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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

Remote Keypad

dated

25th January 2012

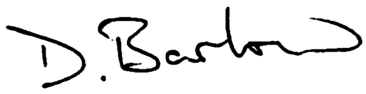
Document History

Issue	Date	Affected page(s)	Description of modifications	Revised by	Approved by
1	25/02/12		Initial release		

Based on report template:
v090319

Equipment Under Test (EUT):	Remote Keypad
Test Commissioned by:	Quatro Electronics Ltd Quatro House School Lane Lytham FY8 5NL
Representative:	Dave Smith
Test Started:	12th December 2011
Test Completed:	12th December 2011
Test Engineer:	Dave Smith
Date of Report:	25th January 2012

Written by: Dave Smith — Checked by: Derek Barlow

Signature:  Signature: 

Date: 25th January 2012 — Date: 30th January 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 a Remote Keypad with a 434.475MHz intentional transmitter. The transmitter is intended for periodic operation and was therefore tested to FCC part 15.231.

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	Remote Keypad	EUT		

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.

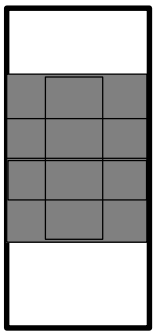
Mod No:	Details	Implemented for
0	As received. No modifications were made during the course of testing.	

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. 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.

Figure 1 General Arrangement of EUT and Peripherals



Eut had an integral antenna and no external cables

Photograph 1 EUT - Front

Photograph 2 EUT - 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
A12	Chase Bilog CBL6111A	1012	25/01/2011	1 year
A19	EMCO 3115 DR Guide (1-18GHz)	2431	25/01/2011	1 year
A24	Chase X-wing Bilog CBL6144 26MHz-3GHz	27590	18/11/2011	1 year
PRE7	LUCIX 0.1GHz to 20GHz	24485	11/01/2011	1 year
R8	Agilent E7405A Spectrum Analyser	MY44212494	19/09/2011	1 year
RFF11	High Pass RF Filter 890MHz to 22GHz	11	20/12/2011	1 year

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:

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.

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)

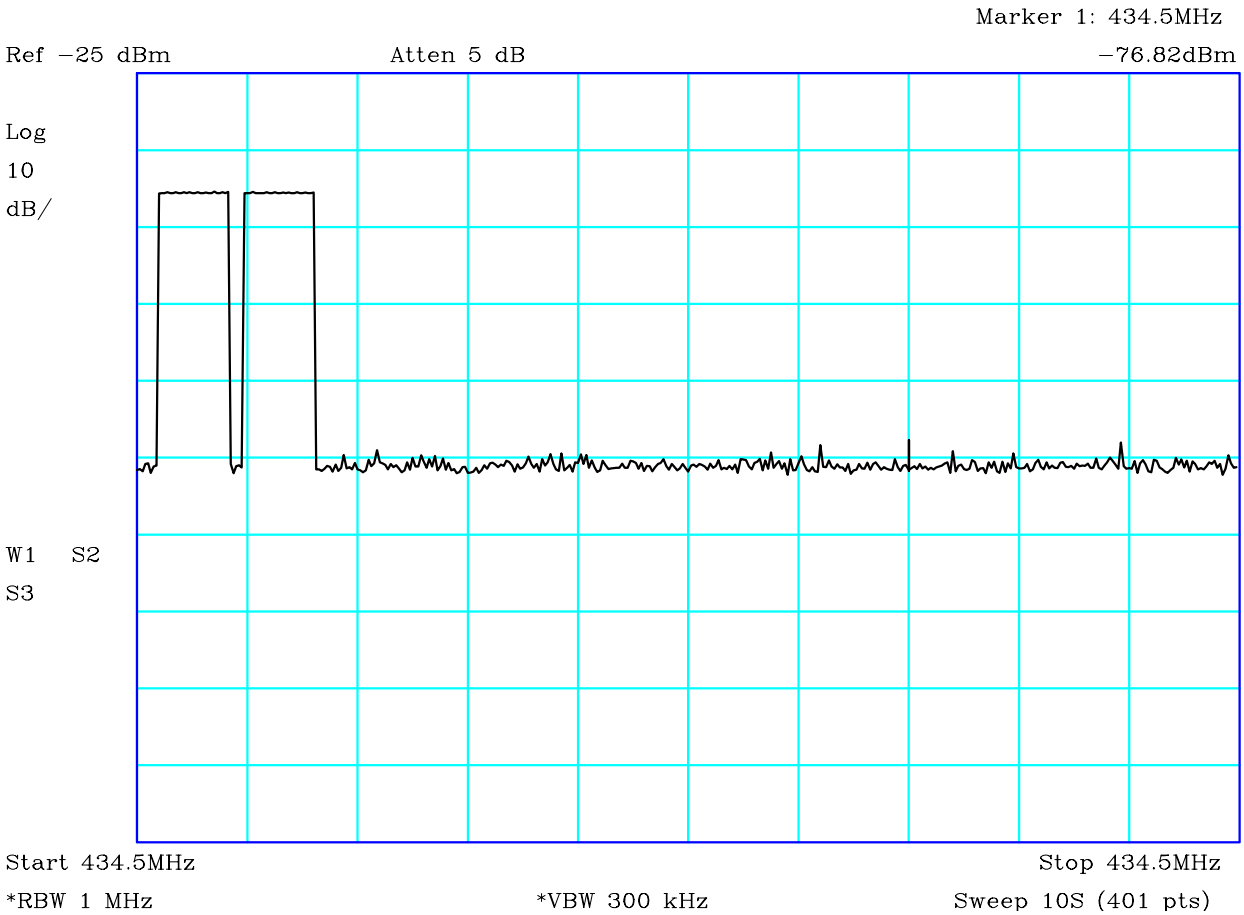
The operation of the transmitter is controlled by a microprocessor. The transmitter is activated by manually entering a key code or presenting a contact tag.

