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Report On

FCC Testing of the
Microlise Ltd MTU4-A (Internal Antenna)
In accordance with FCC CFR 47 Part 15C

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FCC ID: OUUMTU4

Document 75916503 Report 06 Issue 1

July 2012



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COMMERCIAL-IN-CONFIDENCE

REPORT ON

FCC Testing of the
Microlise Ltd MTU4-A (Internal Antenna)
In accordance with FCC CFR 47 Part 15C

Document 75916503 Report 06 Issue 1

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PREPARED FOR

Microlise Ltd
Farrington Way
Eastwood
Nottingham
NG16 3AG

PREPARED BY

Natalie Bennett
Senior Administrator (Technical)

APPROVED BY

Mark Jenkins
Authorised Signatory

DATED

25 July 2012

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 Part 15C. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

G Lawler





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SECTION 1

REPORT SUMMARY

FCC Testing of the
Microlise Ltd MTU4-A (Internal Antenna)
In accordance with FCC CFR 47 Part 15C



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the FCC Testing of the Microlise Ltd MTU4-A (Internal Antenna) to the requirements of FCC CFR 47 Part 15C.

Objective	To perform FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Microlise Ltd
Model Number(s)	MTU4-A
Serial Number(s)	301934040760729
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 15C (2011)
Incoming Release Date	Application Form 23 January 2012
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	PO241451 22 December 2011
Start of Test	9 July 2012
Finish of Test	10 July 2012
Name of Engineer(s)	G Lawler
Related Document(s)	ANSI C63.10: 2009



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 15C is shown below.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
Bluetooth - Internal Antenna				
2.1	15.247 (b)(4)	EIRP Peak Power	Pass	
2.2	15.247 (d)	Spurious and Band Edge Emissions	Pass	



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1.3 APPLICATION FORM

APPLICANT'S DETAILS	
COMPANY NAME :	Microlise Limited
ADDRESS :	Farrington Way, Eastwood, Nottingham, NG16 3AG
NAME FOR CONTACT PURPOSES :	Ian Dickinson
TELEPHONE NO: +44 (1773) 537306	FAX NO: +44 (1773) 537373
	E-MAIL: ian.dickinson@microlise.com

EQUIPMENT INFORMATION			
Model name/number	MTU4	Identification/Part number	MTU4-A
Hardware Version	1.0	Software Version	1.0
Manufacturer	Microlise Limited	Country of Origin	United Kingdom.
FCC ID	OUUMTU4-A (Internal Antenna)	Industry Canada ID	Not yet issued
Technical description (a brief description of the intended use and operation)			
Vehicle tracking and telematics device			
<u>Supply Voltage:</u>			
<input type="checkbox"/>	AC mains	State AC voltage V	and AC frequency Hz
<input checked="" type="checkbox"/>	DC (external)	State DC voltage 6-36 V	and DC current ...2 A
<input checked="" type="checkbox"/>	DC (internal)	State DC voltage 3.7 V	and Battery type Li-ion.....
<u>Frequency characteristics:</u> (Telit GE864 GSM module)			
Transmitter Frequency range	824.2 MHz to 1909.8 MHz	Channel spacing	200 kHz. (if channelized)
Receiver Frequency range	869.2 MHz to 1989.8 MHz	Channel spacing	200 kHz (if channelized)
Designated test frequencies:			
Bottom: MHz	Middle: MHz	Top: MHz	
Intermediate Frequencies : MHz			
Highest Internally Generated Frequency : MHz			
<u>Power characteristics:</u>			
Maximum transmitter power	2 W	Minimum transmitter power	W
<input type="checkbox"/>	Continuous transmission	(if variable)	
<input checked="" type="checkbox"/>	Intermittent transmission	State duty cycle ...100% (worst case)...	
If intermittent, can transmitter be set to continuous transmit test mode? N			
<u>Antenna characteristics:</u>			
<input checked="" type="checkbox"/>	Antenna connector (MTU4-B only)	State impedance	50 ohm
<input type="checkbox"/>	Temporary antenna connector	State impedance	ohm
<input checked="" type="checkbox"/>	Integral antenna (MTU4-A only)	State gain	-1.5 to -1.3 dBi
<u>Modulation characteristics:</u>			
<input type="checkbox"/>	Amplitude	<input checked="" type="checkbox"/>	Other
<input type="checkbox"/>	Frequency	Details: GMSK	
<input type="checkbox"/>	Phase	(GMSK, QSPK etc)	
Can the transmitter operate un-modulated?		N	
ITU Class of emission: 300KGXW.			
<u>Frequency characteristics:</u> (Bluegiga WT32 Bluetooth module)			
Transmitter Frequency range	2400. MHz to 2483.5 MHz	Channel spacing	1 MHz(if channelized)
Receiver Frequency range	2400. MHz to 2483.5. MHz	Channel spacing	1 MHz(if channelized)
Designated test frequencies:			
Bottom: MHz	Middle: MHz	Top: MHz	
Intermediate Frequencies : 1.5 MHz			
Highest Internally Generated Frequency : MHz			



