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dB Technology
|----- (Cambridge Ltd.) -----|

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REPORT ON ELECTROMAGNETIC COMPATIBILITY TESTS

Performed at:
TWENTY PENCE TEST SITE

**Twenty Pence Road,
Cottenham,
Cambridge
U.K.
CB24 8PS**

on

Quatro Electronics Ltd

MFS

dated


28th August 2010

Document History

Issue	Date	Affected page(s)	Description of modifications	Revised by	Approved by
1	28/08/10		Initial release		
2	13/09/10	7	Photos show antenna and EUT	DS	DB

Based on report template:
v090319

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dB Technology (Cambridge) Ltd.*

	Report No: R2817	FCC ID: XL8MFS1501	
	Issue No: 2		
	Test No: T3331	Test Report	Page: 2 of 20

Equipment Under Test (EUT):

MFS

Test Commissioned by:

Quatro Electronics Ltd
Quatro House
School Lane
Lytham
FY8 5NL

Representative:

Dave Smith

Test Started:

26th July 2010

Test Completed:

2nd August 2010

Test Engineer:

Dave Smith

Date of Report:

28th August 2010

Written by: Dave Smith

Checked by: Derek Barlow

Signature: D. A. Smith

Signature: D. Barlow

Date: 28th August 2010

Date: 31st August 2010


dB Technology can only report on the specific unit(s) tested at its site. The responsibility for extrapolating this data to a product line lies solely with the manufacturer.

Test Standards Applied

CFR 47 : 2009

Code of Federal Regulations: Pt 15 Subpart C - Radio Frequency Devices - Intentional Radiators

In particular, the rules of CFR 47 part 15.231 were applied.

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Emissions Test Results Summary


CFR 47 : 2009

PASS

Test	Port	Method	Limit	PASS/FAIL	Notes
Conducted Emissions	ac power	ANSI C63.4:2003	15.207	N/A	#1
Periodic Operation			15.231(a)	PASS	
Radiated Emissions		ANSI C63.4:2003	15.231(b)	PASS	
Bandwidth		ANSI C63.4:2003	15.231(c)	PASS	


specs_fccv090511

#1 Test not required because EUT is battery operated and does not have any connection to the mains.

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1 EUT Details

1.1 General

The EUT was a MFS (Multi-Function Switch) with a 434.475MHz intentional transmitter. The transmitter is intended for periodic operation and was therefore tested to FCC part 15.

The unit has an RJ45 connector but for this particular usage there is no intention to connect anything to this port.

Details of the EUT and associated peripherals used during the tests are listed below. Figure 1 shows the interconnections between the EUT and peripherals.

Item	Manufacturer	Model	Description	Serial No:	Notes
1	Quatro	MSF	EUT	Sample 5A	

1.2 Modifications to EUT and Peripherals

Details of any modifications that were required to achieve compliance are listed below. The modification numbers are referred to in the results sections as appropriate.

Mod No:	Details	Implemented for
0	Product as received for testing on 26th July 2010. This included: the Multi 4001 pcb the GT2D-434.475-US radio module	

1.3 EUT Operating Modes

The EUT was tested in the following operating mode or modes. Generally, operating modes are chosen that will exercise the functions of the EUT as fully as possible and in a manner likely to produce maximum emission levels or susceptibility. Individual test result sheets reference the operating mode of the EUT.

Operating Mode	Details
1	Pulsed transmission at 434.475MHz. The duty cycle was much higher than in normal use in order to aid testing. In normal operation the transmitter is continuously on for a duration of more than 100msec and so no additional reduction in levels could be made by calculating an average based on duty cycle.


