SIGNAL LEAKAGE PART 1- Signal Leakage Rules and the PCO

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The Independent Cable & Telecommunications Association Board of Directors decided to analyze the Federal Communications Commission signal leakage rules and their impact on Private Cable Operators. Bob Palle', Executive Vice President, Blonder Tongue and an ICTA Executive Committee member, volunteered to undertake the task. He and his team produced the following as the first segment of that analysis. Your comments or requests for additional information are welcome at ICTA.

Since 1984, all franchise cable systems have been required by the FCC to comply with specific signal leakage performance, operational and reporting requirements. Until recently, systems outside the definition of a "***Cable System***" were exempt[1] from any of those requirements. They included Private Cable, MMDS, LMDS, and DBS. This is no longer the case. In the fall of 1997, the FCC made a major change in the rules pursuant to Report and Order (R&O) 92-184. This rulemaking requires that the signal leakage provisions be applied to all the systems that previously enjoyed exempt status. New rule sections for ***CFR 47 Part 76*** were written and others amended to effect the changes set out in the R&O. Some of the changes went into effect immediately, some January 1, 1998. But, for most there is a gradual five-year phase-in period. The phase-in period ends and the rules become fully effective January 2003. The purpose of this two-part series is to present in simple terms: (a) what is required now; (b) what will be required after 2003; and (c) what strategies we suggest the operator implement to prepare for the future and to ensure full compliance and increased customer satisfaction in the meantime.

Rule Highlights

The applicable rules are both listed in Table 1 and summarized in the following paragraphs. The summaries are not presented in the same numerical order as the CFR document. Instead, they are presented in order of their operational importance.

Harmful Interference and the Scope of the New Rules

The highest priority signal leakage rule is 76.613, which became effective upon the release of the R&O in 1997. This section first defines harmful interference from a cable system and second, requires that the systems either promptly cure the interference or be in danger of being ordered to shut down by the FCC. It states *" Harmful interference is any emission, radiation or induction which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service…".* The question is… how does one prevent to the extent practicable, the possibility of interference? This answer is simple, through a straightforward signal leakage monitoring and maintenance program.

Several pleasant surprises result from the implementation of such a program. First, the initial investment is not very expensive. Second, one finds that both the employee training and ongoing expense are minimal and blend into the operation. Third, the small initial cost will be repaid ten-fold in increased customer satisfaction and loyalty. The reason is this. If the system is leaking out, then it is just as surely leaking in (ingress). This means degraded picture quality generally in the form of ghosts and co-channel

[1] The rules now refer to those systems as ***non-cable multichannel programming distributors (MVPDs).***

interference. Ingress, when not quickly corrected, leads directly to customer dissatisfaction and complaints. Details of how to implement an ingress prevention program are provided later in this series.

Section 76.620 implements into the rules the essence of R&O 95-184. It reads in pertinent part: *Sections 76.605 (a) (12), 76.610, 76.611, 76.612, 76.614, 76.615(b)(1-6), 76.616, and 76.617 shall apply to all non-cable MVPDs. However, non-cable MVPD systems that are substantially built as of January 1,1998 shall not be subject to these sections until January 1, 2003. "Substantially built" shall be defined as having 75 percent of the distribution plant completed. As of January 1, 2003, 76.615(b)(7) shall apply to all non-cable MVPDs.*

A list of all the rules is presented in Table 1. It provides rule effectivity dates and shows that they are somewhat dependent upon technical and strategic issues. The table gives some insight into a strategy that can soften the impact of compliance and lessen paperwork for both the operator and the FCC (see ***Aeronautical Carrier Level Strategy*** in this article for more details).