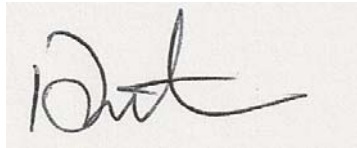
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EQUIPMENT INFORMATION			
Power characteristics:			
Maximum transmitter power	0dBm	Minimum transmitter power (if variable) W
<input type="checkbox"/>	Continuous transmission		
<input checked="" type="checkbox"/>	Intermittent transmission	State duty cycle80%.....	
		If intermittent, can transmitter be set to continuous transmit test mode?	N
Antenna characteristics:			
<input type="checkbox"/>	Antenna connector	State impedance	ohm
<input type="checkbox"/>	Temporary antenna connector	State impedance	ohm
<input checked="" type="checkbox"/>	Integral antenna	State gain	1.5 dBi
Modulation characteristics:			
<input type="checkbox"/>	Amplitude	<input checked="" type="checkbox"/>	Other
<input type="checkbox"/>	Frequency	Details: ...GFSK / n/4DQPSK / 8DQPSK..	
<input type="checkbox"/>	Phase	(GMSK, QSPK etc)	
Can the transmitter operate un-modulated?		N	
ITU Class of emission: ...1M00F9W.....			
Frequency characteristics: (uBlox LEA-6 GPS receiver)			
Transmitter Frequency range ...N/A..... MHz to		Channel spacing	
		(if channelized)	
Receiver Frequency range1575.42 MHz to		Channel spacing	
(if different)		(if channelized)	
Designated test frequencies:			
Bottom: MHz Middle:		Top:	
Intermediate Frequencies :		MHz	
Highest Internally Generated Frequency :			
Power characteristics: (Not applicable – receive only)			
Maximum transmitter power W	Minimum transmitter power (if variable) W
<input type="checkbox"/>	Continuous transmission		
<input type="checkbox"/>	Intermittent transmission	State duty cycle	
		If intermittent, can transmitter be set to continuous transmit test mode?	Y/N
Antenna characteristics:			
<input checked="" type="checkbox"/>	Antenna connector (MTU4-B only)	State impedance ...50.....	ohm
<input type="checkbox"/>	Temporary antenna connector	State impedance	ohm
<input checked="" type="checkbox"/>	Integral antenna (MTU4-A only)	State gain	26 dB (inc. LNA)
Modulation characteristics:			
<input type="checkbox"/>	Amplitude	<input type="checkbox"/>	Other
<input type="checkbox"/>	Frequency	Details:	
<input type="checkbox"/>	Phase	(GMSK, QSPK etc)	
Can the transmitter operate un-modulated?		Y/N	
ITU Class of emission:			
Battery/Power Supply			
Model name/number	...MTU4 battery pack.....	Identification/Part number	...SPEC-MI71331/04 .
Manufacturer	...PMBL Limited.....	Country of Origin	...United Kingdom.....
Ancillaries (if applicable)			
Model name/number	Identification/Part number
Manufacturer	Country of Origin
Extreme conditions:			
Maximum temperature	...85 °C	Minimum temperature	-40 °C
Maximum supply voltage36 V	Minimum supply voltage6 V



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I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

A handwritten signature in black ink, appearing to be 'Ian Dickinson', written on a light-colored rectangular background.