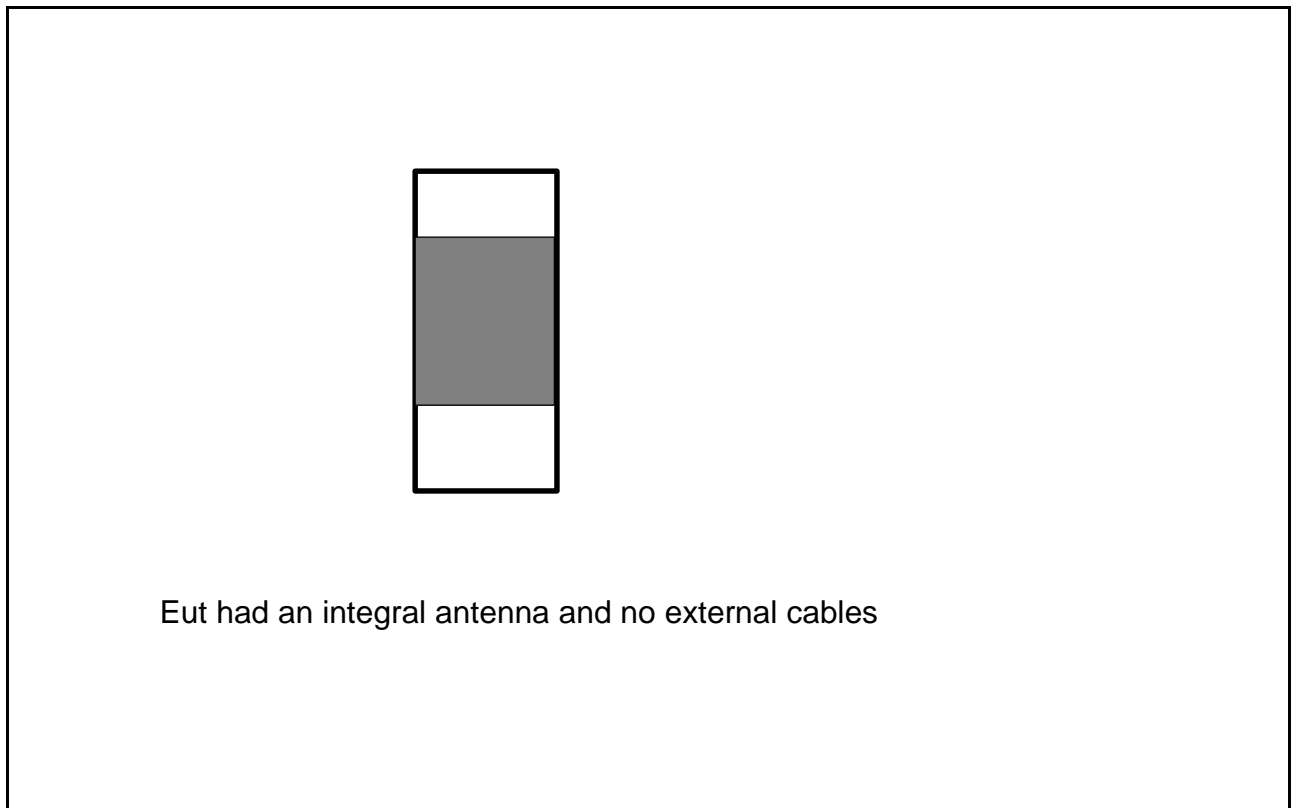

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Figure 1 General Arrangement of EUT and Peripherals




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Photograph 1 EUT - Front




Photograph 2 EUT - Back

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2 Test Equipment

The test equipment used during the tests was one or more of the items listed below. Individual test result sheets indicate which items were used.

Ref No:	Details	Serial Number	Cal Due
A24	Chase X-wing Bilog CBL6144 26MHz-3GHz	27590	13/07/2011
A5	Chase Bilog CBL6111A	1760	21/01/2011
A8	EMCO 3115 DR Guide	6070	25/01/2011
PRE7	LUCIX 0.1GHz to 20GHz	24485	06/05/2011
R8	Agilent E7405A Spectrum Analyser	MY44212494	15/09/2010
RFF11	High Pass RF Filter 890MHz to 22GHz	11	07/05/2011

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3 Test Methods

3.1 Radiated Emissions

This section describes the general method of performing this test. The specific method used and any deviations from this general method are listed in the appropriate results section.

Initial scans are performed in a semi-anechoic screened room at a distance of 3m. Scans are performed over the frequency range specified in the test standard with the antenna both horizontally and vertically polarised. During these scans the EUT and peripherals are rotated through 360°. Bench top EUTs are placed on a non-conducting bench at a height of 0.8m above the ground plane. Floor standing EUTs are placed 0.1m above the ground plane. The results of the scans are shown in the plots included at the end of the report.

Significant emissions identified by the scans are measured on an open area test site at the appropriate test distance using a CISPR16 quasi-peak receiver. Maximised readings are obtained by rotating the EUT through 360° and adjusting the height of the antenna from 1m to 4m. Measurements are made with the antenna both horizontally and vertically polarised and the results tabulated.

Tabulated results show levels based on the following calculation:

Field Strength (dBuV) = receiver reading (dBuV) + CF (dB/m)

CF is the correction factor for the antenna and cable.


For example:

at 434.478MHz receiver reading was 58.8dBuV, combined correction factor = 20.4 (dB/m).

Total field strength = 57.8 + 20.4 = 78.2dBuV/m.

4 Test Results

The following sections contain tabulated test results. Plots of various scans are included at the back of this section.

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4.1 Intermittent Operation Information - 15.231(a)

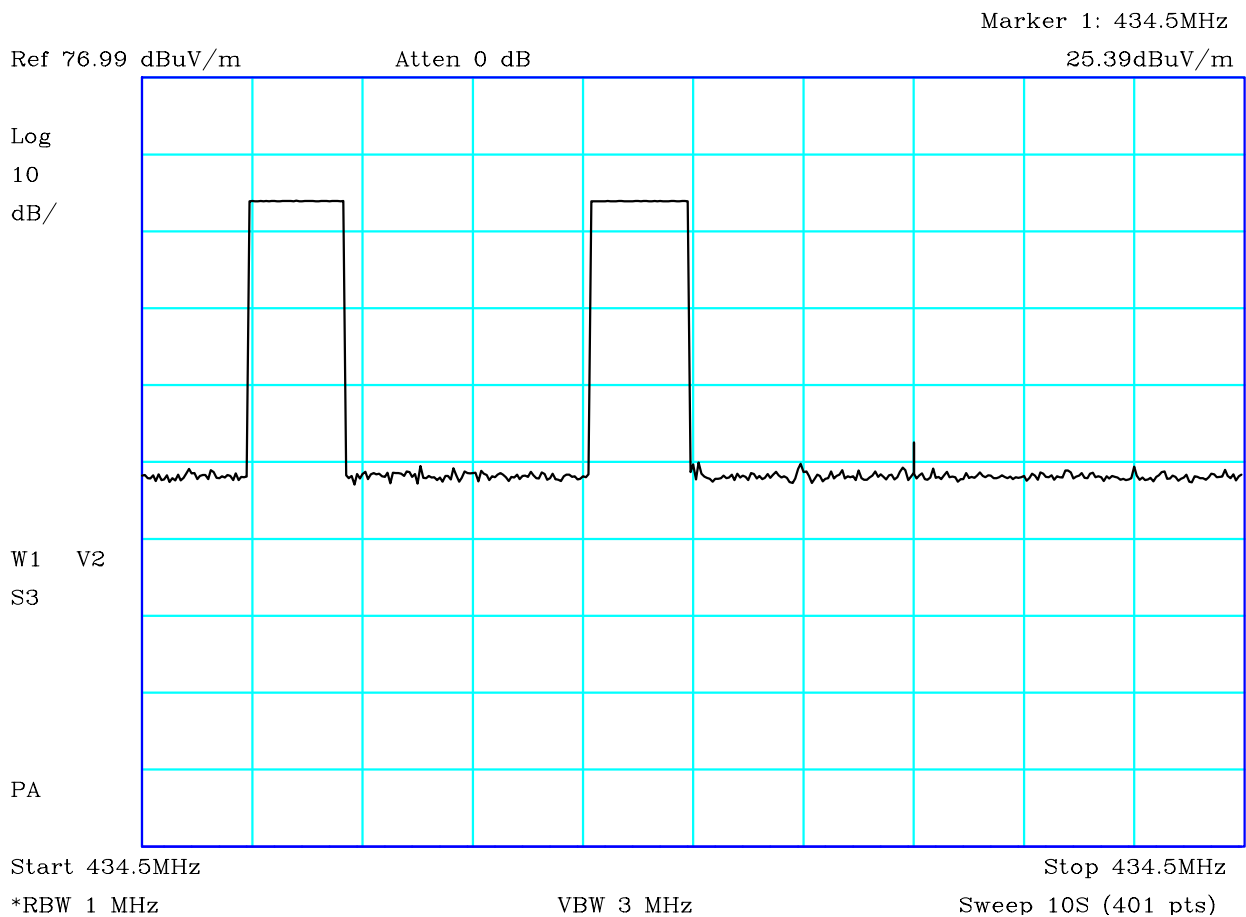
The operation of the transmitter is controlled by a microprocessor. The transmitter is activated when an warning condition is detected (eg. door opened).

