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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

AlertMe.com Ltd

REP800/REP130

(FCC Part 15.249 measurements only)

dated

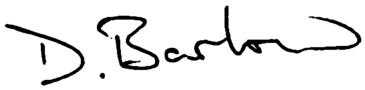
19th May 2012

Document History

Issue	Date	Affected page(s)	Description of modifications	Revised by	Approved by
1	19/05/12		Initial release		
2	31/05/12	1 and 13	AC Power conducted emissions 9kHz RBW clarified.	PB	DB

Based on report template:
v090319

Equipment Under Test (EUT):	REP800/REP130
Test Commissioned by:	AlertMe.com Ltd Compass House 80 Newmarket Road Cambridge CB5 8DZ
Representative:	Bruce Benson
Test Started:	28th April 2012
Test Completed:	17th May 2012
Test Engineer:	Dave Smith
Date of Report:	19th May 2012

Written by:	Dave Smith	Checked by:	Derek Barlow
Signature:		Signature:	
Date:	19th May 2012	Date:	21st May 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 part 15.249 were applied.

Device operating in the 902-928MHz band (part 15.249)

FCC Part	Parameter	
15.207	Conducted Emissions	PASS
15.249	Radiated Emissions Carrier (50mV/m @3m)	PASS
15.249	Radiated Emissions Harmonics (500u|V/m @3m)	PASS
15.209	Radiated Emissions Other	PASS

Contents

1 EUT Details

1.1 General

The EUT was an AlertMe Repeater. The device incorporates two intentional radiators:

(a) Zigbee: operating in the 2.4GHz to 2.4835GHz band. Operates on 15 equally spaced channels starting at 2.405GHz (channel 11) and ending at 2.475GHz (channel 25). O-QPSK (digital) modulation. Integral antenna. Gain of the antenna declared to be 1dBi.

(b) Z-wave: operating in the 902MHz to 928MHz band. The device operates on 908.42 MHz. GFSK modulation. Integral antenna.

This report only covers the operation of the device as an intentional radiator in the 902MHz to 928MHz band.

The device is powered from ac mains or an internal battery.

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	Alertme	REP800/REP130	Sample 1 with wired co-axial connection to Zigbee transmitter		#1
2	Alertme	REP800/REP130	Sample 2 with integral antennas. Z-wave transmitting constant unmodulated carrier Zigbee programmable.		
3	Alertme	REP800/REP130	Sample 3 - with integral antennas. Z-wave constantly transmitting modulated signal		
4	Alertme	REP800/REP130	Sample 4 with integral antennas. Z-wave in receive mode. Zigbee programmable.		#1

#1 Sample not used for tests covered by this test report.

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

Operating Mode	Details
1	Z-wave transmit - carrier wave. Continuously transmitting carrier at 908.42MHz. Output power set to 0.5dBm.
2	Z-wave transmit - modulated. Continuously transmitting modulated carrier at 908.42MHz. Output power set to 0.5dBm.
3	As mode 1 but with Zigbee also transmitting on channel 18.