Signature :

Name :

Ian Dickinson

Position held :

Director of Technical Services

Date :

23 January 2012



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1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Microlise Ltd MTU4-A (Internal Antenna). A full technical description can be found in the manufacturer's documentation.

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.

The EUT was powered from a 12 V DC supply.

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1.6 DEVIATIONS FROM THE STANDARD

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

1.7 MODIFICATION RECORD

Modification 0 - No modifications were made to the test sample during testing.



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SECTION 2

TEST DETAILS

FCC Testing of the
Microlise Ltd MTU4-A (Internal Antenna)
In accordance with FCC CFR 47 Part 15C



2.1 EIRP PEAK POWER

2.1.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (b)(4)

2.1.2 Equipment Under Test and Modification State

MTU4-A (Internal Antenna)-A S/N: 301934040760729 - Modification State 0

2.1.3 Date of Test

9 July 2012

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 Procedure

The EUT was transmitted at maximum power via a cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen and a resolution bandwidth and video bandwidth of 1 MHz were used to perform the measurement. The level on the spectrum analyser was maximised by rotating the EUT 360° and a height search of the measuring antenna. A substitution was then performed using a substitution antenna and signal generator.

This level was maximised by adjusting the height of the measuring antenna once more. The level from the signal generator was then adjusted to achieve the same raw result as with the EUT. This level was then corrected to account for cable loss and antenna factor. If applicable, a peak power analyser was also used to obtain a correction factor for wideband signals such as WLAN.

A calculation was then performed to obtain the final figure.

