EMC TEST REPORT

COMPANY: ERA TECHNOLOGY Ltd

PRODUCT : TESTING TO CFR47 PART15:247
ON A ERA TECHNOLOGY LTD
EAGLE CLOSE COMBAT RADIO

REPORT : EM07028998a

WRITTEN BY:	**D Legge**	
REVIEWED BY:	**D Griffin**	
TEST ENGINEER:	**D Legge**	
ISSUE: 4	**DATE:** 29th April 2008	**TOTAL PAGES: 51**

Opinions and interpretations based on test results are outside our scope of UKAS Accreditation.

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TABLES

GRAPHS

JOB DESCRIPTION

Equipment:	Short range communications transceiver operating in the frequency band 2.4 – 2.483GHz
Equipment Model No.:	Eagle Close Combat Radio – 2500A
Equipment Serial No.:	R00014
Phase:	Compliance
Customer:	ERA Technology Ltd Cleeve Road Leatherhead Surrey KT22 7SA United Kingdom
Test Plan Reference:	TN13110/030 Issue 1
Test Standards:	CFR 47 Part 15:247
FCC Ident	xxxxxxxxxx
Test Location:	Intertek ETL Semko (Leatherhead) Unit D Randalls Way Leatherhead Surrey KT22 TS
Test Work Started:	22/11/2007
Test Work Completed:	29/04/2008

1. TEST SUMMARY

1.1. Eagle Close Combat Radio – 2500A

1.1.1. CFR 47 Part 15:247

TEST STANDARD	TEST	COMMENT
CFR47:Part15:247.a(1)	Two adjacent channels seperation	Pass
CFR47:Part15:247.a(1)	20 dB Bandwidth	Pass
CFR47:Part15:247.a(1)(1)	Dwell Time	Pass
CFR47:Part15:247.a(1)(111)	Number of hopping channels	Pass
CFR47:Part15:247.b(1)	Transmitter Power Output	Pass
CFR47:Part15:247.d	100 kHz out of band emissions	Pass
CFR47:Part15:247.e	Power Density	Note 1

Note: This test not required

1.1.2. CFR 47 Part 15

Product Specific Standard: CFR47 Part 15C

TEST STANDARD	TEST	COMMENT
CFR47 15: 209	Radiated Emissions (Note 1)	Pass
CFR47 15: 205	Restricted Bands of Operation	Pass

Note 1: This test was carried out in a FCC registered chamber, which complies with FCC limits for Radiated Emissions over the frequency range 30MHz to 1000MHz.

2. EQUIPMENT UNDER TEST (EUT)

2.1. Description of the EUT

The ERA Technology Limited Eagle Radio(Eagle PRR Radio) transceiver is a military Close Combat Radio for short range communications between soldiers who are dismounted or in a vehicle.

The radio is powered by internal batteries, and operates in frequency band of 2.4 to 2.4835GHz. The transceiver antenna has a 2.5dBi gain giving a maximum transmitted power of 100mWatts. The radio is a frequency hopping spread spectrum device which has 64 hopping sequences. Each sequence uses exactly 23 separate frequencies with all frequencies separated by 1MHz. There are 71 frequencies between 2.406GHz and 2.477GHz from which each sequence of 23 frequencies are selected. Each frequency is used equally within the hopping sequence.
All tests shall be performed at the following frequencies unless stated otherwise.

2.406GHz, 2.443GHz, 2.477GHz

The EUT was as received with no external visible signs of damage and was of production quality.

2.2. EUT's Modes of Operation

All tests are performed with MSK modulation producing a maximum of 100mW radiated power unless stated otherwise.

Standard test mode waveform profile is MSK.

2.3. EUT Configuration Diagram

See test set up photographs.

2.4. EUT Support Equipment

Software control computer

2.5. Cables Associated With the EUT

EUT PORT	TYPE	LENGTH (m)	TERMINATION/LOAD
EUT	multicore	0.25m	Headphones and microphone.

3. TESTS

3.1. Transmitter Output Power(Conducted)

The testing was performed in accordance with FCC CFR47 Part 15:247b(1)

FCC OET Bulletin 65 Supplement C Table 1 indicates that the maximum permissible limit is 200milliwatts at 2.45GHz for devices operating closer than 2.5cm. This is applicable to the Eagle Close Combat Radio which will be used for occupational/controlled use only. With the specified 2.5dBi antenna gain and the maximum transmitter power of 100mWatts, the maximum EIRP is 178mWatts. With the test mode maximum transmit duty cycle of 70%, the average EIRP is 124mWatts which is compliant with the limit. Note, the per channel duty cycle available to the user is much lower than this at 5.4%. There are also operating and warning instructions in the operators manual to ensure compliance.
The SAR testing exemption threshold is 375/f or 375/2.44 which is equal to 153 milliwatts. Therefore SAR testing is not required.

The RF power output was set to 100 milliwatts(modulated signal) and was measured at the antenna port connecdted directly to a Spectrum Analyser, at the lower, middle and upper frequencies.

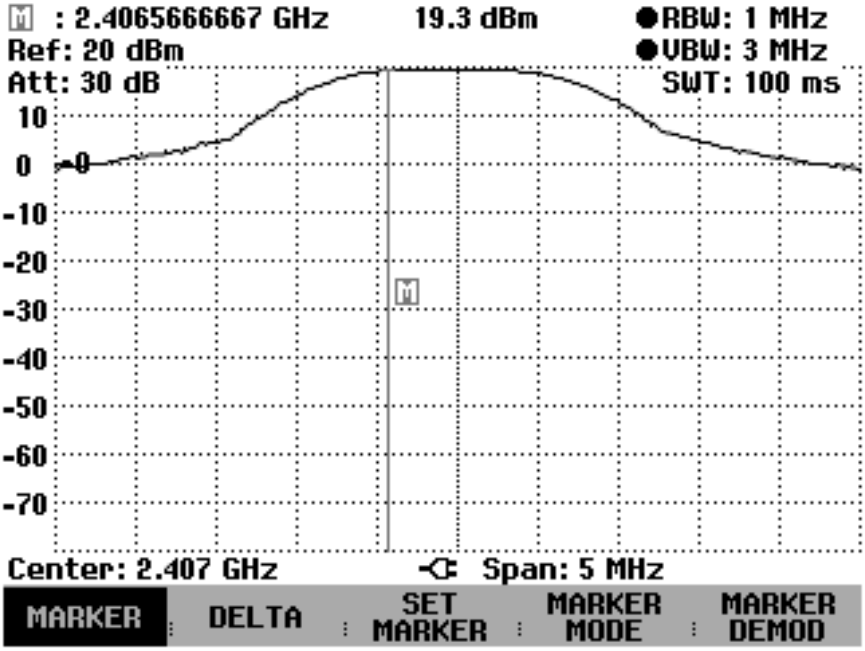
3.2. Transmitter Output Power Test Results

The results are given in Table 1 and pages 8 – 10. These tests were carried out on the 15th April 2008.

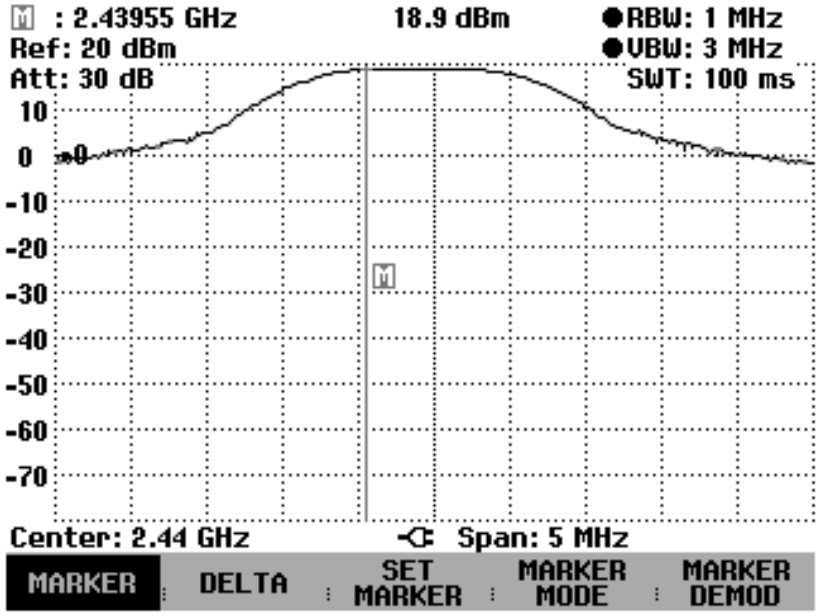
Table 1

Freq GHz	Peak Power dBm	Antenna Gain dBi	Net EIRP dBm	EIRP Limit dBm
2.407	19.3	2.5	21.8	27
2.443	18.9	2.5	21.4	27
2.477	17.8	2.5	20.3	27

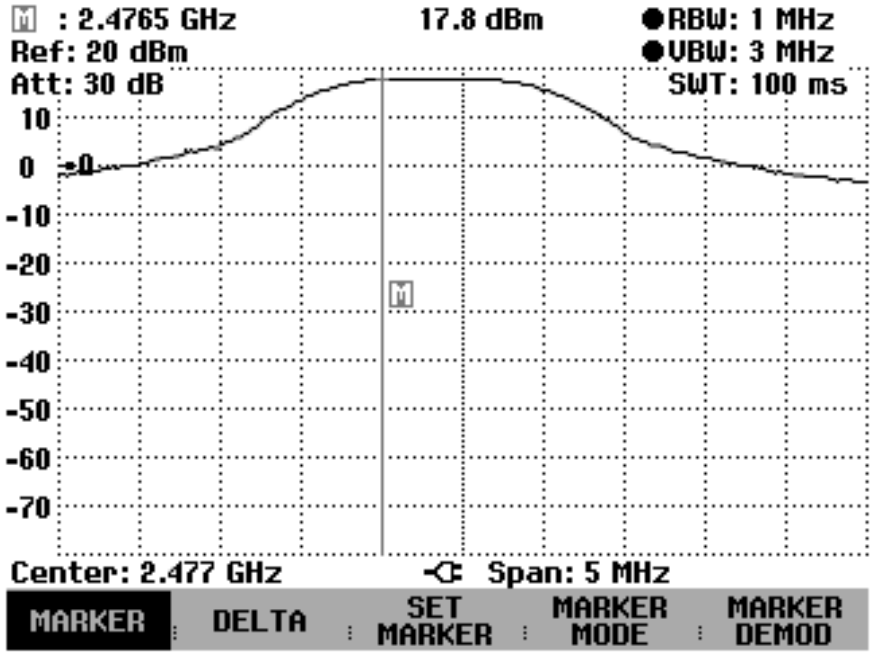
3.3. Test Plots – Conducted Power



Peak Power 2.407GHz



Peak Power 2.44GHz



Peak Power 2.477GHz

3.4. Modifications Performed During Testing

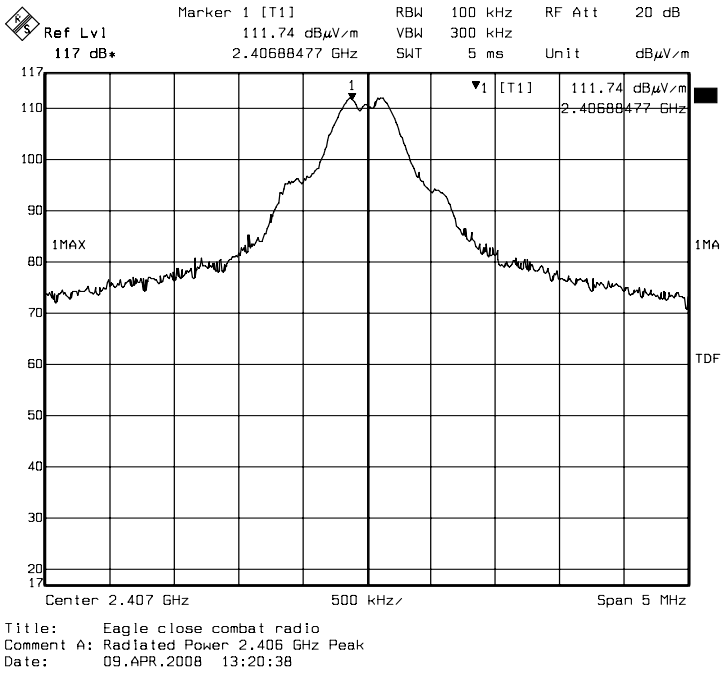
None.

3.5. Transmitter Output Power Tests

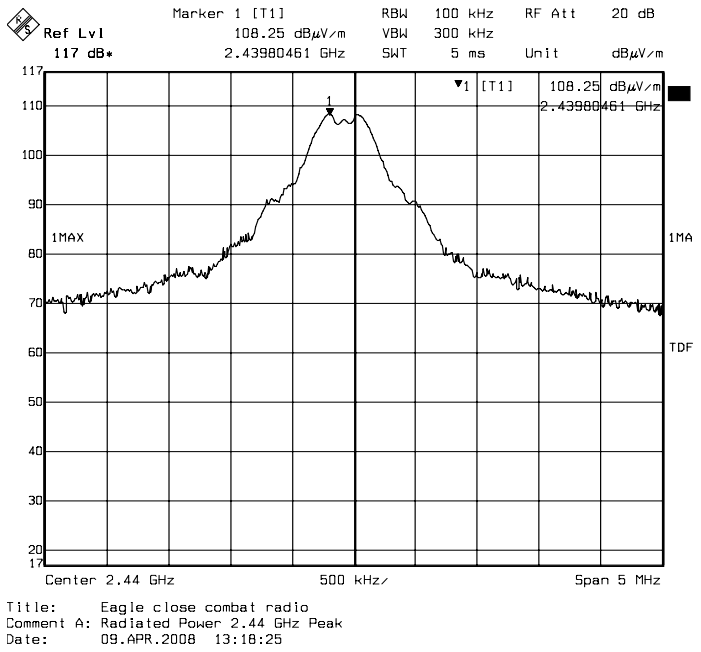
The EUT complied with CFR47:Part 15:247b(1)

3.6. Radiated Peak Powers

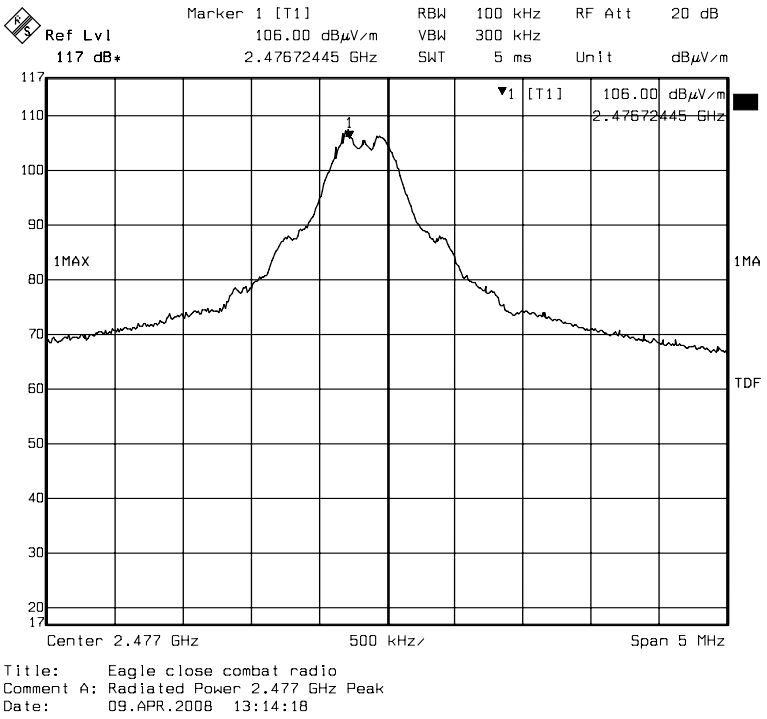
These tests carried out on 9th April 2008



2.406GHz



2.44GHz

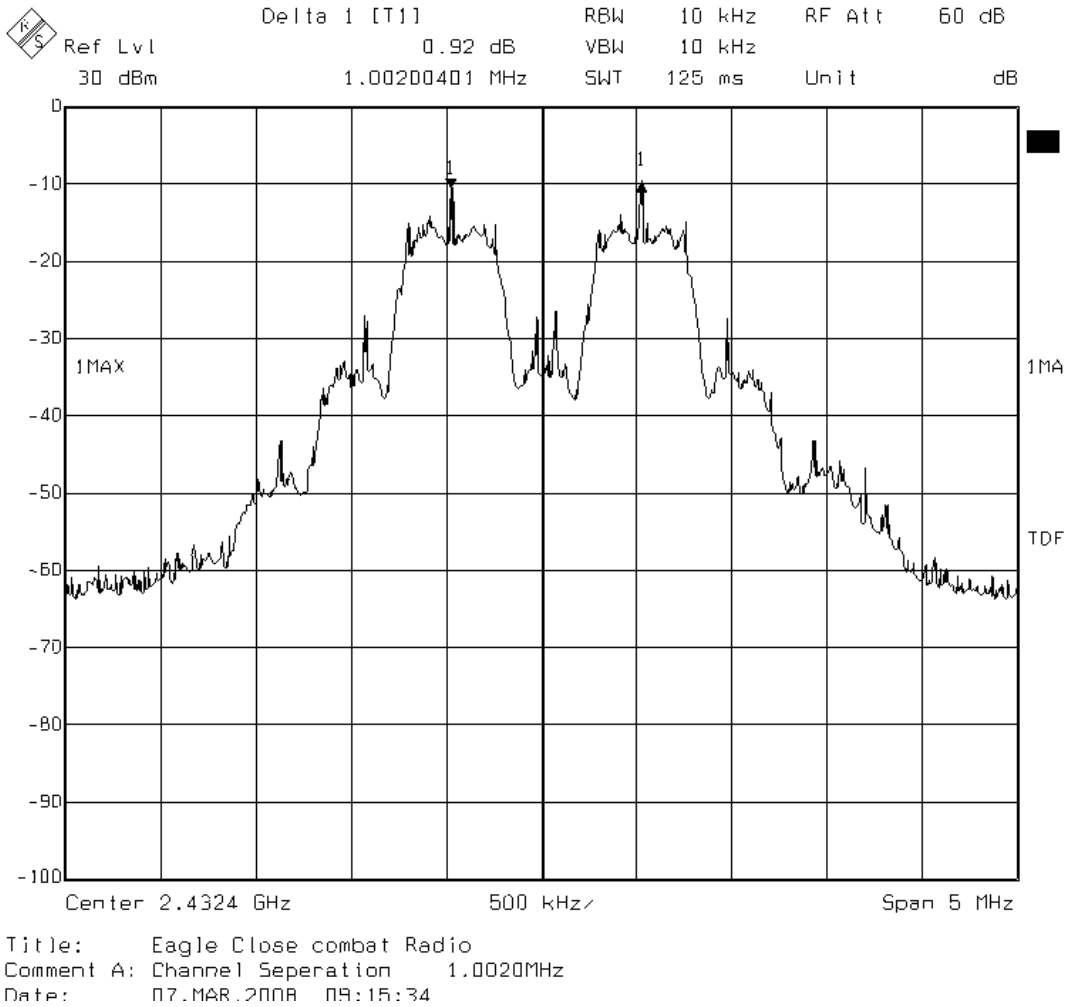

Marker 1 [T1]
RBW 100 kHz
RF Att 20 dB
Ref Lvl
106.00 dBµV/m
VBW 300 kHz
117 dB*
2.47672445 GHz
SWT 5 ms
Unit dBµV/m
1 [T1] 106.00 dBµV/m
2.47672445 GHz
1MAX
1MA
TDF
Center 2.477 GHz
500 kHz/
Span 5 MHz
Title: Eagle close combat radio
Comment A: Radiated Power 2.477 GHz Peak
Date: 09.APR.2008 13:14:18

