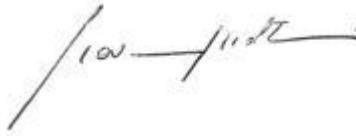


**OGGETTI SOTTOPOSTI A VERIFICHE / ITEMS UNDER TESTS**

|                                                                                                                                            |  |                                                                                                                                                          |                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| <b>Descrizione</b><br><i>Description</i>                                                                                                   |  | Antenna                                                                                                                                                  |                                             |
| <b>Modelli</b><br><i>Model type</i>                                                                                                        |  | MWR (integrated antenna) – DELTA12C/X/BNCM/S/S/17– AS868                                                                                                 |                                             |
| <b>Identificativo interno</b><br><i>Storage No.</i>                                                                                        |  | 170495 (sampled by the applicant)                                                                                                                        |                                             |
| <b>Richiedente</b><br><i>Applicant</i>                                                                                                     |  | TÜV Rheinland LGA Products GmbH                                                                                                                          |                                             |
| <b>Indirizzo</b><br><i>Address</i>                                                                                                         |  | Tillystrasse 2 - 90431 Nürnberg                                                                                                                          |                                             |
| <b>Prove effettuate presso</b><br><i>Test carried out by</i>                                                                               |  | TÜV Rheinland Italia Srl<br>Via E. Mattei, 3 – 20010 Pogliano Milanese (Italia)                                                                          |                                             |
| <b>Scopo delle prove</b><br><i>Scope of the tests</i>                                                                                      |  | Measurement antenna pattern                                                                                                                              |                                             |
| <b>Risultati di prova</b><br><i>Test Results</i>                                                                                           |  | <b>COMPLIANT</b>                                                                                                                                         |                                             |
| <b>Data ricevimento campioni</b><br><i>Date of samples receiving</i>                                                                       |  | 21/12/2017                                                                                                                                               |                                             |
| <b>Data inizio prove</b><br><i>Date of tests start</i>                                                                                     |  | 21/12/2017                                                                                                                                               | <b>Data fine prove</b><br>Date of tests end |
| <b>Rapporto composto da</b><br><i>Test report composed by</i>                                                                              |  | 20 Pages                                                                                                                                                 | 21/12/2017                                  |
| <b>Provato da / Tested by</b><br><i>(name + signature)</i>                                                                                 |  | <b>Approvato da / Approved by</b><br><i>(name + signature)</i>                                                                                           |                                             |
| <br>Andrea Bortolotti<br><i>(Laboratory Technician)</i> |  | <br>Giovanni Molteni<br><i>(Technical &amp; laboratory manager)</i> |                                             |

The results referred in this report are only relevant to the samples tested and described in this report.  
Only complete reproduction of this test report is permitted without written authorisation of TÜV Rheinland Italia

TÜV Rheinland Italia – Via Enrico Mattei, 3 – 20010 Pogliano Milanese (MI) – Italy Tel. +39 02 9396871 Fax. +39 02 93968723

**RELEASE CONTROL RECORD**

| TEST REPORT NUMBER | REASON OF CHANGE                                                 | DATE OF ISSUE |
|--------------------|------------------------------------------------------------------|---------------|
| 28111088-001       | Original release                                                 | 21/12/2017    |
| 28111088-002       | Editorial change                                                 | 27/12/2017    |
| 28111088-003       | Added specification for antenna type DELTA 12 with BNC connector | 03/01/2018    |
| 28111088-004       | Editorial change                                                 | 03/01/2018    |

**OGGETTO SOTTOPOSTO A PROVE / ITEM UNDER TEST**

**Descrizione**

*Description*

Antennas

**Marca**

*Brand*



**Costruttore**

*Manufacturer*

Atlas Copco S.p.a.

**Modelli**

*Models / Type reference*

- |                                    |            |
|------------------------------------|------------|
| 1. MWR (integrated antenna on PCB) | Page 9-11  |
| 2. DELTA12C/X/BNCM/S/S/17          | Page 12-14 |
| 3. AS868                           | Page 15-17 |

**Frequenza di lavoro**

*Working frequency*

920MHz

**Dati di targa**

*Ratings*

Internal battery powered (rechargeable 1,2V battery for dynamometric torch wrench)

230Vac 50Hz for the controller (auxiliary equipment)

**COMPONENTI AUSILIARI / AUXILIARY EQUIPMENT**

| Description                                                       | Manufacturer       | Model    |
|-------------------------------------------------------------------|--------------------|----------|
| Controller for external antenna<br>DELTA12C/X/BNCM/S/S/17 & AS868 | Atlas Copco S.p.a. | FOCUS 61 |



DATI TECNICI ANTENNE / ANTENNA DATASHEET

AS868

# Vertical Antenna for Outdoor use



## Description

Vertical type antenna for outdoor use. Available frequencies : 433.92 MHz or 868.3 MHz. Supplied with 2.50 mt 50 Ohm coaxial cable RG58MIL-C17. (On request: BNC at user side).  
On request: mounting bracket (256 x 140 x 40 mm).

## Descrizione

Antenna VERTICALE per uso esterno. Fornita con 2,50 m di cavo coassiale 50 Ohm RG58 MIL-C17 (Su richiesta: terminato con connettore BNC dal lato utilizzatore). Su richiesta: staffa di fissaggio (256x140x40 mm).

## Technical Specification

Ta = 25 °C

| CHARACTERISTICS |                                                        | MIN | TYP                             | MAX | UNIT     |
|-----------------|--------------------------------------------------------|-----|---------------------------------|-----|----------|
| F <sub>w</sub>  | Working frequency • Frequenza di lavoro                |     | 433.92 or 868.3                 |     | MHz      |
| Z <sub>i</sub>  | Impedance • Impedenza                                  |     | 50                              |     | $\Omega$ |
|                 | Bracket base • Base                                    |     | black PVC • PVC nero            |     |          |
|                 | Stilus • Stilo                                         |     | black inox steel • acciaio nero |     |          |
|                 | 50 $\Omega$ Coaxial cable • Cavo coassiale 50 $\Omega$ |     | 2.5                             |     | mt       |
|                 | BNC connector • Connettore BNC                         |     | on request                      |     |          |
| T <sub>op</sub> | Operating temperature range • Temperatura di lavoro    | -20 |                                 | +80 | °C       |

## DELTA 12



### Key Features

- Range of ISM frequency bands available
- 3dBi gain
- ¼ wave radiating element
- 130mm whip antenna

### General Description

The Delta 12s are a range of ¼ wave ISM whip antennas. This style of antenna is offered in a number of different frequencies that meets all the popular ISM bands. Great quality and affordable pricing, this antenna is perfect for high volume ISM applications within the mobile applications world.