2.1.6 Environmental Conditions

Ambient Temperature	18.9°C
Relative Humidity	68.0%

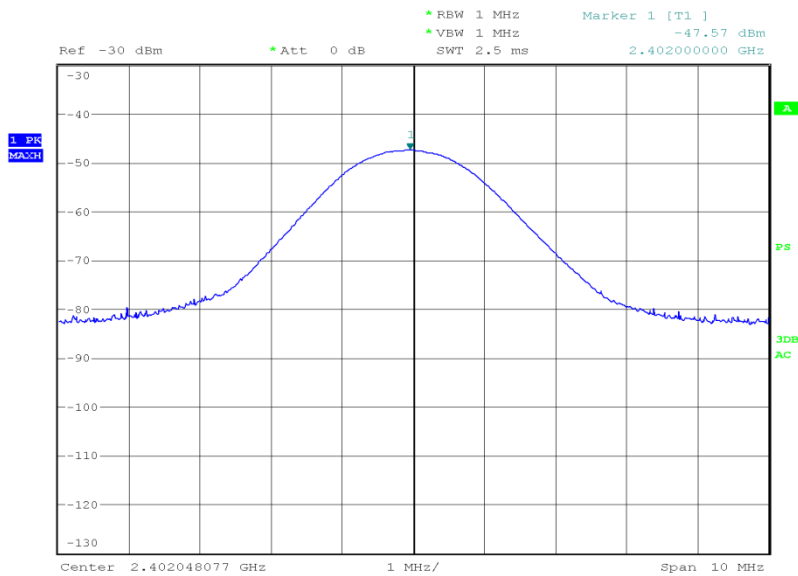


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2.1.7 Test Results

2402 MHz

EIRP (dBm)	EIRP (mW)
-7.04	0.198



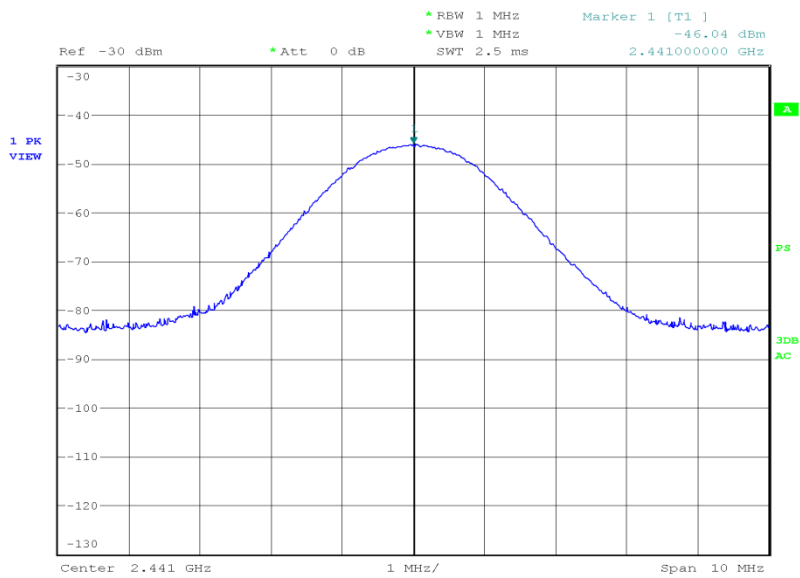
Date: 9.JUL.2012 16:59:44



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2441 MHz

EIRP (dBm)	EIRP (mW)
-6.26	0.237



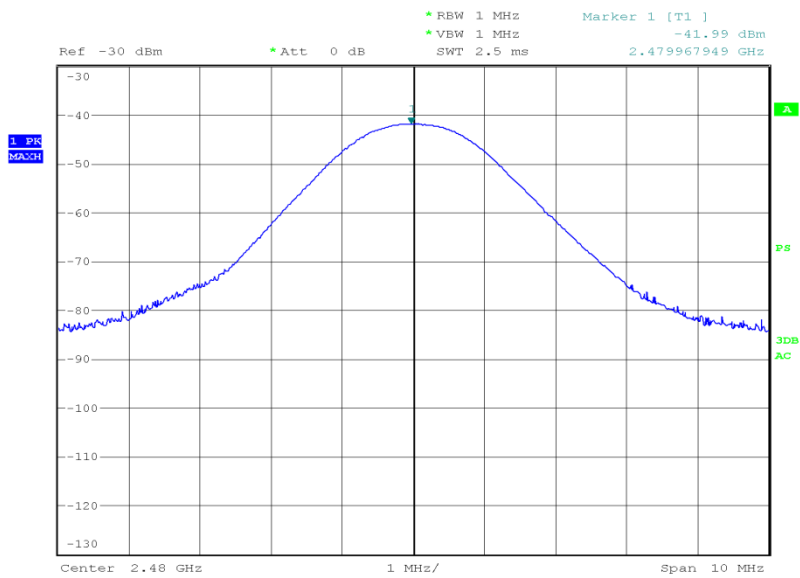
Date: 9.JUL.2012 17:41:19



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2480 MHz

EIRP (dBm)	EIRP (mW)
-2.62	0.547



Date: 9.JUL.2012 18:19:04

Limit

EIRP (dBm)	EIRP (mW)
36.0	4000



2.2 SPURIOUS AND BAND EDGE EMISSIONS

2.2.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (d)

2.2.2 Equipment Under Test and Modification State

MTU4-A (Internal Antenna)-A S/N: 301934040760729 - Modification State 0

2.2.3 Date of Test

9 July 2012 & 10 July 2012

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 Procedure

For conducted emissions, the EUT was set to operate at maximum power on the worst case data rate. The test was performed on the bottom, middle and top channels. The test was performed from 9 kHz to 25 GHz. Firstly, the power of each fundamental frequency was measured in 100 kHz bandwidth and this was used to show a -20 dBc limit line on the trace. The measurement path loss in each relevant frequency band was measured and entered as a reference level offset.

