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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

External Siren

dated

2nd March 2012

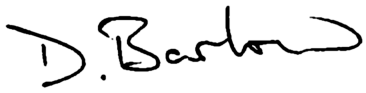
Document History

Issue	Date	Affected page(s)	Description of modifications	Revised by	Approved by
1	02/03/12		Initial release		

Based on report template:
v090319

Equipment Under Test (EUT):	External Siren
Test Commissioned by:	Quatro Electronics Ltd Quatro House School Lane Lytham Lancashire FY8 5NL
Representative:	Dave Smith
Test Started:	21st February 2012
Test Completed:	28th February 2012
Test Engineer:	Dave Smith
Date of Report:	2nd March 2012

Written by: Dave Smith — Checked by: Derek Barlow

Signature:  Signature: 

Date: 28th February 2012 — Date: 2nd March 2012

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	*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.

Emissions Test Results Summary

CFR 47 **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.

Contents

1 EUT Details

1.1 General

The EUT was an External Siren with a 434.475MHz intentional transmitter. The transmitter is intended for periodic operation and was therefore tested to FCC part 15.231.

The device also contains an associated receiver but since it forms part of a transceiver it is only subject to verification. Measurements on the reciver are not included in this test report.

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	External SIREN	EUT	US	

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.

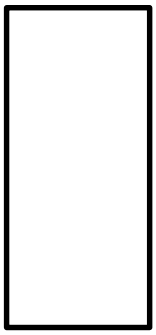
Mod No:	Details	Implemented for
0	Original unit.	
1	Pi attenuator with 56R series element and 100R shunt elements.	Radiated_Emissions

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. Individual test result sheets reference the operating mode of the EUT.

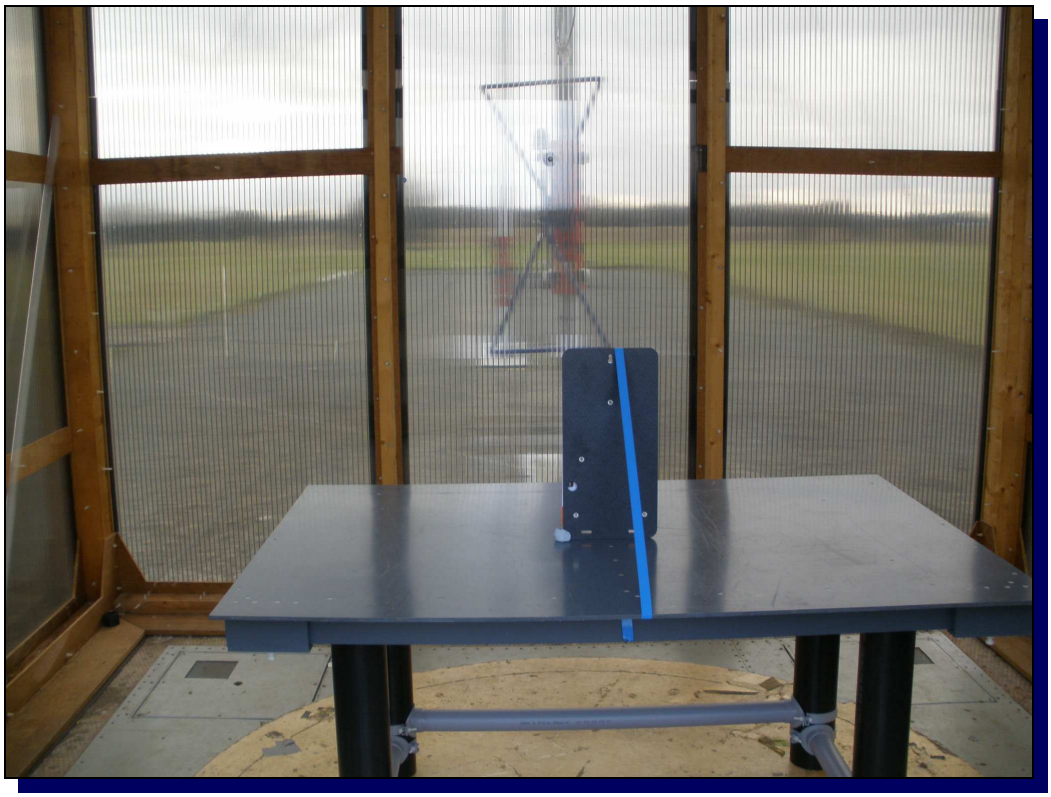
Operating Mode	Details
1	Pulsed transmission at 434.475MHz. Fot the purposes of the test the transmitter was operated with a high duty cycle. In normal operation the transmitter is continuously on for a duration of more than 100msec and so no additional reduction in levels could be made by calculating an average based on duty cycle.

