Product Service

Choose certainty.
Add value.

Report On

FCC CFR 47 Parts 15B and 15C Testing of the
Thales Aerospace Division
Inmarsat Classic Aero SDU

COMMERCIAL-IN-CONFIDENCE

FCC ID: KV6TFS-SDU82155D

Document 75903406 Report 01 Issue 1 September 2008

TUV Product Service Ltd, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuvps.co.uk

REPORT ON

FCC CFR 47 Parts 15B and 15C Testing of the
Thales Aerospace Division
Inmarsat Classic Aero SDU

Document 75903406 Report 01 Issue 1

September 2008

PREPARED FOR

Thales Aerospace Division
86 Bushey Road
Raynes Park
London
SW20 0JW

PREPARED BY

N Bennett
Senior Administrator

APPROVED BY

J Adams
Authorised Signatory

DATED 10 September 2008

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47: Parts 15 B and 15C. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

S C Hartley A R Hubbard

Product Service

CONTENTS

Product Service

SECTION 1

REPORT SUMMARY

FCC CFR 47 Parts 15B and 15C Testing of the
Thales Aerospace Division
Inmarsat Classic Aero SDU

Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Thales Aerospace Division Inmarsat Classic Aero SDU to the requirements of FCC CFR 47 Part 15B 2006 and FCC CFR 47 Part 15C 2006, for the series of tests carried out.

Objective	To perform FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification/Test Plan, for the series of tests carried out.
Manufacturer	Thales Avionics Ltd
Model Number(s)	82155D30G
Serial Number(s)	SDU: 10070 HPA: 01001
Software Version	Test
Hardware Version	D30G
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 15B 2006 FCC CFR 47 Part 15C 2006
Test Plan/Issue/Date	Thales Document: T-145 Issue B 18 Feb 2008
Incoming Release Date	Declaration of Build Status 01 April 2008
Order Number Date	AW000017 15 August 2008
Start of Test	01 August 2008
Finish of Test	09 August 2008
Name of Engineer(s)	A R Hubbard S C Hartley
Related Document(s)	ANSI C63.4 2003. Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz

Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results in accordance with FCC CFR 47 Part 15B 2006, is shown below.

Configuration 1 - As supplied							
Section	Spec Clause	Test Plan Clause	Test Description	Mode	Mod State	Result	Base Standard
2.1	15.109	Clause 8.2	Radiated Emissions (Enclosure Port)	TX		N/A	ANSI C63.4.2003
				RX	0	Pass	

A brief summary of results in accordance with FCC CFR 47 Part 15C 2006, is shown below.

Configuration 1 - As supplied							
Section	Spec Clause	Test Plan Clause	Test Description	Mode	Mod State	Result	Base Standard
2.2	15.209, 15.205	Clause 8.2	Radiated Emissions (Enclosure Port)	TX	0	Pass	ANSI C63.4.2003
				RX		N/A	

N/A Not Applicable

Product Service

1.3 DECLARATION OF BUILD STATUS

MAIN EUT	
MANUFACTURING DESCRIPTION	Top Flight Satcom SDU 82155
MANUFACTURER	Thales Avionics Ltd
TYPE	82155D30G
PART NUMBER	N/A
SERIAL NUMBER	10070
HARDWARE VERSION	D30G
SOFTWARE VERSION	Test
TRANSMITTER OPERATING RANGE	1626.5 to 1662.5 MHz
RECEIVER OPERATING RANGE	1525 to 1559 MHz
COUNTRY OF ORIGIN	United Kingdom
INTERMEDIATE FREQUENCIES	110 MHz
ITU DESIGNATION OF EMISSION	G1D
HIGHEST INTERNALLY GENERATED FREQUENCY	3325 MHz
OUTPUT POWER (W or dBm)	30W
FCC ID	KV6TFS-SDU82155D
INDUSTRY CANADA ID	Non assigned
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	Airborne voice and data communication using Inmarsat BGAN-X satellite communication services

Signature Colin Appleyard
Date 19 August 2008
Declaration of Build Status Serial Number 10070

Product Service

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Thales Aerospace Division Inmarsat Classic Aero SDU as shown in the photograph below. A full technical description can be found in the Manufacturers documentation.

Satellite Data Unit

Product Service

1.4.2 Test Configuration

Configuration 1: As supplied

The EUT was configured in accordance with FCC CFR 47 Part 15B 2006 and FCC CFR 47 Part 15C 2006

1.4.3 Modes of Operation

Modes of operation of each EUT during testing were as follows:

Mode 1 - Tx The SDU was tuned to the bottom (1626.505 MHz), middle (1643.5 MHz) and top channel (1660.495 MHz) and the output power adjusted to maximum for each case.

Mode 2 - Rx The SDU was tuned to the middle channel (1643.5 MHz) and made to transmit, and then the transmitter was commanded off.

Information on the specific test modes utilised are detailed in the test procedure for each individual test.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure, test laboratories or an open test area as appropriate.

The EUT consists of two modules: the Satellite Data Unit (SDU) and the External High Power Amplifier (HPA). Both modules were powered by a 115V, 400Hz AC main supply and cooled by separate external 24V DC fans. The EUT was controlled by RS232 and Ethernet from test equipment external to the test chamber.

For Classic SDU testing, both EUT modules were present.

The tests detailed in this report met the above test requirements.

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.7 MODIFICATION RECORD

No modifications were made to the EUT during testing.

Product Service

SECTION 2

TEST DETAILS

FCC CFR 47 Parts 15B and 15C Testing of the
Thales Aerospace Division
Inmarsat Classic Aero SDU

Product Service

2.1 RADIATED EMISSIONS (ENCLOSURE PORT)

2.1.1 Specification Reference

FCC CFR 47 Part 15B: 2006, Clause 15.109
Thales Document: T-145 Issue B 18 Feb 2008, Clause 8.2

2.1.2 Equipment Under Test

Inmarsat Classic Aero SDU, S/N: SDU: 10070 and HPA: 01001

2.1.3 Date of Test and Modification State

01 August 2008 - Modification State 0

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of ANSI C63.4 2003.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 2

2.1.6 Environmental Conditions

	01 August 2008
Ambient Temperature	19°C
Relative Humidity	48%
Atmospheric Pressure	1008mbar

Product Service

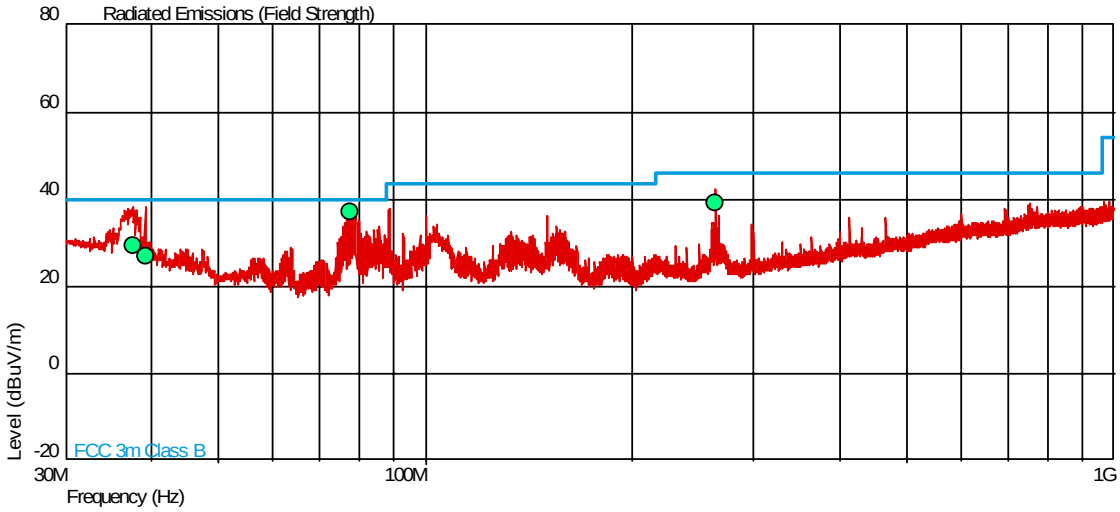
2.1.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 15B: 2006 for Radiated Emissions (Enclosure Port).

The test results are shown below.

