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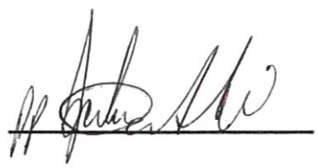
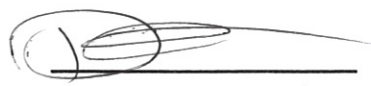
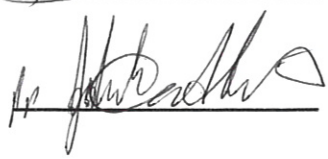
EMC TEST REPORT

COMPANY: CONVERSOR Ltd

PRODUCT : TESTING TO CFR47 PART 95G ON A CONVERSOR LTD CONVERSOR PRO LPRS TRANSMITTER

REPORT : EM09038224

WRITTEN BY:	**D Legge**	
REVIEWED BY:	**D Feasey**	
TEST ENGINEER:	**D Legge**	

ISSUE: 1 **DATE: 22nd April 2009** **TOTAL PAGES: 22**

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TABLES

GRAPHS

JOB DESCRIPTION

Equipment:	Low Power Radio Service Transmitter operating at 216MHz
Equipment Model No.:	Conversor Pro
Equipment Serial No.:	None
Phase:	Compliance
Customer:	Conversor Ltd The Landsbury Estate 102 Guildford Road Woking Surrey GU21 2EP
Test Plan Reference:	-
Test Standards:	CFR 47 Part 95G
FCC Ident	QA6 - CONVERSPRO
Test Location:	Intertek ETL Semko (Leatherhead) Unit D Randalls Way Leatherhead Surrey KT22 TS
Test Work Started:	26/02/2009
Test Work Completed:	09/04/2009

1. TEST SUMMARY

1.1. Conversor Pro Transmitter

1.1.1. CFR 47 Part 95 : sub part G

TEST STANDARD	TEST	COMMENT
CFR47:Part 2:1046	Radiated Power	Pass
CFR47:Part 2:1047	Frequency Deviation	Pass
CFR47:Part 2:1049	Occupied Bandwidth	Pass
CFR47:Part 2:1053	Spurious Radiations Note 1	Pass
CFR47:Part 2:1055	Frequency Stability	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.
See Annex 1 for certification number.

1.1.2. CFR 47 Part 15: sub part C

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.

All the above tests have been carried out to meet the requirements of ANSI C63.4:2003 Test procedures.

2. EQUIPMENT UNDER TEST (EUT)

2.1. Description of the EUT

The Conversor Limited “Conversor Pro” is a discreet radio microphone transmitter that transmits sound to a loop inductor pendant necklace personal hearing aid. The powerful microphone can be handheld or placed on a surface near to the sound source. It gives you the ability to”focus” and choose what you hear, whether in a one to one situation, a group discussion or a lecture hall.

The transmitter is powered by an internal battery of 3.7vdc and operates in the LPRS 216MHz frequency band with a maximum radiated power limit of 100mWatts. The receiver is also powered by a 3.7vdc internal battery.

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 FM modulation, with a maximum of 1mW radiated power.

Standard test mode waveform profile is FM.

2.3. EUT Configuration Diagram

See test set up photographs.

2.4. EUT Support Equipment

None

2.5. Cables Associated With the EUT

PORT	TYPE	LENGTH (m)	TERMINATION/LOAD
13A Plugtoptransformer	Twin	1.0m	Twin Plug jack.
EUT audio skt(plug jack)	3core	1.0m	plug jack

3. TESTS

3.1. Radiated Peak Power

Test method

The EUT(transmitter) was set up in semi lined anechoic chamber at a test distance of 3m.
The EUT has an integral antenna and is designed to operate at 216.54 MHz and was placed on a non conducting support at a height of 1m. The measuring receiving antenna was traversed from 1 to 4m height whilst the EUT was rotated through 360º to maximise the radiated field level in both vertical and horizontal planes. The maximum level was recorded.
The EUT was replaced with a substitution antenna, which was connected via a coaxial cable to a calibrated signal generator. The signal generator was set to the required frequency and the output level adjusted so as to give the same level as recorded for the EUT radiated power level. The ERP was then calculated as below.

Signal Generator dBm	Cable Loss dB	Antenna Gain dB	Total dBm	Total µWatt	Limit mWatt
-24.5	0.4	3.3	- 21.6	6.3	100

The EUT complies with FCC Part2, subpart J : 2.1046
The antenna gain was calculated as follows: -