Figure 1 General Arrangement of EUT and Peripherals



EUT had an integral antenna and no external cables

Photograph 1 Front



Photograph 2 Back

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 Date	Cal interval
A23	EMCO 3115 DR Guide (1-18GHz)	4982	31/01/2012	1 year
A24	Chase X-wing Bilog CBL6144 26MHz-3GHz	27590	18/11/2011	1 year
A5	Chase Bilog CBL6111A	1760	31/01/2012	1 year
PRE7	LUCIX 0.1GHz to 20GHz	24485	08/01/2012	1 year
R4	R&S ESVS10	421872	16/12/2011	1 year
R9	Agilent E7405A Spectrum Analyser	MY45110758	21/11/2011	1 year
RFF11	High Pass RF Filter 890MHz to 22GHz	11	20/12/2011	1 year

3 Test Methods

3.1 Intermittent Operation - 15.231(a)

The output of the unit is coupled into a spectrum analyser which is set to the carrier frequency with zero span and a suitable timebase to capture one whole transmit burst. The unit is put into operation and the output captured for a single transmit burst. The plot of the transmitter output is used to measure the total duration of the transmission. Manufacturer statements are used to provide information on frequency of operation and supervisory signals.

3.2 Radiated Emissions - 15.231(b)

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:

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

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

3.3 Bandwidth - 15.231(c)

The output of the unit is coupled into a spectrum analyser on which the centre frequency is set to the carrier frequency of the transmission. The analyser is set to a narrow bandwidth (10kHz) and the span is adjusted such that the points at each side of the centre frequency which are 20dB down from the peak level can be displayed. The marker is used to identify the frequencies at which the level is 20dB below the maximum level both above and below the carrier frequency. The difference between these frequencies is the bandwidth of the transmission.

4 Test Results

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

4.1 Intermittent Operation Information - 15.231(a)

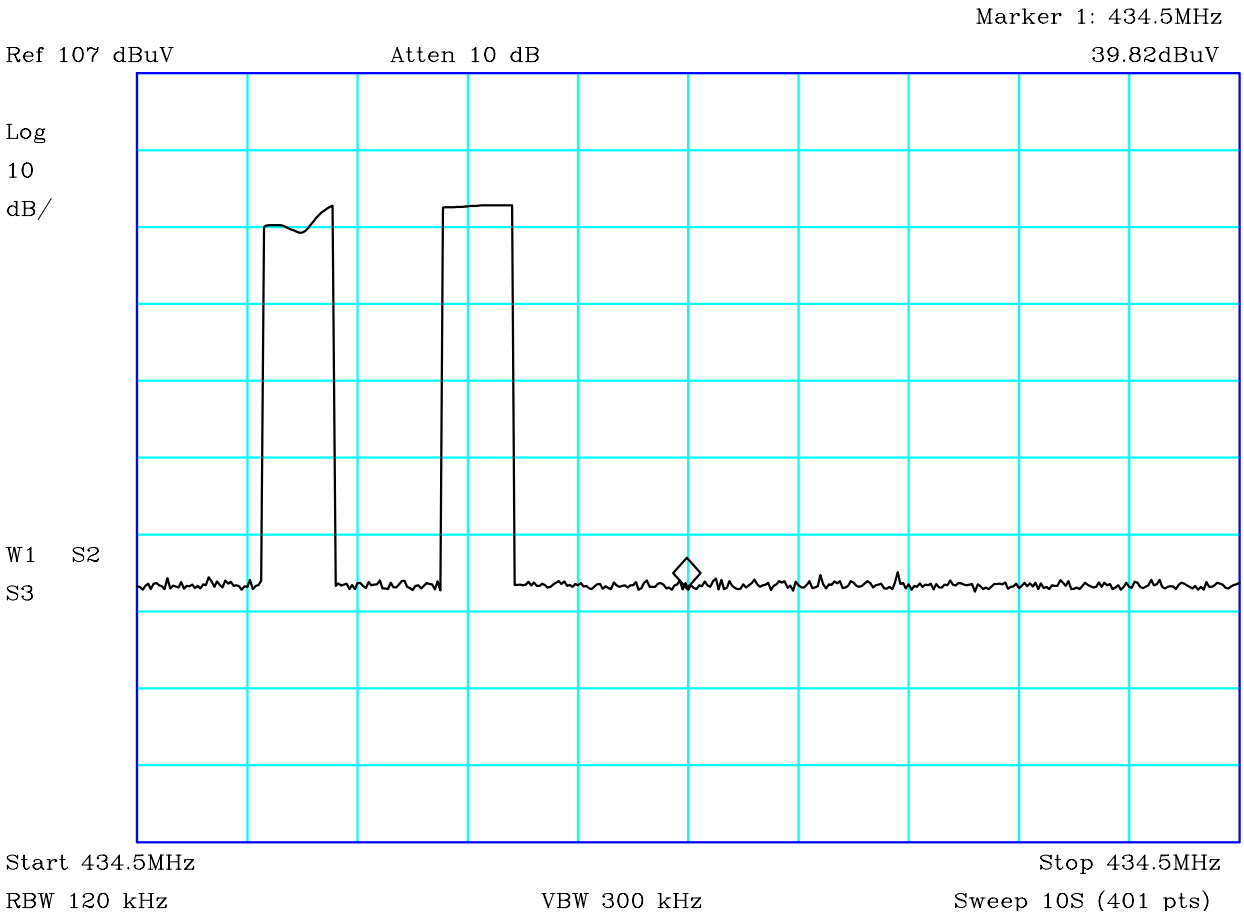
The operation of the transmitter is controlled by a microprocessor. The transmitter is activated by movement detection.

