



The Optimal Solution to Ensure the Excellent Certification Quality of EMI Testing



GW INSTEK

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3GHz Spectrum Analyzers have become an important tool to characterize the EMI testing

In terms of propagating path, there classify into conducted EMI and radiated EMI. The conducted EMI results from that the radiated signal adheres along the power line and hard to detect and recognize. Therefore, it is necessary to build the causes and effects methodology by way of the correct measurement to maintain the electromagnetic compatibility, to target the electromagnetic interference, and to detect radio frequency interference. With the state-of-art design among various testing devices, outstanding low noise floor level of -117dBm at 1 GHz of the 3GHz spectrum analyzer performs extreme sensitivity for picking up weak signals.

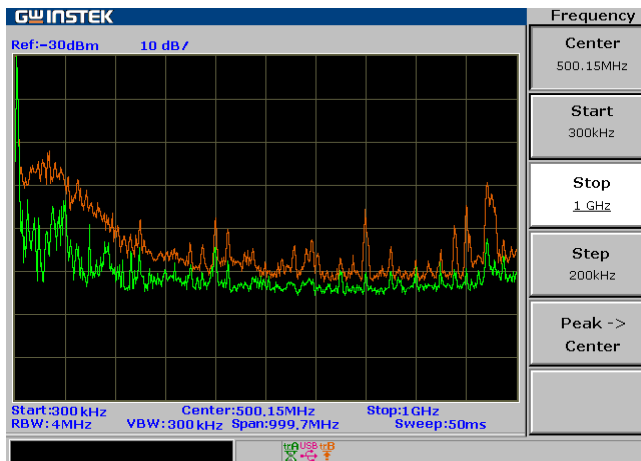


Fig. 1. Using GKT-006 Probes for EMI Emission Diagnosis Systems that have been well adopted for EMC/EMI pre-test of electronic product before delivering to EMI certification Lab, for example.

Along with a transports along other electronic devices or component. And the radiated EMI caused by the unwanted signal of harmonics generated from the system case, antenna or electronic component transmits as a electromagnetic wave to distort other electronic systems.

With the advancement of high-tech development, the issues of EMI come out and diffuse over the broad electronic applications. The increasing operating speed and integrated density semiconductor devices are enlarging the higher noise level than before so that many of the distortion sources of signal become hard to detect and recognize. Therefore, it is necessary to build the causes and effects methodology by way of the correct measurement to maintain the electromagnetic compatibility, to target the electromagnetic interference, and to detect radio frequency interference.

With the state-of-art design among various testing devices, outstanding low noise floor level of -117dBm at 1 GHz of the 3GHz spectrum analyzer performs extreme sensitivity for picking up weak signals. Along with a 20dB-gain preamplifier, the 3GHz spectrum analyzer can further reach an equivalent noise floor level as low as -137dBm, widely extending the measurement range. The transient signal optimization on this spectrum analyzer enables measurement of the power in rapid grasping the EMI sources. These capabilities make the 3GHz spectrum analyzer uniquely suited to solving today's EMI problems.

The requirements of Electromagnetic compliance testing has become the key indicator to forecast the market potential for 3GHz Spectrum Analyzer

Electromagnetic compliance (EMC) remains a hot topic among regulatory groups and manufacturers. With the continued integration of electronics in consumer devices, there will be a significant increase in the number of possible electromagnetic sources present in any given environment. EMC testing, therefore, is necessary to guarantee the safe and effective operation of such products. To combat the risks associated with