G_d = 20Log(f_{MHz}) -31.9 – Antenna factor = 20Log(216.54)-31.9 -11.55 = 3.3dB

These tests carried out on 25th April 2009

3.2. Modulation Characteristics

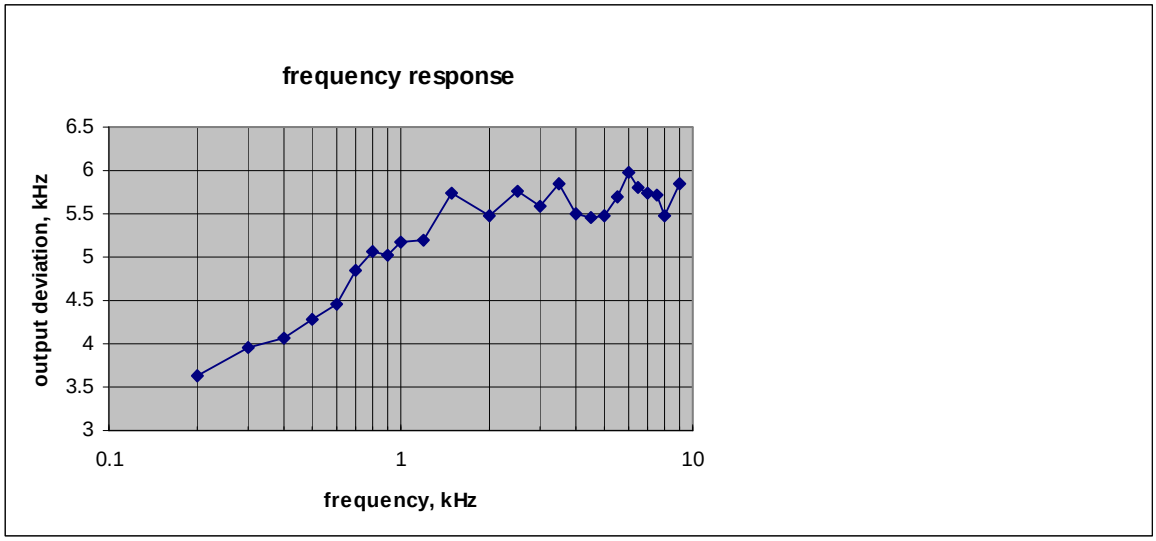
Test Method

An audio signal at 1000Hz was adjusted for approximately 85% rated FM deviation. While maintaining the same amplitude(90mV), the frequency is varied from 0.2kHz to 9kHz. The FM deviation is measured and recorded at several frequencies in order to determine the frequency response.

3.2.1. Frequency Response of Audio Circuit

Audio kHz	Dev ± kHz	Audio kHz	Dev ±kHz	Audio kHz	Dev ± kHz	Audio kHz	Dev ± kHz
0.2	3.64	1.0	5.18	4.5	5.45	9.0	5.85
0.3	3.95	1.2	5.2	5.0	5.47	-	-
0.4	4.07	1.5	5.73	5.5	5.69	-	-
0.5	4.28	2.0	5.48	6.0	5.98	-	-
0.6	4.45	2.5	5.77	6.5	5.8	-	-
0.7	4.85	3.0	5.59	7.0	5.74	-	-
0.8	5.06	3.5	5.85	7.5	5.71	-	-
0.9	5.03	4.0	5.49	8.0	5.48	-	-

Limit: ± 25kHz



The EUT complies with FCC Part2, subpart J: 2.1046

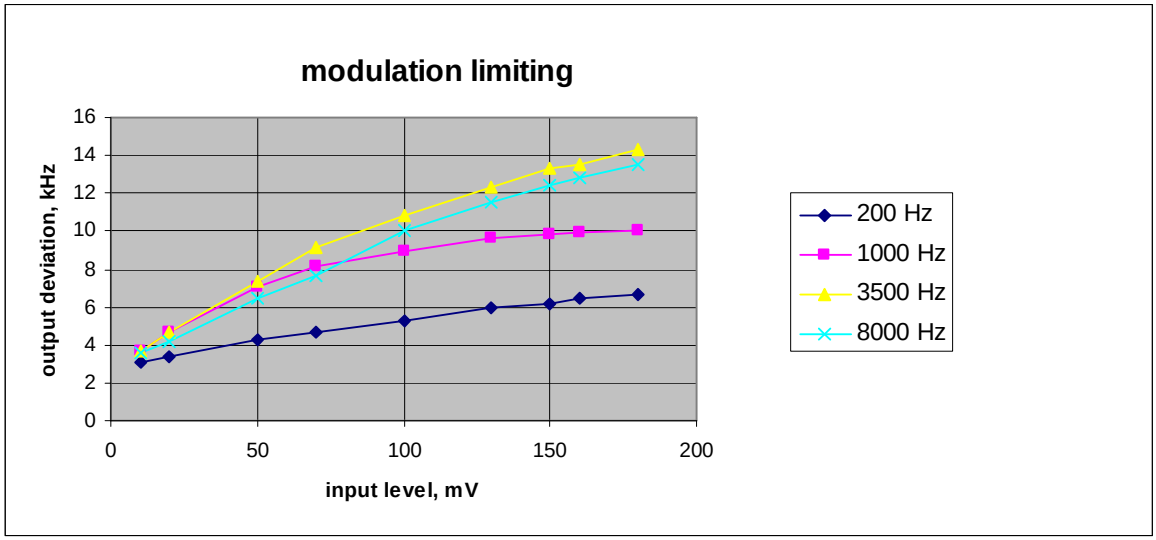
3.2.2. Modulation Limiting of Audio input Circuit

This test carried out using a 1kHz tone adjusted to give approximately 100% modulation, with a test signal level being 160mV.
A series of test voltages were used at four different frequencies in order to assess the limiting characterisics of the modulation input circuitry.