The Delta 12s can be tuned to the ISM (Industrial, Scientific and Medical) radio frequency bands of 151/173, 433/458, 869 and 915MHz. 151/173MHz and 433/458MHz dictate combined frequencies into one antenna. The same style and dimensions of the housing/casing is used for each antenna regardless of its frequency.

### Key Specifications - Electrical

|                  |                               |
|------------------|-------------------------------|
| Frequency:       | 151/173, 433/458, 869, 915MHz |
| Impedance:       | 50 ohm                        |
| VSWR:            | <2                            |
| Gain:            | 3dBi                          |
| Polarization:    | Vertical ¼ wave               |
| Radiation:       | Omnidirectional               |
| Max input power: | 50W                           |

### Key Specifications - Mechanical

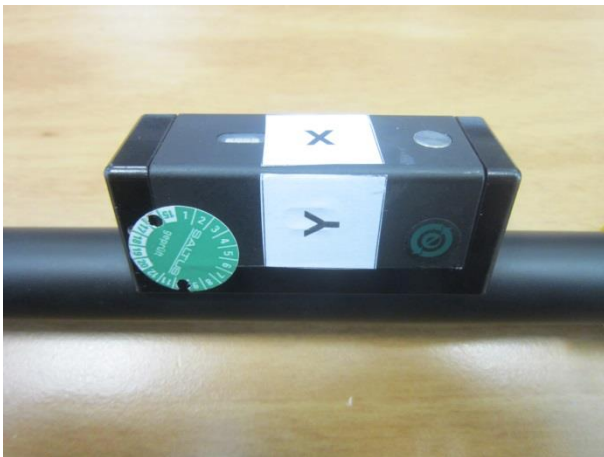
|                  |                |
|------------------|----------------|
| Dimensions:      | 130mm (Length) |
| Connector:       | SMA male       |
| Mounting method: | Direct connect |

**DELTA 12 details**

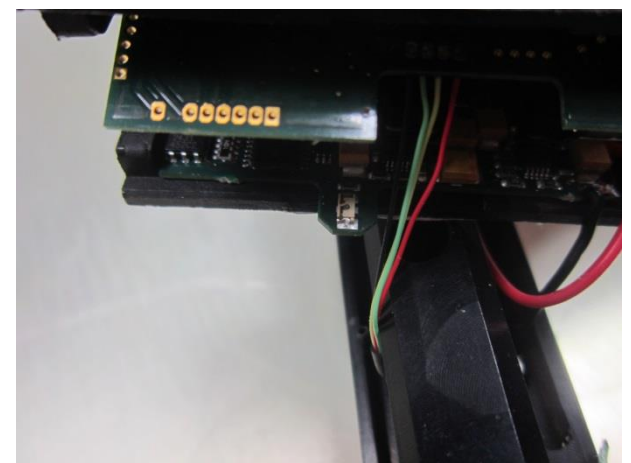
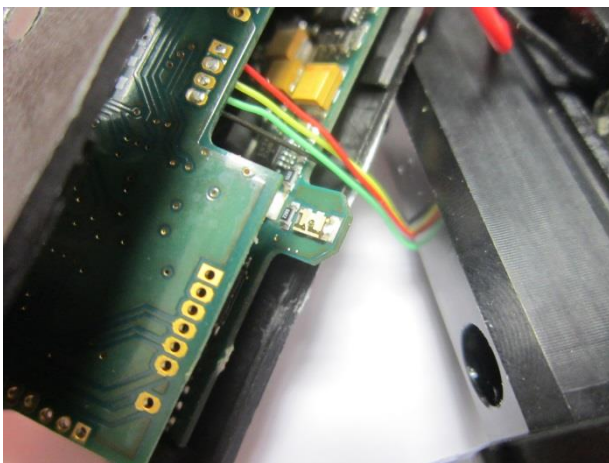
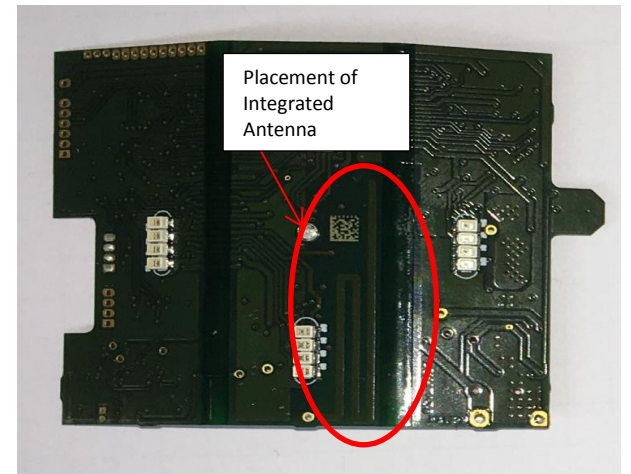
**Ordering Details:**

| Part number            | Description                                              |
|------------------------|----------------------------------------------------------|
| DELTA12/X/SMAM/S/S/17  | 151/173MHz Whip Antenna, SMA Male Connector (130mm Long) |
| DELTA12/X/BNCM/S/S/17  | 151/173MHz Whip Antenna, BNC Male Connector (130mm Long) |
| DELTA12A/X/SMAM/S/S/17 | 433/458MHz Whip Antenna, SMA Male Connector (130mm Long) |
| DELTA12A/X/BNCM/S/S/17 | 433/458MHz Whip Antenna, BNC Male Connector (130mm Long) |
| DELTA12B/X/SMAM/S/S/17 | 869MHz Whip Antenna, SMA Male Connector (130mm Long)     |
| DELTA12B/X/BNCM/S/S/17 | 869MHz Whip Antenna, BNC Male Connector (130mm Long)     |
| DELTA12C/X/SMAM/S/S/17 | 915MHz Whip Antenna, SMA Male Connector (130mm Long)     |
| DELTA12C/X/BNCM/S/S/17 | 915MHz Whip Antenna, BNC Male Connector (130mm Long)     |

