ANALYSIS of BI K11-20 PRE-COMPLIANCE

To the US Dept. of Defense MIL-STD-461G Standard
2 to 30 MHz RE102 Radiated Emission Limit for Aircraft, Fixed Wing ≥ 25 meters Nose to Tail
or Navy Fixed & Air Force Ground Applications

INTRODUCTION

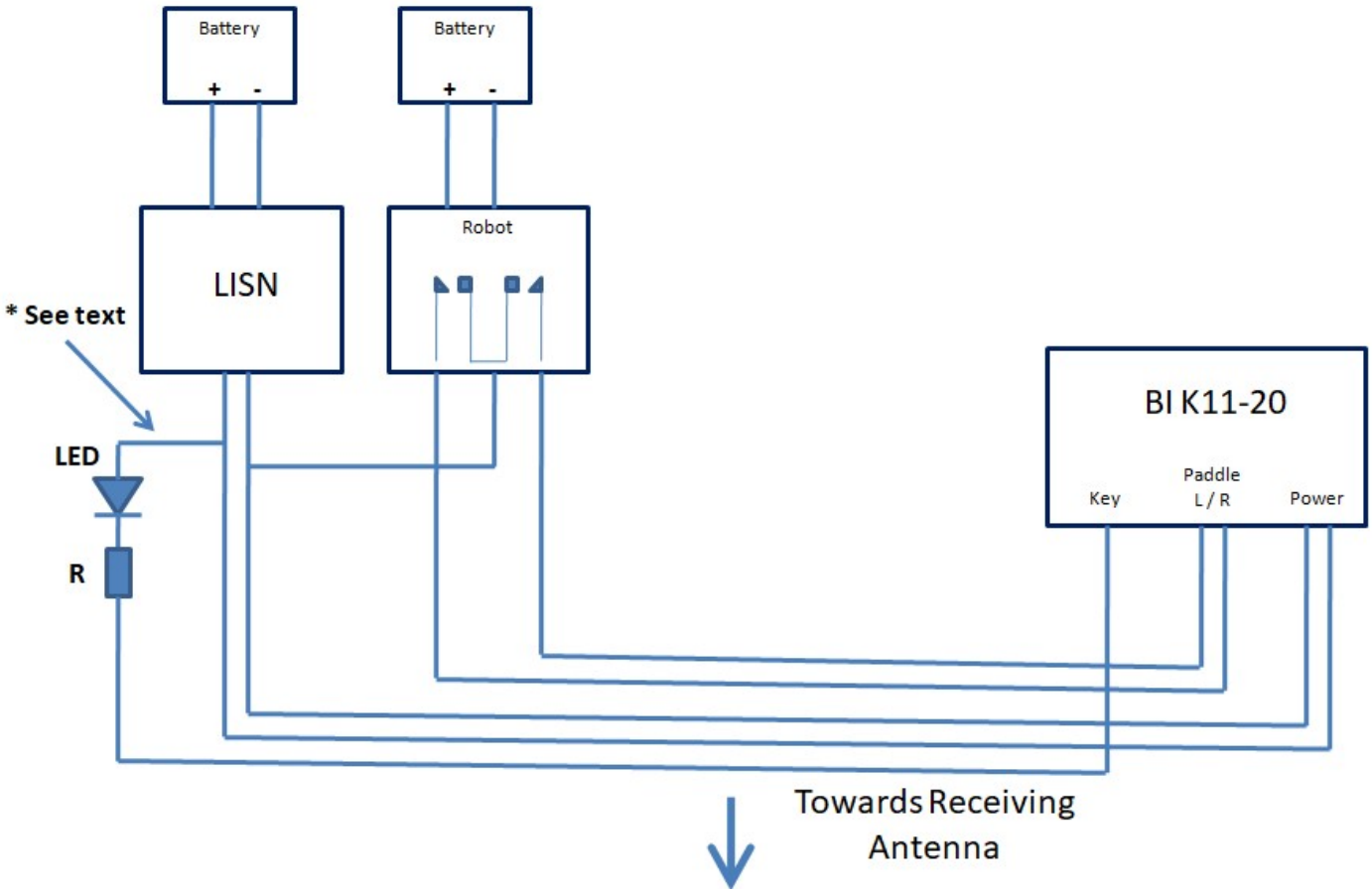
The EMC requirements for amateur radio operations are largely adopted from commercial standards while some provisions are allowed for "homebrewed" systems. As systems in a radio station evolved, the understanding of the interaction of subsystems and electromagnetic environment in which the station can operate efficiently resulted in the need to prevent various threats and functional issues of the station. Emissions and immunity, on-platform quiet electromagnetic environments for extremely sensitive and low-noise radio communications are a requirement for today's radio station.