The table below gives the results

Audio Signal Level mV	FM Deviation ± kHz			
	200 Hz	1000 Hz	3500 Hz	8000 Hz
10	3.1	3.7	3.7	3.6
20	3.4	4.7	4.7	4.2
50	4.3	7.1	7.4	6.5
70	4.7	8.1	9.1	7.7
100	5.3	8.9	10.8	10.0
130	6.0	9.6	12.3	11.5
150	6.2	9.8	13.3	12.4
160	6.5	9.9	13.5	12.8
180	6.7	10	14.3	13.5

Plots of modulation limiting



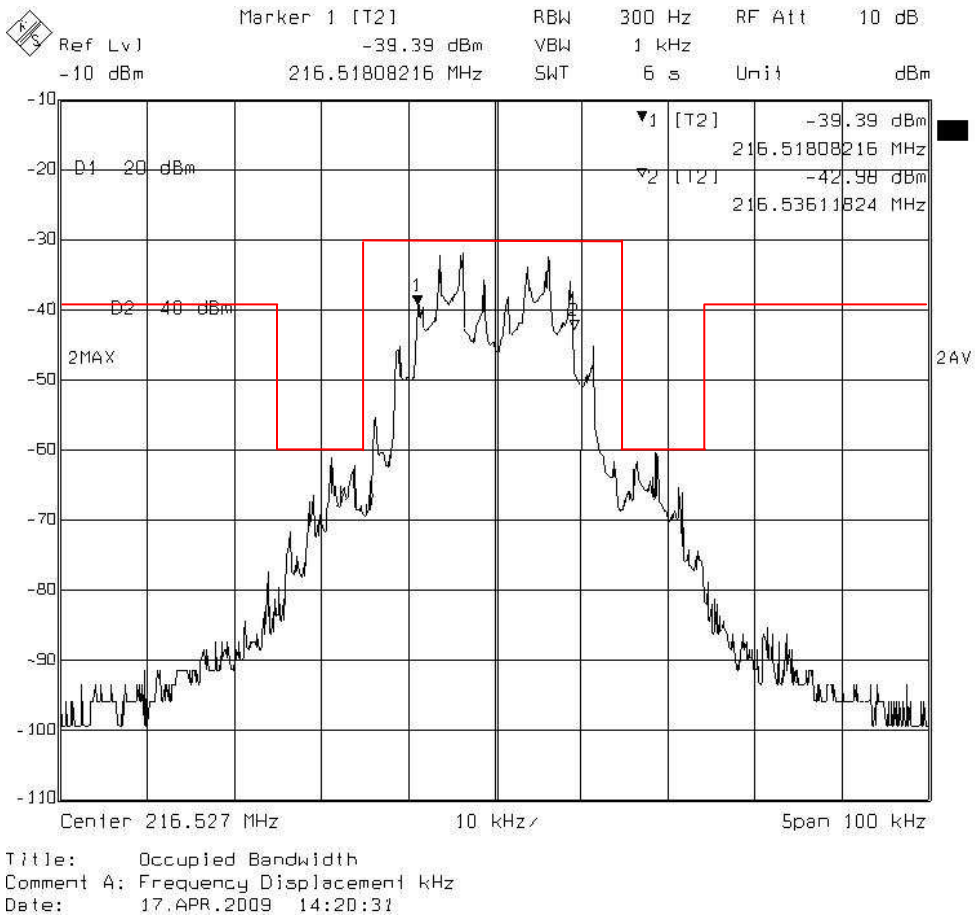
The EUT complies with FCC Part2, subpart J: 2.1047(b)

These tests carried out on the 25th March 2009

3.3. Occupied Bandwidth

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are equal to 0.5% of the total mean power radiated by a given emission.
This test was carried out with the EUT in an environmental chamber, thus equating the relative peak power to - 21.6dBm or 6.3µW actual peak power. With a modulation frequency of 2500Hz it was established that to give 50% modulation a signal level of 25mV was required. The test level being +16dB greater than this requires 160mV signal level. Using a resolution bandwidth of 100kHz, measuring the peak power of the unmodulated carrier giving a reference peak power. Changing the resolution bandwidth to 300Hz, modulate the carrier and measure - 20dBc from the reference level onto the modulated signal plot to give the the lower and upper frequency points.

The plot below shows those points.



- 20 dBc bandwidth = 216.536118 – 216.518082 = 18.036kHz

Therefore EUT complies with FCC Part 2 Subpart J: 2.1049 and 95.635

3.4 RADIATED EMISSIONS < 1000MHZ

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 with both the transmitter and receiver operating together.
As the spurious emissions levels are less than 64.4dBµV/m at 3m distance, substitution measurements are not required.
These tests were carried out on the 26th February 2009

Table 1 and graph 1 show the results for the transmitter and with the receiver operational.

EM09038224 26 Feb 2009 09:51

Radiated Emissions

EUT:	Conversor Pro
Manuf:	Conversor Ltd.
Op Cond:	Tx/Rx
Operator:	S Jackson
Test Spec:	FCC Part 95 (15.209)
Comment:	Horizontal and Vertical
	Full 360 and height maximisation
Result File:	38224r2.dat : Conversor Pro Rad Emissions - FCC Part 15:209 - Peak List

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30MHz	1000MHz	60kHz	120kHz	PK	20msec	Auto	ON	60dB

Transducer	No.	Start	Stop	Name
1	17	30MHz	1000MHz	7602
	18	30MHz	1000MHz	8183
	19	30MHz	1000MHz	7743
	21	30MHz	1000MHz	7287
	22	30MHz	1000MHz	7840

Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	16
	Acc Margin:	10 dB

Peak Search Results

Frequency MHz	PK Level dBµV/m	PK Limit dBµV/m	PK Delta dB
32.4	36.35	49.00	12.65
55.44	30.35	49.00	18.65
130.38	38.28	53.50	15.22
216.54	81.65*	56.40	-25.25
433.08	55.78	56.40	0.62
825.9	48.32	56.40	8.08

