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# Report On

FCC Testing of the  
Crane Electronics Ltd IQVT1 Torque Module  
In accordance with FCC CFR 47 Part 15C

COMMERCIAL-IN-CONFIDENCE

FCC ID: TA6IQVT1

Document 75925573 Report 02 Issue 2

December 2014



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COMMERCIAL-IN-CONFIDENCE

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**PREPARED FOR**

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**APPROVED BY**

**Ryan Henley**  
Authorised Signatory

**DATED**

10 December 2014

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**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  
Crane Electronics Ltd IQVT1 Torque Module  
In accordance with FCC CFR 47 Part 15C



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## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the FCC Testing of the Crane Electronics Ltd IQVT1 Torque Module 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	Crane Electronics Ltd
Model Number(s)	IQVT1
Serial Number(s)	RD939Z0257 (of Getac Tablet)
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 15C (2013)
Disposal	Held Pending Disposal
Reference Number	Not Applicable
Date	Not Applicable
Order Number	044237
Date	30 January 2014
Start of Test	19 February 2014
Finish of Test	23 February 2014
Name of Engineer(s)	G Lawler
Related Document(s)	ANSI C63.10: 2009

**This report has been upissued to Issue 2 and should be read in place of Issue 1. This report has been upissued to correct the model name and remove some typing errors.**



## 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
Transmit				
2.1	15.207	AC Line Conducted Emissions	Pass	
2.2	15.249 (a)	Field Strength of Fundamental	Pass	
2.3	15.249 (a)(d)	Field Strength of Spurious Emissions	Pass	



## 1.3 APPLICATION FORM

MAIN EUT			
MANUFACTURING DESCRIPTION	Torque Module		
MANUFACTURER	Crane Electronics Ltd.		
TYPE	Torque Module		
PART NUMBER	IQVT1-0001-CRXXRX		
SERIAL NUMBER	Not Supplied		
HARDWARE VERSION	101-452 issue B		
SOFTWARE VERSION	Test version supplied		
TRANSMITTER OPERATING RANGE	2400-2480 MHz		
RECEIVER OPERATING RANGE	2400-2480 MHz		
COUNTRY OF ORIGIN	UK		
INTERMEDIATE FREQUENCIES	n/a		
EMISSION DESIGNATOR(S): (i.e. G1D, GXW)	2M00F1D		
MODULATION TYPES: (i.e. GMSK, QPSK)	GFSK		
HIGHEST INTERNALLY GENERATED FREQUENCY	16MHz		
OUTPUT POWER (W or dBm)	0dBm		
FCC ID	TA6IQVT1		
INDUSTRY CANADA ID	Not Supplied		
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	The EUT measures torque and angle from a transducer. The EUT can connect to a transducer with a cable or using RF.		
ANCILLARIES (if applicable)			
MANUFACTURING DESCRIPTION	Rugged Tablet	Rotary Transducer	
MANUFACTURER	Getac	Crane Electronics	
TYPE	Z710	75Nm with angle	
PART NUMBER	52628476201E	UTA-452-0075-AP	
SERIAL NUMBER		88713	
COUNTRY OF ORIGIN	China	UK	

Signature

Held on file at TUV SUD Product Service

Date

04 March 2014



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## **1.4 PRODUCT INFORMATION**

### **1.4.1 Technical Description**

The Equipment Under Test (EUT) was a Crane Electronics Ltd IQVT1 Torque Module. 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 5 V DC supply.

FCC Measurement Facility Registration Number  
90987 Octagon House, Fareham Test Laboratory

## **1.6 DEVIATIONS FROM THE STANDARD**

No deviations from the applicable test standard 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  
Crane Electronics Ltd IQVT1 Torque Module  
In accordance with FCC CFR 47 Part 15C



## **2.1 AC LINE CONDUCTED EMISSIONS**

### **2.1.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.207

### **2.1.2 Equipment Under Test and Modification State**

IQVT1 Torque Module S/N: RD939Z0257 - Modification State 0

### **2.1.3 Date of Test**

23 February 2014

### **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**

A test environment and testing arrangement meeting the specification of ANSI C63.4 was used during all testing. The Equipment Under Test (EUT) was set upon a non-conducting platform at an elevation of 80 cm above a horizontal reference ground plane. A vertical reference ground plane was situated 40 cm from the EUT and bonded to the horizontal reference ground plane.

The EUT was powered by a Line Impedance Stabilization Network (LISN), whereby emissions measurements of the current-carrying conductors were made through this LISN. The LISN was bonded to the horizontal reference ground plane with a separation distance greater than 80 cm from the EUT. A mains supply cable of 1 m length was used to supply mains power to the EUT from the LISN.

A preliminary emissions scan was conducted for each current-carrying conductor of the EUT, using a peak detector over a frequency range of 150 kHz to 30 MHz. At least six of the greatest peak emissions, frequency positions were selected from each preliminary emissions scan for further evaluation as final measuring points.

Final measurement points were measured using quasi-peak and average detectors. All final measurements were assessed against the emission limits in Clause 15.207 of FCC CFR 47 FCC Part 15.

