TELEVISION REPORT, ORDER, RULES, AND REGULATIONS

FEDERAL COMMUNICATIONS COMMISSION

WASHINGTON, D. C.

MAY 3, 1941

The following contains such extracts from the Report of the Federal Communications Commission as are deemed of interest to the members of the Society and other readers of the JOURNAL. *The complete report deals with the following main headings:*

REPORT ON MARCH 20, 1941, TELEVISION HEARING

DOCKET NO. 5806

By the Commission (Fly, Chairman, and Commissioners Walker, Payne, Thompson and Wakefield concurring—Commissioners Case and Craven not participating):

On March 20, 1941, a hearing was held for considering when television broadcasting "shall be placed upon a commercial basis" and for considering rules and regulations and standards for such stations.

Upon the hearings held in January and in April of 1940, the Commission found the industry divided upon the basic question whether television was ready for commercial broadcasting, and also found the industry divided as to transmission standards for television broadcast stations. Some believed that television had not reached the point where it could offer sufficient entertainment value to justify commercial operation and that standardization would result in the freezing of the science at the then level of efficiency. Others were

determined to proceed at all costs with the launching of television on a large scale.

In its report of May 28, 1940, on the April hearing, the Commission declared:

As soon as the engineering opinion of the industry is prepared to approve any one of the competing systems of (television) broadcasting as the standard system the Commission will consider the authorization of full commercialization. That a single uniform system of television broadcasting is essential—so far as the basic standards are concerned—must also be amply clear. The public should not be inflicted with a hodge-podge of different television broadcasting and receiving sets.

Because the situation was one which threatened to hold up coordinated television development indefinitely and to delay public service on a widespread basis, the Commission offered its coöperation to the industry along lines in furtherance of the achievement of higher standards by research and development.

First, it provided for new experimental television stations in various sections of the country to engage in practical demonstration of prevailing competing systems. Later, it collaborated with the Radio Manufacturers Association (RMA) in creating the National Television System Committee (NTSC). The RMA felt that "Because of the inadequacy of the various suggested standards for television" all existing systems should be explored and developed, and new standards formulated. The NTSC was given this task.

The Commission now finds the industry entirely in agreement that television broadcasting is ready for standardization. The standards as finally proposed by the NTSC at the March 20, 1941, hearing, represent, with but few exceptions, the undivided engineering opinion of the industry. Some difference of opinion exists among broadcasters as to the date when commercial operation should begin. The National Broadcasting Company and the Columbia Broadcasting System, in effect, urged some delay in beginning commercial television. However, the Commission is of the opinion that the reasons advanced for the delay are not controlling. Other leading figures in the industry that earlier opposed commercialization, such as Philco, Zenith, and De Forest, now express the view that the present stage of scientific development warrants prompt standardization and commercialization.

The demonstrations conducted by different broadcasters and manufacturers for the benefit of the NTSC and the Commission revealed the merits and demerits of the systems upon which standards could

be based. The eleven volumes constituting the proceedings of the Committee and its sub-committees stand as evidence of the great volume of work done. The Commission acknowledges its appreciation of the RMA and NTSC for their coöperation in performing this worth-while work.

The three-color television system demonstrated by the Columbia Broadcasting System during the past few months has lifted television broadcasting into a new realm in entertainment possibilities. Color television has been known for years but additional research and development were necessary to bring it out of the laboratory for field tests. The three-color system demonstrated insures a place for some scheme of color transmissions in the development of television broadcasting.

The NTSC proposals provide that color television be given a six-month field test before standardization and commercialization. The Commission finds this requirement necessary. However, immediate experimental color program transmissions are encouraged.

The standards proposed by the NTSC provide for most of the improvements held out as readily possible a year ago for monochrome transmissions (black and white pictures). These standards fix the line and frame frequencies at 525 and 30, respectively.* The 525 lines provide for greater detail in the pictures transmitted than the 441 lines advocated a year ago. They give substantially equal resolution and more fully exploit the possibilities of the frequency bands allocated for television. Different line and frame frequencies will likely be required for color transmissions. This, however, is a matter for future consideration after color transmissions have been adequately field tested.

A year ago one of the weakest phases of the proposed television standards was an unreliable synchronizing pulse which frequently caused the loss of the picture under interference conditions. A few weeks before the March 20, 1941, hearing, developments were brought forth for greatly intensifying the synchronizing signals transmitted. These developments have been incorporated in the new standards.