**MWR (integrated antenna)**



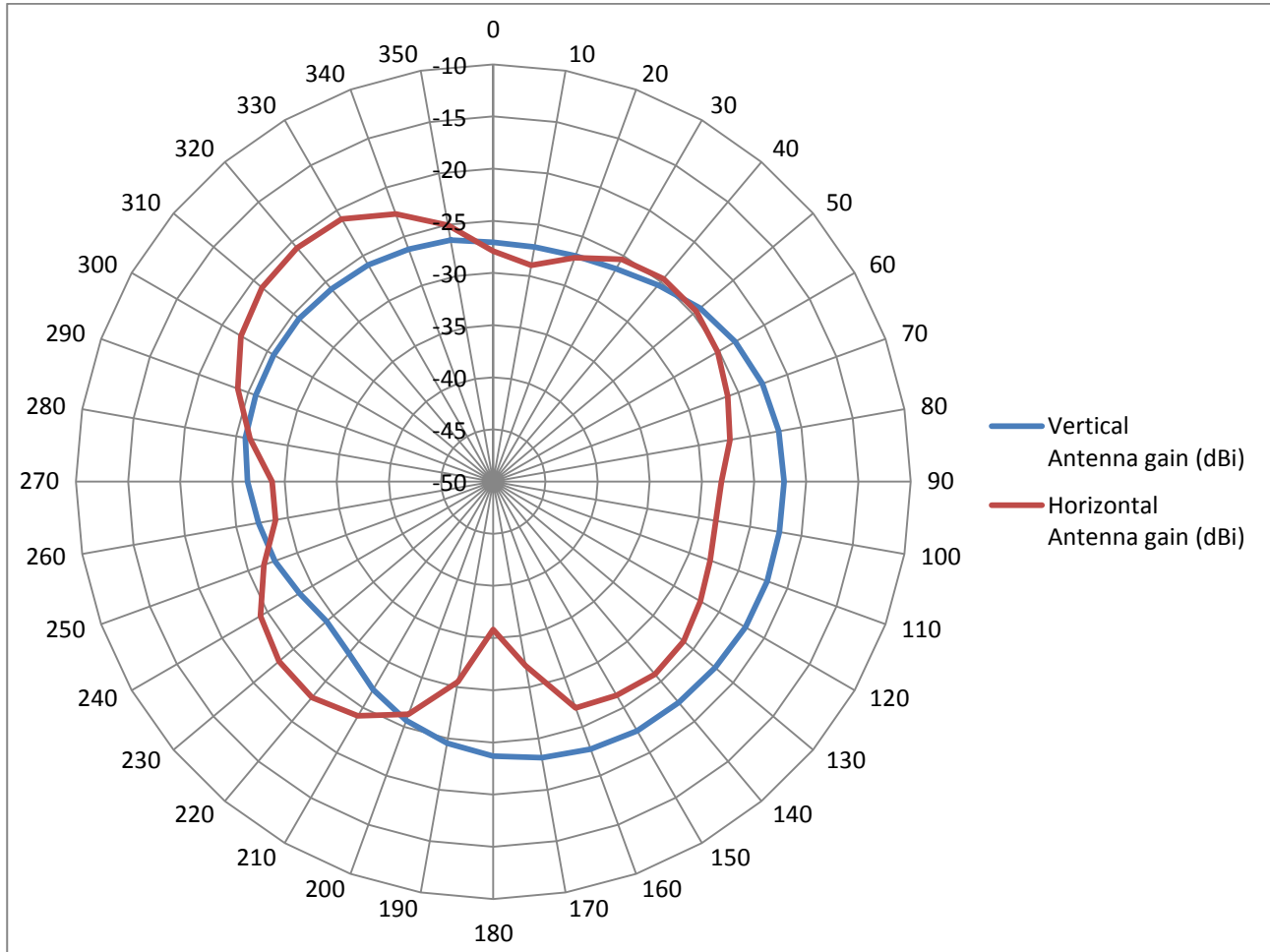
---BLANK---



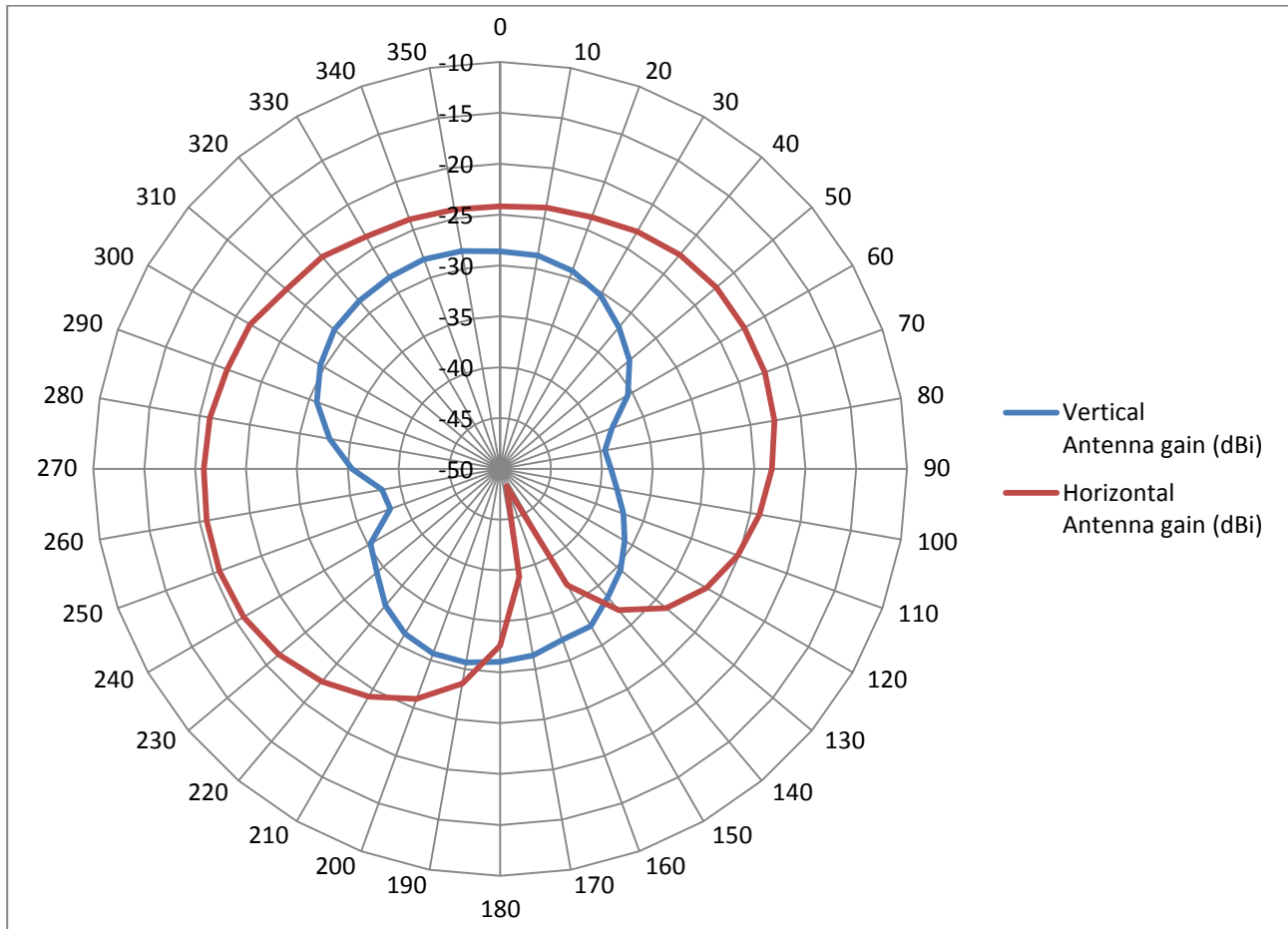
**1 ) Result for MWR integrated antenna @ 920MHz working frequency**