electromagnetic interference (EMI), product manufacturers are adopting spectrum analyzers as reliable tools for EMC testing. Typically lightweight and feature-rich, spectrum analyzers can be used in conjunction with antennas, line impedance stabilization networks (LISNs), and near-field probes to find EMI radiation sources. The use of spectrum analyzers often saves time and money for engineers who do not wish to travel to an EMC lab for their compliance tests. Spectrum analyzers that can handle an 3~20GHz frequency range are well suited for examining satellite communications systems' operations, testing communications equipment, and fulfilling wireless system commissioning and troubleshooting. The communications industry is perhaps the most important area of growth for spectrum analyzers, as this sector continues to witness the deployment of new wireless networks and standards that must be tested for EMI. As technologies such as WiMAX, 3G wireless, and WCDMA continue to evolve, they are expected to contribute a significant proportion of revenues to the overall spectrum-analyzer market. Although spectrum analyzers have been known for their somewhat hefty price tag in the past, the introduction of lower- cost testers has made such devices more affordable and desirable to many end users. This is largely attributed to vendors who have moved toward the development of less-expensive handheld devices.

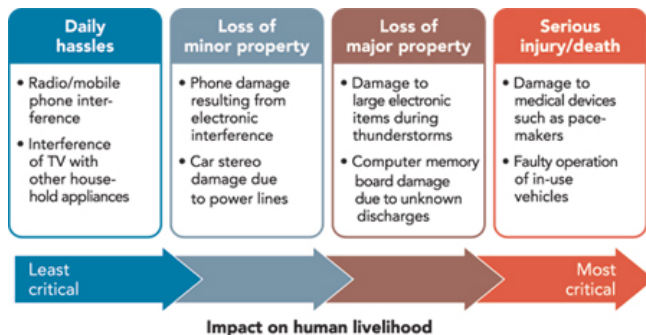


Fig. 2. There is a wide range of human risk associated with electromagnetic interference

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With their small footprints and portable nature, such products allow for utility both in the field and on the bench. Despite the increased use of handheld devices, spectrum-analyzer vendors must realize that their revenues may be hindered by the availability of previously used systems currently in the market, which are prime options for R&D engineers who wish to minimize operating costs. Even with used systems available, the mature spectrum analyzer market will continue to experience modest growth, given its importance in EMC testing. There depicts market revenues from 2003 to 2007 and expected revenues for 2008 in Fig.2. With a high degree of market competition and price sensitivity, vendors must understand the importance of developing products with enough features and capabilities to satisfy the testing needs of end users.

EMI Measurement Overview

With a compact spectrum analyzer, the manufacturers making electronic products can easily build up the production line for EMI testing or electronic system designer can have the technical capability to develop the high the capacity have been adopted by way of radiated EMI ad Conducted EMI. For a formal EMI certification test, in either an EMI chamber or an open field site, the receiving antenna will pick up the emissions with in a distance of 8 or 10 meters. This means the emissions may come from anywhere within the DUT. The antenna will receive them all the emissions, they can come from the top, bottom, right or left hand side.

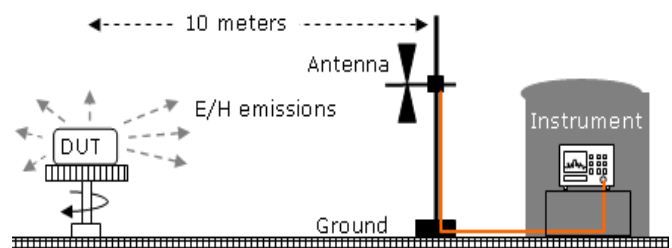


Fig. 3. EMI testing in Open side.

In Fig.3, the DUT is placed on a rotatable table, the receiving antenna is located 10 meters from the DUT, and its stature is adjustable. The antenna output is connected to a spectrum analyzer which is located in a shielded room. A perfect Ground is needed to ensure an isolated environment. During the measurement, the table will rotate 360 degrees, so that the antenna can receive the omni directional emissions. The antenna is also vertically adjustable to catch the upward emissions. However, the EMI testing results can not distinguish where on the DUT the emissions were generated. When the emissions are too strong and fail to pass regulations, the source needs to be suppressed and thus have to be identified first. The near field probe is used to find the source of emissions on the DUT.

