

## **A Method And System For Conducting Radar Cross Section Measurements**

### **FIELD OF THE INVENTION**

The present invention relates to a method and system for conducting radar cross section measurements.

### **BACKGROUND**

When electromagnetic signals from a radar are incident on a target, electromagnetic energy is dispersed or scattered isotropically. Distribution of the electromagnetic energy depends on the size, shape, composition of the target and the frequency used. Power reflected or scattered by a radar target may be expressed as a product of an effective area (scattering cross section) and an incident power density. Reflected or scattered power from the target that is directed back towards the radar is called backscattering cross section or radar cross section (RCS).

Generally, RCS measurements are conducted both in an anechoic chamber and outdoor open range depending on the size of the object. Due to the variable background noise, conducting RCS measurements in the outdoor open range are more challenging compared to those carried out at the anechoic chamber.

Figure 1 illustrates a conventional anechoic and outdoor RCS measurement system 100. Firstly, an initial background measurement is conducted (without any target), whereby a measurement device 101 measures the transmitted power (antenna 103) and received power (of the background) received by the antenna 103. Secondly, a calibration measurement is carried using a known target (calibration target), whereby the transmitted and received power (of the calibration target) are measured by the measurement device 101. Thirdly, a target 105 is placed on a turntable 107. The turntable 107 is rotated by an angle 0-360° during which the measurement device 101 transmit and measures the received power (of the calibration target). From the signals measured of the background, calibration target and the target 105, a target 105 signature is derived.

One drawback of the above conventional RCS measurement system 100 is that it is widely implemented for non-variable background measurements as only compensation is applied for stable background. If the background is variable and, in particular, is located

at the same distance as the target, then the accuracy and sensitivity of the system 100 are affected as the variable background cannot be compensated. Conventional RCS measurement system 100 can only generate accurate results provided that during the background measurements, all the other objects in particular, along the same distance (in the background e.g. trees) do not change or move. Whenever there is change in the background during the background, calibration or target measurements, accuracy of the system 100 is affected.

Furthermore, for low frequency measurements, the above system 100 would require a large free space facility, so that there is minimum interaction from the trees or moving objects.

Accordingly, there is a need for an improved RCS measurement system which at least overcomes the above drawbacks.

## **SUMMARY**

In accordance with a first aspect of the present invention there is provided a method of conducting radar cross section measurements, the method comprising the steps of positioning an active screen between a transceiver unit and a target area; periodically switching the active screen between an OPEN position in which the active screen is electromagnetically transparent and a CLOSE position in which the active screen is electromagnetically opaque; transmitting electromagnetic signals towards the target area utilising the transceiver unit; measuring a first received signal when the active screen is in the OPEN position; measuring a second received signal when the active screen is in the CLOSE position; and deriving a target signature based on the measured first and second received signals; wherein a frequency of the switching of the active screen is chosen such that respective background components in the first and second received signals are substantially constant.

The method may further comprise performing software based processing of the received first and second signals to remove signal components that have not passed through the active screen from the first received signal.

The method may further comprise utilising hardware based processing of the received first and second signals to remove signal components that have not passed through the active screen from the first received signal.

The method may comprise transmitting electromagnetic signals towards the target area without a target located in the target area utilising the transceiver unit; measuring a first group of the first and second received signals; transmitting electromagnetic signals towards the target area with a calibration target located in the target area utilising the transceiver unit; measuring a second group of the first and second received signals; transmitting electromagnetic signals towards the target area with a target to be measured located in the target area utilising the transceiver unit; measuring a third group of the first and second received signals; and deriving the target signature based on the measured groups of first and second received signals.

In accordance with a second aspect of the present invention there is provided a system for conducting radar cross section measurements, the system comprising an active screen for location between a transceiver unit and a target area, the active screen being operable to periodically switch between an OPEN position in which the active screen is electromagnetically transparent and a CLOSE position in which the active screen is electromagnetically opaque; a transceiver unit for transmitting electromagnetic signals towards a target area; a measurement unit for measuring a first received signal when the active screen is in the OPEN position and for measuring a second received signal when the active screen is in the CLOSE position; and for deriving a target signature based on the measured first and second received signals; wherein a frequency of the switching of the active screen is chosen such that respective background components in the first and second received signals are substantially constant.

