between the substation and the customer and will be moved from Section 15.8 to 15.4 to set it apart with the other definitions. Also as suggested by UTC, the inclusion of the word "harmful" to describe interference in Section 15.8(c), is consistent with other Part 15 language and will be included. We further agree that the note in 15.7 be modified so that it remain applicable to other carrier current systems. Further, we agree that Section 15.8(b) should be modified to apply to all existing PLC users to insure that the initial data base will contain all necessary information. Since the effort is in the best interest of all PLC users, the Commission expects existing users to voluntarily cooperate in the notification procedure. Moreover, we agree with the modification suggested by UTC that Section 90.63(g) be amended to include in the notification process, changes to existing systems. Finally, we are amending Part 90.63(g) to include the receiver location of PLCs as a parameter to be furnished for the data base rather than requiring extensive routing information.

Action

18. In view of the public comments and considerations discussed herein, we are amending the Commission's Rules in response to the Notice of Proposed Rule Making. Accordingly to provide appropriate recognition for PLCs and to provide for a notification activity and notification procedure to help anticipate and avoid potential interference problems, the following rule changes are adopted:

A. Section 2.106, Footnote U.S. 294 is added to provide recognition for PLC operations between 10-490 kHz.

B. Parts 15 and 90 are amended as proposed in the Notice with certain minor modifications included for clarity.

C. Designation of the North American Electric Reliability Council to serve as the notification activity subject to receipt of the required security clearances.

19. For further information regarding matters covered in this document contact Sam Tropea (202) 653-8167.

20. Accordingly, IT IS ORDERED, that, pursuant to the authority contained in Sections 4(i) and 303(c) of the Communications Act of 1934, as amended, the Commission's Rules ARE AMENDED as set forth in the attached Appendix B, effective _____.

(8)

21. IT IS FURTHER ORDERED that the proceeding is TERMINATED.

FEDERAL COMMUNICATIONS COMMISSION

WILLIAM J. TRICARICO
Secretary

Attachments:

Appendices A and B

APPENDIX A

COMMENTS FILED BY

Aeronautical Radio Inc.
Alabama Electric Corporation
Alabama Power Company
American Electric Power Service Corporation
American Telephone and Telegraph Company
Atlantic City Electric Company
Carolina Power and Light Company
The Cleveland Electric Illuminating Company
Department of Energy
Duke Power Company
Edison Electric Institute
Electronics Industry Association
Florida Power and Light Company
Florida Power Corporation
General Electric Company
Gulf Power Company
Houston Lighting and Power Company
Manufacturers Radio Frequency Advisory Committee
National Electric Manufacturers Association
North American Electric Reliability Council
Ohio Edison
Pacific Gas and Electric Company
Philadelphia Electric Company
Rochester Gas and Electric Corporation
Southern California Edison Company
Southern Company Services
Tampa Electric Company
Tennessee Valley Authority
Utilities Telecommunications Council
Virginia Electric Power Company

Why no DOT, USCG, WGA, etc comments?

REPLY COMMENTS FILED BY

Utilities Telecommunications Council

APPENDIX B

For the reasons set forth in the preamble, Parts 2, 15 and 90 of Chapters I of Title 47 of the Code of Federal Regulations are amended as follows:

A. Part 2 Frequency Allocations and Radio Treaty Matters; General Rules and Regulations.

1. In Section 2.106 the Table of Frequency Allocations is amended by adding in column 7, the footnote designator US294 for the band 10-14 kHz, 14-19.95 kHz, 19.95-20.05 kHz, 20.05-59 kHz, 59-61 kHz, 61-70 kHz, 70-90 kHz, 90-110 kHz, 110-130 kHz, 130-160 kHz, 160-190 kHz, 190-200 kHz, 200-275 kHz, 275-285 kHz, 285-325 kHz, 325-335 kHz, 335-405 kHz, 405-415 kHz, 415-490 kHz and the text of footnote US 294 is added in proper numerical sequence to the list of footnotes following the Table as follows:

2.106 Table of Frequency Allocations

* * * * *

US Footnotes

* * * * *

U.S. 294 In the spectrum below 490 kHz electric utilities operate Power Line Carrier (PLC) systems on power transmission lines for communications to provide for reliability and security of electric service to the public. These PLC systems operate under the provisions of Part 15 of the Federal Communication Commission's Rules and Regulations or Chapter 7 of the National Telecommunications and Information Administration's Manual of Regulations and Procedures for Federal Radio Frequency Management, on an unprotected and noninterference basis with respect to authorized radio users. Notification of intent to place new or revised radio frequency assignments or PLC frequency uses in the bands below 490 kHz is to be made in accordance with the Rules and Regulations and Procedures of the FCC and NTIA, and users are urged to minimize potential interference to the degree practicable. This footnote does not provide any allocation status to PLC radio frequency uses.