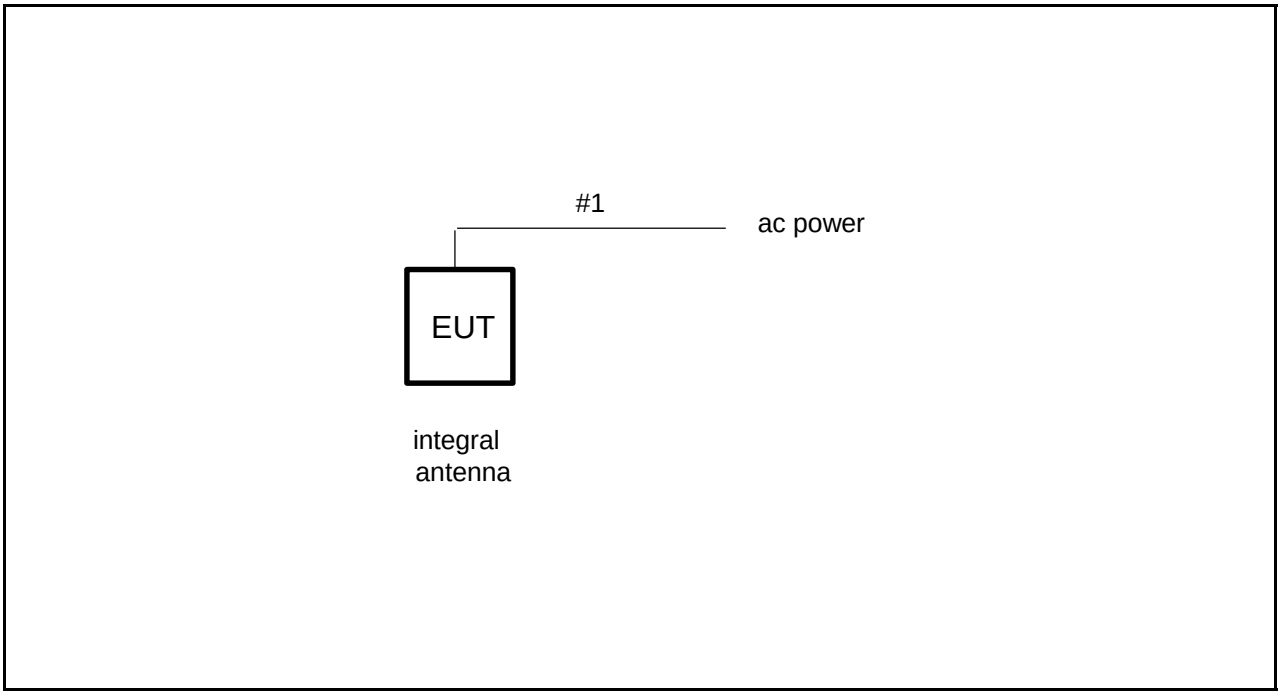
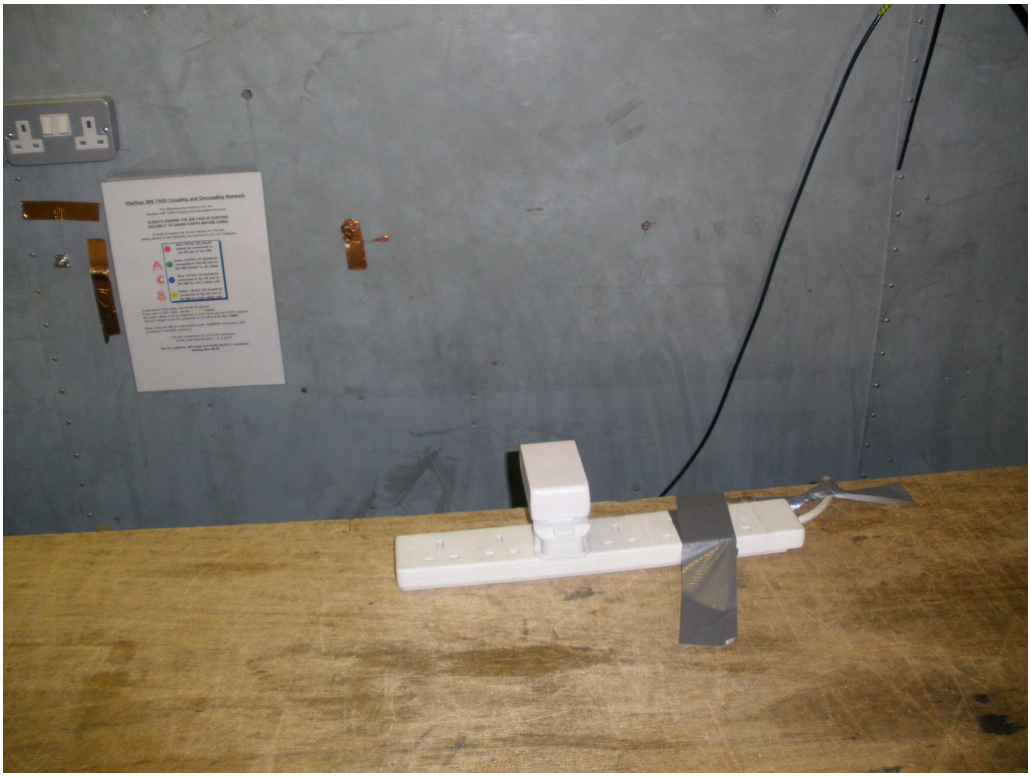
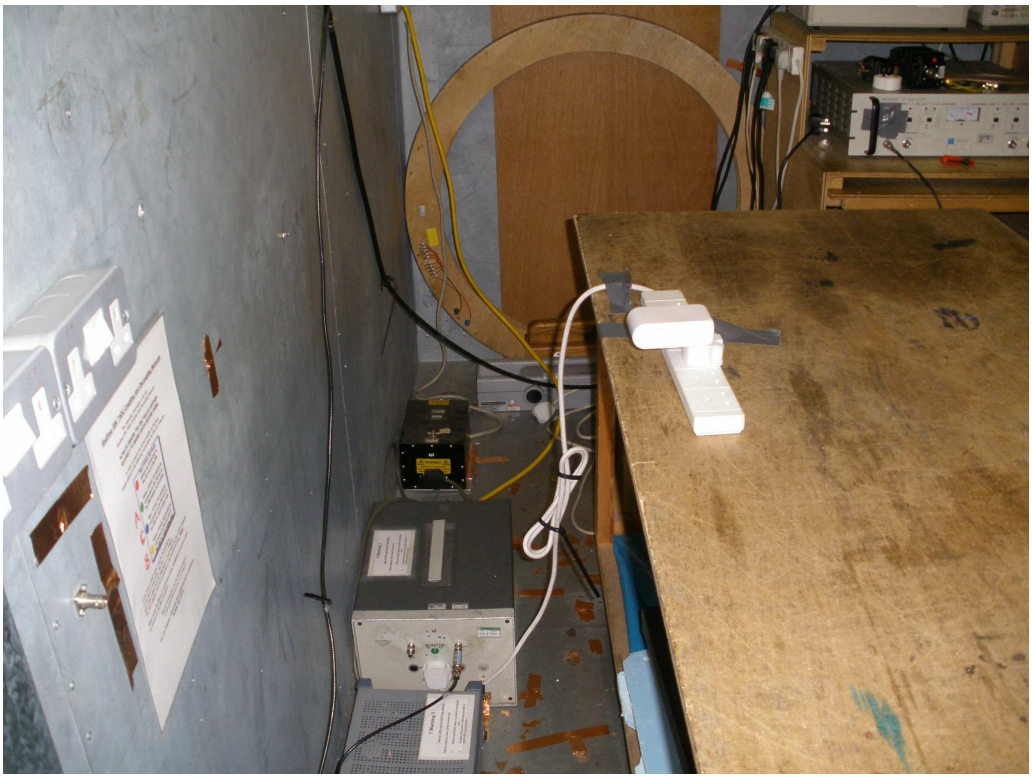


Figure 1 EUT and Peripherals

	Description	Type	Length	Notes
#1	Mains extension lead	Unscreened	1.5m	



Photograph 1 Conducted Emissions - Front



Photograph 2 Conducted Emissions - Back

Photograph 3 Radiated Emissions - Upright - Front

Photograph 4 Radiated Emissions - Flat - 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 Dat	Cal Interval
A15	Chase X-wing Bilog CBL6140 20MHz-2GHz	1047	18/11/2011	1 year
A20	Alpha 61932500 Horn Antenna (18-26GHz)	50	#1	1 year
A22	Alpha 61932400 Horn Antenna (12.4-18GHz)	55	#1	1 year
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
L1	EMCO 3825/2 LISN	1358	16/02/2012	1 year
PRE7	LUCIX 0.1GHz to 20GHz	24485	08/01/2012	1 year
PRE8	LUCIX 18GHz to 26.5GHz	24486	08/01/2012	1 year
R1	CHASE LHR 7000	1056	31/01/2012	1 year
R4	R&S ESVS10	421872	16/10/2011	1 year
R8	Agilent E7405A Spectrum Analyser	MY44212494	19/09/2011	1 year
R9	Agilent E7405A Spectrum Analyser	MY45110758	21/11/2011	1 year
RFF01	High Pass RF Filter 3GHz to 12.75GHz	1	08/02/2012	1 year
RFF04	Low Pass RF Filter 0MHz to 2GHz	4	08/02/2012	1 year
RFF15	Band Pass Filter 1GHz to 2GHz	15	08/02/2012	1 year
RFF22	High Pass Filter - 1.35GHz (to 10GHz) HPM13017	33	08/02/2012	1 year

#1 Standard Gain Horns - Factors derived by calculation from dimensions.

3 Test Methods

3.1 Conducted Emissions - ac power

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.

Bench top EUTs and peripheral equipment are normally placed on a 0.8m high non-conducting bench, positioned 0.4m from one of the metallic walls of a screened room. Floor standing EUTs are normally placed 0.1m above the metallic floor of the screened room. Mains leads are bundled so as not to exceed 1m.

The EUT is powered using a 50ohm/50uH Line Impedance Stabilisation Network (LISN). Peripherals are powered using a second a 50ohm/50uH LISN. These LISNs are bonded to the screened room floor.

With the correct supply voltage applied to the EUT scans are performed on both the live and neutral line outputs of the LISN using quasi-peak detection over the specified frequency range. The results of these scans are shown in the plots section at the end of the report.

Significant emissions identified by the scans are measured and the results tabulated. The table of results is shown in the conducted emissions results section.

Final Level (dBuV)	=	Receiver Reading (dBuV)	+	Combined Cable & Attenuator Correction Factor (dB)

Example: if at 191kHz the receiver level is 45.8 dBuV

@ 191kHz Final Level = 45.8 + 10.0 = 55.8 dBuV

3.2 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 up to 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. Attempts are made to identify the layout of cables that give highest readings.

