Radioelectronics and Communications Systems
Vol. 42, No. 12, pp. 45–48, 1999

Izvestiya VUZ. Radioelektronika
Vol. 42, No. 12, pp. 65–71, 1999
UDC 621.78; 621.382

CIRCUIT TECHNOLOGY FEATURES OF RECEIVING DEVICES OF NAVSTAR AND GLONASS SATELLITE RADIO NAVIGATION SYSTEMS

A. I. Kirichenko, A. A. Lipatov, S. N. Patishchev, and E. T. Skorik

SE UkrKosmos, Kiev, Ukraine

The paper considered circuit technology features of the users' navigation ground mobile equipment (in particular using a SN-3301 receiving device as an example).

Users' navigation equipment (UNE) of satellite navigation systems (SNS) has covered small-scale production prototypes weighing 20–30 kg and power consumption of 200–300 W to small-size and economical devices having dimensions of a match box and even installed in watches.. At present some 60 companies manufacture some 45 types of UNE [1]. Every month up to 60,000 UNE's are manufactured, while the total cost of UNE's sold in 1998 reached some US$ 2 billion, while by 2000, according to forecasts, it will reach US$ 3 billion. By 2000 the cost of individual types of UNE's will be US$ 500 [2], and as early as in 1998 the US Magellan Co. announced commercial production of the *Pioneer* navigation device for yachtsmen and tourists at the price of US$ 99.9. Naturally, that the cost of the specialized UNE's remains rather high.

A special place is held by the equipment operating simultaneously in the navigation fields of SNS NAVSTAR (the USA) and GLONASS (Russia). At present such UNE are commercially put out by Trimble Navigation and Ashtech (both in the US), NovAtel (Canada), and Man Technology (Germany). UNE's operation using signals of SNS makes it possible to do positioning at higher accuracy and continuity owing to a better geometrical factor of observing space vehicles (SV). When using two systems the most likely is the observation of five SV's required for the user's positioning. This is also explained by the fact that NAVSTAR SNS has a greater number of highly effective SV's, while in GLONASS SNS the S/A open code of standard accuracy is not coarsened.

The most strict requirements are placed on UNE of aviation application. Let us consider the requirements to SNS and methods of meeting them using SN-3301 commercial equipment manufactured by the Orizon-Navigation State Enterprise (Smela, Ukraine). SNS consists of a radio receiving device (RND) fulfilling the functions of reception and primary digital signal processing and that of digital processor solving the navigational problem and fulfilling the function of controlling SNS in general.

Main requirements to RND: GLONASS working reception frequencies $(1602 + 0.562n)$ MHz, where $n = -7, ..., -1, 0, 1, ..., 24$; the modulating PSP code of standard accuracy has the clock frequency of 511 kHz; NAVSTAR — 1575.42 MHz; the clock frequency of the modulating PSP code of standard accuracy (S/A) constitutes 1.023 MHz; the susceptibility level (real sensitivity) on the working frequency of reception is not more than –165 dBW; the relative susceptibility level to a sinusoidal interference at frequency penetrating to the band of working frequencies of reception, of the GLONASS and NAVSTAR signal is not more than 21 dB and 24 dB, respectively; the relative susceptibility level in the side and image channels of reception is at least 70 and 50 dB, respectively; the susceptibility level to blocking is at least – 10dBW; the input circuits should retain their operational capacity even if affected by a signal of 1W within the band of reception working frequencies; the band of working temperatures is from –40 to +70 °C; the power supply is 50.5 V; consumed power is not more than 4.5 W.

REFERENCES

1. Receiver Survey, GPS World, pp. 36-52, January 1999.
2. Global Navigation Systems [in Russian], vol. 71, no. 10, TIIER, 1983.
3. M. Basic and D. Liusenbard, MSN and CT, pp. 8-10, March, 1987.
4. Yu. S. Dubinko, The Completely Hardware Digital Radio Receiver of GPS Signals [in Russian], Glonass.
5. M. E. Il'chenko, A. A. Lipatov, N. A. Mogil'chenko, and T. N. Narytnik, Microwave Integral Devices of Telecommunications Systems [in Russian], Tekhnika, Kiev, 1998.
6. D. M. Acos and J. B. Y. Tsui, IEEE Trans.: Microwave Theory and Techniques, vol. 44, no. 12, pp. 233-2339. 1999.

25 April 1999