* limit exceeded

PAGE 2

Table 1

EM09038224 26 Feb 2009 09:51

Radiated Emissions

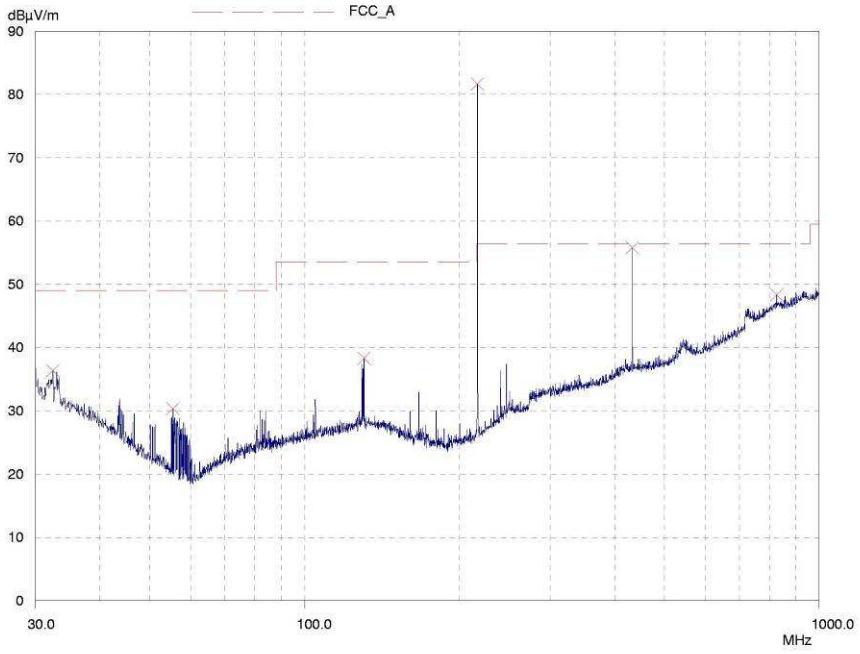
EUT:	Conversor Pro
Manuf:	Conversor Ltd.
Op Cond:	Tx/Rx
Operator:	S Jackson
Test Spec:	FCC Part 95 (15.209)
Comment:	Horizontal and Vertical
	Full 360 and height maximisation
Result File:	38224r2.dat : Conversor Pro Rad Emissions - FCC Part 15:209 - Peak List

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
30MHz	1000MHz	60kHz	120kHz	PK	20msec	Auto	ON	60dB

See following page for transducer set listing.

Prescan Measurement:	Detector:	X PK
	Meas Time:	see scan settings
	Peaks:	16
	Acc Margin:	10 dB