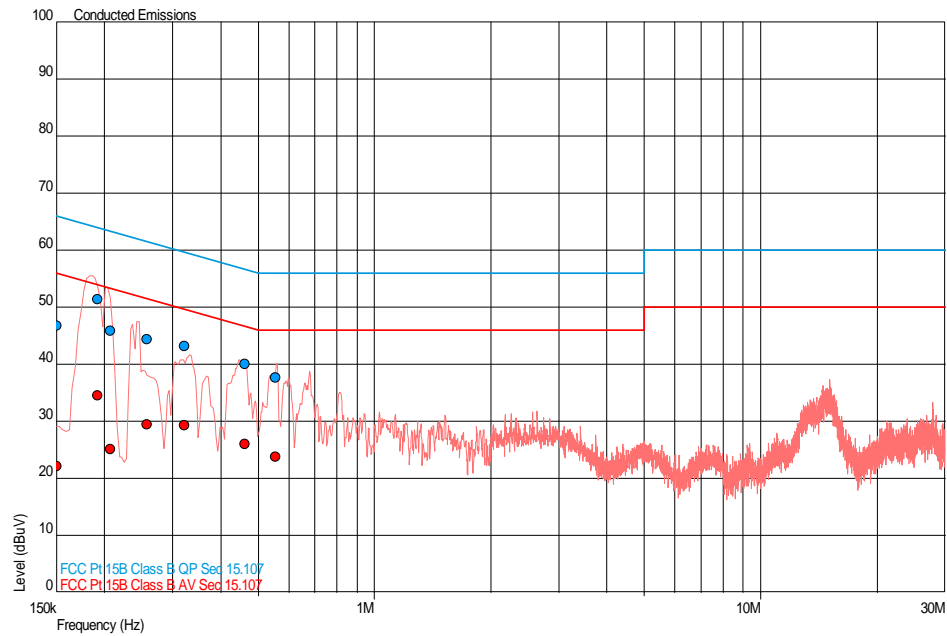
### **2.1.6 Environmental Conditions**

Ambient Temperature	21.5°C
Relative Humidity	37.0%



## 2.1.7 Test Results

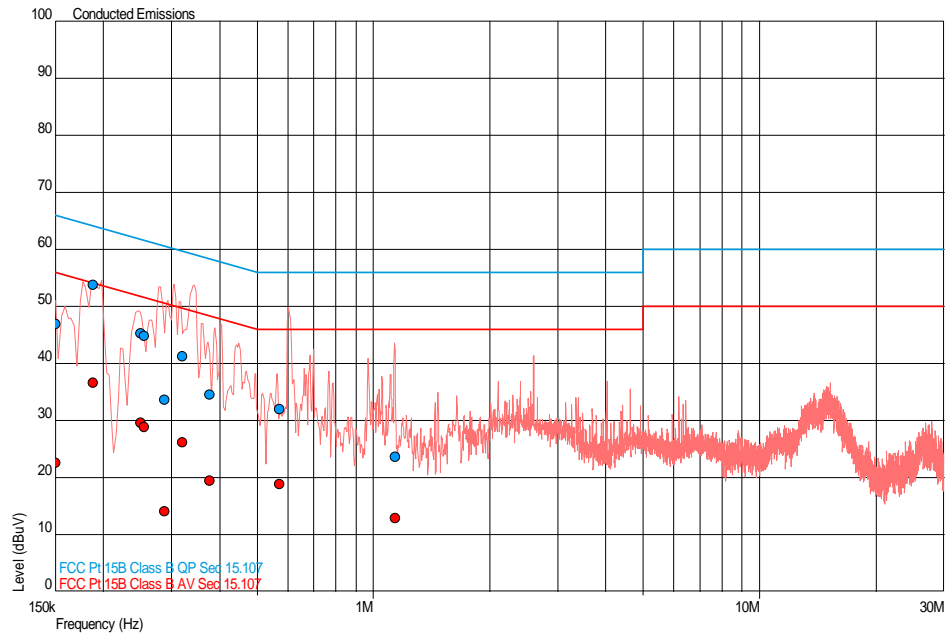
### Live Line



Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dBμV)	AV Level (dBμV)	AV Limit (dBμV)	AV Margin (dBμV)
0.150	46.8	66.0	-19.2	22.1	56.0	-33.9
0.192	51.4	64.0	-12.6	34.5	54.0	-19.5
0.207	46.0	63.3	-17.3	25.2	53.3	-28.1
0.258	44.4	61.5	-17.1	29.4	51.5	-22.1
0.321	43.2	59.7	-16.4	29.3	49.7	-20.4
0.461	40.1	56.7	-16.6	26.1	46.7	-20.6
0.553	37.6	56.0	-18.4	23.8	46.0	-22.2



### Neutral Line



Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dBμV)	AV Level (dBμV)	AV Limit (dBμV)	AV Margin (dBμV)
0.150	46.9	66.0	-19.1	22.6	56.0	-33.4
0.188	53.8	64.1	-10.3	36.6	54.1	-17.5
0.249	45.3	61.8	-16.5	29.7	51.8	-22.1
0.255	44.9	61.6	-16.7	28.9	51.6	-22.7
0.288	33.7	60.6	-26.9	14.1	50.6	-36.5
0.321	41.3	59.7	-18.4	26.2	49.7	-23.5
0.378	34.5	58.3	-23.8	19.5	48.3	-28.8
0.571	32.0	56.0	-24.0	18.9	46.0	-27.1
1.140	23.6	56.0	-32.4	12.9	46.0	-33.1



## **2.2 FIELD STRENGTH OF FUNDAMENTAL**

### **2.2.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.249 (a)

### **2.2.2 Equipment Under Test and Modification State**

IQVT1 Torque Module S/N: RD939Z0257 - Modification State 0

### **2.2.3 Date of Test**

19 February 2014

### **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**

A test environment and testing arrangement meeting the specification of ANSI C63.4 was used during all testing. The Equipment Under Test (EUT) was set upon a non-conducting platform at an elevation of 80 cm above a horizontal reference ground plane.

The horizontal reference ground plane encompasses a turntable which is used to adjust the azimuth of the EUT. An antenna positioner is used to elevate the measuring antenna above the horizontal reference ground plane whereby the antenna elevation is adjustable between 1 m and 4 m.

During peak emissions measurements the spectrum analyser peak detector was configured with a resolution bandwidth of 1 MHz and a video bandwidth of 1 MHz.

An exploratory radiated emissions measurement of the fundamental was made by azimuth emissions searches over a range of 0° and 360°. These exploratory radiated emissions measurements were made at the fundamental frequency using a peak detector, with the measuring antenna in both vertical and horizontal polarizations. The azimuth and antenna polarisation that yielded the greatest peak emission level determined. To determine the greatest peak emission level, the measuring antenna height was adjusted within an elevation range of 1 m to 4 m, at the aforementioned azimuth and antenna polarisation.

The greatest peak emission level was recorded and assessed against FCC CFR47 15.249(a) emission limits. All fundamental peak emissions levels were below the average emissions limits and therefore average emissions levels were not determined.

