TangiTek CleanSignal™ Technology Evaluation

US Federal Research Lab Test Report
September 2012

Table of Contents

Table of Figures

1. Introduction[1]

TangiTek LLC develops and licenses composite materials designed to attenuate extremely high frequency background noise. In this report, a subset of TangiTek's CleanSignal™ composite materials was evaluated for frequencies from 2 GHz to 40 GHz. The tests performed for this report illustrate the effectiveness of TangiTek's CleanSignal™ composite material at attenuating background noise in a line-of-sight laboratory measurement.

2. Task Description

TangiTek requested an independent US Government - Federal Research Laboratory's support for product testing. The request was to evaluate the effectiveness of TangiTek's CleanSignal™ composite material in reducing or attenuating extremely high frequency background noise.

There were many options discussed on how to best evaluate the material. However, due to the program funding restraints, it was decided that a simple laboratory bench test would be performed and the results would be presented in a brief report. In this agreement, TangiTek would provide seven different composite samples (shown in Table 1), background information on the material, and technical support. The federal lab would provide engineering support, laboratory space, specialized radio frequency (RF) test equipment, and generate the report.

3. Test Procedure

The frequency band used for testing was from 2 GHz to 40 GHz. In order to better evaluate the performance of the material, the frequency band was divided into 2 ranges. The first band ranged from 2GHz to 10 GHz (band 1). The second ranged from 10 GHz to 40 GHz (band 2). This allowed narrow band antennas to be used which improved signal quality.

A line-of-sight measurement was used to evaluate the materials. A Network Analyzer was used to generate and analyze the RF signals and narrow band antennas were used to transmit and receive the signals (see Figures 1 and 2). The Network Analyzer is an Agilent E8361A and is calibrated for frequencies from 10 MHz to 67 GHz. Band 1 used circular polarized antennas commercially available from Antenna Research Associates part number CBS-218/A-RH. The antennas used for band 2 are Vivaldi antennas built by Federal Lab (see Figure 3).

[1] *This document is based on a report submitted to TangiTek by an independent US Government Federal Research Laboratory. Please contact TangiTek (contact information at the end of this document) for more information about the test report.*