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 manually 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: A12_FS_10B CBL015_11A - -
Factor Set 2: A19_3m_10A PRE7_CBL052_CBL093_11A RFF11_10A -
Factor Set 3: - - - -
Test Equipment: R8 A12 A19 PRE7 RFF11

Radiated Emissions

Company: Quatro Electronics Ltd *Product:* Remote Keypad
Date: 12/12/2011 *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	0	3	1	434.480	V	55.4	20.8		76.1	80.8	4.7	qp
2	1	0	3	1	434.480	H	44.7	20.8		65.4	80.8	15.4	qp

Results	**Minimum Margin**	**4.7 dB**	
	PASS/FAIL	**PASS**	

Notes	Comments and Observations
	Results of scans shown in plot 2

Key: qp - quasi-peak, av - average, pk - peak

4.3 Radiated Emissions - Spurious below 1GHz and at Band Edges- 15.231(b)

Factor Set 1: A12_FS_10B CBL015_11A - -
Factor Set 2: A19_3m_10A PRE7_CBL052_CBL093_11A RFF11_10A -
Factor Set 3: - - - -
Test Equipment: R8 A12 A19 PRE7 RFF11

Radiated Emissions

Company: Quatro Electronics Ltd *Product:* Remote Keypad
Date: 12/12/2011 *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	0	3	1	433.932	V	10.5	20.8		31.2	60.8	29.6	qp
2	1	0	3	1	433.932	H	4.4	20.8		25.2	60.8	35.6	qp
2	1	0	3	1	435.018	V	11.9	20.8		32.7	60.8	28.1	qp
2	1	0	3	1	435.018	H	6.2	20.8		27.0	60.8	33.8	qp
2	1	0	3	1	868.960	V	30.4	29.3		59.7	60.8	1.1	qp
2	1	0	3	1	868.960	H	23.3	29.3		52.5	60.8	8.3	qp

Results	**Minimum Margin**	**1.1 dB**	
	PASS/FAIL	**PASS**	

Notes	Comments and Observations

Results of scans shown in plots 1, 2 and 5.