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* Certain experimental systems require variable line and frame frequencies. However, the fixed values proposed appear to be best for monochrome transmissions, because only 30-frame pictures have been fully developed and as long as the frequency band for television channels (aural and visual) is limited to 6 megacycles not more than 525 lines can be employed to advantage with 30 frames.

The demonstrations witnessed by the Commission impressively showed the tenacity with which this new form of synchronizing signals holds the picture in place under extremely adverse interference conditions.

The proposed standards require frequency modulation for sound accompanying the pictures. Television is therefore benefited by the recent development of frequency modulation.

The standards proposed by the NTSC reasonably satisfy the requirement for advancing television to a high level of efficiency within presently known developments. These standards are adopted by the Commission and made effective immediately.

The Commission feels that this state of the science affords some reasonable assurance against early obsolescence of equipment. At the same time, it must explicitly recognize the advancing and necessarily fluid state of the science. Accordingly, procedure has been provided for the consideration of new developments, including, but by no means limited to, color television.

Procedure is also provided for expediting completion of the television stations now authorized by the Commission. Existing licensees and permittees who can satisfy the Commission that their station construction will meet all the engineering requirements of the rules and regulations and standards for such stations may begin commercial operation on July 1, 1941.

The Commission finds that at least six months will be required for obtaining comparative test data on the alternative methods permitted for transmitting synchronizing signals. Such data are necessary for further limiting the signal synchronizing standards. The Commission is requesting the industry to provide the necessary test data as to both color transmissions and synchronizing signals within the six-month period following the beginning of commercial operation.

The regulations require that at least 15 hours' program service per week shall be rendered by each station.

The Commission adheres to the policy set forth in its report on the April, 1940, television hearing regarding multiple ownership or control of television broadcast stations. Under this policy no person is permitted to own or control more than three television broadcast stations.

This is to preserve the public benefits of competition in the use of the limited number of channels available for television broadcasting.

The order and appropriate regulations carrying out the principles

of this report were adopted by a unanimous vote of the Commission *en banc* in its meeting of April 30, 1941.

II. TELEVISION TRANSMISSION STANDARDS

The Television Channel

(*1*) The width of the standard television broadcast channel shall be six megacycles per second.

(*2*) It shall be standard to locate the visual carrier 4.5 megacycles lower in frequency than the unmodulated aural carrier.

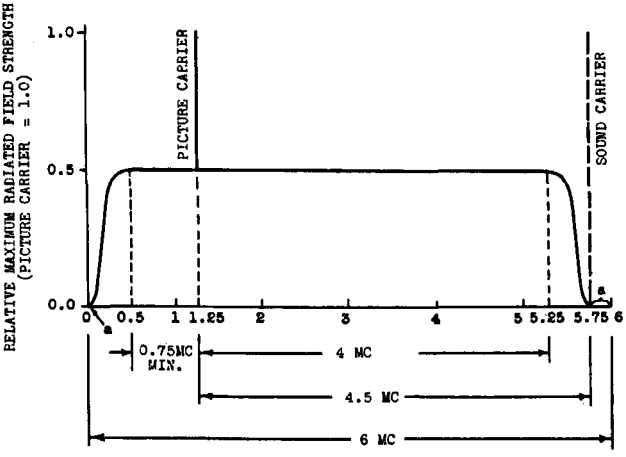

FIG. 1. Idealized picture transmission amplitude characteristic. Relative field strength of picture side band not to exceed 0.0005. Drawing not to scale.

(*3*) It shall be standard to locate the unmodulated aural carrier 0.25 megacycle lower than the upper frequency limit of the channel.

(*4*) The standard visual transmission amplitude characteristic shall be that shown in Fig. 1.*

(*5*) The standard number of scanning lines per frame period shall be 525, interlaced two to one.**

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* In the use of any type of transmission permitted under Standards 9 and 15, the emissions (aural and visual) must be kept strictly within the 6 megacycle band authorized.

** The presently favored values for lines and for frame and field frequencies for experimentally field testing color transmissions are, respectively, 375, 60, and 120.

(6) The standard frame frequency shall be 30 per second and the standard field frequency shall be 60 per second.**

(7) The standard aspect ratio of the transmitted television picture shall be 4 units horizontally to 3 units vertically.

(8) It shall be standard, during the active scanning intervals, to scan the scene from left to right horizontally and from top to bottom vertically, at uniform velocities.