Significant emissions identified by the scans are measured on an open area test site at the appropriate test distance using the specified detector function. Maximised readings are obtained by rotating the EUT through 360° and adjusting the height of the antenna from 1 m 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 receiver reading was 57.8dBuV 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 Conducted Emissions (Power) - Results

Factor Set 1: L1_11A AB002_CBL005_CBL039_11A - -
Factor Set 2: - - - -
Factor Set 3: - - - -
Test Equipment: R1 L1

Conducted Emissions (Power)

Company: AlertMe.com Ltd *Product:* REP800/REP130
Date: 04/05/12 *Test Eng:* Dave Smith
Ports: ac power
Test: ANSI C63.4:2003 using limits of FCC(B)
Ports:
Test: using limits of

Plot	Op Mode	Mod State	Line (L/N)	Fact Set	Freq. MHz	Det qp/ av	Rec. Level dBuV	Corr'n Factor dB	Total Level dBuV	Limit FCC dBuV	Margin FCC dB	Notes
7	3	0	L	1	0.194	qp	27.1	10.0	37.1	63.9	26.8	
7	3	0	L	1	0.194	av	16.8	10.0	26.8	53.9	27.1	
7	3	0	L	1	0.263	qp	24.4	10.0	34.4	61.4	26.9	
7	3	0	L	1	0.263	av	14.3	10.0	24.3	51.4	27.0	
7	3	0	L	1	1.587	qp	24.1	10.0	34.1	56.0	21.9	
7	3	0	L	1	1.587	av	14.0	10.0	24.0	46.0	22.0	
8	3	0	N	1	0.200	qp	28.0	10.0	38.0	63.6	25.6	
8	3	0	N	1	0.200	av	8.0	10.0	18.0	53.6	35.6	
8	3	0	N	1	0.319	qp	22.8	10.0	32.8	59.7	26.9	
8	3	0	N	1	0.319	av	10.0	10.0	20.0	49.7	29.7	
8	3	0	N	1	1.587	qp	24.6	10.0	34.6	56.0	21.4	
8	3	0	N	1	1.587	av	12.0	10.0	22.0	46.0	24.0	

Results	**Minimum Margin**	**21.4 dB**	
	PASS/FAIL	**PASS**	

Notes	Comments and Observations
	Results of scans shown in plots 7 and 8. Measurements made with both Z-wave and Zigbee transmitting which was considered to be the "worse case" mode (Sample 2). All AC power conducted emissions measurements were made using a 9kHz resolution bandwidth. Limits for 15.207 are shown.

4.2 Z-wave Radiated Emissions - Carrier and Band Edges - 15.249

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

Radiated Emissions

Company: AlertMe.com Ltd *Product:* REP800/REP130
Date: 03/05/2012 *Test Eng:* Dave Smith
Ports:
Test: ANSI C63.4:2003 using limits of 15.249
Ports:
Test: ANSI C63.4:2003 using limits of 15.209

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 dBuV/m	Margin FCC dB	Notes
	carrier												
2	1	1	3	1	908.410	V	45.3	29.8		75.1	94.0	18.9	#1
2	1	1	3	1	908.410	H	46.0	29.8		75.8	94.0	18.2	#1
3	2	1	3	1	908.410	V	43.2	29.8		73.0	94.0	21.0	#2
3	2	1	3	1	908.410	H	43.0	29.8		72.8	94.0	21.2	#2
	band edges												
3	2	1	3	1	902.000	V	-2.3	29.5		27.2	46.0	18.8	#2
3	2	1	3	1	902.000	H	-2.3	29.5		27.2	46.0	18.8	#2
3	2	1	3	1	928.000	V	-2.0	30.6		28.6	46.0	17.4	#2
3	2	1	3	1	928.000	H	-2.2	30.6		28.4	46.0	17.6	#2

Results	**Minimum Margin**	**17.4 dB**	
	PASS/FAIL	**PASS**	

Notes	Comments and Observations
	Results of scans shown in plots 2 and 3.
	Carrier: limit of 15.249. Band edge: general emissions limit of 15.209
#1	Sample 2 - carrier wave.
#2	Sample 3 - normal modulation.
	Maximum of flat and upright.
	Maximised readings using quasi peak detector

4.3 Z-wave Radiated Emissions - Tx Spurious Below 1GHz - 15.249

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

Radiated Emissions

Company: AlertMe.com Ltd *Product:* REP800/REP130
Date: 08/05/2012 *Test Eng:* Dave Smith
Ports:
Test: ANSI C63.4:2003 using limits of 15.209
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
1	1	0	3	1	43.220	V	4.3	12.0		16.3	40.0	23.7	qp
1	1	0	3	1	43.220	H	1.0	12.0		13.0	40.0	27.0	qp
1	1	0	3	1	56.600	V	7.2	6.7		13.9	40.0	26.1	qp
1	1	0	3	1	56.600	H	2.0	6.7		8.7	40.0	31.3	qp
3	1	0	3	1	443.700	V	11.5	20.7		32.2	46.0	13.8	qp
3	1	0	3	1	443.700	H	12.2	20.7		32.9	46.0	13.1	qp

Results	**Minimum Margin**	**13.1 dB**	
	PASS/FAIL	**PASS**	

Notes	Comments and Observations
	Results of scans shown in plots 1 to 3. General limits of 15.209 applied.

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

4.4 Z-wave Radiated Emissions - Tx Spurious Above 1GHz - 15.249

Factor Set 1: A23_3m_10A PRE7_CBL052_CBL093_11A RFF22_11A -
Factor Set 2: A23_3m_10A PRE7_11A CBL059_CBL018_CBL065_CBL060_10A RFF15_11A 1 m cable
Factor Set 3: - - - -
Test Equipment: R8 A23 PRE7 RFF22 RFF15