Table 1

		Aeronautical Band Operation 108-118MHz; 225-400MHz		
		If *Any Carrier is* equal to or greater than 38.75 dBmV		If *All Carriers* Are *Less* Than 38.75dBmV
FCC Rule		**Existing System (at least 75% complete on Jan 1,1998)**	**New[2] System**	**Any System**
76.605	(a) (12) Signal Leakage Limits	Effective Jan 1, 2003	***YES Applies Now***	Effective Jan 1, 2003
76.609	(h) (1-5) Measurement Procedures	Effective Jan 1, 2003	***YES Applies Now***	Effective Jan 1, 2003
76.610	Scope of Application	Effective Jan 1, 2003	***YES Applies Now***	NO Does Not Apply
76.611	CLI Calculations	Effective Jan 1, 2003	***YES Applies Now***	NO Does Not Apply
76.612	Frequency Offsets	Effective Jan 1, 2003	***YES Applies Now***	NO Does Not Apply
76.613	***Harmful Interference***	***YES Applies Now***	***YES Applies Now***	***YES Applies Now***
76.614	Regular Monitoring	Effective Jan 1, 2003	***YES Applies Now***	NO Does Not Apply
76.615	(b) (1-6) FCC Notification	Effective Jan 1, 2003	***YES Applies Now***	NO Does Not Apply
	(1) Legal Name	Effective Jan 1, 2003	***YES Applies Now***	NO Does Not Apply
	(2) IRS Employer ID (EI)	Effective Jan 1, 2003	***YES Applies Now***	NO Does Not Apply
	(3) Key Personnel	Effective Jan 1, 2003	***YES Applies Now***	NO Does Not Apply
	(4) Carrier Frequencies & Modulation Type	Effective Jan 1, 2003	***YES Applies Now***	NO Does Not Apply
	(5) Coordinates & Distant Point	Effective Jan 1, 2003	***YES Applies Now***	NO Does Not Apply
	(6) Monitoring Procedure	Effective Jan 1, 2003	***YES Applies Now***	NO Does Not Apply
	(7) Annual FCC Notification	Effective Jan 1, 2003	Effective Jan 1, 2003	NO Does Not Apply
	Operation Near Emergency Frequencies	Effective Jan 1, 2003	***YES Applies Now***	Effective Jan 1, 2003
76.617	Responsibility For Interference from Terminal Equipment (STBs)	Effective Jan 1, 2003	***YES Applies Now***	Effective Jan 1, 2003

Technical Standards

Section 76.605(a)(h) states that signal leakage must not exceed 20 micro-volts/meter from 54 MHz to 216 MHz at 3 meters and 15 micro-volts/meter at all other frequencies. It refers to section 76.609(h) for the procedures. Section 76.609(h) describes the exact measurement process and details the equipment required. The equipment simply consists of a horizontal dipole antenna and a field strength meter. The

[2] New systems are those that were less than 75% complete on January 1, 1998.

measurement parameters set forth in this section are intended for strand based cable systems. The requirement states that during the measurement the receiving antenna must be a minimum of three meters distance from (1) the cable, (2) earth ground, and (3) any other conductors. As such, the parameters are not very friendly to conducting measurements in an MDU. Blonder Tongue is preparing a new measurement process that is specifically targeted for use in MDU systems. The notion is to have the new process reviewed by the FCC Cable Service Bureau prior to publication of the next article.

Scope of Application

Section 76.610 prescribes the applicability of sections 76.611, 76.612, 76.615 and 76.616 to systems that transport any carrier in the aeronautical frequency bands at a level of ***38.75dBmV or greater***. Those systems that choose to operate all aeronautical band carriers at a level lower than 38.75 dBmV have an alternate strategy available to them. See paragraph titled ***Aeronautical Band Carrier Level Strategy.***

Signal Leakage Performance Criteria

This section 76.611 sets out the basic performance in precise engineering detail that is beyond the scope of this first article. In general, the section provides the operator a choice of several approaches to substantiating and maintaining signal leakage compliance:

> (1) Sample at least 75% of the cable strand. Record the leaks found in the sample. Determine that the Cumulative Leakage Index (CLI) is within certain limits by using one of the two formulas provided.
>
> (2) Perform airspace measurement at an altitude of 450 meters above the cable system and ensure that the field strength generated by the cable system does not exceed 10 micro-volts/meter RMS.
>
> The section allows that either an unmodulated or modulated test carrier may be used for testing. However, if a modulated carrier is used, all measurements must be corrected to correlate with unmodulated carrier test result equivalents. The test carrier must be in the 108-137 MHz band and its frequency must be offset pursuant to 76.612

Frequency Separation Standards (Aeronautical Frequency Offsets)

Section 76.612 states that all carriers in the frequency bands of 108-137 MHz and 225-400 MHz must be offset from certain radionavigation and radiocommunication frequencies as follows:

> 1. For the bands of 118-137 MHz; 225-328.6 MHz; 335.4-400 MHz: offsets shall be 12.5 kHz with a tolerance of +/- 5KHz. If HRC, the carriers must be multiples of 6.0003 MHz +/-1 Hz.
>
> 2. For the bands of 108-118 and 329.6-335.4 MHz, offsets shall be 25 kHz +/- 5 kHz.
> Blonder Tongue recommends carrier frequencies that are compliant with the above rules in its publication ***CATV Reference Guide.*** Copies are provided free of charge upon request.

Regular Monitoring

This section 76.614 states that all systems that operate in the 108-137 and 225-400 MHz bands shall perform regular monitoring for signal leakage. The system must be capable of detecting and recording in a log all leaks found that are in excess of 20 micro-volts/meter at a distance of 3 meters. The log must be made available upon request by the Commission for a minimum of two years.