The EUT is NOT hand held and is always installed in the same orientation.
The tests were performed in this orientation.
It was considered unnecessary to repeat the tests in three orthoganol planes.

The band edges were assumed to be at the maximum permitted occupied band limits i.e. +/- 0.125% above and below the operating frequency.

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.

To establish that these transients were not an issue, quasi peak measurements were made at the nominal band edge points as shown above.

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

Factor Set 1: A12_FS_10B CBL015_11A - -
Factor Set 2: A19_3m_10A PRE7_CBL052_CBL093_11A RFF11_10A -
Factor Set 3: - - - -
Test Equipment: R8 A12 A19 PRE7 RFF11

Radiated Emissions

Company: Quatro Electronics Ltd *Product:* Remote Keypad
Date: 12/12/2011 *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
4	1	0	3	2	3475.800	V	56.7	-8.6		48.1	54.0	5.9	Av
4	1	0	3	2	3475.800	H	52.2	-8.6		43.6	54.0	10.4	Av
4	1	0	3	2	3910.275	V	57.0	-7.0		50.0	54.0	4.0	Av
4	1	0	3	2	3910.275	H	57.2	-7.0		50.2	54.0	3.8	Av
4	1	0	3	2	4344.800	V	45.7	-6.9		38.8	54.0	15.2	Av
4	1	0	3	2	4344.800	H	47.3	-6.9		40.4	54.0	13.6	Av
4	1	0	3	2	3475.800	V	58.9	-8.6		50.3	74.0	23.7	Pk
4	1	0	3	2	3475.800	H	55.7	-8.6		47.1	74.0	26.9	Pk
4	1	0	3	2	3910.275	V	59.2	-7.0		52.1	74.0	21.9	Pk
4	1	0	3	2	3910.275	H	60.0	-7.0		52.9	74.0	21.1	Pk
4	1	0	3	2	4344.800	V	51.5	-6.9		44.6	74.0	29.4	Pk
4	1	0	3	2	4344.800	H	52.5	-6.9		45.6	74.0	28.4	Pk

Results	**Minimum Margin**	**3.8 dB**	
	PASS/FAIL	**PASS**	

Notes	Comments and Observations
	Results of scans shown in plots 3 and 4.

Key: qp - quasi-peak, av - average, pk - peak

4.5 Bandwidth - 15.231(c)

Test Equipment: R8 A24

Radiated Emissions

Company:	Quatro Electronics Ltd	*Product:*	Remote Keypad
Date:	12/12/2011	*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.

