CRITICAL STEPS TO COMPLIANCE

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These remarks are limited to the steps required to comply with the technical aspects and standards of the recently adopted (2 February 1972) rules for Cable Television Service, Part 76, Subpart K, Technical Standards of the FCC Rules and Regulations on Telecommunication.

Initially, the rules exempt any system that serves fewer than 50 subscribers and those systems that serve only residents in apartment dwellings under common ownership, control, or management. All other systems must comply.

A system is further defined as "each separate and distinct community or municipal entity (including single, discrete, unincorporated areas) served with cable television facilities, "even if there is a single head-end and identical ownership of facilities extending into several communities". Each system thus defined must comply separately with the new rules.

New systems may not commence operation nor may existing systems add television broadcast signals until they have received a certificate of compliance. Existing systems cannot continue carrying television broadcast signals beyond March 31, 1977 without obtaining a certificate of compliance (unless application was made at least 30 days prior to the need for certification).

Para 76.13 identifies methods of filing applications for certificates of compliance for the four different categories of applicants; (1) cable systems not operational prior to March 31, 1972, (2) systems authorized to carry signals prior to March 31, 1972, but were not yet operational, (3) systems proposing to add television signals, and (4) systems with existing operations. No standard form is prescribed but the information to be filed for each of the above categories must be submitted in three copies to the FCC.

Para 76.201 requires systems of 3,500 or more subscribers to designate a channel for the exclusive use of operating as a local outlet, originating programming to a significant extent and providing facilities for such local production, (subject of course to disposition of the current litigation of this issue in the courts).

Systems that operate in whole or in part within one of the major television markets must comply with the minimum channel capacity and access channel rules. For new systems commencing operations after March 31, 1972 the rules are effective immediately, other systems must comply by March 31, 1977 or earlier if television signals are added to the system or if access channels are designated, the rules governing their operation will apply.

These rules require a minimum of 120 MHz (20 television channels) be made available for immediate or potential use; that 6 MHz of capacity be made available for Class II and III channel use for each Class I channel carried; that the

distribution plant be capable of non-voice return communications; that at least one channel shall be designated for each of the access categories, general public, education and local government; that at least minimum equipment and facilities be made available for program production on the public access channel; that unused time on the local origination and designated access channels be made available for leased access services, and further, when all of these channels are in use during 80% of the week days for 80% of the time during any consecutive three-hour period for 6 consecutive weeks, a new channel shall be made available within 6 months for any or all of these purposes.

Subpart K of the Rules, relating to Technical Standards is effective immediately, that is March 31, 1972. Para 76.601 of the rules requires that each system be designed, installed and operated in a manner that fully complies with the rules in this subpart. This means that immediately system operators must maintain in their local system office a listing of the cable television channels that the system delivers to its subscribers, the station(s) whose signals are delivered to subscribers on these Class I cable channels, and a specification for each subscriber of the minimum visual signal level maintained on each Class I channel under normal operating conditions.

Each system operator must conduct performance tests at least once during each calendar year; this means that the

first set of measurements must be made and must be kept on file at the system's local office by no later than December 31, 1972. Thereafter, intervals between measurements may be as long as 14 months, but in any event, measurements must be made and kept on record for each calendar year (including 1972) for five years, and must be made available for inspection to the Commission or the Commission's field representative on request.

The tests are to be made to determine the extent to which the system performs in compliance with the standards prescribed in para 76.605. For new systems commencing operations after March 31, 1972 compliance with the standards in 76.605 is immediately mandatory; for systems in operation prior to March 31, 1972 compliance is not mandatory until March 31, 1977 except for the rules governing radiation which are in effect immediately.

Performance tests must be made on each Class I television channel identified above in the listing and for each system/community or entity satisfying the Commission's definition of CATV system. Further, for each Class I channel, the tests shall be performed at three widely separated points in the distribution system of which at least one is representative of the subscriber terminals most distant from system input. Although Para 76.605 (a) requires performance to comply with the rules at <u>any</u> subscriber terminal, the measurements themselves may be made at convenient monitoring points <u>if the</u>

technical data are included to relate the measured performance to the performance as would be viewed through a nearby subscriber terminal.

This provision would allow, for example, a system to establish high signal level monitoring points out of the last line extenders in the distribution system. Generally there would be no active devices beyond this point and the subscribers terminals. In the case of systems using set-top converters we believe that laboratory measurements can be used to relate their performance to a subscribers terminal. This provision of the rules thereby relieves any system operator of the necessity to gain access to subscribers property to make performance measurements.