### **2.2.6 Environmental Conditions**

Ambient Temperature	18.7°C
Relative Humidity	43.0%

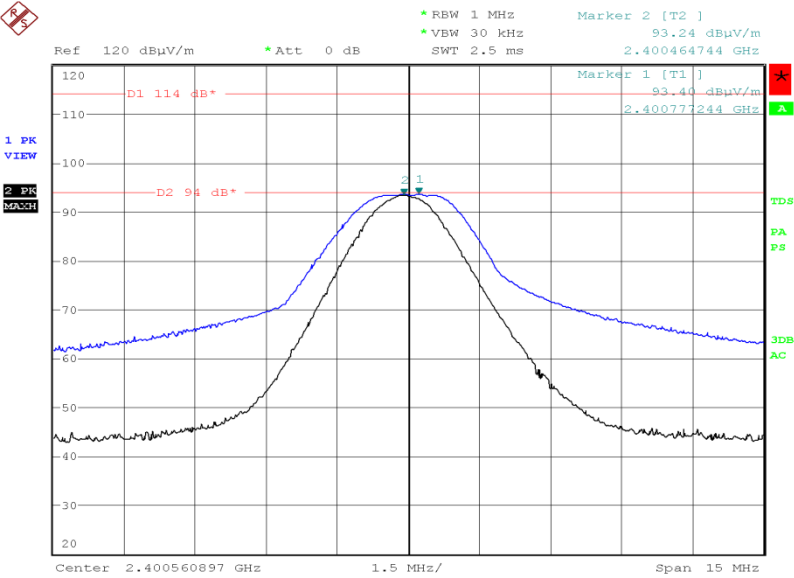


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2.2.7 Test Results

2400 MHz

Fundamental



Date: 19.FEB.2014 17:43:49

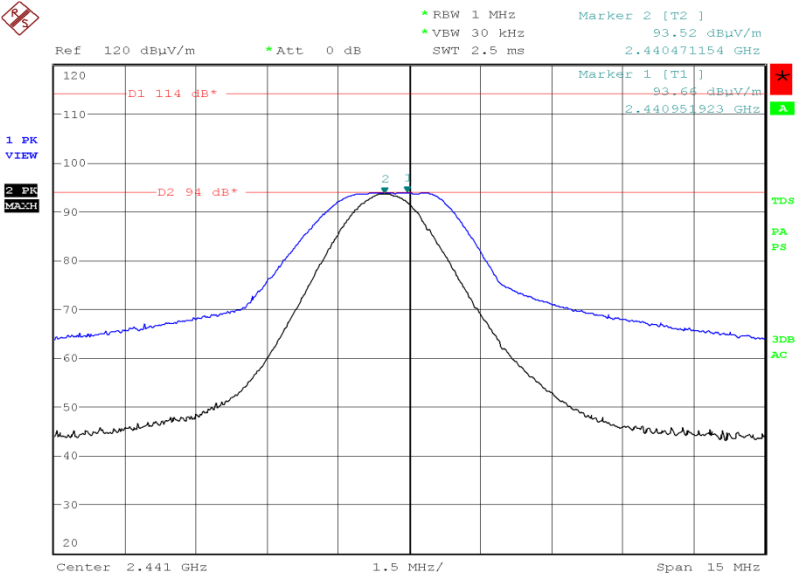
Frequency (MHz)	Average Result (dBμv/m)	Peak Result (dBμv/m)	Average Limit (dBμv/m)	Peak Limit (dBμv/m)
2400.00	75.06	93.40	93.98	114.00



Product Service

2440 MHz

Fundamental



Date: 19.FEB.2014 18:50:55

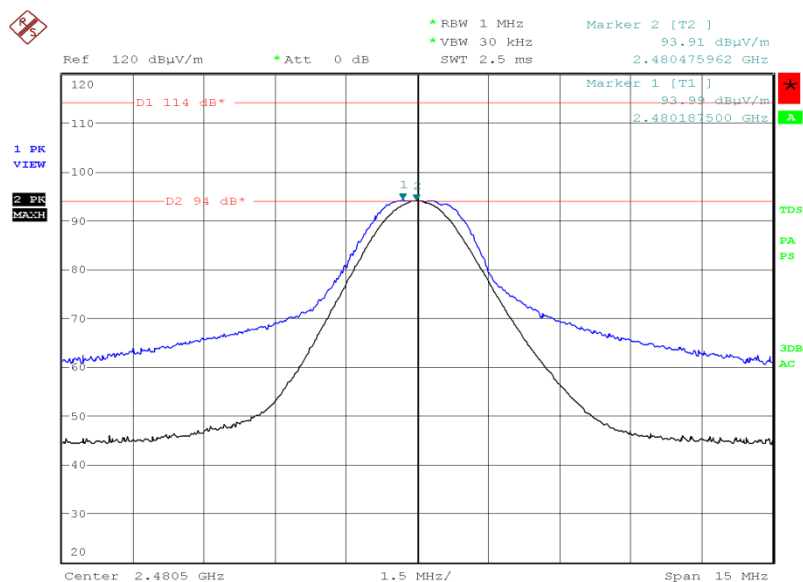
Frequency (MHz)	Average Result (dBμV/m)	Peak Result (dBμV/m)	Average Limit (dBμV/m)	Peak Limit (dBμV/m)
2441.00	75.32	93.62	93.98	114.00



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2480 MHz

## Fundamental



Date: 19.FEB.2014 19:45:47

Frequency (MHz)	Average Result (dBμv/m)	Peak Result (dBμv/m)	Average Limit (dBμv/m)	Peak Limit (dBμv/m)
2480.00	75.65	93.99	93.98	114.00

Limit Clause 15.249 (a) and A2.9

Fundamental Frequency (MHz)	Field Strength of Fundamental (millivolts/meter)
902 to 928	50
2400 to 2483.5	50
5725 to 5875	50
24000 to 24250	250



## **2.3 FIELD STRENGTH OF SPURIOUS EMISSIONS**

### **2.3.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.249 (a)(d)

### **2.3.2 Equipment Under Test and Modification State**

IQVT1 Torque Module S/N: RD939Z0257 - Modification State 0

### **2.3.3 Date of Test**

19 February 2014 & 23 February 2014

### **2.3.4 Test Equipment Used**

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

### **2.3.5 Test Procedure**

A test environment and testing arrangement meeting the specification of ANSI C63.4 was used during all testing. The Equipment Under Test (EUT) was set upon a non-conducting platform at an elevation of 80 cm above a horizontal reference ground plane.

The horizontal reference ground plane encompasses a turntable which is used to adjust the azimuth of the EUT. An antenna positioner is used to elevate the measuring antenna above the horizontal reference ground plane whereby the antenna elevation is adjustable between 1 m and 4 m.

During peak emissions measurements the spectrum analyser peak detector was configured with a resolution bandwidth of 1 MHz and a video bandwidth of 1 MHz.

Exploratory radiated emissions measurements were made by azimuth emissions searches over a range of 0° and 360°. These exploratory radiated emissions measurements were made using a peak detector, with the measuring antenna in both vertical and horizontal polarizations. The azimuth and antenna polarisation that yielded the greatest peak emission level determined. To determine the greatest peak emission level, the measuring antenna height was adjusted within an elevation range of 1 m to 4 m, at the aforementioned azimuth and antenna polarisation.

The greatest peak emission level was recorded and assessed against FCC CFR47 15.249(a) emission limits. All harmonic and spurious peak emissions levels were below the average emissions limits and therefore average emissions levels were not determined.