For radiated emissions, the test method described above was also used. However, the measurement was performed from 30 MHz to 25 GHz and the path loss is incorporated as a transducer factor and entered into the spectrum analyser.

The band edge measurements were performed in accordance with ANSI C63.10, Clause 6.9.3. The results were analysed to ensure compliance with restricted bands. The EUT was set to the lowest and highest operating frequencies.

2.2.6 Environmental Conditions

Ambient Temperature	18.5 - 19.0°C
Relative Humidity	68.0 - 70.0%



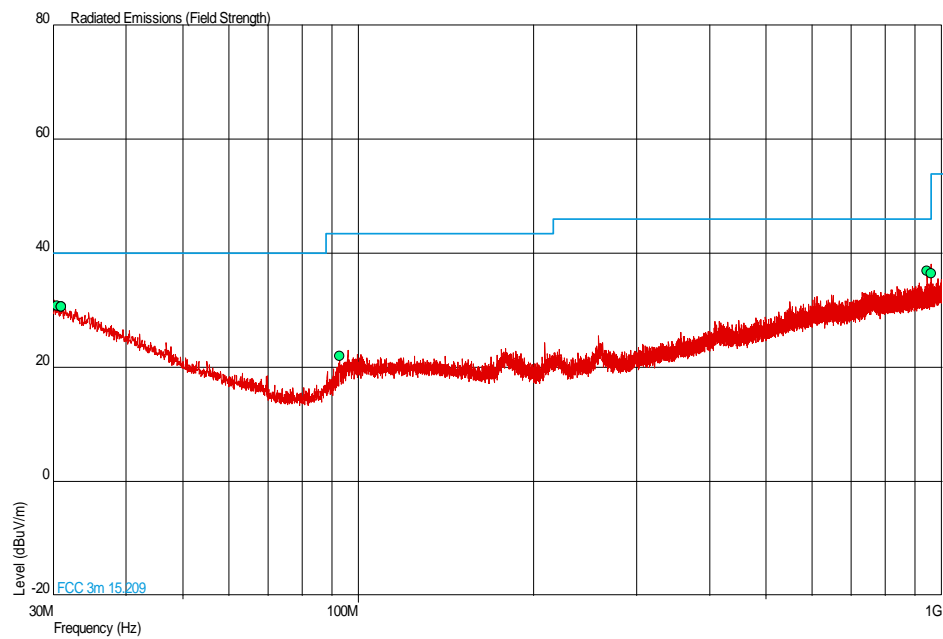
2.2.7 Test Results

12 V DC Supply

Spurious Radiated Emissions

2402 MHz

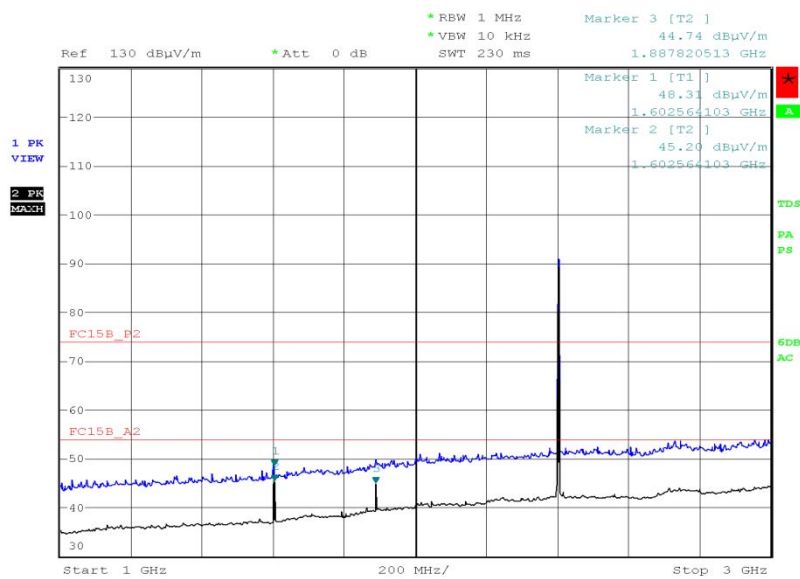
30 MHz to 1 GHz