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:

- it is an automatically operated device which transmits for a period of less than 5 seconds.
- 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.



Plot shows total transmitter activation time as less than 2 seconds.

4.2 Radiated Emissions Results - Carrier - 15.231(b)

Factor Set 1: A5_FS_10C CBL015_11A - -
Factor Set 2: - - - -
Factor Set 3: - - - -
Test Equipment: R4 A5

Radiated Emissions

Company: Quatro Electronics Ltd *Product:* External Siren
Date: 21/02/2012 *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_C dBuV/m	Margin FCC_C dB	Notes
2	1	1	3	1	434.476	V	55.5	20.4		75.9	80.8	4.9	
2	1	1	3	1	434.476	H	54.4	20.4		74.8	80.8	6.0	

Results	**Minimum Margin**	**4.9 dB**	
	PASS/FAIL	**PASS**	

Notes	Comments and Observations
	All measurements made with a quasi-peak detector. The EUT is NOT hand held and is always installed in the same orientation. The tests were performed in this orientation.

4.3 Radiated Emissions - Spurious below 1GHz - 15.231(b)

Factor Set 1: A5_FS_10C CBL015_11A - -
Factor Set 2: - - - -
Factor Set 3: - - - -
Test Equipment: R4 A5

Radiated Emissions

Company: Quatro Electronics Ltd *Product:* External Siren
Date: 21/02/2012 *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_C dBuV/m	Margin FCC_C dB	Notes
5	1	1	3	1	433.932	V	2.0	20.4		22.4	60.8	38.4	
5	1	1	3	1	433.932	H	2.2	20.4		22.6	60.8	38.2	
5	1	1	3	1	435.018	V	3.8	20.4		24.2	60.8	36.6	
5	1	1	3	1	435.018	H	2.0	20.4		22.4	60.8	38.4	
2	1	1	3	1	868.957	V	23.5	29.3		52.8	60.8	8.0	
2	1	1	3	1	868.957	H	13.3	29.3		42.6	60.8	18.2	

Results	**Minimum Margin**	**8.0 dB**	
	PASS/FAIL	**PASS**	

Notes	Comments and Observations
	The band edges were assumed to be at the maximum permitted occupied band limits i.e. +/- 0.125% above and below the operating frequency. All measurements made with 120kHz QP detector.

4.4 Radiated Emissions Results - Spurious above 1GHz - 15.231(b)

Factor Set 1:	A23_3m_10A PRE7_CBL052_CBL093_11A RFF11_10A -	
Factor Set 2:	A23_3m_10A PRE7_11A RFF11_10A CBL059_CBL018_CBL065_CBL060_10A	1 m cable
Factor Set 3:	- - - -	
Test Equipment:	R9 A23 PRE7 RFF11	

Radiated Emissions

Company:	Quatro Electronics Ltd	*Product:*	External Siren
Date:	22/02/2012	*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
3	1	1	3	2	1303.599	V	51.5	-11.2		40.2	54.0	13.8	
3	1	1	3	2	1303.599	H	48.7	-11.2		37.5	54.0	16.5	
4	1	1	3	1	3475.850	V	50.5	-8.3		42.2	54.0	11.8	
4	1	1	3	1	3475.850	H	48.0	-8.3		39.7	54.0	14.3	
4	1	1	3	1	3910.310	V	54.0	-6.6		47.4	54.0	6.6	
4	1	1	3	1	3910.310	H	51.4	-6.6		44.9	54.0	9.1	
4	1	1	3	1	4344.725	V	52.7	-6.9		45.8	54.0	8.2	
4	1	1	3	1	4344.725	H	52.5	-6.9		45.5	54.0	8.5	

Results	**Minimum Margin**	**6.6**	**dB**
	PASS/FAIL	**PASS**	

Notes	Comments and Observations
	Results of scans shown in plots 3 and 4. Measurements made with 1MHz BW peak detector.

4.5 Bandwidth - 15.231(c)

Radiated Emissions

Company:	Quatro Electronics Ltd	*Product:*	External Siren
Date:	22/02/2012	*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

The bandwidth must not exceed 0.25% of operating frequency.