### **2.3.6 Environmental Conditions**

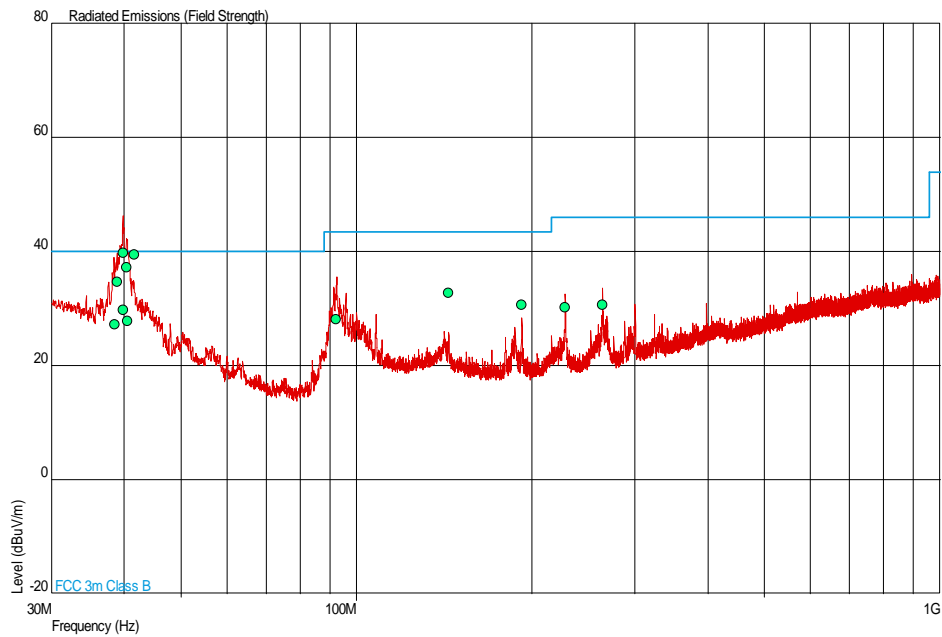
Ambient Temperature	18.7 - 21.5°C
Relative Humidity	37.0 - 43.0%



### 2.3.7 Test Results

2400 MHz

30 MHz to 1 GHz



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
38.539	27.2	22.9	40.0	100	-12.8	77.1	166	1.00	Horizontal
38.938	34.7	54.3	40.0	100	-5.3	45.7	299	1.00	Vertical
39.853	29.8	30.9	40.0	100	-10.2	69.1	313	2.55	Horizontal
39.879	39.8	97.7	40.0	100	-0.2	2.3	301	1.00	Vertical
40.432	37.2	72.4	40.0	100	-2.8	27.6	0	1.00	Vertical
40.488	27.8	24.5	40.0	100	-12.2	75.5	292	1.57	Horizontal
41.600	39.4	93.3	40.0	100	-0.6	6.7	341	1.00	Vertical
92.124	28.1	25.4	43.5	150	-15.4	124.6	318	1.00	Vertical
143.990	32.7	43.2	43.5	150	-10.8	106.8	271	1.75	Horizontal
191.978	30.6	33.9	43.5	150	-12.9	116.1	81	1.00	Horizontal
227.994	30.2	32.4	46.0	200	-15.8	167.6	260	1.57	Horizontal
264.013	30.7	34.3	46.0	200	-15.3	165.7	79	1.36	Horizontal

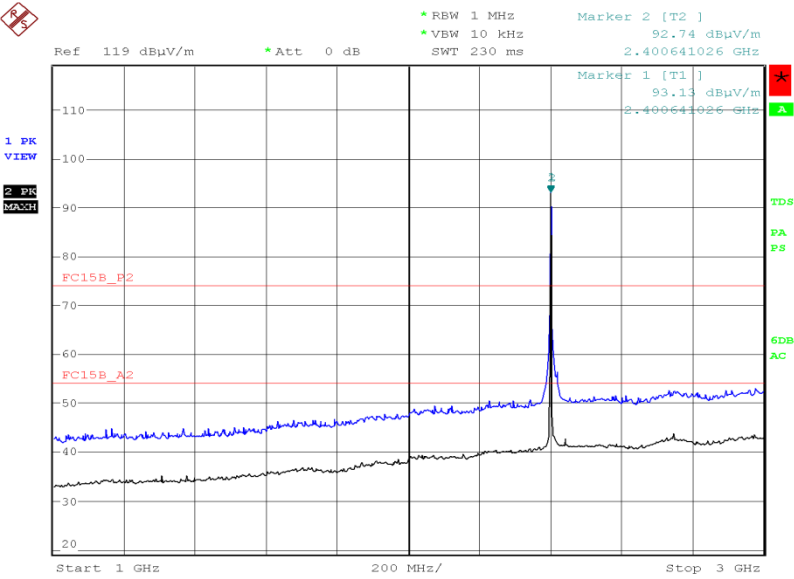


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1 GHz to 25 GHz

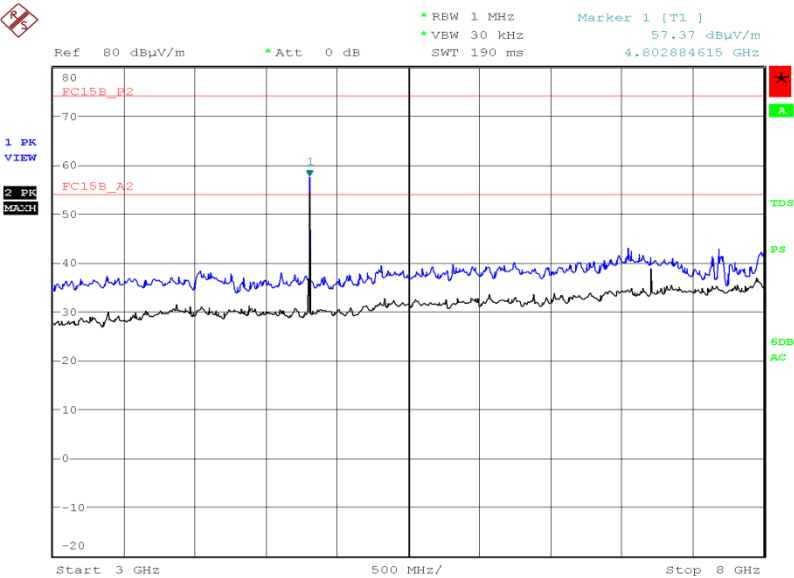
Frequency (GHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBµV/m)	Final Average (dBµV/m)
4.803	Vertical	200	221	60.22	41.88