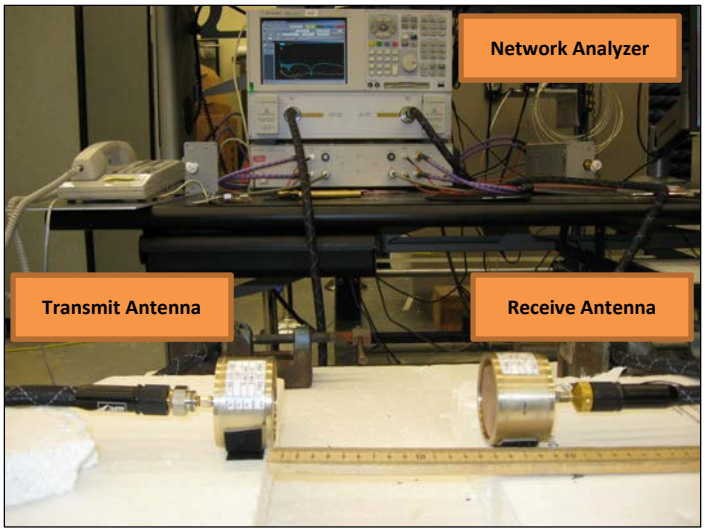

Figure 1 Image of Network Analyzer and the 2 GHz to 10 GHz band antennas

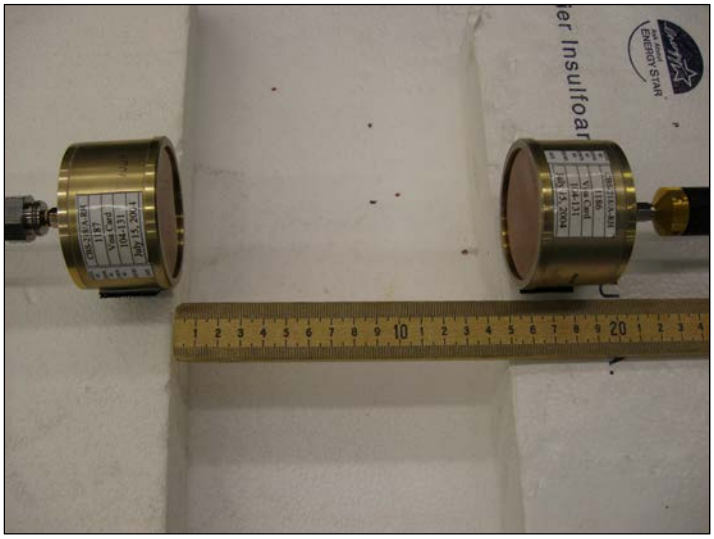

Figure 2 Image of the antennas used for the 2 GHz to 10 GHz band

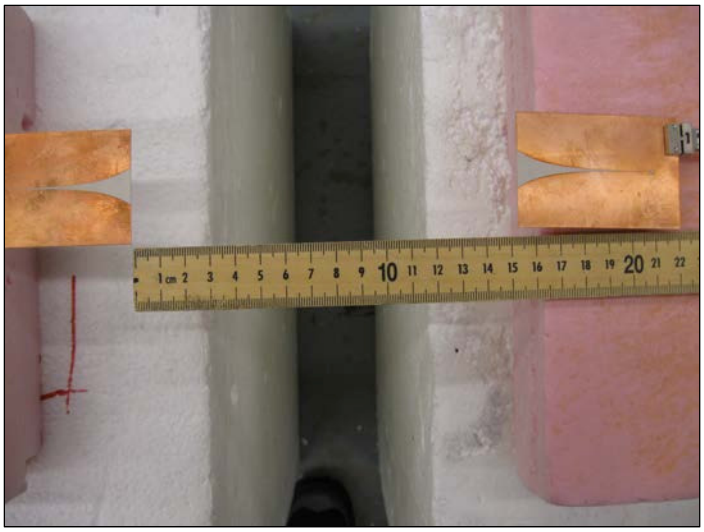

Figure 3 Image of the antennas used for the 10 GHz to 40 GHz band

First, a baseline measurement was made with no material present for both band 1 and 2 (see Figure 4). This was done by placing transmit and receive antennas 15 centimeters apart and using the Network Analyzer to generate and analyze the RF signals in an S21 mode. Second, the samples were placed between the antennas with the focus of the antennas pointed to the center of the sample. This was done by holding the sample between 2 Styrofoam blocks (see Figure 5). Special care was taken in preventing the RF signal from wrapping around the sample. Third, the Network Analyzer was used to analyze the RF signals and output the data. Finally, the net difference was calculated by subtracting the baseline measurement from the value produced while the sample was present.