2.477GHz

4. HOPPING CHANNEL SEPARATION

Channel Seperation (1.00200MHz)

This test carried out on 7th March 2008

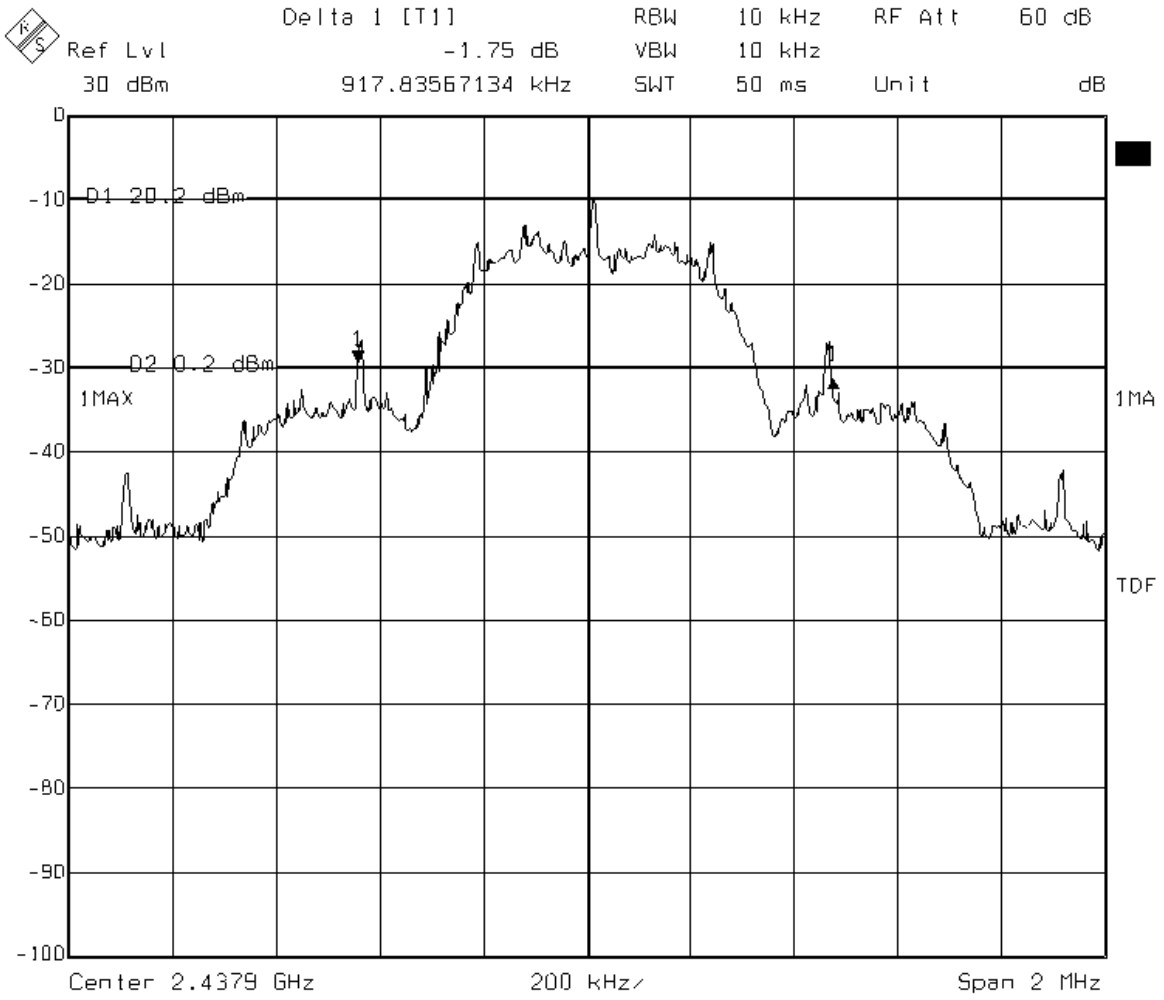


4.1. Pseudorandom Hopping and Receiver Hopping

The client attests that the receiver bandwidth hops In synchrony with the transmit bandwidth. This is necessary for the correct operation of the equipment.

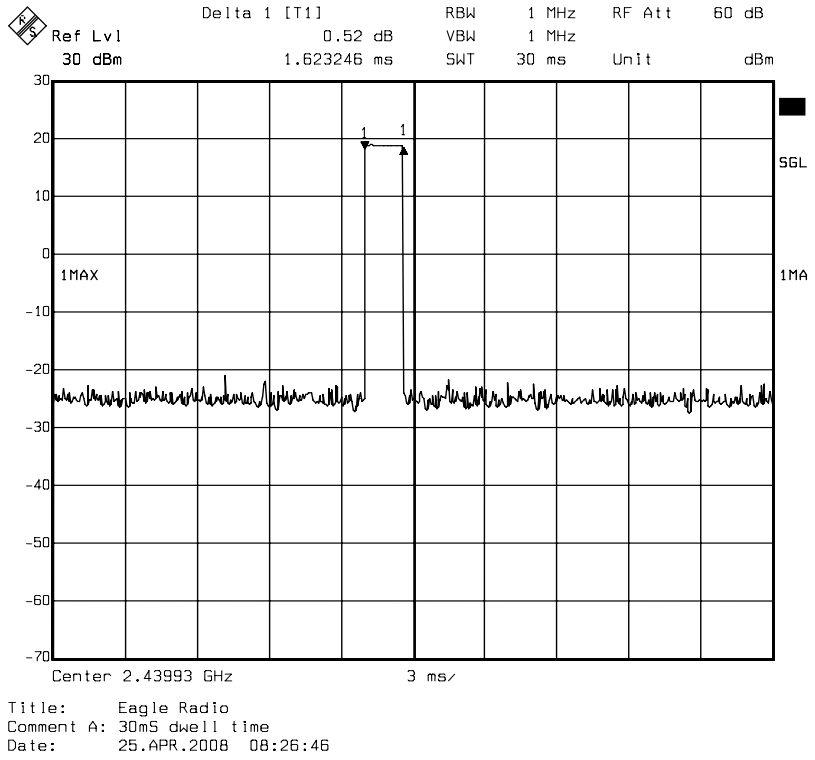
4.2. Hopping Channel Bandwidth

Occupied bandwidth 917.835671kHz

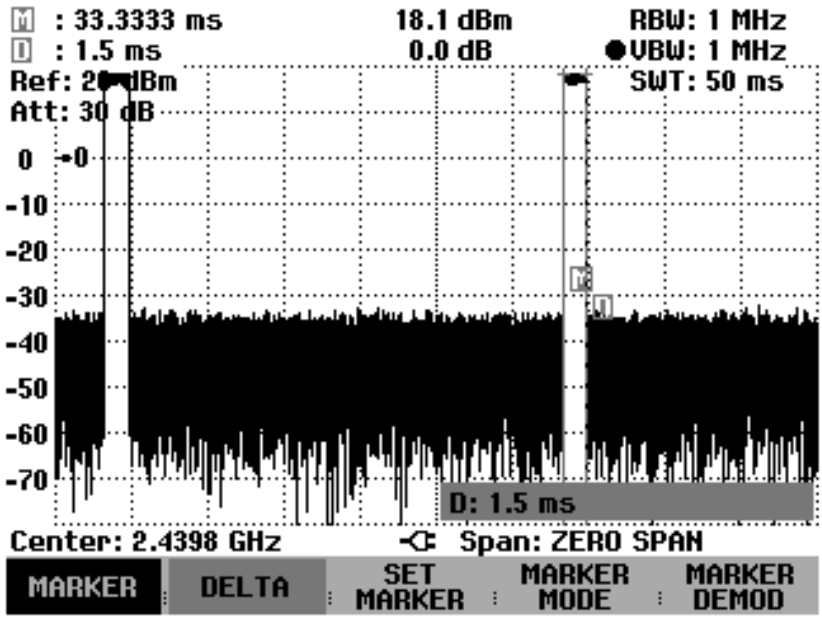


Title: Eagle Close combat Radio
Comment A: Occupied bandwidth -20dBc
Date: 07.MAR.2008 09:07:33

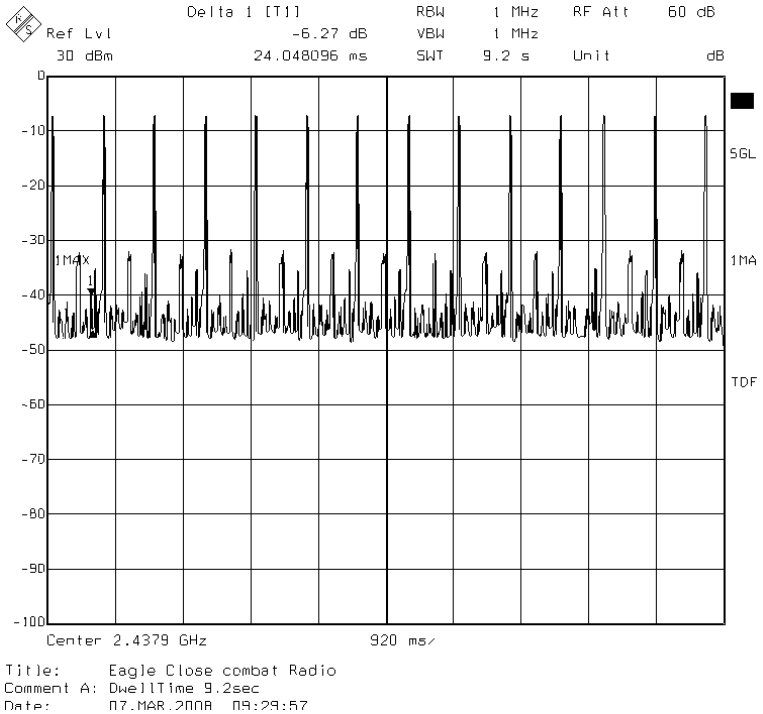
4.3. Dwell Time 15:247a.1.iii



Dwell time per channel is 1.62mS



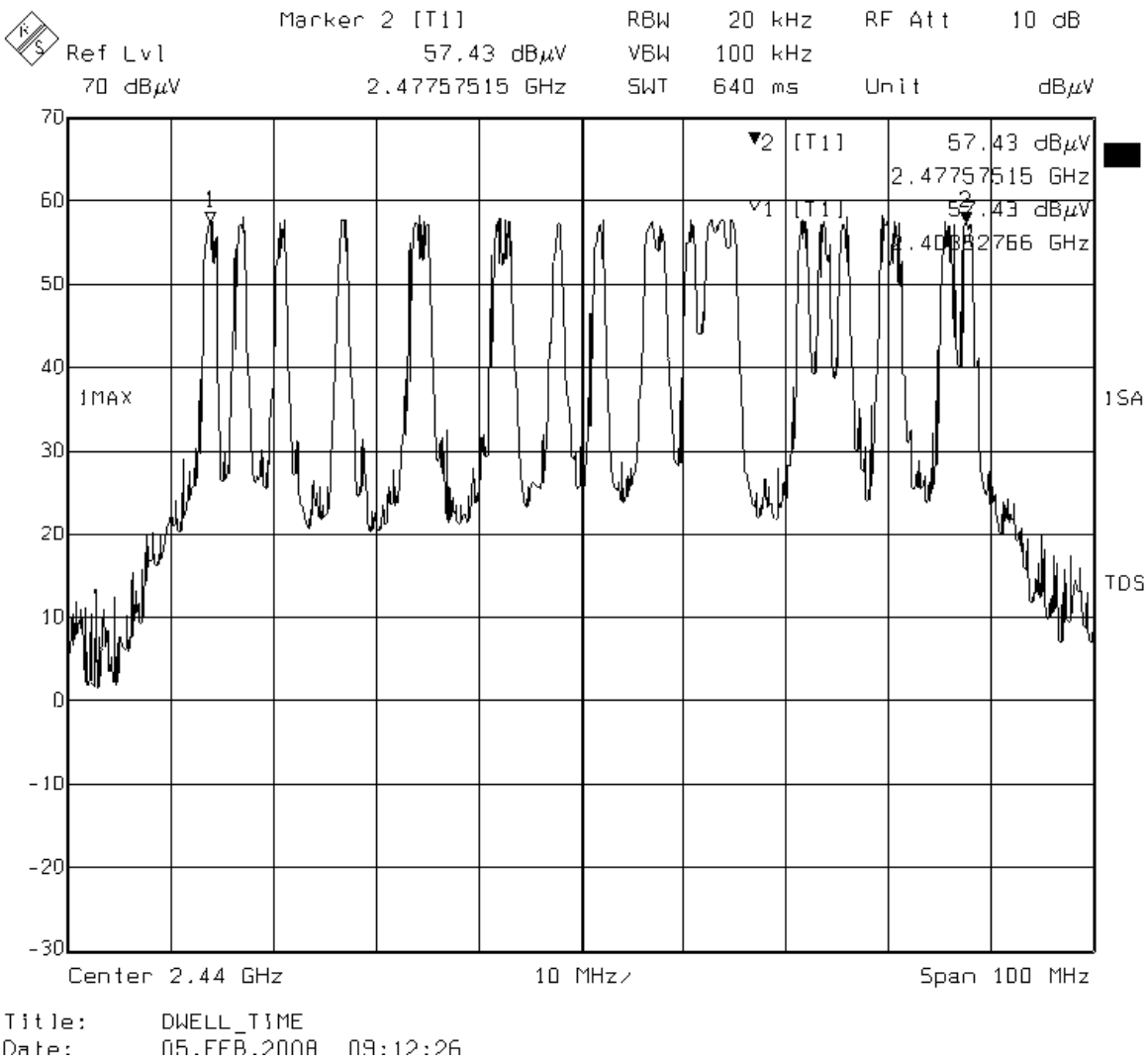
Dwell time showing 30ms repetition on fixed hopping channel



14 transmissions on one hopping frequency in a 9.2 second period

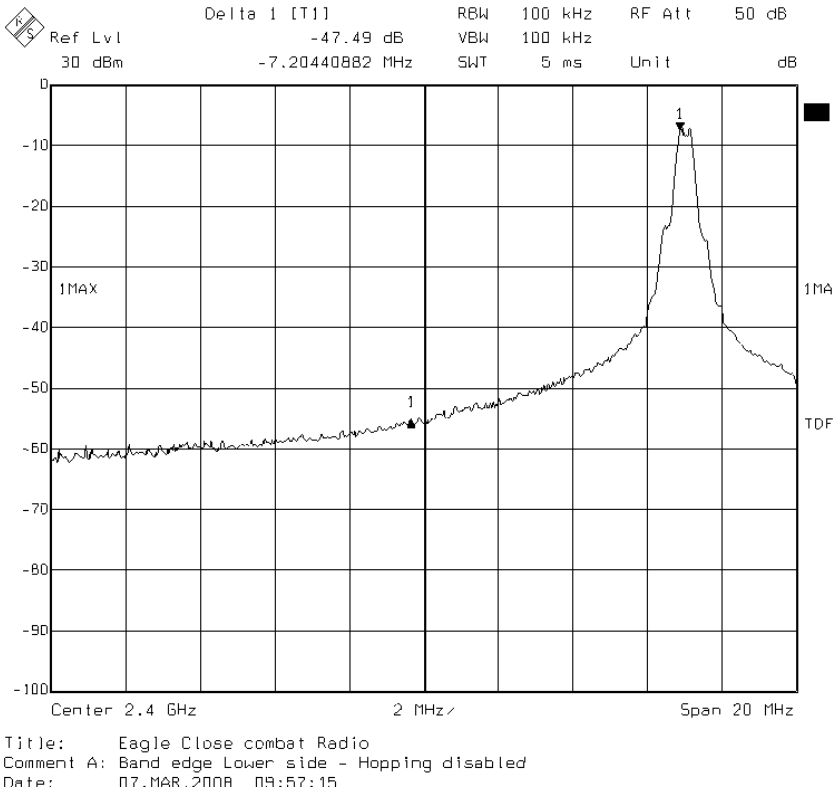
Total Occupancy time is therefore 14 x 1.62Ms = 22.68mS

4.4. Number of Hopping Channels

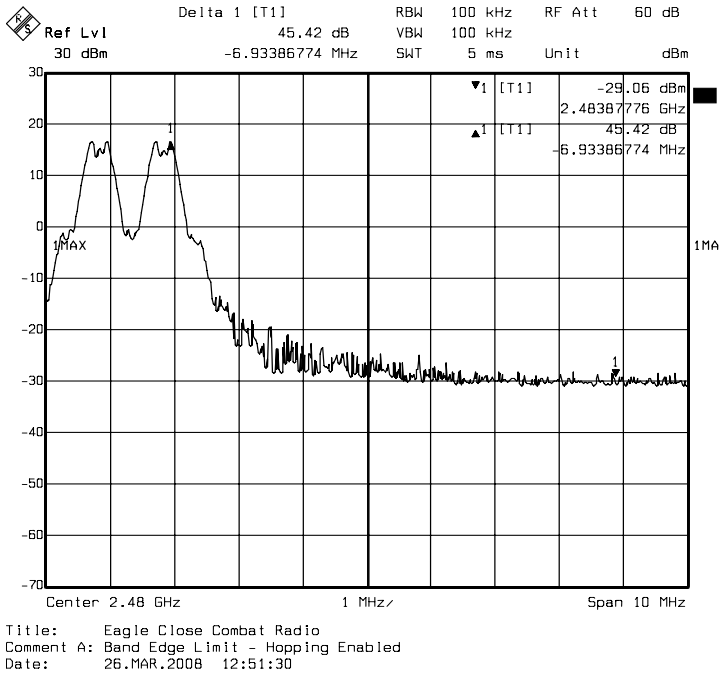


This test carried out on the 5th March 2008

4.5. Band Edge Compliance



Lower Channel – Hopping Disabled



Upper Channel – Hopping Disabled

5. RADIATED EMISSIONS < 1000MHZ

5.1. Test Procedure

These tests were carried out using an FCC registered test site at a distance of 3 metres and an automated test system covering the frequency range 30MHz to 1000MHz. Tests were carried out in both transmit and receive modes. These tests were carried out on the 2nd February 2008

Table 2 and graph 1 shows the results for the Eagle Close combat radio in transmit mode.