1 GHz to 3 GHz



Date: 19.FEB.2014 18:11:59

3 GHz to 8 GHz

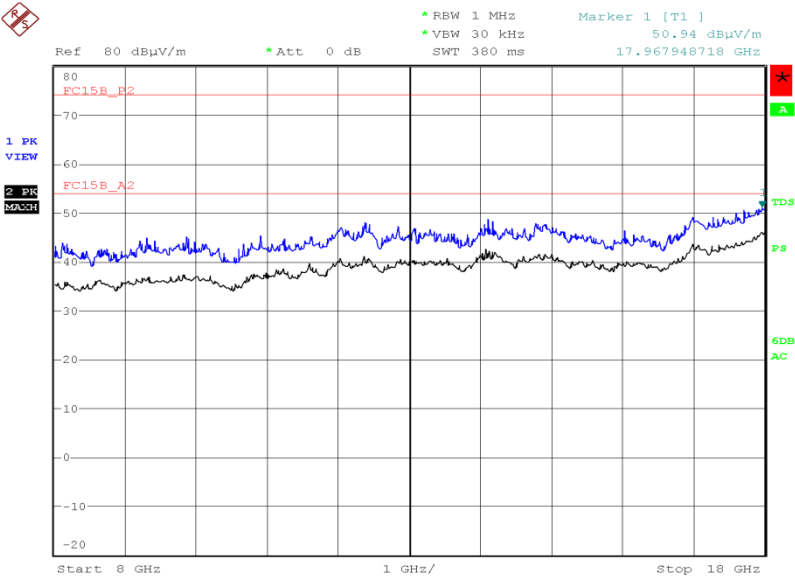


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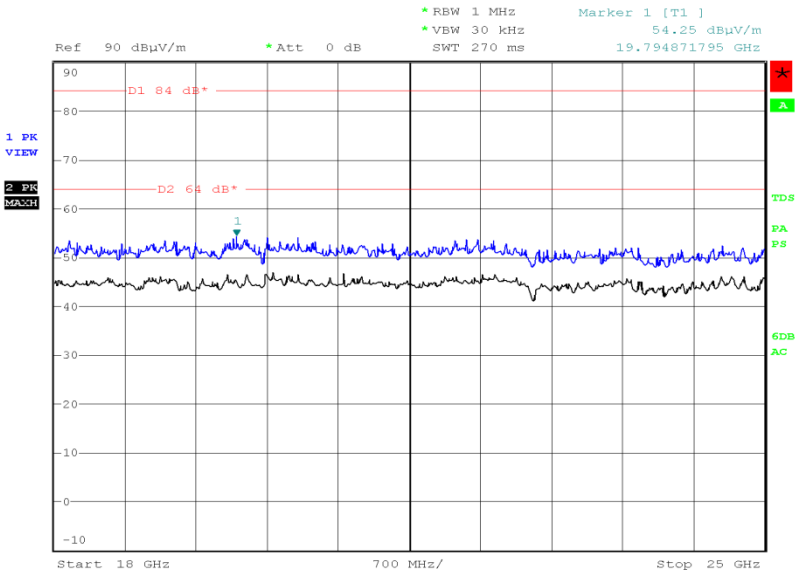
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8 GHz to 18 GHz

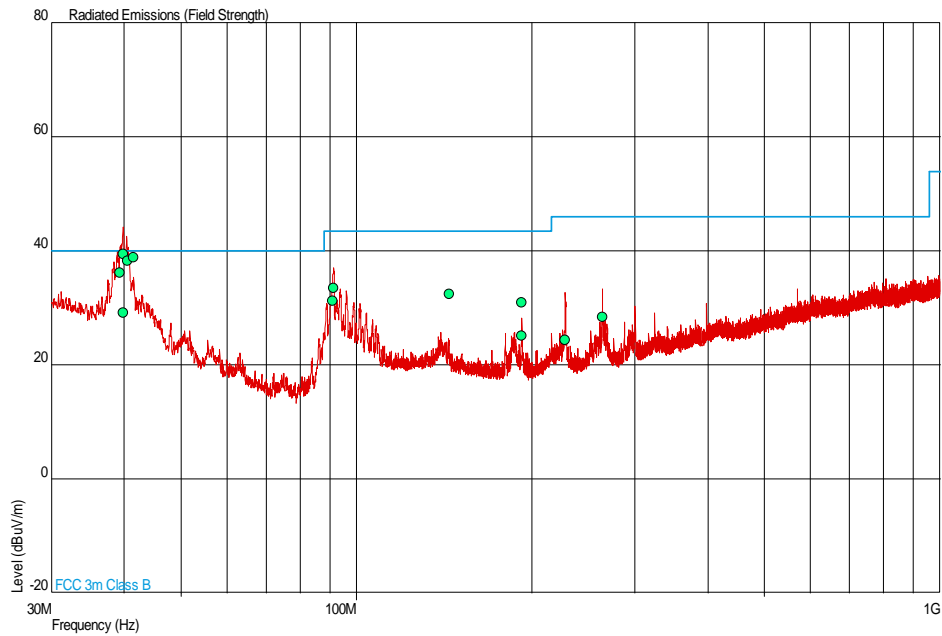


Date: 19.FEB.2014 23:45:12

18 GHz to 25 GHz



Date: 23.FEB.2014 21:08:28

2440 MHz30 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
39.362	36.1	63.8	40.0	100	-3.9	36.2	360	1.16	Vertical
39.805	29.2	28.8	40.0	100	-10.8	71.2	278	3.83	Horizontal
39.861	39.5	94.4	40.0	100	-0.5	5.6	295	1.00	Vertical
40.468	38.4	83.2	40.0	100	-1.6	16.8	330	1.00	Vertical
41.552	38.8	87.1	40.0	100	-1.2	12.9	328	1.00	Vertical
91.109	31.2	36.3	43.5	150	-12.3	113.7	262	2.25	Horizontal
91.364	33.4	46.8	43.5	150	-10.1	103.2	0	1.09	Vertical
144.044	32.5	42.2	43.5	150	-11.0	107.8	62	2.15	Horizontal
191.951	25.2	18.2	43.5	150	-18.3	131.8	168	1.16	Vertical
191.973	30.9	35.1	43.5	150	-12.6	114.9	261	1.00	Horizontal
228.057	24.4	16.6	46.0	200	-21.6	183.4	242	1.80	Horizontal
264.110	28.5	26.6	46.0	200	-17.5	173.4	43	1.00	Horizontal