When activated the transmitter sends a single sequence of pulses which lasts for less than 5 seconds - see plot below. No other sequence of pulses is transmitted until a new warning condition is detected. In any case, no retransmission occurs within 3 minutes of a previous transmission, regardless of whether a new warning condition occurs.

In addition, this same sequence of pulses is sent out once every 18 hours for supervisory purposes.


This is considered to meet the rules of 15.231 as:

- o it is an automatically operated device which transmits for a period of less than 5 seconds.
- o transmissions at regular predetermined intervals are limited to supervision transmissions to determine system integrity in a security or safety application and does not exceed a rate of 2 seconds per hour.



CF1:A24_3m_090306 CF2:CBL059_CBL062_CBL065_CBL060_090306

Plot shows total transmitter activation time as 3.975 seconds.


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4.2 Radiated Emissions Results - Carrier - 15.231(b)

Factor Set 1:	A5_FS_10B CBL015_09C	-	-	-	-
Factor Set 2:	-	-	-	-	-
Factor Set 3:	-	-	-	-	-
Test Equipment: R8 A5 CSET005					

Radiated Emissions

Company: Quatro Electronics Ltd										Product: MFS				
Date: 26/07/2010										Test Eng: Dave Smith				
Ports:														
Test: ANSI C63.4:2003 using limits of 15.231(b)														
Ports:														
Test: using limits of														
Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	Corr'n Factor dB/m	Corr'n Factor dB	Total Level dBuV/m	Limit FCC_B dBuV/m	Margin FCC_B dB	Notes	
2	1	0	3	1	434.476	V	57.8	20.4		78.2	80.8	2.6		
2	1	0	3	1	434.476	H	47.1	20.4		67.5	80.8	13.3		
Results											Minimum Margin PASS/FAIL		2.6 dB PASS	
Notes	Comments and Observations													
	<p>Results of scans shown in plot 2.</p> <p>All measurements are peak measurements with 120kHz measuring bandwidth. Limit shown is average limit.</p> <p>Since all peak measurements are below the average limit there is no requirement to perform average measurements.</p> <p>The EUT is NOT hand held and is always installed in the same orientation. The tests were performed in this orientation.</p> <p>It was considered unnecessary to repeat the tests in three orthoganol planes.</p>													


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4.3 Radiated Emissions Results - Harmonics - 15.231(b)

Factor Set 1: A8_3m_10B RFF11_09B PRE7_CBL051_CBL053_09B
Factor Set 2:
Factor Set 3: - - - -
Test Equipment: R8 A8 PRE7 RFF11

Radiated Emissions

Company: Quatro Electronics Ltd					Product: MFS								
Date: 02/08/10					Test Eng: Dave Smith								
Ports:													
Test: ANSI C63.4:2003					using limits of 15.231(b)					=FCC B			
Ports:													
Test:					using limits of								
Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	Corr'n Factor dB/m	Corr'n Factor dB	Total Level dBuV/m	Limit FCC_C dBuV/m	Margin FCC_C dB	Notes
average													
4	1	0	3	1	3041.000	V	38.6	-9.6		28.9	60.8	31.9	#1
4	1	0	3	1	3041.000	H	37.5	-9.6		27.8	60.8	33.0	#1
4	1	0	3	1	3910.290	V	46.6	-7.2		39.4	54.0	14.6	#2
4	1	0	3	1	3910.290	H	45.2	-7.2		38.0	54.0	16.0	#2
4	1	0	3	1	4344.806	V	53.2	-7.3		45.9	54.0	8.1	#2
4	1	0	3	1	4344.806	H	46.4	-7.3		39.1	54.0	14.9	#2
peak													
4	1	0	3	1	3041.000	V	50.5	-9.6		40.9	80.8	39.9	#1
4	1	0	3	1	3041.000	H	48.6	-9.6		38.9	80.8	41.9	#1
4	1	0	3	1	3910.290	V	51.1	-7.2		43.9	74.0	30.1	#2
4	1	0	3	1	3910.290	H	51.7	-7.2		44.5	74.0	29.5	#2
4	1	0	3	1	4344.806	V	55.8	-7.3		48.5	74.0	25.5	#2
4	1	0	3	1	4344.806	H	51.2	-7.3		43.9	74.0	30.1	#2
Results											Minimum Margin		
											PASS/FAIL		
											8.1 dB		
											PASS		
Notes		Comments and Observations											
#1		Limit = -20dBc - not within a restricted frequency band.											
#2		Limit = general FCC part C limit - frequency within a restricted frequency band.											
		Results of pre-scans shown in plots 1 to 4.											


