



**REPORT ON THE CERTIFICATION TESTING OF A
TUNSTALL ELECTRONICS Ltd
GEM PENDANT
WITH RESPECT TO
THE FCC RULES CFR 47, PART 15.231 September 2007
INTENTIONAL RADIATOR SPECIFICATION**



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TUNSTALL ELECTRONICS Ltd
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WITH RESPECT TO
THE FCC RULES CFR 47, PART 15.231 September 2007
INTENTIONAL RADIATOR SPECIFICATION**

TEST DATE: 20th – 26th March 2008

TESTED BY: _____ S HODGKINSON

APPROVED BY: _____ J CHARTERS
RADIO SECTION
LEADER

DATE: 25th April 2008 _____

Distribution:

Copy Nos: 1. Tunstall Electronics Ltd
2. FCC EVALUATION LABORATORIES
3. TRL Compliance Ltd

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Notes:

1. Component failure during test	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>
2. If Yes, details of failure:		
3. The facilities used for the testing of the product contain in this report are FCC Listed.		
4. The contents of the attached applicants declarations and other supplied information are not covered by the scope of this laboratory's UKAS or FCC accreditations' and is provided in good faith.		



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CERTIFICATE OF CONFORMITY & COMPLIANCE

FCC IDENTITY: G2X6460411
PURPOSE OF TEST: Certification
TEST SPECIFICATION: FCC RULES CFR 47, Part 15.231 September 2007
TEST RESULT: Compliant to Specification
EQUIPMENT UNDER TEST: Gem Pendant
EQUIPMENT MODEL No: P64604/11
ITU: EMISSION CODE: 97k5F1D
EQUIPMENT TYPE: Periodic Transmitter
PRODUCT USE: Personal Care Monitoring & Alarm System
CARRIER EMISSION: 5432.50 μ V/m @ 3m
ANTENNA TYPE: Integral
ALTERNATIVE ANTENNA: Not applicable
BAND OF OPERATION: 312 MHz
CHANNEL SPACING: Not applicable, wideband
NUMBER OF CHANNELS: 1
FREQUENCY GENERATION: SAW Resonator Crystal Synthesiser
MODULATION METHOD: Amplitude Digital Angle
POWER SOURCE(s): 3.0Vdc
TEST DATE(s): 20th – 26th March 2008
ORDER No(s): 103810
APPLICANT: Tunstall Electronics Ltd
ADDRESS: Whitley Lodge
Whitley Bridge
Yorkshire
DN14 0HR

TESTED BY:

S HODGKINSON

APPROVED BY:

J CHARTERS
RADIO SECTION
LEADER

APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT): Gem Pendant

EQUIPMENT TYPE: Periodic Transmitter

PURPOSE OF TEST: Certification

TEST SPECIFICATION(s): FCC RULES CFR 47, Part 15.231 September 2007

TEST RESULT: COMPLIANT Yes No

APPLICANT'S CATEGORY: MANUFACTURER IMPORTER DISTRIBUTOR TEST HOUSE AGENT

APPLICANT'S ORDER No(s): 102738

APPLICANT'S CONTACT PERSON(s): Mr Quanli Qu

E-mail address: Quanli.Qu@tunstall.co.uk

APPLICANT: Tunstall Electronics Ltd

ADDRESS: Whitley Lodge
Whitley Bridge
Yorkshire
DN14 0HR

TEL: +44 (0) 1977 661234

FAX: +44 (0) 1977 662452

EUT(s) COUNTRY OF ORIGIN: United Kingdom

TEST LABORATORY: TRL Compliance Ltd

UKAS ACCREDITATION No: 0728

TEST DATE(s): 20th – 26th March 2008

TEST REPORT No: RU1444/8506

EQUIPMENT TEST / EXAMINATIONS REQUIRED

1.	TEST/EXAMINATION	RULE PART	DETECTOR	APPLICABILITY
	Intentional Emission Frequency:	15.231(b)	Quasi Peak	Yes
	Intentional Emission Field Strength:	15.231(b)	Quasi Peak	Yes
	Intentional Emission Band Occupancy:	15.231(c)	Peak	Yes
	Intentional Emission ERP (mW):	-	-	No
	Spurious Emissions – Conducted:	15.207	-	No
	Spurious Emissions – Radiated <1000MHz:	15.231(b) 15.209	Quasi Peak	Yes
	Spurious Emissions – Radiated >1000MHz:	15.231(b) 15.209	Quasi Peak Average	Yes
	Maximum Frequency of Search:	15.33	-	Yes
	Antenna Arrangements Integral:	15.203	-	Yes
	Antenna Arrangements External Connector:	15.204	-	N/A
	Restricted Bands	15.205	-	Yes
	Extrapolation Factor	15.31(f)	-	Yes