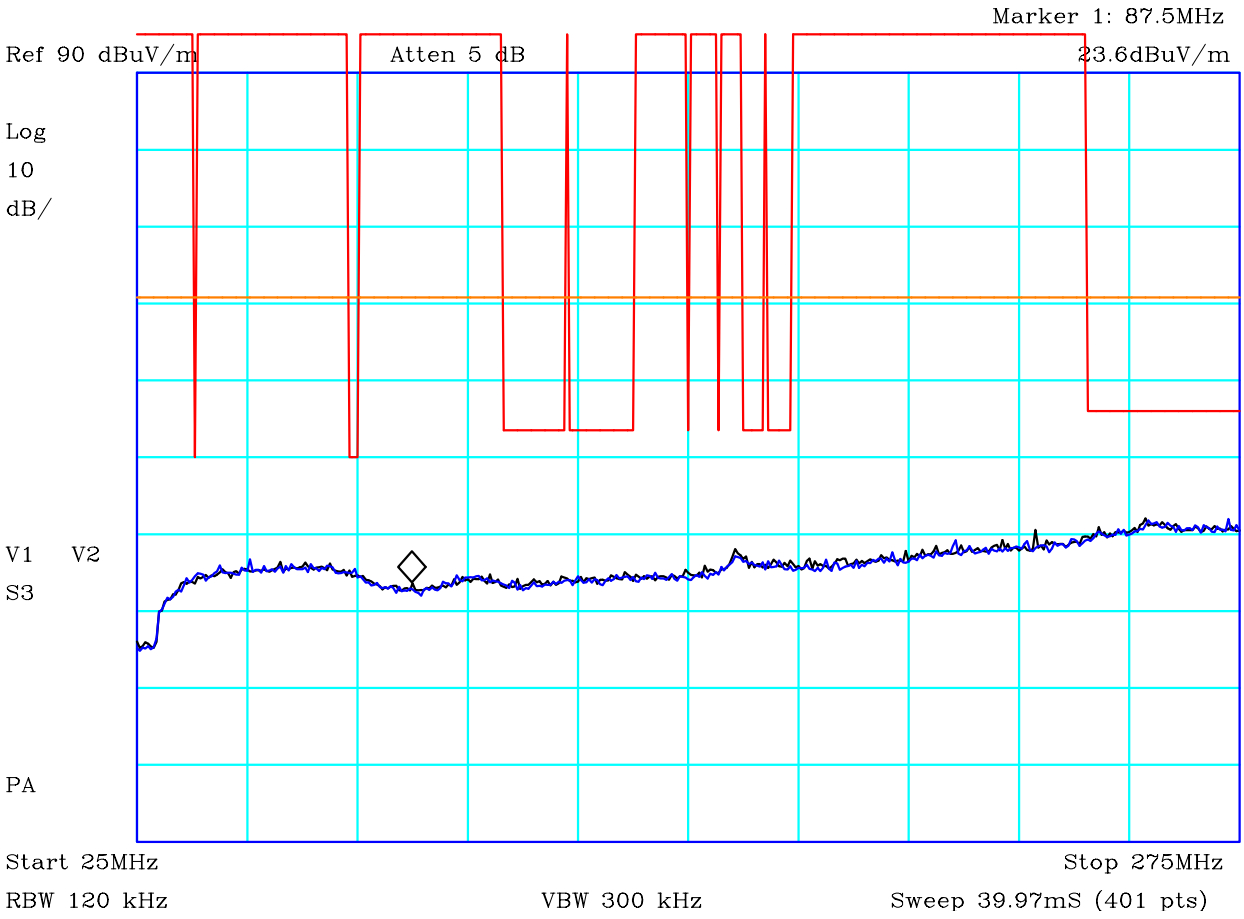
In this case, as the operating frequency is 434.475MHz, the maximum allowable bandwidth is 1.09MHz
Plot 6 shows emissions measurements over this band.

The bandwidth is defined at points 20dB down from the carrier.

The bandwidth was measured as 40.5kHz.

This is significantly below the maximum permitted bandwidth of 1.09MHz.

PASS



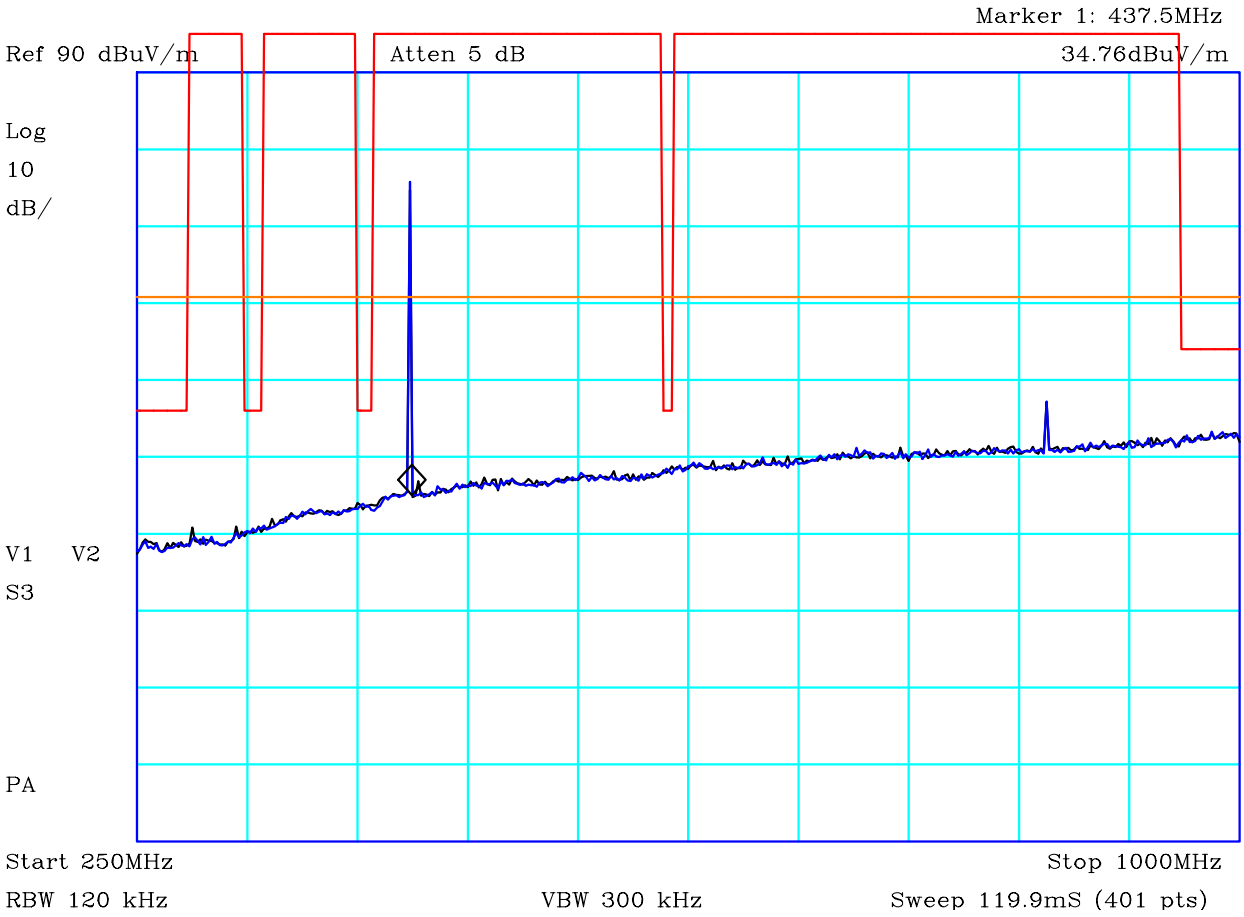
CF1:A24_3m_101116 CF2:CBL059_CBL018_CBL065_CBL060_100806