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4.4 Radiated Emissions Results - At Band Edges - 15.231(b)

Factor Set 1:	A5_FS_10B CBL015_09C	-	-	-	-
Factor Set 2:	-	-	-	-	-
Factor Set 3:	-	-	-	-	-
Test Equipment: R8 A5 CSET005					

Radiated Emissions

Company: Quatro Electronics Ltd					Product: MFS									
Date: 02/08/2010					Test Eng: Dave Smith									
Ports:														
Test: ANSI C63.4:2003					using limits of				15.231(b)					
Ports:														
Test:					using limits of									
Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	Corr'n Factor dB/m	Corr'n Factor dB	Total Level dBuV/m	Limit FCC_B dBuV/m	Margin FCC_B dB	Notes	
5	1	0	3	1	433.932	V	5.0	20.4		25.4	60.8	35.4		
5	1	0	3	1	435.018	V	5.5	20.4		25.9	60.8	34.9		
5	1	0	3	1	433.932	H	3.8	20.4		24.2	60.8	36.6		
5	1	0	3	1	435.018	H	3.5	20.4		23.9	60.8	36.9		
Results											Minimum Margin PASS/FAIL		34.9 dB PASS	
Notes		Comments and Observations												
<p>The band edges were assumed to be at the maximum permitted occupied band limits i.e. +/- 0.125% above and below the operating frequency.</p> <p>Plot 5 shows emissions measurements over this band. This plot shows transient emissions produced when the transmitter turns on. These emissions were captured because a peak detector was employed along with a "maximum hold" on the spectrum analyser. The plot is a maximum hold of a large number of sweeps.</p> <p>To establish that these transients were not an issue, quasi peak measurements were made at the nominal band edge points as shown above.</p>														

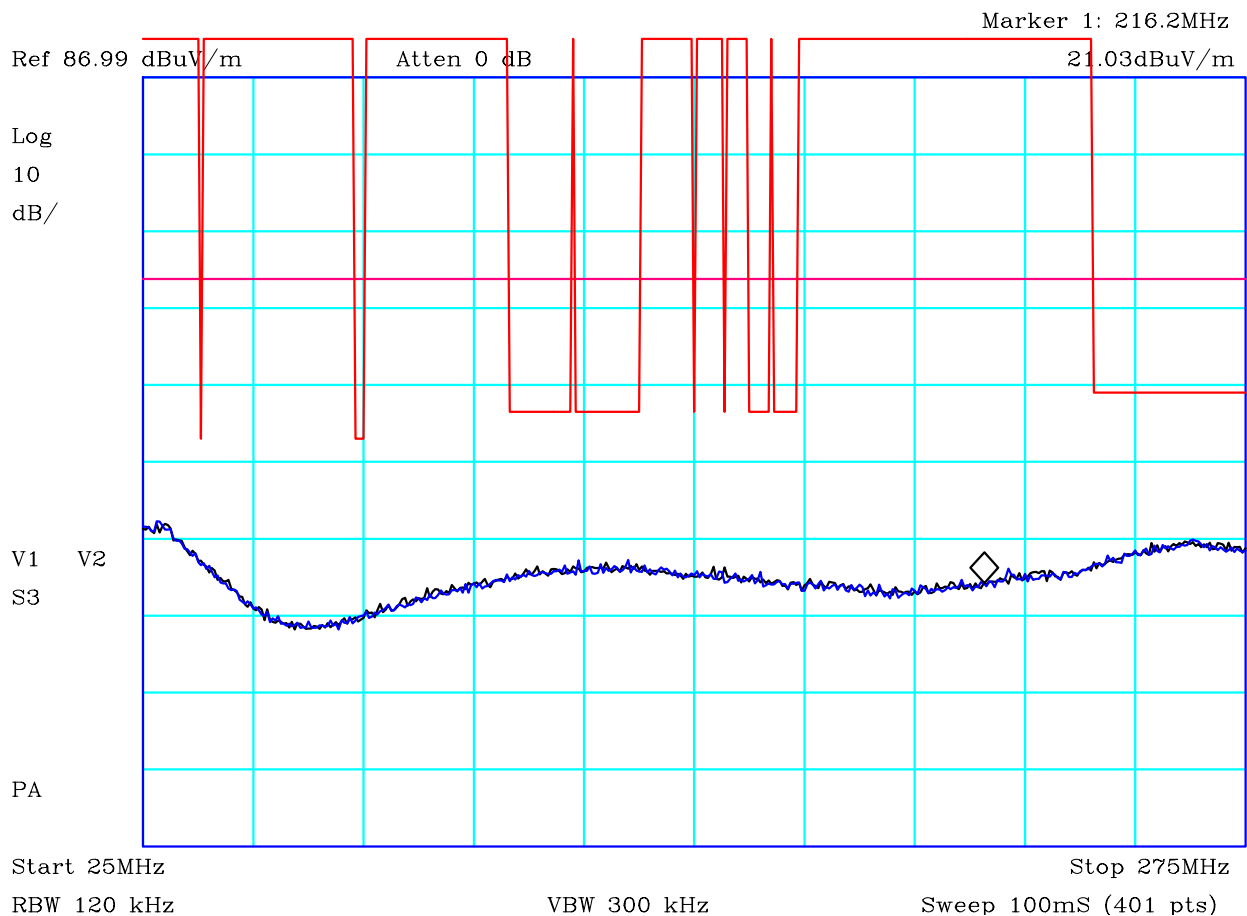
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	Test No: T3331		Test Report

4.5 Bandwidth - 15.231(c)

Factor Set 1:	-	-	-	-
Factor Set 2:	-	-	-	-
Factor Set 3:	-	-	-	-
Test Equipment: R8 A24				