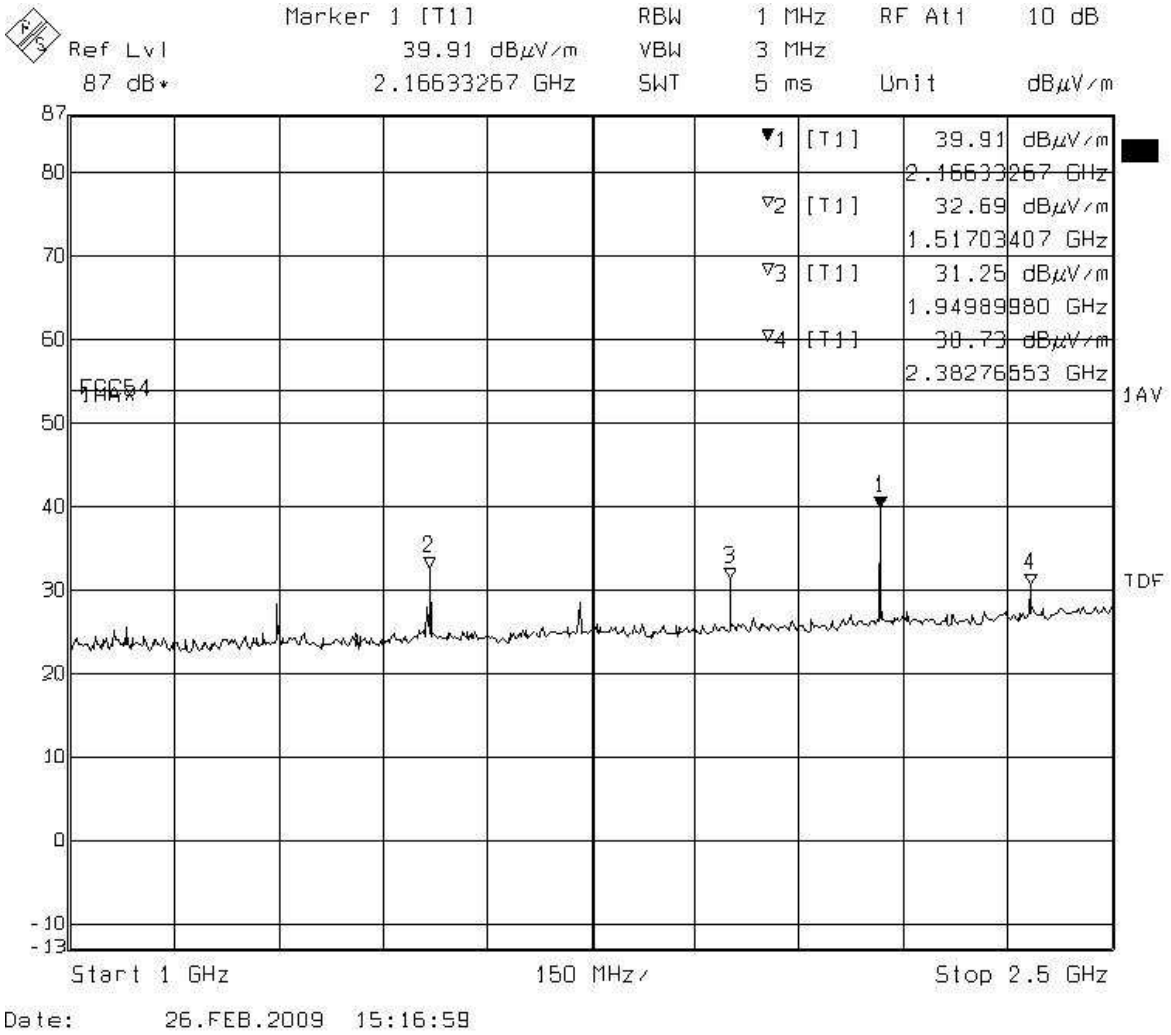


PAGE 1

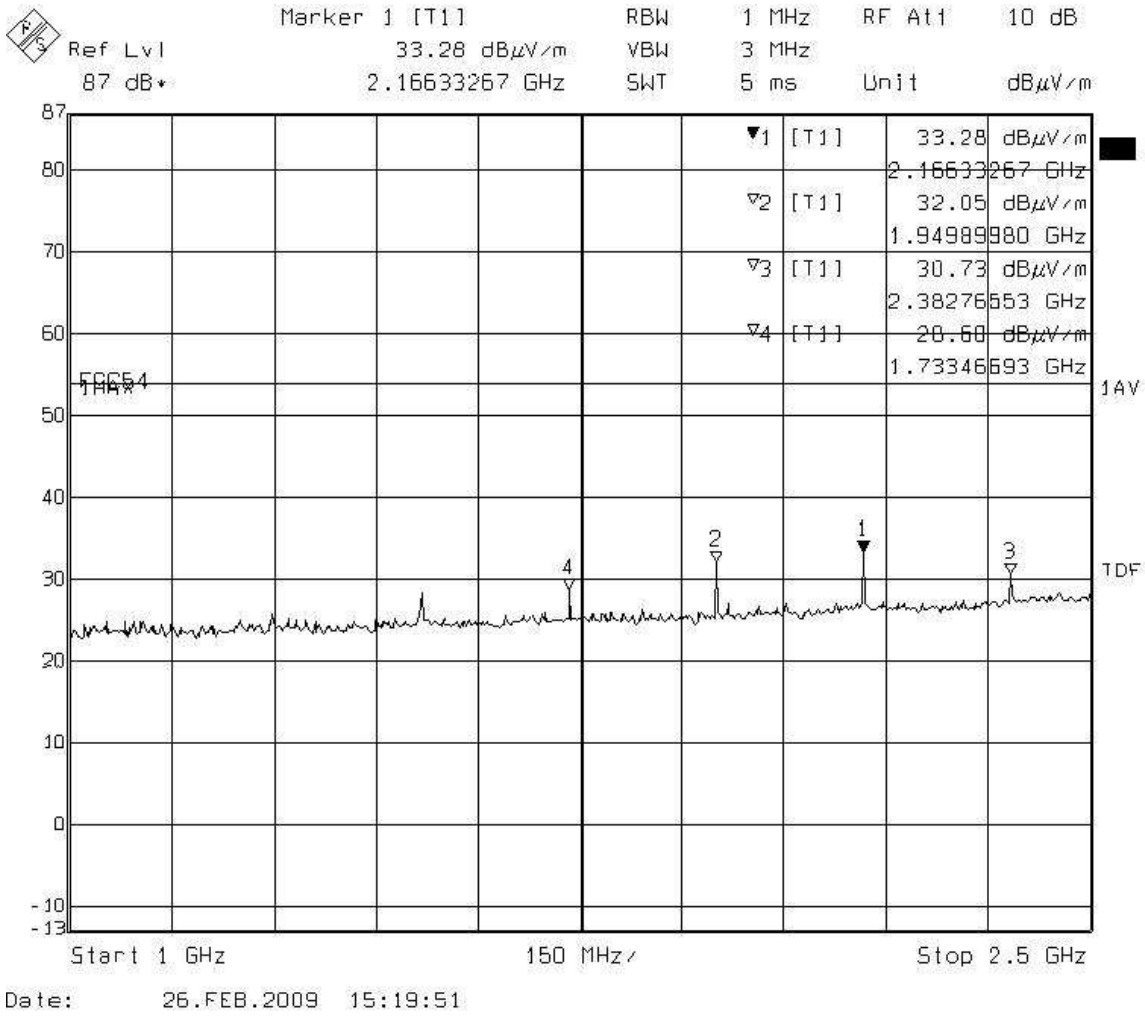
Graph 1

3.5 Radiated Emissions > 1000MHz

The testing was performed as required by CFR47 Part 95 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.
As the spurious emissions levels are less than 64.4dBµV/m at 3m distance, substitution measurements are not required.
The following plots shows the results upto 2.5GHz in both horizontal and vertical polarisations.



