

Description Of Minor Modification

LIVETV Terminal Emission Designator and Spectral Mask

This application is for a minor modification of Iridium's mobile earth station authorization (call sign E960132). The purpose of the minor modification is to add authority for a new version of the OpenPort antenna, known as Live TV, that will be used on aircraft. Iridium is adding an emission designator 667KQ7W and a directional antenna. The combined modification of the new terminal is operated so as to not increase its interference potential with respect to the originally authorized mobile earth stations.

The new terminal offers a greater bandwidth than the existing terminals, based on the existing air interface waveform and on using multiple frequencies and time slots to obtain an increased data rate. The bandwidth of the composite waveform is greater than that of an existing Iridium terminal. However, the new terminal uses reduced transmitter power with a directional antenna to operate within the EIRP and EIRP density authorized for the current mobile earth stations. Specifically, the new spectral mask will have a maximum transmitter power per transmission of 2 watts when 4 to 16 frequencies are used. This transmitter power is averaged over a maximum of 4 transmission time slots of 8.28 milliseconds in each 90 millisecond frame on each of the 4 to 16 frequencies simultaneously. Therefore the maximum duty cycle is $4 \times 8.28 / 90 = 0.368$. The maximum mean transmitter power is 0.736 watts with a maximum EIRP of 6.36 dBW. Hence the modifications comply with 25.118 for notification as a minor modification of the licensed mobile earth stations.

1 Existing spectral mask

The Iridium system is able to operate in the frequency band 1616 to 1626.5 MHz, although only 1617.775 – 1626.5 MHz is authorised for operational use and the band 1617.775- 1618.725 MHz is shared with Globalstar. Operation of the LiveTV terminals will be limited to the sub-band that is not shared with Globalstar, currently 1618.725 - 1626.5 MHz. The Iridium system divides this spectrum into channels spaced by 41.67 kHz, and into time slots allowing four duplex channels per frequency. The existing Iridium terminals operate on one frequency and one time slot at any one time. Both frequency and time slots can change at hand-off. The emission designator is 41K7Q7W which declares a necessary bandwidth of 41.7 kHz.¹

The FCC spectral mask is defined in terms of multiples of the authorised bandwidth, which is taken from the emission designator. The frequency break points are 50%, 100% and 250% of the authorised bandwidth, giving a spectral mask of the form shown in figure 1. This Figure shows a number of channels, and the in-band spectral mask reaches its final value at the third adjacent channel. The dB values in the figure are power densities per Hz and are calculated as shown in the table. The final step (>250% bandwidth) of FCC paragraph 25.202 (f) (3) is determined by calculating the “transmitter

¹The original emission designator was 41KQ7W. The updated emission designator for this emission in this minor modification is 41K7Q7W pursuant to Part 2 Subpart C.

power in watts” as the power while the transmitter is on and not its mean power. A gated measurement is made only while the transmitter is active.

Main lobe	Total power	+7.7 dBW
	Equivalent rectangular bandwidth	25 kHz (44 dB Hz)
	Main lobe power density	-36.3 dBW/Hz
First step (50 to 100%)	Power density -25 dBc/4kHz	-17.3dBW/4kHz -53.3 dBW/Hz
Second step (100 to 250%)	Power density -35 dBc/4kHz	-27.3 dBW/4kHz -63.3 dBW/Hz
Final step (>250%)	Power density -50.7 dBc/4kHz	-43 dBW/4kHz -79 dBW/Hz