Configuration 1 - Mode 2

30MHz to1GHz



Frequency (MHz)	QP Level (dBuV/m)	QP Level (uV/m)	QP Limit (dBuV/m)	QP Limit (uV/m)	QP Margin (dBuV/m)	QP Margin (uV/m)	Angle (Deg)	Height (m)	Polarity
37.559	29.6	30.2	40.0	100.0	-10.4	-69.8	25	1.00	Vertical
39.167	26.9	22.1	40.0	100.0	-13.1	-77.9	353	1.00	Vertical
77.860	37.3	73.3	40.0	100.0	-2.7	-26.7	53	1.00	Vertical
263.996	39.0	89.1	46.0	200.0	-7.0	-110.4	301	1.00	Horizontal

1GHz to 18GHz

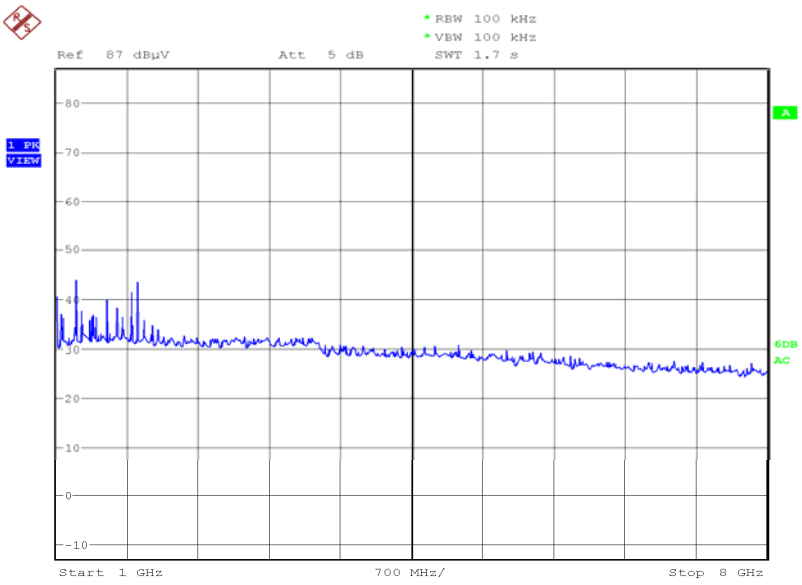
Frequency GHz	Antenna Polarisation	Antenna Height cm	EUT Arc degrees	Result dBµV/m	Level (uV/m)	Limit dBµV/m	Limit (uV/m)	Margin dB	Margin (uV/m)	Result
1.19025	Vertical	100	256	33.44	47.0	74.00	5000.0	-40.56	-4953	Pass
1.19025	Vertical	100	256	23.89	15.7	54.00	500.0	-30.11	-483.3	Pass

Product Service

Configuration 1 – Mode 2

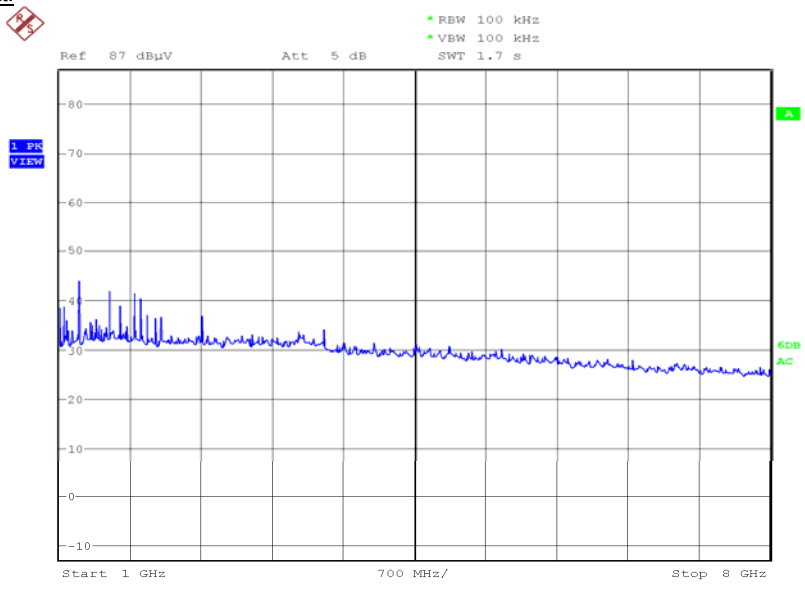
1GHz to 8GHz

Vertical



Date: 1.AUG.2008 15:37:22

Horizontal

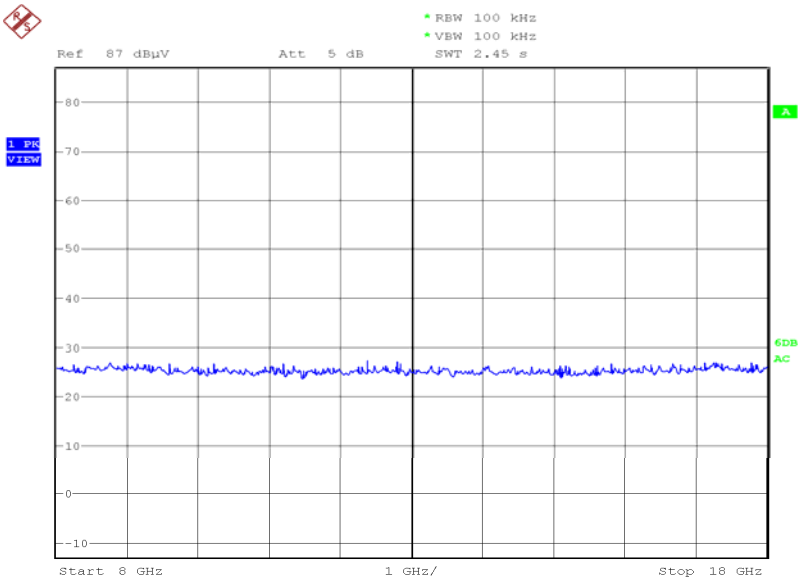


Date: 1.AUG.2008 15:40:14

Product Service

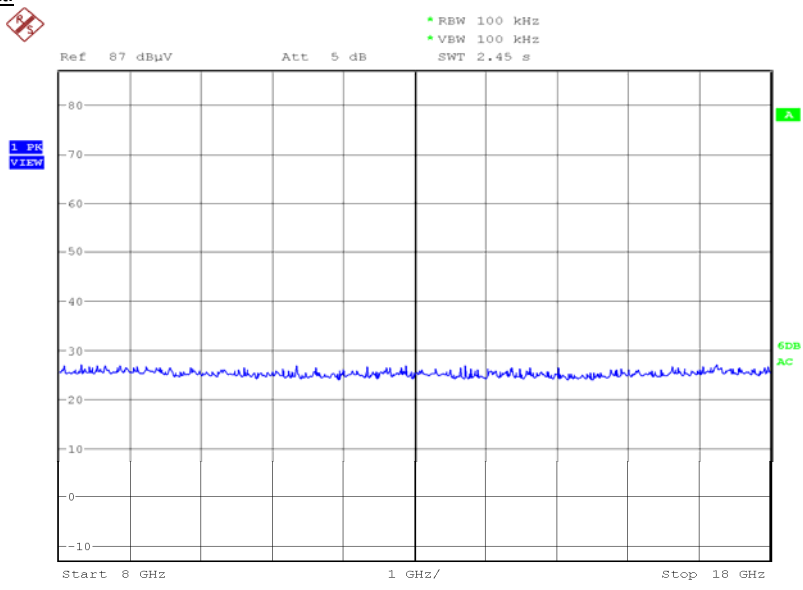
8GHz to 18GHz

Vertical



Date: 1.AUG.2008 15:51:03

Horizontal



Date: 1.AUG.2008 15:47:05

2.2 RADIATED EMISSIONS (ENCLOSURE PORT)

2.2.1 Specification Reference

FCC CFR 47 Part 15C: 2006, Clause 15.209, 15.205
Thales Document: T-145 Issue B 18 Feb 2008, Clause 8.2

2.2.2 Equipment Under Test

Inmarsat Classic Aero SDU, S/N: SDU: 10070. HPA: 01001

2.2.3 Date of Test and Modification State

01 and 02 August 2008 - Modification State 0

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of ANSI C63.4 2003

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.2.6 Environmental Conditions

	01 August 2008	02 August 2008
Ambient Temperature	19°C	21°C
Relative Humidity	48%	58%
Atmospheric Pressure	1008mbar	1009mbar

Product Service

2.2.7 Test Results

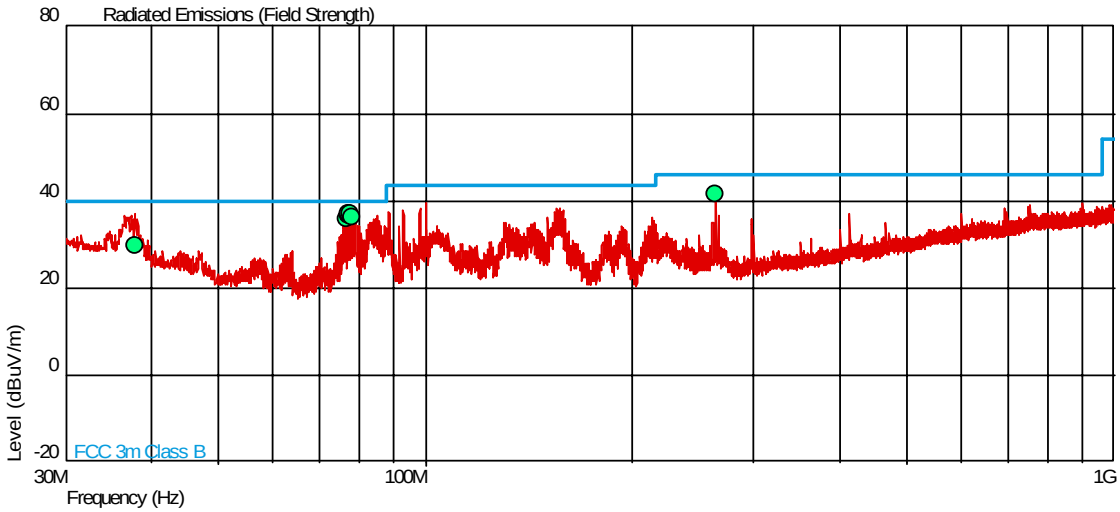
For the period of test the EUT met the requirements of FCC Part 15C: 2006 Clause 15.209 for Radiated Emissions (Enclosure Port).