Radiated Emissions

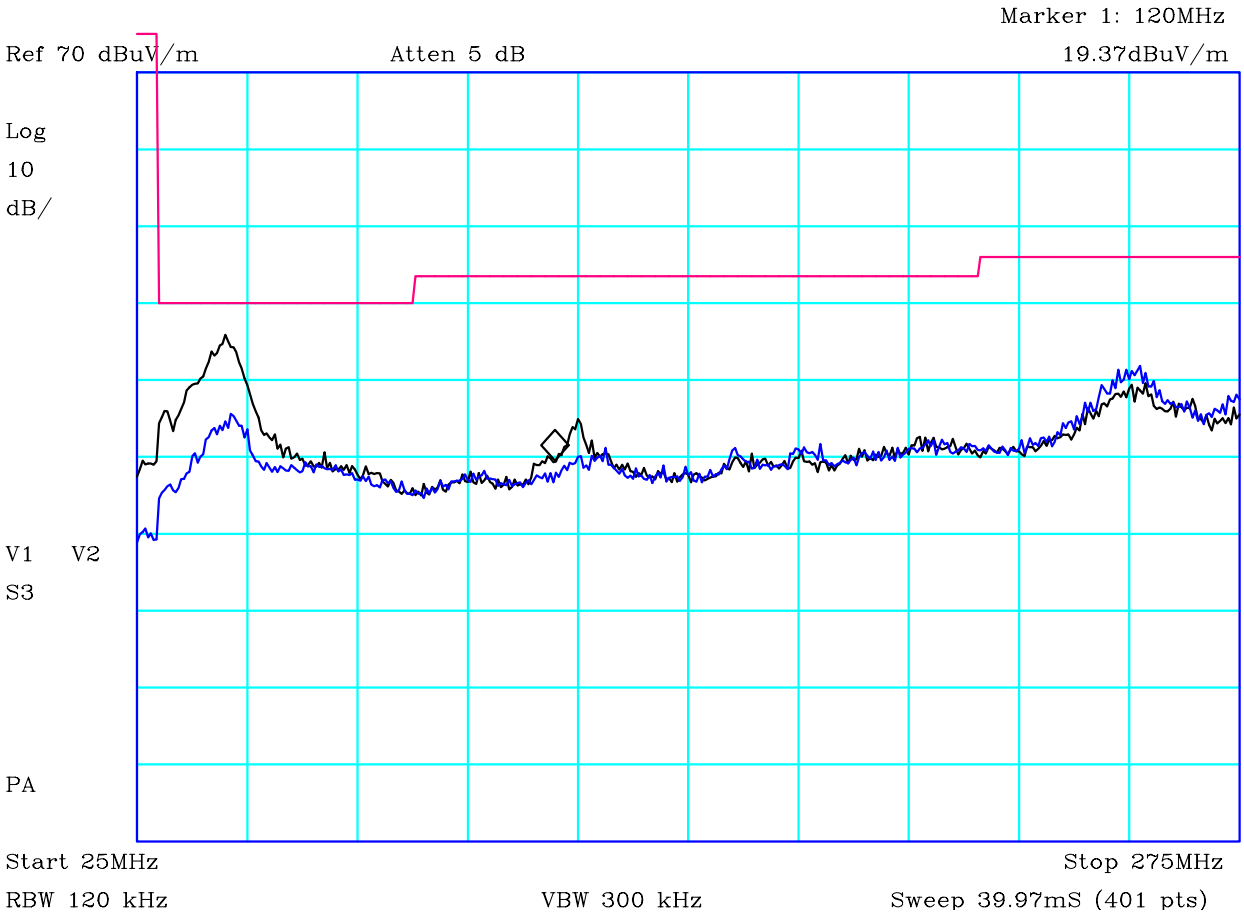
Company: AlertMe.com Ltd *Product:* REP800/REP130
Date: 04/05/2012 *Test Eng:* Dave Smith
Ports:
Test: ANSI C63.4:2003 using limits of 15.209
Ports:
Test: using limits of

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 dBuV/m	Margin FCC dB	Notes
4	1	0	3	2	1816.784	V	57.3	-9.8		47.4	54.0	6.6	pk
4	1	0	3	2	1816.784	H	57.4	-9.8		47.6	54.0	6.4	pk
5	1	0	3	1	2724.866	V	54.4	-10.6		43.8	54.0	10.2	pk
5	1	0	3	1	2724.866	H	53.3	-10.6		42.7	54.0	11.3	pk
5	1	0	3	1	3633.558	V	49.2	-7.6		41.6	54.0	12.4	pk
5	1	0	3	1	3633.558	H	49.5	-7.6		41.9	54.0	12.1	pk
5	1	0	3	1	4872.150	V	51.7	-5.5		46.2	54.0	7.8	pk
5	1	0	3	1	4872.150	H	50.1	-5.5		44.6	54.0	9.4	pk

Results	**Minimum Margin**	**6.4 dB**	
	PASS/FAIL	**PASS**	

Notes	Comments and Observations
	Results of scans shown in plots 4 to 6 Peak measurement are comfortably below average limit so no average measurement performed.

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



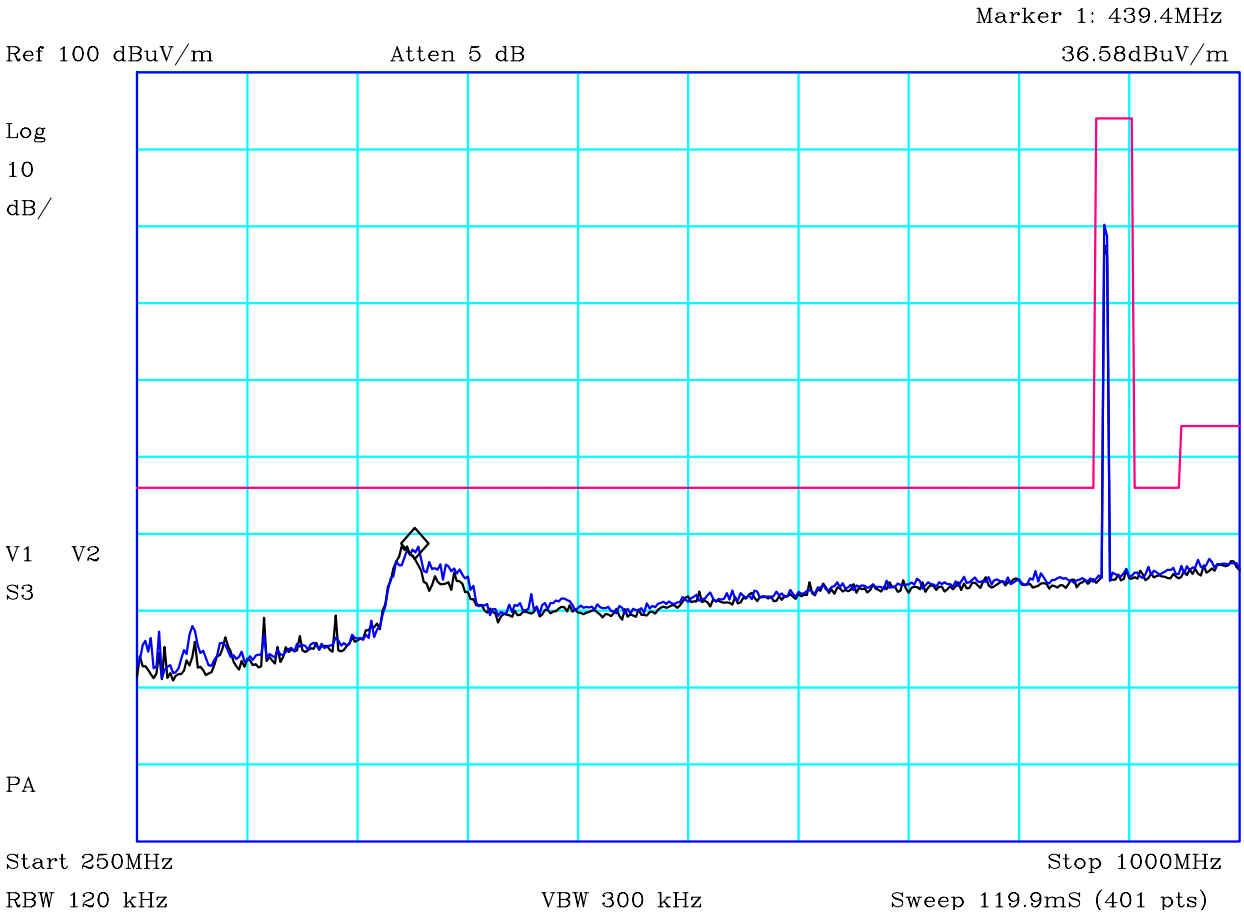
CF1:A24_3m_101116 CF2:CBL002_CBL069_100809