Horizontal Polarisation



Vertical Polarisation

The EUT complied with FCC Part 2: Subpart J: 2.1053

These tests carried out on the 26 February 2009

3.6 Uncertainty Budget Calculations

Symbol	Source of Uncertainty	Value	Probability distribution	Divisor	c_i	u_i(y)	$(u_i(y))^2$	v_i or v_{eff}	ui^4(y)
RI	Receiver Indication	0.05	normal 2	2.000	1	0.03	0.001	∞	0
dVsw	Receiver Sine Wave	1.60	normal 2	2.000	1	0.80	0.640	∞	0
dVpa	Receiver Pulse Amplitude	1.60	normal 2	2.000	1	0.80	0.640	∞	0
dVpr	Receiver Pulse repetition	1.60	normal 2	2.000	1	0.80	0.640	∞	0
dVnf	Noise Floor Proximity	1.60	normal 2	2.000	1	0.80	0.640	∞	0
AF	Antenna Factor Calibration	1.20	normal 2	2.000	1	0.60	0.360	∞	0
CL	Cable Loss	0.50	normal 2	2.000	1	0.25	0.063	∞	0
AD	Antenna Directivity	3.00	rectangular	1.732	1	1.73	3.000	∞	0
AH	Antenna Factor Height Dependence	1.00	rectangular	1.732	1	0.58	0.333	∞	0
AP	Antenna Phase Centre Variation	0.50	rectangular	1.732	1	0.29	0.083	∞	0
AI	Antenna Factor Frequency Interpolation	0.68	rectangular	1.732	1	0.39	0.154	∞	0
SI	Site Imperfections	4.00	triangular	2.449	1	1.63	2.667	∞	0
DV	Measurement Distance Variation	0.60	rectangular	1.732	1	0.35	0.120	∞	0
Fstep	Frequency step error	0.00	rectangular	1.732	1	0.00	0.000	∞	0
M	Mismatch	-1.99	U-shaped	1.414	1	-1.41	1.990	∞	0
	Receiver VRC 0.216		-						0
	Antenna +Cable VRC 0.95		-						0
R_S	Measurement System Repeatability	0.96	normal 1	1.000	1	0.96	0.922	13	0.0653343 51
R_{EUT}	Repeatability of EUT	0.00	normal 1	1.000	1	0.00	0.000		0
$u_c(F_S)$	Combined Standard Uncertainty		normal			3.50	12.252	2298	0.0653343 51
$U(F_S)$	**Expanded Uncertainty**		**normal k=**	**1.64**		**5.7**		2298	

FREQUENCY STABILITY

3.7 Test Procedure

The frequency stability of the transmitter was measured over the temperature range of - 30º to +50º at a nominal voltage of 3.7vdc, Lower voltage 3.15vdc and upper volyage 4.25vdc as required by CFR 47 Part2:1055
These tests were carried out using a reference test point at -6dBc(lower)ure greater stability. The EUT was allowed to stabilise for 30 minutes at the required temperatures and voltage settings.

The following plots show each temperature setting and voltage setting.

Nominal Voltage(3.7vdc)

Voltage dc	Temperature ºC	Frequency MHz	Comments Δ Hz	Limit ± kHz
3.7	21(Ambient)	216.443867	-	10.8
3.7	-10	216.443867	-	10.8
3.7	-20	216.443867	-	10.8
3.7	-30	216.443867	-	10.8
3.7	+10	216.443867	-	10.8
3.7	+20	216.443867	-	10.8
3.7	+30	216.443867	-	10.8
3.7	+50	216.447875	4008	10.8

Nominal Voltage(3.1.25vdc)

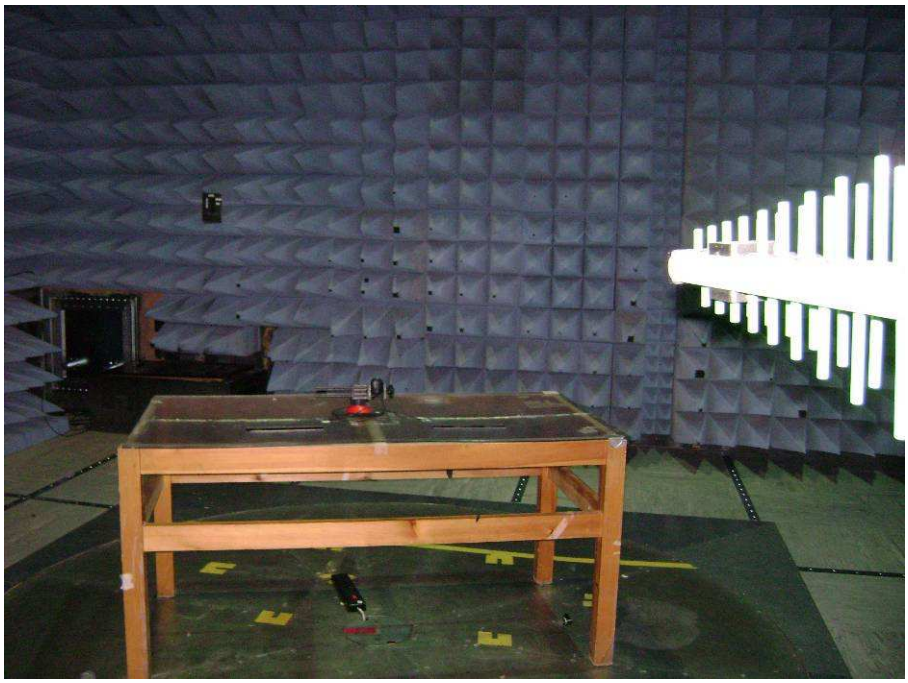
Voltage dc	Temperature ºC	Frequency MHz	Comments Δ Hz	Limit ± kHz
3.125	21(Ambient)	216.450951	-	10.8
3.125	-10	216.450951	-	10.8
3.125	-20	216.450951	-	10.8
3.125	-30	216.450951	-	10.8
3.125	+10	216.450951	-	10.8
3.125	+20	216.450951	-	10.8
3.125	+30	216.450951	-	10.8
3.125	+50	216.450951	-	10.8