The measurement unit may comprise software based processing means for processing of the received first and second signals to remove signal components that have not passed through the active screen from the first received signal.

The measurement unit may comprise hardware based processing means for processing of the received first and second signals to remove signal components that have not passed through the active screen from the first received signal.

The transceiver may transmit electromagnetic signals towards the target area without a target located in the target area utilising the transceiver unit; the measurement unit may measure a first group of the first and second received signals; the transceiver may transmit electromagnetic signals towards the target area with a calibration target located in the target area utilising the transceiver unit; the measurement unit may measure a second group of the first and second received signals; the transceiver may transmit electromagnetic signals towards the target area with a target to be measured located in the target area utilising the transceiver unit; the measurement unit may measure a third group of the first and second received signals; and the measurement unit may derive the target signature based on the measured groups of first and second received signals.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

Non-limiting embodiments of the invention are described hereinafter with reference to the drawings, in which:

Figure 1 is a schematic diagram of a conventional radar cross section (RCS) measurement system;

Figure 2 is a schematic diagram of a RCS measurement system in accordance with a first embodiment; and

Figure 3 is a graph showing the results of the various measurements taken by utilising the RCS measurement system of Figure 2;

Figure 4 is a schematic diagram of a RCS measurement system in accordance with a second embodiment;

Figure 5 is a schematic diagram illustrating a computer system for use in the RCS measurement system of Figures 2 and 4; and

Figure 6 is a flow chart illustrating an RCS measurement method in accordance with an example embodiment.

Figure 7 shows a schematic drawings of an active screen used in example embodiments.

## DETAILED DESCRIPTION

Figure 2 is schematic diagram illustrating a RCS measurement system 200 in accordance with the first embodiment.

A transmitter/receiver antenna 201, for example, of the type Tx/Rx is placed on an elevated antenna mast 221 having an height of about 1.6m. A target 217 can be placed behind an active screen 209, the active screen 209 and the target 217 being placed on a foam table 203 having a height of about 1.6m. Similarly, a calibration target 207 can be placed behind the active screen 209. The active screen 209 is vertically tilted (upwards) at an angle of about 15° so as to minimise reflection of radar signals from the active screen 209. The calibration target used in the embodiment is a Luneberg spherical lens.

An electromagnetic signal 223 from the antenna 201 is transmitted towards the target 217. A portion of the incident signal 223 passes through an amplitude modulated active screen 209 positioned in front of the target 217.

The active screen 209 consists of periodic patterns of active elements. The parameters of the active screen are typically as per Table 1 attached below:

| Parameters      | Demonstration   |
|-----------------|-----------------|
| Frequency Range | S band (3GHz)   |
| Screen Size     | 25cm x 50cm     |
| Element Type    | Active elements |
| Array           | 10 by 10        |
| Polarization    | Horizontal      |

Table 1: Active Screen parameters

The physical dimension of the active screen 209 in an example implementation is about 25cm x 50cm. With reference to Figure 7, the active screen 209 consists of an integrated array (10 x 10) of dipoles 700. An active element in the form of a solid state pin diode 702 is integrated on each dipole 700 to create an array of active elements, i.e. a total of 100 active elements are used in the example implementation of an S band screen. The electrical properties of the pin diodes 702 can be varied. The operation of the screen 209 is based on the variation of the voltage level from about 0Volt to about

3Volt in the example implementation. At 0Volt, the active elements make the screen 290 transparent and at the 3Volt state the active elements make the screen 209 opaque with respect to the relevant electromagnetic signals.

In the embodiment, all the elements of the active screen 209 are optimized for use with the S band frequency. The operation of the active screen 209 is controlled by a function generator having an operating frequency of about 30Hz. Depending on the frequency range of operation, the above parameters of the active screen 209 may appropriately vary. . The layout of the active screen 209 depends on the user requirement.

Returning to Figure 2, the active screen 209 is switched between OPEN and CLOSE positions periodically. When the active screen 209 is in OPEN position, the reflected electromagnetic signal 215 from the target 217 passes through the active screen 209, towards the direction of the antenna 201. The reflected energy (target signature) consists of the energies from a background signal 211 behind the active screen 209 and a target signal 215 reflected from the target 217. When the active screen 209 is in CLOSE position, the target signature is not available as no energy is reflected back from the target 217.