Radiated Emissions


Company: Quatro Electronics Ltd		Product: MFS	
Date: 02/08/2010		Test Eng: Dave Smith	
Ports:			
Test: ANSI C63.4:2003		using limits of 15.231(c)	
Ports:			
Test:		using limits of	
Notes	Comments and Observations		
	<p>The bandwidth must not exceed 0.25% of operating frequency.</p> <p>In this case, as the operating frequency is 434.475MHz, the maximum allowable bandwidth is 1.09MHz</p> <p>Plot 6 shows emissions measurements over this band.</p> <p>The bandwidth is defined at points 20dB down from the carrier.</p> <p>From plot 6 it can be determined that</p> <p>-20dBc point to left of carrier = 434.4489 MHz</p> <p>-20dBc point to right of carrier = 434.4889 MHz</p> <p>Bandwidth = 40 kHz</p> <p>This is significantly below the maximum permitted of 1.09MHz.</p> <p>PASS</p>		

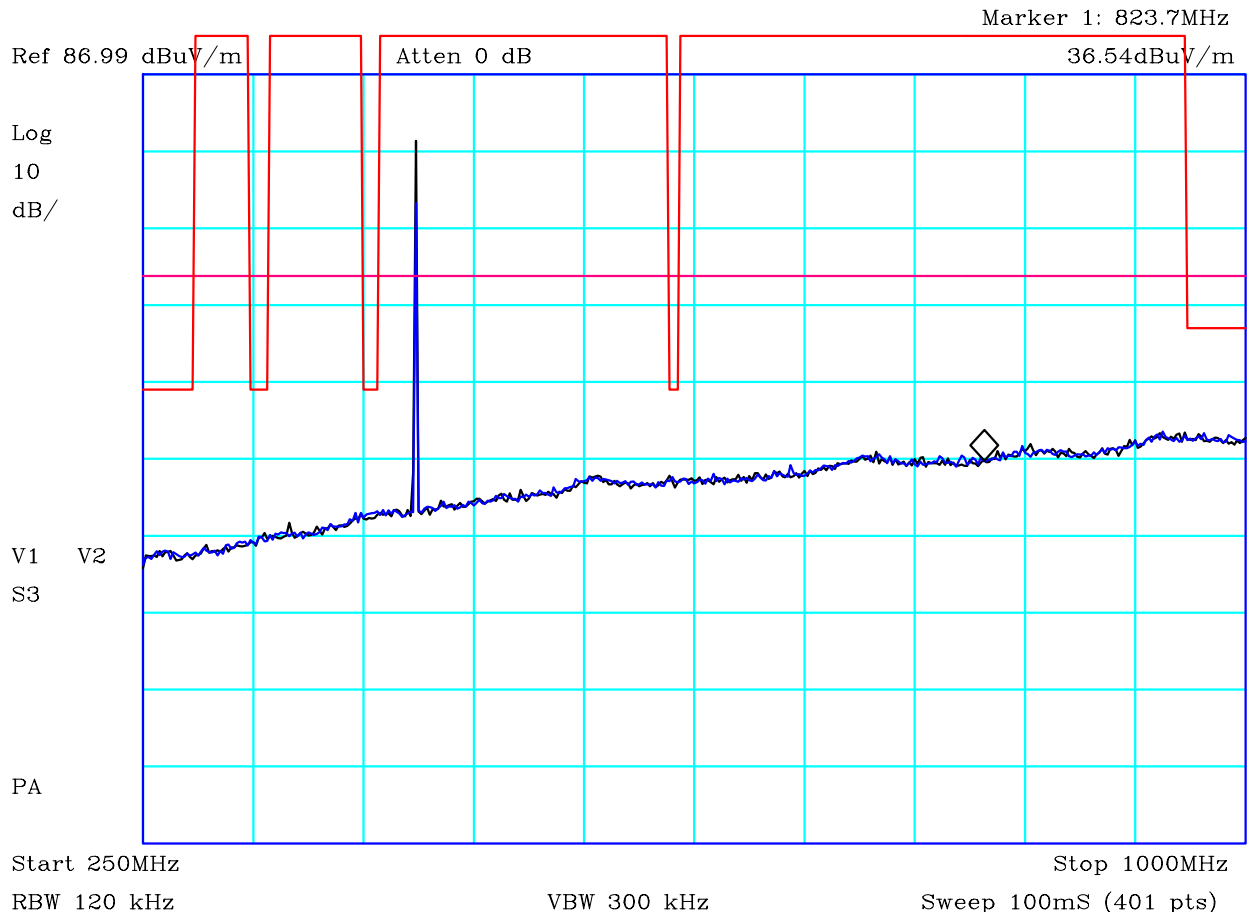


CF1:A5_FS_100208 CF2:CBL002_CBL003_090306

PLOT 1 Radiated Emissions - 25MHz to 275MHz

Company:	Quatro	Product:	MSF
Date:	02/08/2010	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(VIO)	FCC periodic	Limit2:(RED)	FCC Restricted Bands
Limit3:		Limit4:	
Transmitting Sample 5A Black - Vertical Blue - Horizontal			
Facility:	Anech_1	Height	1m
Distance	3m	Polarisation	V+H
Angle	0-360	File:	H070246B
Mode:	1	Modification State:	0