(9) It shall be standard in television transmission to modulate a carrier within a single television channel for both picture and synchronizing signals, the two signals comprising different modulation ranges in frequency or amplitude or both.*

(10) It shall be standard that a decrease in initial light intensity cause an increase in radiated power.

(11) It shall be standard that the black level be represented by a definite carrier level, independent of light and shade in the picture.

(12) It shall be standard to transmit the black level at 75 per cent (with a tolerance of plus or minus 2.5 per cent) of the peak carrier amplitude.

Aural Signal Modulation

(13) It shall be standard to use frequency modulation for the television transmission with a maximum frequency swing of 75 kilocycles.

(14) It shall be standard to preëmphasize the sound transmission in accordance with the impedance-frequency characteristic of a series inductance-resistance network having a time constant of 100 microseconds.

Synchronizing Signals

(15) It shall be standard in television transmission to radiate a synchronizing wave-form which will adequately operate a receiver which is responsive to the synchronizing wave-form shown in appended Fig. 2.

(16) It shall be standard that the time interval between the leading edges of successive horizontal pulses shall vary less than one-half of one per cent of the average interval.

(17) It shall be standard in television studio transmission that the rate of change of the frequency of recurrence of the leading edges of the horizontal syn-

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* Practical receivers of the "RA" type (those which attenuate the carrier 50 per cent before detection) designed for the synchronizing signals shown in Fig. 2 will also receive interchangeably any of the following:

(a) Amplitude modulated synchronizing and picture signals of the 500-kilocycle vertical synchronizing pulse type.

(b) Synchronizing signals of the alternate carrier type with amplitude modulated picture signals.

(c) Frequency modulated picture and synchronizing signals.

Each of the above signals will be permitted over a reasonable period for transmitting regularly scheduled programs as required by Sec. 4.261 (a) of the Rules and Regulations Governing Television Broadcast Stations.

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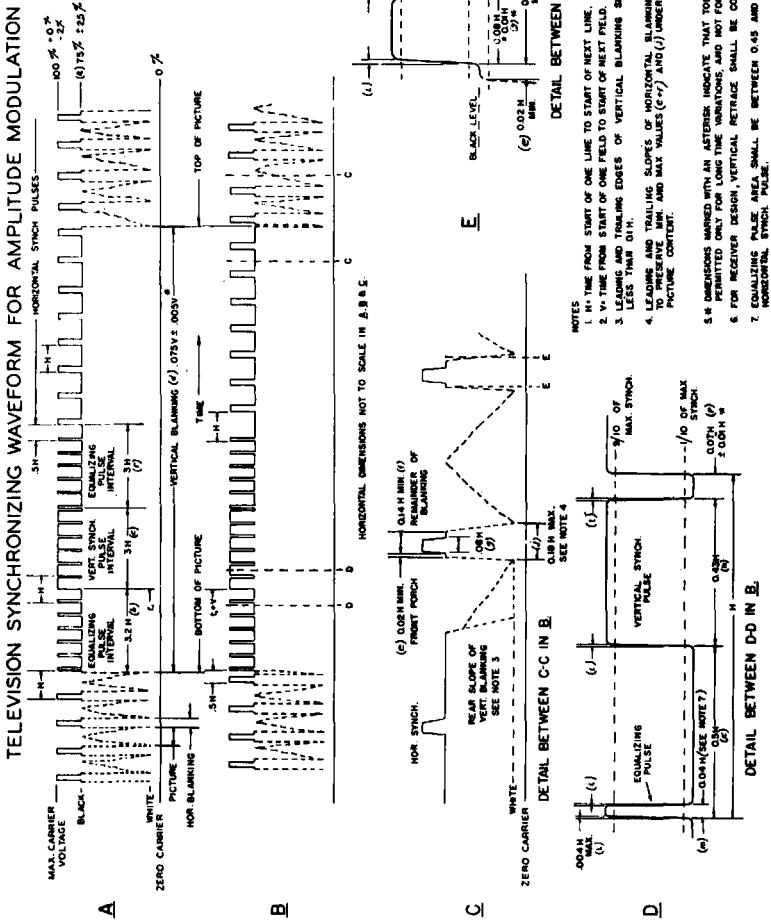

FIG. 2. Synchronizing wave-form.

chronizing signals be not greater than 0.15 per cent per second, the frequency to be determined by an averaging process carried out over a period of not less than 20, nor more than 100 lines, such lines not to include any portion of the vertical blanking signal.

(*18*) It shall be standard to rate the visual transmitter in terms of its peak power when transmitting a standard television signal.

