Data and Bidirectional Transmissions under Part 15.231

Application Note AN-00128

Introduction

In designing products that incorporate RF, it is always important to consider not only technical issues, but also legal factors. While an RF stage may be capable of meeting functional objectives, its operation may not be legally allowable in the country of intended operation. For operation within the United States, the Federal Communications Commission (FCC) is responsible for the regulation of all RF devices. These rules are made up of numerous volumes, and unlicensed operation in the frequencies from 260 to 470MHz is governed by Part 15, Section 231. This application note is intended to provide an overview of two distinct issues related to compliance under this section.

- The change in stance with respect to data transmissions for devices intending to comply with this portion of the code; and
- How bidirectional devices such as transceivers are viewed by the code. The preceding item also plays an important role.

For more information on Part 15.231, please review Linx Application Note AN-00125: "Considerations for Operation within the 260 to 470MHz Band."

Transmission of Data

The overriding intention of the FCC with respect to transmissions occurring under Part 15 in this band is that they must be periodic in nature. Under Section 15.231(a)–(d), the restrictions on remote control operation were implemented to limit the proliferation of equipment (i.e., to reduce the number of possible radiators in the field). Until recently, the Commission was adamant that no data transmissions of any type were permitted, and only remote control signals were allowed. That is no longer the case.

Data is now permitted, provided (as stated in 15.231(a)) it is sent with a control signal. NTIA, the regulatory agency for the Federal Government spectrum used by the majority of 15.231 transmitters, objected to allowing any data transmissions. Because of this, the FCC stated that "[t]he net result of the changes we are adopting is that operation under Section 15.231(a) will continue to be limited to devices that transmit a control signal, but such devices will be permitted to transmit data with the control signal." As an example, it would be acceptable for a low tire pressure warning system to send the tire pressure when it transmits an alarm signal, but it would not be acceptable for the same system to transmit the tire pressure without the alarm. While the band remains inappropriate for continuous data transfer, this regulatory change does allow some exciting options for periodic data to accompany control and command signals.

FCC representatives have stressed that this is not intended to be a loophole for the sake of sending data only. If there is no intention to use the control signal, the FCC would have to question whether the product is properly classified as a control transmitter. It does, however, open up some exciting opportunities, especially for bidirectional links.

Bidirectional Operation

Applications coming under the restrictions of FCC Part 15.231 have generally been implemented as simplex (one-direction) links. With the increasing availability of low-cost transceiver solutions, such as the Linx LT Series, bidirectional links are now a practical alternative. Bidirectional communication opens a whole new world of opportunity for designers. Security can be enhanced, transmissions sequenced and coordinated, confirmations received, and many other significant advantages realized.

Since Part 15.231 has not generally been applied to transceivers, clarification was needed as to how this regulation would be applied to bidirectional links. With this in mind, Linx initiated dialog with senior FCC personnel. These FCC officials demonstrated outstanding responsiveness, and from those discussions came the following understanding.

A simple way to look at Part 15.231 as it pertains to transceiver operation is to think of the transceiver as a separate transmitter and receiver. If the application is legally allowable in each direction, it is likely to meet with approval.

For example, a car owner presses a button to lock their vehicle. This is a manual event and, under Part 15.231 rules, the transmission may continue for as long as the user holds the button.

Once released, however, the transmission must cease within five seconds. The transceiver onboard the automobile receives the signal, and once the incoming transmission ceases, it sends a confirming transmission. Since this confirming transmission is activated automatically, it must cease within five seconds of activation. The confirming transmission activates a LED onboard the user's keyfob to provide visual indication that the door is locked. At the same time, the vehicle can send all kinds of ancillary data (i.e., time, temperature, tread wear, coordinates, and so on). But note that this must be in relation to the confirming signal, the purpose of which is to control something, in this case, a LED indicator.

Now let's consider a more automated event. The vehicle owner goes to the mall and parks their car. While the owner is inside the mall, the vehicle is struck by a shopping cart. The vehicle then initiates a transmission to the user. Since the transmission is automatically activated, it is required to cease within five seconds of activation. At the other end, the user's keyfob buzzes and vibrates to alert the driver of the bad news. Since the transmission from the vehicle is remotely controlling something (LED, buzzer, etc.) at the driver's end, data (such as the time and force of impact, or even the estimated cost of repairs) may also accompany the control signal.

Summary

Applications that call for the continuous transmission of data are not legally appropriate for operation under FCC Part 15.231. Periodic data is now allowed under section A–D, but must always accompany a legitimate control or command function. Paragraph E remains an option for those unable to meet this requirement. The legality of a transceiver is considered from the standpoint of a separated transmitter and receiver. Automatic transmissions confirming an initial transmission are acceptable, but must control something, and cease within five seconds.

CFR Part 15, Section 231 is listed here for your convenient reference. Since it is subject to revision, the latest version should be obtained from the FCC.

Section 15.231

Periodic operation in the band 40.66–40.70MHz and above 70MHz.
(a) The provisions of this Section are restricted to periodic operation within the band 40.66–40.70MHz and above 70MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm

condition. (b) In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66–40.70	2,250	225
70–130	1,250	125
130–174	1,250 to 3,750**	125 to 375**
174–260	3,750	375
260–470	3,750 to 12,500**	375 to 1,250**
Above 470	12,500	1,250

** linear interpolations

Figure 1

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130–174MHz, uV/m at 3 meters = 56.81818(F) – 6136.3636; for the band 260–470MHz, uV/m at 3 meters = 41.6667(F) – 7083.3333. The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level.]

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

(d) For devices operating within the frequency band 40.66–40.70MHz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be + 0.01%. This frequency tolerance shall be maintained for a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) and may be employed for any type of operation, including operation prohibited in paragraph (a), provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this Section, except the field strength table in paragraph (b) is replaced by the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66–40.70	1,000	100
70–130	500	50
130–174	500 to 1,500**	50 TO 150**
174–260	1,500	150
260–470	1,500 to 5,000**	150 to 500**
Above 470	5,000	500

** linear interpolations

Figure 2

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130–174MHz, uV/m at 3 meters = 22.72727(F) – 2454.545; for the band 260–470MHz, uV/m at 3 meters = 16.6667(F) – 2833.3333. The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level.]

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

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