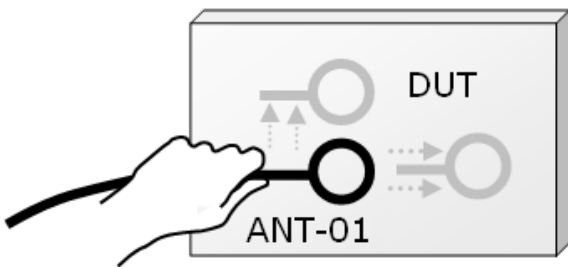


Fig. 4. Moving the probe around the DUT

The GKT-006 is a near field probe set which is used to connect to a spectrum analyzer (in most of cases) to detect the E or H field. The detection is done by holding the probe and moving it around the DUT as shown in Fig.4. When the probe is moved to the vicinity of the source, the E/H field will be inducted through the probe, showing the measured strength on the spectrum analyzer. The emission source can be located accordingly. During the operation, the probes (two loop and one stub probe) are used by means of “non-direct touch” so the probes will induct the E/H field. The probes are insulated

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with plastic so that short circuits to the DUT are avoided. Different types of probes are chosen to fit different frequencies and DUT shapes. The tip probe is a direct touch probe which allows the probe tip to directly test the circuits. Even though there is no ground connection to the probe the FR signal can still be measured for spot testing and location measuring.

A Spectrum analyzer is the most widely used instrument for EMI emission measurements. A spectrum analyzer provides the frequency and strength information of signals. With the use of a moving probe the source location of emissions can be found rapidly. For diagnostic purposes, it is recommended that our spectrum analyzer is used in the “Peak Hold” trace mode to record emissions. If emissions are weak, an additional preamplifier can be used for amplifying emissions for measurement. Besides, the 3GHz spectrum analyzer can be an automatic test instrument instead of external computer control. Users can define their own macros through keypad on the front panel and store them into sequence sets at most. Each sequence including pause steps, which can be paused at the instant while observing the measurement result. The quick EMI pretest can be implemented on spectrum analyzer with EMI filter.

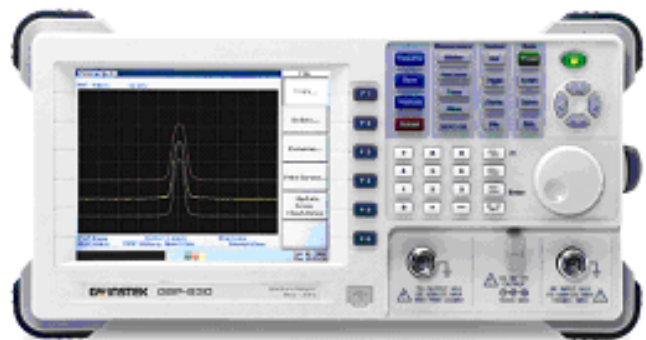


Fig. 5. The typical 3GHz Spectrum Analyzer



Fig. 6. The main tool of EMI diagnostic package

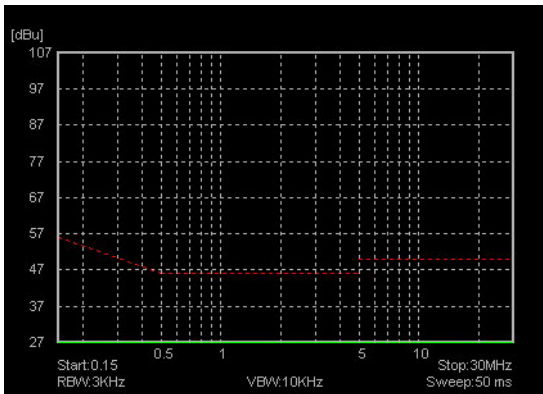


Fig. 7. The EMI-specific software installed in EMI diagnostic package

Interfaces and Connections of EMI Measurement

The probes have different connector types due to their characteristics. When a probe is connected to a spectrum analyzer, a suitable adapter is needed. Possible connections are as follows.