(*19*) It shall be standard in the modulation of the visual transmitter that the radio frequency signal amplitude be 15 per cent or less of the peak amplitude, for maximum white.

(*20*) It shall be standard to employ an unmodulated radiated carrier power of the aural transmission not less than 50 per cent nor more than 100 per cent of the peak radiated power of the picture transmission.

(*21*) It shall be standard in television broadcasting to radiate signals having horizontal polarization.

III. CHANGE OR MODIFICATION OF TRANSMISSION STANDARDS

The Commission will consider the question whether a proposed change or modification of transmission standards adopted for television would be in the public interest, convenience, and necessity, upon petition being filed by the person proposing such change or modification, setting forth the following:

(*a*) The exact character of the change or modification proposed;
(*b*) The effect of the proposed change or modification upon all other transmission standards that have been adopted by the Commission for television broadcast stations;
(*c*) The experimentation and field tests that have been made to show that the proposed change or modification accomplishes an improvement and is technically feasible;
(*d*) The effect of the proposed change or modification in the adopted standards upon operation and obsolescence of receivers;
(*e*) The change in equipment required in existing television broadcast stations for incorporating the proposed change or modification in the adopted standards, and
(*f*) The facts and reasons upon which the petitioner bases his conclusion that the proposed change or modification would be in the public interest, convenience, and necessity.

Should a change or modification in the transmission standards be adopted by the Commission, the effective date thereof will be determined in the light of the considerations mentioned in sub-paragraph (*d*) above.

Following is a list of Television Broadcast Stations, at present operating, under construction, experimental, and relay broadcast.

SCHEDULE A

(AT PRESENT OPERATING)

Licensee and Location	Call Letters	Frequency (Kc)	Power Visual	Power Aural
Columbia Broadcasting System, Inc., New York, N. Y.	*W2XAB*	60,000–66,000 (Channel No. 2)	7½ kw	7½ kw
Don Lee Broadcasting System, Los Angeles, Calif. T. Hollywood, Calif.	*W6XAO*	50,000–56,000 (Channel No. 1)	1 kw	150 kw
National Broadcasting Co., Inc., New York, N. Y.	*W2XBS*	50,000–56,000 (Channel No. 1)	12 kw	15 kw
Philco Radio and Television Corporation, Philadelphia, Pa.	*W3XE*	66,000–72,000 (Channel No. 3)	10 kw	10 kw
Zenith Radio Corporation, Chicago, Ill.	*W9XZV*	50,000–56,000 (Channel No. 1)	1 kw	1 kw

SCHEDULE B

(UNDER CONSTRUCTION)

Licensee and Location	Call Letters	Frequency (Kc)	Power Visual	Power Aural
Earle C. Anthony, Inc., Los Angeles, Calif.	*W6XEA*	96,000–102,000 (Channel No. 6)	1 kw	1 kw C. P.*
Balaban & Katz Corp., Chicago, Ill.	*W9XBK*	60,000–66,000 (Channel No. 2)	1 kw	1 kw C. P.
Bamberger Broadcasting Service, Inc., New York, N. Y.	*W2XBB*	96,000–102,000 (Channel No. 6)	1 kw	1 kw C. P.
Columbia Broadcasting System, Inc., Chicago, Ill.	*W9XCB*	78,000–84,000 (Channel No. 4)	1 kw	1 kw C. P.
Crosley Corporation, Cincinnati, Ohio	*W8XCT*	50,000–56,000 (Channel No. 1)	1 kw	1 kw C. P.
Don Lee Broadcasting System, San Francisco, Calif.	*W6XDL*	50,000–56,000 (Channel No. 1)	1 kw	1 kw C. P.
Allen B. DuMont Laboratories, Inc., Washington, D. C.	*W3XWT*	50,000–56,000 (Channel No. 1)	1 kw	1 kw C. P.
Allen B. DuMont Laboratories, Inc., New York, N. Y.	*W2XWV*	78,000–84,000 (Channel No. 4)	1 kw	1 kw C. P.

* C. P. = Construction Permit.