The test results are shown below.

Configuration 1 - Mode 1

Bottom Channel

30MHz to 1GHz



Frequency (MHz)	QP Level (dBuV/m)	QP Level (uV/m)	QP Limit (dBuV/m)	QP Limit (uV/m)	QP Margin (dBuV/m)	QP Margin (uV/m)	Angle (Deg)	Height (m)	Polarity
37.948	29.6	30.2	40.0	100.0	-10.4	-69.8	326	1.00	Vertical
76.795	35.9	62.4	40.0	100.0	-4.1	-37.6	39	1.00	Vertical
77.151	36.6	67.6	40.0	100.0	-3.4	-32.4	43	1.00	Vertical
77.504	37.2	72.4	40.0	100.0	-2.8	-27.6	36	1.00	Vertical
77.857	36.9	70.0	40.0	100.0	-3.1	-30.0	51	1.00	Vertical
78.212	36.4	66.1	40.0	100.0	-3.6	-33.9	79	1.00	Vertical
264.004	41.5	118.9	46.0	200.0	-4.5	-80.6	78	1.00	Horizontal

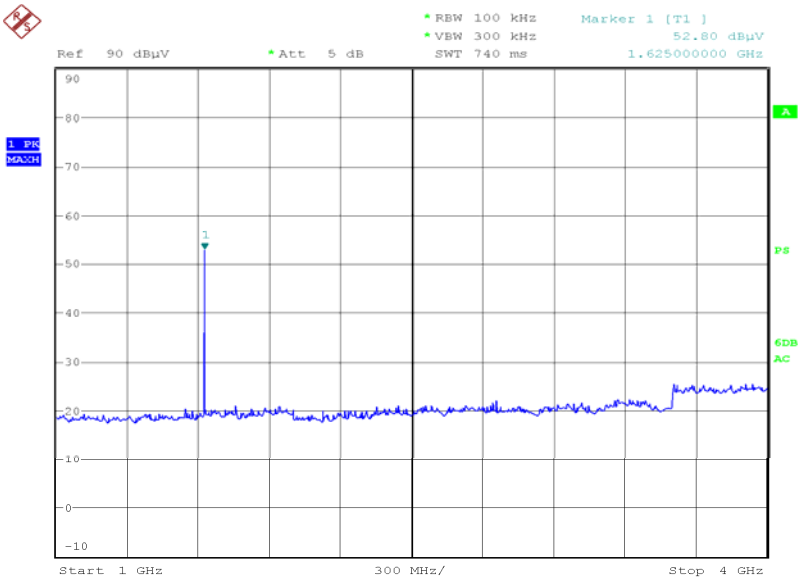
1GHz to 17GHz

Frequency GHz	Antenna Polarisation	Antenna Height cm	EUT Arc degrees	Result dBµV/m	Level (uV/m)	Limit dBµV/m	Limit (uV/m)	Margin dB	Margin (uV/m)	Result
6.506	Horizontal	100	201	52.2	407.4	74.0	5000.0	-21.8	-4592.6	Pass
6.506	Horizontal	100	201	43.9	156.7	54.0	500.0	-10.1	-343.3	Pass