PLOT 1 Radiated Emissions - 25MHz to 275MHz

Company:	Quatro	Product:	External Siren
Date:	22nd February 2012	Test Eng:	Dave Smith
Method:	Ansi C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands	Limit2:(ORG)	15.23
Limit3:		Limit4:	

Black: Vertical
Blue: Horizontal

Facility:	Anech_2	Height	1.5m	Mode:	1
Distance	3m	Polarisation	V+H	Modification State:	1
Angle	0-360	File:	H21224DE		



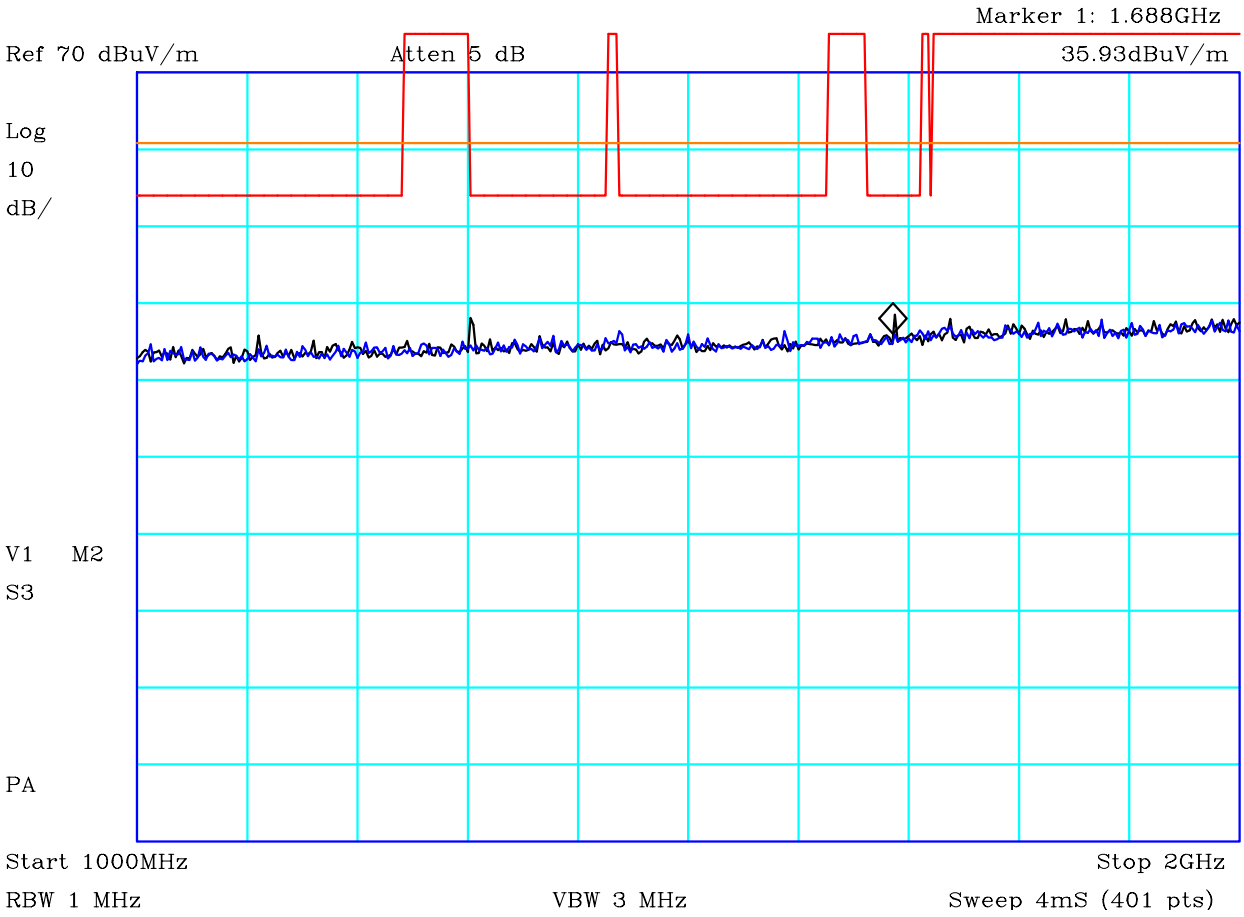
CF1:A24_3m_101116 CF2:CBL059_CBL018_CBL065_CBL060_100806