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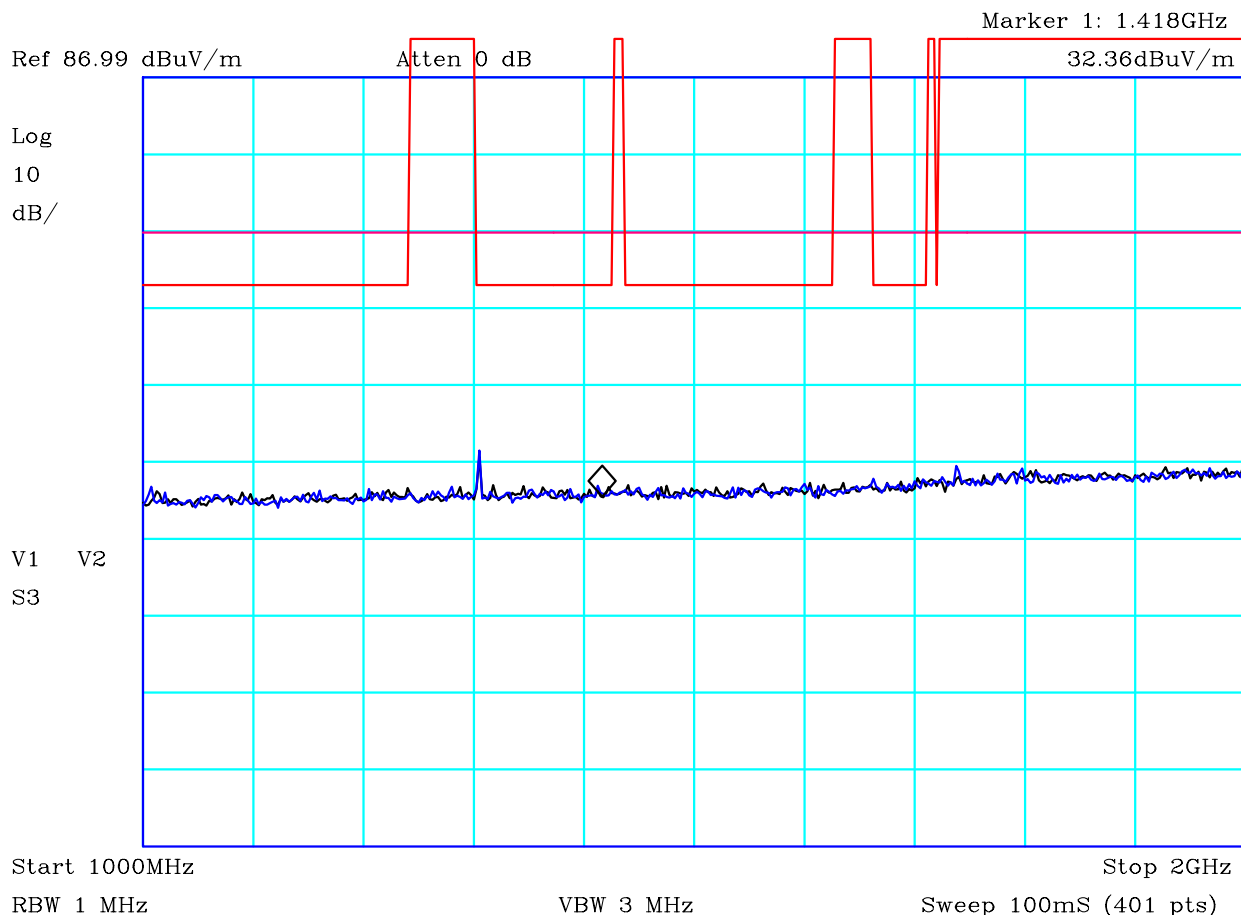


CF1:A5_FS_100208 CF2:CBL002_CBL003_090306

PLOT 2 Radiated Emissions - 250MHz to 1GHz

Company:	Quatro	Product:	MSF
Date:	02/08/2010	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(VIO)	FCC periodic	Limit2:(RED)	FCC Restricted Bands
Limit3:		Limit4:	
Transmitting Sample 5A Black - Vertical Blue - Horizontal			
Facility:	Anech_1	Height	1m
Distance	3m	Polarisation	V+H
Angle	0-360	File:	H0702470
Mode:	1	Modification State:	0


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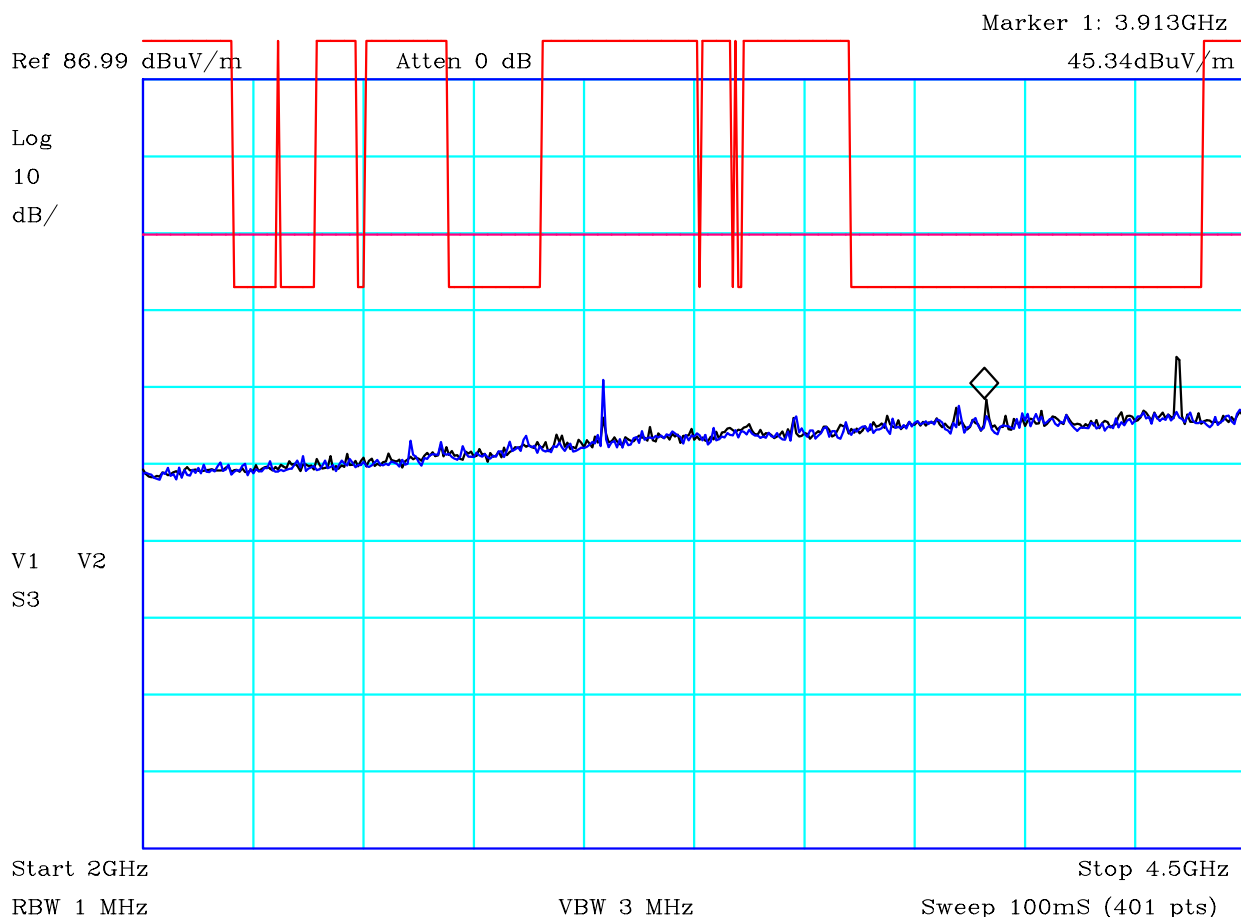