An analysis of the spurious emissions from the BI K11-20 Morse Keyer is performed in a pre-compliance test. The test itself uses the United States Department of Defense Interface Standard, MIL-STD-461G, Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment, RE 102, Radiated Emissions, Electric Field as a reference point. MIL-STD-461G is used as it provides more practical requirements of radio environments. The test is limited to 2 MHz to 30 MHz frequency range where CW is more commonly used.

The emissions from an unmodified unit are recorded. Gradual modifications are implemented and the resulting emissions are then recorded. It is hoped that the analysis presented will provide the user with an understanding on how to optimize the electromagnetic environment in which BI K11-20 Morse Keyer is operated and thus allowing for sensitive and low-noise radio equipment operations.

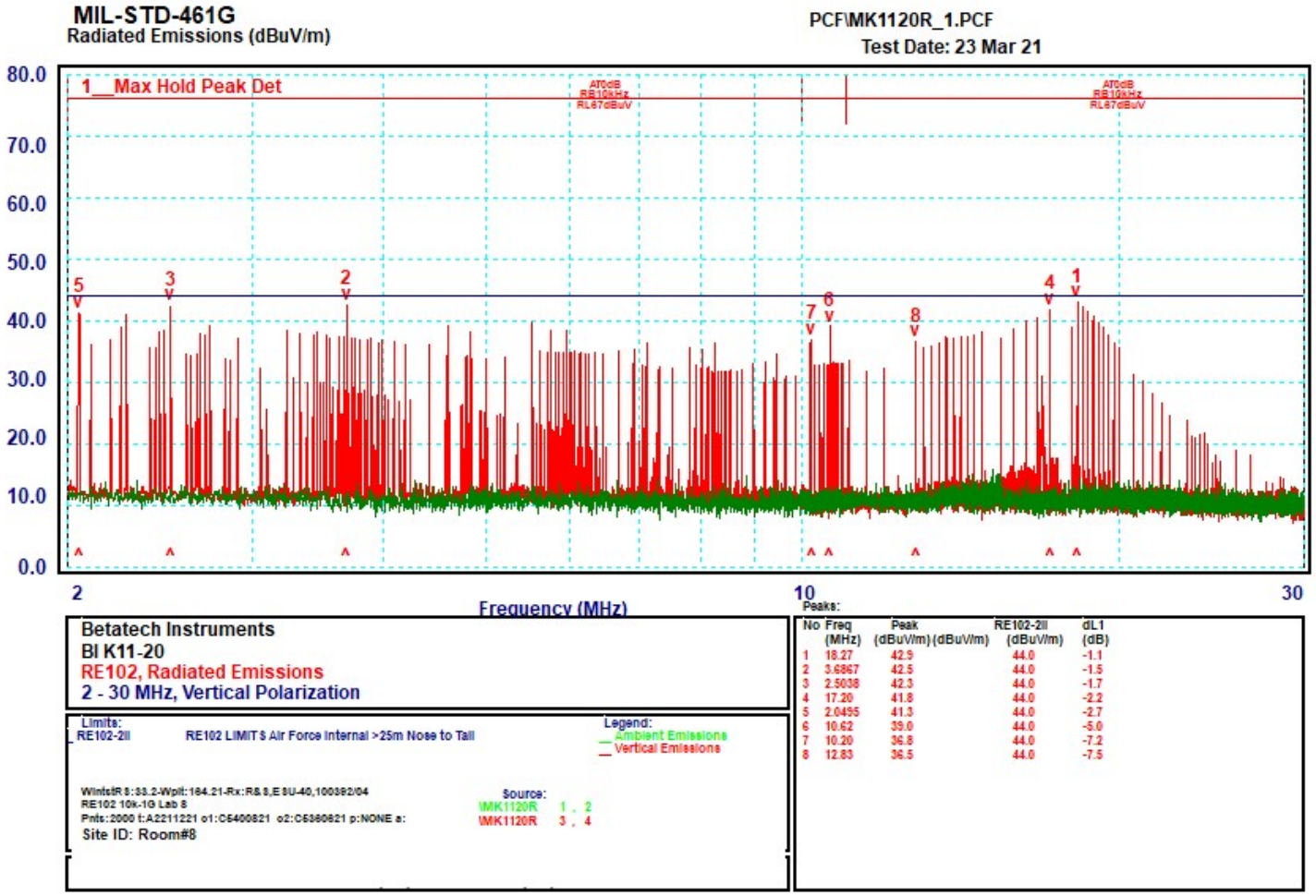
TEST SETUP

The test specimen layout follows the requirements as prescribed in MIL-STD-461G for RE 102. The block diagram of the EUT layout and supporting equipment is as follows. The robot simulates dit and dash generation from an iambic paddle.