Licensee and Location	Call Letters	Frequency (Kc)	Power Visual	Au
Hughes Productions Division of Hughes Tool Co., Los Angeles, Calif.	*W6XHH*	60,000–66,000 (Channel No. 2)	10 kw	10 C. I
Hughes Productions Division of Hughes Tool Co., San Francisco, Calif.	*W6XHT*	60,000–66,000 (Channel No. 2)	10 kw	10 C. I
The Journal Company (The Milwaukee Journal), Milwaukee, Wis.	*W9XMJ*	66,000–72,000 (Channel No. 3)	1 kw	1 C. I
Metropolitan Television, Inc., New York, N. Y.	*W2XMT*	162,000–168,000 (Channel No. 8)	250 w	1 C. I
National Broadcasting Company, Inc., Washington, D. C.	*W3XMB*	60,000–66,000 (Channel No. 2)	1 kw	1 C. I
National Broadcasting Company, Inc., Philadelphia, Pa.	*W3XPP*	102,000–108,000 (Channel No. 7)	1 kw	1 C.
Television Productions, Inc. (Area of Los Angeles, Calif.)	*W6XYZ*	78,000–84,000 (Channel No. 4)	1 kw	1 C.
WCAU Braodcasting Co., Philadelphia, Pa.	*W3XAU*	84,000–90,000 (Channel No. 5)	1 kw	1 C.

SCHEDULE C

EXPERIMENTAL TELEVISION BROADCAST STATIONS

Licensee and Location	Call Letters	Frequency (Kc)	Power Visual	Au
Allen B. DuMont Laboratories, Inc., Passaic, N. J.	*W2XVT*	78,000–84,000 (Channel No. 4)	5 kw	5 C.
Balaban & Katz Corp. (Area of Chicago, Ill.)		384,000–396,000	10 w	C.
Columbia Broadcasting System, Inc., Los Angeles, Calif.	*W6XCB*	162,000–168,000 (Channel No. 8)	1 kw condl.	1 C.
Farnsworth Television & Radio Corp., Ft. Wayne, Ind.		66,000–72,000 (Channel No. 3)	1 kw	1 C.
General Electric Company, Scotland, N. Y.	*W2XB*	60,000–86,000	10 kw	3
Kansas State College of Agriculture & Applied Science, Manhattan, Kans.	*W9XAK*	50,000–56,000 (Channel No. 1)	100 w	100 C.
Leroy's Jewelers, Los Angeles, Calif.	*W6XLJ*	230,000–236,000 (Channel No. 13)	1 kw condl.	1 C.

Licensee and Location	Call Letters	Frequency (Kc)	Power Visual	Power Aural
rdue University, West Lafayette, Ind.	*W9XG*	66,000–72,000	750 w	750 w C. P.
CA Manufacturing Company, Inc., Portable (Camden, N. J.)	*W3XAD*	321,000–327,000	500 w	500 w
CA Manufacturing Company, Inc., Camden, N. J.	*W3XEP*	84,000–90,000 (Channel No. 5)	30 kw	30 kw
ite University of Iowa, owa City, Iowa	*W9XUI*	50,000–56,000 (Channel No. 1) 210,000–216,000 (Channel No. 12)	100 w	
EXPERIMENTAL TELEVISION RELAY BROADCAST				
laban & Katz Corp. (Area of Chicago, Ill.)	*W9XBT*	204,000–210,000 210,000–216,000 (Channel Nos. 11 & 12)	250 w	C. P.
laban & Katz Corp. (Area of Chicago, Ill.)		384,000–396,000	10 w	C. P.
lumbia Broadcasting System, New York, N. Y.	*W2XCB*	336,000–384,000	6.5 w	C. P.
n Lee Broadcasting System (Area of Los ngeles, Calif.)	*W6XDU*	318,000–330,000	6.5 w	
n B. DuMont Laboratories, Inc. (Area of lew York, N. Y.)	*WIOXKT*	258,000–264,000 264,000–270,000 (Channels Nos. 15 & 16)	50 w	
ieral Electric Company, New Scotland, I. Y.	*W2XI*	162,000–168,00 (Channel No. 8)	10 w	
ieral Electric Company, Schenectady, I. Y.	*W2XD*	156,000–162,000 162,000–168,000	40 w	C. P.
tional Broadcasting o., Inc., Portable Camden, N. J., and lew York, N. Y.)	*W2XBT*	162,000–168,000	400 w	
tional Broadcasting o., Inc., New York, I. Y. (Port.-Mobile)	*W2XBU*	282,000–294,000	15 w	
lco Radio and Television Corporation, hiladelphia, Pa.	*W3XP*	230,000–236,000 236,000–242,000 (Channels Nos. 13 & 14)	125 w	C. P.
evision Productions, nc. (Area of Los Aneles, Calif.)	*W6XLA*	230,000–236,000 236,000–242,000	250 w	