Frequency (MHz)	QP Level (dBμV/m)	QP Level (μV/m)	QP Limit (dBμV/m)	QP Limit (μV/m)	QP Margin (dBμV/m)	QP Margin (μV/m)	Angle (Deg)	Height (m)	Polarity	
30.488	30.8	34.7	40.0	100	-9.2	65.3	56	1.00	Horizontal	
30.922	30.6	33.9	40.0	100	-9.4	66.1	53	1.00	Vertical	
30.996	30.6	33.9	40.0	100	-9.4	66.1	7	1.00	Vertical	
92.898	22.0	12.6	43.5	150	-21.5	137.4	124	1.00	Vertical	
944.002	37.0	70.8	46.0	200	-9.0	129.2	191	1.00	Vertical	
957.722	36.4	66.1	46.0	200	-9.6	133.9	32	1.00	Vertical	

1 GHz to 25 GHz

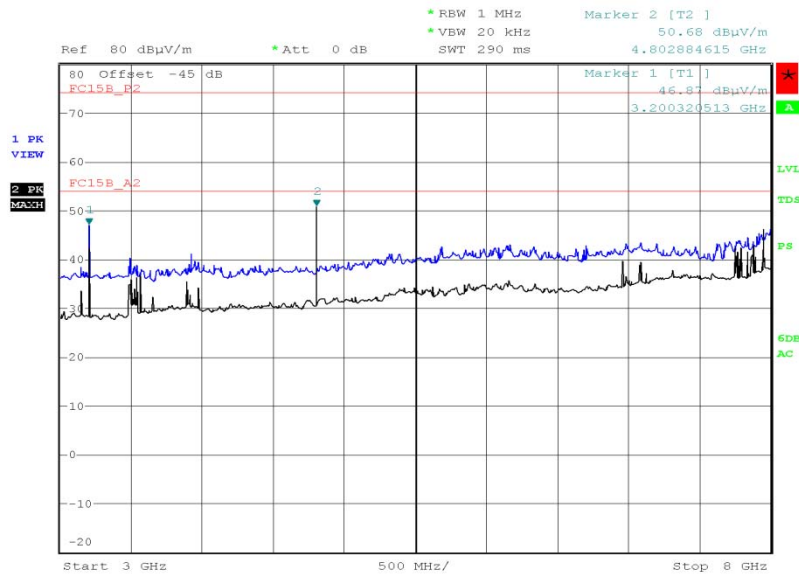
Frequency (GHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBµV/m)	Final Average (dBµV/m)
1.601	Horizontal	100	253	49.88	43.76
4.803	Vertical	131	077	52.86	49.26
4.804	Vertical	131	077	65.17	32.77

1 GHz to 3 GHz

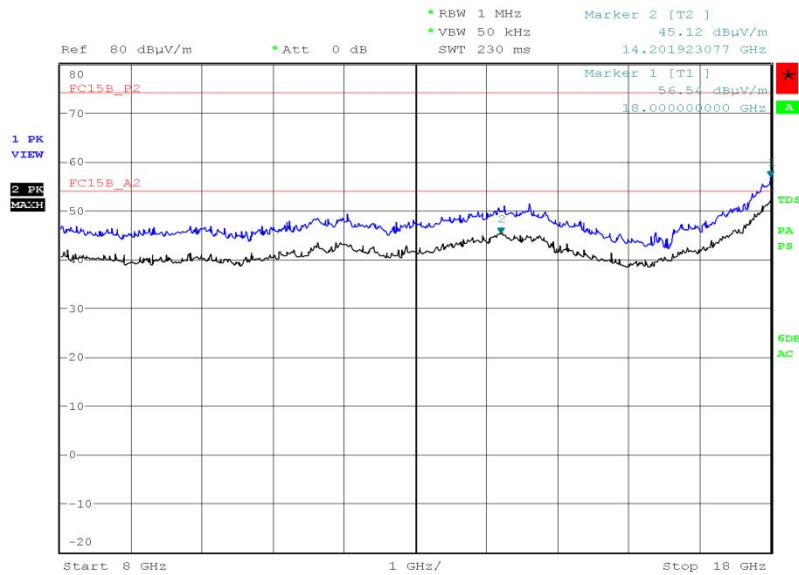
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3 GHz to 8 GHz

