Common Interference Factors and Control Measures for 5G Terminals

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Abstract: In recent years, the development trend of communication industry in intelligent, broadband and mobile is obvious, the use of wireless traffic is rising rapidly, and information consumption has become a new symbol of accelerated economic growth. The continuous development of mobile communications has become an important guarantee of how to improve the level of social informatization and promote the development of the national economy. Nowadays, not only tends to the network update rate, but also tends to the emerging development of 5G network, in order to improve the level of informatization. Communication system has been updated from one generation to five generations, even though four generations of communication systems have been widely put into use, but not up to the needs of certain senior staff and the construction of various aspects of the country. In order to make the 5G system and the satellite system and the transmitter system merge and share, to avoid the interference to the satellite system in orbit and the plan to use the satellite system, the in-depth understanding and practice, go to solve the problem of self-interference, mutual interference, in order to ensure the efficiency of receiving information.

Keywords: 5G; Interference; Factors; Measures

1. Introduction

5G terminal refers to the input and output equipment of 5G communication technology, which is a peripheral device relative to the mainframe of the computer, and does not provide computing and processing functions by itself. According to the planning of the three major carriers for 2019 at the publication meeting, there will be more than 10 models of 5G terminals, including Huawei, ZTE and so on.In August 2018, China Mobile and China Unicom jointly announced the official commercialization of 5G terminals.The most important feature of 5G terminals is that they are fast network speeds, support for high speed rate connections, and support for massive connections.5G's performance of 4G, with a lower latency and a larger capacity, is 10 times faster than that of 4G. Speed is 10 times that of 4G. 5G in order to improve the wireless transmission rate, based on 4G developed a new frequency band resources, but the frequency is not in the gold is on the frequency band, so go to use the increase of base stations and other methods to overcome the millimeter wave penetration is poor, attenuation is poor and other shortcomings. Although it is possible to overcome the fact that the accurate transmission and reception of signals can be hindered by the factors that exist in the receiving part of the terminal equipment, it is necessary to find these factors and actively overcome them.

2. Common Interference Factors for 5G Terminals

2.1 Self-interference of 5G terminals

The 5G structure can not be used independently under the non-independent networking mode, and should be connected with LTE, 5GgNB and eNB, i.e., it is possible to send and receive information only when 5G and LTE signals are supported, and there is the influence of intermodulation interference and harmonic interference. In 5G and LTE frequency selection, the terminal RF device will occur nonlinear harmonic interference signal, but also cause the impact of terminal sensitivity. Terminal internal interference is mostly caused by internal nonlinear strong equipment, which, in turn, is divided into two

categories of active nonlinear and passive nonlinear devices, and the interference caused by active devices is stronger than passive devices. Ideal amplifier power will first amplify the signal to a certain extent, the power signal in order to effectively amplify the linear; and when the input power is larger, it will cause the signal to enter the nonlinear region, below the ideal signal band, so that the output is a higher-order variable, resulting in the presence of a certain amount of interference when the received machine sensitivity decreases, and can not reach the expected linear ideal zone.

2.2 Influence of Power Consumption in 5G Terminals

There are many factors affecting power consumption, but they can be simply categorized into their own influence, network factors, and business-related factors. The power consumption performance of the terminal is mainly determined by its own hardware design, clock design, speakers, screen and other peripherals, WiFi, Bluetooth, these hardware will affect the power consumption. OTT heartbeat consumes power within 2 ms, and will automatically shut down after exceeding that, while LTE hibernation time is shorter (less than 1s), which has a greater impact on OTT heartbeat power consumption. Therefore, operators should consider whether they need to extend the OTT sleep time. In addition, the OTT needs to be woken up twice to complete the release of the RRc message, so it has a large impact on the OTT heartbeat power consumption. The parameters in the above analysis only affect the uplink power control to a certain extent. The impact of the service on the terminal power consumption mainly lies in the fact that the heartbeat packet mechanism of the OTT service will recognize and release the heartbeat packet according to the state of the connection while the mechanism establishes the connection, thus realizing the support of the heartbeat push function. Under the OOM/RRC push mechanism, the OTT service can realize a heartbeat packet frequency as low as 3 dB (1 heartbeat packet transmitted per second) through this push mechanism.

3. Measures to control common interference factors in 5G terminals

3.1 Controlling the nonlinear reduction of PA

According to the above analysis of the factors of 5G terminal self-interference, get the nonlinearity of the device is the most important a key point, want to get a section of the signal without harmonic interference, need to reduce the nonlinear input of the PA, improve the performance of the device, can be analyzed from the performance indicators of the device to improve the good optimization of the device.