Product Service

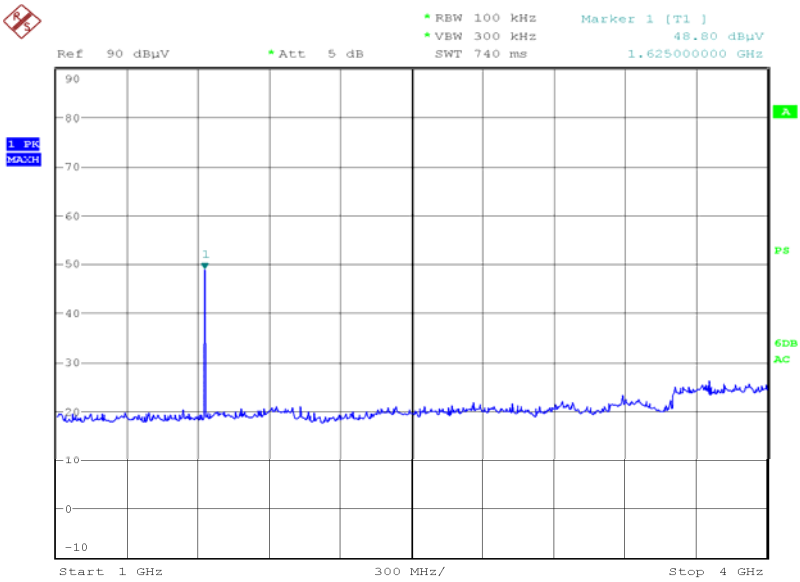
1GHz to 4GHz

Vertical



Date: 2.AUG.2008 11:32:22

Horizontal

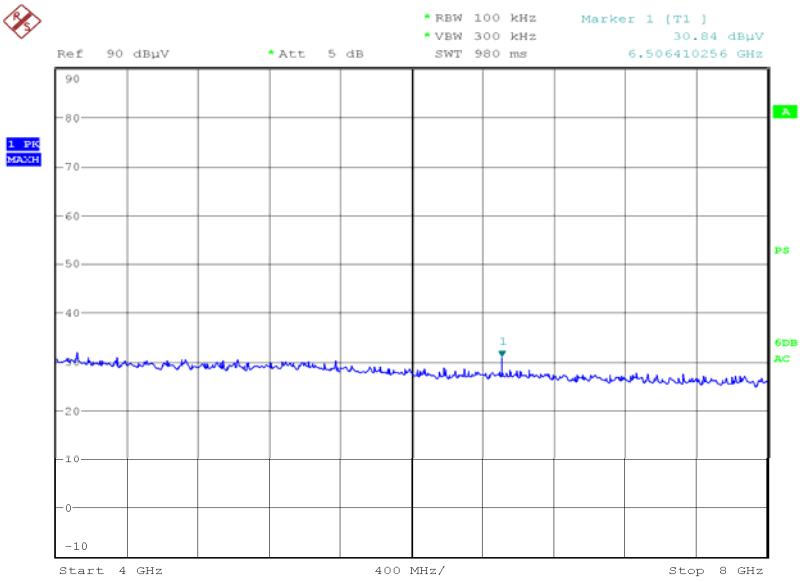


Date: 2.AUG.2008 11:29:25

Product Service

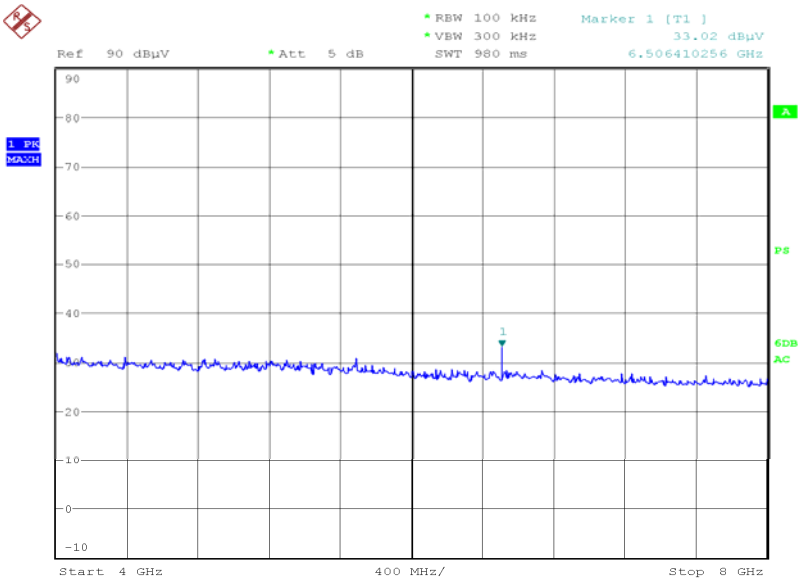
4GHz to 8GHz

Vertical



Date: 2.AUG.2008 11:11:05

Horizontal

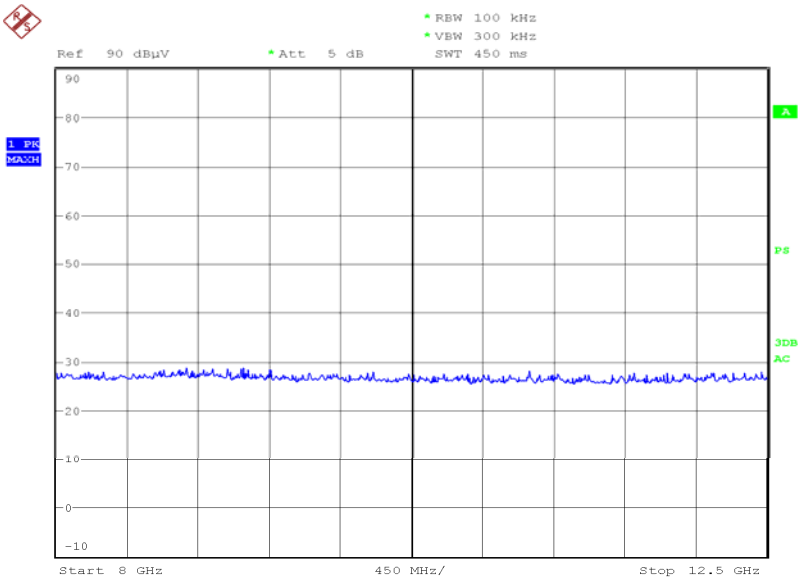


Date: 2.AUG.2008 11:13:27

Product Service

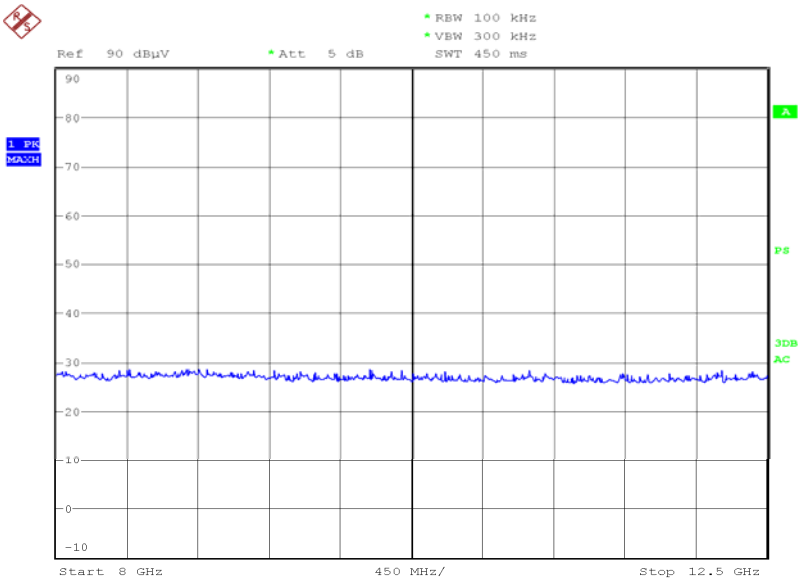
8GHz to 12.5GHz

Vertical



Date: 2.AUG.2008 10:13:55

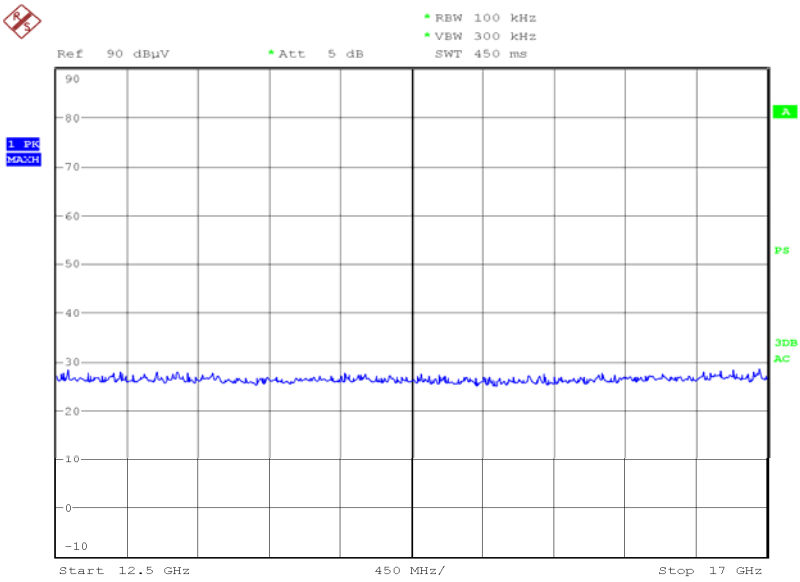
Horizontal



Date: 2.AUG.2008 10:07:04

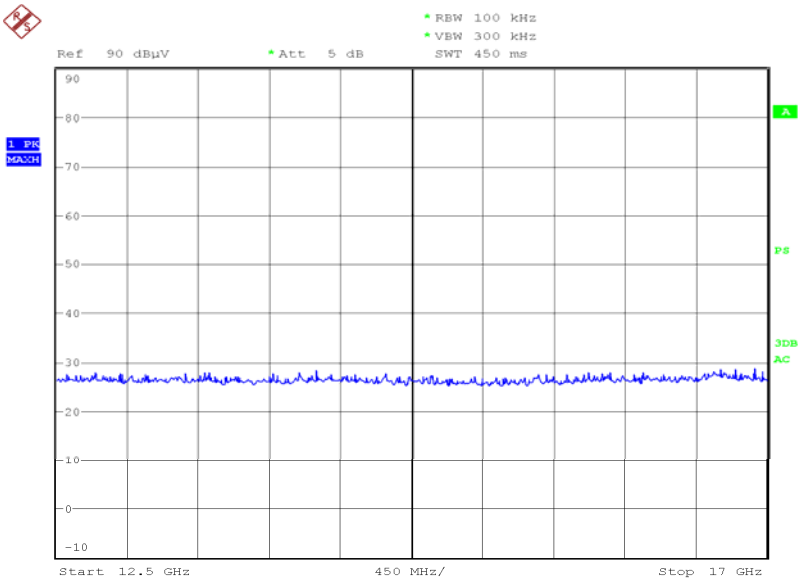
12.5GHz to 17GHz

Vertical



Date: 2.AUG.2008 10:12:00

Horizontal

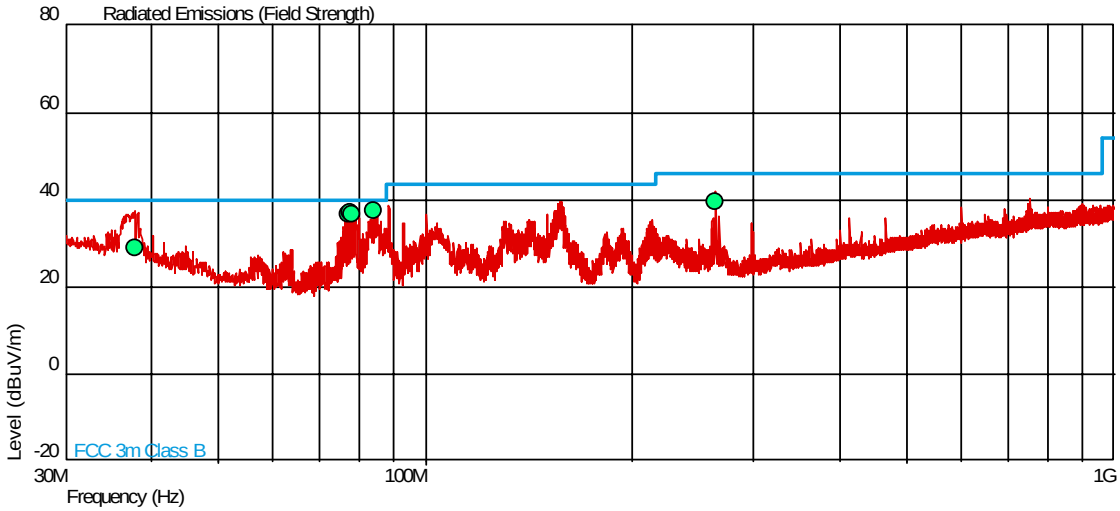


Date: 2.AUG.2008 10:09:16

Product Service

Middle Channel

30MHz to 1GHz



Frequency (MHz)	QP Level (dBuV/m)	QP Level (uV/m)	QP Limit (dBuV/m)	QP Limit (uV/m)	QP Margin (dBuV/m)	QP Margin (uV/m)	Angle (Deg)	Height (m)	Polarity
37.753	29.2	28.8	40.0	100.0	-10.8	-71.2	333	1.00	Vertical
77.500	36.9	70.0	40.0	100.0	-3.1	-30.0	17	1.00	Vertical
77.858	37.1	71.6	40.0	100.0	-2.9	-28.4	55	1.00	Vertical
78.213	36.7	68.4	40.0	100.0	-3.3	-31.6	60	1.00	Vertical
84.270	37.6	75.9	40.0	100.0	-2.4	-24.1	321	1.77	Vertical
263.996	39.6	95.5	46.0	200.0	-6.4	-104.5	138	1.00	Horizontal