PLOT 1 Radiated Emissions - Z-Wave Tx - 25MHz to 275MHz

Company:	Alertme	Product:	Repeater
Date:	09/05/2012	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(VIO)	FCC(B)@3m	Limit2:	
Limit3:		Limit4:	

Sample 2. Black: vertical, Blue: Horizontal
Continuous transmit on 908MHz.
Maximum of flat and upright positions.

Facility:	Anech_2	Height	1m	Mode:	1
Distance	3m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H2409626		



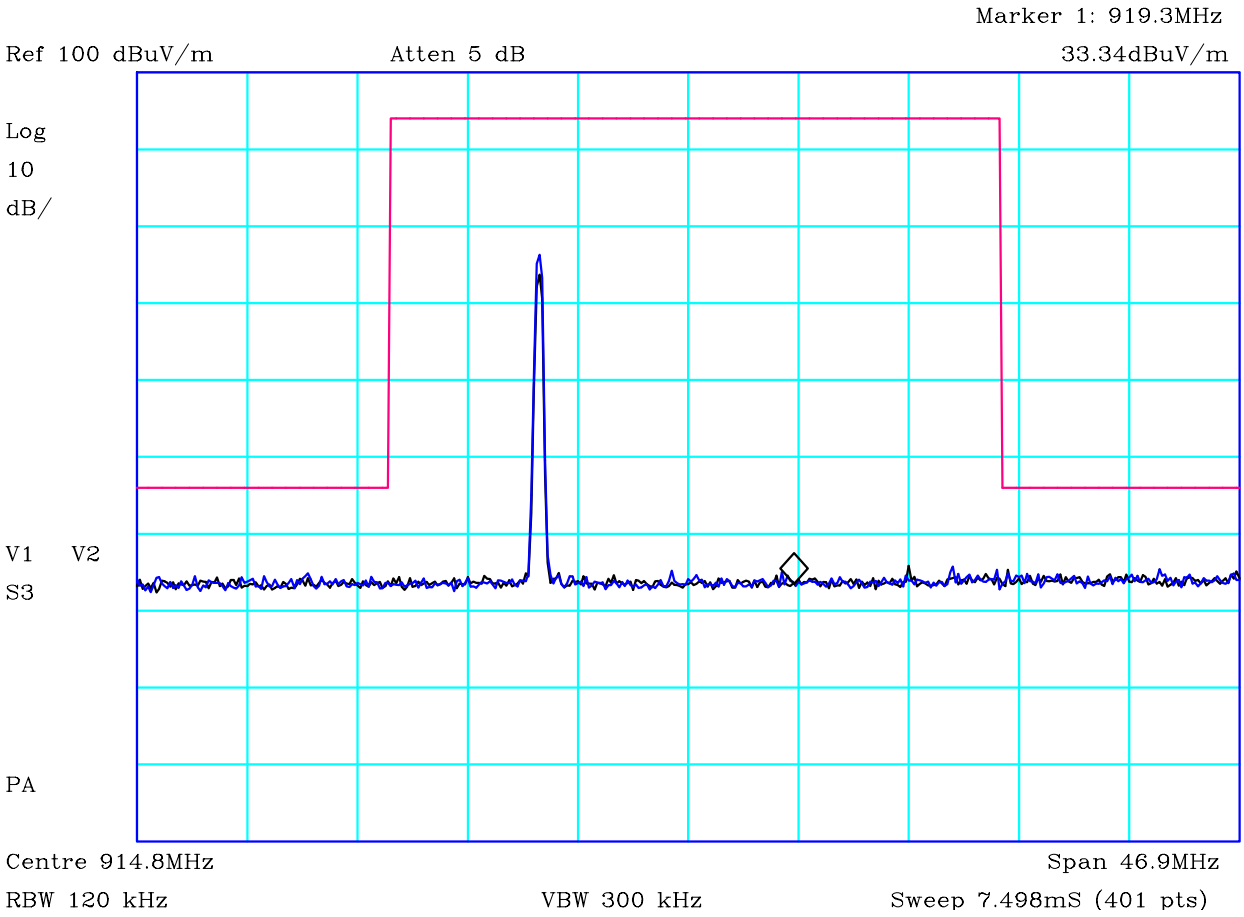
CF1:A24_3m_101116 CF2:CBL002_CBL069_100809

PLOT 2 Radiated Emissions - Z-Wave Tx - 250MHz to 1GHz

Company:	Alertme	Product:	Repeater
Date:	04/05/2012	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(VIO)	FCC(B)@3m	Limit2:	
Limit3:		Limit4:	

Sample 2. Black: vertical, Blue: Horizontal
Continuous transmit on 908MHz.
Maximum of flat and upright positions.

Facility:	Anech_2	Height	1m	Mode:	1
Distance	3m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H2404679		