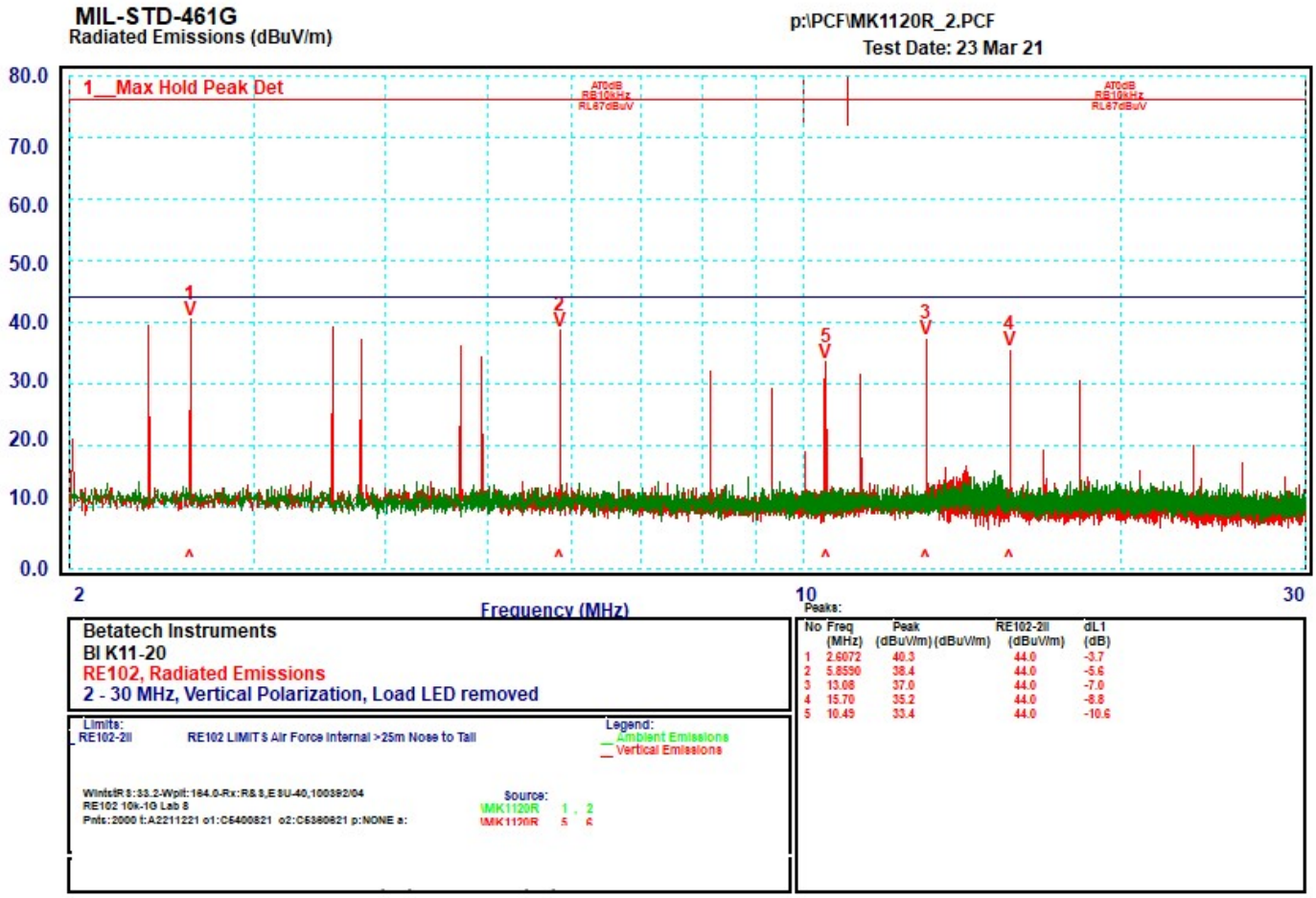


RESULTS

The unmodified BI K11-20 board meets the requirements for RE102 Radiated Emission Limit for Aircraft, Fixed Wing ≥ 25 meters Nose to Tail or Navy Fixed & Air Force Ground Applications in the range of 2 MHz to 30 MHz. A lot of broadband spikes are contributed by the on-off keying of LED light.



When the LED light is disconnected from the power (+) terminal, effectively removing the LED light from the test setup while still keeping the wire attached to the KEY terminal of the BI K11-20 board, we see a significant reduction of the broadband spike occurrences. The remaining spikes, when listened to, correspond to the relay (dit and dash) on-off of the robot:



CONCLUSION

For even stricter electromagnetic compatibility requirements, such as Army Ground applications, further refinements can be achieved by adding minor modifications to the BI K11-20 board. The transmit/receive keying waveform (simulated by LED in test setup) can be shaped better by placing a small capacitor on the base of the keying transistor in the K11 board. The paddle keying can be shaped better by placing RC filters on the paddle (one each for L and R). This is intended to shape the on-off waveform of the paddle L/R and thus reducing the remaining broadband emission. Finally, placing the keyer in a metal enclosure can further reduce overall emission.

Setup Photos