Report Of

Shielding Effectiveness Test
For

DefenderShield

Test Date(s): September 1 – October 2, 2012

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I certify that I am authorized to sign for the test facility and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US Tech (Agent Responsible For Test):

By: ______________________________

Name: Alan Ghasiani__________

Title: ComplianceEngineer–President

Date: October3,2012

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1 General Information

1.1 Characterization of Test Sample

Three test samples, referred to as SUT herein, used were received by US Tech on August 28, 2012 and September 27, 2012 in good operating condition.

1.2 Product Description

The Sample Under Test (SUT) is the DefenderShield. The SUT is a proprietary material which is used as a protective shield against RF and magnetic field radiation in consumer and professional applications.

2 Test Facility

Testing was performed at US Tech's test facility located in Alpharetta, Georgia. This test facility consists of a 24' L X 10' W X 10.5' H Lindgren Modular Shielded room lined with FT-100 ferrite panels, FAA-400 and EHP-18PCL Pyramid Absorbers. EUT power is run through steel conduit beneath the ground plane and is filtered by screen room quality filters located at the shielded enclosure power input panel. Available power is 120/220 VAC 50/60 Hz. The anechoic chamber has been verified to comply with the –0, +6 dB field uniformity requirement of IEC 61000-4-3.

US Tech is an FCC Recognized (Designation Number US5117) and NVLAP Accredited laboratory (Lab Code 200162-0).

2.1 Test Equipment

A list of test equipment used for these measurements is found in Table 1, following.

Table 1. Test Instruments and Accessories Used

INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
Audio signal Generator	1G-5218	Heathkit	1G-5218-01	Adjusted with Calibrated meter
Spectrum Analyzer	8566B	Hewlett Packard	2747A05665	07/18/12
PRE-AMPLIFIER	8449B	Hewlett Packard	3008A00480	04/12/12
PRE-AMPLIFIER	8447D	Hewlett Packard	2944A07436	10/21/2011
Signal generator	8664A	Hewlett Packard	2333A00259	During Test
Signal Generator	8664A	Hewlett Packard	3438A00787	10/29/11
Audio Power Amplifier	EXA2950	GEM Sound	NA	Not required
HORN ANTENNA	3115	EMCO	9107-3723	08/10/11 2yr.
Graphic Multimeter	Fluke	867B	DM7060268	5/18/12
ELF Field Monitor	ELF-70D/66D	Walker Scientific	K71988-1	Not required for this test
Shielded Box	000	Custom made		NA
Wire spool	NA	NA	NA	NA
Log Periodic Yagi Antenna	LPY2	Ramsey Electronics	WA5VJB	NA

Note: The calibration interval of the above test instruments is 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

3 Theory of Measurement

Shielding effectiveness is measured by transmitting a CW signal and measuring the level of the transmitted signal by a receiving antenna (or probe) with and without the shield, provided that:

1. Nothing changes in the setup except for placing the shield
2. The isolation between the two sides of the shield is larger than the anticipated shielding effectiveness (signals that could bypass the shield should be sufficiently minimized).

Then, shielding effectiveness is determined by:

SE (in dB) = 20 log (E1/E2)

Where E1 and E2 are the signals measured by the receiving antenna with and without the shield, using the same physical test setup for both measurements.

Since spectrum analyzers read power, shielding effectiveness is determined by the dB difference between the two shielded and unshielded power levels, read in dBm.

4 Test Configuration and Procedure

The objective is to measure shielding effectiveness of the SUT at different frequencies. Section 4.1 of this report outlines the procedures used to measure low frequency (30 and 300 Hz) magnetic field shielding, and Section 4.2 of this report outlines the procedures used to measure EMC shielding at higher frequencies.

4.1 Extremely Low Frequency (ELF) Electromagnetic Radiation (EMR) Shielding Effectiveness (Magnetic Component at 60 and 300 Hz)

Figures 1 and 2 show the test configuration used to measure Magnetic Field component of Electromagnetic radiation Shielding Effectiveness of the SUT at Extremely Low Frequency of 60 and 300 Hz.