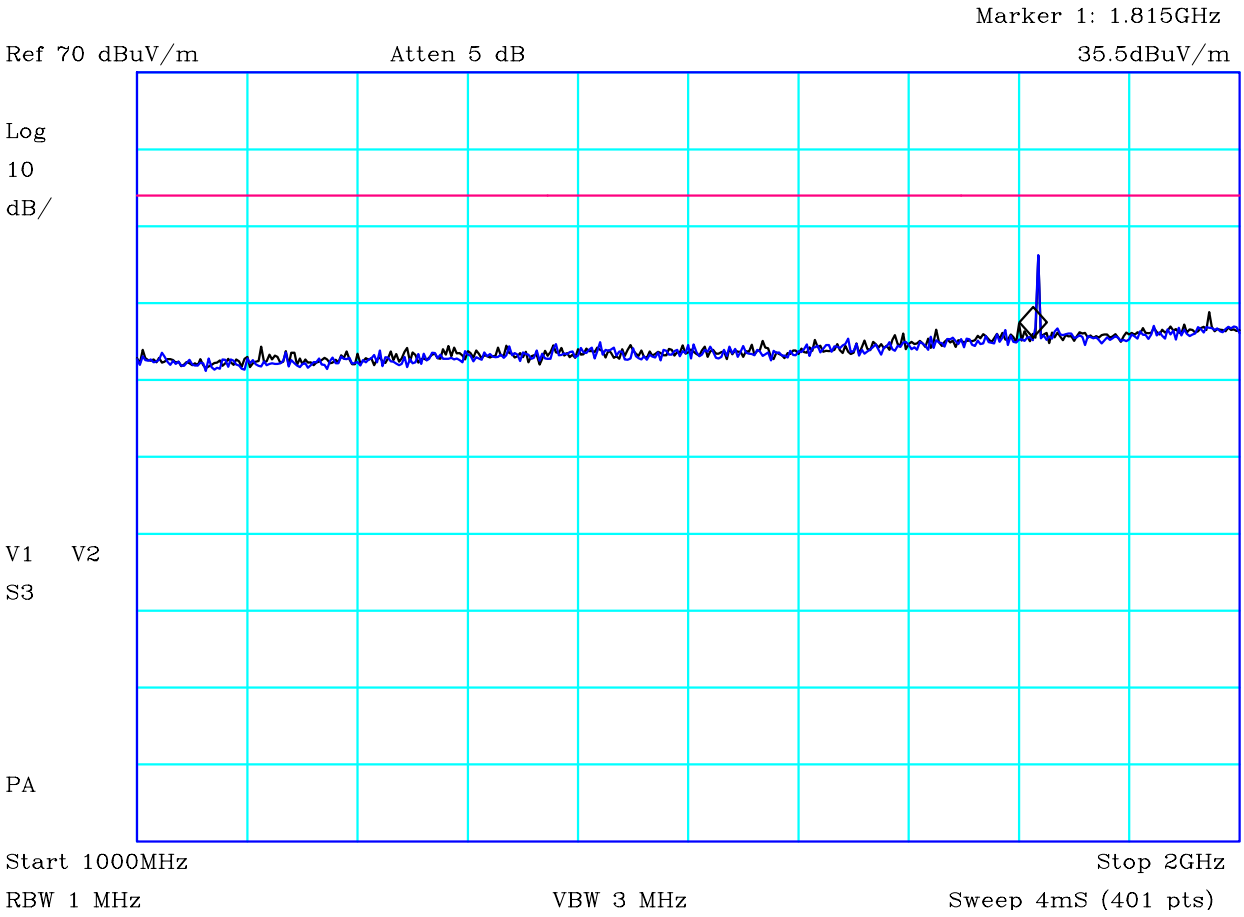
CF1:A24_3m_101116 CF2:CBL002_CBL069_100809

PLOT 3 Radiated Emissions - Z-Wave Tx - Band Edges - Modulated Transmitter

Company:	Alertme	Product:	Repeater
Date:	09/05/2012	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(VIO)	FCC(B)@3m	Limit2:	
Limit3:		Limit4:	

Sample 3.
Black: vertical, Blue: horizontal
Maximum of flat and upright positions.
Modulated 908MHz Tx

Facility:	Anech_2	Height	1m,1.5m	Mode:	2
Distance	3m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H2409613		



CF1:A23_3m_100806 CF2:CBL059_CBL018_CBL065_CBL060_100806 CF3:PRE7_CBL052_CBL093_110112
CF4:RFF15_110112

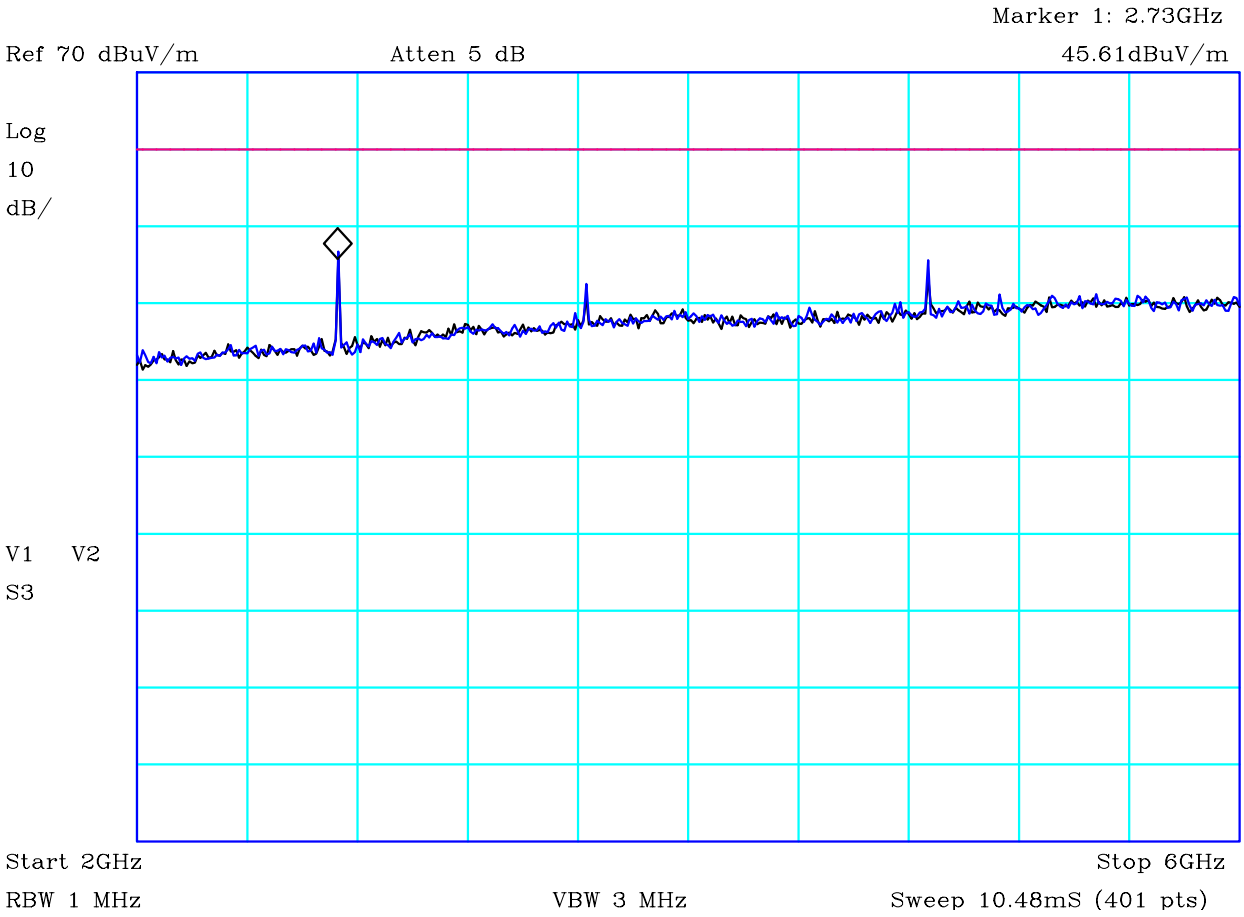
PLOT 4 Radiated Emissions - Z-Wave Tx - 1GHz to 2GHz

Company:	Alertme	Product:	Repeater
Date:	04/05/2012	Test Eng:	Dave Smith
Method:	Ansi C63.4	Method:	
Limit1:(VIO)	FCC(B)@3m	Limit2:	
Limit3:		Limit4:	

Sample 2.. Black: vertical, Blue: Horizontal
Continuous transmit on 908MHz.
Maximum of flat and upright positions.