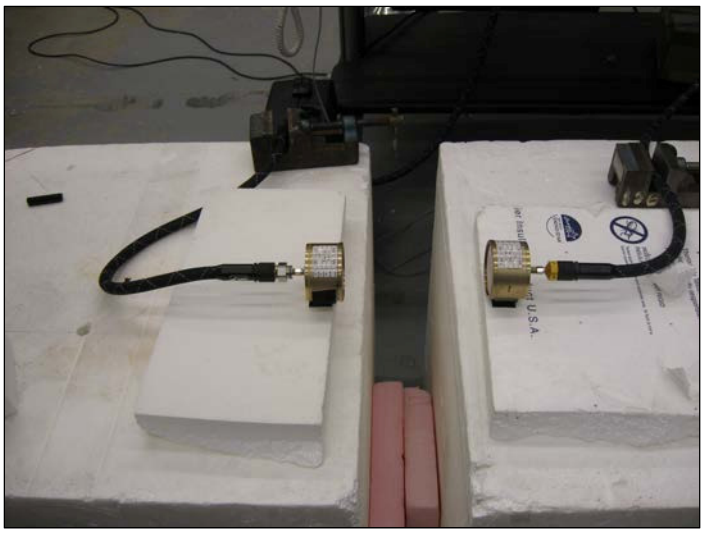

Figure 4 Image of the baseline test setup

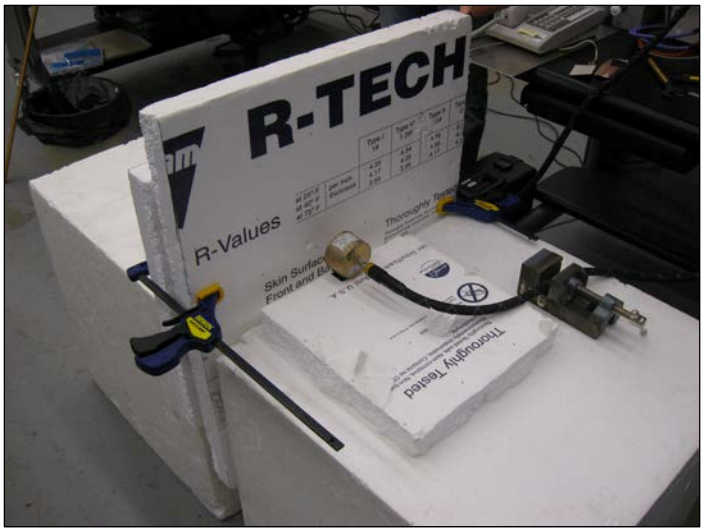

Figure 5 Image of test setup with test sample

4. Results

TangiTek provided the federal lab with seven different composite samples (Figures 6 – 12). The composite material ranged from sheets of fabric to sheets of metal. Each sample also had a unique identification number (ID). The samples were evaluated separately and the results are illustrated in Figures 13 – 20. Table 1 below provides a list of samples tested, a brief description of each sample provided and their dimensions.

Table 1 TangiTek – CleanSignal™ Samples provided for testing

Sample #	Sample ID	Description	Approximate Dimensions (w x l x d)	Approximate Sample Weight (oz)
1	PQ0412SA0912001	Fabric - High-performance quilt, with metalized fabric exterior	9'' x 12'' x 0.06"	2.00
2	PQ0312SA1112001	Fabric - Quilt with metalized fabric exterior	11'' x 12'' x 0.06"	2.50
3	KG0412SA1213001	Gasket - Flexible metalized gasket composite	12'' x 13'' x 0.05"	2.00
4	SHL0412AB040705005	Fabric – Quilt with black non-conductive rip-stop nylon exterior	4" x 7" x 0.05"	0.40
5	TST0911SA0411001	Circuit Board- Rigid structural composite	4" x 11" x 0.06"	2.75
6	TST0412SA0612001	Structural High-performance rigid composite	6" x 12" x 0.06"	1.33
7	TG0712SA1212MM02	Gasket- High-performance compressible composite	12" x 12" x 0.05" (0.04" compressed)	4.00

Figure 6 Image of Sample 1 (ID: PQ0412SA0912001)

Figure 7 Image of Sample 2 (ID: PQ0312SA1112001)

Figure 8 Image of Sample 3 (ID: KG0412SA1213001)

Figure 9 Image of Sample 4 (ID: SHL0412AB0407050055)

Figure 10 Image of Sample 5 (ID: TST0911SA0411001)

Figure 11 Image of Sample 6 (ID: TST0412SA0612001)

Figure 12 Image of Sample 7 (ID: TG0712SA1212MM02)

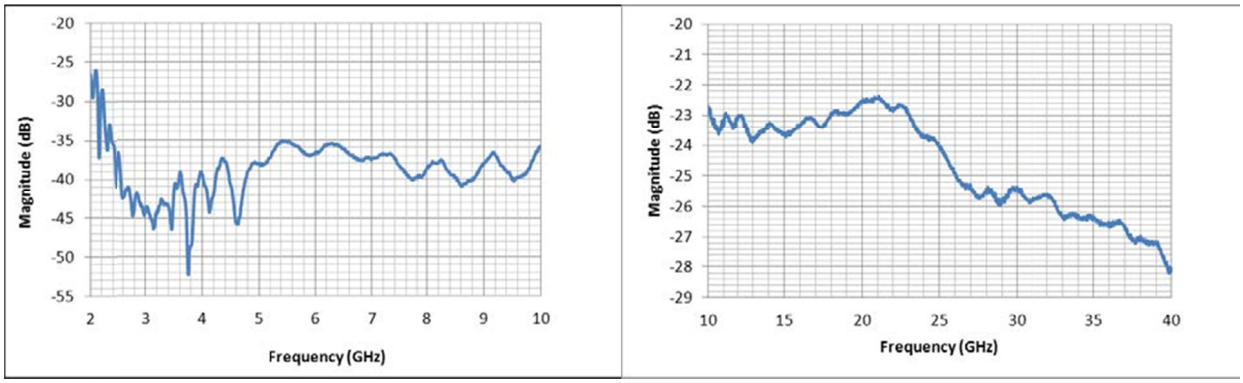

Figure 13 Illustration of baseline measurements (band 1 on left and band 2 on right)