Date: 9.JUL.2012 20:01:48

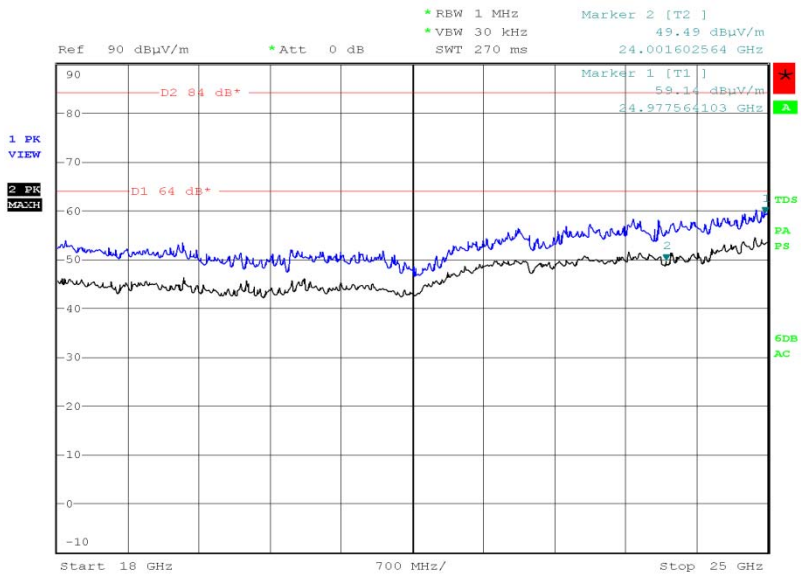
8 GHz to 18 GHz

Date: 9.JUL.2012 19:54:02



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18 GHz to 25 GHz



Date: 10.JUL.2012 17:58:55

Limit

Peak (dBμV/m)	Average (dBμV/m)
74.0	54.0

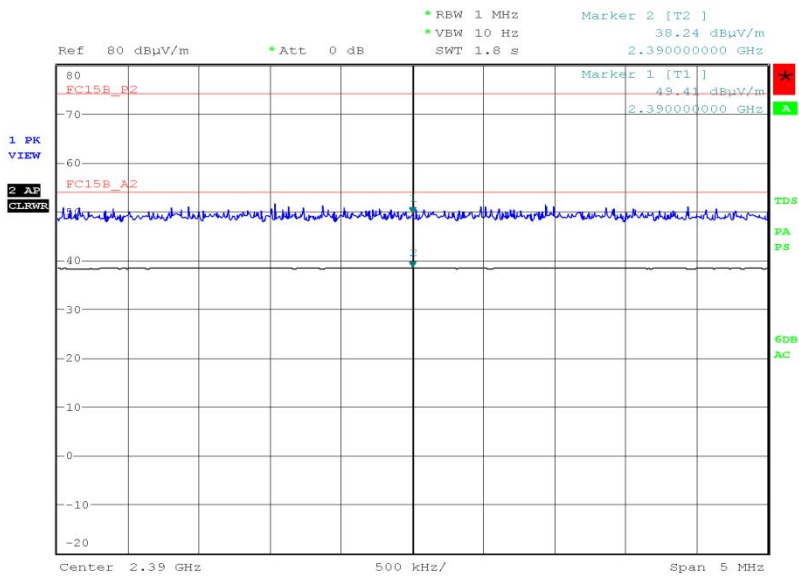


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Band Edge Emissions

2402 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Horizontal	49.41	38.24



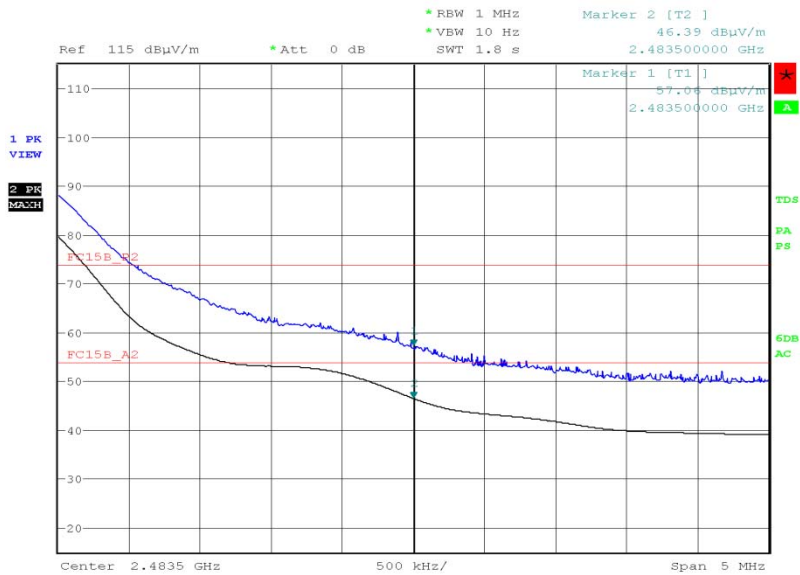
Date: 9.JUL.2012 17:03:55



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2480 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Horizontal	57.06	46.39



Date: 9.JUL.2012 18:22:56

Limit

Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0



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SECTION 3

TEST EQUIPMENT USED



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 – EIRP Peak Power					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	8-Dec-2012
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	14-Nov-2012
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
Mast Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	3171	12	22-Aug-2012
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	20-Dec-2012
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	29-Sep-2012
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	27-Jan-2013
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3703	-	TU
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	12	26-Aug-2012
Tilt Antenna Mast	mature GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	mature GmbH	NCD	3917	-	TU