Table 3 and graph 2 show the results for the Eagle Close combat radio in receive mode.

Table 2

EUT Eagle Close Combat Radio
Manufacturer ERA Technology Ltd.
Operating Mode Transmit
standard FCC Part 15.209
temp 22
humidity 42
operator S Jackson
Scan

QP Horizontal

Frequency(Hz)	Level(dBuV/m)	Height(m)	Polar	Angle(Deg)	Limit(dBuV/m)	Margin(dBuV/m)	Comment	Detector	RBW(Hz)
33.183 M	33.71	3.30	|	164.00	40.00	-6.29		QP	120.0 k
34.606 M	30.72	3.56	|	100.00	40.00	-9.28		QP	120.0 k
43.551 M	25.18	2.08	|	92.00	40.00	-14.82		QP	120.0 k
67.889 M	20.84	2.82	|	94.00	40.00	-19.16		QP	120.0 k

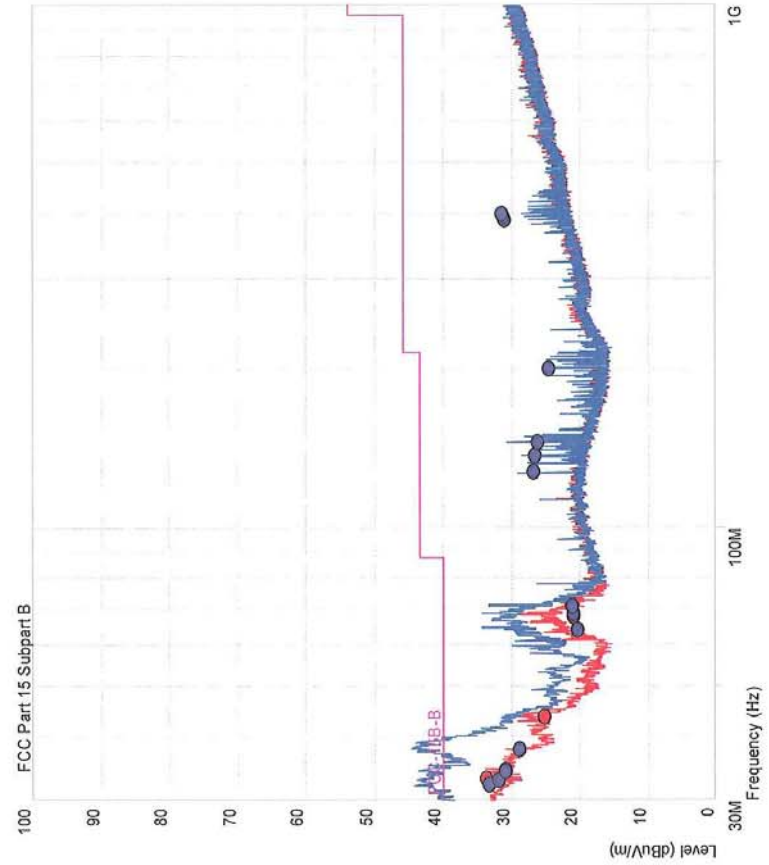
QP Vertical

Frequency(Hz)	Level(dBuV/m)	Height(m)	Polar	Angle(Deg)	Limit(dBuV/m)	Margin(dBuV/m)	Comment	Detector	RBW(Hz)
32.242 M	33.29	2.57	|	221.00	40.00	-6.71		QP	120.0 k
32.865 M	31.80	1.84	|	163.00	40.00	-8.20		QP	120.0 k
34.21 M	30.72	4.00	|	6.00	40.00	-9.28		QP	120.0 k
37.786 M	28.78	1.09	|	85.00	40.00	-11.22		QP	120.0 k
63.847 M	20.39	2.08	|	60.00	40.00	-19.61		QP	120.0 k
68.518 M	20.89	1.00	|	307.00	40.00	-19.11		QP	120.0 k
70.889 M	21.19	1.09	|	342.00	40.00	-18.81		QP	120.0 k
127.85 M	26.83	3.07	|	51.00	43.50	-16.67		QP	120.0 k
137.673 M	26.56	2.33	|	140.00	43.50	-16.94		QP	120.0 k
145.478 M	26.23	2.09	|	148.00	43.50	-17.27		QP	120.0 k
202.209 M	24.45	3.32	|	48.00	43.50	-19.05		QP	120.0 k
389.127 M	31.07	3.57	|	0.00	46.00	-14.93		QP	120.0 k
394.567 M	31.18	1.34	|	345.00	46.00	-14.82		QP	120.0 k
398.643 M	31.31	2.08	|	228.00	46.00	-14.69		QP	120.0 k

Graph 1

EM07028998

Scan



Red Horizontal

Blue Vertical

Table 3

EUT Eagle Close Combat Radio
Manufacturer ERA Technology Ltd.
Operating Mode Receive
standard FCC Part 15.209
temp 22
humidity 42
operator S Jackson
Scan

QP Horizontal

Frequency(Hz)	Level(dBuV/m)	Height(m)	Polar	Angle(Deg)	Limit(dBuV/m)	Margin(dBuV/m)	Comment	Detector	RBW(Hz)

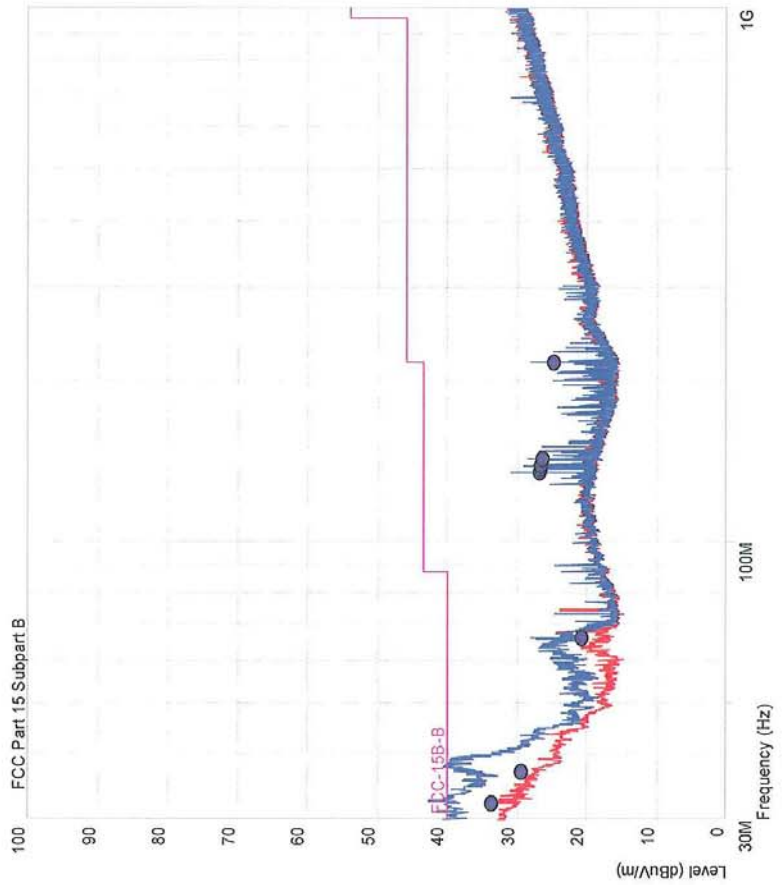
QP Vertical

Frequency(Hz)	Level(dBuV/m)	Height(m)	Polar	Angle(Deg)	Limit(dBuV/m)	Margin(dBuV/m)	Comment	Detector	RBW(Hz)
32.251 M	33.62	3.57	|	333.00	40.00	-6.38		QP	120.0 k
37.154 M	29.35	1.59	|	165.00	40.00	-10.65		QP	120.0 k
66.165 M	20.72	1.82	|	134.00	40.00	-19.28		QP	120.0 k
135.01 M	26.68	1.34	|	185.00	43.50	-16.82		QP	120.0 k
137.282 M	26.66	1.82	|	345.00	43.50	-16.84		QP	120.0 k
139.185 M	26.61	2.56	|	151.00	43.50	-16.89		QP	120.0 k
143.265 M	26.43	2.32	|	360.00	43.50	-17.07		QP	120.0 k
216.048 M	24.70	3.55	|	92.00	46.00	-21.30		QP	120.0 k

Graph 2

EM07028998

Scan



Red Horizontal

Blue Vertical

5.2 Radiated Emissions > 1000MHz

The testing was performed as required by CFR47 Part15:247d in a FCC registered test site. Testing was carried out at a distance of 3 metres with the appropriate antenna's connected to a pre amplifier and spectrum analyser situated outside the test chamber.The transducer factors for the Antenna,cables and preamplifier are automatically calculated into the test results and the results are presented with data corrected.

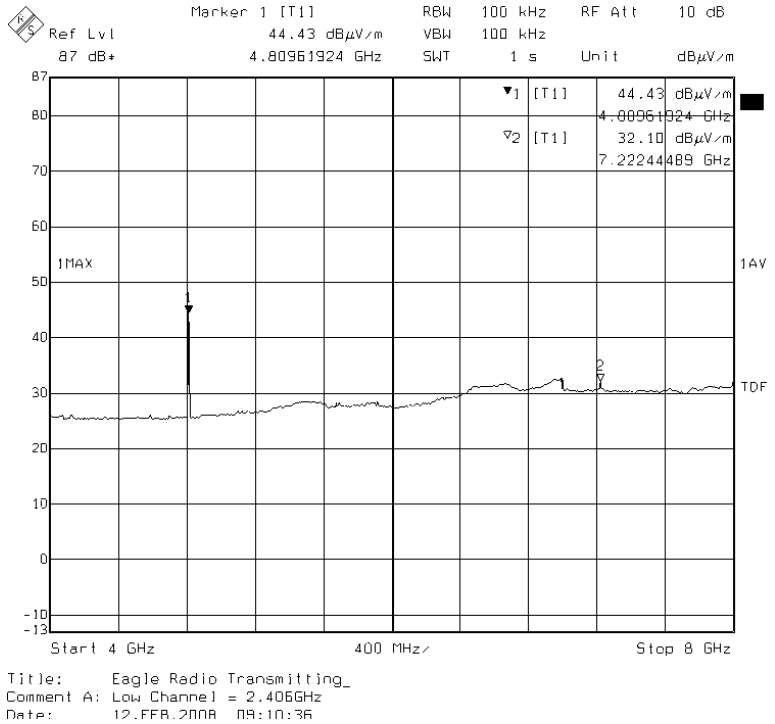
The Eagle Close Combat radio transceiver was tuned to a frequency of 2.406GHz and a power output of 100 milliwatts. The frequency was scanned over the frequency range of 1GHz to 24GHz. Any frequencies with amplitudes above the measuring system noise were recorded. These measurements were carried out with a Resolution bandwidth of 100kHz using an average detector and a peak detector. This procedure was then carried out at 2.44GHz and 2.477GHz.
All frequencies with amplitudes recorded were found to be more than 20 dB below the intentional frequency amplitude levels.

Table 4 shows gives the page numbers for the plots for test frequencies.

