

# Nonlinear Propagation of Radio- Wave in Ionosphere

Igor Grigorov, VA3ZNW

E-mail: [antentop@antentop.org](mailto:antentop@antentop.org)

There are a lot of interesting phenomena at ionosphere propagation of radio-wave (for example, remember LDE!). One of such phenomenon is **nonlinear propagation of radio- wave in ionosphere**. What is it this effect? A very exactly description of the phenomenon was given by Vladislav, RX3ALL, at a message sent by him in the RU- QRP- C forum on December 19, 2005.

(Below the message is given with some cuttings)

--It was an interesting propagation yesterday night on 20 meters. I turned on my transceiver approximately at 19-30 UTC (22-30 local time). Nobody was at the band. Suddenly I heard a very loud station, it was an Ukrainian ham station/MM, it keyed on CQ.

*I give my call/QRP with 5-watts running by my IC-718. Only "QRZ?" I have received. After several unsuccessful attempts to do QSO I increase my power to 10 watts. The Ukrainian station, operator Gene, gave me 599...*

*A vessel, whence the Ukrainian station has been worked, was at the Atlantic Ocean. Distance between our stations was approximately 7500 kms. I sent CQ near (on frequency) the Ukrainian station, and, in several minutes one station from Argentina called me, after the QSO, another station from Argentina called me! (All calls are in my log.)*

*BUT! The stations did not hear me on 5 watts, however when I run 10 watts, I have received 579 and 589.*



Station **UA3ZNW** at middle 1980s.

**Left corner:** CW Transceiver and PA for 160, 80, 40, 20

**Right corner:** PSU 0-16 VDC, 0- 24 VDC, 250- 500 VDC, 6.3 VAC, 12.6 VAC  
Receiver for 10 meters

**Center:** Automatic key, transmitter for 10 meters, receiver for 160, 80, 40 and 20 meters.  
AM transmitter for 160 meters.

**All equipment are home brew**

*About 21-00 UTC I worked with Uruguay, CV5D, operator Lu. The same story, at 5 watts no QSO, at 10 watts 579.*

*After 21-00 UTC the 20 meters band was closed.*

*Regards, Vladislav, RX3ALL 72!--*

Vladislav met with a very interesting phenomenon, which is named (by me) **nonlinear propagation of radio- wave in ionosphere**. The phenomenon is, that at some small power (say 5 watts, as Vladislav had) it is impossible to do a QSO, nobody answers, however, if the power is a little increased (say to 10 watts, as Vladislav did), the QSO is going on 59. As a rule, this phenomenon is observed at DX QSO, if the distant is more than 2000 kms.

I have noticed this phenomenon in 1980s. At the times I had ham call **UA3ZNV** and I often sent CQ at 10 meters using a home brew transistor AM transmitter. 12 Volts from a PSU with manually variable voltage was going to the PA of the transmitter, and I had 3-watts RF power.

So, at the times I have met the same phenomenon as Vladislav met at 2005. When 12 Volts feed the PA, nobody answers, BUT, when 16 Volts feed the PA, I have received 59 from far stations. My transmitter runs 5 watts when 16 volts were across PA. So, it impossible explain, why at 3 watts G4HQR, but at 5 watts – '59.' Usual theory of radio- propagation has no answer on the question.

I have noticed one more interesting effect of **nonlinear propagation of radio- wave in ionosphere**. It is possible to name this phenomenon as a **trigger effect**. The phenomenon is that at some small power (say 1 watt) nobody answers. However if the power is a little increased (say to 2 watts) you have received 59. Then power decreased (say, again to 1 watt) but anyway you have received 59 from your correspondent.

## **Nonlinear Propagation of Radio- Wave**

At first I noticed trigger effect at 10 meters band. Since an RF transistor of my PA was overheated at 16 volts, I worried, that it would go out of operation during QSO. In 1980s the RF power transistor costs pretty penny. So, I called my correspondent when my PA was fed by 16 volts, after that reduced voltage to 12 volts, and made QSO. As a rule, the QSO was completely done. The truth, sometimes during QSO my signs were ceased, then I again increased the voltage to 16 volts for a while.

A power radio station located in my city also could be the cause of the trigger effect. For example, I for a long time call DX station, no answer, then power station from my city have made QSO with the DX, after that the DX gives me 59. Such phenomenon often is observed by me in contents, when I try QRP. I call for a long time a far station, no answer, then a powerful station has made QSO with the DX. That is all, the DX gives me 599.

At first I thought that these strange things are only on 10 meters. But then I observed the phenomena on others amateur HF bands, from 160 up to 10 meters. The truth, on the 10 meters these phenomena are more sharply than on low-frequency HF ranges. Lots of hams and professionals also are familiar with the strange phenomena. My attempts to find a science explanation to these interesting phenomena are failed.

Professionals and scientists in personal talking about the phenomena sad me, that it is a whim of propagation or lack of my antenna or lack of the receiver of my correspondent. May be... But by me this effect was marked at various receivers, both self-made and professional, at different antennas, on diverse bands, and at stable (for the time) propagation...

**... It seems to me this riddle is still unsolved ...**

**73/72! I.G.**