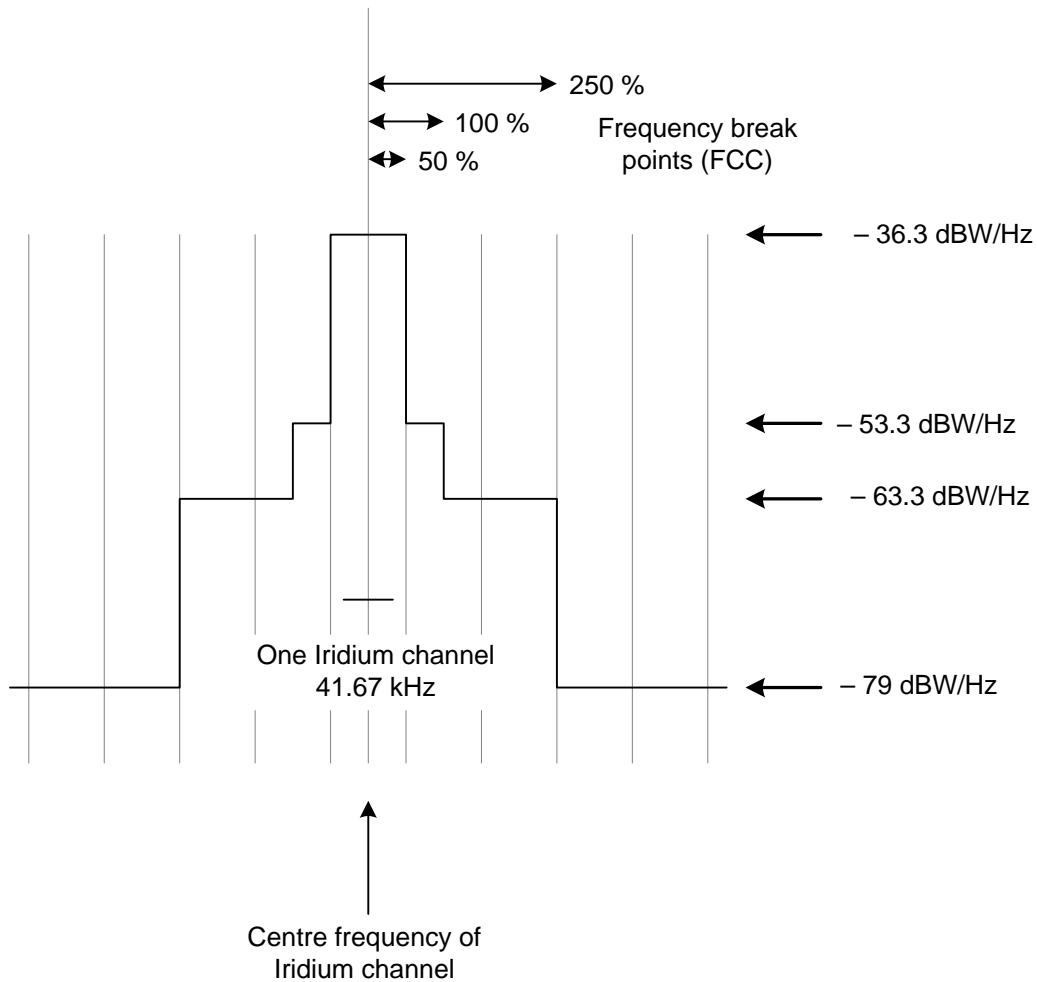


Figure 1. FCC spectral mask for existing terminals

LiveTV Terminal Spectrum.

The new LiveTV system retains the existing frequency and time multiplexing system. It uses a composite waveform which is the sum of a number of the existing waveforms (up to a maximum of 16). In this way it appears to an external observer as if it were a number of existing co-located Iridium terminals of the current design. The maximum number of frequencies and time slots is 16 and 4 respectively, the frequencies being arranged as a contiguous block. It does not necessarily use all frequencies and time slots available. It determines the number of slots based on traffic load and the level of service contracted. The EIRP of each component part of the waveform is a little less than that of the existing single carrier terminals. The composite signal is transmitted toward the Iridium satellite by means of a directional antenna.

The necessary bandwidth of such a composite signal is 667 kHz. with an emission designator 667KQ7W. The LiveTV terminal signal emission is represented by Figure 2.

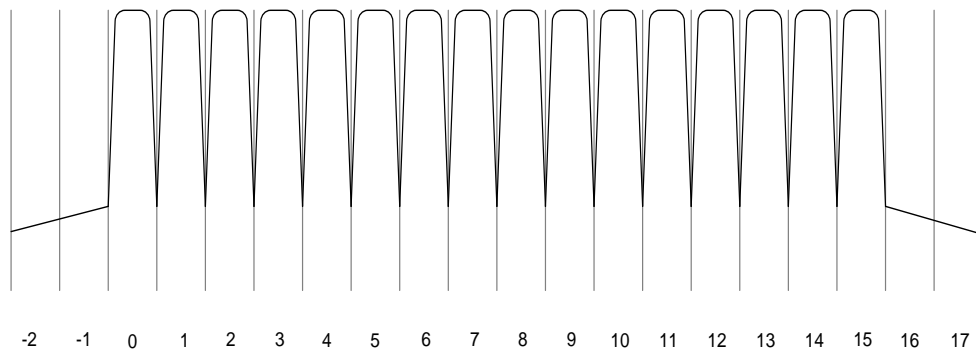


Figure 2. Idealised spectrum of LiveTV terminal

This figure represents an idealised spectrum of the output of a terminal operating on all 16 channels. The individual sub-carriers are on channels labelled 0 to 15, and a certain amount of spectral re-growth is shown in channels -2 and -1, also channels 16 and 17.

The overall bandwidth of this waveform is 667 kHz, excluding spectral re-growth. It should be considered as a number of co-located terminals, and the spectral mask of figure 1 is essentially divided and applied at the band edges, as shown in a general form in figure 3. This figure represents the top 5 channels of figure 2, with the FCC mask of figure 1 applied to its upper edge.

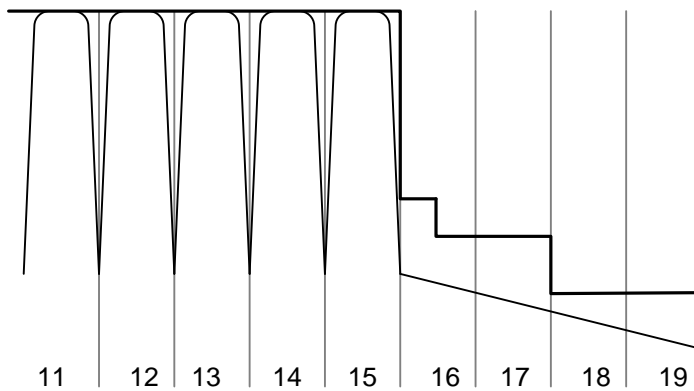


Figure 3. General form of proposed spectral mask

2 LiveTV Terminal spectral mask

Figure 4 is a representation of the LiveTV terminal spectral mask with the FCC emission mask applied based on the upper most frequency carrier. The emissions in any unoccupied channel are at least as low as is required from any existing single carrier terminal.