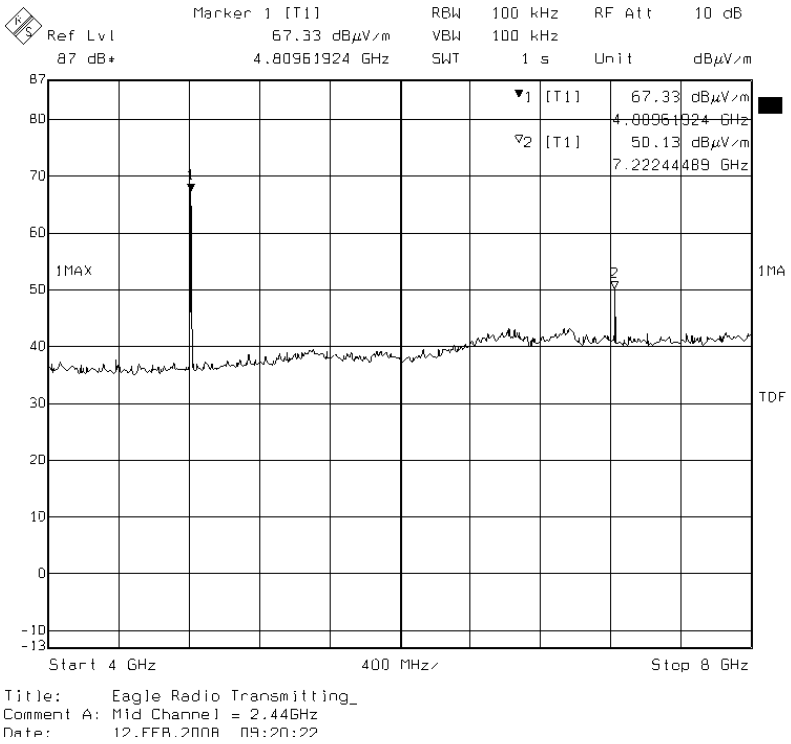
Table 4

Frequency MHz	Page numbers
2.406	23 - 27
2.44	28 - 31
2.47	32 - 35

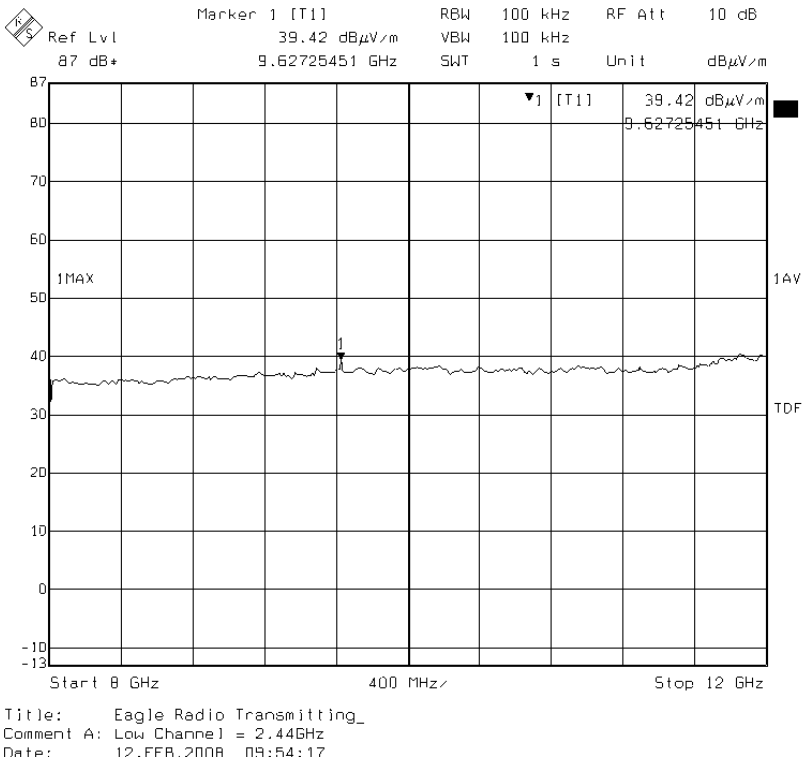
2.406GHz



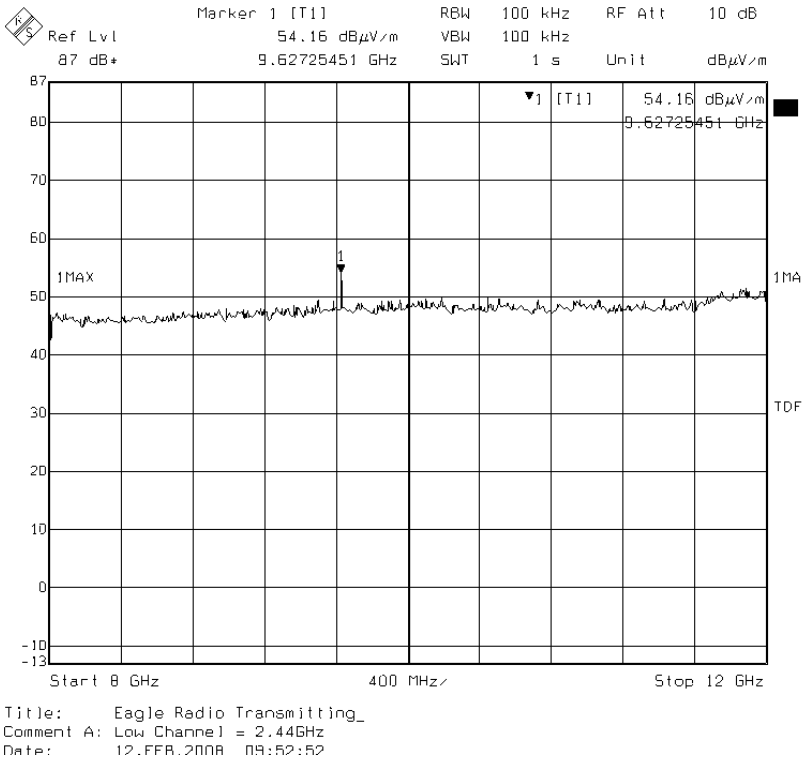
Average



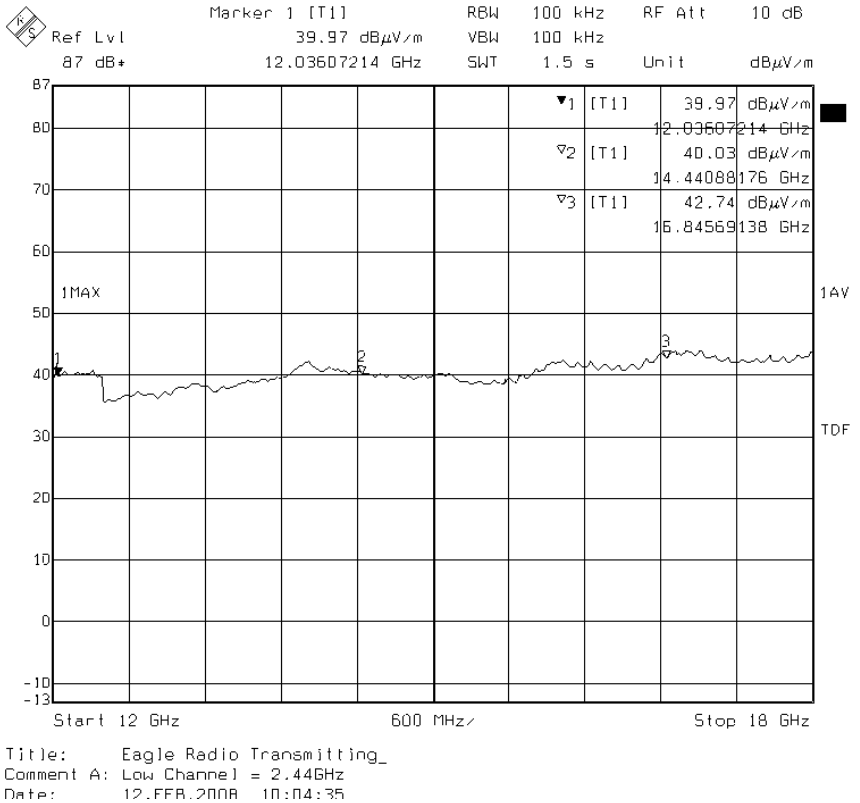
Peak



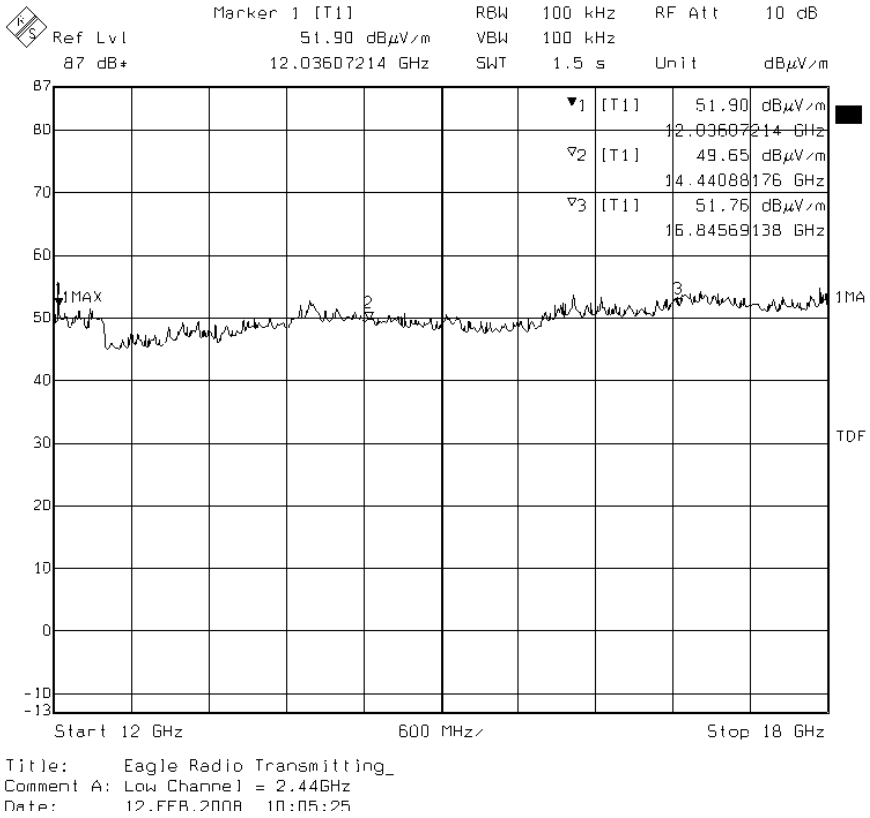
Average



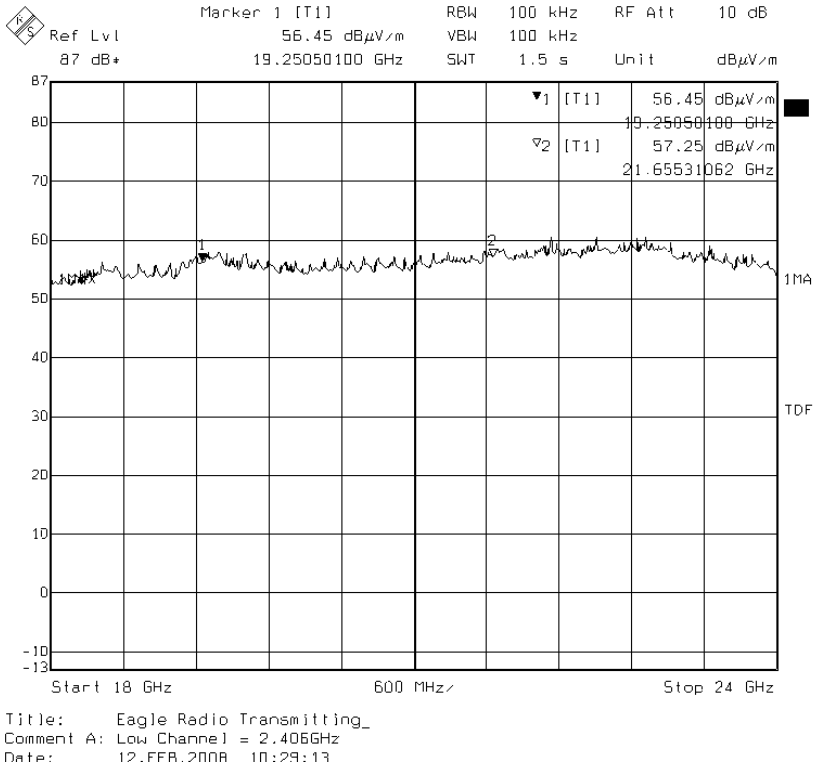
Peak



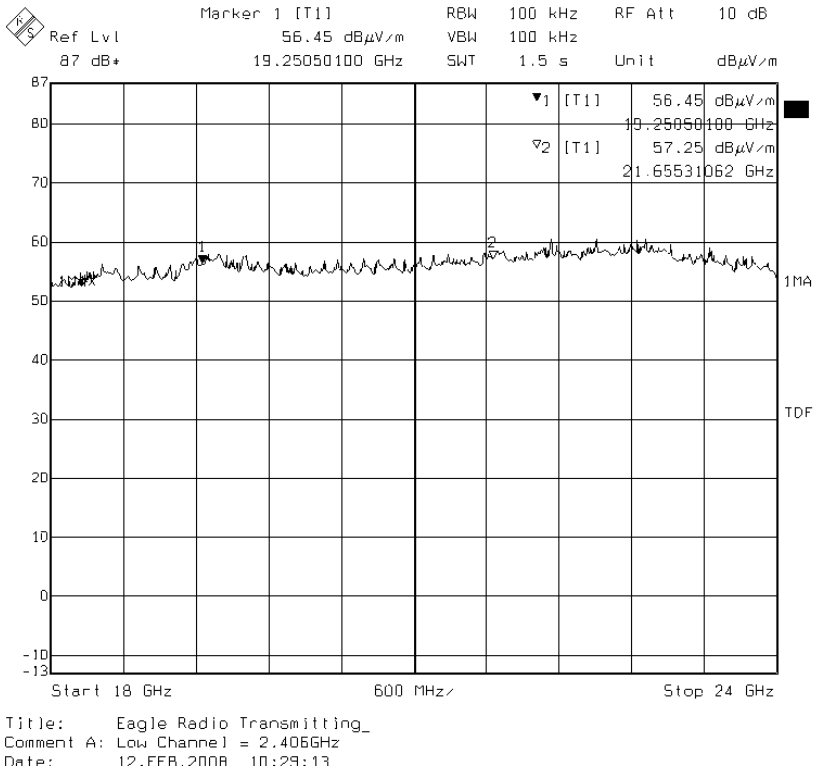
Average



Peak

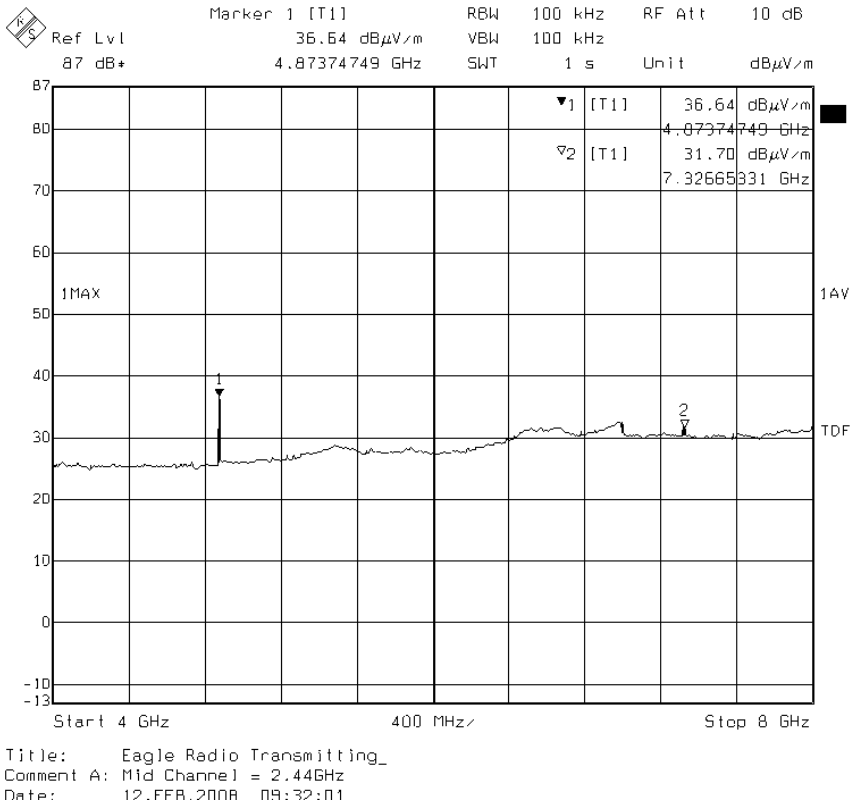


Average

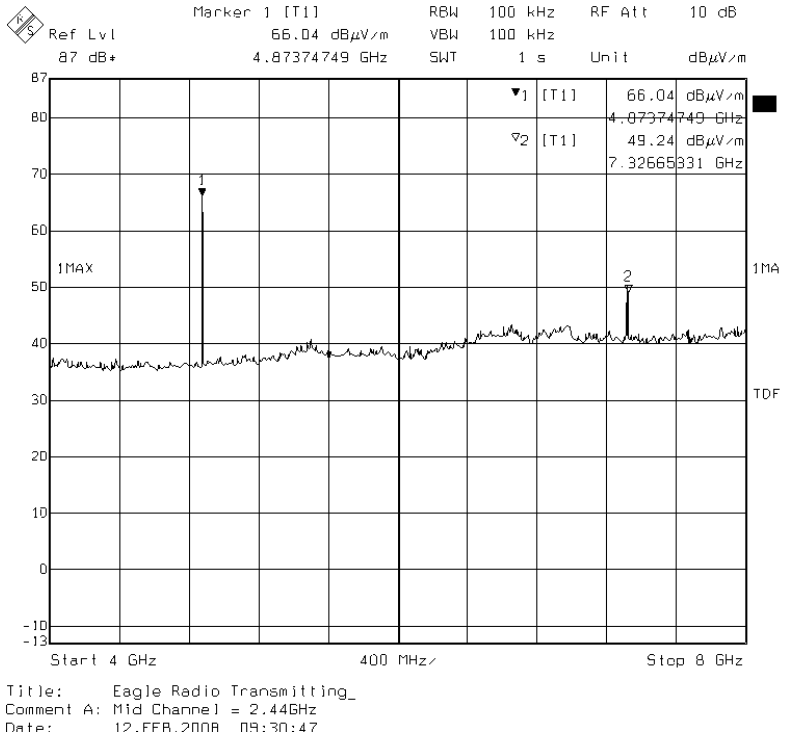


Peak

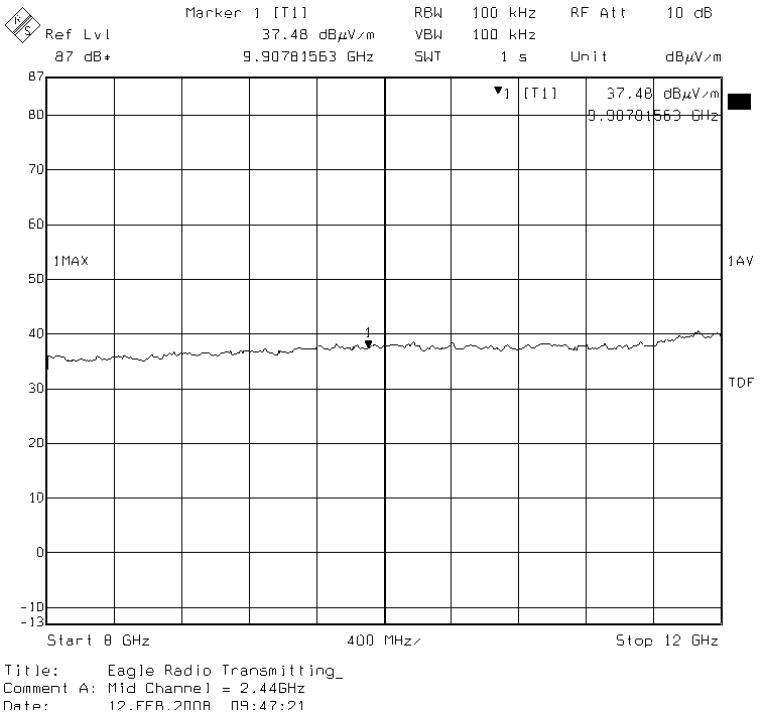
2.443GHz



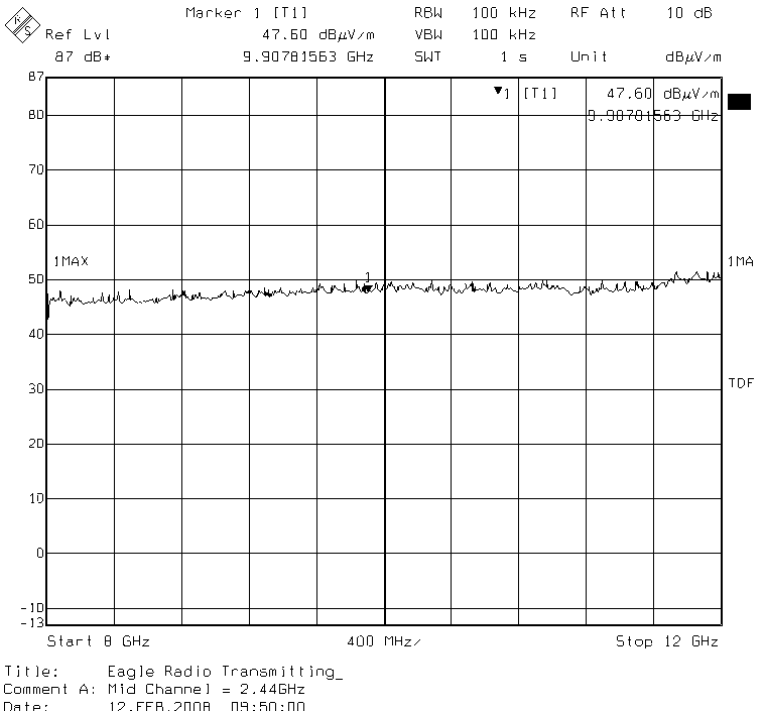
Average



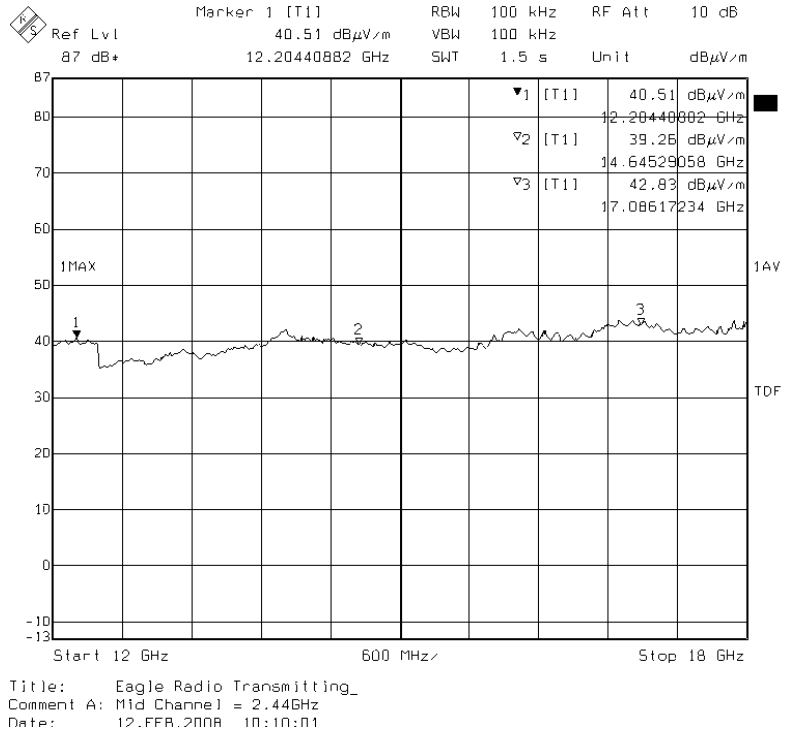
Peak



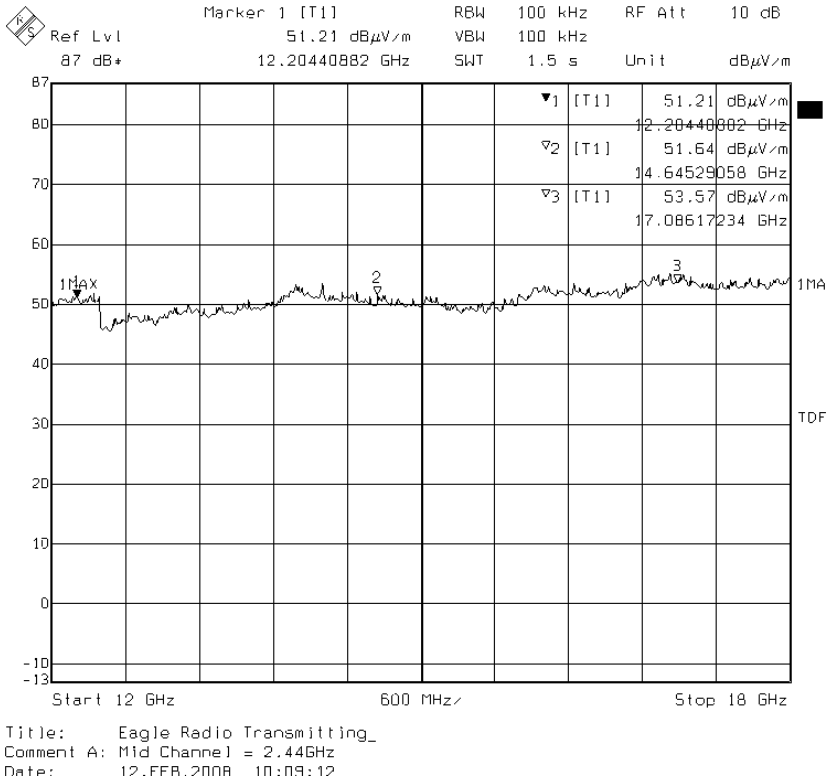
Average



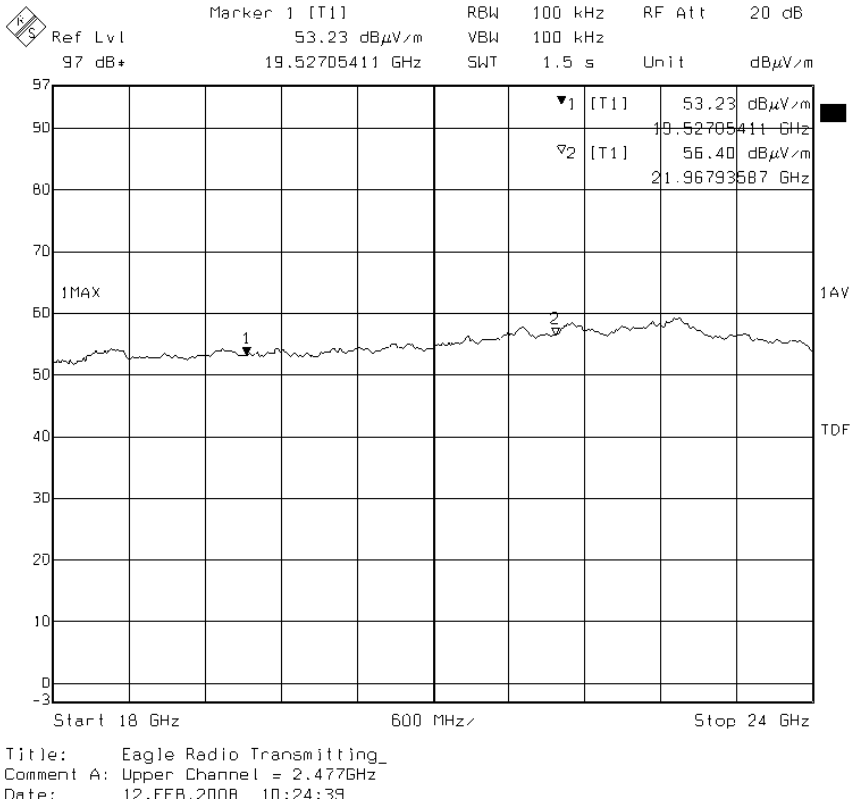
Peak



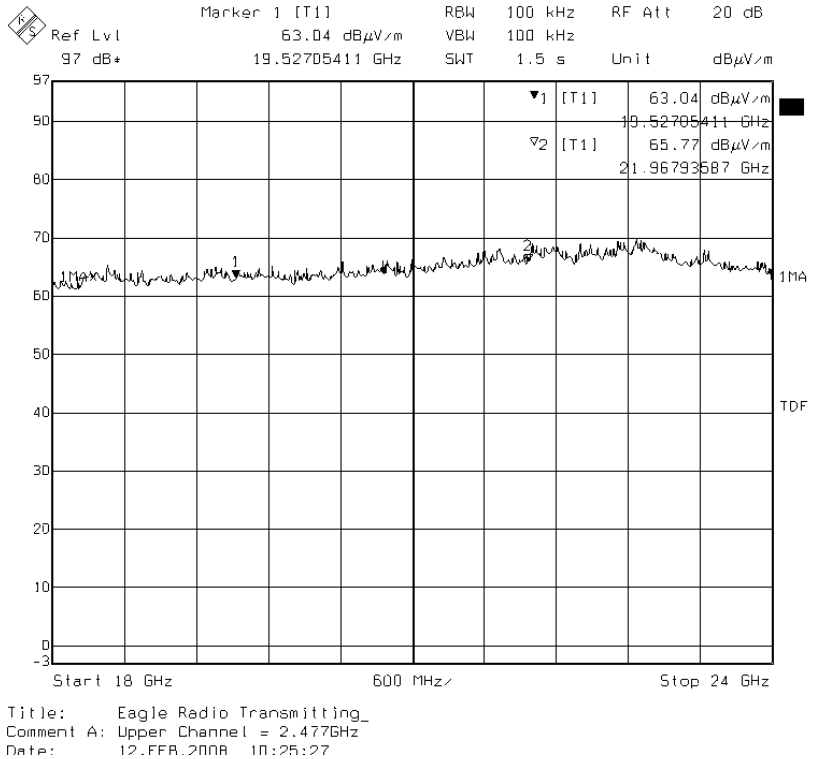
Average



Peak

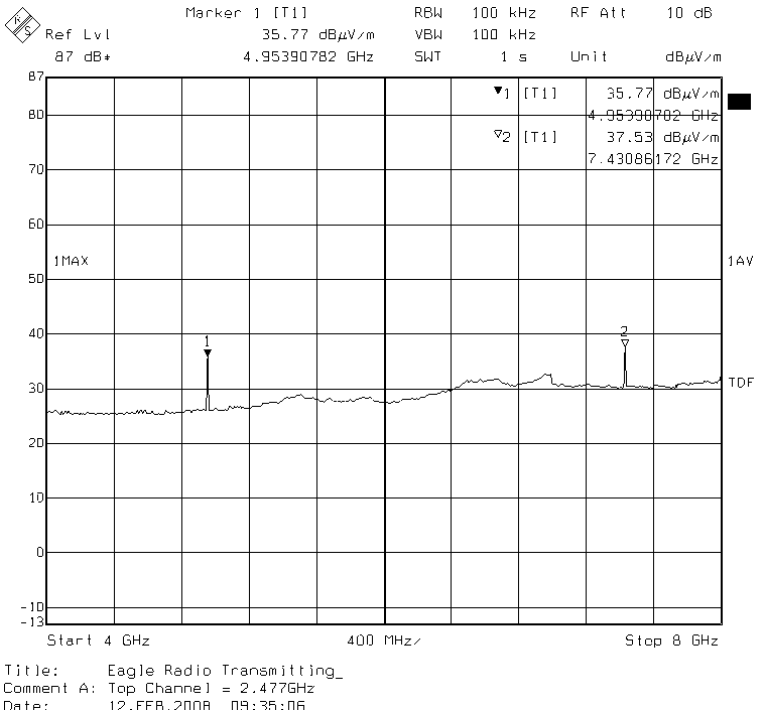


Average

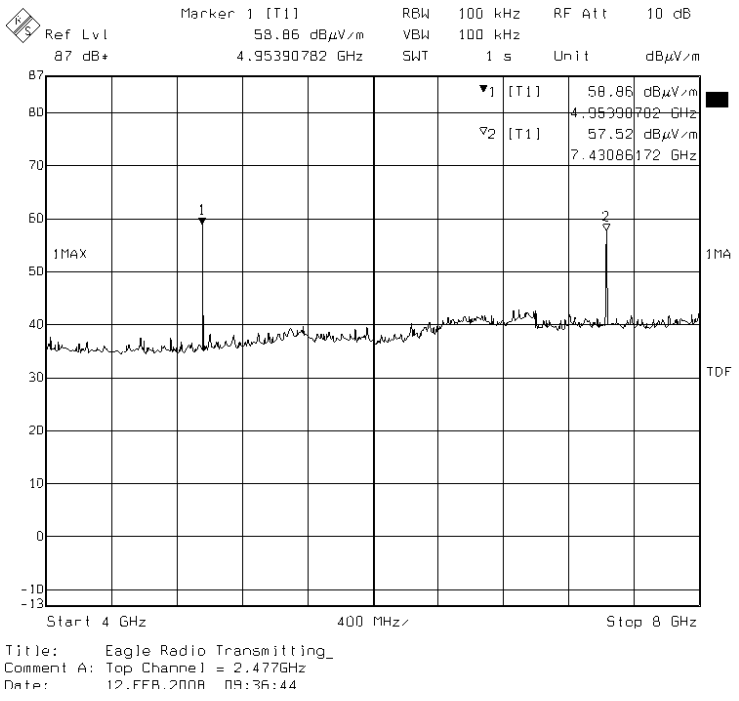


Peak

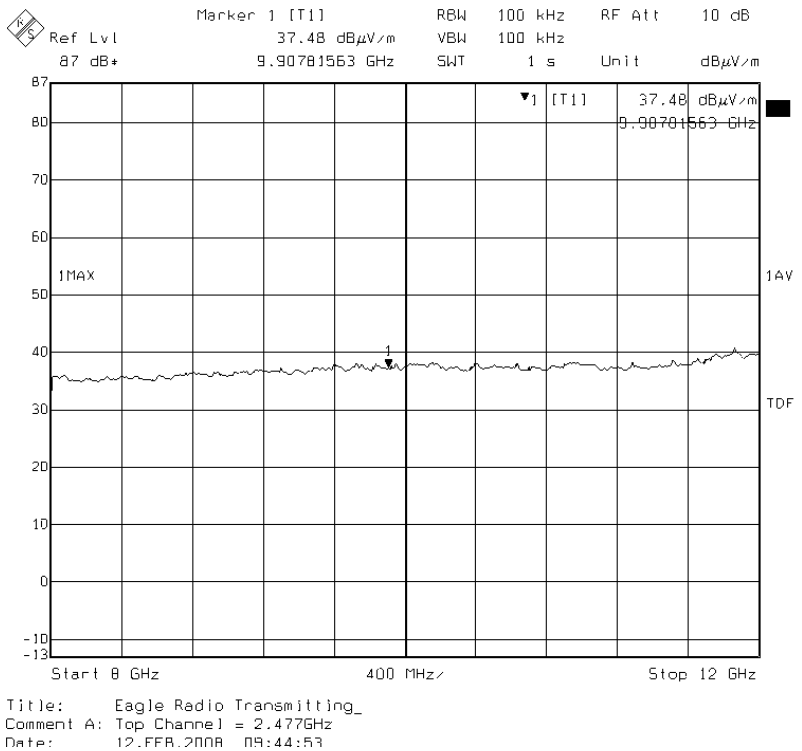
2.477GHz



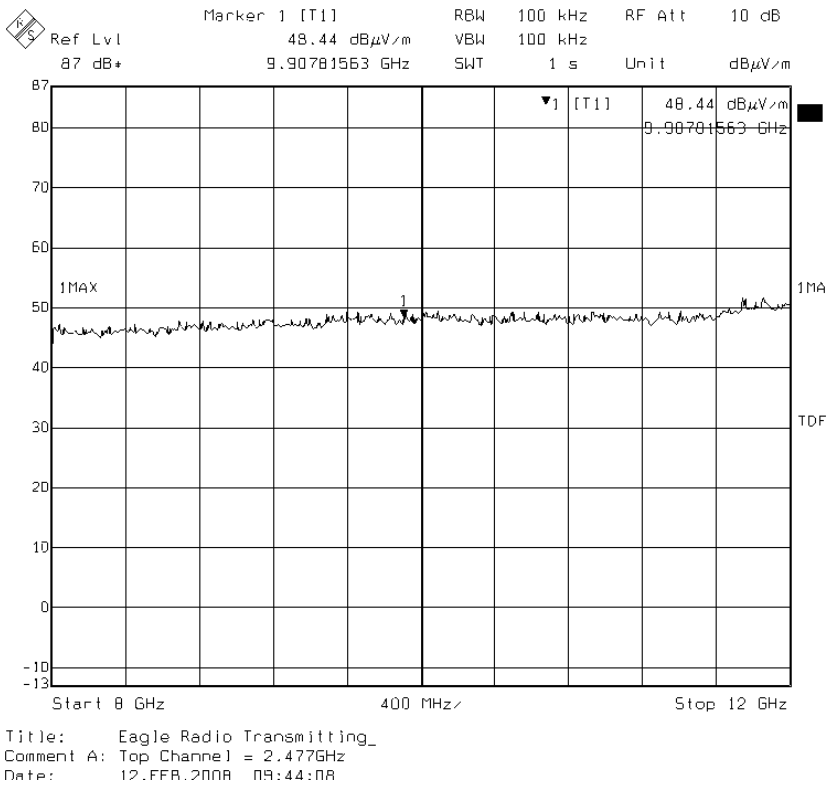
Average



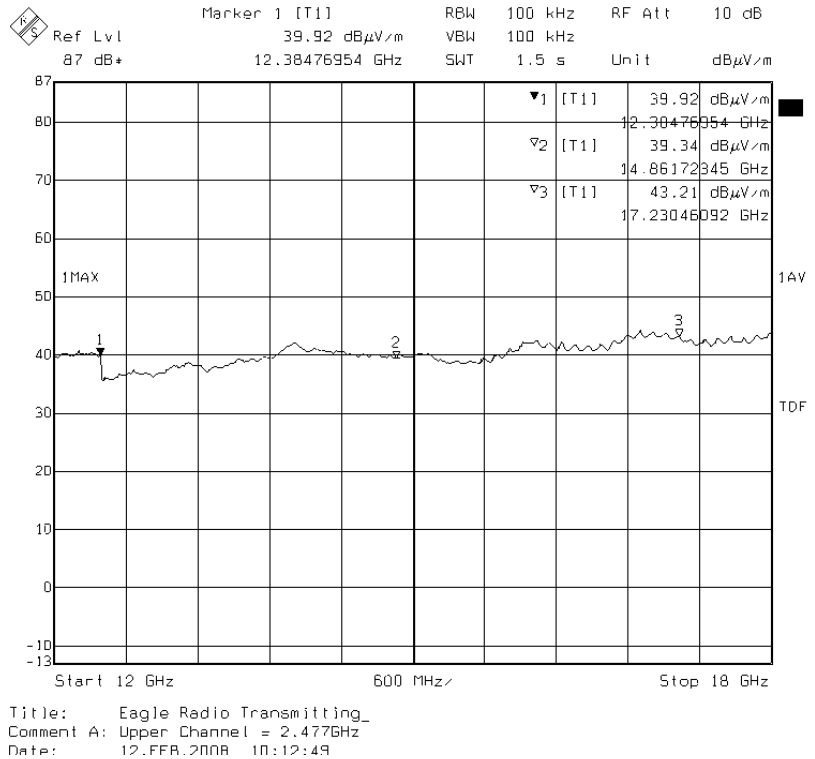
Peak



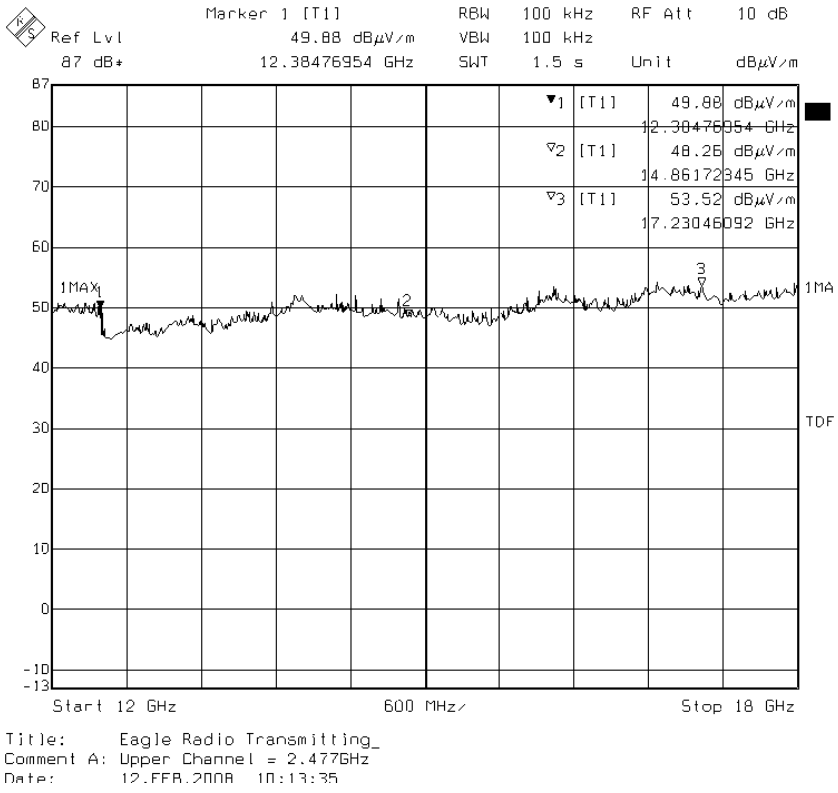