2. Product Use: Personal Care Monitoring & Alarm System

3. Emission Designator: 97k5F1D

4. Duty Cycle: <100%

5. Transmitter bit or pulse rate and level: 1000bps

6. Temperatures: Ambient (T_{nom}) 15°C

7. Supply Voltages: V_{nom} +3Vdc

Note: V_{nom} voltages are as stated above unless otherwise shown on the test report page

8. Equipment Category: Single channel
Two channel
Multi-channel

9. Channel spacing: Narrowband
Wideband

TRANSMITTER TESTS

TRANSMITTER SPURIOUS EMISSIONS – RADIATED – PART 15.209

Ambient temperature	=	20°C(<1GHz)	3m measurements <1GHz	[X]
Relative humidity	=	62% (<1GHz),	1m measurements >1GHz	[X]
Conditions	=	Open Area Test Site (OATS)	3m extrapolated from 1m	[X]
Supply voltage	=	+3Vdc		
Channel number	=	1		

Bottom Channel	FREQ. (MHz)	MEAS Rx (dB μ V)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	Distance correction factor	FIELD ST'GH (dB μ V/ m)	FIELD ST'GH (μ V/m)	LIMIT (μ V/m)
30MHz - 88MHz								note 12	
88MHz - 216MHz								note 12	
216MHz - 960MHz	936.0MHz	13.10	4.48	20.82	-		38.4	83.40	543.25
960MHz - 1GHz								note 12	
1GHz - 4GHz	1559.8MHz(r) 1871.9MHz 2183.9MHz 2495.9MHz(r) 2807.9MHz(r)	59.50 56.94 53.56 57.18 52.33	0.91 1.03 1.13 1.33 1.48	25.15 27.30 27.60 28.74 28.91	35.49 35.13 34.85 34.76 34.80	9.5 9.5 9.5 9.5 9.5	40.57 40.64 37.90 42.99 38.38	106.78 107.64 78.52 141.09 82.98	500.00 543.25 543.25 500.00 500.00
Limits	30MHz to 88MHz			100 μ V/m @ 3m					
	88MHz to 216MHz			150 μ V/m @ 3m					
	216MHz to 960MHz			200 μ V/m @ 3m					
	960MHz to 1GHz			500 μ V/m @ 3m					
	1GHz to 4GHz			500 μ V/m @ 3m					

Notes:

- 1 Results quoted are extrapolated as indicated
- 2 Emissions were searched to: (x) 1000MHz inclusive, as per Part 15.33a
- 3 Extrapolation factor 9.5dB from 1m to 3m, as per Part 15.31f
- 4 Measurements >1GHz @ 1m as per Part 15.31f(1)
- 5 Receiver detector >1GHz = CISPR, Quasi-Peak, 120kHz bandwidth
- 6 Receiver detector >1GHz = Peak Hold, 1MHz resolution bandwidth
- 7 New batteries used for battery powered products.
- 8 See Annex F for Emissions Graph(s)
- 9 Due to the transmitted signal lasting only 1.80 seconds a modified unit, which allowed continuous transmission, was used during spurious emissions testing.
- 10 (r) Denotes restricted band .
- 11 Spurious limit level of 543.25 μ V/m was calculated by reducing the fundamental limit level by 20 dB, as per 15.231(b).
- 12 Only emissions within 20 dB's of the limit are recorded.

Test Method:

- 1 As per Radio – Noise Emissions, ANSI C63.4: 2003
- 2 Measuring distances as Notes 1 to 4 above
- 3 EUT 0.8 metre above ground plane
- 4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthogonal planes.
Maximum results recorded.

The test equipment used for the Transmitter Spurious Emissions – Radiated – Part 15.209 tests are shown overleaf:

TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	EQUIPMENT USED
RADIO COMMUNICATIONS ANALYSER	R & S	CMTA 52	894715 / 003	05	
LOOP ANTENNA	R & S	HFH2	881058-53	07	
ENVIRONMENTAL CHAMBER (temp)	SHARETREE	TCC125 - 815P	CS 203	11	
HORN ANTENNA	EMCO	3115	9010 - 3580	138	X
HORN ANTENNA	EMCO	3115	9010 - 3581	139	
RF SIGNAL GEN	MARCONI	2042	119388 / 080	176	
TEMPERATURE INDICATOR	FLUKE	52 Series II	74700044	426	
SPECTRUM ANALYSER	ANRITSU	MS2665C	MT26089	479	
RF SIGNAL GEN	AGILENT	8341B	2819A02239	552	
PRE AMPLIFIER	AGILENT	8449B	3008A016	572	X
RECEIVER	R & S	ESHS 10	830051/001	UH03	
RECEIVER	R & S	ESVS 10	825892/003	UH04	
RANGE 1	TRL	3 METRE	N/A	UH06	X
MULTIMETER	AVOMeter	M3004	M3270006	UH41	
BILOG ANTENNA	CHASE	CBL6112	2129	UH93	X
POWER SUPPLY	THANDOR	PL320QMD	044749	UH100	
OSCILLOSCOPE	TEKTRONIX	TDS520B	B020491	UH122	
POWER METER	MARCONI	6960B	237036/001	UH132	
RECEIVER	R & S	ESVS 10	841431/014	UH186	X
RECEIVER	R & S	ESHS 10	841429/012	UH187	
BILOG ANTENNA	YORK	CBL611/A	1618	UH191	
500W AUDIO AMPLIFIER	PRO POWER	STA-162	688200474	UH196	
POWER SENSOR	MARCONI	6920	1564	UH228	
SPECTRUM ANALYSER	R & S	FSU	200034	UH281	X
RF SIGNAL GEN	HP	83630B	3722A00588	UH340	