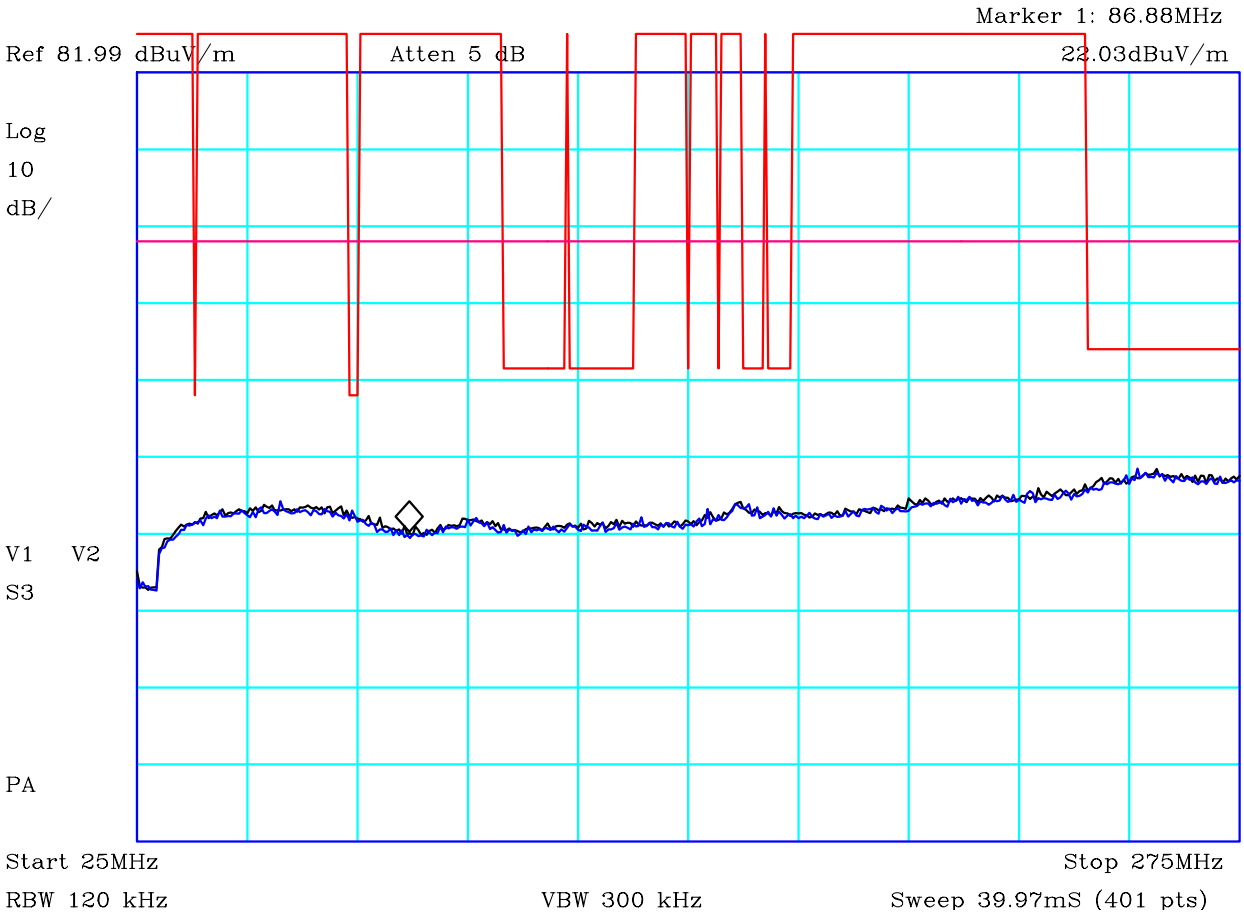
From plot 5 it can be determined that

-20dBc point to left of carrier = 434.4560 MHz
-20dBc point to right of carrier = 434.4985 MHz

Bandwidth = 42.5 kHz

This is significantly below the maximum permitted of 1.09MHz.