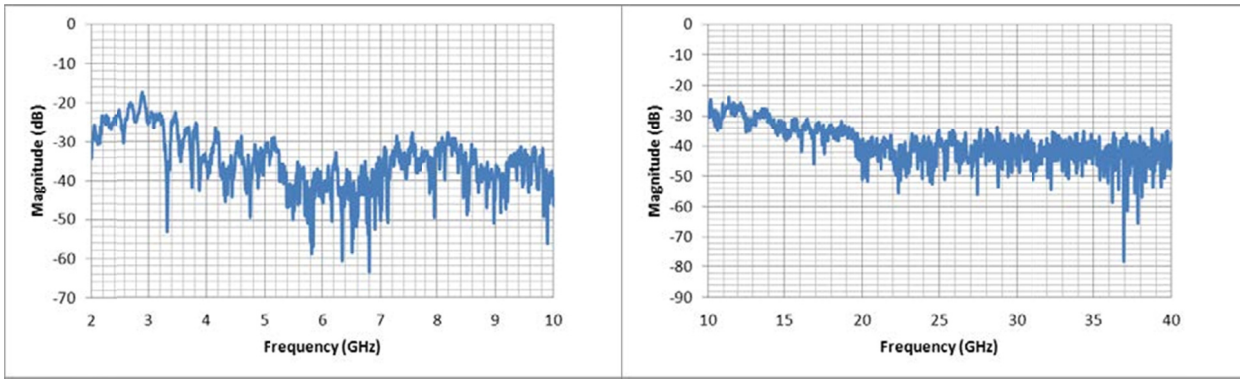

Figure 14 Illustration of baseline - sample 1 measurements (band 1 on left and band 2 on right)

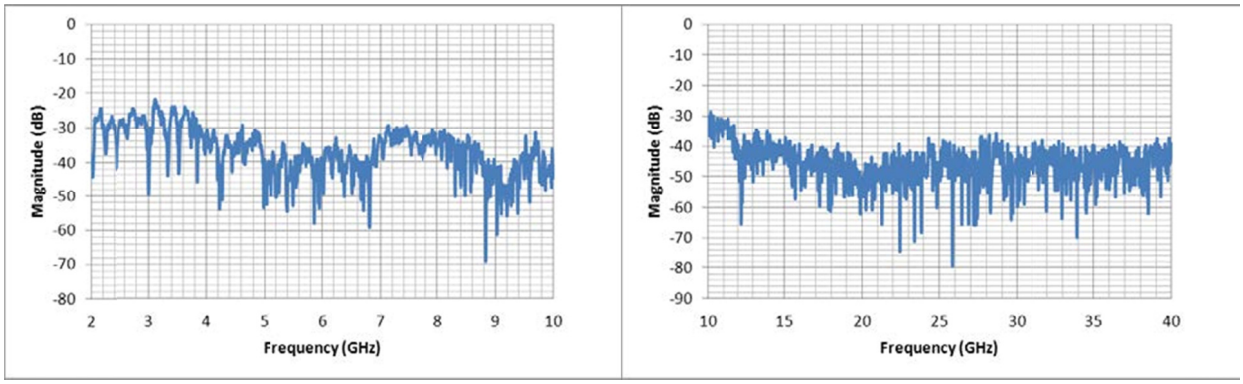

Figure 15 Illustration of baseline - sample 2 measurements (band 1 on left and band 2 on right)