PLOT 2 Radiated Emissions - 250MHz to 1GHz

Company:	Quatro	Product:	External Siren
Date:	22nd February 2012	Test Eng:	Dave Smith
Method:	Ansi C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands	Limit2:(ORG)	15.23
Limit3:		Limit4:	

Black: Vertical
Blue: Horizontal

Facility:	Anech_2	Height	1m,.5m,2m	Mode:	1
Distance	3m	Polarisation	V+H	Modification State:	1
Angle	0-360	File:	H21224D9		



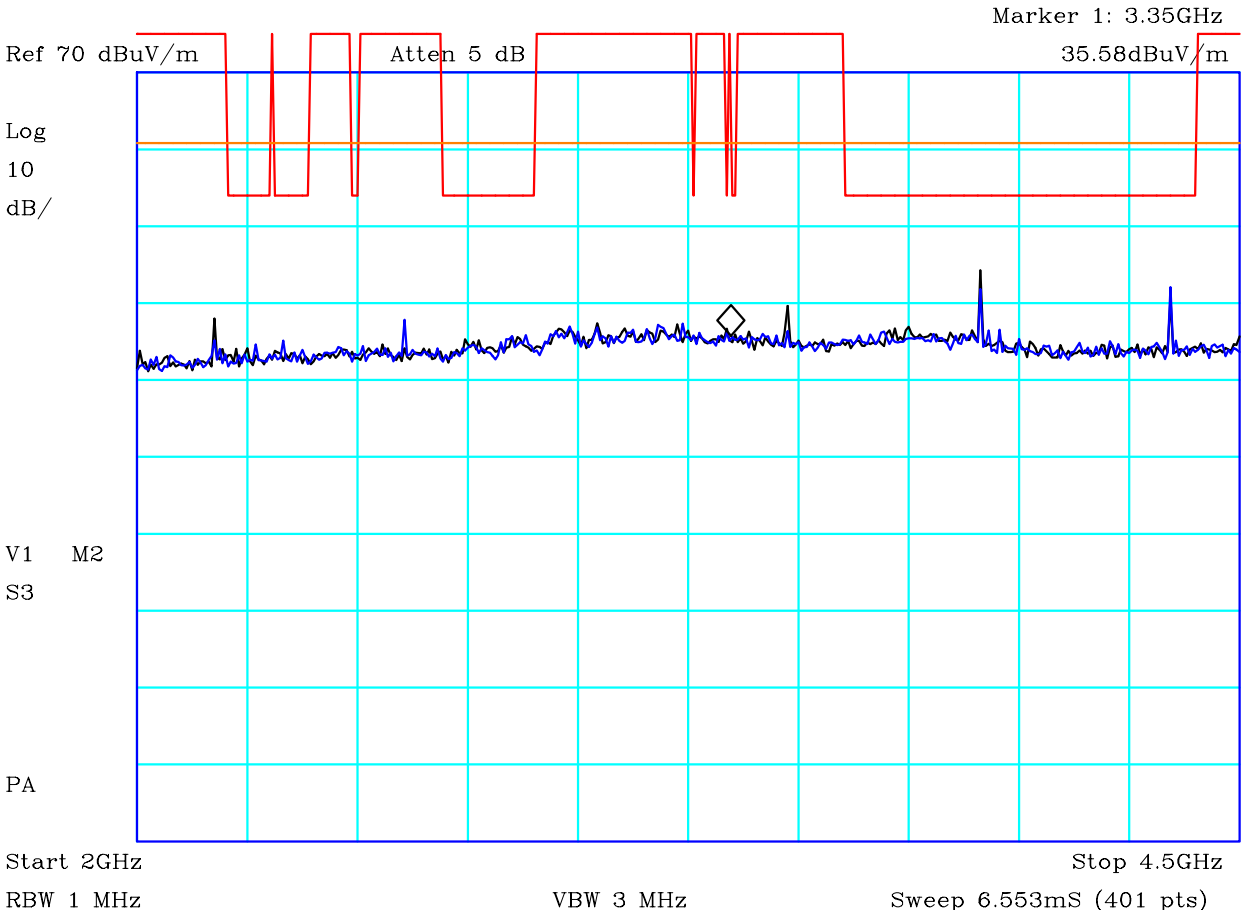
CF1:A23_3m_100806 CF2:PRE7_110112 CF3:RFF11_100806 CF4:CBL059_CBL018_CBL065_CBL060_100806