1. When the loop probes ANT-01, ANT-02 and ANT-03 are connected to a spectrum analyzer, an N to BNC adapter (ADP-01) is needed because these probes are BNC type connectors. The cable used in the GKT-006 is a test lead with BNC connectors at both ends.
2. One can use probe detector PR-03 to point out and track the conduction properties of electrical circuit by

the configuration as shown in Fig.9. This connection is well performed on spectrum analyzer instead of the oscilloscope that can't activate the RF detection kit without 50Ω input impedance.

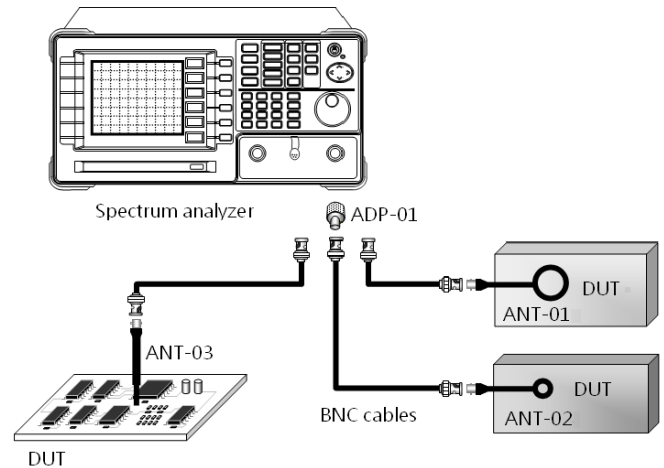


Fig. 8. BNC probe Connections is well-posed with RF cable and loop probes ANT-01, ANT-02 and ANT-03, which enable to measure the background noise of peripheral signal from TV or radio.

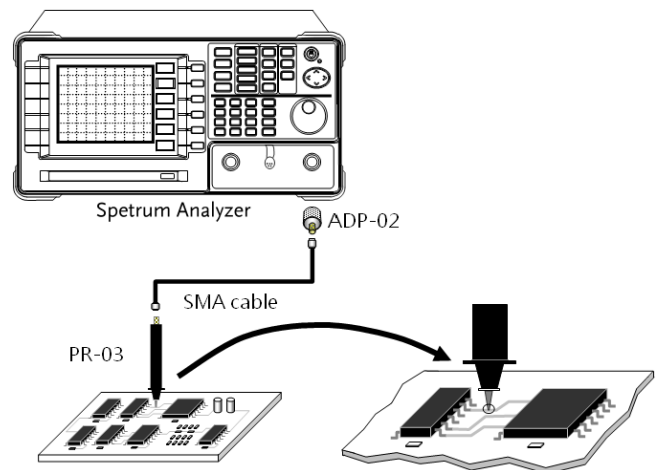


Fig. 9. Correct connections is well-posed with SMA cable and probe detector PR-03 to track the circuit conduction

In terms of a spectrum analyzer set-up, we shall have the primary setting of frequency range by scanning two zones, 30MHz~300MHz and 300MHz~1GHz under 120KHz of

RBW setting. At first, enter the function key "Trace" and select "Peak" to pick out the main sources of largest noise level by sequence as "Trace" then "More" then "Detection". In terms of the further advanced test, we can choose the major source of noise peak 120MHz, for example. Assign the center frequency as this noise peak 120MHz and set the frequency span to 4MHz. Then select "Detection", then enter "Q Peak", and use "AVG" to pick out the maximum and average value which will be the practical way.

Example 1. Quickly checking the conduction properties of electrical circuit



Fig. 10. Optimal solution of EMI emission Measurement

As shown in Fig.10, applying kits of loop probes to proceed in simple tracking the EMI characteristics will make it possible to save much more time in testing site of production line. There are kits including ANT-01, BNC cable, ADP-01 and a 10dB pre-amplifier GAP-802 to capture the EMI emission source in this figure.