TRANSMITTER TESTS

TRANSMITTER INTENTIONAL EMISSION – RADIATED – Part 15.231 September 2007

Ambient temperature	=	7.0°C(<1GHz),	3m measurements @ fc	[X]
Relative humidity	=	62%(<1GHz),	10m measurements @ fc	[]
Conditions	=	Open Area Test Site (OATS)	30m measurements @ fc	[]
Supply voltage	=	+3Vdc	30m extrapolated from 3m	[]
Channel number	=	1	30m extrapolated from 10m	[]

FREQ. (MHz)	MEASUREMENT Rx. READING (dB μ V)	CABLE LOSS (dB)	ANT FACTOR (dB/m)	FIELD STRENGTH (dB μ V/m)	FIELD STRENGTH (μ V/m)
312.0	59.29	2.01	13.4	74.7	5432.50
Limit value @ fc		5915.6 (μ V/m)			
Band occupancy @ -20dBc	f lower			f higher	
	311.978600MHz			312.076100MHz	
	Occupied Bandwidth			Limit	
	97.5kHz			780kHz	
Transmitter on time during Alarm Condition	1.80 Seconds			Removal of the alarm condition	
Transmitter on time during manual trigger transmission.	1.80 Seconds			Deactivation within 5 seconds of manual trigger release	
Supervision Transmission	1s			2 seconds per hour	

For band occupancy see spectrum analyser plots – Annex E

For transmitter timing pulses see oscilloscope plots – Annex G

Notes:

- 1 Results quoted are extrapolated as indicated
- 2 Receiver detector @ fc = Quasi Peak 120kHz bandwidth.
- 3 When battery powered the EUT was powered with new batteries
- 4 Supervision transmission repeated every 4 hours.

Test Method:

- 1 As per Radio – Noise Emissions, ANSI C63.4: 2003
- 2 Measuring distances 3m
- 3 EUT 0.8 metre above ground plane
- 4 Emissions maximised by rotation of EUT, on an automatic turntable. Raising and lowering the receiver antenna between 1m & 4m. Horizontal and vertical polarisations, of the receive antenna. EUT orientation in three orthogonal planes. Maximum results recorded

The test equipment used for the Transmitter Intentional Emission – Radiated – Part 15.231 September 2007 tests are shown overleaf:

TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	EQUIPMENT USED
RADIO COMMUNICATIONS ANALYSER	R & S	CMTA 52	894715 / 003	05	
LOOP ANTENNA	R & S	HFH2	881058-53	07	
ENVIRONMENTAL CHAMBER (temp)	SHARETREE	TCC125 - 815P	CS 203	11	
AE, DRG HORN, 1GHz - 18GHz	EMCO	3115	9010 - 3580	138	
AE, DRG HORN, 1GHz - 18GHz	EMCO	3115	9010 - 3581	139	
RF SIGNAL GEN	MARCONI	2042	119388 / 080	176	
TEMPERATURE INDICATOR	FLUKE	52 Series II	74700044	426	
SPECTRUM ANALYSER	ANRITSU	MS2665C	MT26089	479	
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PRE AMPLIFIER	AGILENT	8449B	3008A016	572	
RECEIVER	R & S	ESHS 10	830051/001	UH03	
RECEIVER	R & S	ESVS 10	825892/003	UH04	X
RANGE 1	TRL	3 METRE	N/A	UH06	X
MULTIMETER	AVOMeter	M3004	M3270006	UH41	
BILOG ANTENNA	CHASE	CBL6112	2129	UH93	X
POWER SUPPLY	THANDOR	PL320QMD	044749	UH100	
OSCILLOSCOPE	TEKTRONIX	TDS520B	B020491	UH122	X
POWER METER	MARCONI	6960B	237036/001	UH132	
RECEIVER	R & S	ESVS 10	841431/014	UH186	X
RECEIVER	R & S	ESHS 10	841429/012	UH187	
BILOG ANTENNA	YORK	CBL611/A	1618	UH191	
500W AUDIO AMPLIFIER	PRO POWER	STA-162	688200474	UH196	
POWER SENSOR	MARCONI	6920	1564	UH228	
SPECTRUM ANALYSER	R & S	FSU	200034	UH281	
RF SIGNAL GEN	HP	83630B	3722A00588	UH340	