CF1:A8_3m_100208 CF2:CBL002_CBL003_090306 CF3:PRE7_100121 CF4:RFF11_090306

PLOT 3 Radiated Emissions - 1GHz to 2GHz

Company:	Quatro	Product:	MSF
Date:	02/08/2010	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(VIO)	FCC periodic@1.5m	Limit2:(RED)	FCC Restricted Bands@1.5m
Limit3:		Limit4:	
Transmitting Sample 5A Black - Vertical Blue - Horizontal			
Facility:	Anech_1	Height	1m
Distance	1.5m	Polarisation	V+H
Angle	0-360	File:	H07024B8
Mode:	1	Modification State:	0

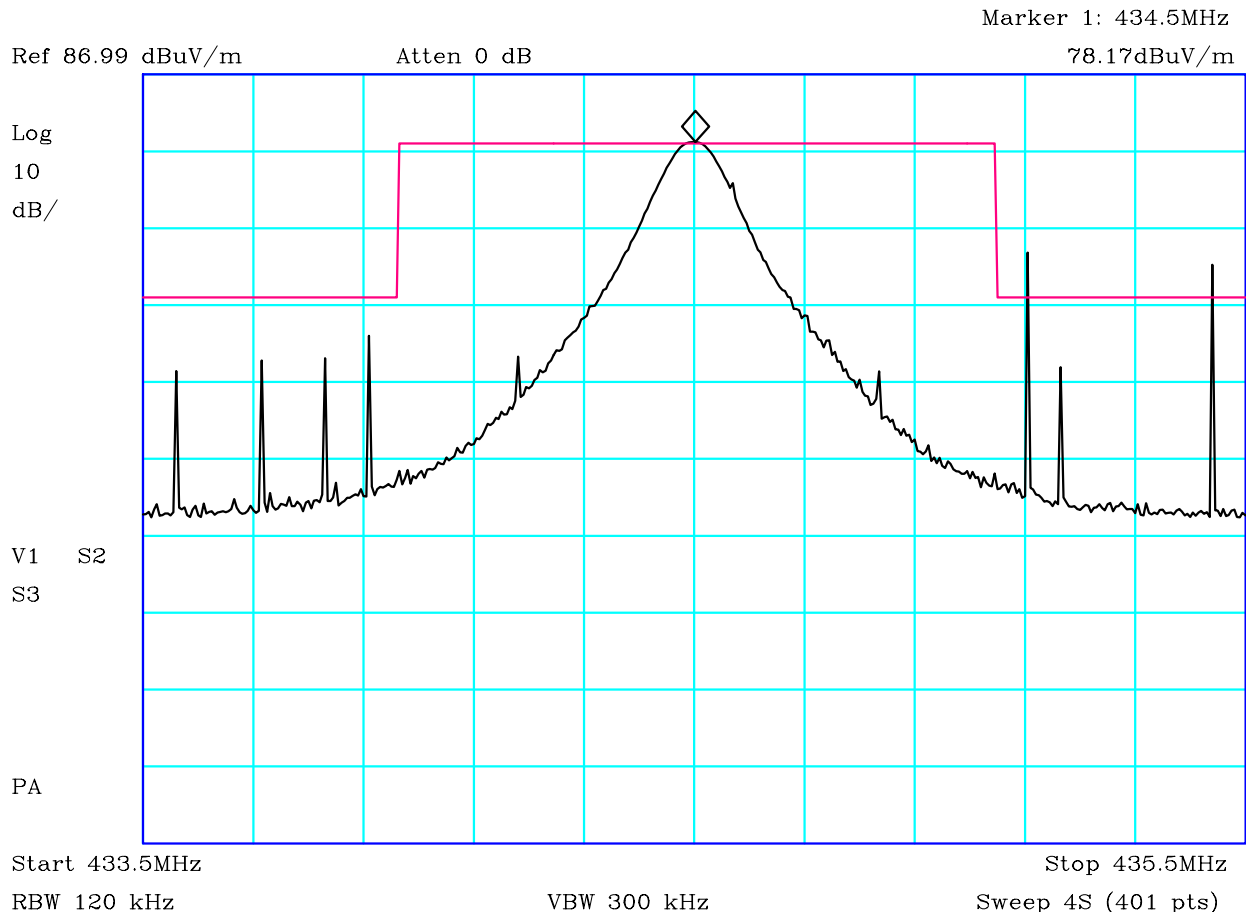
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CF1:A8_3m_100208 CF2:CBL002_CBL003_090306 CF3:PRE7_100121 CF4:RFF11_090306