Also the level of each main lobe is equal to or lower than that of a single-frequency waveform. The level depends on the number of frequencies and time slots in use.

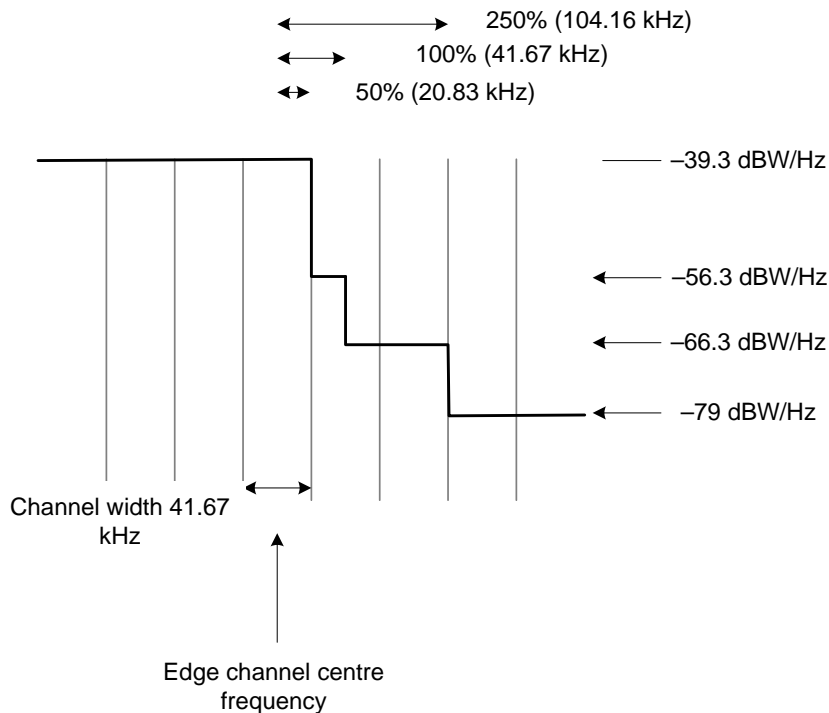


Figure 4. Spectral mask of LiveTV Terminal Emission

4 LiveTV terminal antenna

This LiveTV terminal uses a directional antenna consisting of seven radiating elements. See Figure 5. Six of these elements are set in a hexagon and provide all around coverage for low and medium angles of elevation. Each of the side looking radiating elements consist of patch antennas. The patches are fed with a Wilkinson divider. This gives 7 possible beam positions from the combination of the side looking patches and the top patch.

Each of the side looking radiating elements has an elliptical beamwidth of approximately 70 by 60 degrees with the narrow axis horizontal. The top patch has a beamwidth of approximately 70 degrees.

The signal is switched from one antenna radiating element to another to track and maintain a signal with the satellite.

Since the overall EIRP spectral density in the mainbeam of the LiveTV terminal is equal to or less than that of authorized mobile earth stations, the LiveTV terminal emits less energy outside of its mainbeam than that which is emitted from currently authorized omnidirectional terminals. Consequently the LiveTV terminal has less interference potential than the currently authorized omnidirectional terminals.

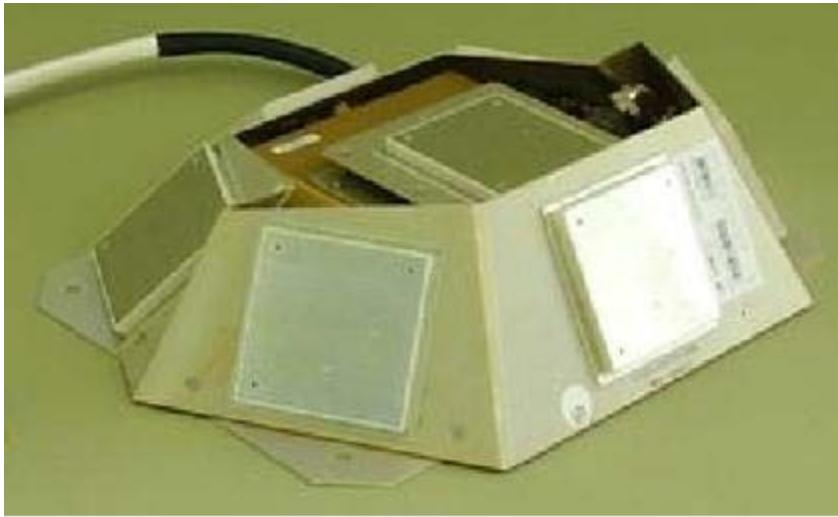


Figure 5. LiveTV Terminal Antenna