Passive Subsystem Antenna Array Design for TeraSCREEN Security Screening System

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***Abstract*—The FP7 project TeraSCREEN is focused on the development of a multi-frequency multi-mode Terahertz (THz) detection prototype for security screening. In this paper the passive subsystem antenna array is presented which consists of standard gain horn antennas, a waveguide manifold in order to reduce the antenna separation and improve the array resolution and compact waveguide twists required to change the polarization between the mixers and the antenna manifold.**

I. INTRODUCTION

THE challenge for any security screening system is to identify potentially harmful objects such as weapons and explosives concealed under clothing. Classical border and security checkpoints are no longer capable of fulfilling the demands of today's ever growing security requirements, especially with respect to the high throughput generally required which entails a high detection rate of threat material and a low false alarm rate. Therefore TeraSCREEN [1] proposes to develop an innovative concept of multi-frequency multi-mode Terahertz (THz) detection with new automatic detection and classification functionalities. This innovative screening system will combine multi-frequency images taken by passive and active subsystems which will scan the subjects and obtain complementary spatial and spectral information, thus allowing for automatic threat recognition. The TeraSCREEN Prototype System will comprise a passive subsystem operating at several frequencies up to the 360 GHz developed in this project, and an active subsystem which will be the first to operate at 360 GHz in MIMO mode.

In this paper the design of the passive subsytem antenna array that forms the TeraSCREEN prototype system is presented.

II. RESULTS

The array antenna configuration has been defined as two lines of eight elements (2x8) in which the elements of both lines (upper and lower line) will have an offset between them in order to have the pixels as close together as possible, Fig. 1. A waveguide manifold section will be used to assemble the mixer elements and the antenna array. This manifold will be designed to be manufactured in two pieces, with a cut in the E plane since the losses caused by an H plane cut would be higher. The physical location of the IF port in the mixer devices requires a polarization orientation change between the mixers and the manifold input ports, in order to minimize the spacing required between mixers. This polarization change will be made using compact waveguide twist sections, between the mixers and the manifold.

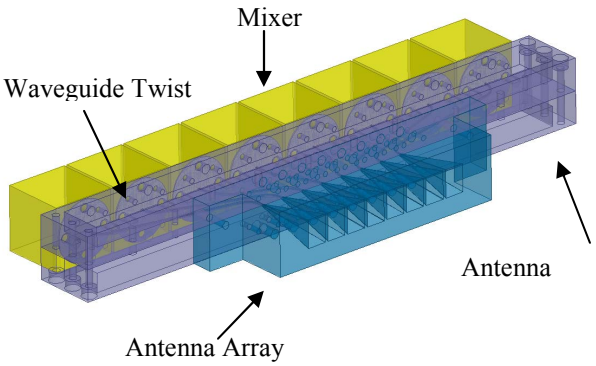

Fig. 1. 1x8 TeraSCREEN Passive Subsystem configuration.

Here, the simulation results of the waveguide antenna manifold, Fig. 2, and the compact waveguide twists, Fig. 3, are presented.

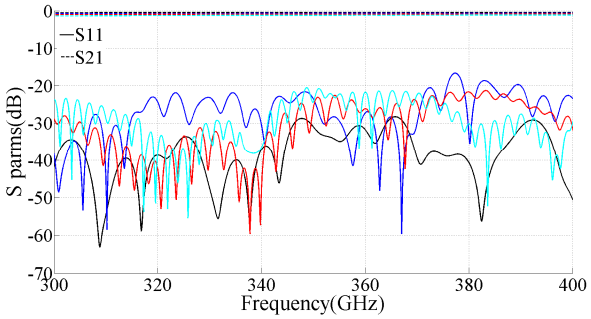

Fig. 2. S parameters simulation of the waveguide manifold.

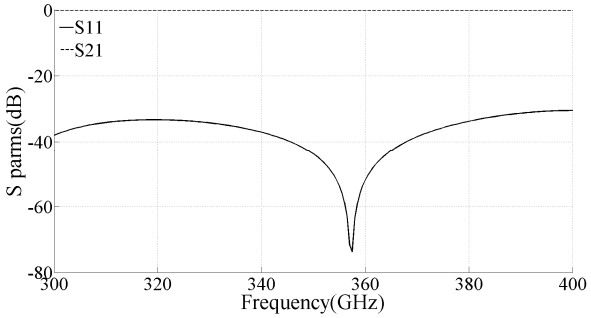

Fig. 3. S parameters simulation of the compact waveguide twist.

III. SUMMARY

This paper shows the simulation results of the passive subsystem antenna array of the TeraSCREEN prototype. The antenna array presented here is formed by a waveguide manifold, compact waveguide twists and standard gain horn antennas in order to obtain good antenna characteristics for the TeraSCREEN prototype. The measurements results are expected to be ready by the time of the conference.

ACKNOWLEDGEMENT

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REFERENCES

[1]. http://fp7-terascreen.com/