ANNEX A
PHOTOGRAPHS

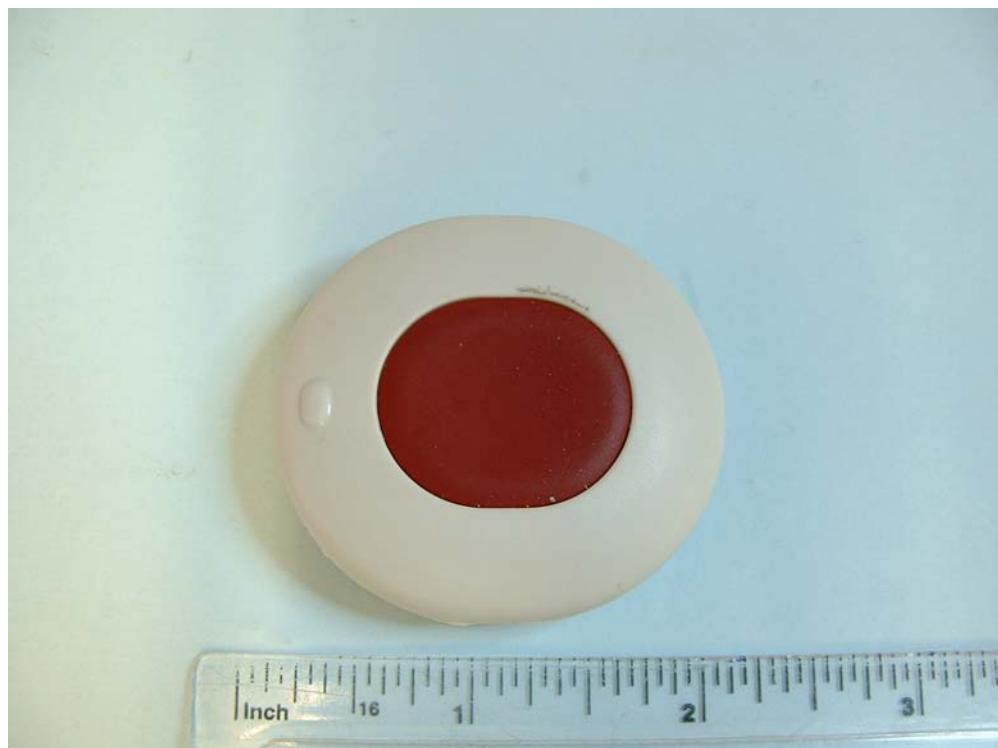
PHOTOGRAPH No. 1

TEST SETUP



PHOTOGRAPH No. 2

TRANSMITTER FRONT VIEW



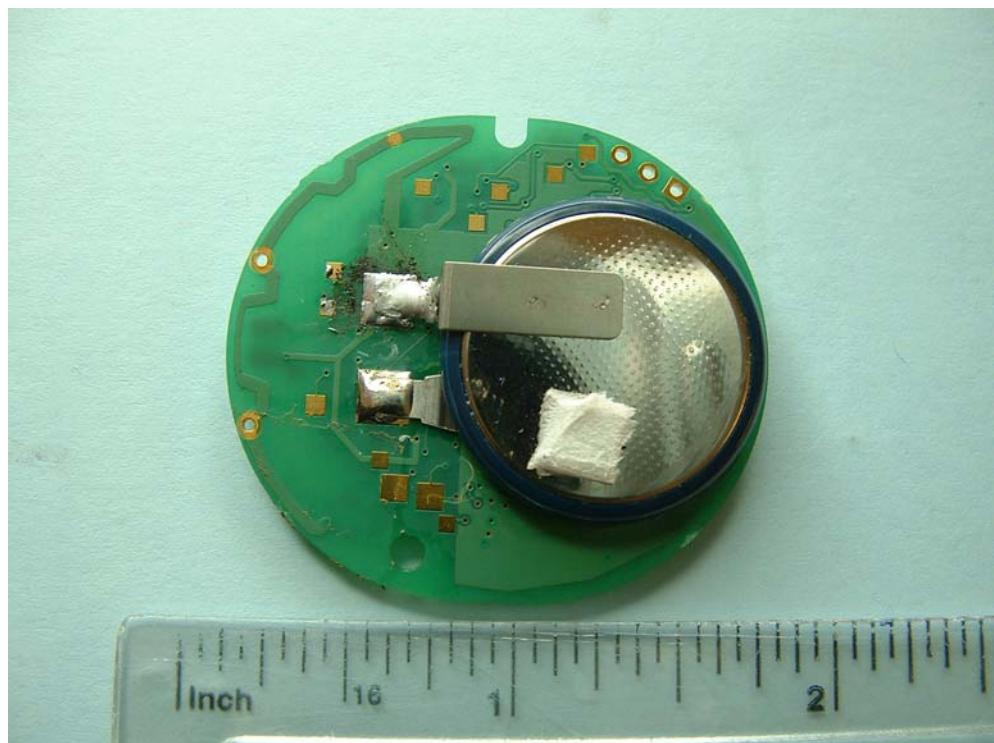
PHOTOGRAPH No. 3

TRANSMITTER REAR VIEW



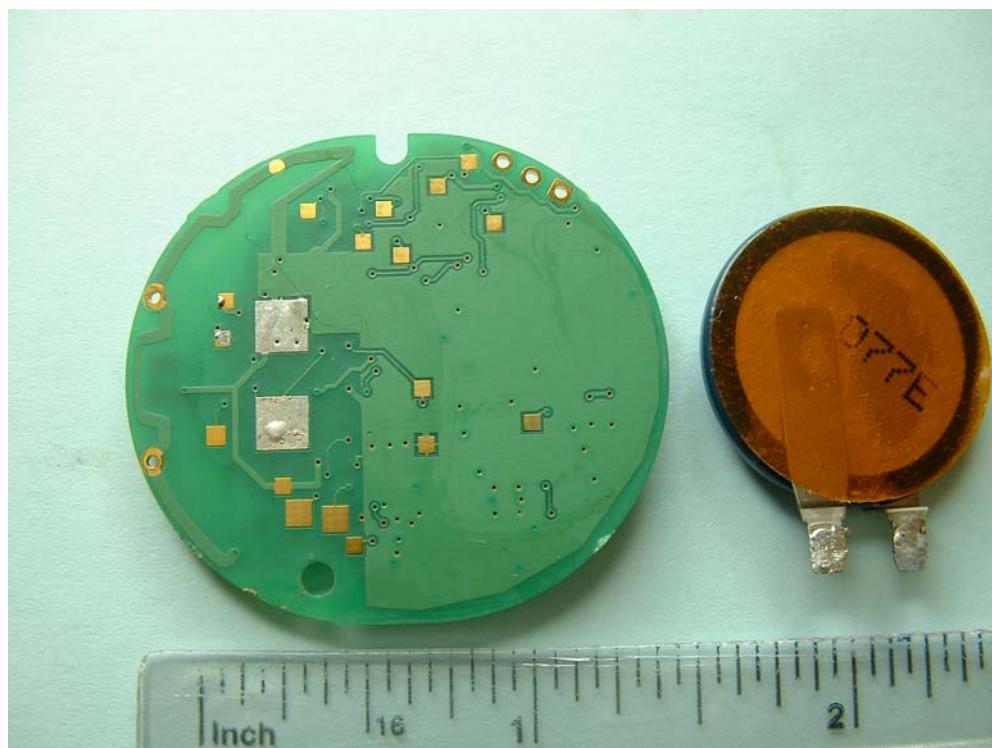
PHOTOGRAPH No. 4

RF PCB TRACK SIDE



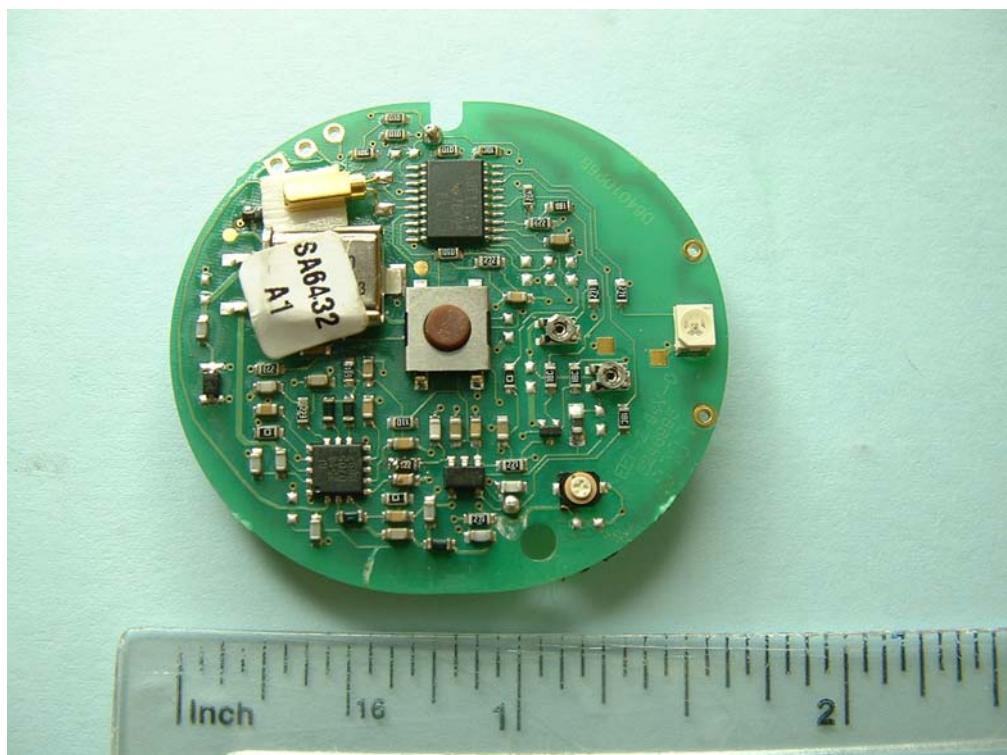
PHOTOGRAPH No. 5

**RF PCB TRACK SIDE
BATTERY REMOVED**



PHOTOGRAPH No. 6

RF PCB COMPONENT SIDE



ANNEX B
APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

a.	TCB	-	APPLICATION	[X]
		-	FEE	[X]
b.	AGENT'S LETTER OF AUTHORISATION	-		[X]
c.	MODEL(s) vs IDENTITY	-		[X]
d.	ALTERNATIVE TRADE NAME DECLARATION(s)	-		[]
e.	LABELLING	-	PHOTOGRAPHS	[X]
		-	DECLARATION	[X]
		-	DRAWINGS	[X]
f.	TECHNICAL DESCRIPTION	-		[X]
g.	BLOCK DIAGRAMS	-	Tx	[X]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
h.	CIRCUIT DIAGRAMS	-	Tx	[X]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
i.	COMPONENT LOCATION	-	Tx	[X]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
j.	PCB TRACK LAYOUT	-	Tx	[X]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
