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11 September 2000

Magalie Roman Salas,
Office of Secretary,
Federal Communications Commision

Comment on ET Docket No. 98-153; FCC 00-163
"Revision of the Rules Regarding Ultra-Wideband Transmission Systems"

Dear Magalie,

CSSIP would like to commend the FCC on moving to bring Ground Penetrating Radar (GPR) into the regulatory framework. Our group has been working for 8 years in the field of GPR. We have had considerable success in developing a pulse compression type radar as opposed to the impulse type radars which have traditionally been used for GPR. In addition many other groups have researched pulse compression techniques for GPR. The particular pulse compression methodology we have used is Stepped Frequency Ground Penetrating Radar (SFGPR). We offer the following comments:

Detailed comments on the "Summary of Proposed Rule Making" as appeared in the Federal Register, June 14, 2000.

Paragraph 3, Question 3: The UWB definition should not be limited to devices that solely use pulsed emissions where the bandwidth is directly related to the narrow pulse width. A wide variety of pulse compression techniques are available to a radar designer; examples are stepped frequency, swept frequency, chirp and noise. Provided that radars employing these techniques meet the proposed emission limits, possible victim receivers will be protected against interference. Pulse compression radars have some advantages over impulse radar, the most notable being the ease with which the received signal can be efficiently digitized. These advantages will not be available to GPR users if the FCC chooses to exclude pulse compression radar by adopting an overly narrow definition of UWB.

Impulse radar clearly dominates the current market for GPR in part because it is simpler to implement than pulse compression radars. However improved availability of powerful signal processing and improved radio frequency hardware as a result of the recent boom in communications technologies ensures that interest will grow in the use of pulse compression radars for GPR. It would be gravely unfortunate if the possible uptake of pulse compression techniques for GPR were impeded by an overly narrow definition of UWB.

Paragraph 3, Questions 2 and 1: Given our comments above we suggest staying with the OSD/DARPA definition of UWB but have no objection to using the –10 dB rather than the –20 dB points.

Paragraphs 8 and 10: We suggest that there is an inconsistency in the protection of wideband receivers above and below 1 GHz. Wideband receivers are used below 1 GHz. The most notable future use will be the 6 MHz bandwidth of digital television in the UHF and VHF bands.

Paragraph 10 proposes the following for above 1GHz "(1) the peak level of the emission when measured over a bandwidth of 50MHz shall not exceed the maximum permitted average emission level by more than 20dB; and (2) the absolute peak output of the emission over its entire bandwidth shall not exceed the maximum permitted average emission level by more than $[20 + 20\log_{10}(\text{-10 dB bandwidth of the UWB emission in Hz/50 MHz})]$ or 60 dB, whichever is the lower value." We suggest that for consistency the FCC should apply a similar peak signal strength limit below 1 GHz. 50 MHz was chosen as the widest bandwidth of any likely victim receiver above 1GHz. The widest bandwidth of any likely victim receiver below 1 GHz is 6 MHz, the bandwidth of a digital television receiver. Below 1 GHz quasi-peak detectors with a bandwidth of 120kHz are used to measure emissions. 6 MHz is 50 times 120kHz just as 50 MHz is 50 times the measurement bandwidth of 1 MHz to be used above 1 GHz. Therefore we propose the following emission limits below 1 GHz. (1) the peak level of the emission when measured over a bandwidth of 6MHz shall not exceed the maximum permitted quasi-peak emission level by more than 20dB; and (2) the absolute peak output of the emission over its entire bandwidth shall not exceed the maximum permitted quasi-peak emission level by more than $[20 + 20\log_{10}(\text{-10 dB bandwidth of the UWB emission in Hz/6 MHz})]$ or 60 dB, whichever is the lower value.

General comments on ET Docket 98-153

Borehole radars: GPR is sometimes performed using borehole antennas. This area may expand in the future as many groups are trying to adapt GPR for collision avoidance in horizontal directional drilling. Clearly borehole GPR is extremely unlikely to cause interference to other users of the radio spectrum. We suggest that the FCC consider a blanket exemption for borehole and underground GPR work.

Testing of emission limits for GPR: To our reading it is implicit in both the Federal Register document and the FCC's "Notice of Proposed Rule Making" that the emission limits applying to GPRs are intended to be measured when the GPR antennas are in contact with, or close proximity to the ground. Cleary this should be made explicit.

Further we suggest that a standard test be specified for GPR systems. This test would involve using the GPR antennas on some standard medium and measuring the emissions into free space. The standard medium should be readily obtainable and have electrical properties which are sufficiently reproducible to ensure fair and consistent tests. Suitable media might be dry sand, freshwater, salty-water (of some specified conductivity), or concrete (made from specified materials).

Minor comments on "Notice of Proposed Rule Making", ET Docket 98-153, FCC 00-163,

Paragraph 36- It should be possible for most GPRs, be they impulse or pulse compression to exercise some degree of control over the placement of spectral lines within the GPS band. We agree with earlier comments that it is not practical to notch out the GPS band.

Paragraph 54- A spiral antenna is a dispersive antenna as well. A horn antenna is considerably less dispersive than a spiral antenna.

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