PASS



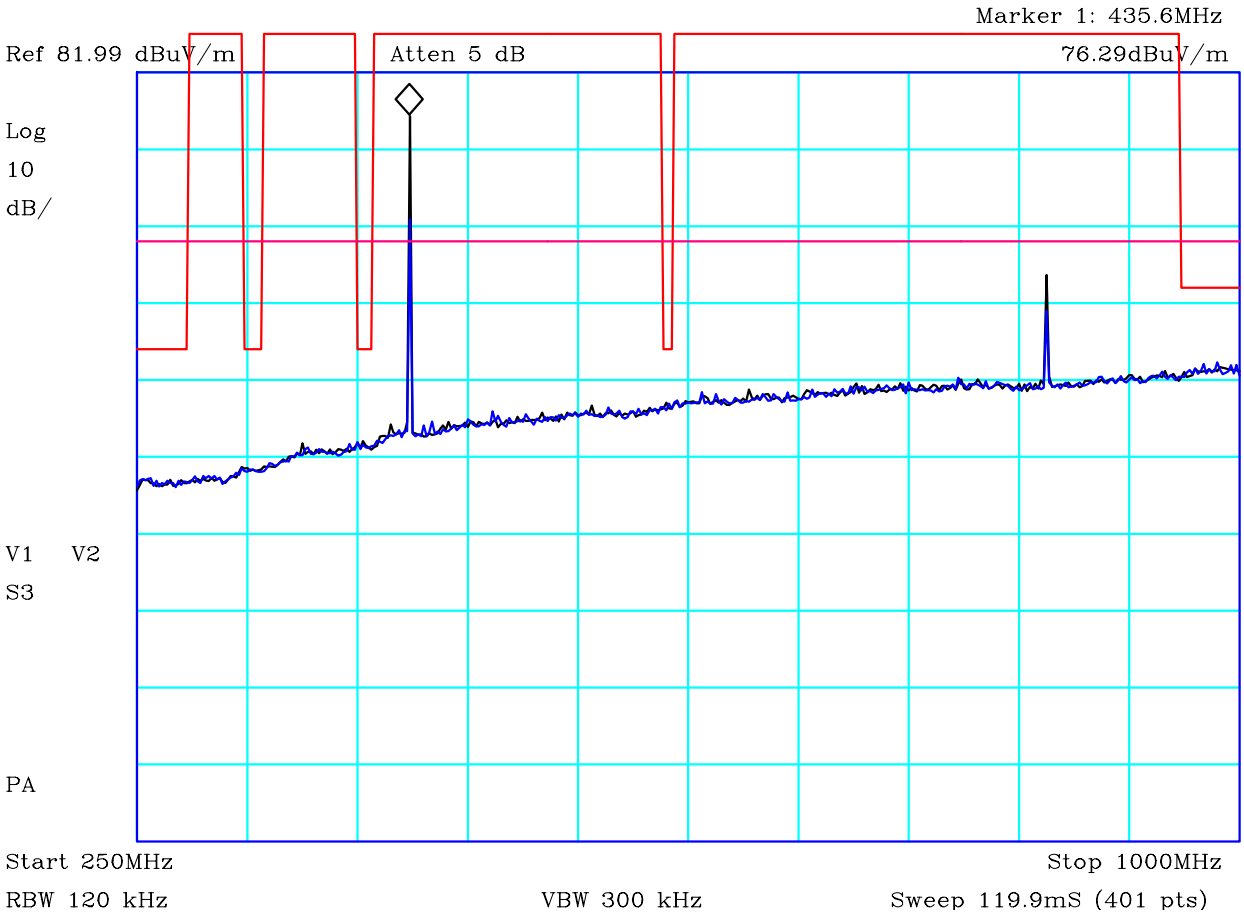
CF1:A24_3m_101116 CF2:CBL059_CBL018_CBL065_CBL060_100806

PLOT 1 Radiated Emissions - 25MHz to 275MHz

Company:	Quatro	Product:	Remote Keypad
Date:	12/12/2011	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands	Limit2:(VIO)	FCC_15.231
Limit3:		Limit4:	

Black: vertical
Blue: horizontal

Facility:	Anech_2	Height	1.5m	Mode:	1
Distance	3m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H1B124D5		