1GHz to 17GHz

Frequency GHz	Antenna Polarisation	Antenna Height cm	EUT Arc degrees	Result dBµV/m	Level (uV/m)	Limit dBµV/m	Limit (uV/m)	Margin dB	Margin (uV/m)	Result
4.931	Horizontal	100	144	34.83	55.1	74.00	5000.0	-39.17	-4944.9	Pass
4.931	Horizontal	100	144	24.96	17.7	54.00	500.0	-29.04	-482.3	Pass
6.574	Horizontal	100	203	49.39	294.8	74.00	5000.0	-24.61	-4705.2	Pass
6.574	Horizontal	100	203	40.89	110.8	54.00	500.0	-13.18	-389.2	Pass

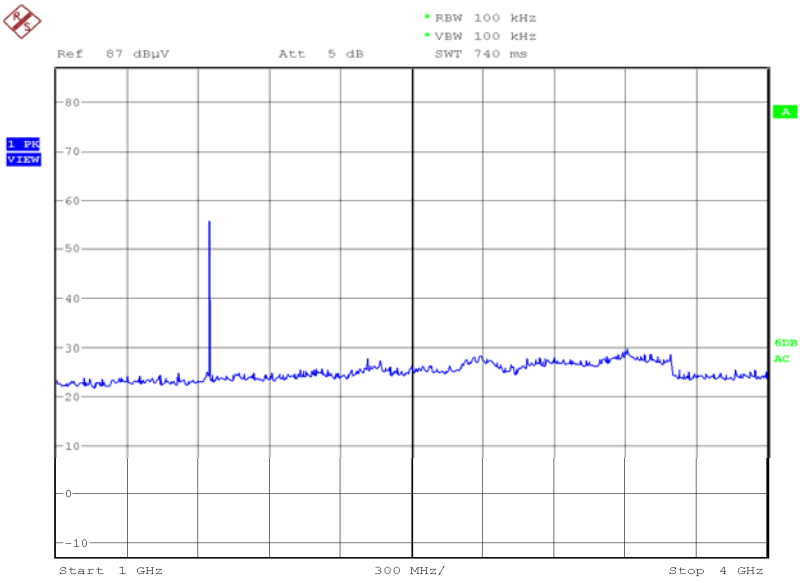
Product Service

Conifguration 1 – Mode 1

Middle Channel

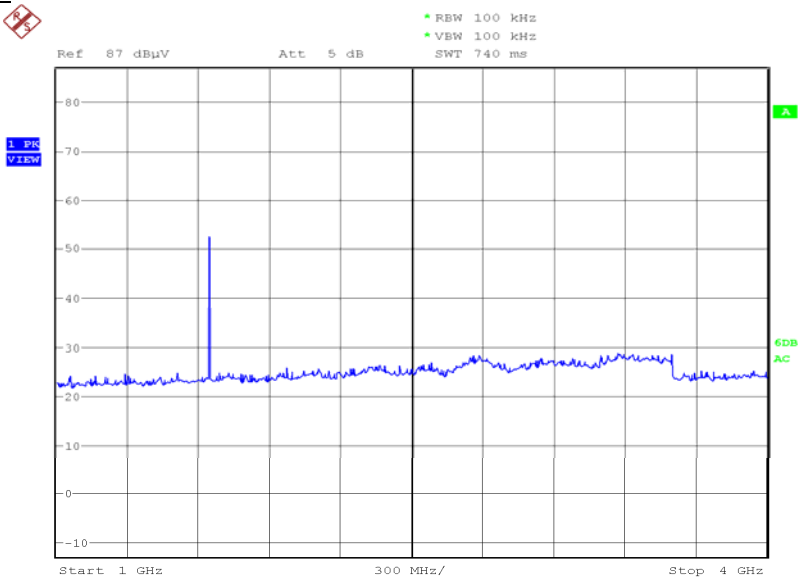
1GHz to 4GHz

Vertical



Date: 1.AUG.2008 16:16:43

Horizontal

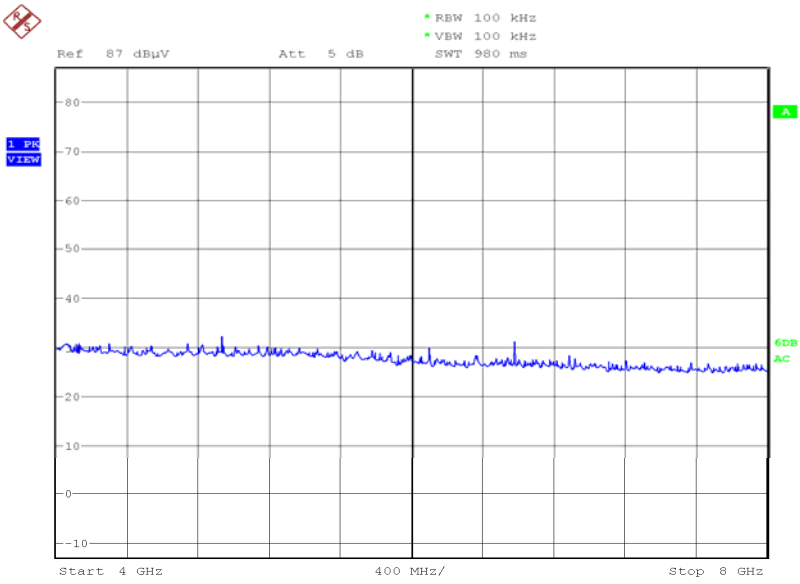


Date: 1.AUG.2008 16:20:16

Product Service

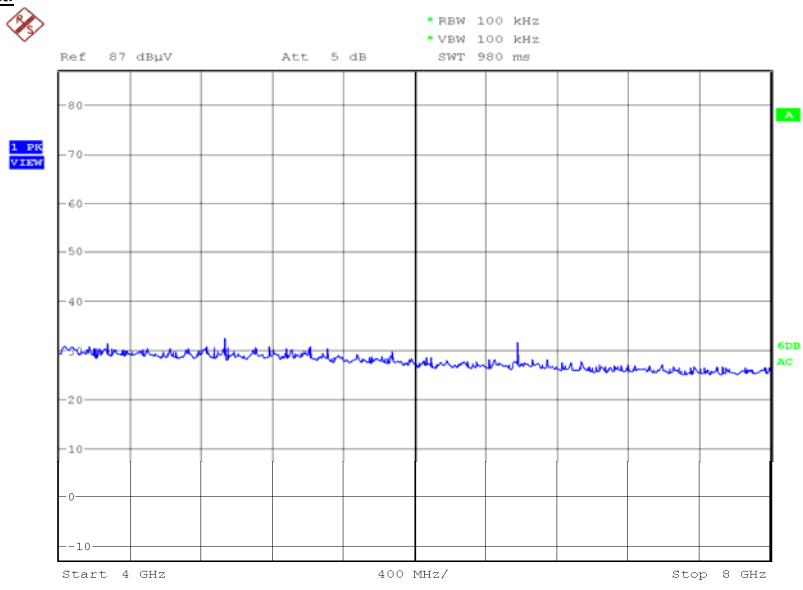
4GHz to 8GHz

Vertical



Date: 1.AUG.2008 16:32:49

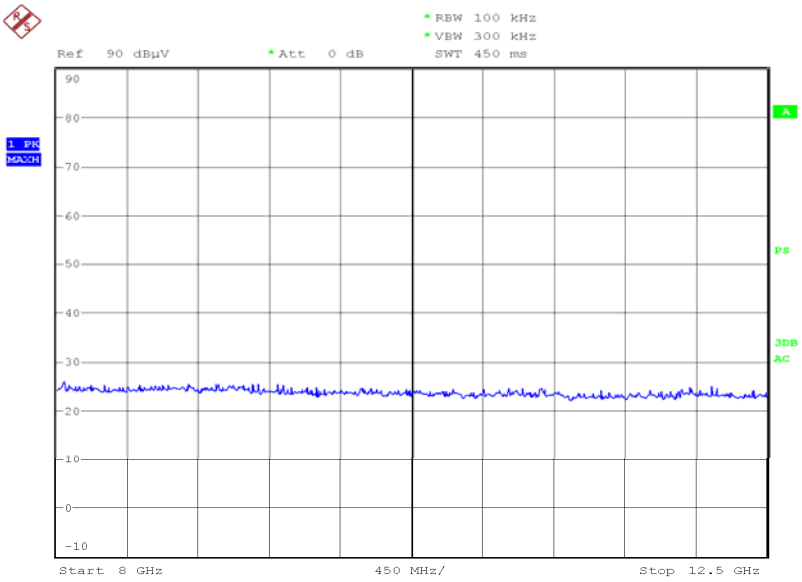
Horizontal



Date: 1.AUG.2008 16:36:29

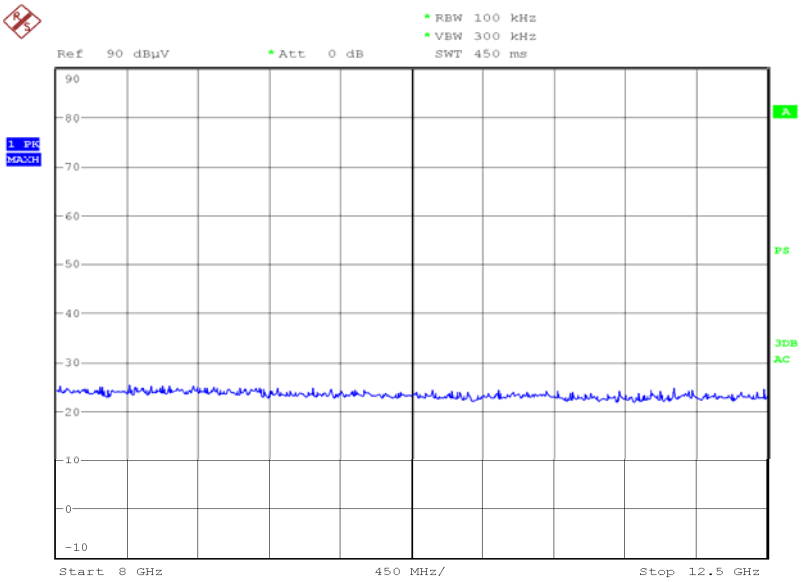
8GHz to 12.5GHz

Vertical



Date: 2.AUG.2008 09:46:49

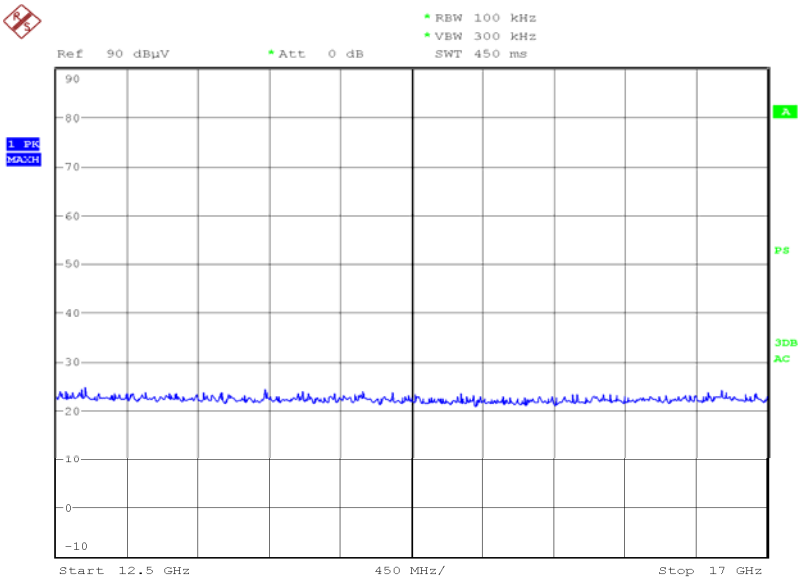
Horizontal



Date: 2.AUG.2008 09:37:31

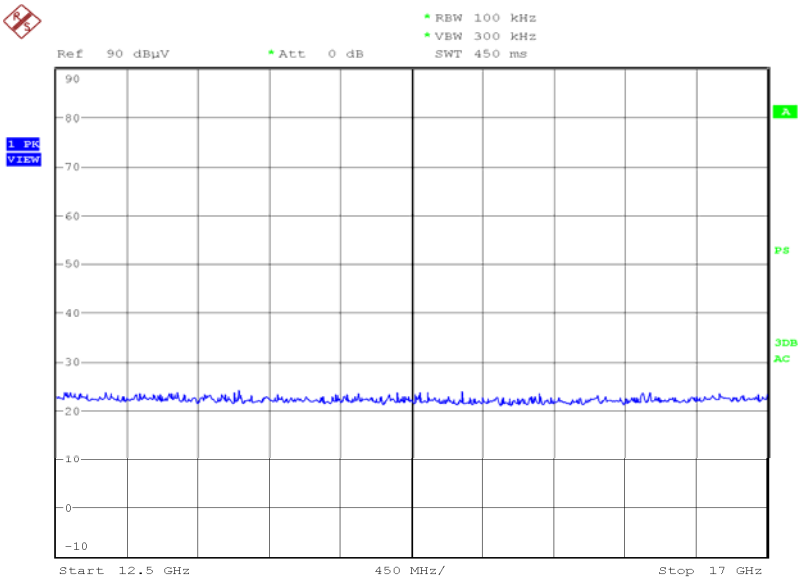
12.5GHz to 17GHz