Nominal Voltage(4.25vdc)

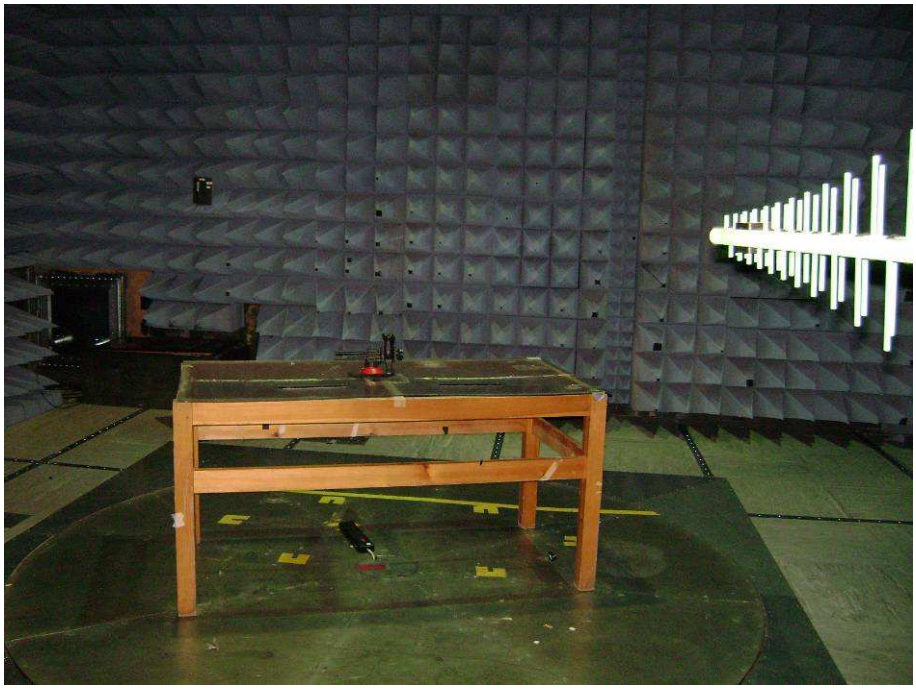
Voltage dc	Temperature ºC	Frequency MHz	Comments Δ Hz	Limit ± kHz
4.25	21(Ambient)	216.450951	-	10.8
4.25	-10	216.446943	4008	10.8
4.25	-20	216.450951	-	10.8
4.25	-30	216.450951	-	10.8
4.25	+10	216.454959	4008	10.8
4.25	+20	216.454959	4008	10.8
4.25	+30	216.450951	-	10.8
4.25	+50	216.450951	-	10.8