By making use of the amplitude modulated active screen 209, the present embodiment can provide compensation for variable background. Typically, an about 33 ms pulse is used for switching the active screen 209 between OPEN and CLOSE positions. It will be appreciated that when the about 33 ms pulse is utilised, variable background (usually trees) could be considered as stable and therefore, after necessary subtractions (see formulae (1)-(14) below), background variations can be effectively compensated.

In order to derive the appropriate compensation for background variations, a series of measurements, namely a background measurement, a calibration measurement, and a target measurement are carried out using the measurements system 200.

Firstly, the background measurement is conducted whereby the active screen 209 is switched between OPEN (not powered) and CLOSE (powered) positions. When the active screen 209 is in OPEN position, the reflected energy from the background  $U_{Bkgd}^O$  consists of a stable signal from the OPEN screen  $\overline{U}_s^O$ , a stable signal from the

background  $\bar{U}_B$ , a variable signal from the background  $\tilde{U}_B$ , and a stable signal from static background behind the active screen 209 with a transmission coefficient of the OPEN screen  $K_O \bar{U}_{BS}$ . The reflected background energy  $U_{Bkgd}^O$  measured when the screen is in OPEN position can be expressed by the following equation (1) :

$$U_{Bkgd}^O = \bar{U}_S^O + \bar{U}_B + \tilde{U}_B + K_O \bar{U}_{BS} \quad \dots\dots\dots (1)$$

When the active screen is in CLOSE position, the reflected energy from the background  $U_{Bkgd}^C$  consists of a stable signal from the CLOSE screen  $\bar{U}_S^C$ , a stable signal from background  $\bar{U}_B$ , a variable signal from the background  $\tilde{U}_B$ , and a stable signal from static background behind screen with a transmission coefficient of CLOSE screen  $K_C \bar{U}_{BS}$ . The reflected background energy  $U_{Bkgd}^C$  measured when the screen is in CLOSE position can be expressed by the following equation (2):

$$U_{Bkgd}^C = \bar{U}_S^C + \bar{U}_B + \tilde{U}_B + K_C \bar{U}_{BS} \quad \dots\dots\dots (2)$$

It can be appreciated that when the active screen operates at a frequency of 30Hz, the variable signal from background  $\tilde{U}_B$  does not change during the 33 ms switching. During this time, variable background (usually trees) can be considered stable and after the subtraction of signals, background can be compensated. A repetition frequency of around 30Hz is used for switching the active screen 209 depending on the antenna 201 and associated signal generating/processing equipment. However, the measurement as such has no limitation on the repetition frequency values, provided suitable equipment is used.

By subtracting the reflected background energy measured when the active screen 209 is in OPEN position  $U_{Bkgd}^O$  from that of the energy in CLOSE position  $U_{Bkgd}^C$ , the reflected energy of the background  $\Delta U_{Bkgd}$  can be calculated from the following equation (3):

$$\Delta U_{Bkgd} = (\bar{U}_S^O - \bar{U}_S^C) + \bar{U}_{BS}(K_O - K_C) \quad \dots\dots\dots (3)$$

In relation to the subtraction of signals, subtraction occurs for each consecutive open and close positions measurement, i.e. the subtraction processing occurs at 1/2 of the frequency of screen switching so that the background practically does not change during the consecutive measurements.

Secondly, the calibration measurement is carried out to measure the energy reflected whereby the calibration target 207 is placed on the second foam table 205 and the active screen 209 is switched between in OPEN (not powered) and CLOSE (powered) positions. When the active screen 209 is in OPEN position, the reflected calibration energy  $U_{Cal}^O$  consists of a stable signal  $K_O \bar{U}_{Cal}$  from the calibration target 207 having a transmission coefficient  $K_O$  of the active screen 209 in the OPEN position, a stable signal from the OPEN screen  $\bar{U}_S^O$ , a stable signal from the background  $\bar{U}_B$ , a variable signal from the background  $\tilde{U}_B$  and a stable signal from static background behind screen with transmission coefficient of OPEN screen  $K_O \bar{U}_{BS}$ . The reflected calibration energy  $U_{Cal}^O$  measured when the active screen 209 is in OPEN position can be expressed by the following equation (4):

$$U_{Cal}^O = K_O \bar{U}_{Cal} + \bar{U}_S^O + \bar{U}_B + \tilde{U}_B + K_O \bar{U}_{BS} \quad \dots\dots\dots (4)$$