k.	BILL OF MATERIALS	-	Tx	[X]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
l.	USER INSTALLATION / OPERATING INSTRUCTIONS	-		[X]

ANNEX C
MEASUREMENT UNCERTAINTY

Radio Testing – General Uncertainty Schedule

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence where no required test level exists.

[1] Adjacent Channel Power

Uncertainty in test result = **1.86dB**

[2] Carrier Power

Uncertainty in test result (Equipment - TRLUH120) = **2.18dB**
Uncertainty in test result (Equipment – TRL05) = **1.08dB**
Uncertainty in test result (Equipment – TRL479) = **2.48dB**

[3] Effective Radiated Power

Uncertainty in test result = **4.71dB**

[4] Spurious Emissions

Uncertainty in test result = **4.75dB**

[5] Maximum frequency error

Uncertainty in test result (Equipment - TRLUH120) = **119ppm**
Uncertainty in test result (Equipment – TRL05) = **0.113ppm**
Uncertainty in test result (Equipment – TRL479) = **0.265ppm**

[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field

Uncertainty in test result (14kHz – 30MHz) = **4.8dB**, Uncertainty in test result (30MHz – 1GHz) = **4.6dB**,
Uncertainty in test result (1GHz-18GHz) = **4.7dB**

[7] Frequency deviation

Uncertainty in test result = **3.2%**

[8] Magnetic Field Emissions

Uncertainty in test result = **2.3dB**

[9] Conducted Spurious

Uncertainty in test result (Equipment TRL479) Up to 8.1GHz = **3.31dB**
Uncertainty in test result (Equipment TRL479) 8.1GHz – 15.3GHz = **4.43dB**
Uncertainty in test result (Equipment TRL479) 15.3GHz – 21GHz = **5.34dB**
Uncertainty in test result (Equipment TRLUH120) Up to 26GHz = **3.14dB**

[10] Channel Bandwidth

Uncertainty in test result = **15.5%**

[11] Amplitude and Time Measurement – Oscilloscope

Uncertainty in overall test level = **2.1dB**, Uncertainty in time measurement = **0.59%**, Uncertainty in Amplitude measurement = **0.82%**

[11] Power Line Conduction

Uncertainty in test result = **3.4dB**

[12] Spectrum Mask Measurements

Uncertainty in test result = **2.59% (frequency)**
Uncertainty in test result = **1.32dB (amplitude)**