Section 2.2 – Spurious and Band Edge Emissions					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	8-Dec-2012
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	14-Nov-2012
Antenna (Double Ridge Guide)	Q-Par Angus Ltd	QSH 180K	1511	24	2-Aug-2012
Pre-Amplifier	Phase One	PS04-0086	1533	12	20-Sep-2012
Pre-Amplifier	Phase One	PS04-0087	1534	12	26-Sep-2012
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
Mast Controller	Inn-Co GmbH	CO 1000	1606	-	TU
GSM Test Set	Rohde & Schwarz	CMU 200	2809	12	8-Jun-2013
Antenna (Bilog)	Chase	CBL6143	2904	24	12-May-2013
High Pass Filter (3GHz)	RLC Electronics	F-100-3000-5-R	3349	12	29-May-2013
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	20-Dec-2012
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	29-Sep-2012
3 GHz High Pass Filter	K&L Microwave	11SH10-3000/X18000-O/O	3552	12	16-Apr-2013
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	27-Jan-2013
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3703	-	TU
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	12	26-Aug-2012
Tilt Antenna Mast	mature GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	mature GmbH	NCD	3917	-	TU
Amplifier	Phase One	PS06-0060	3175	12	10-Jul-2013

TU – Traceability Unscheduled, O/P MON – Output Monitored with Calibrated Equipment



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3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	MU
EIRP Peak Power	30MHz to 1GHz: ± 5.1 dB 1GHz to 40GHz: ± 6.3 dB
Spurious and Band Edge Emissions	30MHz to 1GHz: ± 5.1 dB 1GHz to 40GHz: ± 6.3 dB



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SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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