When the active screen 209 is in CLOSE position, the reflected calibration energy  $U_{Cal}^C$  consists of a stable signal  $K_C \bar{U}_{Cal}$  from calibration target 207 having a transmission coefficient  $K_C$  of the active screen 209 in CLOSE position, a stable signal  $\bar{U}_S^C$  from the CLOSE screen, a stable signal from the background  $\bar{U}_B$ , a variable signal from the background  $\tilde{U}_B$  and a stable signal from static background behind screen with a transmission coefficient of CLOSED screen  $K_C \bar{U}_{BS}$ . The reflected calibration energy  $U_{Cal}^C$  measured when the active screen 209 is in CLOSE position can be expressed by the following equation (5):

$$U_{Cal}^C = K_C \bar{U}_{Cal} + \bar{U}_S^C + \bar{U}_B + \tilde{U}_B + K_C \bar{U}_{BS} \dots\dots\dots(5)$$

By subtracting the reflected calibration energy when the active screen 209 is in OPEN position  $U_{Cal}^O$  from that of the energy when the active screen 209 is in CLOSE position  $U_{Cal}^C$ , the reflected energy  $\Delta U_{Cal}$  from the calibration target 207 can be computed from the following equation (6):

$$\Delta U_{Cal} = \bar{U}_{Cal}(K_O - K_C) + (\bar{U}_S^O - \bar{U}_S) + \bar{U}_{BS}(K_O - K_C) \dots\dots\dots(6)$$

Thirdly, the target measurement is carried to measure the energy reflected when the target 217 is placed on the first foam table 203 (i.e. behind the active screen 209) and the active screen 209 is switched between OPEN (not powered) and CLOSE (powered) positions. When the active screen 209 is in OPEN position, the reflected target energy  $U_{Target}^O$  consists of a stable signal  $K_O \bar{U}_T$  from the target 217 having a transmission coefficient  $K_O$  of the active screen 209 in the OPEN position, a stable signal  $\bar{U}_S^O$  from the active screen 209 in the OPEN position, a stable signal from the background  $\bar{U}_B$ , a variable signal from the background  $\tilde{U}_B$  and a stable signal from static background behind screen with a transmission coefficient of OPEN screen  $K_O \bar{U}_{BS}$ . The reflected target energy  $U_{Target}^O$  measured when the active screen 209 is in OPEN position can be expressed by the following equation (7):

$$U_{Target}^O = K_O \bar{U}_T + \bar{U}_S^O + \bar{U}_B + \tilde{U}_B + K_O \bar{U}_{BS} \dots\dots\dots(7)$$

When the active screen 209 is in CLOSE position, the reflected target energy  $U_{Target}^C$  consists of a stable signal  $K_C \bar{U}_T$  from the target 217 having a transmission coefficient  $K_C$  of the active screen 209 in CLOSE position, a stable signal  $\bar{U}_S^O$  of the active screen 209 in CLOSE position, a stable signal from the background  $\bar{U}_B$ , a variable signal from the background  $\tilde{U}_B$  and a stable signal from static background behind screen with a transmission coefficient of CLOSED screen  $K_C \bar{U}_{BS}$ . The reflected target

energy  $U_{Target}^C$  measured when the active screen 209 is in CLOSE position is expressed by the following equation (8):

$$U_{Target}^C = K_C \bar{U}_T + \bar{U}_S^C + \bar{U}_B + \tilde{U}_B + K_C \bar{U}_{BS} \quad \dots\dots\dots (8)$$

By subtracting the reflected target energy when the active screen 209 is in OPEN position  $U_{Target}^O$  from that of the energy when the active screen 209 is in CLOSE position  $\Delta U_{Target}$ , the reflected energy from the target 217 can be computed from the following equation (9):

$$\Delta U_{Target} = \bar{U}_T (K_O - K_C) + (\bar{U}_S^O - \bar{U}_S) + \bar{U}_{BS} (K_O - K_C) \quad \dots\dots\dots (9)$$