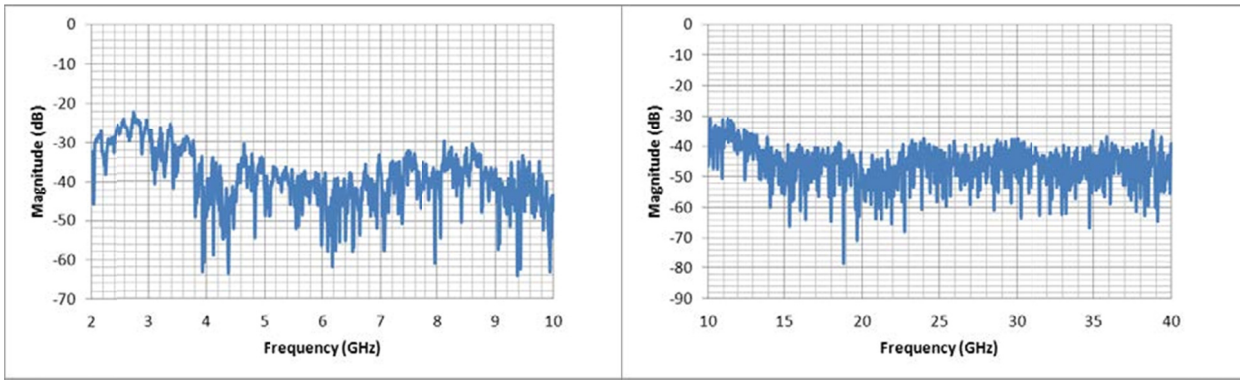

Figure 16 Illustration of baseline - sample 3 measurements (band 1 on left and band 2 on right)

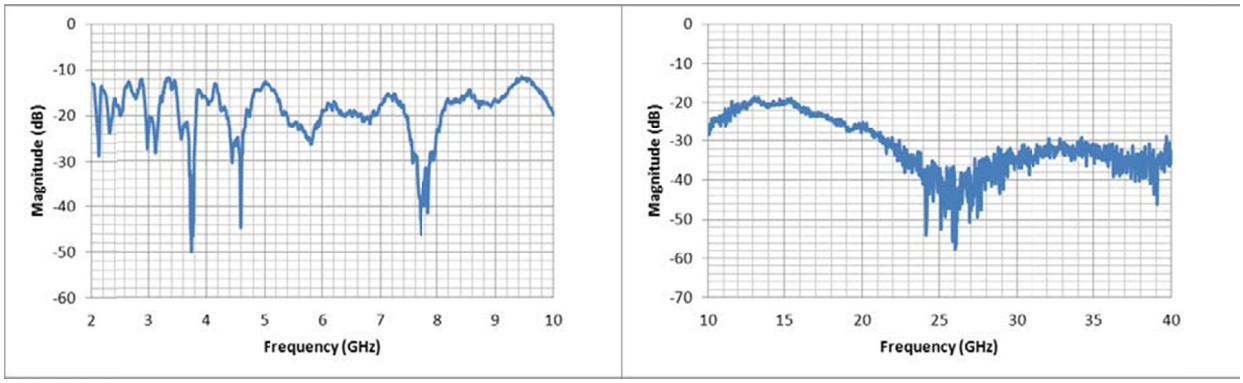

Figure 17 Illustration of baseline - sample 4 measurements (band 1 on left and band 2 on right)

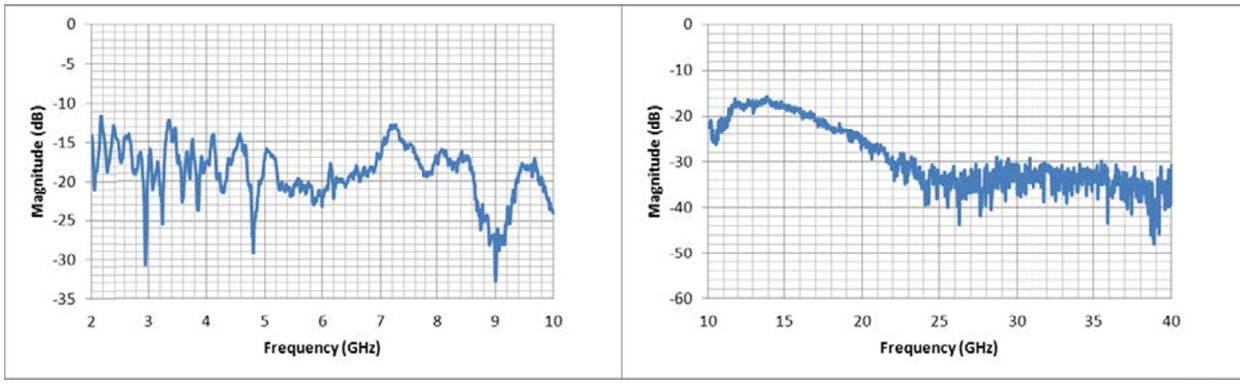

Figure 18 Illustration of baseline - sample 5 measurements (band 1 on left and band 2 on right)