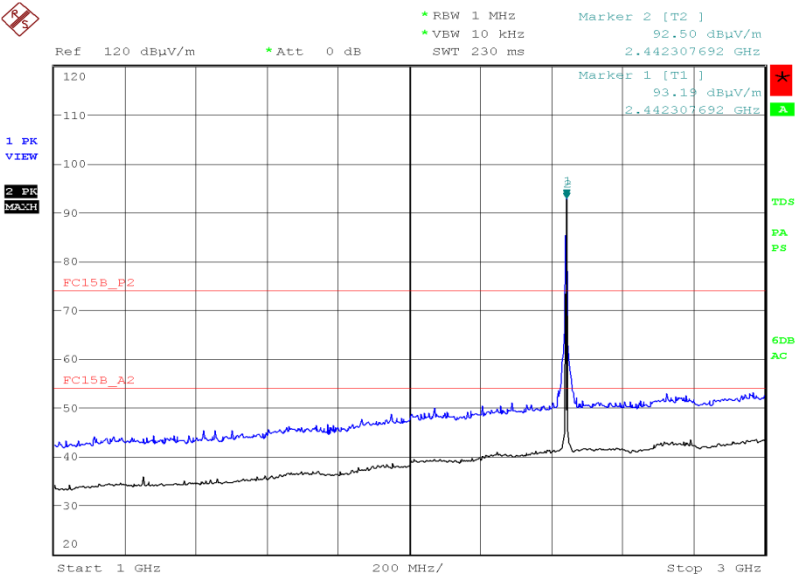


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1 GHz to 25 GHz

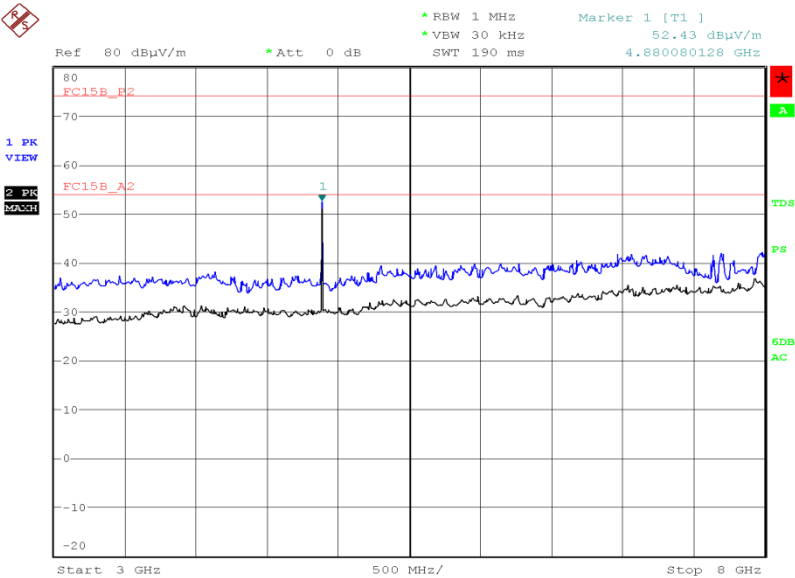
Frequency (GHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBµV/m)	Final Average (dBµV/m)
4.880	Horizontal	125	238	52.43	38.82

1 GHz to 3 GHz



Date: 19.FEB.2014 18:40:38

3 GHz to 8 GHz

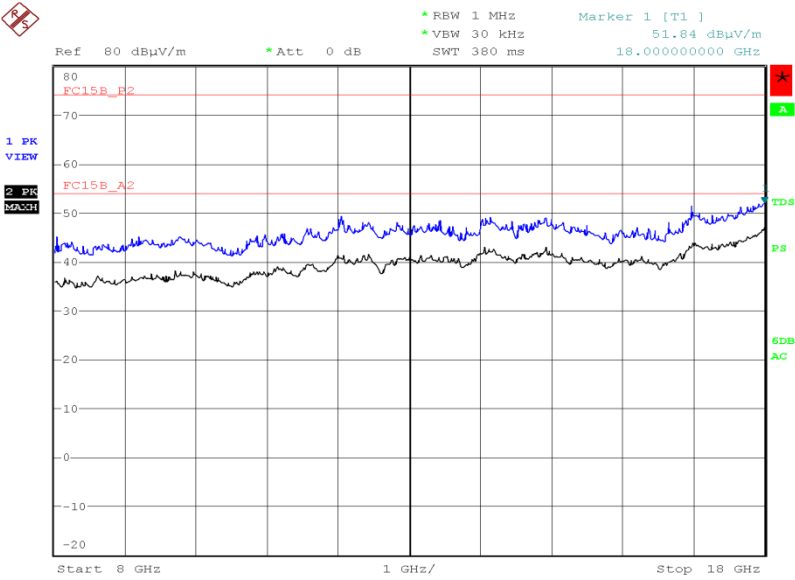


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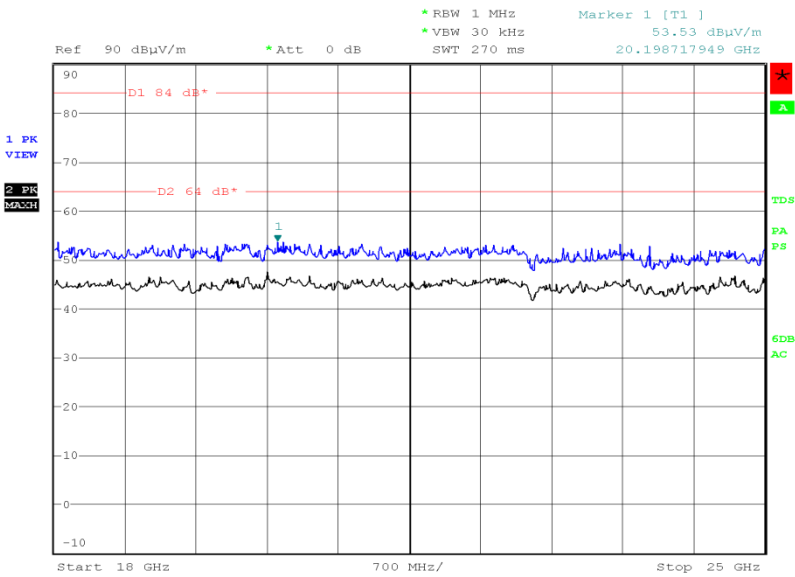
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8 GHz to 18 GHz