| Deg TT | Vertical polarization |                    | Horizontal polarization |                    |
|--------|-----------------------|--------------------|-------------------------|--------------------|
|        | X-Z axes              | Y axes             | X-Z axes                | Y axes             |
|        | Antenna gain (dBi)    | Antenna gain (dBi) | Antenna gain (dBi)      | Antenna gain (dBi) |
| 0      | -27,06                | -28,62             | -28,62                  | -24,18             |
| 10     | -27,17                | -28,71             | -28,71                  | -23,91             |
| 20     | -26,96                | -29,27             | -29,27                  | -23,66             |
| 30     | -26,45                | -30,29             | -30,29                  | -23,07             |
| 40     | -25,41                | -31,85             | -31,85                  | -22,53             |
| 50     | -24,14                | -33,4              | -33,4                   | -22,27             |
| 60     | -23,21                | -35,49             | -35,49                  | -22,28             |
| 70     | -22,55                | -38,31             | -38,31                  | -22,3              |
| 80     | -22,21                | -39,54             | -39,54                  | -22,62             |
| 90     | -22,12                | -39,11             | -39,11                  | -23,3              |
| 100    | -22,14                | -38,34             | -38,34                  | -24,11             |
| 110    | -22,08                | -37,12             | -37,12                  | -25,14             |
| 120    | -22,09                | -35,86             | -35,86                  | -26,57             |
| 130    | -22,24                | -34,54             | -34,54                  | -28,69             |
| 140    | -22,36                | -33,53             | -33,53                  | -31,87             |
| 150    | -22,42                | -32,15             | -32,15                  | -36,81             |
| 160    | -22,72                | -32,14             | -32,14                  | -48,18             |
| 170    | -23,12                | -31,39             | -31,39                  | -39,21             |
| 180    | -23,69                | -31,02             | -31,02                  | -32,64             |
| 190    | -24,54                | -30,69             | -30,69                  | -28,57             |
| 200    | -25,63                | -30,69             | -30,69                  | -25,95             |
| 210    | -26,96                | -31,28             | -31,28                  | -24,15             |
| 220    | -28,49                | -32,47             | -32,47                  | -22,71             |
| 230    | -29,16                | -34,16             | -34,16                  | -21,6              |
| 240    | -28,56                | -35,28             | -35,28                  | -20,89             |
| 250    | -27,73                | -38,5              | -38,5                   | -20,63             |
| 260    | -27,16                | -38,18             | -38,18                  | -20,7              |
| 270    | -26,46                | -35,41             | -35,41                  | -20,86             |
| 280    | -25,88                | -32,97             | -32,97                  | -21,02             |
| 290    | -25,78                | -30,8              | -30,8                   | -21,42             |
| 300    | -25,71                | -29,57             | -29,57                  | -21,6              |
| 310    | -25,7                 | -28,7              | -28,7                   | -22,56             |
| 320    | -25,89                | -28,43             | -28,43                  | -22,79             |
| 330    | -26,01                | -28,25             | -28,25                  | -23,64             |
| 340    | -26,3                 | -28,08             | -28,08                  | -23,92             |
| 350    | -26,48                | -28,25             | -28,25                  | -24,1              |

**Graphical representation of antenna gain for X-Z axes (MWR integrated Antenna)**



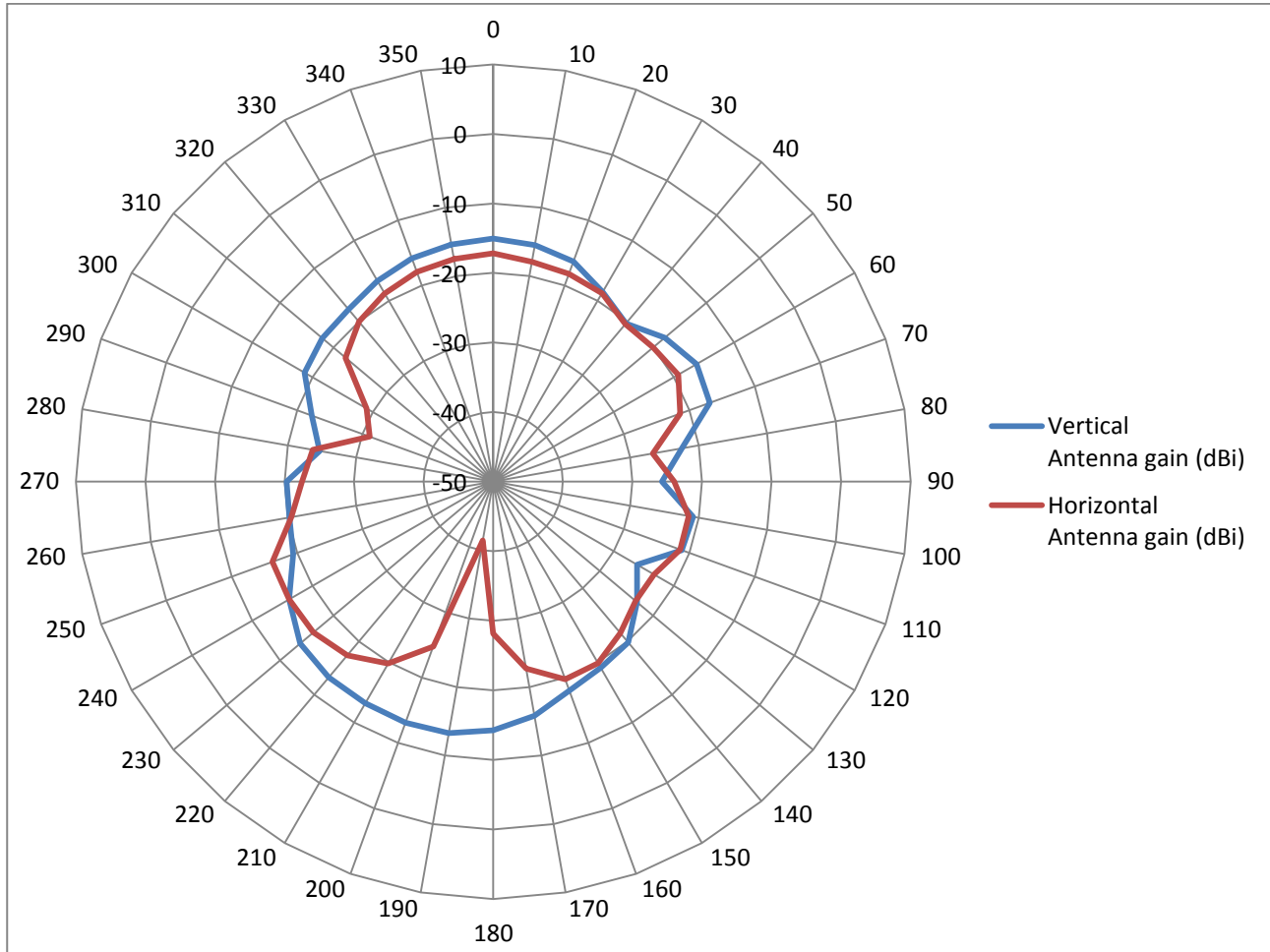
**Graphical representation of antenna gain for Y axes (MWR integrated Antenna)**