B. Part 15 - Radio Frequency Devices.

1. In Section 15.3, the first sentence is revised and the Section is amended to read as follows:

§15.3 General Conditions of Operation

Persons operating restricted or incidental radiation devices (including Power Line Carrier Systems) shall not be deemed to have any vested or recognizable right to the continued use of any given frequency by virtue of prior registration or certification of equipment, or on the basis of prior notification of use pursuant to Section 90.63(g) of this chapter. Operation of these devices is subject to the conditions that no harmful interference is

caused and that interference must be accepted that may be caused by other incidental or restricted radiation devices, industrial, scientific or medical equipment, or from any authorized radio user.

2. A new subparagraph (t) of Section 15.4 is added to define a Power Line Carrier System to read as follows:

15.4 General definitions

* * * * *

(t) Power Line Carrier system

A carrier current system used by an electric power utility entity on transmission lines for protective relaying, telemetering, etc. for general supervision of the power system. The system operates by the transmission of radio frequency signals in the band from 10 kHz to 490 kHz by conduction over the electric power transmission lines of the system. The system does not include those electric lines which connect the distribution substation to the customer or house wiring.

3. In Section 15.7, the note is revised to read as follows:

§Section 15.7 General Requirement for Restricted Radiation Devices

(e) * * *

NOTE: Radio receivers, cable television systems, Class I TV devices, low power communications devices, and Power Line Carrier systems as used by electric utilities on power transmission lines are regulated elsewhere in this chapter and are not regulated by this section.

4. A new Section 15.8 is added to Subpart A as follows:

§15.8 Operation of a Power Line Carrier System

(a) A power utility operating Power Line Carrier systems shall submit the details of all existing systems plus any proposed new systems or changes to existing systems to a industry -operated entity as set forth in Section 90.63(g) of this chapter. No notification to the FCC is required.

(b) The operating parameters of a Power Line Carrier System (particularly the frequency) shall be selected to achieve the highest practical degree of compatibility with authorized users of the radio spectrum. A Power Line Carrier System shall operate on an unprotected, noninterference basis in accordance with Section 15.3 of this Part. If harmful interference occurs, the electric power utility shall discontinue or adjust its Power Line Carrier operation, as required, to remedy the interference.

(c) Power Line Carrier systems apparatus shall be operated with the minimum power possible to accomplish the desired purpose.

(d) The best engineering principles shall be utilized in the generation of radio frequency currents by Power Line Carrier systems so as to guard against interference to authorized radio users, particularly on the fundamental and harmonic frequencies.

(e) Power Line Carrier system apparatus shall conform to such engineering standards as may from time to time be promulgated by the Commission. In addition, such systems should adhere to industry approved standards designed to enhance the use of Power Line Carrier systems.

C. Part 90 - Private Land Mobile Radio Services

1. Section 90.63 is amended by the addition of a new section (g) to set forth the frequencies available for, and the limitations placed on, the use of PLC systems as follows:

§90.63 Power Radio Service.

(g) The frequencies 10-490 kHz are used to operate electric utility Power Line Carrier (PLC) systems on power transmission lines for communications essential to the reliability and security of electric service to the public, in accordance with Part 15 of this chapter. Any electric utility fulfilling requirements in subparagraph (a)(1) of this section may operate PLC systems and shall supply to a Federal Communications Commission/National Telecommunications and Information Administration recognized industry-operated enity, information on all existing, changes to existing, and proposed systems for inclusion in a data base. Such information shall include the frequency, power, location of transmitter(s), location of receivers and other technical and operational parameters, which would characterize the system's potential both to interfere with authorized radio users, and to receive destructive interference from these users. In an agreed upon format, the industry-operated entity shall provide the National Telecommunications and Information Administration and the Commission of these system characteristics prior to implementation of any proposed PLC system and shall provide monthly or periodic lists with supplements of PLC systems. The Federal Communications Commission and National Telecommunications and Information Administration shall supply appropriate application and licensing information to the notification activity regarding authorized radio stations operating in the band. PLC systems in this band operate on a noninterference basis to radio systems assigned frequencies by the NTIA or licensed by the FCC and are not protected from interference due to these radio operations.

* * * * *