Date: 19.FEB.2014 23:23:21

18 GHz to 25 GHz

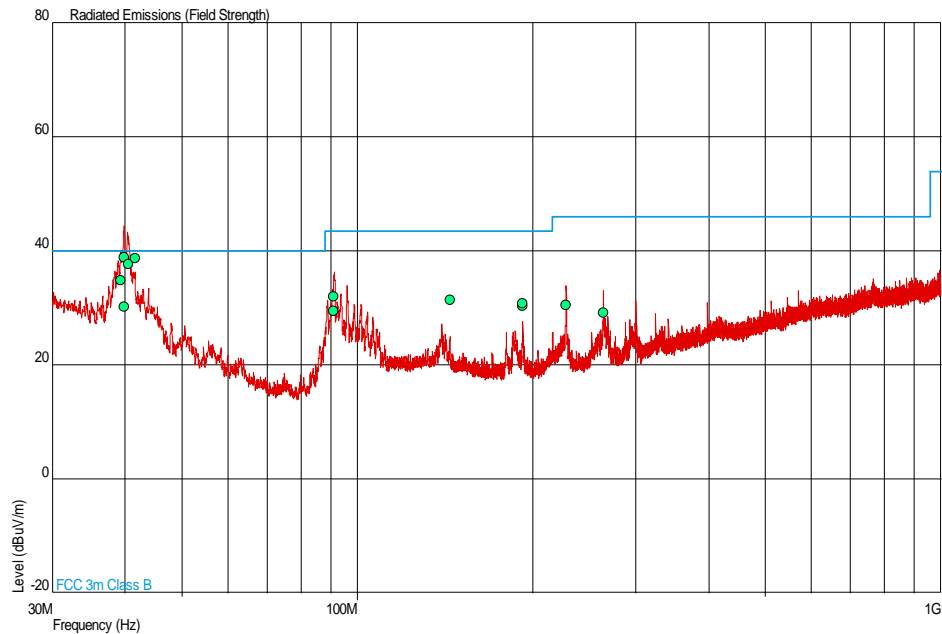


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2480 MHz

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
39.311	34.9	55.6	40.0	100	-5.1	44.4	14	1.00	Vertical
39.853	38.9	88.1	40.0	100	-1.1	11.9	0	1.00	Vertical
39.861	30.3	32.7	40.0	100	-9.7	67.3	225	3.61	Horizontal
40.500	37.7	76.7	40.0	100	-2.3	23.3	359	1.00	Vertical
41.570	38.7	86.1	40.0	100	-1.3	13.9	8	1.00	Vertical
91.012	32.1	40.3	43.5	150	-11.4	109.7	58	1.00	Vertical
91.076	29.5	29.9	43.5	150	-14.0	120.1	112	1.64	Horizontal
144.205	31.4	37.2	43.5	150	-12.1	112.8	259	2.34	Horizontal
191.987	30.9	35.1	43.5	150	-12.6	114.9	258	1.00	Horizontal
191.993	30.4	33.1	43.5	150	-13.1	116.9	325	1.00	Vertical
227.997	30.5	33.5	46.0	200	-15.5	166.5	62	1.25	Horizontal
263.955	29.2	28.8	46.0	200	-16.8	171.2	100	1.04	Horizontal

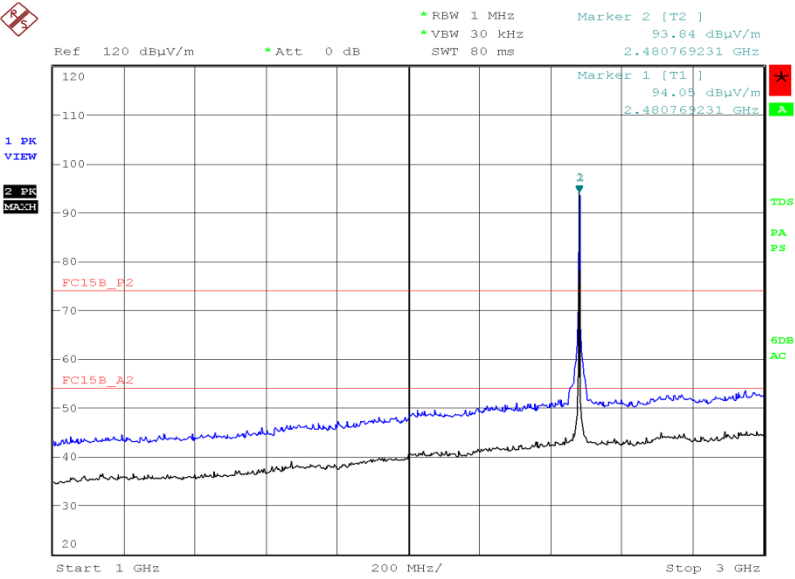


Product Service

1 GHz to 25 GHz

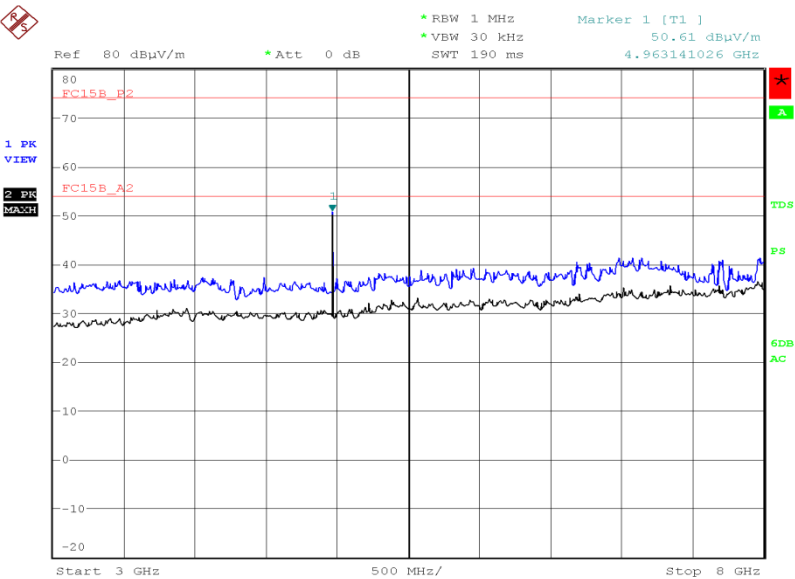
Frequency (GHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBµV/m)	Final Average (dBµV/m)
4.961	Horizontal	183	237	57.68	39.34