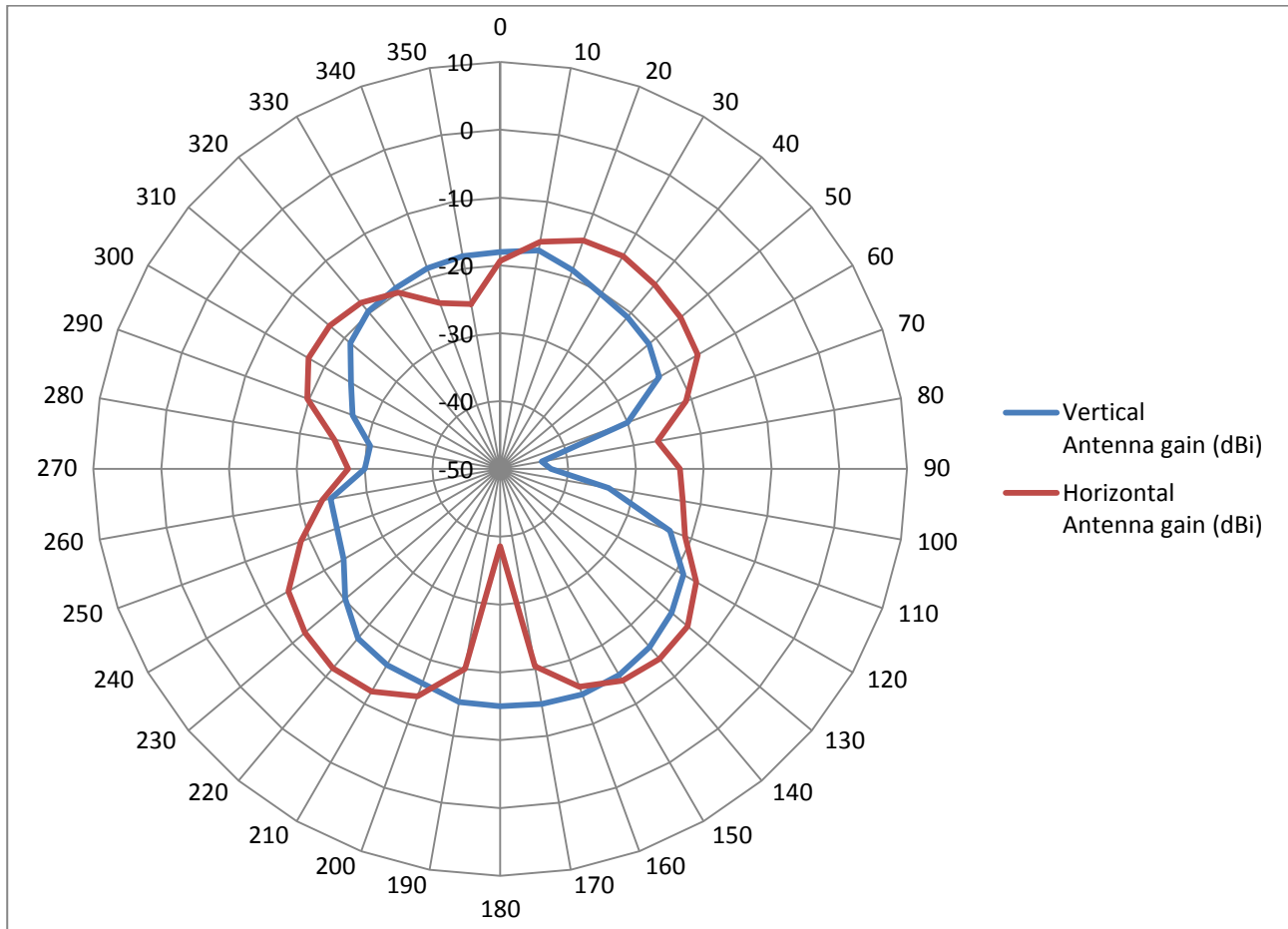
**2) Result for DELTA12C/X/BNCM/S/S/17 antenna @ 920MHz working frequency**