Notification Requirements

Section 76.615 states that prior to operation in the aeronautical bands the operator must notify the FCC of the following:

- Legal Name and local address of the operator.
- Internal Revenue Service Employer Identification (E.I.) number [see §§ 76.620 (b)]
- The names and telephone numbers of the local operator employees who are responsible for compliance with §§ 76.610 & 76.611.
- A list of carrier and sub-carrier frequencies, tolerance, types of modulation and maximum average power levels.
- The geographical coordinates that denote a point at the center of the system and the distance to the most remote point of the cable plant (existing or planned).
- A complete description of the routine monitoring procedure and the method of calibrating the measurement equipment .

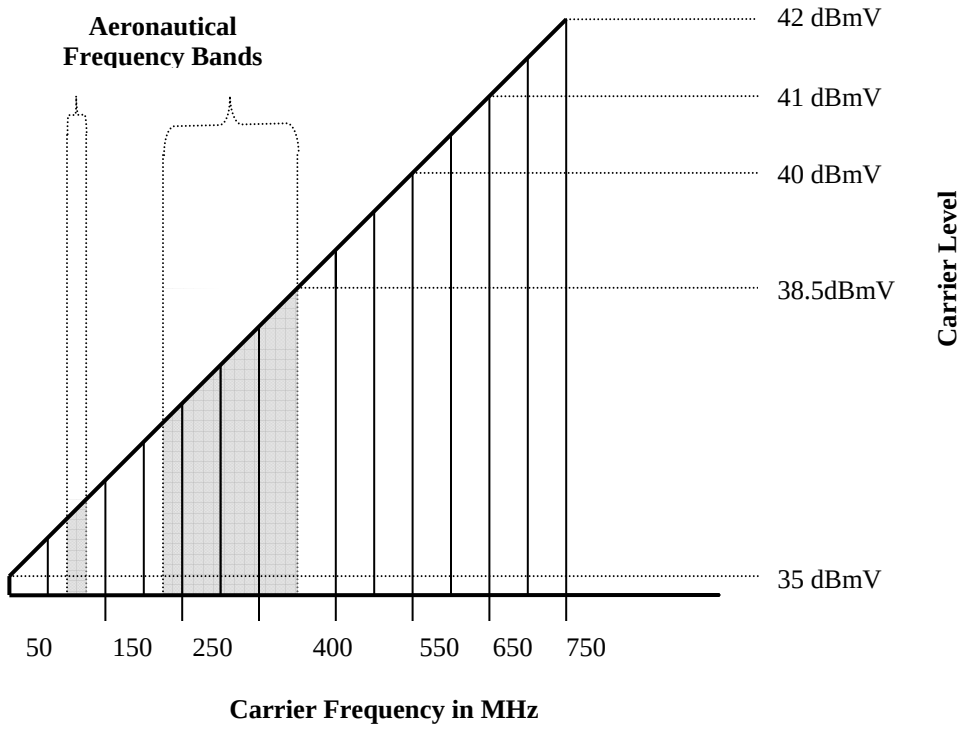
Emergency Frequencies & Responsibility for Interference

Section 76.616 warns the operator to not place carriers near the emergency frequencies of 121.5 MHz, 156.8 MHz and 243.0 MHz. Section 76.617 states that responsibility for interference caused by a subscriber terminal (STB) or associated equipment shall be the responsibility of the operator. If leakage occurs the operator is required only to discontinue service to the subscriber during the correction period.

Aeronautical Band Carrier Level Strategy

Systems that choose to operate ***all the aeronautical band carriers*** at signal levels ***below 38.75 dBmV*** can avoid the drudgery required by sections 76.610, 76.611, 76.612, 76.614 and, 76.615. This concept was suggested as long ago as 1984, but it was not implemented in actual practice for several reasons. The systems at that time were typically 450MHz capacity and distribution carrier levels in the 400 MHz range approximated 42-45 dBmV. Reducing those levels to below 38.75 dBmV would sacrifice signal level even if the measurement, calculation, and reporting tasks would be reduced. Today, however, the 750 MHz system conditions are generally different enough to prompt serious reconsideration of the reduced carrier level approach. The following chart illustrates the point. It presents the 7dB linear tilt output profile of a typical distribution amplifier. The uppermost aeronautical carrier in this scheme is channel 53, at 38.5 dBmV. This is below the 38.75 dBmV threshold, and therefore would not trigger the effectivity of section 76.610 and other sections referenced therein.

The immediate impact of all the foregoing is as follows. First, the FCC notification and reporting rules apply now to ***new***^{2} standalone MDU systems (the FCC reports that they already have received some). Second, for 18 GHz networks, new MDU additions will trigger omniscient monitoring and reporting requirements when the new additions equal more than 25% of the total system. Therefore, the conscientious PCO should already be committed to signal leakage monitoring and reporting. The next article in this series will provide the details of how to implement and maintain a successful program.


Aeronautical
Frequency Bands
42 dBmV
41 dBmV
40 dBmV
38.5dBmV
35 dBmV
Carrier Level
50
150
250
400
550
650
750
Carrier Frequency in MHz