Average



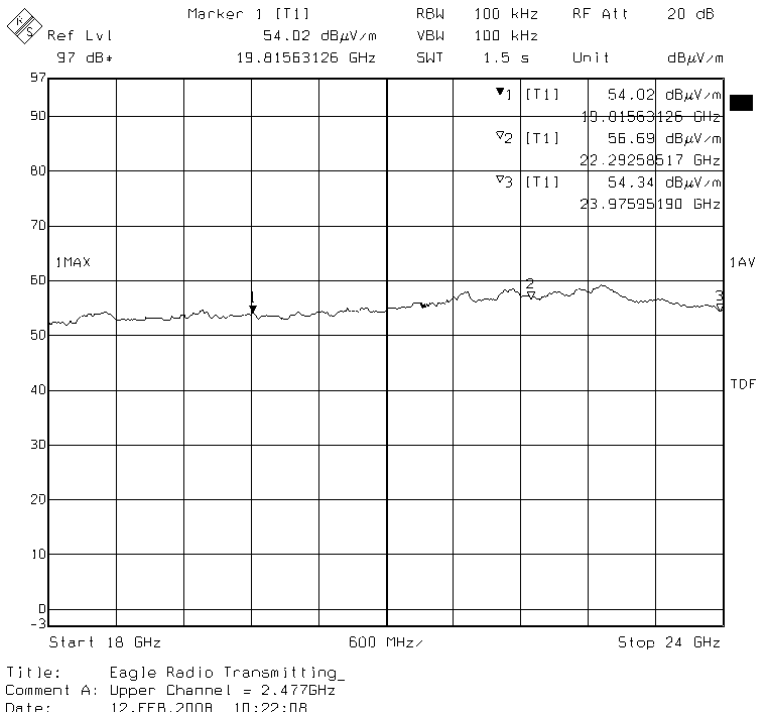
Peak



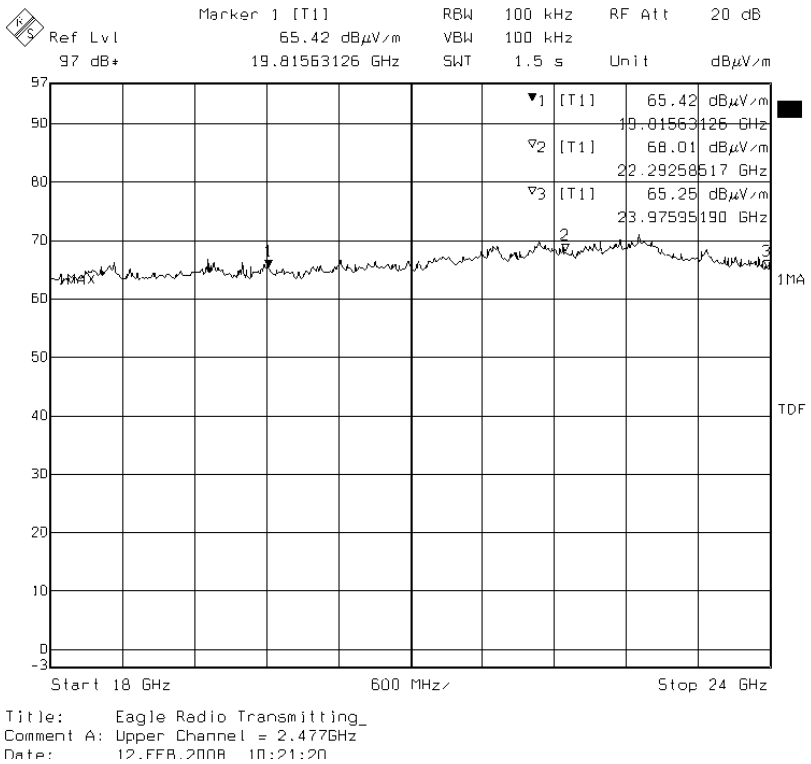
Average



Peak



Average



Peak

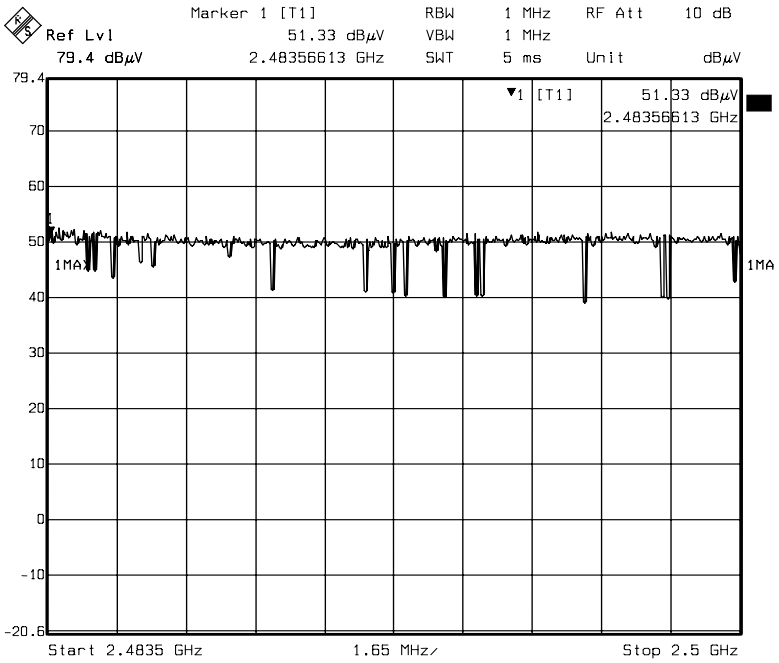
6. RADIATED EMISSIONS CFR47 PART15:205

6.1. Test Procedure – Restricted Bands

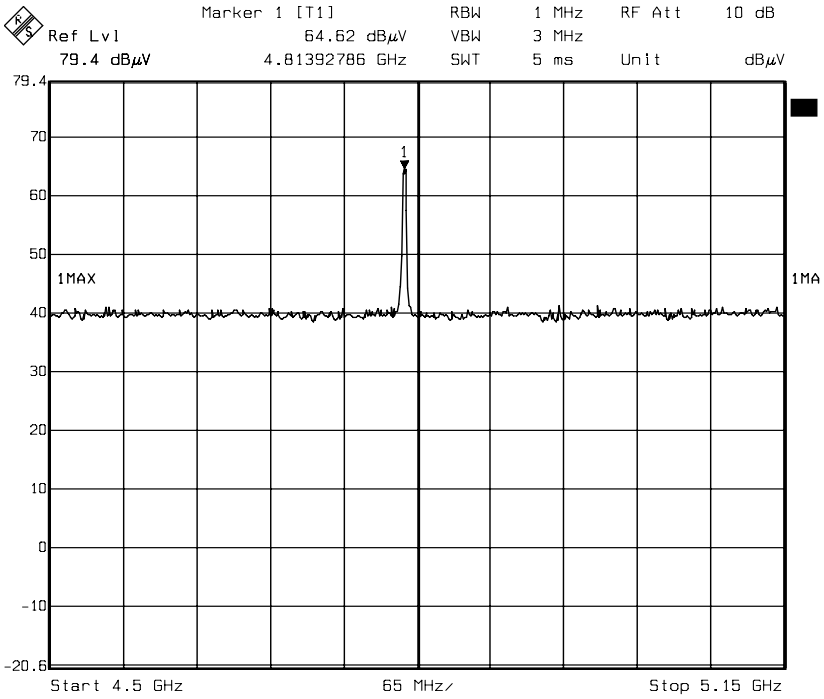
The Eagle Close Combat radio transceiver was set to 2.406, 2.443 and 2.477GHz in turn, with the transceiver set to maximum output. The frequency ranges from 2.4835 to 2.5 GHz, 4.5 to 5.15GHz and 7.25 to 7.75GHz were scanned using a spectrum analyser for peak detectors via a preamplifier with a nominal gain of 28dB.
These tests carried out using a 1.0MHz RBW and a VBW of 3MHz as required by Part 15 :205.

Plots of these tests are shown in section 6.2. Table 5 shows the calculations for the levels recorded.

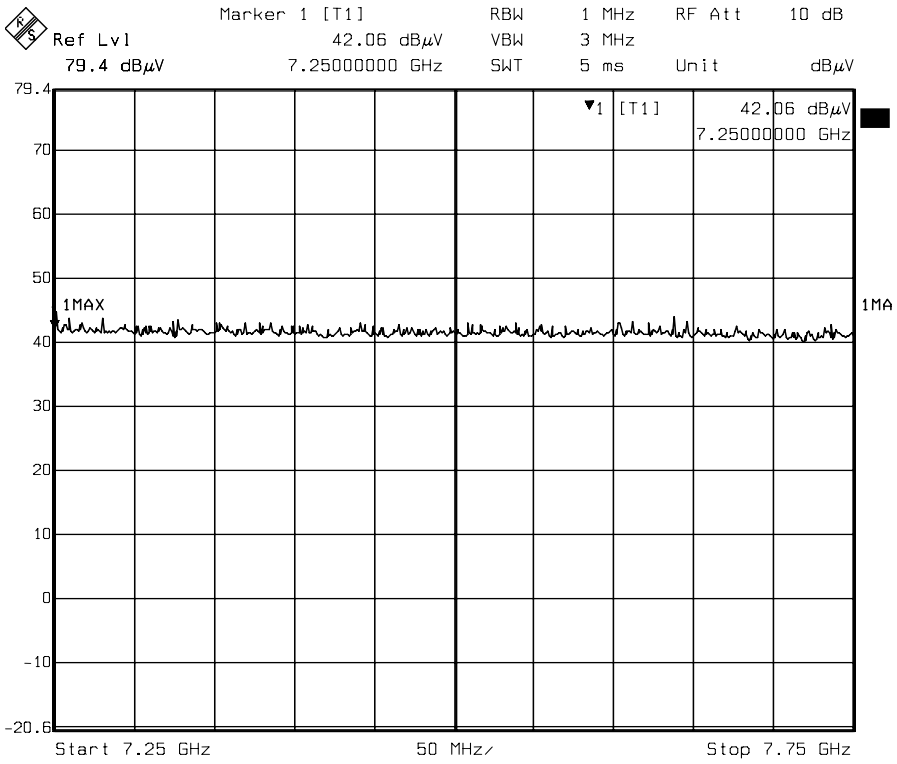
6.2. Plots of Restricted Bands



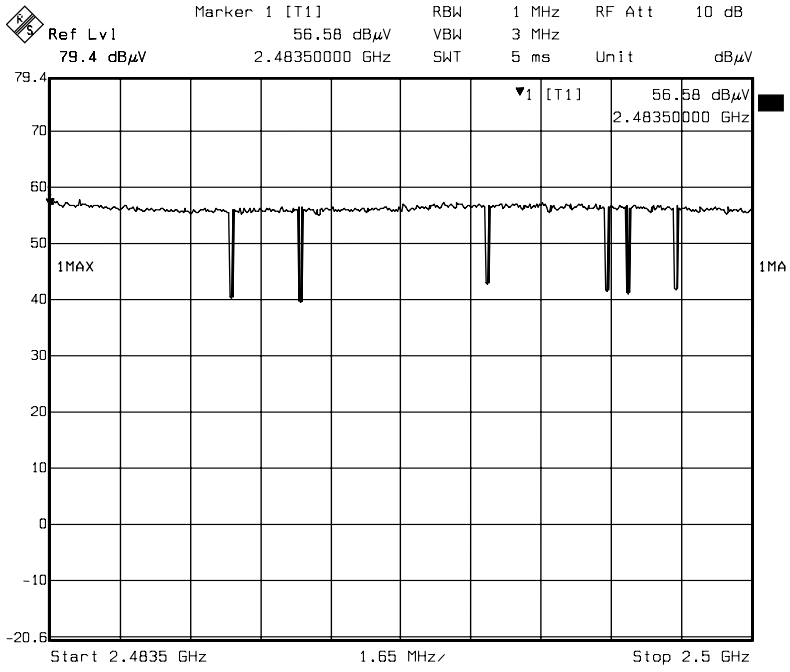
Title: Eagle Close Combat Radio
Comment A: Restricted Bands 2.406GHz Peak
Date: 26.MAR.2008 11:51:55



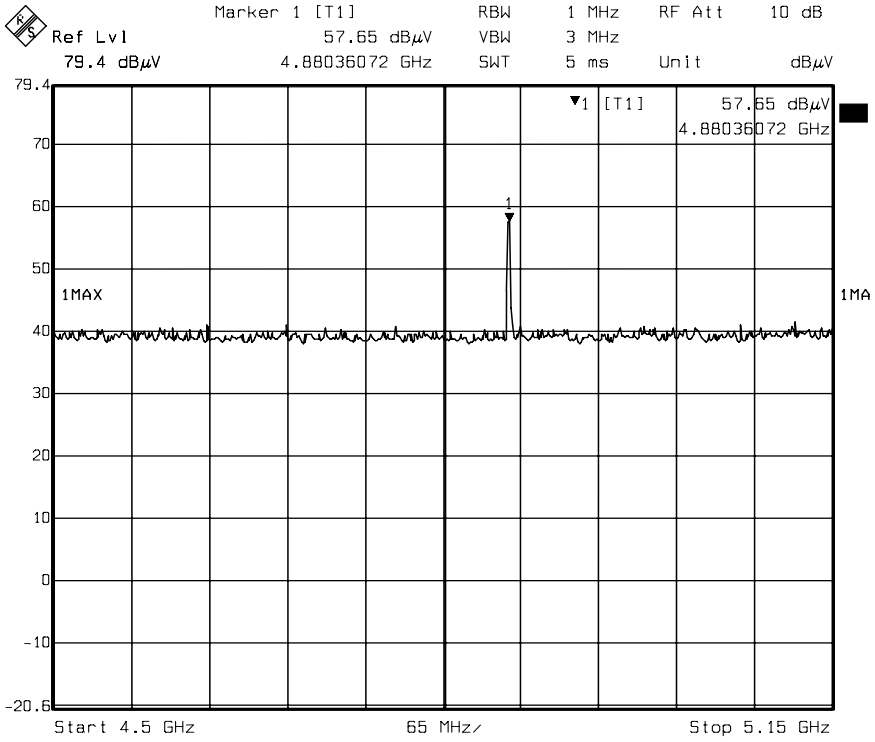
Title: Eagle Close Combat Radio
Comment A: Restricted Bands 2.406GHz Peak