Vertical



Date: 2.AUG.2008 09:43:16

Horizontal

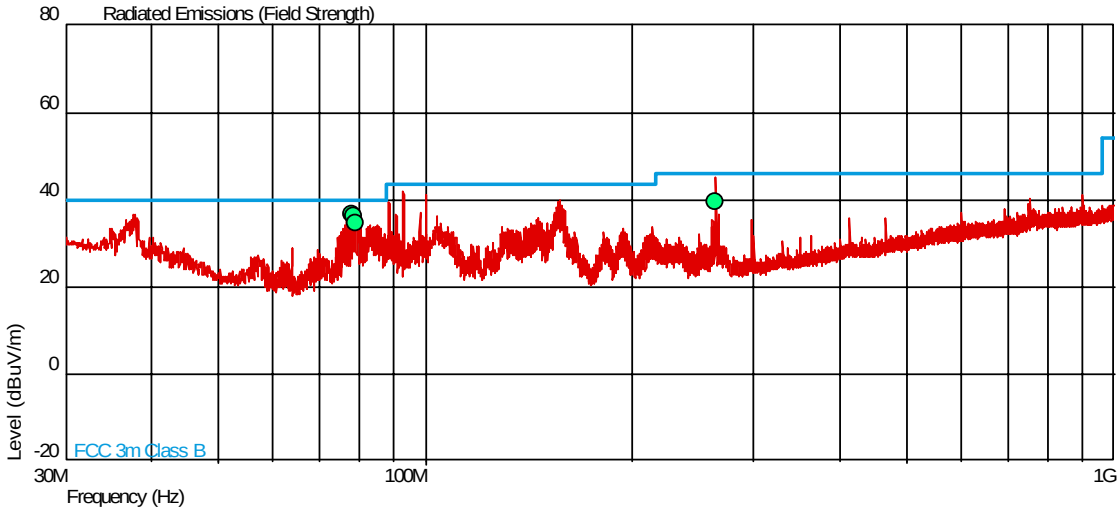


Date: 2.AUG.2008 09:40:02

Product Service

Top Channel

30MHz to 1GHz



Frequency (MHz)	QP Level (dBuV/m)	QP Level (uV/m)	QP Limit (dBuV/m)	QP Limit (uV/m)	QP Margin (dBuV/m)	QP Margin (uV/m)	Angle (Deg)	Height (m)	Polarity
78.214	36.9	70.0	40.0	100.0	-3.1	-30.0	83	1.00	Vertical
78.570	36.4	66.1	40.0	100.0	-3.6	-33.9	79	1.00	Vertical
78.928	34.7	54.3	40.0	100.0	-5.3	-45.7	82	1.00	Vertical
263.994	39.4	93.3	46.0	200.0	-6.6	-106.7	358	1.00	Vertical

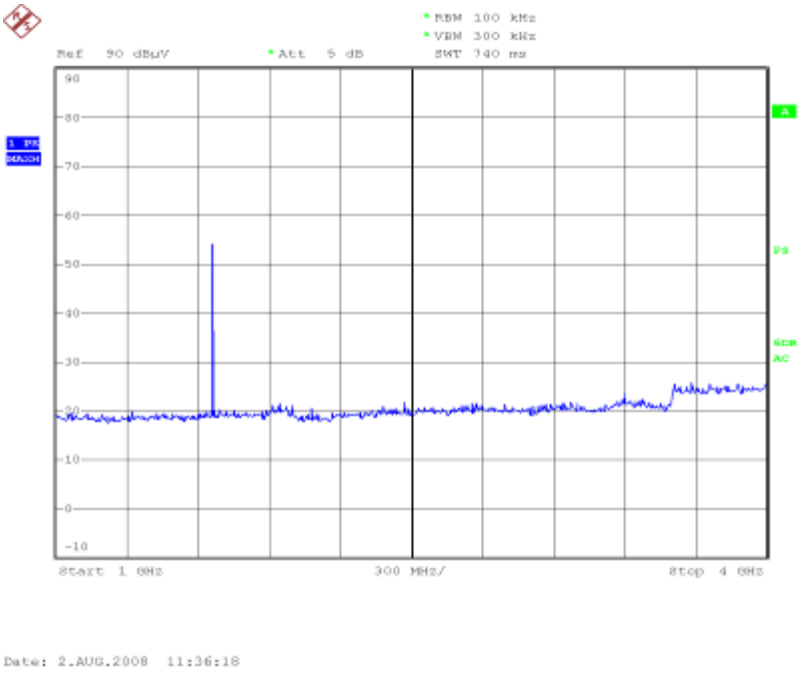
1GHz to 18GHz

Frequency GHz	Antenna Polarisation	Antenna Height cm	EUT Arc degrees	Result dBµV/m	Level (uV/m)	Limit dBµV/m	Limit (uV/m)	Margin dB	Margin (uV/m)	Result
4.981	Horizontal	100	143	47.4	234.4	74.0	5000.0	-26.6	-4765.6	Pass
4.981	Horizontal	100	143	38.7	86.1	54.0	500.0	-15.3	-413.9	Pass
6.642	Horizontal	100	231	51.0	354.8	74.0	5000.0	-23.0	-4645.2	Pass
6.642	Horizontal	100	231	42.8	138.0	54.0	500.0	-11.2	-362.0	Pass
4.981	Vertical	100	143	49.9	312.6	74.0	5000.0	-24.1	-4687.4	Pass
4.981	Vertical	100	143	41.8	123.0	54.0	500.0	-12.2	-377.0	Pass