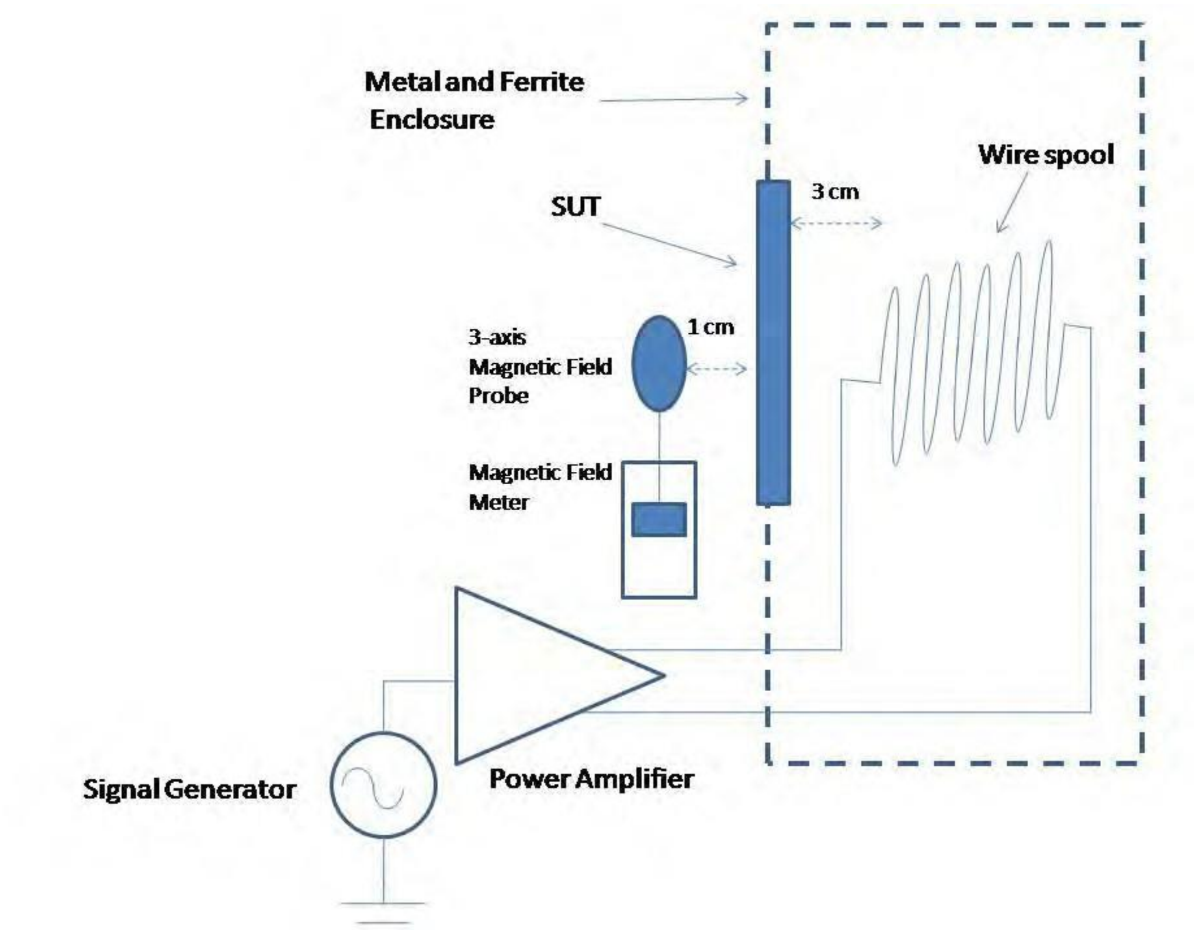

Figure 1. ELF EMR (Magnetic Component at 60 and 300 Hz) Test Configuration Diagram

4.1.1 Detailed Test Procedure

An audio signal generator was set to generate 60 and 300 Hz signals which were then amplified for power to drive a wire spool for generating large magnetic fields. A wire spool was used as a magnetic field generator and was placed inside a custom enclosure filled with ferrite tiles and having a rectangular opening slightly smaller than the EUT. A calibrated Gauss meter probe was placed at a fixed position facing the opening. The dynamic range of the probe was noted, and the setup was examined to confirm the required system dynamic range as follows: The opening was closed with a thick steel layer of ferrite tiles; the audio current level was increased until the minimum valid reading noted by the Gauss meter specifications was reached without the amplifier going into compression; the level was recorded as L1 (if the amplifier went into compression before this minimum was achieved, the Gauss level at the compression point was recorded as L1); then the metal/ferrite plate was removed and the probe was placed at the exact same distance from the opening as the metal/ferrite plate had been (which is the thickness of the ferrite stack); this level was recorded as L2. The difference of the two magnetic field levels was established as maximum dynamic range (DR) of the system. The DR was computed as:

DR = (L2- L1)/L2

Then the SUT (labeled as no. 2) was placed to cover and shield the entire opening; the audio current level was increased slowly to that of the unshielded (open) condition; the Gauss level was recorded as L3. The shielding effectiveness was computed as:

SE = (L3-L1)/L3

Frequency = 300 Hz
L1= 12 mG (shielding with thick ferrite tiles)
L2 = 3.2 Gauss
DR= (3.2-0.012)/3.2 = 99.63%
L3 = 56 mG (shielding with SUT)

SE @ 300 Hz = (L2- L3)/L2 = 98.25%

Frequency = 60 Hz
L1= 79 mG (shielding with thick ferrite tiles)
L2 = 6 Gauss
DR= (6-0.079)/6 = 98.68%
L3 = 290 mG (shielding SUT)

SE @ 60 Hz = (L2- L3)/L2 = 95.16%

Figure 2. ELF EMR (Magnetic Component at 60 and 300 Hz) Test Configuration Photograph

4.2 Radio Frequency (RF) Electromagnetic Radiation (EMR) Shielding Effectiveness

Figures 3, 4 and 5 show the test configuration used to measure RF EMR Shielding Effectiveness of the SUT at high frequencies.

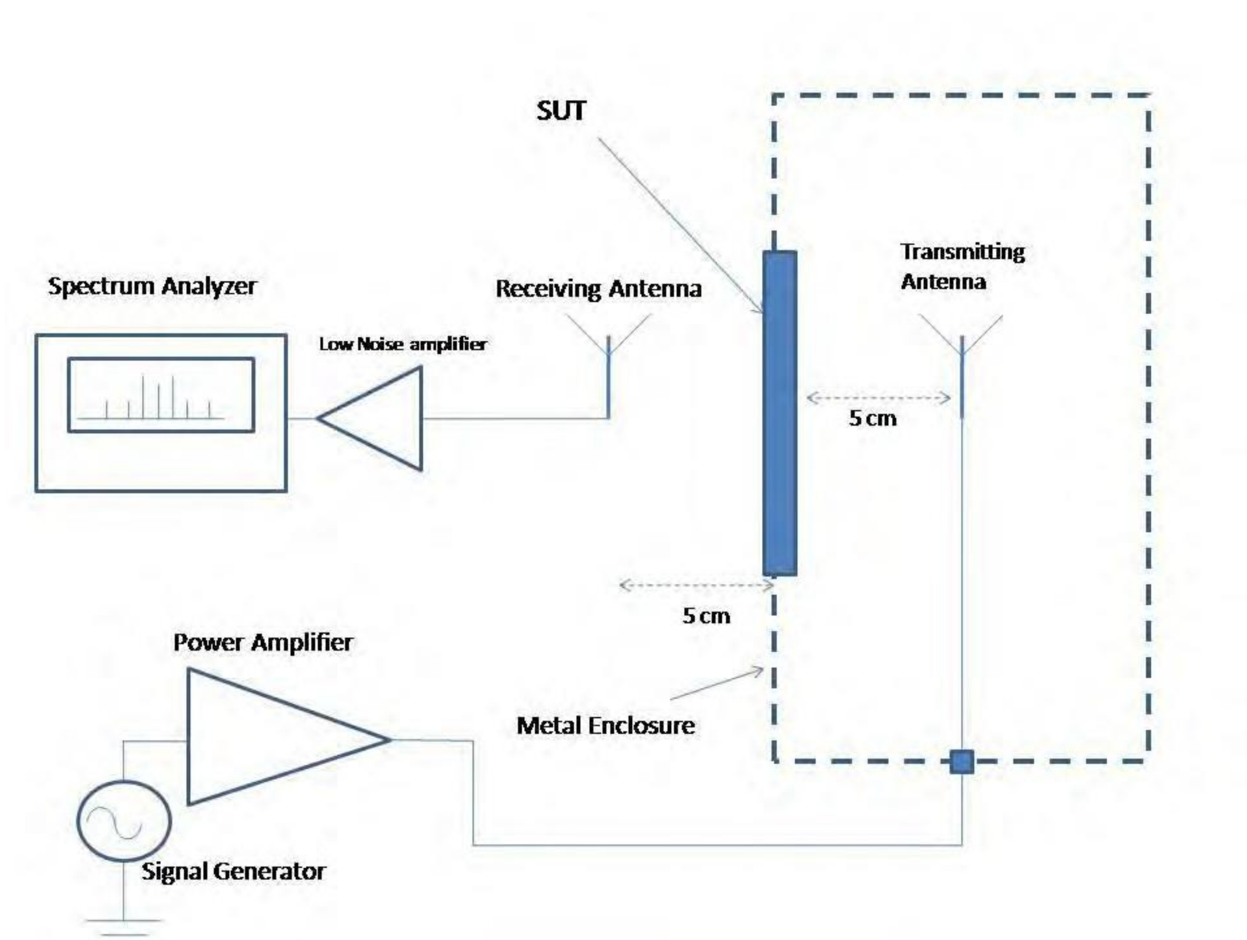

Figure 3. RF EMR Test Configuration Diagram

4.2.1 Detailed Test Procedure

The procedure used for the high frequency measurements required an adequate level of isolation between the transmitting and the receiving sides of the measurement system. As required, the isolation level was confirmed to be greater than anticipated shielding effectiveness by at least 6 dB. The system dynamic range (DR) was established similarly to the low frequency method. DR = P2 –P1 where P2 is the power measured by the spectrum analyzer at which the amplifier still operates in the linear region but near compression when there is no shield installed, and P1 is 3 dB above the noise floor.