By subtracting the reflected background energy  $\Delta U_{Bkgd}$  (i.e. Equation 3) from each of the reflected target energy  $\Delta U_{Target}$  (i.e. Equation 9) and reflected calibration energy  $\Delta U_{Cal}$  (i.e. Equation 6), the following equations (10) and (11) can be derived:

$$\Delta U_{Target} - \Delta U_{Bkgd} = \bar{U}_T (K_O - K_C) \quad \dots\dots\dots (10)$$

$$\Delta U_{Cal} - \Delta U_{Bkgd} = \bar{U}_{Cal} (K_O - K_C) \quad \dots\dots\dots (11)$$

From the above equations (10) and (11), the RCS of target ( $\sigma_{Target}$ ) can be calculated by substituting the RCS of Calibration target ( $\sigma_{cal}$ ) as given by the following equations (12) to (14):

$$\sigma_{Target} = \sigma_{Cal} (\Delta U_{Target} - \Delta U_{Bkgd} / \Delta U_{Cal} - \Delta U_{Bkgd})^2 \quad \dots\dots\dots (12)$$

$$= \sigma_{Cal} (U_T (K_O - K_C) / U_{Cal} (K_O - K_C))^2 \quad \dots\dots\dots (13)$$

$$= \sigma_{Cal} (U_T / U_{Cal})^2 \quad \dots\dots\dots (14)$$

Using the above equations 12 to 14, the RCS of target,  $\sigma_{Target}$ , can be easily derived. For example, by substituting the known RCS of calibration target  $\sigma_{Cal}$  (defined by a user), stable signal from target  $U_T$  (measured signal) and stable signal from calibration

target  $U_{Cal}$  (measured signal), the RCS of target,  $\sigma_{Target}$ , can be calculated using the equation (14).

The above equations (1) to (14) can be utilised in determining the various parameters involved during RCS measurements in accordance with the first embodiment. For example, a computer system 500 (refer to Figure 5) can be provided in the RCS measurement system 200 to execute a programme for deriving the various RCS parameters based on the above equations (1) to (14).

Figure 3 is a graph 300 showing the various measurements taken by utilising the RCS measurement system 200. The graph 300 shows the background measurement results 301 and the target measurement results 302. It can be seen that the background noise before compensation is about -75dB (curve 301) and after compensation in the target measurement (curve 302) is about 110 dB. In Figure 3, peak A corresponds to the background, which in the described example is 207 (Figure 2), and peak B corresponds to the target 217 (Figure 2) behind the Active Screen 209 (Figure 2)

Figure 4 is a schematic diagram of a RCS measurement system 400 in accordance with a second embodiment. The second embodiment uses a frequency modulated active screen 419 to measure the RCS of a target 415 with reduced background noise.

The active screen 419 is positioned in front of the target 415, the target 415 being mounted on a raised foam table 417. The active screen 419 is periodically switched between OPEN and CLOSE positions by using a modulating signal 425 from a function generator 407 having a modulation frequency of  $F_m$ .

The active screen 419 consists of periodic patterns of active elements and can be implemented in the same way as screen 209 (Figure 2). The parameters of the active screen 419 are typically as per Table 2 below:

| Parameters      | Demonstration          |
|-----------------|------------------------|
| Frequency Range | S band (3GHz)          |
| Screen Size     | 25cm x 50cm            |
| Element Type    | dipole with associated |

| Parameters   | Demonstration |
|--------------|---------------|
|              | pin diode     |
| Array        | 10 by 10      |
| Polarization | Horizontal    |

Table 2: Active Screen parameters

The physical dimension of the active screen 419 is about 25cm x 50cm. The active screen 419 consists of an integrated array (10 x 10) of active elements i.e. a total of 100 active elements are used in the implementation of an S band screen.

In the embodiment, all the elements of the active screen 419 are optimized for use with the S band frequency. The operation of the active screen 419 is controlled by a function generator having an operating frequency of about 30Hz. Depending on the frequency of operation, the above parameters of the active screen 419 may appropriately be chosen. The layout of the active screen 419 depends on the user requirement.