[13] Adjacent Sub Band Selectivity

Uncertainty in test result = **1.24dB**

[14] Receiver Blocking – Listen Mode, Radiated

Uncertainty in test result = **3.42dB**

[15] Receiver Blocking – Talk Mode, Radiated

Uncertainty in test result = **3.36dB**

[16] Receiver Blocking – Talk Mode, Conducted

Uncertainty in test result = **1.24dB**

[17] Receiver Threshold

Uncertainty in test result = **3.23dB**

[18] Transmission Time Measurement

Uncertainty in test result = **7.98%**

ANNEX D
TEST EQUIPMENT CALIBRATION

TRL Number	Equipment Type	Manufacturer	Last Cal Calibration	Calibration Period	Due For Calibration
UH004	Receiver	R&S	06/11/2007	12	06/11/2008
UH06/07	NSA Cal	TRL	17/12/2007	12	17/12/2008
UH06/07	IC OATS Submission	TRL	01/06/2007	24	01/06/2009
UH006	3m Range ERP CAL	TRL	08/12/2006	12	08/12/2007
UH028	Log Periodic Ant	Schwarbeck	30/05/2007	24	30/05/2009
UH029	Bicone Antenna	Schwarbeck	22/05/2007	24	22/05/2009
UH041	Multimeter	AVOMeter	04/01/2007	12	04/01/2008
UH093	Antenna	Chase	21/05/2007	24	21/05/2009
UH122	Oscilloscope	Tektronix	07/06/2005	24	07/06/2007
UH132	Power meter	Marconi	10/01/2007	12	10/01/2008
UH162	ERP Cable Cal	TRL	02/01/2007	12	02/01/2008
UH186	Receiver	R&S	12/12/2007	12	12/12/2008
UH187	Receiver	R&S	12/12/2007	12	12/12/2008
UH191	Bilog Antenna	York	11/08/2006	24	11/08/2008
UH195	LISN	R&S	09/01/2007	12	09/01/2008
UH228	Power Sensor	Marconi	15/01/2007	12	15/01/2008
UH253	1m Cable N type	TRL	07/12/2006	12	07/12/2007
UH254	1m Cable N type	TRL	07/12/2006	12	07/12/2007
UH265	Notch filer	Telonic	11/01/2006	24	11/01/2008
UH269	1m Cable N type	TRL	07/12/2006	12	07/12/2007
UH270	1m Cable N type	TRL	07/12/2006	12	07/12/2007
UH271	1.5m Cable N type	TRL	07/12/2006	12	07/12/2007
UH272	1.5m Cable N type	TRL	07/12/2006	12	07/12/2007
UH273	2m Cable N type	TRL	07/12/2006	12	07/12/2007
UH274	2m Cable N type	TRL	07/12/2006	12	07/12/2007
UH281	Spectrum Analyser	R&S	25/10/2007	12	25/10/2008
UH340	Signal Generator	HP	29/06/2006	12	29/06/2007
L005	CMTA	R&S	10/01/2007	12	10/01/2008
L007	Loop Antenna	R&S	22/05/2007	24	22/05/2009
L138	1-18GHz Horn	EMCO	23/05/2007	24	23/05/2009
L139	1-18GHz Horn	EMCO	23/05/2007	24	23/05/2009
L176	Signal Generator	Marconi	01/03/2007	12	01/03/2008
L193	Bicone Antenna	Chase	12/10/2003	24	12/10/2005
L203	Log Periodic Ant	Chase	21/10/2003	24	21/10/2005
L343	CCIR Noise Filter	TRL	20/09/2006	12	20/09/2007
L426	Temperature Indicator	Fluke	09/01/2007	12	09/01/2008
L479	Analyser	Anritsu	09/01/2007	12	09/01/2008
L552	Signal Generator	Agilent	24/07/2006	12	24/07/2007
L572	Pre Amplifier	Agilent		Calibrate in use	