Calibrated signal generators were used to provide the signals at different frequencies. A transmitting antenna was placed inside a metal enclosure (positioned facing the opening or the SUT) to produce the field. The signals picked up from the receiving antenna, located outside the enclosure and facing the opening or the SUT, were amplified and fed into the spectrum analyzer. The difference in the two measurements (one with the SUT and one with the opening) recorded by the spectrum analyzer was used to determine shielding effectiveness as calculated below:

SE (dB) = P2- P3 + any adjustment for increasing the signal generator output level to exceed the noise floor by at least 3 dB; where P3 is the reading in dBm by the spectrum analyzer when the SUT is installed and P2 is the reading in dBm by the spectrum analyzer when the enclosure is open.

The spectrum analyzer settings were as follows: Resolution Bandwidth = 300 Hz, Video Bandwidth = 1 KHz, Span =20 KHz, dynamic range near 90 dB.

Note: If ambient signals were present at the test frequencies, the test frequencies were shifted slightly (less than 10 KHz) to avoid overlapping.

Figure 4. Photograph of the Open Test Enclosure

Figure 5. Photograph of the SUT Installed on the Test Enclosure

5 Summary and Test Results

Following is a summary of the DefenderShield Extremely Low Frequency (ELF) Electromagnetic Radiation (EMR) (Magnetic Component) and Radio Frequency (RF) Electromagnetic Radiation (EMR) Shielding Effectiveness results when the SUT is measured as described in this test report:

ELF EMR (Magnetic Component) Shielding Effectiveness @ 300 Hz = 98.25%

ELF EMR (Magnetic Component) Shielding Effectiveness @ 60 Hz = 95.16%

Table 2 below lists the RF EMR shielding effectiveness results for the DefenderShield, SUT labeled no.2. The measurement uncertainty (with a 95% confidence level) for this test is ± 1 dB.

Table 2. RF EMR Test Results

Frequency in MHz	Shielding Effectiveness in dB		Shielding Effectiveness in Percent	
	Horizontal	Vertical		
800	-36.1	-30.9	99.97545	99.91872
1700	-34.9	-26.1	99.96764	99.75453
1900	-34.2	-25.8	99.96198	99.73697
2100	-33	-24.5	99.94988	99.64519
5000	-28.9	-21.1	99.87118	99.22375