PLOT 4 Radiated Emissions - 2GHz to 4.5MHz


Company:	Quatro	Product:	MSF
Date:	02/08/2010	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(VIO)	FCC periodic@1.5m	Limit2:(RED)	FCC Restricted Bands@1.5m
Limit3:		Limit4:	
Transmitting Sample 5A Black - Vertical Blue - Horizontal			
Facility:	Anech_1	Height	1m
Distance	1.5m	Polarisation	V+H
Angle	0-360	File:	H07024B3
Mode:	1	Modification State:	0

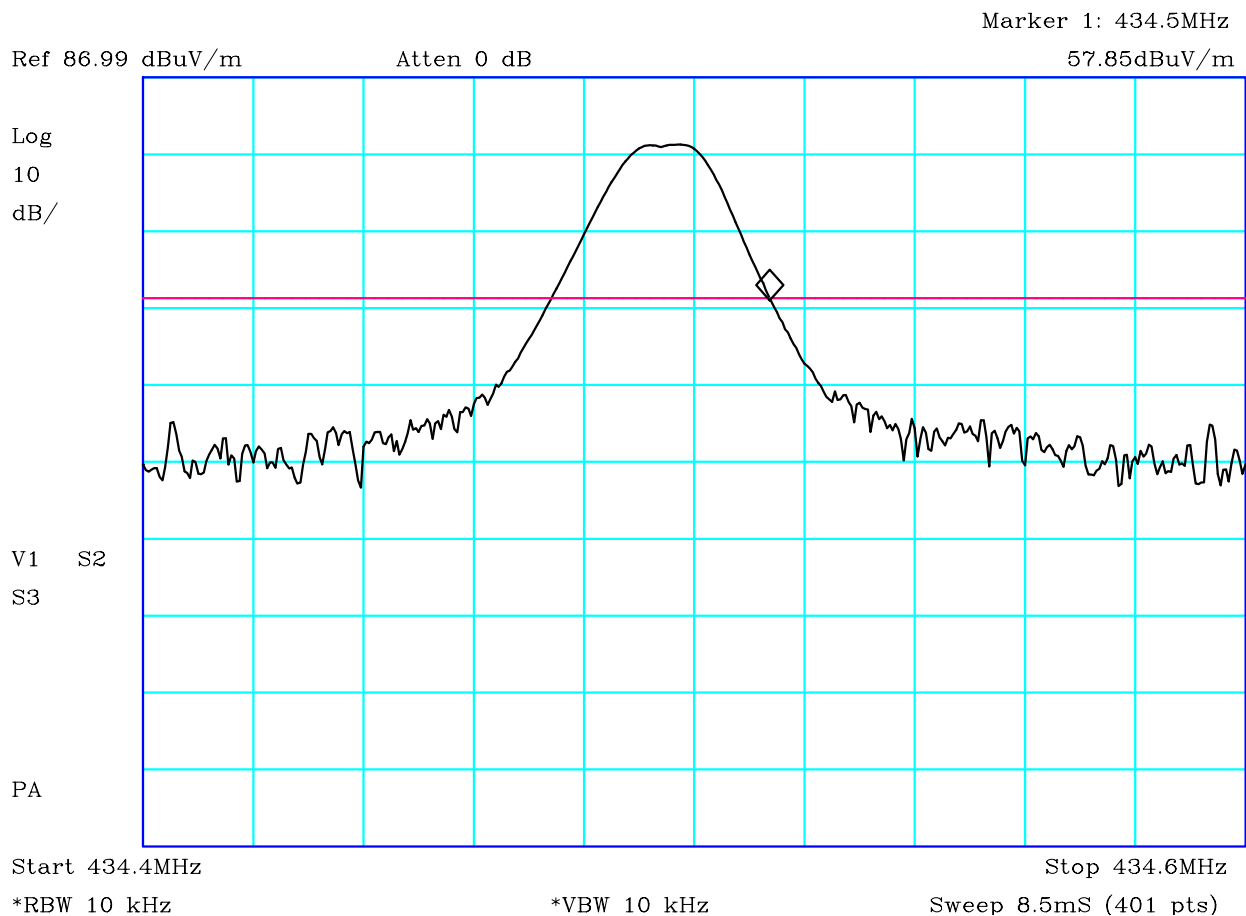


CF1:A5_FS_100208 CF2:CBL002_CBL003_090306

PLOT 5 Radiated Emissions - at Band Edges

Company:	Quatro	Product:	MFS
Date:	02/08/2010	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(VIO)	-20dBc ($\pm 0.125\%$ carrier)	Limit2:	
Limit3:		Limit4:	
<p>The band edges were assumed to be the maximum occupied band limits i.e. width = 0.25% of operating frequency. The limit shown is the carrier limit within the allowed occupied band (carrier $\pm 0.125\%$) and the spurious limit outside of this band.</p> <p>"Spikes" were transients when transmitter turns on. The quasi peaks levels of these transients were very low - see tabulated results for "Radiated Emissions at Band Edges".</p>			
Facility:	Anech_1	Height	1m
Distance	3m	Polarisation	V
Angle		File:	H070247D
		Mode:	1
		Modification State:	0

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CF1:A5_FS_100208 CF2:CBL002_CBL003_090306

PLOT 6 Bandwidth Plot

Company:	Quatro	Product:	MFS
Date:	02/08/2010	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(VIO)	-20dBc	Limit2:	
Limit3:		Limit4:	

-20dBc to left of peak = 434.4489MHz
-20dBc to right of peak = 434.4889MHz

Occupied bandwidth = 40kHz
Limit = 1.09MHz

Facility:	Anech_1	Height	1m	Mode:	1
Distance	3m	Polarisation	V	Modification State:	0
Angle		File:	H070248B		