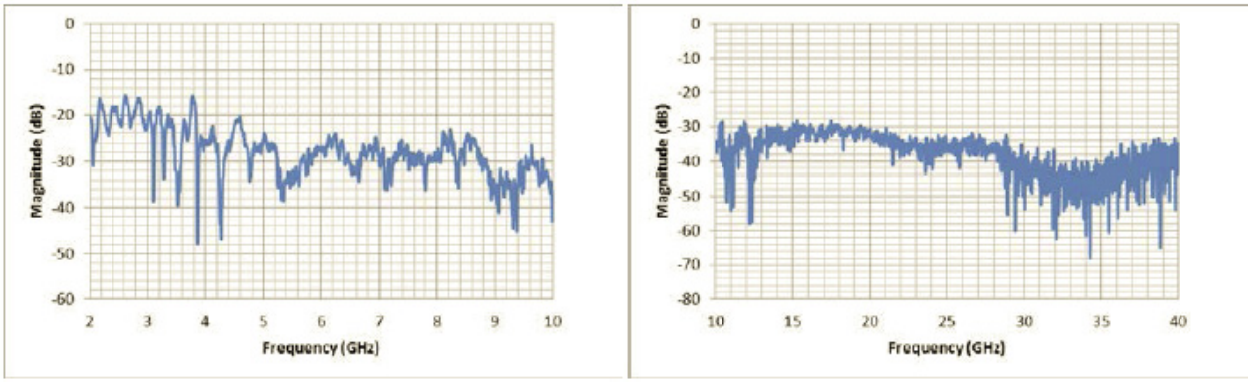

Figure 19 Illustration of baseline - sample 6 measurements (band 1 on left and band 2 on right)

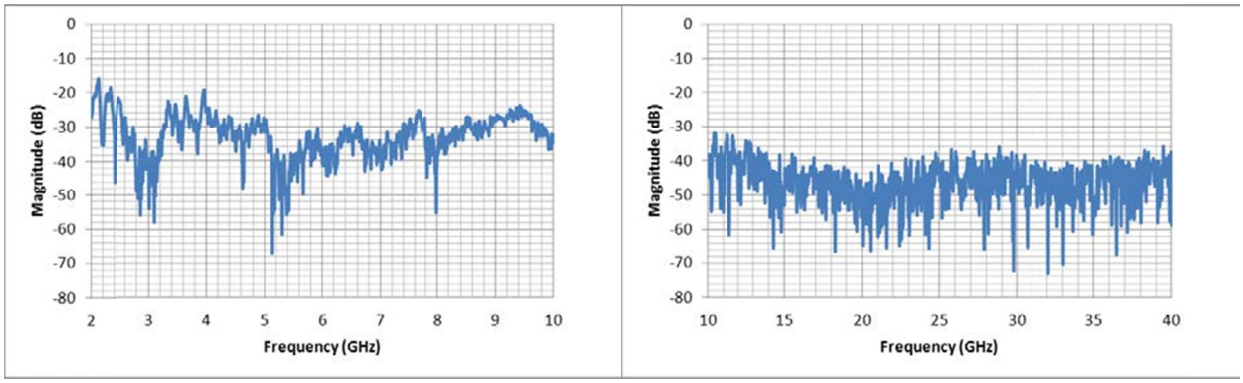

Figure 20 Illustration of baseline - sample 7 measurements (band 1 on left and band 2 on right)

5. Conclusion

As the results illustrate, the TangiTek CleanSignal™ composite material was effective at attenuating RF noise in the 2 GHz to 40 GHz bandwidth. The results also show that some samples were more effective than others. In particular, some samples appeared to have a bandpass filter effect. This effect is of special interest for it can be used to improve existing project work being done at this laboratory.

6. Contact

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