The measurement system uses a transceiver equipment in the form of a programmable network analyser (PNA) 401 to generate and receive a desired signal. The PNA 401 is coupled to a Tx antenna 411 and controls transmission of an incident electromagnetic signal 421 having an incident frequency  $F_0$  through the transmitter antenna 411.

As the active screen 419 is switched between OPEN or CLOSE in a periodic manner [frequency  $F_m$ ], the electromagnetic signal passing through the active screen 419 will be modulated by the modulation frequency  $F_m$ . Therefore, the scattered wave from the target 415 will have a modulated frequency of  $F_0$ ,  $F_0 \pm NF_m$ . On the other hand, the scattered wave from surrounding structures (not shown) for which the electromagnetic energy does not pass through the active screen 419, and including the variable background, will only have a frequency of  $F_0$ , i.e. the frequency of the incident electromagnetic signal 421.

The receiver antenna 413 is operable to receive the scattered electromagnetic field from the target 415, the surrounding structures, and including the variable background. The filter 409 suppresses undesired signals and generates a signal with frequency  $F_0 + F_m$  in this example embodiment. It will be appreciated that alternatively the filter 409 may generate a signal with frequency  $F_0 - F_m$ . The output from the filter 409 is directed to a

mixer 405. The output, with a frequency  $F_m$ , from the function generator 407 is also directed to the mixer 405. The output signal from the mixer 405 can be expressed by  $(F_0 + F_m) \pm NF_m$ . The mixer 405 shifts the frequency of the signal from the filter 409, including shifting to a component  $(F_0 + F_m) - F_m = F_0$ , i.e. towards  $F_0$ , which is the receiver frequency of the PNA 401. The output from the mixer 405 is directed to a second filter 403, which suppresses signals with frequencies  $F_0 \pm NF_m$ , to obtain the desired signal  $F_0$ .

It will be appreciated that thus the signal received at the PNA 401 (at  $F_0$ ) contains only signals which passed through the active screen 419 prior to being received at the receiver antenna 413. Therefore, other received signals such as those reflected from background objects outside the active screen 419 have been eliminated in this embodiment. Similar to the embodiment described above with reference to Figure 2, it will be appreciated that when e.g. an about 33 ms pulse is utilised for the OPEN and CLOSE periods, variable background behind the active screen 419 can be considered as stable and therefore, after subtractions, background variations can be effectively compensated.

As in the first embodiment, firstly, a background measurement is conducted without any target 415 behind the active screen 419 so as to measure the initial background level. Upon completing the background measurement, a calibration measurement is carried out by placing a calibration target (e.g. Sphere) behind the active screen 419, which the system 400 uses as a reference. Finally, the target of interest is placed which is rotated by an angle of  $0^\circ$ - $360^\circ$ . The measurement system 400 measures the target signature during the rotation of the target.

Figure 5 is a schematic diagram illustrating a computer system 500 for use in the described RCS measurement systems. The functionalities may be implemented as software, such as a computer program being executed within the computer system 500, and instructing the computer system 500 to conduct the method of the example embodiment.

The computer system 500 comprises a computer module 502, input modules such as a keyboard 504 and mouse 506 and a plurality of output devices such as a display 508, and printer 510.

The computer module 502 is connected to a computer network 512 via a suitable transceiver device 514, to enable access to e.g. the Internet or other network systems such as Local Area Network (LAN) or Wide Area Network (WAN).

The computer module 502 in the example includes a processor 518, a Random Access Memory (RAM) 520 and a Read Only Memory (ROM) 522. The computer module 502 also includes a number of Input/Output (I/O) interfaces, for example I/O interface 524 to the display 508, and I/O interface 526 to the keyboard 504.

The components of the computer module 502 typically communicate via an interconnected bus 528 and in a manner known to the person skilled in the relevant art.

The application program is typically supplied to the user of the computer system 500 encoded on a data storage medium such as a CD-ROM or flash memory carrier and read utilising a corresponding data storage medium drive of a data storage device 530. The application program is read and controlled in its execution by the processor 518. Intermediate storage of program data maybe accomplished using RAM 520.