PLOT 3 Radiated Emissions - 1GHz to 2GHz

Company:	Quatro	Product:	External Siren
Date:	22nd February 2012	Test Eng:	Dave Smith
Method:	Ansi C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands	Limit2:(ORG)	15.23
Limit3:		Limit4:	

Black: Vertical
Blue: Horizontal

Facility:	Anech_2	Height	1.5m	Mode:	1
Distance	3m	Polarisation	V+H	Modification State:	1
Angle	0-360	File:	H212249D		



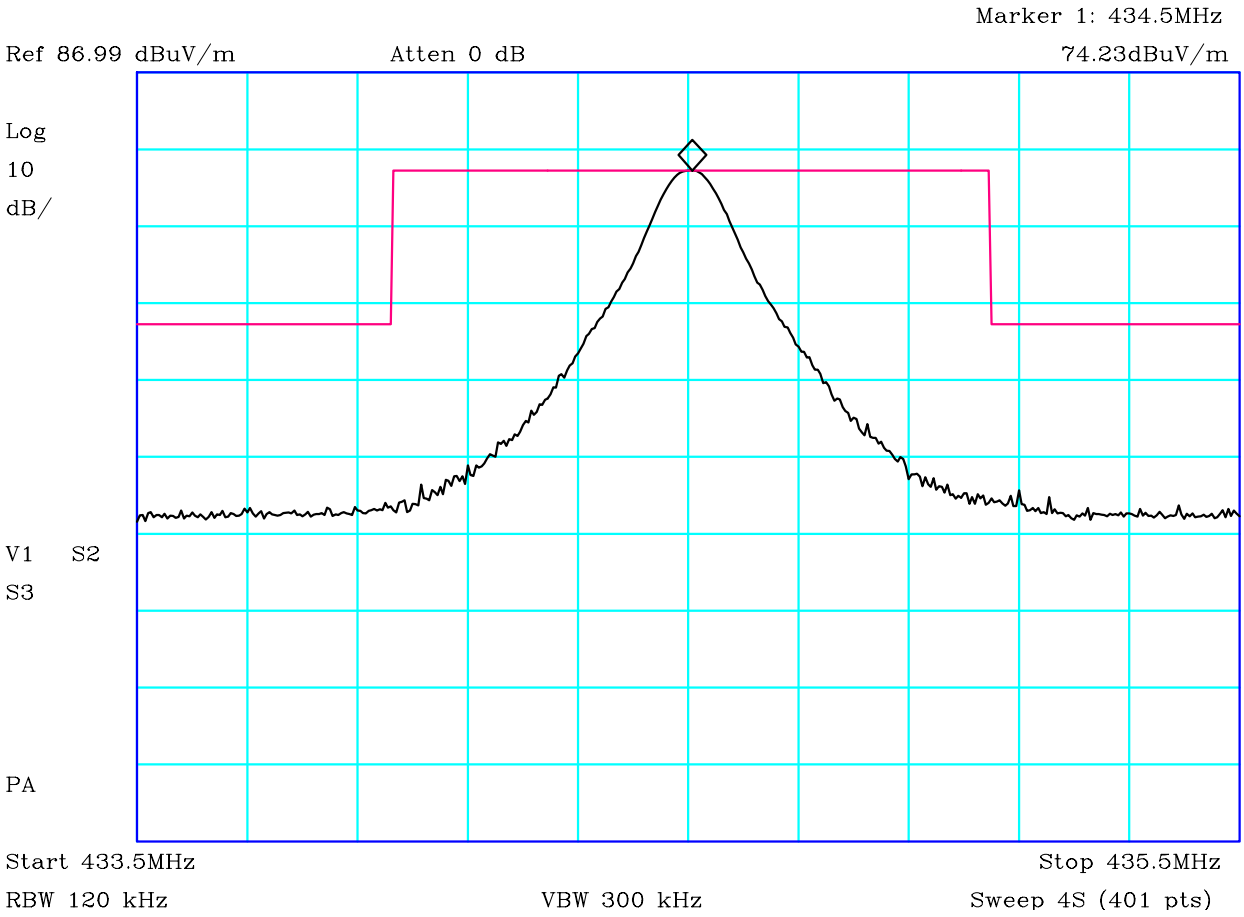
CF1:A23_3m_100806 CF2:PRE7_CBL052_CBL093_110112 CF3:RFF11_100806

PLOT 4 Radiated Emissions - 2GHz to 4.5GHz

Company:	Quatro	Product:	External Siren
Date:	22nd February 2012	Test Eng:	Dave Smith
Method:	Ansi C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands	Limit2:(ORG)	15.23
Limit3:		Limit4:	

Black: Vertical
Blue: Horizontal

Facility:	Anech_2	Height	1.5m	Mode:	1
Distance	3m	Polarisation	V+H	Modification State:	1
Angle	0-360	File:	H212244C		