| Deg TT | Vertical polarization |                    | Horizontal polarization |                    |
|--------|-----------------------|--------------------|-------------------------|--------------------|
|        | X-Z axes              | Y axes             | X-Z axes                | Y axes             |
|        | Antenna gain (dBi)    | Antenna gain (dBi) | Antenna gain (dBi)      | Antenna gain (dBi) |
| 0      | -15,04                | -18                | -17,18                  | -19,34             |
| 10     | -15,45                | -17,29             | -17,92                  | -16,02             |
| 20     | -16,31                | -18,81             | -18,22                  | -14,17             |
| 30     | -18,54                | -20,25             | -18,73                  | -13,76             |
| 40     | -20,33                | -20,77             | -20,43                  | -14,54             |
| 50     | -17,81                | -21,34             | -20,01                  | -15,25             |
| 60     | -16,26                | -22,91             | -19,3                   | -16,34             |
| 70     | -16,85                | -30,02             | -21,42                  | -20,82             |
| 80     | -22,48                | -43,78             | -26,7                   | -26,42             |
| 90     | -25,73                | -42,52             | -24                     | -23,49             |
| 100    | -20,8                 | -33,73             | -21,47                  | -22,64             |
| 110    | -21,15                | -23,35             | -21,38                  | -21                |
| 120    | -26,1                 | -18,82             | -23,29                  | -16,63             |
| 130    | -23,02                | -17,01             | -23,28                  | -13,91             |
| 140    | -19,79                | -15,72             | -21,6                   | -13,42             |
| 150    | -19,09                | -14,92             | -19,83                  | -13,92             |
| 160    | -18,02                | -14,6              | -19,75                  | -15,84             |
| 170    | -15,8                 | -14,79             | -22,7                   | -20,46             |
| 180    | -14,23                | -14,99             | -28,13                  | -38,61             |
| 190    | -13,3                 | -15,08             | -41,39                  | -20,04             |
| 200    | -13,12                | -16,36             | -24,76                  | -14,31             |
| 210    | -13,23                | -16,59             | -19,77                  | -12,09             |
| 220    | -13,24                | -17,38             | -17,37                  | -11,61             |
| 230    | -13,78                | -20,17             | -16,26                  | -12,41             |
| 240    | -16,14                | -23,32             | -16,13                  | -13,92             |
| 250    | -19,41                | -24,39             | -16,24                  | -18,7              |
| 260    | -20,25                | -24,61             | -20,52                  | -23,37             |
| 270    | -20,27                | -30,02             | -22,52                  | -27,58             |
| 280    | -24,64                | -30,53             | -23,67                  | -25,19             |
| 290    | -22,25                | -26,82             | -31,1                   | -19,73             |
| 300    | -18,67                | -24,57             | -28,99                  | -17,34             |
| 310    | -17,92                | -21,13             | -22,28                  | -17,16             |
| 320    | -17,66                | -19,69             | -19,98                  | -18,04             |
| 330    | -16,68                | -19,22             | -18,77                  | -19,97             |
| 340    | -15,86                | -18,53             | -17,91                  | -24,01             |
| 350    | -15,39                | -18,16             | -17,48                  | -25,33             |

**Graphical representation of antenna gain for X-Z axes (DELTA12C/X/BNCM/S/S/17 antenna)**



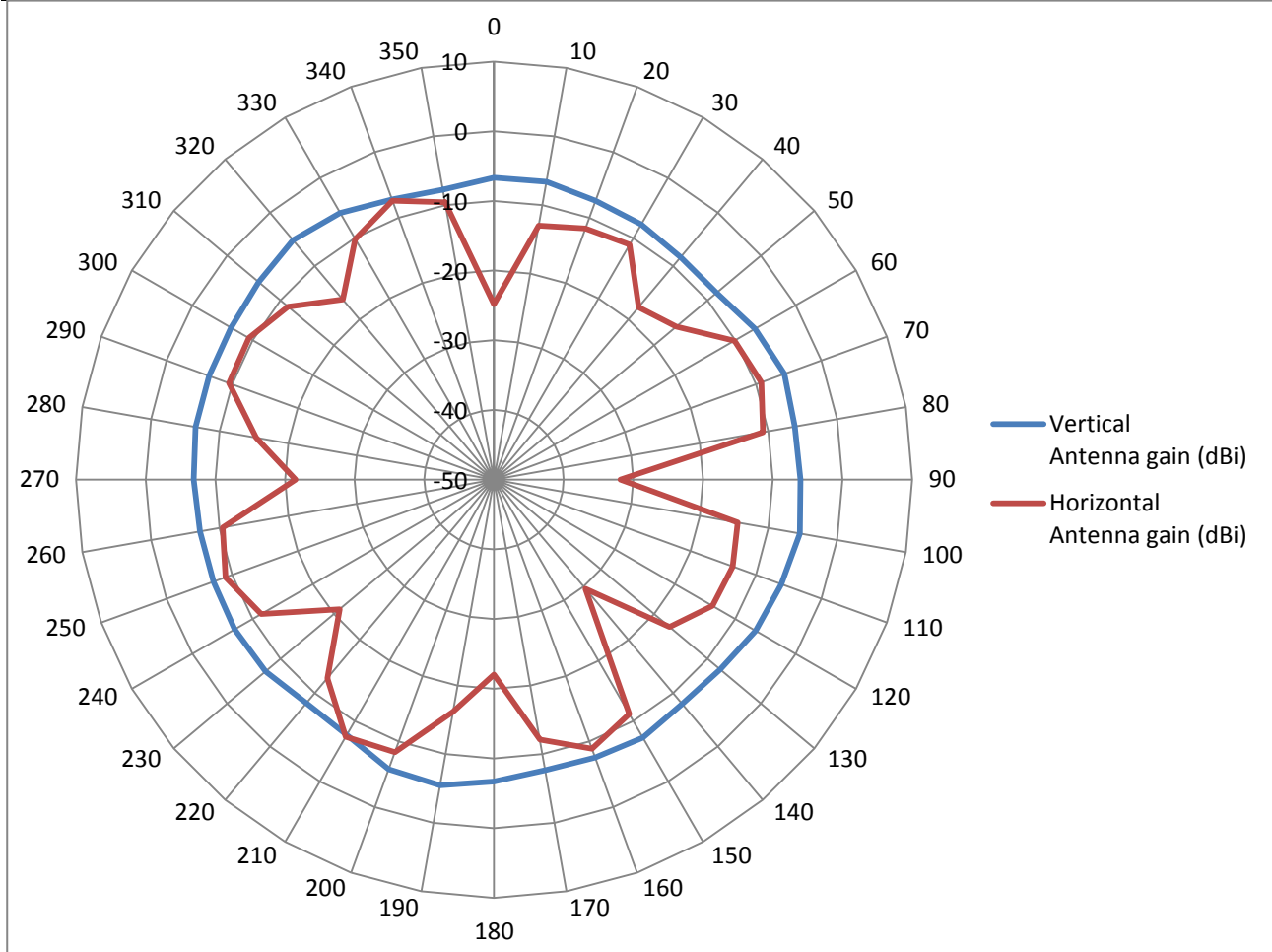
**Graphical representation of antenna gain for Y axes (DELTA12C/X/BNCM/S/S/17 antenna)**