Date: 26.MAR.2008 11:44:11



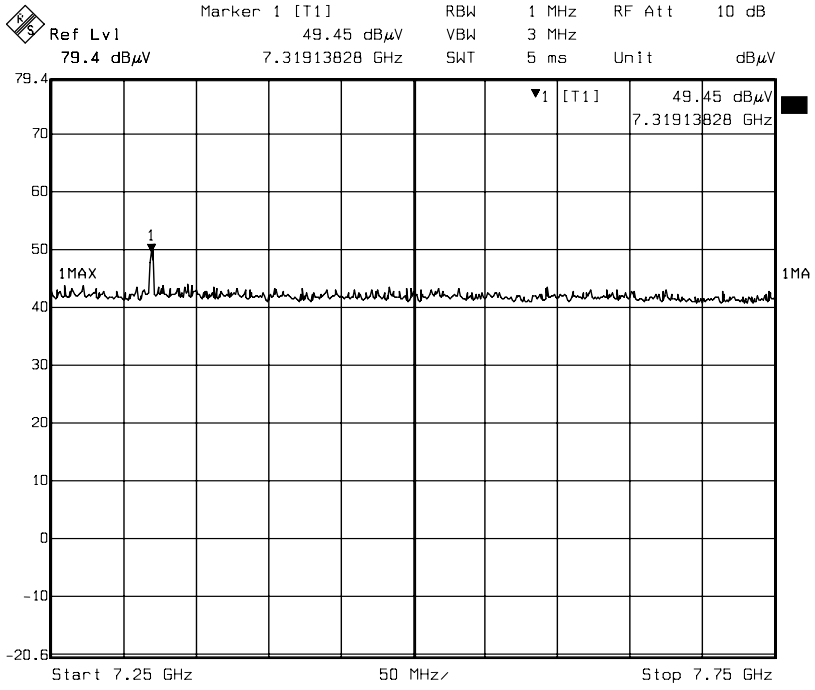
Title: Eagle Close Combat Radio
Comment A: Restricted Bands 2.406GHz Peak
Date: 26.MAR.2008 11:53:34



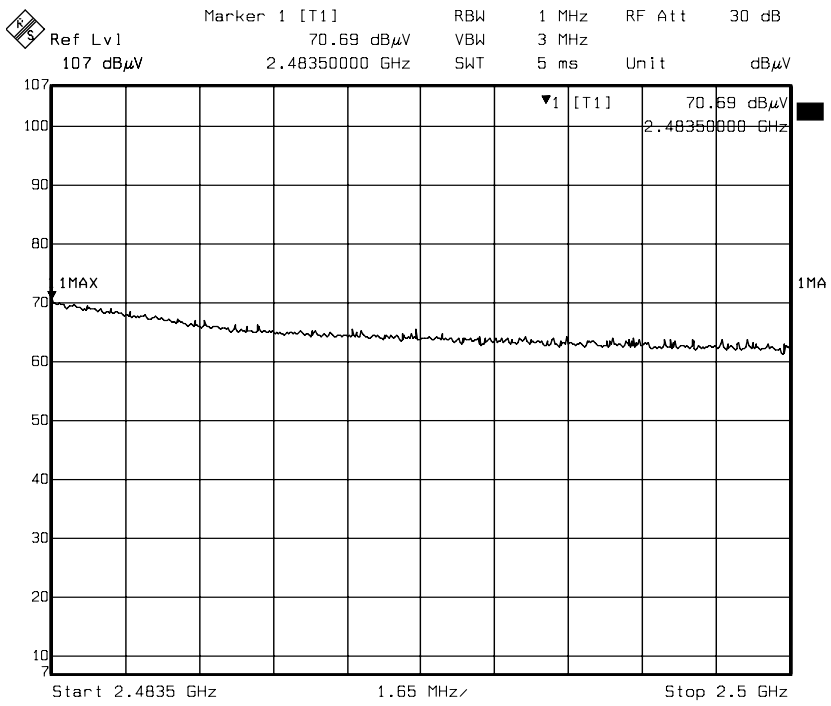
Title: Eagle Close Combat Radio
Comment A: Restricted Bands 2.443GHz Peak
Date: 26.MAR.2008 12:15:08



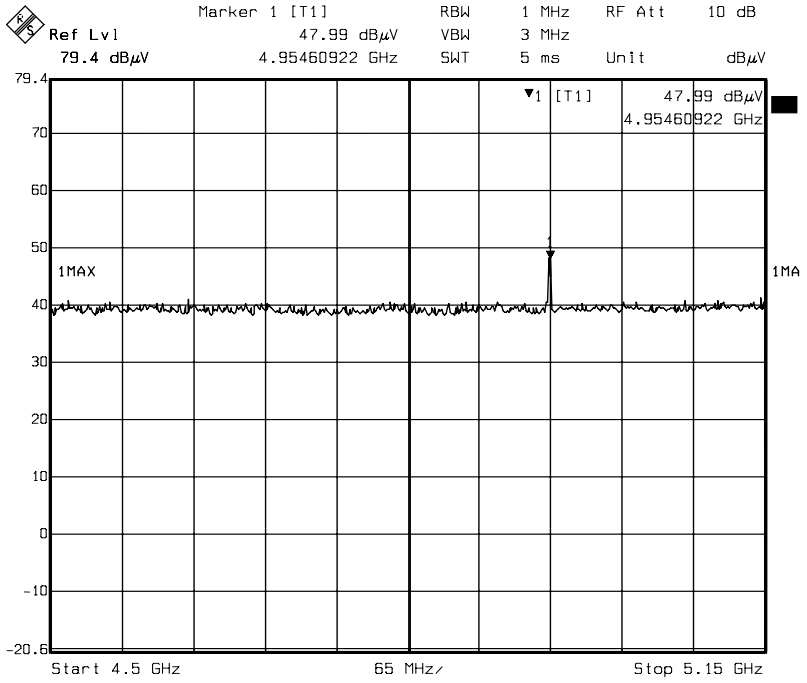
Title: Eagle Close Combat Radio
Comment A: Restricted Bands 2.443GHz Peak
Date: 26.MAR.2008 12:18:39



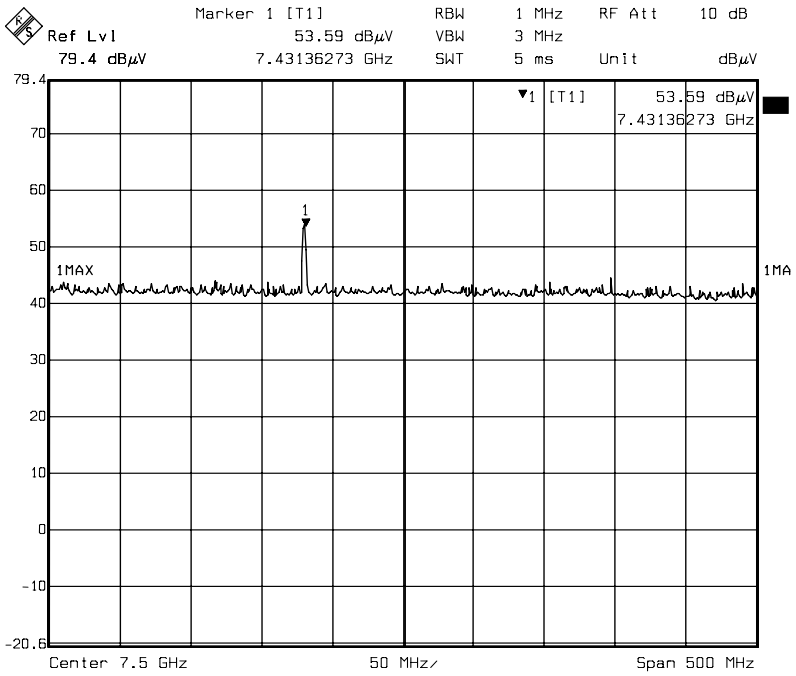
Title: Eagle Close Combat Radio
Comment A: Restricted Bands 2.443GHz Peak
Date: 26.MAR.2008 12:23:06



Title: Eagle Close Combat Radio
Comment A: Resticted Bandwidth - 2.477GHz
Date: 27.MAR.2008 14:11:17



Title: Eagle Close Combat Radio
Comment A: Restricted Bands 2.477GHz Peak
Date: 26.MAR.2008 12:02:42



Title: Eagle Close Combat Radio
Comment A: Restricted Bands 2.477GHz Peak
Date: 26.MAR.2008 11:58:18

Table 5

These measurements are peak measurements. Hence the duty cycle correction factor is used to demonstrate compliance with the average limit as follows:

Average field strength = Peak – 20*log10(dwell time per channel).