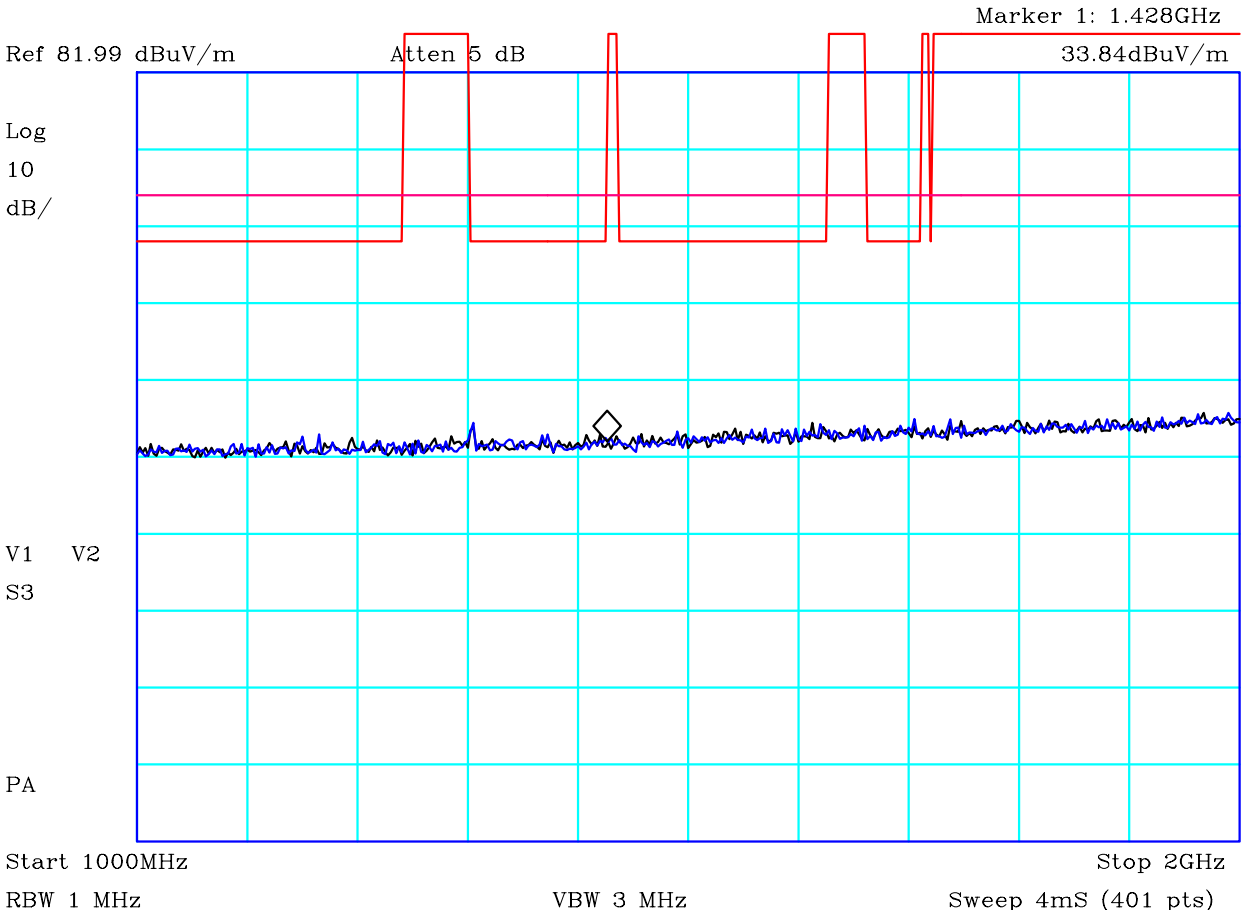
CF1:A24_3m_101116 CF2:CBL059_CBL018_CBL065_CBL060_100806

PLOT 2 Radiated Emissions - 250MHz to 1GHz

Company:	Quatro	Product:	Remote Keypad
Date:	12/12/2011	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands	Limit2:(VIO)	FCC_15.231
Limit3:		Limit4:	

Black: vertical
Blue: horizontal

Facility:	Anech_2	Height	1.5m	Mode:	1
Distance	3m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H1B124CD		