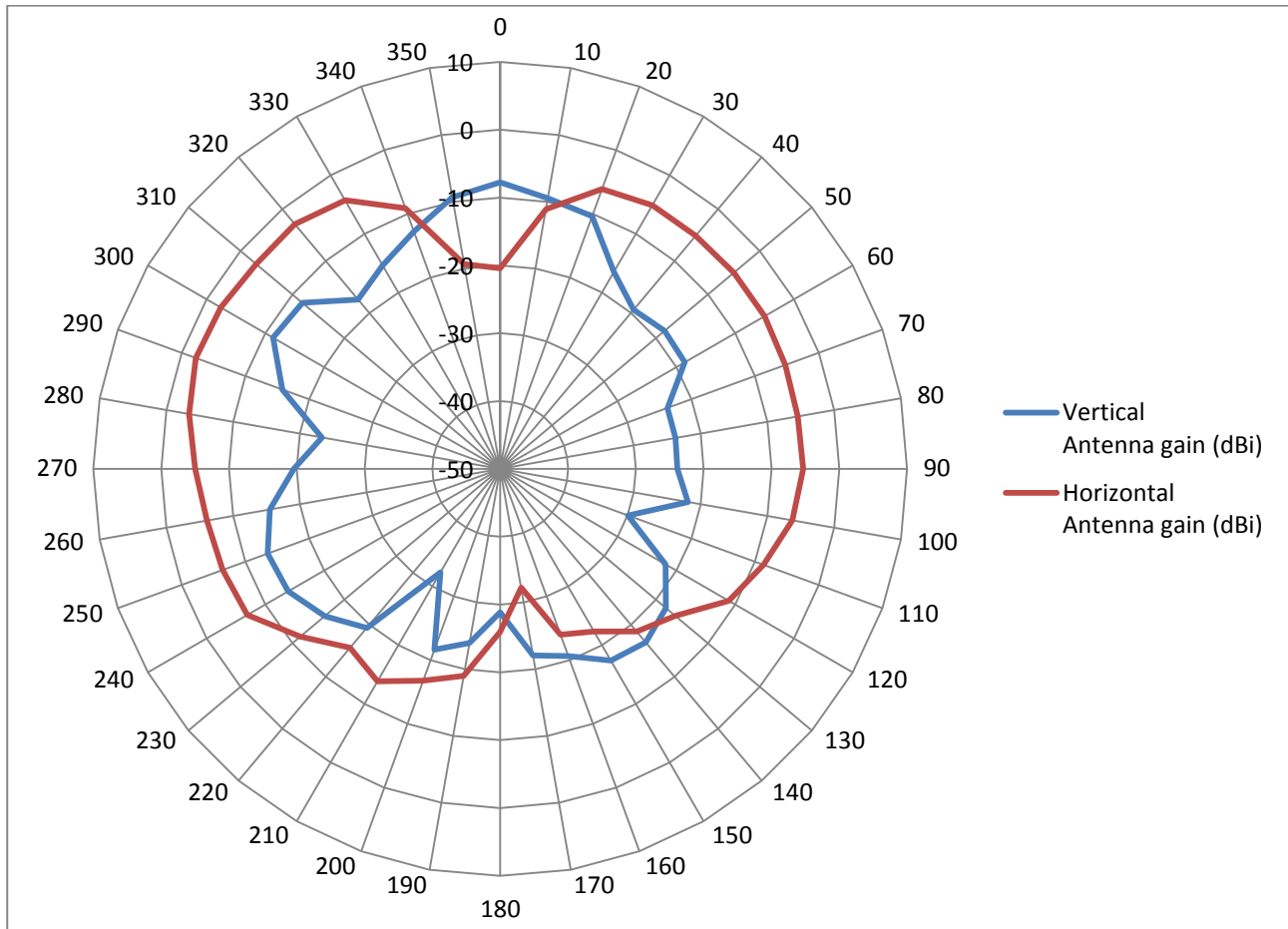
**3) Result for AS868 antenna @ 920MHz working frequency**

| Deg TT | Vertical polarization |                    | Horizontal polarization |                    |
|--------|-----------------------|--------------------|-------------------------|--------------------|
|        | X-Z axes              | Y axes             | X-Z axes                | Y axes             |
|        | Antenna gain (dBi)    | Antenna gain (dBi) | Antenna gain (dBi)      | Antenna gain (dBi) |
| 0      | -6,69                 | -7,75              | -24,84                  | -20,42             |
| 10     | -6,6                  | -9,47              | -12,98                  | -11,12             |
| 20     | -7,41                 | -10,37             | -11,63                  | -6,07              |
| 30     | -7,72                 | -16,46             | -11,06                  | -5,12              |
| 40     | -8,31                 | -19,41             | -17,72                  | -5,14              |
| 50     | -8,27                 | -18,38             | -15,86                  | -5                 |
| 60     | -6,73                 | -18,58             | -10,13                  | -4,97              |
| 70     | -5,66                 | -23,77             | -9,17                   | -5,25              |
| 80     | -6,17                 | -23,77             | -10,81                  | -5,44              |
| 90     | -6                    | -23,89             | -31,84                  | -5,31              |
| 100    | -5,41                 | -21,88             | -14,48                  | -6,25              |
| 110    | -6,11                 | -29,96             | -13,55                  | -8,67              |
| 120    | -6,64                 | -21,82             | -13,81                  | -11,07             |
| 130    | -7,63                 | -18,09             | -17,11                  | -16,28             |
| 140    | -7,98                 | -16,6              | -29,56                  | -18,69             |
| 150    | -7,27                 | -17,38             | -11,19                  | -22,31             |
| 160    | -7,56                 | -20,65             | -8,9                    | -23,99             |
| 170    | -7,65                 | -22,09             | -12,12                  | -32,23             |
| 180    | -6,68                 | -28,83             | -22,01                  | -25,97             |
| 190    | -5,48                 | -23,95             | -16,17                  | -19                |
| 200    | -5,8                  | -21,61             | -8,4                    | -16,79             |
| 210    | -7,7                  | -32,4              | -7,39                   | -13,81             |
| 220    | -8,13                 | -19,4              | -12,8                   | -15,57             |
| 230    | -7,2                  | -16,24             | -21,09                  | -11,52             |
| 240    | -7,03                 | -13,88             | -11,43                  | -6,91              |
| 250    | -7,14                 | -13,52             | -8,97                   | -6,42              |
| 260    | -7,16                 | -15,49             | -10,45                  | -6,09              |
| 270    | -6,87                 | -19,55             | -21,5                   | -5,03              |
| 280    | -6,52                 | -23,31             | -15,32                  | -3,43              |
| 290    | -6,48                 | -15,8              | -9,51                   | -2,2               |
| 300    | -6,41                 | -11,33             | -9,37                   | -2,42              |
| 310    | -5,92                 | -11,9              | -11,39                  | -3,03              |
| 320    | -5,13                 | -17,4              | -16,24                  | -2,88              |
| 330    | -5,84                 | -15,33             | -10,16                  | -4,27              |
| 340    | -7,22                 | -12,75             | -7,41                   | -9,09              |
| 350    | -7,75                 | -9,34              | -9,6                    | -19,36             |