The dwell time per channel is 1.62ms in every 30ms as recorded in Section 4.3. This gives the duty cycle correction factor of 20*log10(1.62/30) = 25.4dB.

Band (GHz)	Freq (GHz)	Pk/ Av	Reading dB (uV)	Antenna factor dB (3/m)	Pre-amp and cables factor (dB)	Duty cycle correction (dB)	Net dB (uV/ m)	Limit dB (uV/m)	Margin (dB)
2.4835-2.5	2.406	Pk	51.33	28.3	-25.92	0	53.71	74	-20.29
2.4835-2.5	2.406	Av	51.33	28.3	-25.92	-25.4	28.31	54	-25.69
4.5-5.15	2.406	Pk	64.62	33.2	-24.9	0	72.92	74	-1.08
4.5-5.15	2.406	Av	64.62	33.2	-24.9	-25.4	47.52	54	-6.48
7.25-7.75	2.406	Pk	42.06	36.3	-25.22	0	53.14	74	-20.86
7.25-7.75	2.406	Av	42.06	36.3	-25.22	-25.4	27.74	54	-26.26
2.4835-2.5	2.443	Pk	56.58	28.3	-25.92	0	58.96	74	-15.04
2.4835-2.5	2.443	Av	56.58	28.3	-25.92	-25.4	33.56	54	-20.44
4.5-5.15	2.443	Pk	57.65	33.2	-24.9	0	65.95	74	-8.05
4.5-5.15	2.443	Av	57.65	33.2	-24.9	-25.4	40.55	54	-13.45
7.25-7.75	2.443	Pk	48.62	36.3	-25.22	0	59.7	74	-14.3
7.25-7.75	2.443	Av	48.62	36.3	-25.22	-25.4	34.3	54	-19.7
2.4835-2.5	2.477	Pk	70.69	28.3	-25.92	0	73.07	74	-0.93
2.4835-2.5	2.477	Av	70.69	28.3	-25.92	-25.4	47.67	54	-6.33
4.5-5.15	2.477	Pk	47.99	33.2	-24.9	0	56.29	74	-17.71
4.5-5.15	2.477	Av	47.99	33.2	-24.9	-25.4	30.89	54	-23.11
7.25-7.75	2.477	Pk	53.59	36.3	-25.22	0	64.67	74	-9.33
7.25-7.75	2.477	Av	53.59	36.3	-25.22	-25.4	39.27	54	-14.73

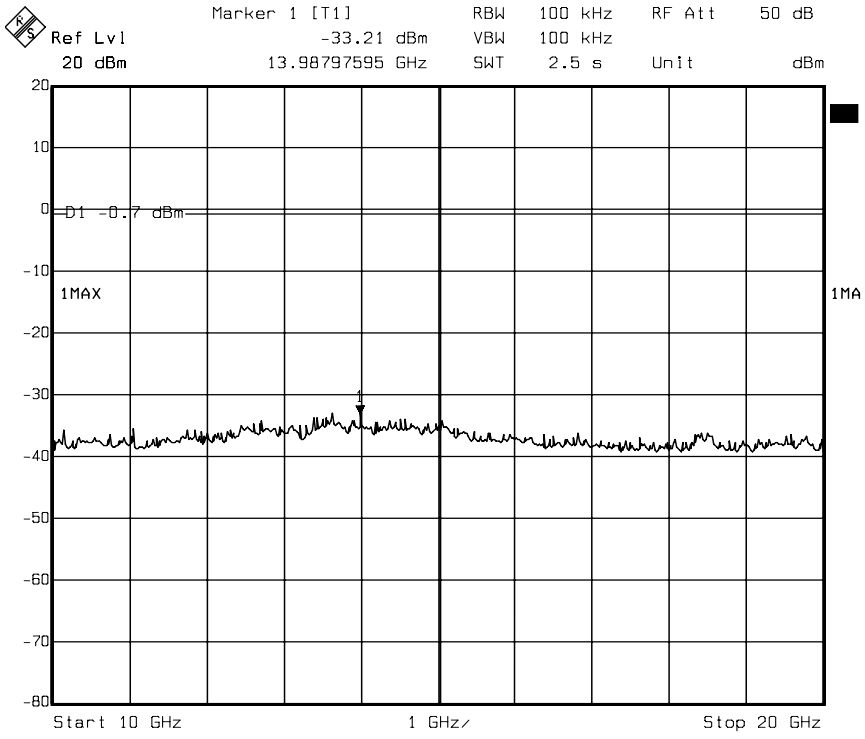
7. CONDUCTED EMISSIONS CFR47 PART15:247

7.1. Test Procedure

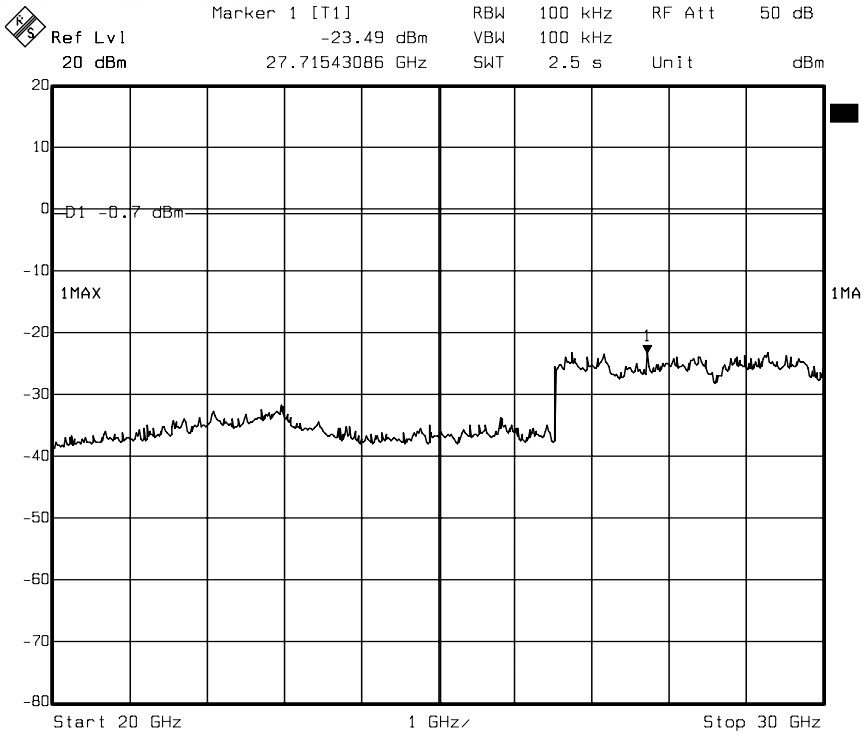
The Eagle Close Combat radio transceiver was set to 2.406, 2.443 and 2.477GHz in turn, with the transceiver set to maximum output. The frequency ranges from 30MHz to 3 GHz, 2 to 10GHz, 10 to 20GHz and 20 to 30GHz were scanned using a spectrum analyser with peak detector.
These tests carried out using a 100kHz RBW and a VBW as required by Part 15 :247.

Plots of these tests are shown in section 7.2 with the limits 20dB down from the peak conducted power measurements as shown in Section 3.2.

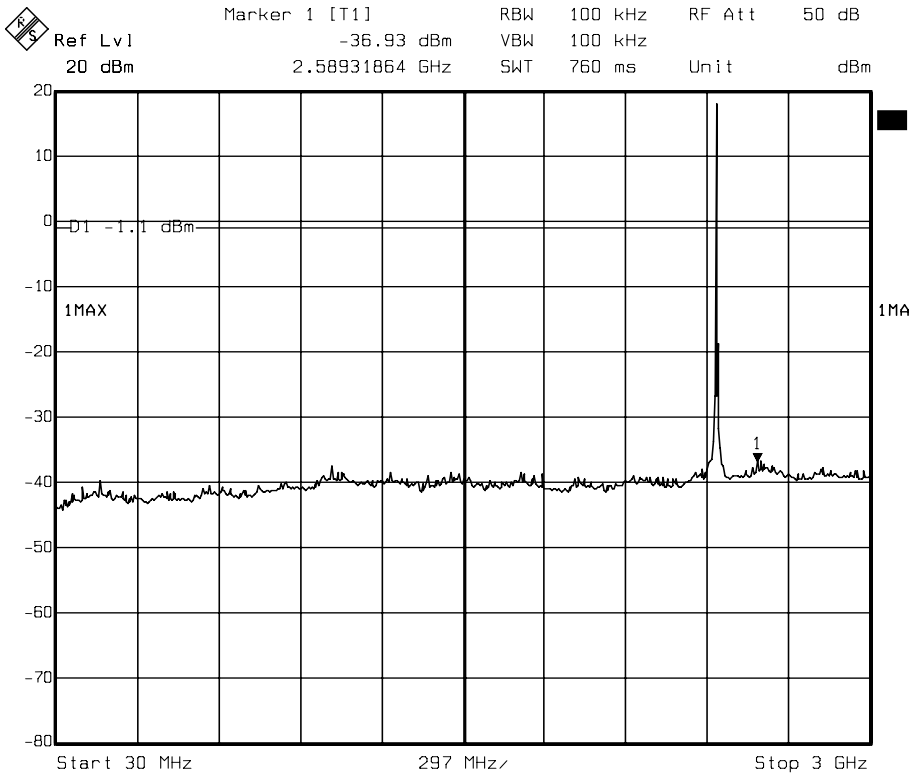
7.2. Plots of conducted emissions



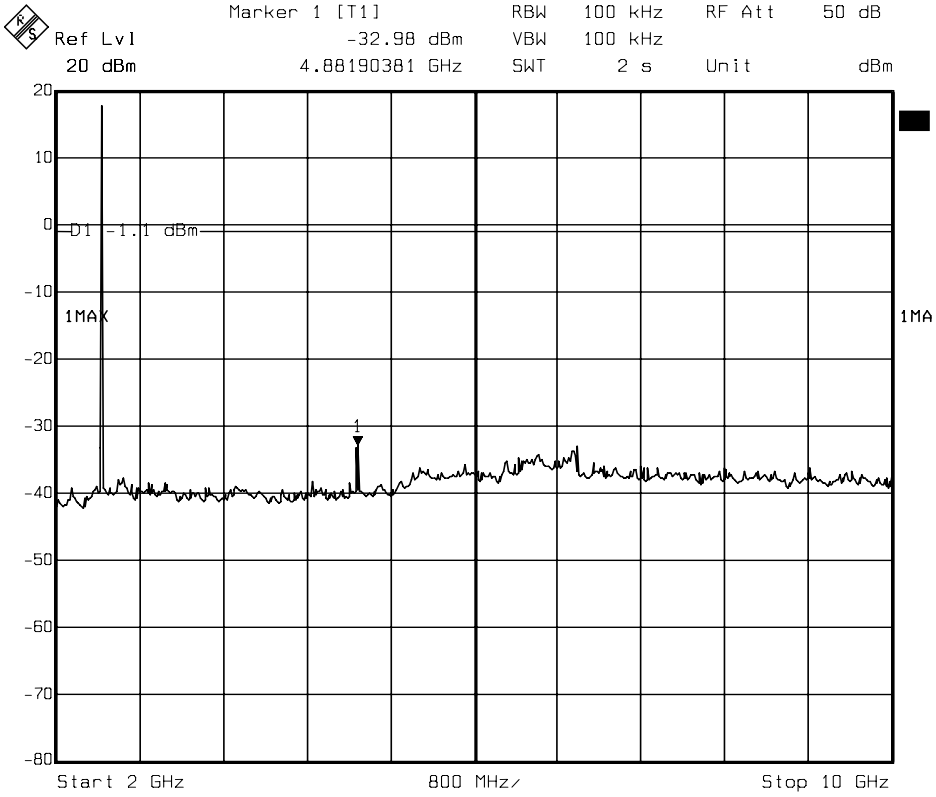
Title: Eagle Radio Conducted Emissions
Comment A: Low channel
Date: 23.APR.2008 09:41:20



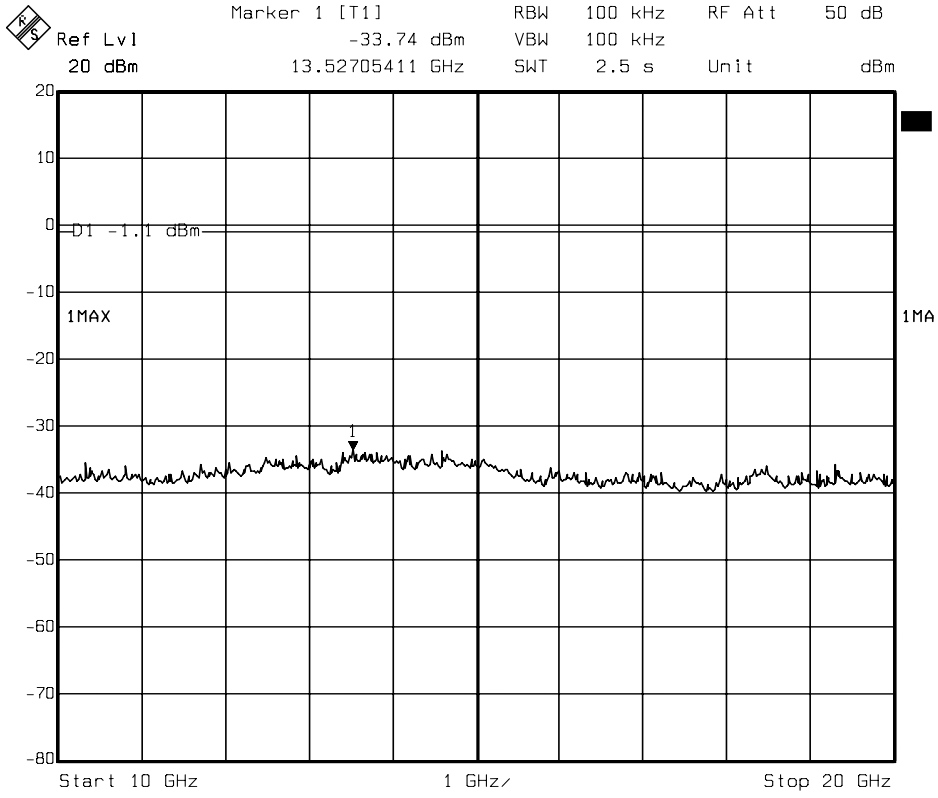
Title: Eagle Radio Conducted Emissions
Comment A: Low channel
Date: 23.APR.2008 09:42:05



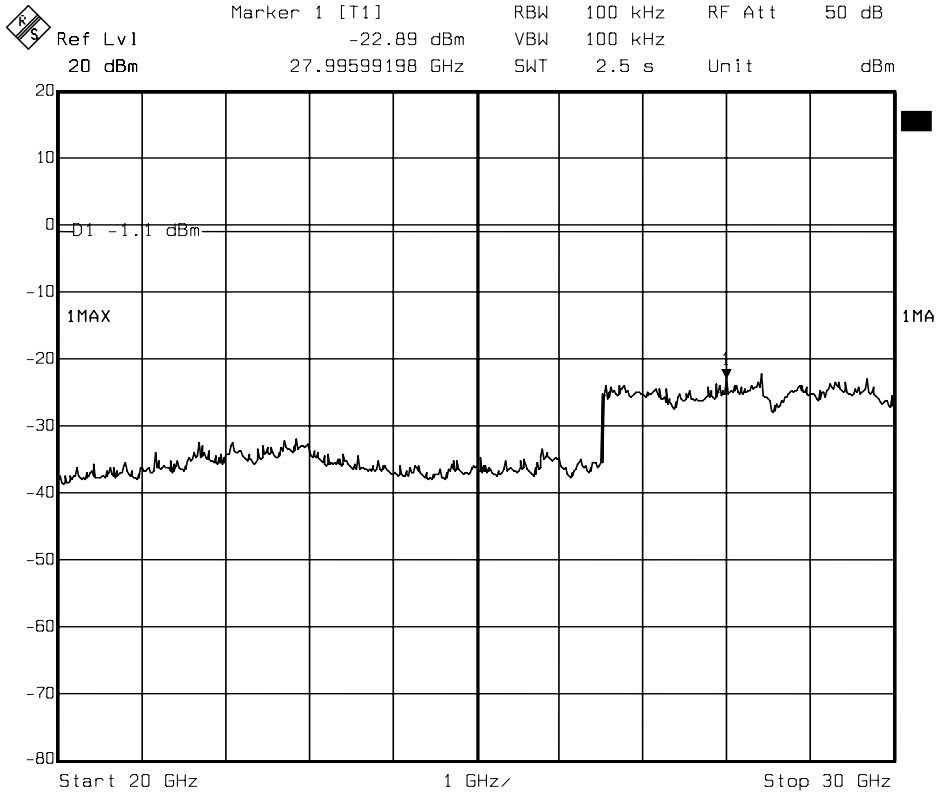
Title: Eagle Radio Conducted Emissions
Comment A: Mid channel
Date: 23.APR.2008 09:33:51