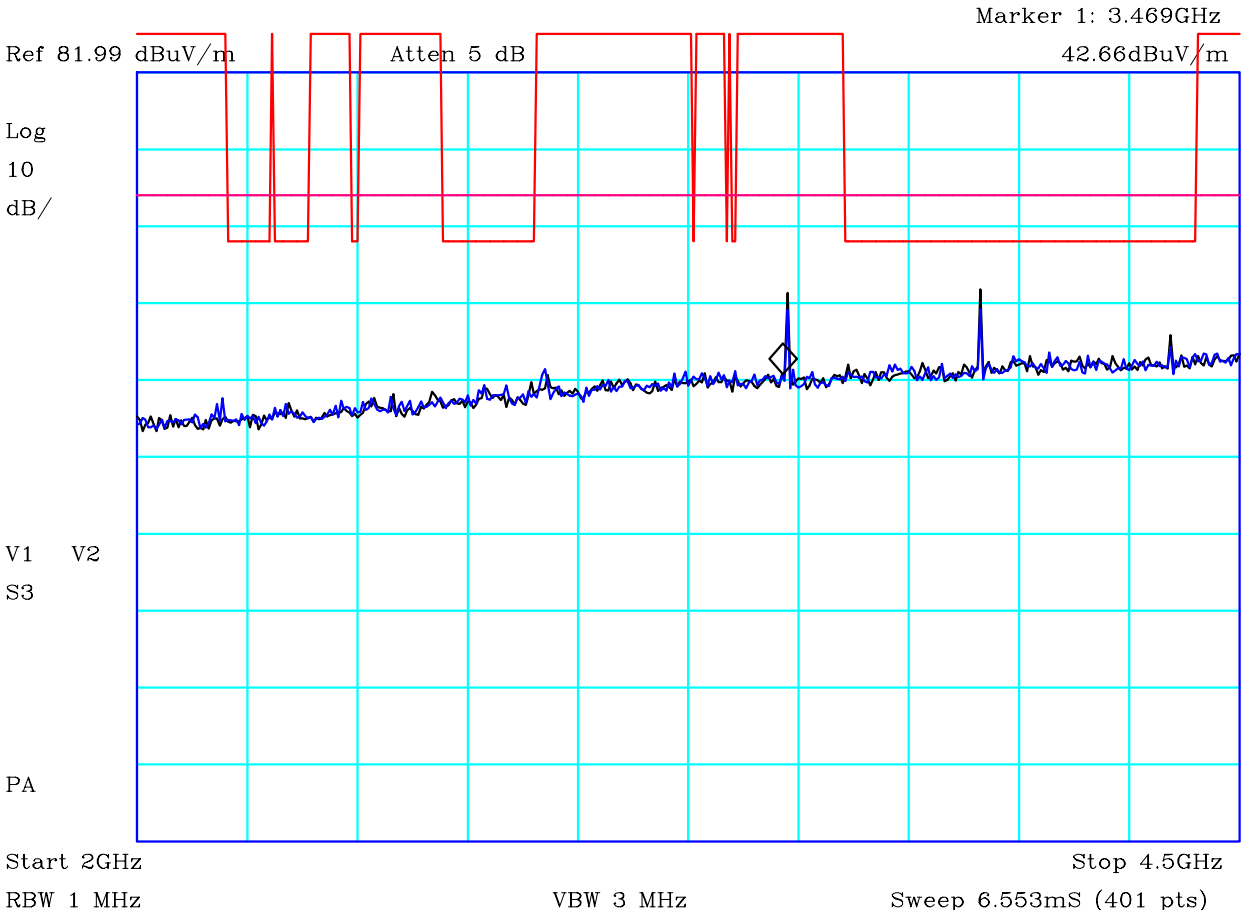
CF1:A19_3m_100806 CF2:CBL059_CBL018_CBL065_CBL060_100806 CF3:RFF11_100806 CF4:PRE7_110112

PLOT 3 Radiated Emissions - 1GHz to 2GHz

Company:	Quatro	Product:	Remote Keypad
Date:	12/12/2011	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands@1.5m	Limit2:(VIO)	FCC_15.231
Limit3:		Limit4:	

Black: vertical
Blue: horizontal

Facility:	Anech_2	Height	1.5m	Mode:	1
Distance	1.5m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H1B1250E		