3.2 Adding a filter after the PA

There are two ways to add a filter, the first is to add a filter after the PA, the purpose is to add a section of filtering to suppress harmonics at the output of the PA, but it is difficult to completely eliminate the effects of the required filtering technology is also very stringent; the second is to improve the technology of the filter after the PA, in the first case it is difficult to achieve a complete solution to the harmonic signals of the interference, if the technology of the filter is improved to give a solution to the interference due to nonlinear sources. give a solution to the interference due to nonlinear sources. And the known filter selector is to eliminate the interference by attenuating the other frequency components by the specified frequency values in the signal. The main parameters of this filter are the center frequency and the operating bandwidth. Usually, the center frequency is determined by the device, and the bandwidth needs to be determined according to the system specifications. With the development of RF front-end technology and devices, RF front-end design has gradually become more complex. RF filter refers to the signal in the propagation process may produce nonlinear products through the filtering means to eliminate or reduce. RF filter is a very important and growing antenna technology, it can be high frequency signal from the antenna inside the transmitter, to achieve the purpose of controlling the attenuation of high-frequency signals and suppressing harmonic interference signals. Previously, this method is simple to realize, and the cost is very low compared with others, but if only by increasing the filter, only part of the harmonic interference signal output by the transmitting antenna can be eliminated, and for the harmonic signals of the PA output PCB can not be completely suppressed. Therefore, this method can be considered to be used in combination with the rest of the methods.

3.3 Improvement of MIMO antenna system isolation

MIMO antenna system mobile communication system, the base station side of each antenna unit has an independent signal transmission and reception, but also to the base station multiple antenna units for transmitting and receiving signals, which need to improve the isolation degree of the multibeam antenna system. mimo technology has become a new generation of mobile communication upgraded one of the core technologies, which in the future of the 3G mobile communication will play an increasingly important role. mimo technology can increase channel utilization to increase the number of users each base station can support to achieve greater spectral efficiency and a wider range of content. MIMO technology can achieve higher spectral efficiency and greater range of content volume by increasing channel utilization and increasing the number of users that each base station can support. In order to achieve the desired performance metrics (e.g., peak data rate, latency, BER, and carrier utilization), it is necessary and critical to improve the isolation between antenna units or within the system and between neighboring antenna units.

The interference in the self-interference within the terminal comes from the coupling of the transmitter antenna and the receiver antenna, and the 5G terminals are using antenna arrays, to improve the isolation degree of transceiver antenna arrays to solve the interference factors, the direct method is to add the distance between the transmitter antenna and the receiver antenna, and to pay attention to the radiation degree of the signals in the physical space, so as to improve the isolation degree of the antenna arrays: (1) By changing the current distribution of the antennas, the antennas can be isolated from each other. In the case of antenna current distribution, most of them are combined with each other by digging slots on the ground and introducing coupling branches between the antennas, to improve the antenna isolation degree by influencing the antenna ground plane and the antenna signal current from them. (2) Use the parasitic principle, in the MIMO antenna unit to join the parasitic components to reduce the combination between the antennas, the isolation between the antennas is more obvious. (3) The introduction of metamaterials, material specificity, the design of the corresponding unit structure, so that the electric and magnetic fields of the antenna caused by the corresponding resonance, reduce the MIMO antenna and the coupling between the unit, to achieve the purpose.

4. Conclusion

In summary, under the continuous development of 5G network, the network is indispensable everywhere in daily life, whether it is in life, study, entertainment and work have a great connection with the Internet. The 5G terminal system is also constantly moving forward under the progress of the network, changing its own performance to better improve services. In the development of terminal 5G band, the self-interference problem has a great impact on its application and development, and the problem of intermodulation interference should be resolved by actively adopting scientific methods. In this paper, the problems related to self-interference in terminal 5G band are studied, and some solution strategies are proposed, such as reducing the nonlinearity of control PA, improving the isolation degree of MIMO antenna system, and selecting and applying the method of time-division scheduling. Through these solutions mentioned above, the terminal 5G frequency band self-interference problem is improved, but also better for the good development of the 5G network system and outlook, not only lies in the 5G conditions, may be later under the influence of the terminal more than 5G, its full range of applications to play a certain positive role in promoting the construction of the motherland to add a force.

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