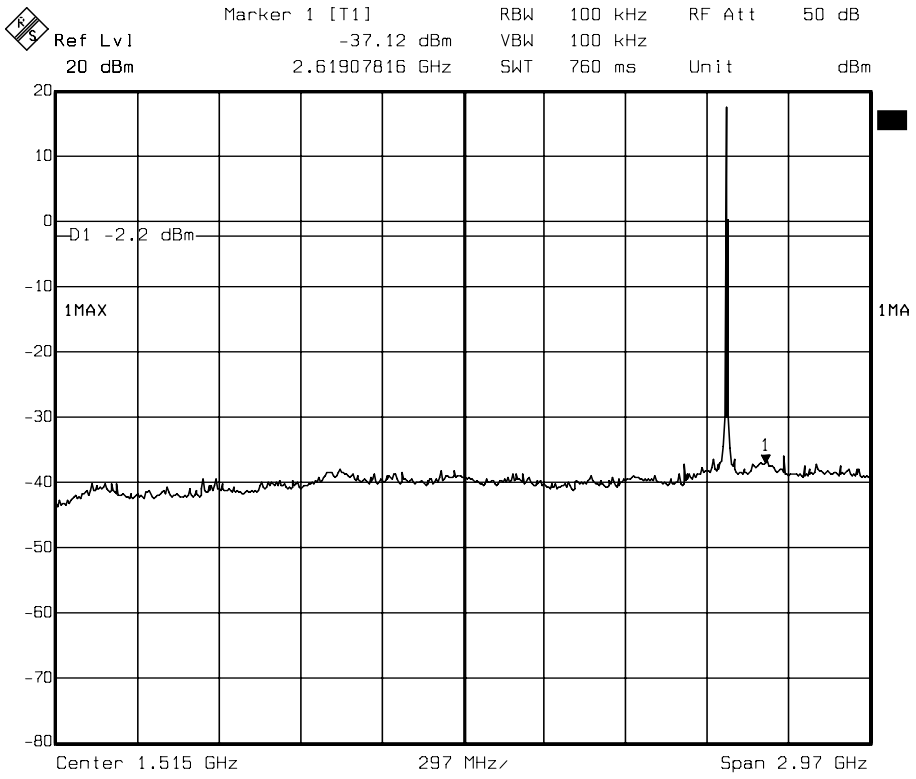
Title: Eagle Radio Conducted Emissions
Comment A: Mid channel
Date: 23.APR.2008 09:34:57



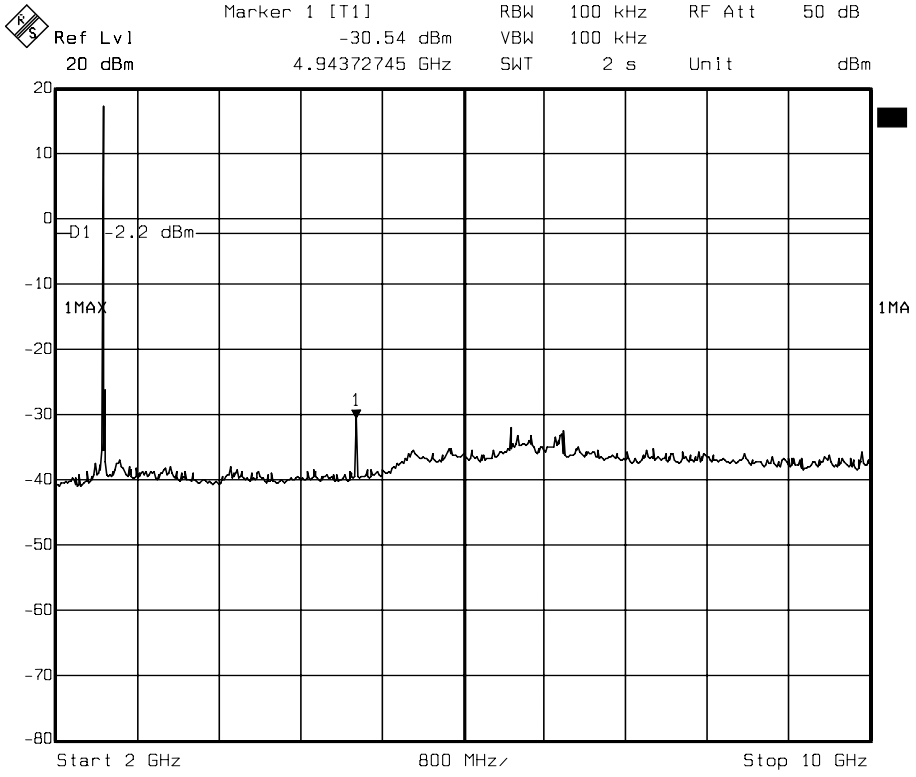
Title: Eagle Radio Conducted Emissions
Comment A: Mid channel
Date: 23.APR.2008 09:35:56



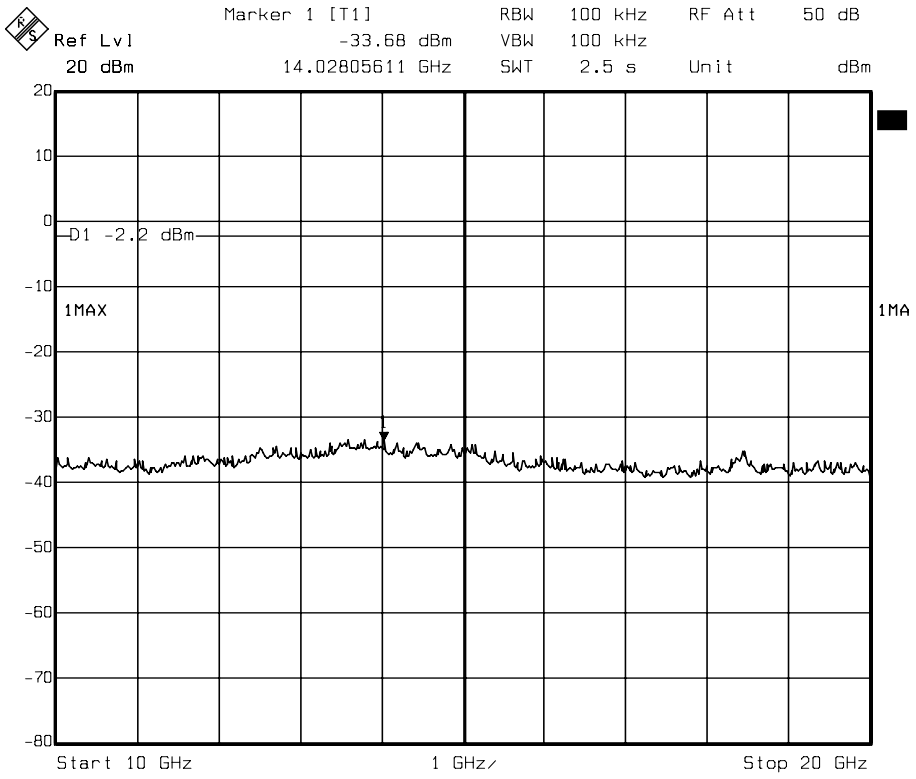
Title: Eagle Radio Conducted Emissions
Comment A: Mid channel
Date: 23.APR.2008 09:36:50



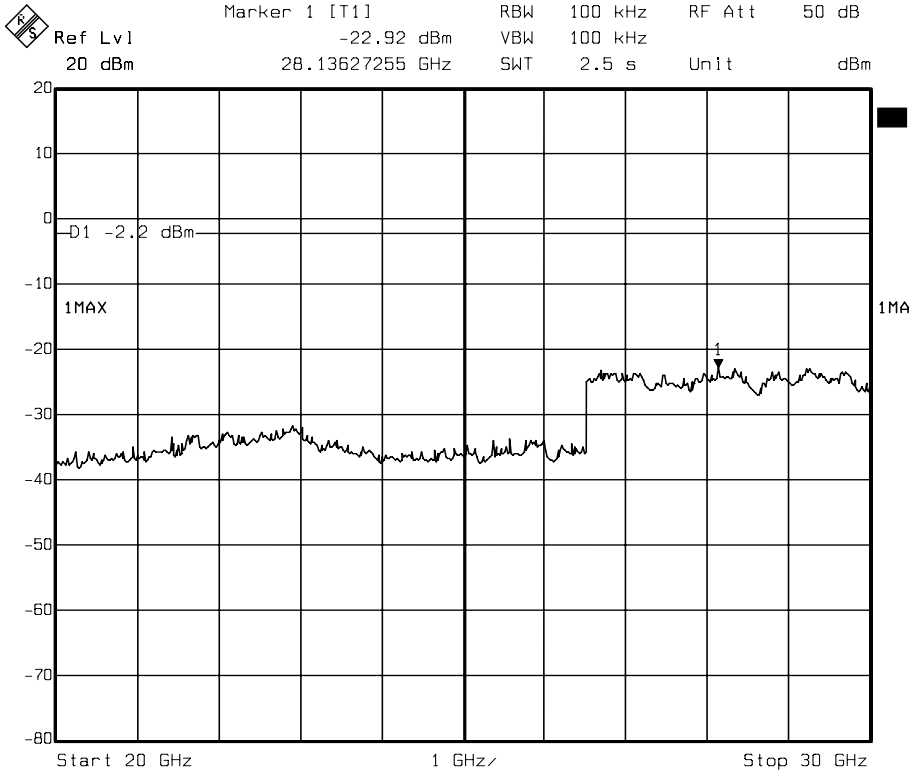
Title: Eagle Radio Conducted Emissions
Comment A: High channel
Date: 23.APR.2008 09:18:31



Title: Eagle Radio Conducted Emissions
Comment A: High channel
Date: 23.APR.2008 09:26:14

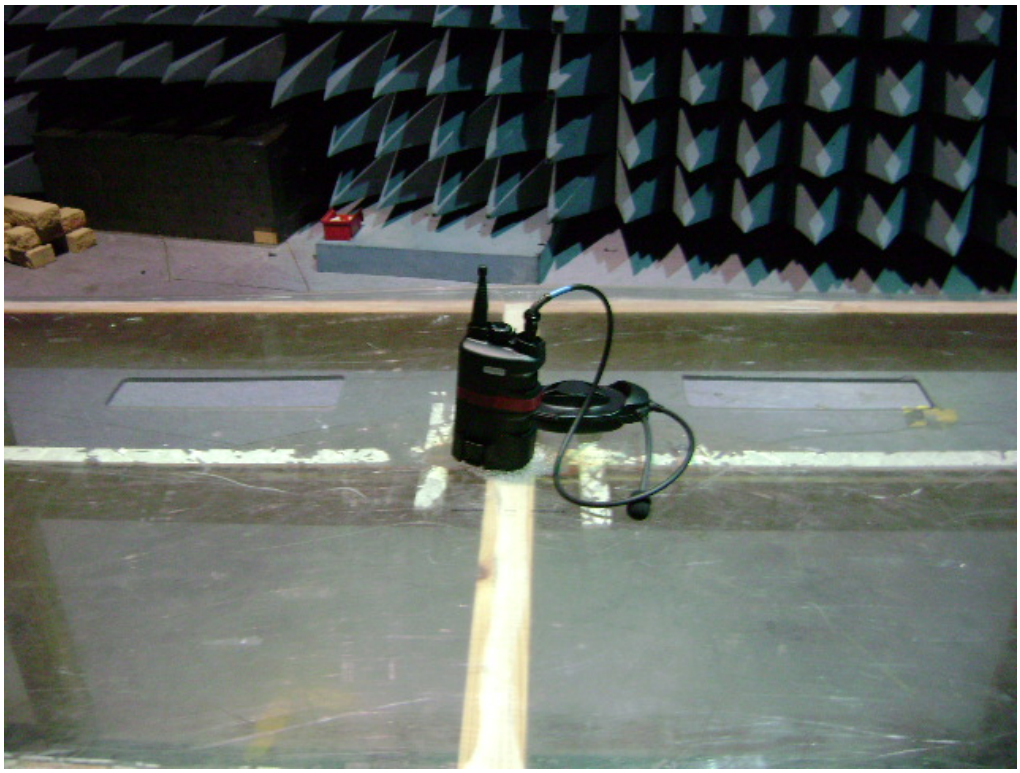


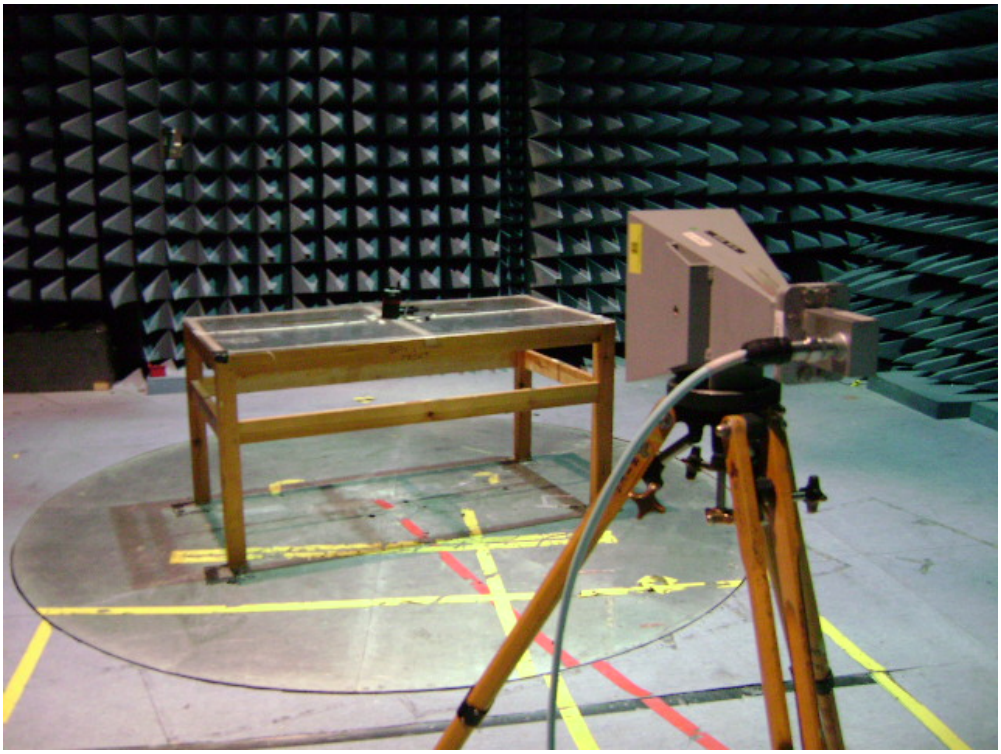
Title: Eagle Radio Conducted Emissions
Comment A: High channel
Date: 23.APR.2008 09:27:49

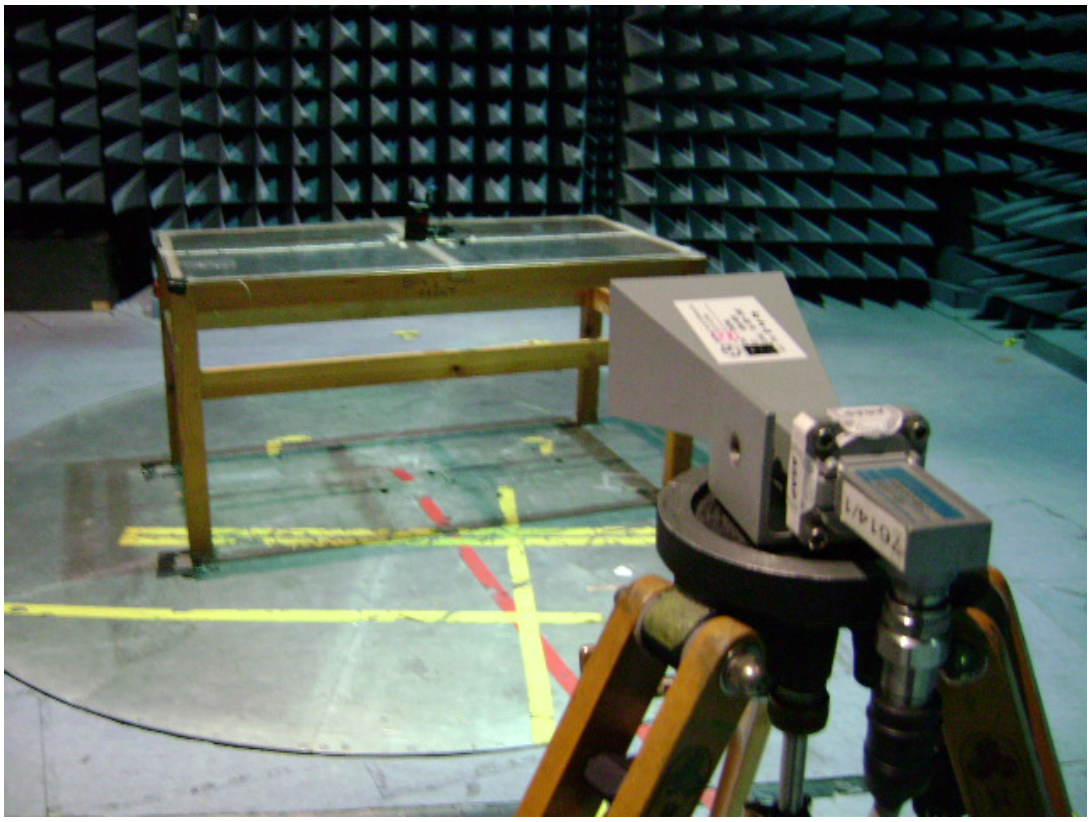


Title: Eagle Radio Conducted Emissions
Comment A: High channel
Date: 23.APR.2008 09:29:10

8. PHOTOGRAPHS OF TEST SETUP







9. TEST EQUIPMENT

Equipment	Type	ID
Test Bay 1	Environment	7400
Chase Bilog	Antenna	8164
3115 Horn	Antenna	7512
3160 Horn	Antenna	7614
3161 Horn	Antenna	7617
12- 12 Horn	Antenna	7615
12A – 18 Horn	Antenna	7513
Advantest R3361	Spectrum Analyser	7461
Rohde & Schwarz FSEK	Spectrum Analyser	7811
Rohde&Schwarz FSH3	Spectrum Analyser	DM006916
Rohde & Schwarz	ESS Receiver	7700
Marconi Pre-amp	54432-010A	7772
ERA Microwave Pre-amp	WBA3-4	7534
Oregon Scientific	Environmental Sensor	7916
Cable N Type	10m	7063
Cable N Type	4m	7968
Cable N Type	1m	8185
Cable N Type	1m	8186
Cable microwave	5m	8247
Cable microwave	4m	7177
Cable microwave	2m	7405

All test equipment used was within its calibration period.