1 GHz to 3 GHz



Date: 19.FEB.2014 19:21:52

3 GHz to 8 GHz

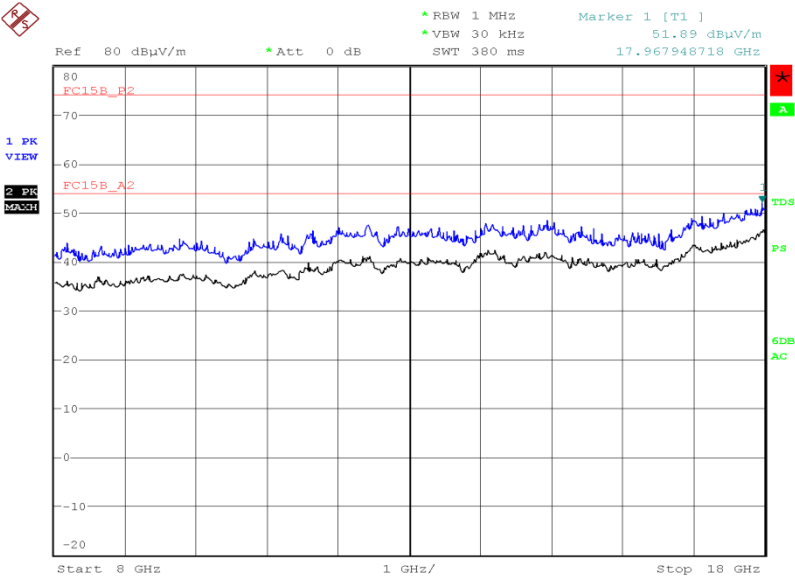


Date: 19.FEB.2014 20:32:36



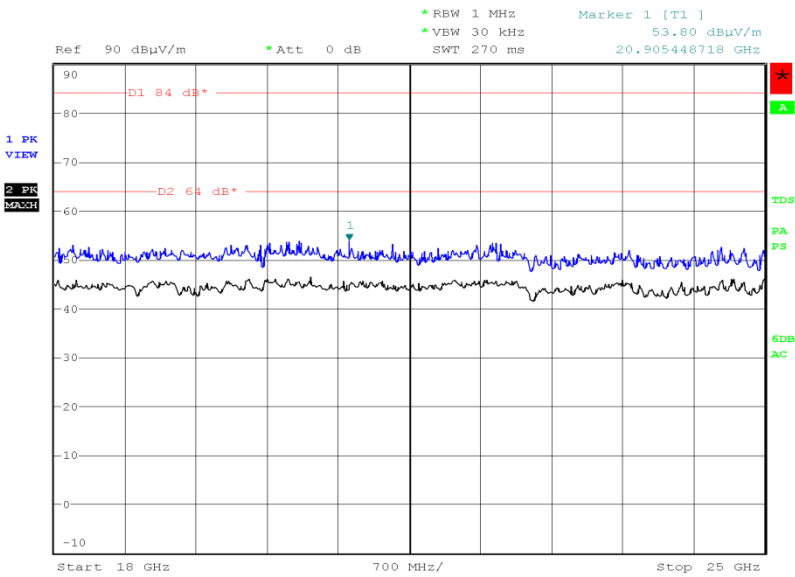
Product Service

8 GHz to 18 GHz



Date: 19.FEB.2014 23:36:37

18 GHz to 25 GHz



Date: 23.FEB.2014 21:13:06



Product Service

Limit Clause15.249 (a)

Fundamental Frequency (MHz)	Field Strength of Harmonics (microvolts/meter)
902 to 928	500
2400 to 2483.5	500
5725 to 5875	500
24000 to 24250	2500

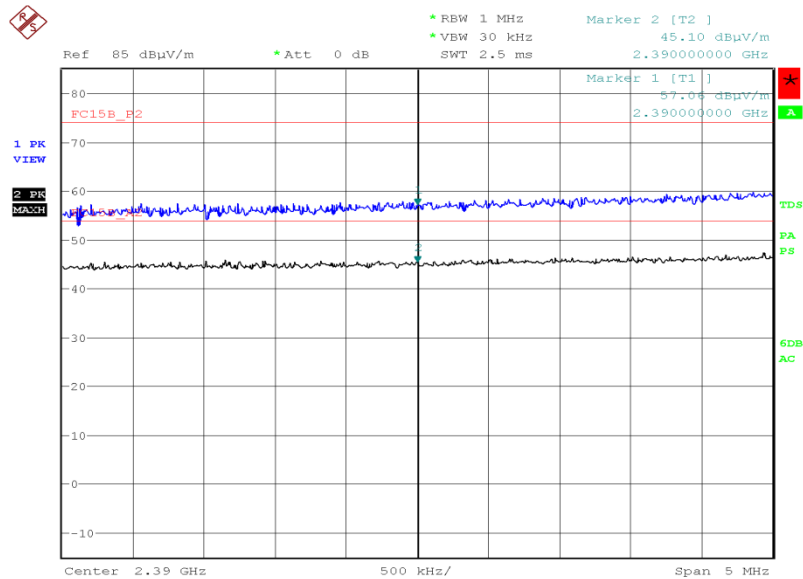
15.249 (d), 15.209

Frequency (MHz)	Field Strength (microvolts/meter)
0.009 to 0.490	2400/F (kHz)
0.490 to 1.705	24000/F (kHz)
1.705 to 30.0	30
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

### Band Edge Emissions

2400 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	57.06	38.72



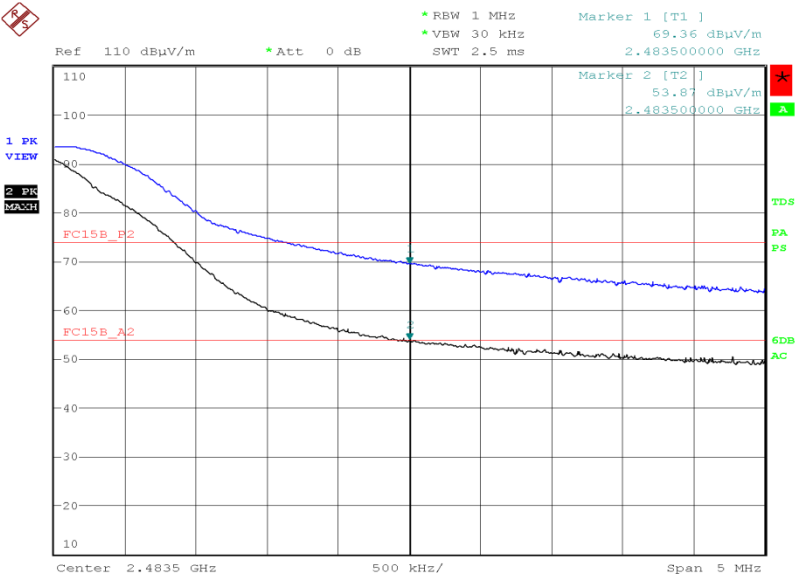
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2480 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	69.36	51.02



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Limit 15.249(d)

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
<b>Section 2.1 – AC Line Conducted Emissions</b>					
Transient Limiter	Hewlett Packard	11947A	15	12	10-Dec-2014
LISN (1 Phase)	Chase	MN 2050	336	12	28-Mar-2014
Screened Room (5)	Rainford	Rainford	1545	24	10-Jan-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
<b>Section 2.2 - Field Strength of Fundamental</b>					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	3-Apr-2014
Screened Room (5)	Rainford	Rainford	1545	24	10-Jan-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	maturo GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	maturo GmbH	NCD	3917	-	TU
<b>Section 2.3 - Field Strength of Spurious Emissions</b>					
Antenna (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	26-Nov-2015
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	3-Apr-2014
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	1002	12	18-Sep-2014
Pre-Amplifier	Phase One	PS04-0086	1533	12	19-Dec-2014
Pre-Amplifier	Phase One	PS04-0087	1534	12	30-Sep-2014
Screened Room (5)	Rainford	Rainford	1545	24	10-Jan-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
High Pass Filter (3GHz)	RLC Electronics	F-100-3000-5-R	3349	12	30-May-2014
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	maturo GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	maturo GmbH	NCD	3917	-	TU
1 Metre SMA Cable	Rhophase	3PS-1801A-1000-3PS	4101	12	5-Nov-2014
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	1-Oct-2014

TU – Traceability Unscheduled



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### 3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	MU
AC Line Conducted Emissions	$\pm 3.2$ dB
Field Strength of Fundamental	30MHz to 1GHz: $\pm 5.1$ dB 1GHz to 40GHz: $\pm 6.3$ dB
Field Strength of Spurious Emissions	30MHz to 1GHz: $\pm 5.1$ dB 1GHz to 40GHz: $\pm 6.3$ dB



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## **SECTION 4**

### **ACCREDITATION, DISCLAIMERS AND COPYRIGHT**



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#### 4.1 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  
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