Part of the Rules with which systems must comply and maintain records of compliance for inspection by the Commission are those relating to radiation. The radiation limitations are effective immediately and measurements demonstrating this fact must be on hand at the local system office no later than December 31, 1972. As presently defined in Para 76.601 these measurements must be made on each Class I television channel at each of the three widely separated subscriber locations, but the intent of the rules as just explained by Mr. Lines of the FCC is to include any radiation from the cable system, and the precise wording of the rules will probably be amended to effect this intent.

Next, a few comments about some of the measurement problems. For example, measurement of visual carrier frequency is not as easy as it might sound. A calibrated signal generator can be mixed with each visual carrier and the zero beat identified with either a high resolution spectrum analyzer or on the screen of a television receiver. Using a receiver for this purpose though presents problems since the signal generator carrier will beat with each of the 15 kHz sidebands of the visual carrier and absolute identification of the correct zero beat is difficult. Alternatively a frequency counter can be used, sampling the visual carrier. The modulation of the carrier must be removed before the counter will read properly. The "black box" to do the modulation stripping does not yet exist as off-the-shelf equipment so each engineer will have to develop his own equipment for this purpose.

I see no reason why the aural carrier need be measured since its relationship to the visual is established at the broadcast transmitter and carriage on cable does not affect this relationship. In the few cases of Class I channels receiving inputs from microwave systems that separate the visual and aural carriers, or from direct studio feeds, the aural carrier must then be measured to assure compliance with the rules.

The wording of para 76.605 (a) (2) appears to exempt systems using converters from the $\pm$ 25 kHz tolerance and to

apply only the ± 250 kHz requirement, however the intent of the rules, which will no doubt be clarified, is not to relieve the system of the requirement for ± 25 kHz tolerance but to restrain the visual carrier frequency stability as viewed through the converter at the subscribers terminals to ± 250 kHz.

In complying with the visual signal level requirements the critical aspect is in maintaining calibration accuracy of the signal level meter. Typically in broadcast field measurements it is customary to calibrate the field meter before and after each reading, and if the calibration has changed the process must be repeated until one is satisfied the calibration has held constant during the measurement process. Most broadcast field strength meters have built in calibrators for this purpose. No such instrument is available for the CATV industry, yet accurate signal level measurements are the very keystone to proper system operation. The adjustments of amplifier input and output levels, governing overload distortions and noise are critically dependent upon accurate level measurements, yet this is probably typically the single weakest link in system operation and maintenance.

A good calibration procedure will be mandatory in complying with the rules; the calibration should be traceable to the National Bureau of Standards. For example, a laboratory signal

generator with calibrated output, a bolometer power meter to transfer d-c calibration to r-f, or the Selby Micro-potentiometer can be used to accurately calibrate the signal level meters.

A calibrated spectrum analyzer would also be most useful for these level measurements since photographs could be taken as records of the measurements, and the single display could show the level relationship between all visual and aural carriers that are required of Para 76.605 (a), (4), (5) and (6).

The hum and low frequency disturbances are to be measured relative to the visual signal level (sync tips), which will require baseband equipment such as an oscilloscope to display the bar and window test signal. Measurement of window tilt then will be evidence of low frequency response.

Channel frequency response can be measured with a signal generator input at the system head-end. In the case of wide-band antennas such as log-periodic the input at the first active amplifier seems satisfactory; in the case of a single channel yagi antenna, open field measurements may be required to demonstrate compliance. In the case of tower mounted preamplifiers, the input must be to the preamp and since this is going to be physically difficult we would recommend a separate downlead be installed and used for this purpose.

Someone would still have to climb the tower to make the change-over for the measurement but test equipment would not be necessary on the tower. New system design ought to include facilities for coaxial switching at the tower mounted preamp input for these test purposes. The sweep or signal generator obviously must operate through the UHF band.

The NCTA Standard 005-0669 describes a method of system noise measurement that can be accomplished using the signal level meter, but the requirement of para 76.605 (a) (9) holding off-set co-channel interference to 36 dB will probably require a high resolution spectrum analyzer for identification and level measurement of the co-channel(s). If the interference is limited to one easily identified off-set co-channel the level can be ascertained by measuring the level of the 10 or 20 kHz off-set beat. With the level of the desired channel and the beat frequency both known, the level of the interfering co-channel can be calculated.

Compliance with Para 76.605 (a) (10) may also require the use of a spectrum analyzer. It is probably not going to be possible to measure discrete interfering signal levels at -46 dB with a field strength meter as indicated in Para 76.609 (f) of the rules. If, for example, system noise is at -40 dB, the typical SLM will read approximately -43 dB (allowing corrections for bandwidth, peak-to-rms, and detector non-linearities). A discrete interference at -46 dB would therefore be about 3 dB below the noise level and impossible to identify.