ANNEX E
BANDWIDTH PLOT

BANDWIDTH PLOT

OccBW:97.5 kHz

CTR:312.0273 MHz

RLV: 0.00dBm

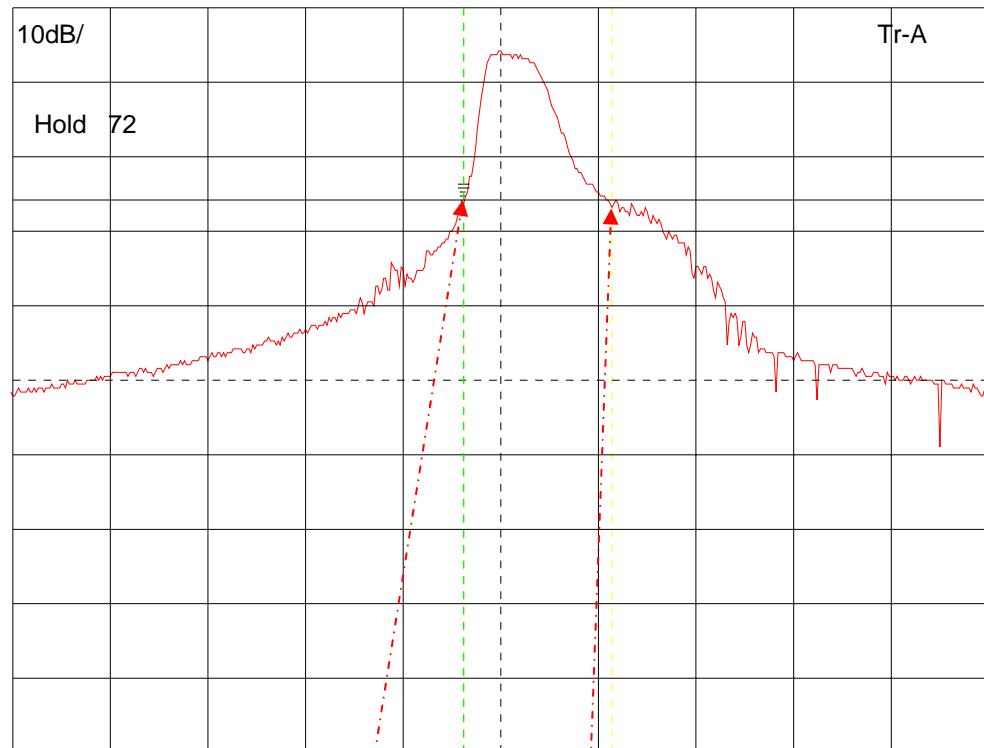
RB 10kHz#

VB 10kHz

AT 10dB#

ST 84s#

Band auto



CF:312.0020MHz

Span:650kHz

f_{Lower}

f_{Higher}

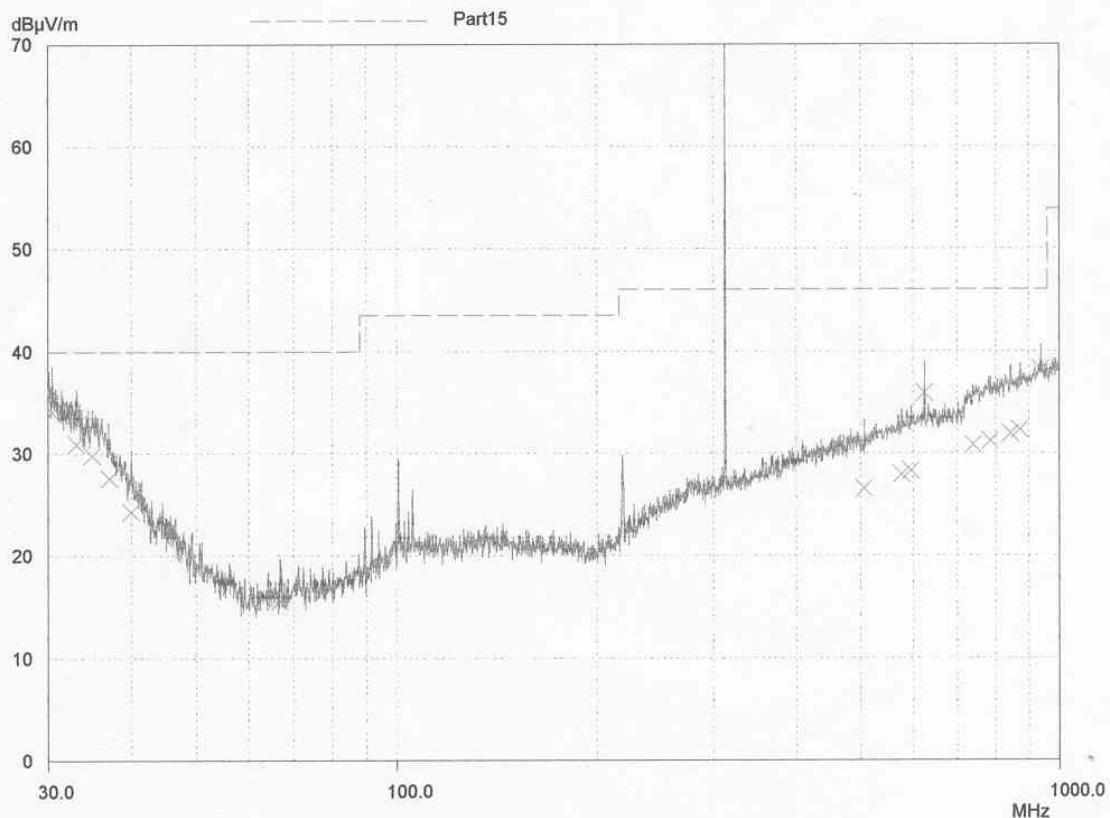
f_{Lower} = 311.978600MHz
 f_{Higher} = 312.076100MHz
Occupied Bandwidth = 97.5kHz

ANNEX F
EMISSIONS GRAPH(s)

E-Field Radiation (30MHz-1GHz)

EUT: Gem Trigger
 Manuf: Tunstall telecom
 Op Cond: Prescan 30MHz - 1000MHz
 Operator: S Hodgkinson
 Test Spec: Part15
 Comment: Unit in permanent Tx mode, Unit side on to Rx antenna.
 Rx antenna Vertical.

Scan Settings		(1 Range) Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
30MHz	1000MHz	50kHz	120kHz	PK	1msec	Auto	ON	60dB	
Transducer	No.	Start	Stop	Name					
1	21	30MHz	1000MHz	UH72					
	22	30MHz	1000MHz	UH93					
Final Measurement:		Detector:	X QP						
		Meas Time:	2sec						
		Subranges:	50						
		Acc Margin:	10 dB						



ANNEX G
TRANSMITTER TIMING PULSES