1.816797 GHz

Facility:	Anech_2	Height	1m	Mode:	1
Distance	3m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H2404442		



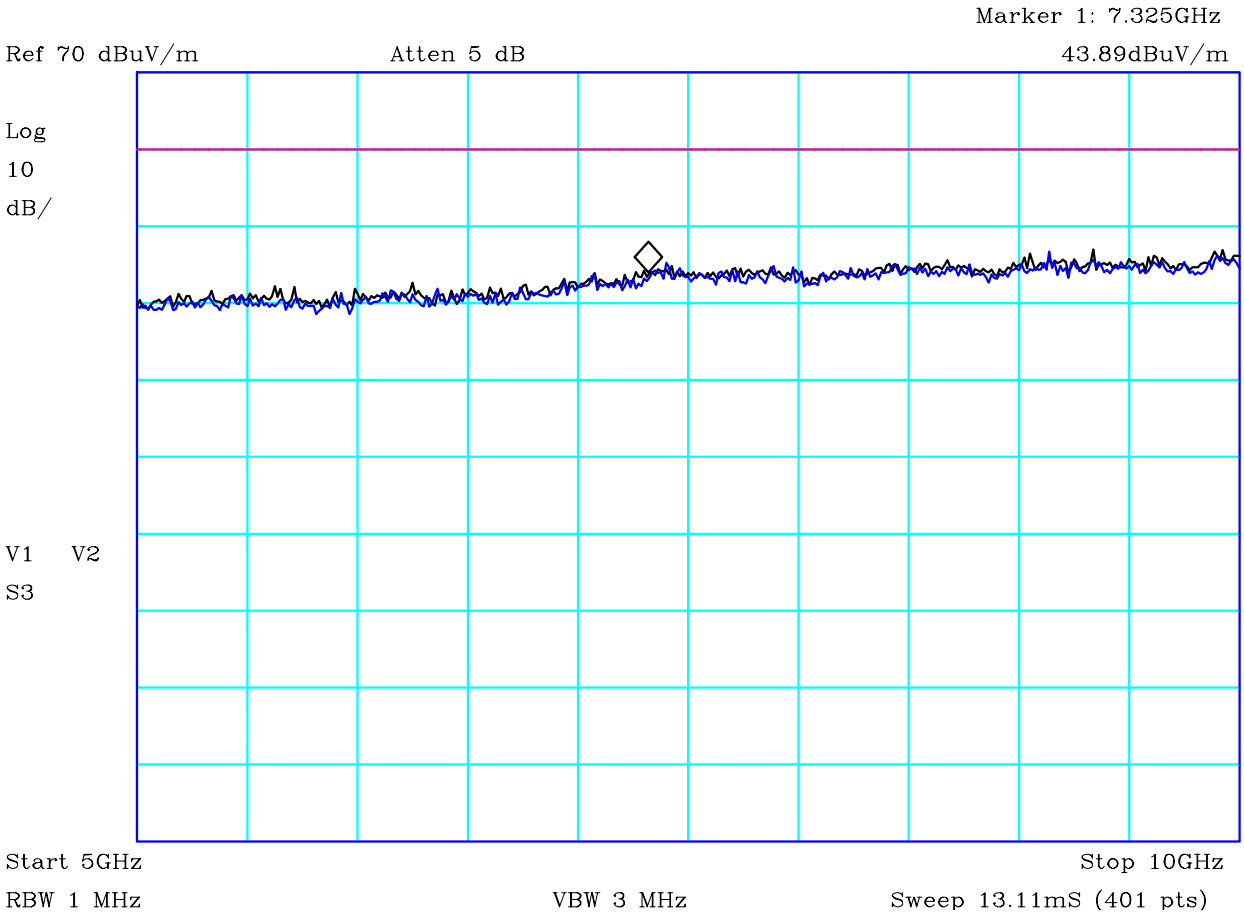
CF1:A23_3m_100806 CF2:PRE7_CBL052_CBL093_110112 CF3:RFF22_110221

PLOT 5 Radiated Emissions - Z-Wave Tx - 2GHz to 6GHz

Company:	Alertme	Product:	Repeater
Date:	04/05/2012	Test Eng:	Dave Smith
Method:	Ansi C63.4	Method:	
Limit1:(VIO)	FCC(B)@1.5m	Limit2:	
Limit3:		Limit4:	

Sample 2. Black: vertical, Blue: Horizontal
Continuous transmit on 908MHz.
Maximum of flat and upright positions.

Facility:	Anech_2	Height	1m	Mode:	1
Distance	3m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H2404519		



CF1:A23_3m_100806 CF2:PRE7_CBL052_CBL093_110112 CF3:RFF22_110221

PLOT 6 Radiated Emissions - Z-Wave Tx - 5GHz to 10GHz

Company:	Alertme	Product:	Repeater
Date:	04/05/2012	Test Eng:	Dave Smith
Method:	Ansi C63.4	Method:	
Limit1:(VIO)	FCC(B)@1.5m	Limit2:	
Limit3:		Limit4:	

Sample 2. Black: vertical, Blue: Horizontal
Continuous transmit on 908MHz.
Maximum of flat and upright positions.