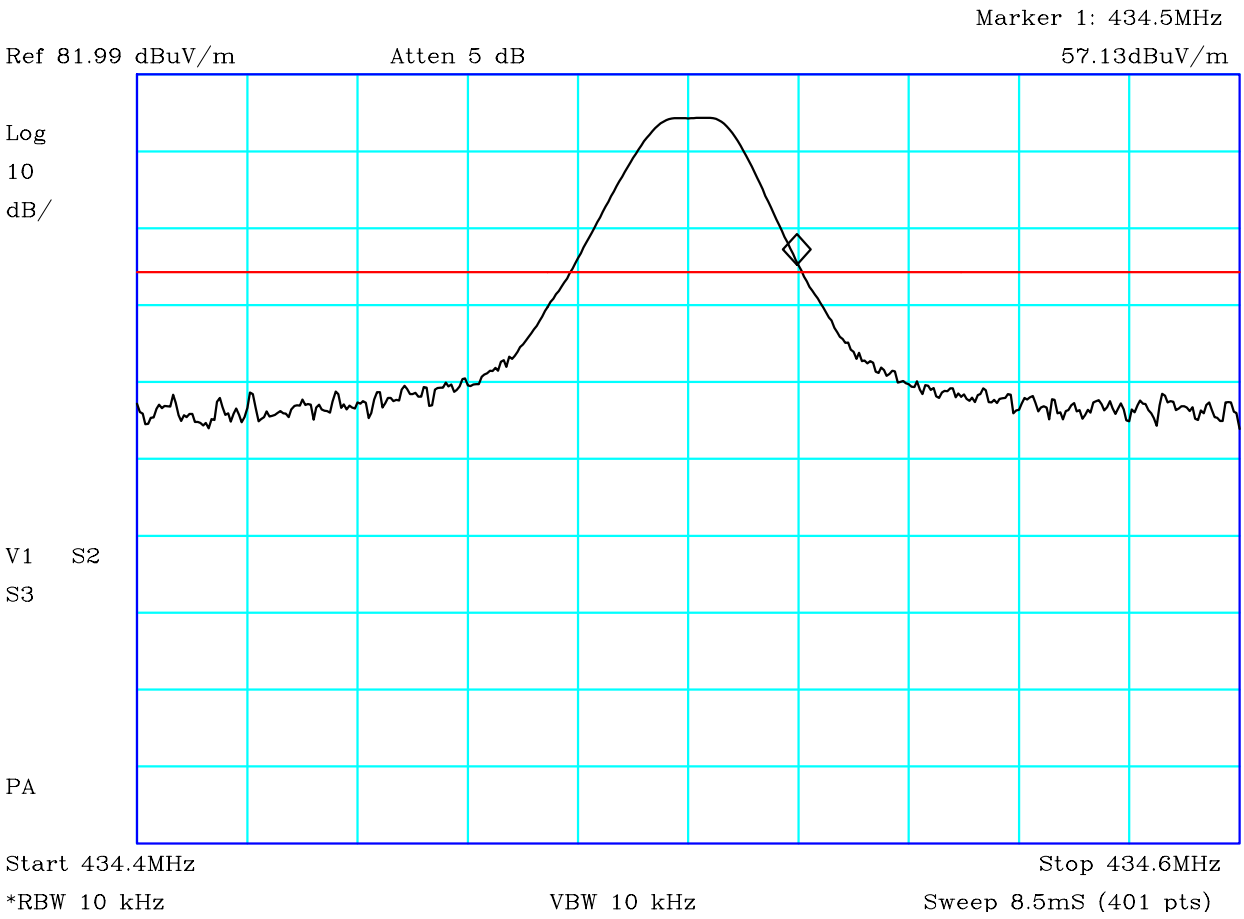
CF1:A19_3m_100806 CF2:CBL059_CBL018_CBL065_CBL060_100806 CF3:RFF11_100806 CF4:PRE7_110112

PLOT 4 Radiated Emissions - 2GHz to 4.5GHz

Company:	Quatro	Product:	Remote Keypad
Date:	12/12/2011	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands@1.5m	Limit2:(VIO)	FCC_15.231
Limit3:		Limit4:	

Black: vertical
Blue: horizontal

Facility:	Anech_2	Height	1.5m	Mode:	1
Distance	1.5m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H1B1251B		



CF1:A24_3m_101116 CF2:CBL059_CBL018_CBL065_CBL060_100806

PLOT 5 Bandwidth Plot

Company:	Quatro	Product:	Remote Keypad
Date:	12/12/2011	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(RED)	-20dBc	Limit2:	
Limit3:		Limit4:	

-20dBc to left of peak = 434.4560MHz
-20dBc to left of peak = 434.4985MHz

Occupied bandwidth = 42.5kHz
Limit = 1.09MHz

Facility:	Anech_2	Height	1.5m	Mode:	1
Distance	3m	Polarisation	V	Modification State:	0
Angle		File:	H1B1253D		