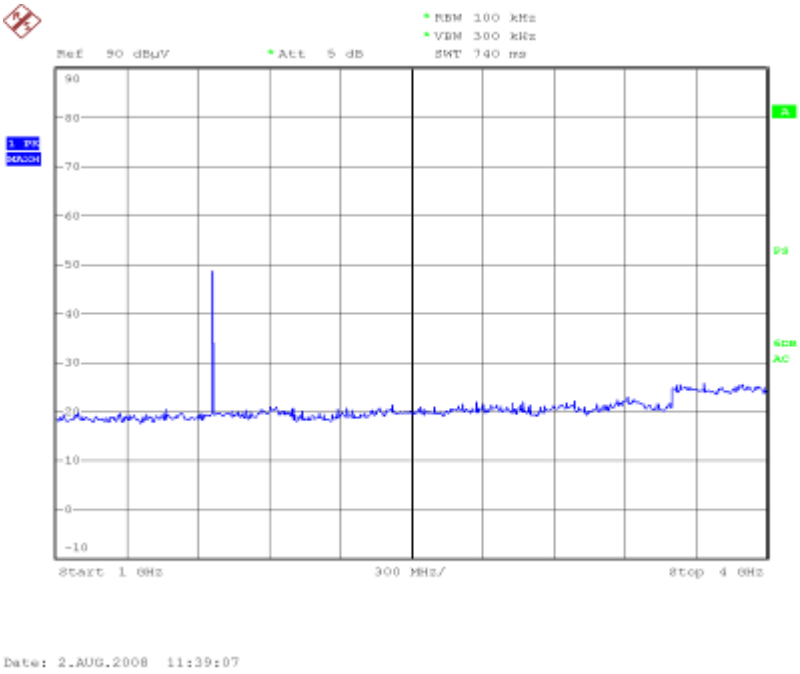
Product Service

1GHz to 4GHz

Vertical



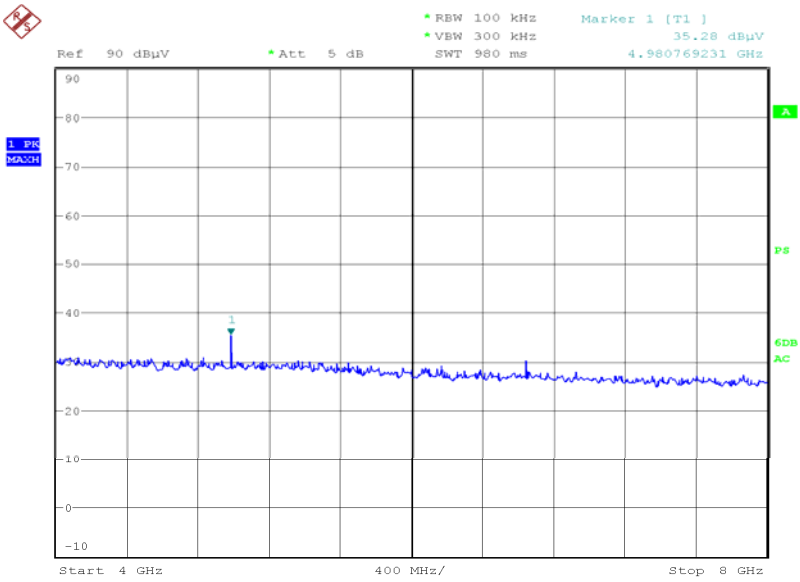
Horizontal



Product Service

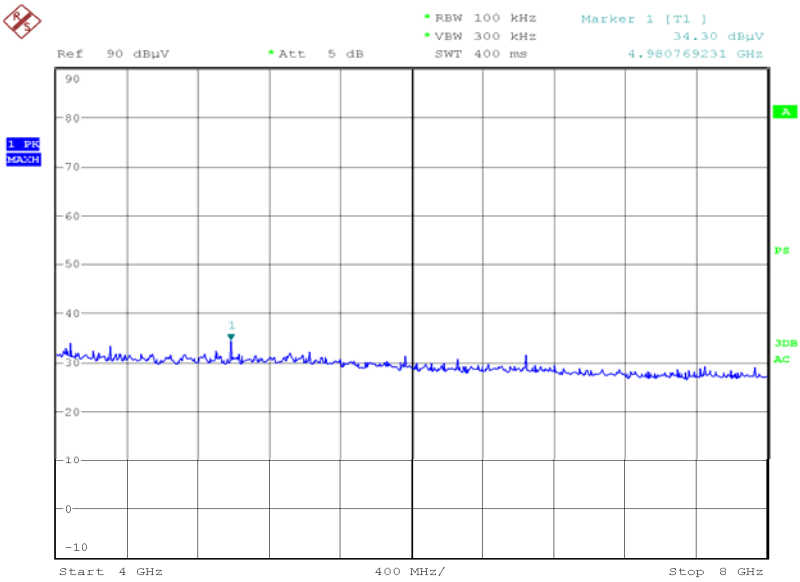
4GHz to 8GHz

Vertical



Date: 2.AUG.2008 10:58:18

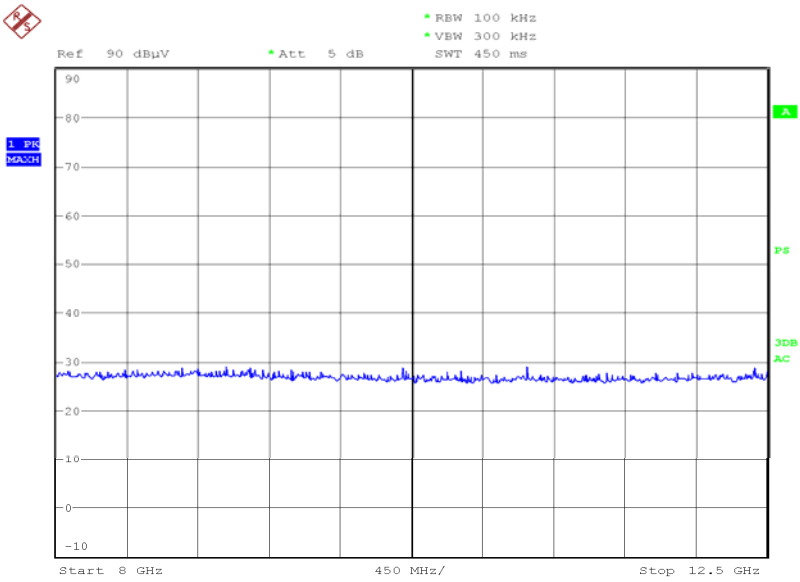
Horizontal



Date: 2.AUG.2008 10:40:56

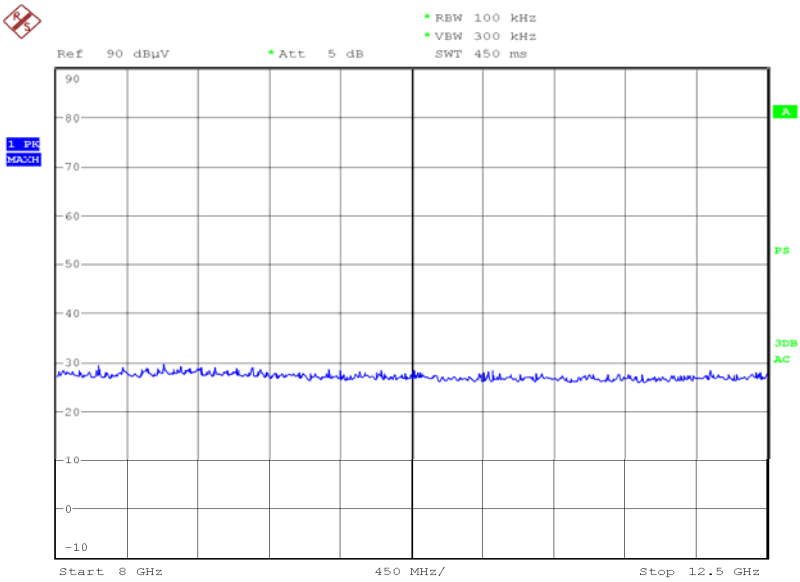
8GHz to 12.5GHz

Vertical



Date: 2.AUG.2008 10:22:49

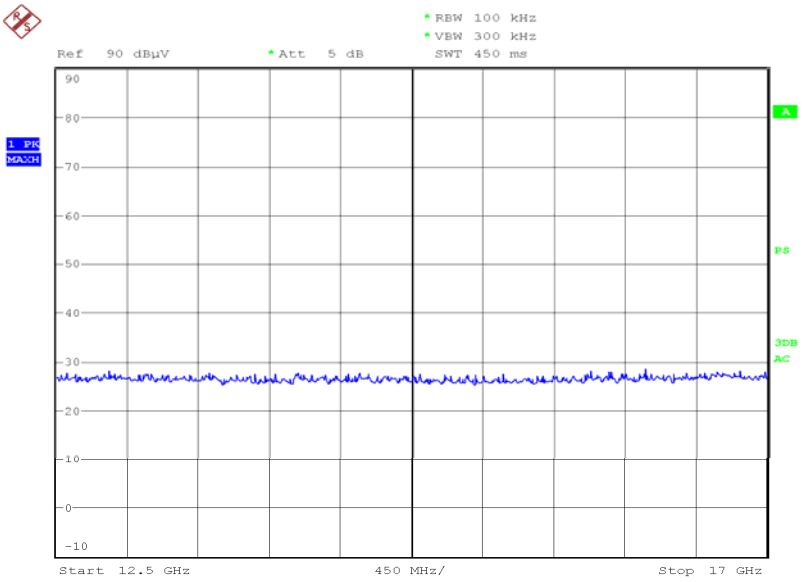
Horizontal



Date: 2.AUG.2008 10:31:44

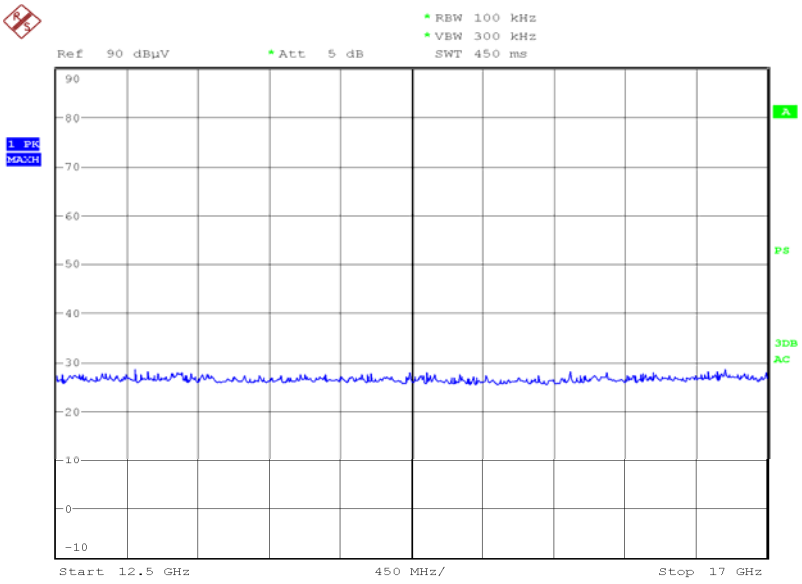
12.5GHz to 17GHz

Vertical



Date: 2.AUG.2008 10:24:55

Horizontal



Date: 2.AUG.2008 10:28:20

Product Service

SECTION 3

TEST EQUIPMENT USED

Product Service

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 and 2.2 EMC - Radiated Emissions					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	2-Sep-2008
Dual Power Supply Unit	Thurlby	PL320	288	-	TU
Pre-Amplifier	Phase One	PS04-0085	1532	-	TU
Pre-Amplifier	Phase One	PS04-0086	1533	-	TU
Screened Room (5)	Rainford	Rainford	1545	36	11-Feb-2011
Mast Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Turntable/Mast Controller	EMCO	2090	1607	-	TU
High Pass Filter (4GHz)	RLC Electronics	F-100-4000-5-R	2773	-	OP Mon
Filter (Hi Pass)	Lorch	9HP7-7000-SR	2833	12	31-Oct-2008
Antenna (Bilog)	Chase	CBL6143	2904	24	28-Nov-2009
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	3171	12	25-Jul-2009
Compliance 3 Emissions	Schaffner	C3e Software V.4.00.00	3274	-	N/A - Software
EMI Receiver	Rohde & Schwarz	ESU26	3581	12	20-Jul-2009

TU – Traceability Unscheduled
OP Mon – Output monitored using calibrated equipment.

Product Service

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	Frequency / Parameter	MU