These tests took place on the 9th April 2009

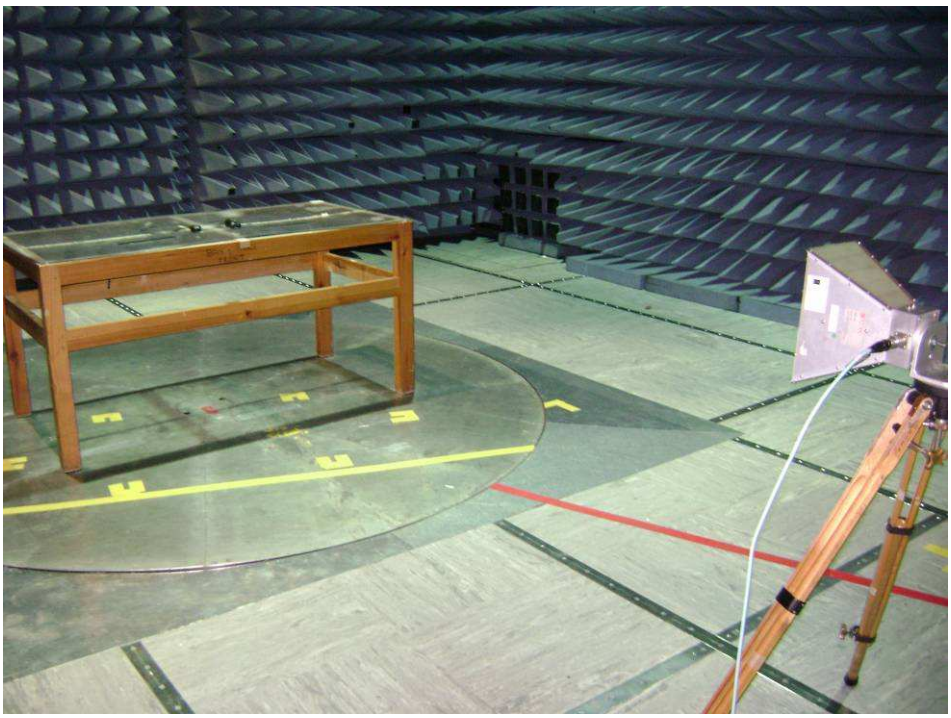
4 PHOTOGRAPHS OF TEST SETUPS



Receiver radiated emissions below 1GHz



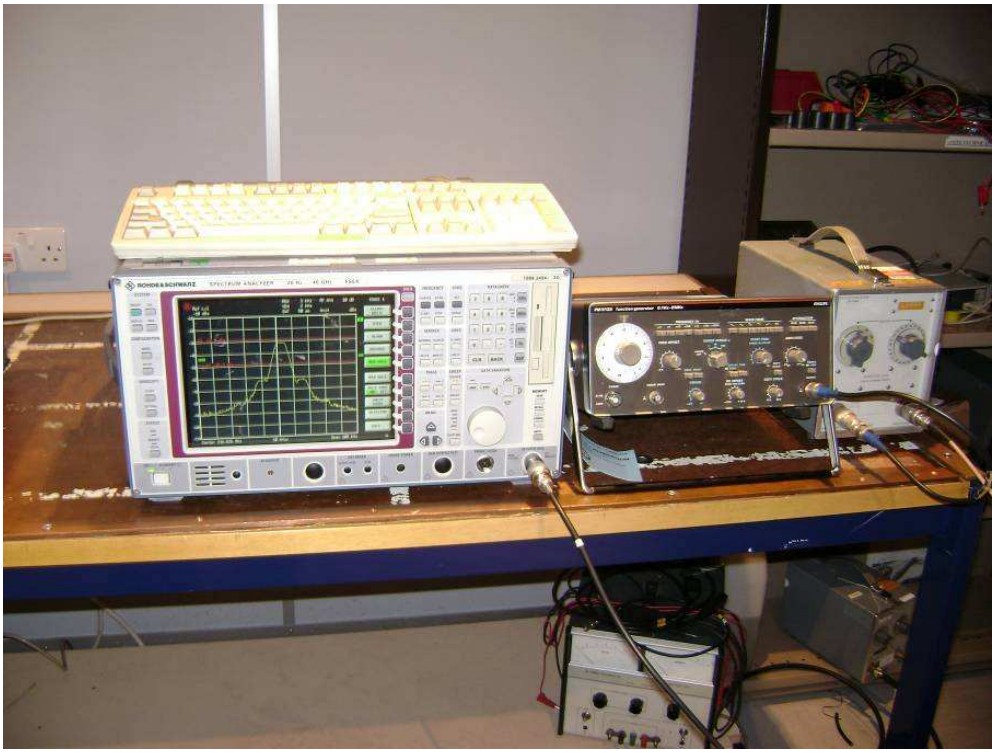
Transmitter radiated emissions below 1GHz



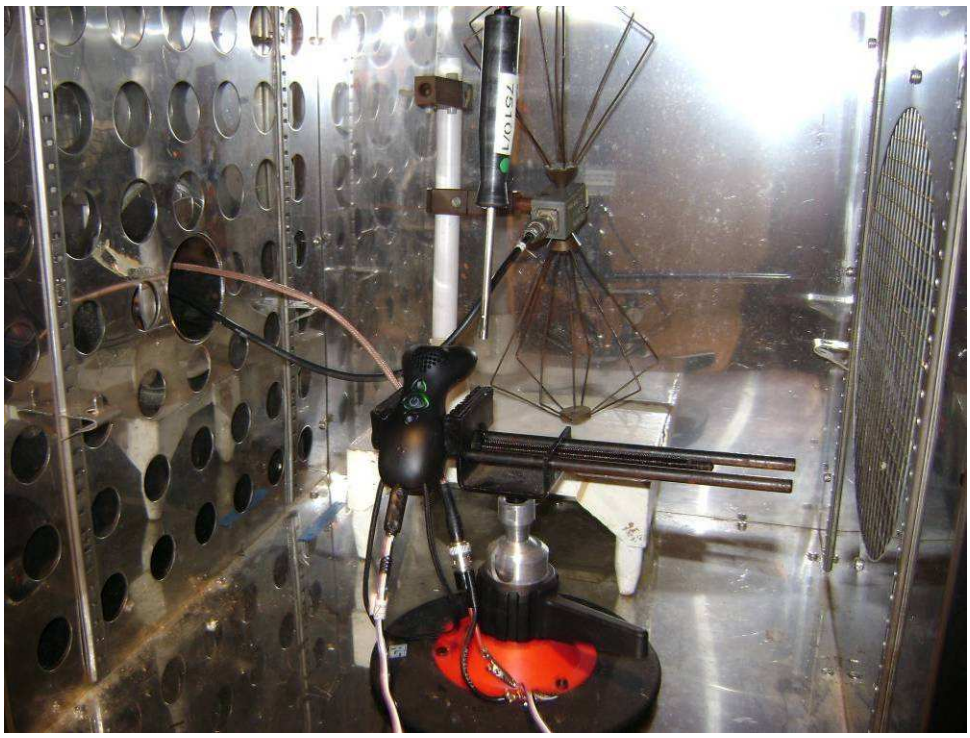
Radiated Emissions above 1GHz

Modulation characteristics

Environmental Chamber



Occupied Bandwidth



Environmental Chamber

Frequency Stability

5 TEST EQUIPMENT

Equipment	Type	ID
Test Bay 1	Environment	7400
Chase Bilog	Antenna	7485
Emco 3115 Horn	Antenna	7512
Rohde & Scwarz	Antenna	7520
Rohde & Schwarz FSEK	Spectrum Analyser	8267
Rohde & Schwarz CMTA 54	Communications Analyser	7771
Rohde & Schwarz ESVS10	Receiver	7462
Phillips PM5132	Function Generator	8005
ERA Microwave Pre-amp	WBA3-4	7534
Apel Ringway chamber	Environmental	7782
Digitron	Digital Thermocouple	7510
Fluke 79	Digital voltmeter	7854
Hewlett Packard	Step Attenuator	7950
Oregon Scientific	Environmental Sensor	7439
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	8185

All test equipment used was within its calibration period.

Annex 1 FCC Registration Certificate

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