Figure 6 shows a flow chart 600 illustrating a method of conducting radar cross section measurements in an example embodiment. At step 601 an active screen is positioned between a transceiver unit and a target area. At step 603, the active screen is periodically switched between an OPEN position in which the active screen is electromagnetically transparent and a CLOSE position in which the active screen is electromagnetically opaque. At step 605, electromagnetic signals are transmitted towards the target area utilising the transceiver unit. At step 607, a first received signal is measured when the active screen is in the OPEN position. At step 609, a second received signal is measured when the active screen is in the CLOSE position; and, at step 611, a target signature is derived based on the measured first and second received signals, wherein a frequency of the switching of the active screen is chosen such that respective background components in the first and second received signals are substantially constant.

Successful implementation of the above embodiments can overcome the drawbacks faced in conventional RCS measurement systems.

Both the above embodiments are aimed in minimising variations in background reference level while conducting background, calibration and target measurements . The short switching period of opening and closing of the active screen 419, results in higher accuracy of measurement. .

For low frequency measurements, a time reduction is achieved as the measurement setup can be done in a confined space compared to the large facility required for typical low frequency measurements. In addition, for low frequency measurements higher accuracy is achieved, as the system provides accurate background compensation.

It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

**CLAIMS:**

1. A method of conducting radar cross section measurements, the method comprising the steps of:

- positioning an active screen between a transceiver unit and a target area;
- periodically switching the active screen between an OPEN position in which the active screen is electromagnetically transparent and a CLOSE position in which the active screen is electromagnetically opaque;
- transmitting electromagnetic signals towards the target area utilising the transceiver unit;
- measuring a first received signal when the active screen is in the OPEN position;
- measuring a second received signal when the active screen is in the CLOSE position; and
- deriving a target signature based on the measured first and second received signals;
- wherein a frequency of the switching of the active screen is chosen such that respective background components in the first and second received signals are substantially constant.

2. The method as claimed in claim 1, further comprising performing software based processing of the received first and second signals to remove signal components that have not passed through the active screen from the first received signal.

3. The method as claimed in claim 1, further comprising utilising hardware based processing of the received first and second signals to remove signal components that have not passed through the active screen from the first received signal.

4. The method as claimed in any one of claims 1 to 3, comprising

- transmitting electromagnetic signals towards the target area without a target located in the target area utilising the transceiver unit;
- measuring a first group of the first and second received signals;
- transmitting electromagnetic signals towards the target area with a calibration target located in the target area utilising the transceiver unit;
- measuring a second group of the first and second received signals;
- transmitting electromagnetic signals towards the target area with a target to be measured located in the target area utilising the transceiver unit;
- measuring a third group of the first and second received signals; and

deriving the target signature based on the measured groups of first and second received signals.

5. A system for conducting radar cross section measurements, the system comprising:  
an active screen for location between a transceiver unit and a target area, the active screen being operable to periodically switch between an OPEN position in which the active screen is electromagnetically transparent and a CLOSE position in which the active screen is electromagnetically opaque;

a transceiver unit for transmitting electromagnetic signals towards a target area;

a measurement unit for measuring a first received signal when the active screen is in the OPEN position and for measuring a second received signal when the active screen is in the CLOSE position; and for deriving a target signature based on the measured first and second received signals;

wherein a frequency of the switching of the active screen is chosen such that respective background components in the first and second received signals are substantially constant.

6. The system as claimed in claim 5, wherein the measurement unit comprises software based processing means for processing of the received first and second signals to remove signal components that have not passed through the active screen from the first received signal.

7. The system as claimed in claim 5, the measurement unit comprises hardware based processing means for processing of the received first and second signals to remove signal components that have not passed through the active screen from the first received signal.

8. The system as claimed in any one of claims 5 to 7, wherein

the transceiver transmits electromagnetic signals towards the target area without a target located in the target area utilising the transceiver unit;

the measurement unit measures a first group of the first and second received signals;

the transceiver transmits electromagnetic signals towards the target area with a calibration target located in the target area utilising the transceiver unit;

the measurement unit measures a second group of the first and second received signals;

the transceiver transmits electromagnetic signals towards the target area with a target to be measured located in the target area utilising the transceiver unit;

the measurement unit measures a third group of the first and second received signals; and

the measurement unit derives the target signature based on the measured groups of first and second received signals.