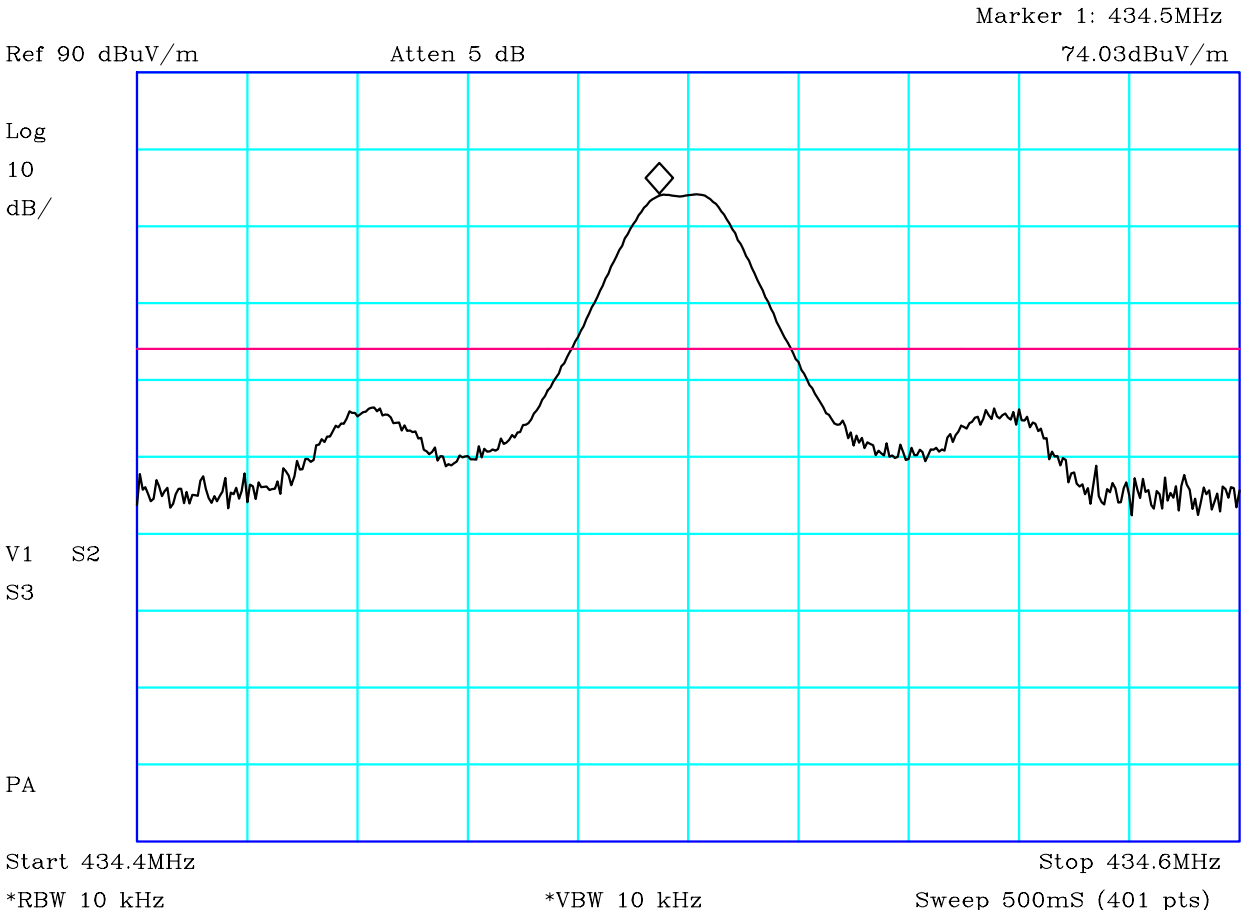
CF1:A24_3m_101116 CF2:CBL059_CBL062_CBL065_CBL060_090306

PLOT 5 Radiated Emissions - Band Edges

Company:	Quatro	Product:	External Siren
Date:	22nd February 2012	Test Eng:	Dave Smith
Method:	Ansi C63.4	Method:	
Limit1:(VIO)	-20dBc (0.125% carrier)	Limit2:	
Limit3:		Limit4:	

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 +/- 0.125%) and the spurious limit outside of this band.

Facility:	Anech_2	Height	1m	Mode:	1
Distance	3m	Polarisation	V	Modification State:	1
Angle	0-360	File:	H2122519		



CF1:A24_3m_101116 CF4:CBL059_CBL018_CBL065_CBL060_100806

PLOT 6 Occupied Bandwidth

Company:	Quatro	Product:	External Siren
Date:	22nd February 2012	Test Eng:	Dave Smith
Method:	Ansi C63.4	Method:	
Limit1:(VIO)	-20dBc	Limit2:	
Limit3:		Limit4:	

-20dBc to left of peak: 434.4555MHz
-20dBc to right of peak: 434.496MHz
Occupied bandwidth = 40.05kHz
Limit = 1.09MHz

Facility:	Anech_2	Height	1m	Mode:	1
Distance	3m	Polarisation	V	Modification State:	1
Angle	0-360	File:	H2122508		