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*
Conducted Emissions, LISN	150kHz to 30MHz Amplitude	3.2dB*
Conducted Emissions, ISN	150kHz to 30MHz Amplitude	2.1dB
Substitution Antenna, Radiated Field	30MHz to 18GHz Amplitude	2.6dB
Discontinuous Interference	150kHz to 30MHz Amplitude	3.0dB*
Interference Power	30MHz to 300MHz Amplitude	3.0dB*
Radiated E-Field Susceptibility	26MHz to 2.5GHz Test Amplitude	1.4dB†
Conducted Susceptibility	100kHz to 250MHz Amplitude	1.8dB†
Power Frequency Magnetic Field	50Hz/60Hz Amplitude	0.45%
Magnetic Emissions	9kHz to 30MHz Amplitude	3.4dB*
Magnetic Field/Flux iaw EN 50366	10Hz to 400kHz	2.64%
Harmonics and Flicker	The test was applied using proprietary equipment that meets the requirements of EN 61000-3-2 and EN 61000-3-3	—
Mains Voltage Variations and Interrupts	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-11	—
Fast Transient Burst	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-4	—
Electrostatic Discharge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-2	—
Surge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-5	—
Vehicle Transients	The test was applied using proprietary equipment that meets the requirements of ISO 7637-1 and 2	—
Compass Safe Distance	Azimuth Accuracy	0.10°

Worst case error for both Time and Frequency measurement 12 parts in 10^6.

* In accordance with CISPR 16-4
† In accordance with UKAS Lab 34

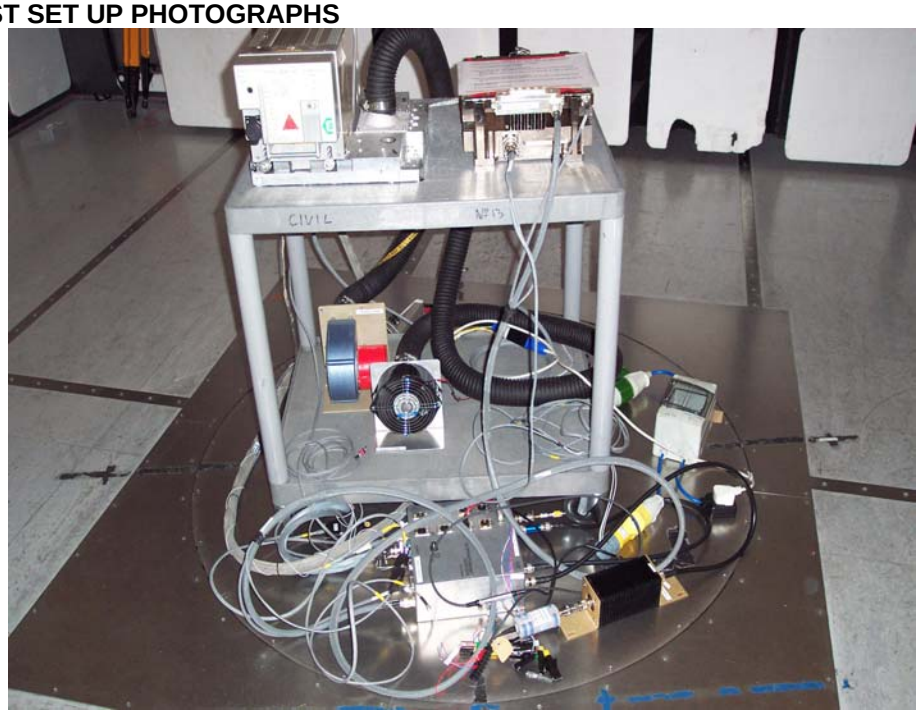
Product Service

SECTION 4

PHOTOGRAPHS

Product Service

4.1 TEST SET UP PHOTOGRAPHS



Radiated Emissions – 30MHz to 1GHz

Radiated Emissions – 1GHz to 18GHz

Product Service

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

Product Service

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).