Example 2. The Pre-test Measurement for the Advanced Test on the Process Equipments in Semiconductor Manufacturing Sector

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To attain the highly precision in robot movement along the process chambers on equipment is significantly affected by the normal programmable operation. And the preventive maintenances of the equipment often spent much time and efforts while going for the preliminary check with conducted EMI calibration as shown in Fig.11.[1]

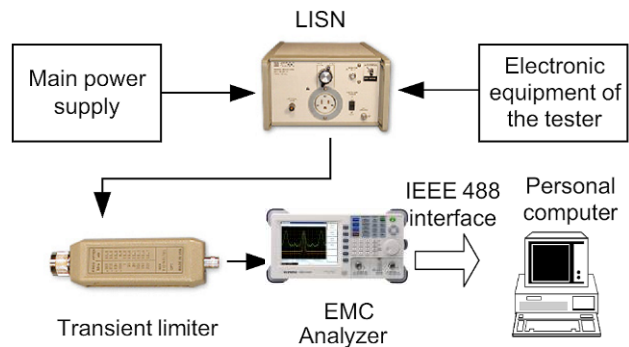


Fig. 11. It takes much time for certification connection for normal conducted EMI, which can cost-efficiently adopt the pre-test measurement by simple EMI emission detection.

The profound influence Pre-test by Spectrum analyzer Measurement System on Conducted EMI certification

The noise sources can be decomposed into common mode noise and differential mode noise. These two components of noise sources are respectively caused by their associated current. The noise can be extracted from the line impedance stabilization network (LISN), shown in Fig.12, the measured value after feed through noise separator can be acquired by spectrum analyzer. With a EMI detection bundled on a 3GHz spectrum analyzer, Either involving the commitments of EMI detection or simply build the easy connection may allow you to get rid of most of the EMI troublesome.

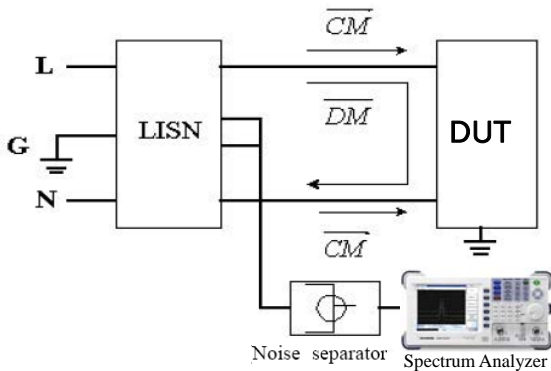


Fig. 12. Measurement system for Conducted EMI.

As an approach to killer application, 3GHz spectrum analyzer inherits the advantages of high performance, affordable cost, easy to use and light-weight portability. Moreover, its extremely low noise floor greatly increases the measurement range, advanced user interface brings users with significant visual enhancement, and versatile powerful functions make measurements simple and accurate. The 3GHz spectrum analyzers have been offers with the greatest performance-to-price ratio in the market. Using the 3GHz spectrum analyzer as a EMI/EMC pre-test measurement tool will likely eliminate the possibility of measurement algorithm errors after addressing the EMI testing in certification lab. The leadership of 3GHz spectrum analyzer in delivering the test industry's first dedicated EMI measurement suite has given it rapid adoption by a wide range of EMI/EMC certification. There is a very good chance that one's electronic product will successfully undergo EMI/EMC certification test with the 3GHz spectrum analyzer making many of the measurements. If an issue does arise during the EMI/EMC test, having the easily portable single box SA available provides a means to quickly troubleshoot circuits. The 3GHz spectrum analyzer can help the engineer rescue the EMI/EMC effort

by rapidly identifying the issues. This can prevent the lengthy setbacks that can occur with outdated and inefficient test equipment.

References

- [1] A. Krusubthaworn, R. Sivaratana, V. Ungvichian, A. Siritaratiwat., Testing parameters of TMR heads affected by dynamic-tester induced EMI, Journal of Magnetism and Magnetic Materials 316(2007) e142-e144.

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