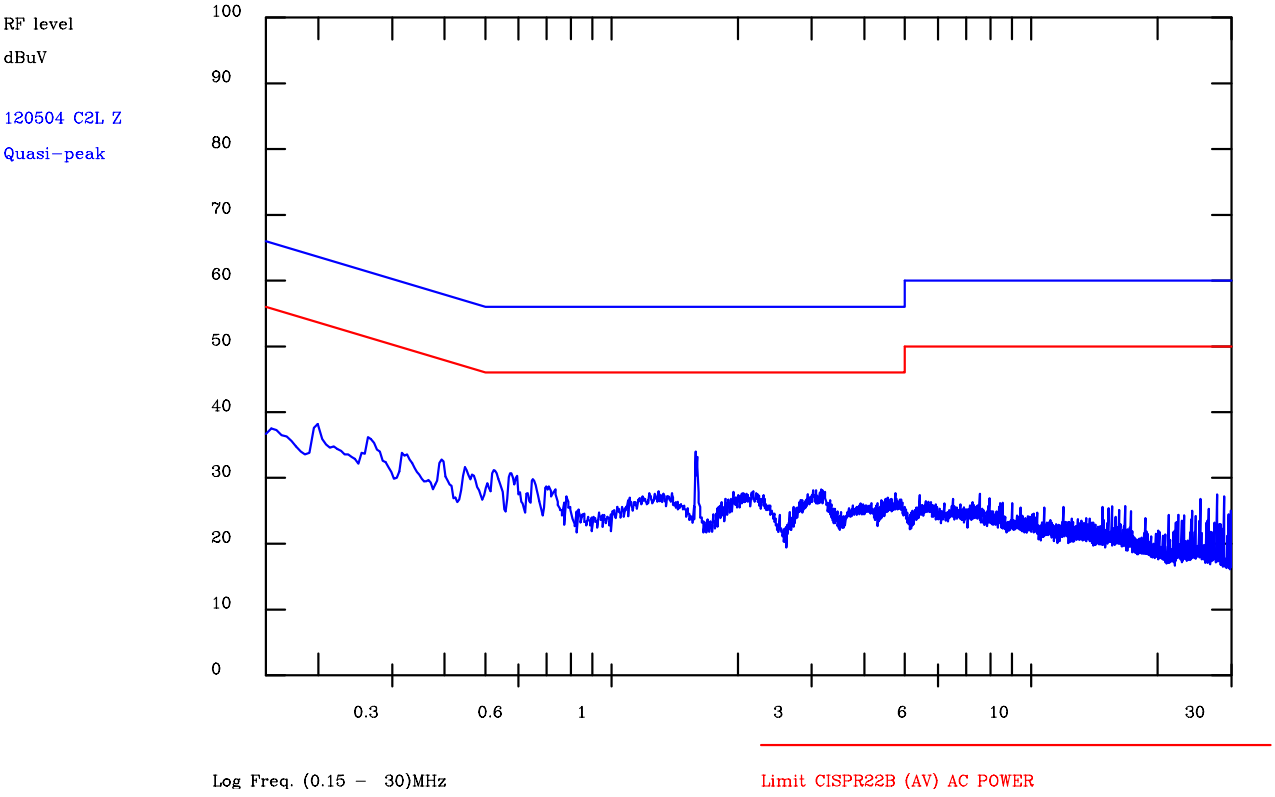
Facility:	Anech_2	Height	1m	Mode:	1
Distance	3m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H240450F		

Chase EMS 6.21

Notes

Analyse 120504 C2L Z wave Tx, ch 18 Tx

Test: 150kHz-30MHz (L1+CSET001) dBuV



PLOT 7 Conducted Emissions - Live Line - Z-wave & Zigbee Tx

Company:	Alertme	Product:	Repeater
Date:	04 May 12	Test Engineer:	Dave Smith
Test:	FCC part 15	Limit:	FCC Class B

Notes:
Z-wave Transmitting. Zigbee transmitting on Ch 18.
Sample 2.

Equip:R1,L1,AB002,CBL005,CBL039

Line:	Live	Attenuator:	10dB PAD	Operating Mode:	3
Detector:	QuasiPeak			Mod. State:	0
LISN:	EMCO	Filename:	C2504789.plt		

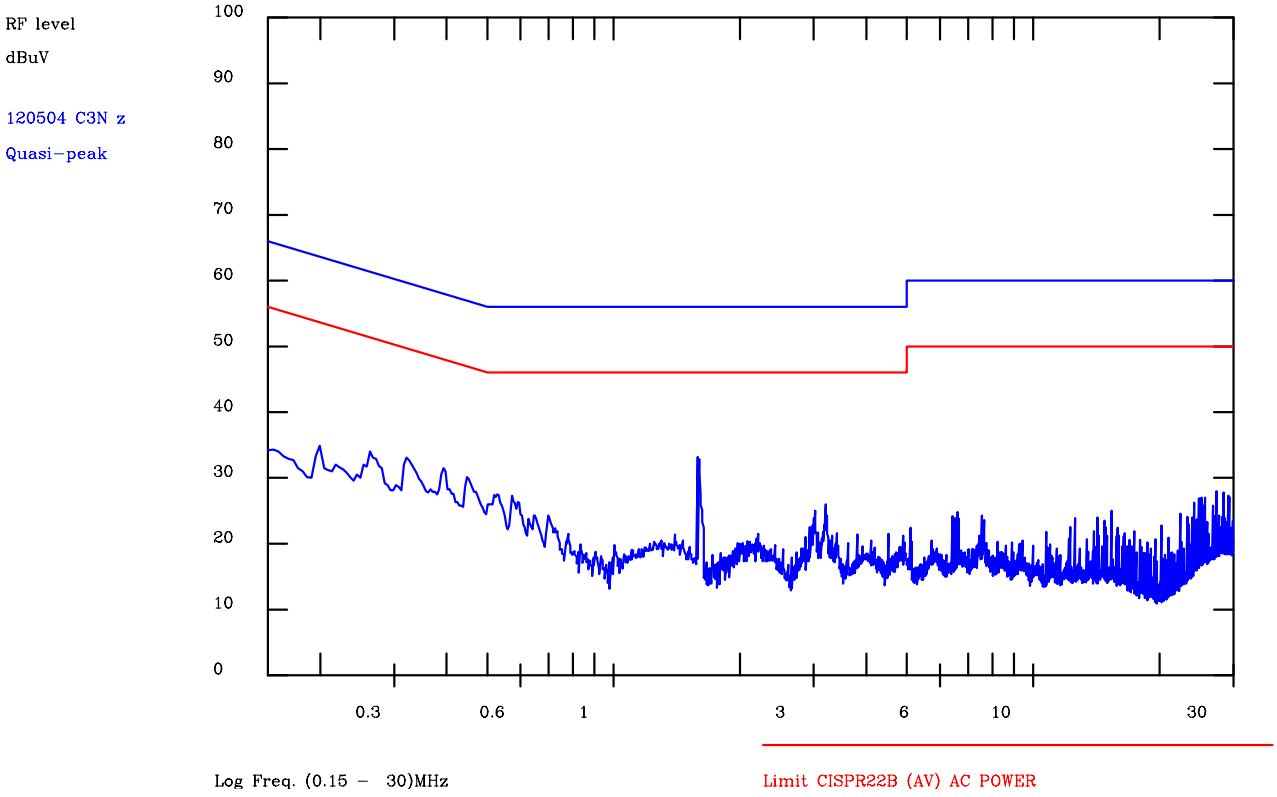
Frequency List (MHz)

Chase EMS 6.21

Notes

Analyse 120504 C3N z-wave Tx, ch 18 Tx

Test: 150kHz-30MHz (L1+CSET001) dBuV



PLOT 8 Conducted Emissions - Neutral Line - Z-wave & Zigbee Tx

Company:	Alertme	Product:	Repeater
Date:	04 May 12	Test Engineer:	Dave Smith
Test:	FCC part 15	Limit:	FCC Class B

Notes:
Z-wave Transmitting. Zigbee transmitting on Ch 18.
Sample 2.

Equip:R1,L1,AB002,CBL005,CBL039

Line:	Neutral	Attenuator:	10dB PAD	Operating Mode:	3
Detector:	QuasiPeak			Mod. State:	0
LISN:	EMCO	Filename:	C250479C.plt		

Frequency List (MHz)