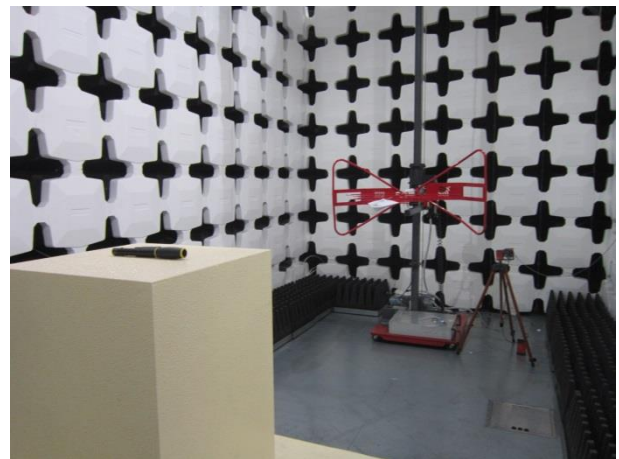
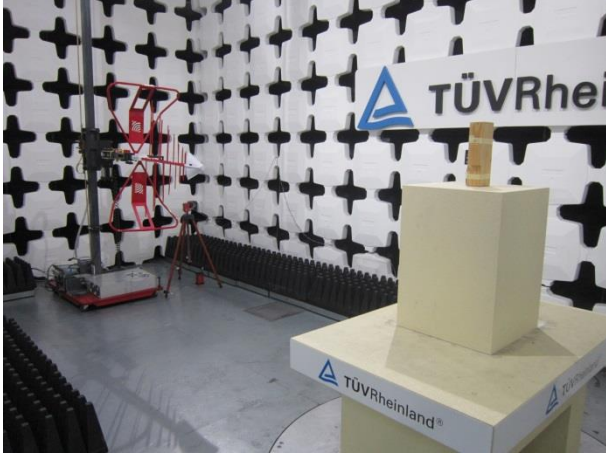
**Graphical representation of antenna gain for X-Z axes (AS868 antenna)**



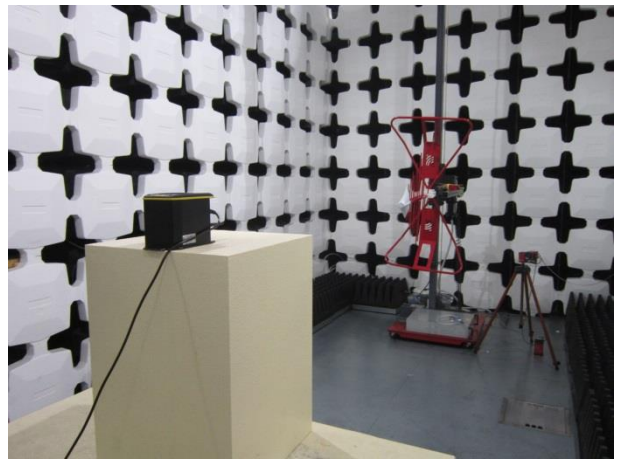
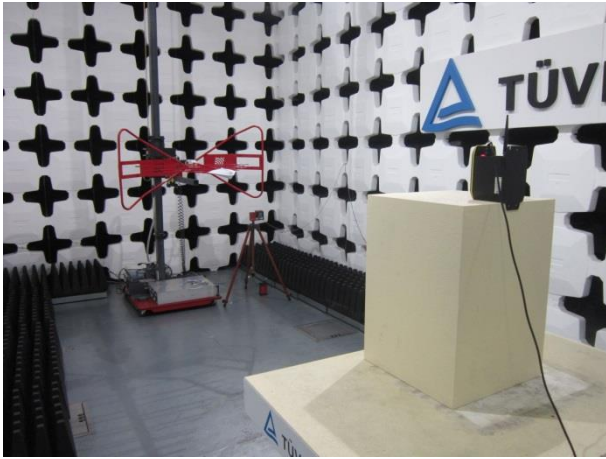
**Graphical representation of antenna gain for Y axes (AS868 antenna)**



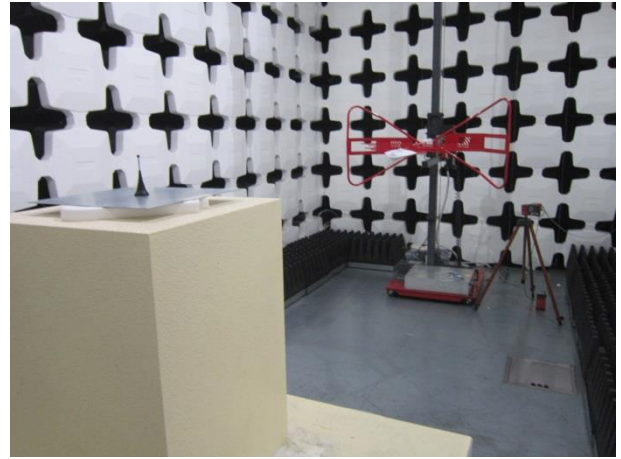
**PHOTOGRAPHIC DOCUMENTATION – Test setup 1 (MWR integrated antenna)**



**PHOTOGRAPHIC DOCUMENTATION – Test setup 2 (DELTA12C/X/BNCM/S/S/17 antenna)**



**PHOTOGRAPHIC DOCUMENTATION – Test setup 3 (AS868 with ground reference plane 35x35cm)**



**END OF TEST REPORT**