REPORT ON THE CERTIFICATION TESTING OF A TMS23 TYRE PRESSURE MONITORING SYSTEM ON BEHALF OF A M BROMLEY LIMITED WITH RESPECT TO THE FCC RULES CFR 47, PART 15.231(e) 10th July 2008 INTENTIONAL RADIATOR SPECIFICATION

UKAS TESTING 0971

TEST REPORT NO: 9F2842WUS1

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FCC ID: TMITMS23

REPORT ON THE CERTIFICATION TESTING OF A TMS23 TYRE PRESSURE MONITORING SYSTEM ON BEHALF OF A M BROMLEY LIMITED WITH RESPECT TO THE FCC RULES CFR 47, PART 15.231(e) 10th July 2008 INTENTIONAL RADIATOR SPECIFICATION

TEST DATE: 15th – 19th January 2010

TESTED BY: S HODGKINSON — Digitally signed by S HODGKINSON DN: CN = S HODGKINSON, C = GB, O = TRL COMPLIANCE LTD Reason: I am the author of this document Date: 2010.01.28 08:43:40 Z — S HODGKINSON

APPROVED BY: John Charters — Digitally signed by John Charters DN: CN = John Charters, C = GB Reason: I am approving this document Date: 2010.01.28 09:17:39 Z — J CHARTERS PRODUCT MANAGER

DATE: 27th January 2010

Distribution:

Copy Nos:
1. A M Bromley Limited
2. FCC EVALUATION LABORATORIES
3. TRaC Telecoms and Radio, Upholland

UP HOLLAND
Moss View, Nipe Lane, Up Holland, West Lancashire, WN8 9PY, UK.
T +44 (0)1695 556666 **F** +44 (0)1695 557077 **E** test@tracglobal.com
www.tracglobal.com

CONTENTS

Notes:

1. Component failure during test — YES [ ] NO [X]
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.

CERTIFICATE OF CONFORMITY & COMPLIANCE

FCC IDENTITY:	TMITMS23					
PURPOSE OF TEST:	Certification					
TEST SPECIFICATION:	FCC RULES CFR 47, Part 15.231(e) 10th July 2008					
TEST RESULT:	Compliant to Specification					
EQUIPMENT UNDER TEST:	Tyre pressure monitor					
EQUIPMENT MODEL Nos:	TMS23					
ITU: EMISSION CODE:	118kF1D					
EQUIPMENT TYPE:	Periodic Transmitter					
PRODUCT USE:	Tyre pressure monitoring system					
CARRIER EMISSION:	4216.96µV/m @ 3m					
ANTENNA TYPE:	Integral					
ALTERNATIVE ANTENNA:	Not applicable					
BAND OF OPERATION:	433.9375 MHz					
CHANNEL SPACING:	Not applicable, wideband					
NUMBER OF CHANNELS:	1					
FREQUENCY GENERATION:	SAW Resonator	[ ]	Crystal	[X]	Synthesiser	[ ]
MODULATION METHOD:	Amplitude	[ ]	Digital	[ ]	Angle	[X]
POWER SOURCE(s):	+3.6Vdc					
TEST DATE(s):	15th – 19th January 2010					
ORDER No(s):	P6263					
APPLICANT:	A M Bromley Limited					
ADDRESS:	West Road House 26a West Road Buxton Derbyshire SK17 6HF					

TESTED BY: S HODGKINSON — Digitally signed by S HODGKINSON DN: CN = S HODGKINSON, C = GB, O = TRL COMPLIANCE LTD Reason: I am the author of this document Date: 2010.01.28 08:44:04 Z — S HODGKINSON

APPROVED BY: John Charters — Digitally signed by John Charters DN: CN = John Charters, C = GB Reason: I am approving this document Date: 2010.01.28 09:17:56 Z — J CHARTERS PRODUCT MANAGER

APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT):	TMS23
EQUIPMENT TYPE:	Periodic Transmitter
PURPOSE OF TEST:	Certification
TEST SPECIFICATION(s):	FCC RULES CFR 47, Part 15.231(e) 10th July 2008
TEST RESULT:	COMPLIANT Yes [X] No [ ]
APPLICANT'S CATEGORY:	MANUFACTURER [X] IMPORTER [ ] DISTRIBUTOR [ ] TEST HOUSE [ ] AGENT [ ]
APPLICANT'S ORDER No(s):	P6263
APPLICANT'S CONTACT PERSON(s):	Andrew Bromley
E-mail address:	andrew.bromley@ambromley.co.uk
APPLICANT:	A M Bromley Ltd
ADDRESS:	West Road House 26a West Road Buxton Derbyshire SK17 6HF
TEL:	+44(0) 1298 77166
EUT(s) COUNTRY OF ORIGIN:	United Kingdom
TEST LABORATORY:	TRaC Telecoms and Radio Up Holland
UKAS ACCREDITATION No:	0971
TEST DATE(s) :	15th – 19th January 2010
TEST REPORT No:	9F2842WUS1

EQUIPMENT TEST / EXAMINATIONS REQUIRED

1.

TEST/EXAMINATION	RULE PART	DETECTOR	APPLICABILITY
Intentional Emission Frequency:	15.231(e)	Quasi Peak	Yes
Intentional Emission Field Strength:	15.231(e)	Quasi Peak	Yes
Intentional Emission Band Occupancy:	15.231(e)	Peak	Yes
Intentional Emission ERP (mW):	-	-	No
Spurious Emissions – Conducted:	15.207	-	No
Spurious Emissions – Radiated <1000MHz:	15.231(e) 15.209	Quasi Peak	Yes
Spurious Emissions – Radiated >1000MHz:	15.231(e) 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: Tyre pressure monitoring

3. Emission Designator: 118kF1D

4. Duty Cycle: <100%

5. Temperatures: Ambient (Tnom) 7.0^{o}C

6. Supply Voltages: Vnom +3.6Vdc

Note: Vnom voltages are as stated above unless otherwise shown on the test report page

7. Equipment Category:
   Single channel [X]
   Two channel [ ]
   Multi-channel [ ]

8. Channel spacing:
   Narrowband [ ]
   Wideband [X]

TRANSMITTER TESTS

TRANSMITTER SPURIOUS EMISSIONS – RADIATED – PART 15.209

Ambient temperature	=	7.0°C(<1GHz)	3m measurements <1GHz	[X]
Relative humidity	=	68% (<1GHz),	3m measurements >1GHz	[X]
Conditions	=	Open Area Test Site (OATS)	3m extrapolated from 1m	[ ]
Supply voltage	=	+3.6Vdc		
Channel number	=	1		

Bottom Channel	**FREQ. (MHz)**	**MEAS Rx (dBµV)**	**CABLE LOSS (dB)**	**ANT FACT. (dB/m)**	**PRE AMP (dB)**	**FIELD ST'GH (dBµV/m)**	**FIELD ST'GH (µV/m)**	**LIMIT (µV/m)**
30MHz - 88MHz							note 8	
88MHz - 216MHz							note 8	
216MHz - 960MHz	867.875	27.93	3.80	20.47	N/A	52.20	407.38	500
960MHz - 1GHz							note 8	
1GHz - 4GHz	1301.783 1301.783 1735.711 1735.711	58.67 54.06 53.14 45.86	1.56 1.56 2.26 2.26	24.90 24.90 26.16 26.16	37.20 37.20 36.77 36.77	47.93pk 43.32Av 44.79pk 37.51Av	249.17 146.55 173.58 75.07	5011.0 500.0 5011.0 500.0

Limits	30MHz to 88MHz	100µV/m @ 3m
	88MHz to 216MHz	150µV/m @ 3m
	216MHz to 960MHz	500µV/m @ 3m
	960MHz to 1GHz	500µV/m @ 3m
	1GHz to 4GHz	500µV/m @ 3m

Notes:

1 Results quoted are extrapolated as indicated
2 Emissions were searched to: (**x**) 1000MHz inclusive, as per Part 15.33a
3 Measurements >1GHz @ 3m
4 Receiver detector >1GHz = CISPR, Quasi-Peak, 120kHz bandwidth
5 Receiver detector >1GHz = Peak Hold, 1MHz resolution bandwidth
6 New batteries used for battery powered products.
7 See Annex F for Emissions Graph(s)
8 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 orthagonal planes.
Maximum results recorded.

The test equipment used for the Transmitter Spurious Emissions – Radiated – Part 15.209 tests is 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	ESU	100081	UH377	**X**
RF SIGNAL GEN	HP	83630B	3722A00588	UH340	

TRANSMITTER TESTS

TRANSMITTER INTENTIONAL EMISSION – RADIATED – Part 15.231 September 2007

Ambient temperature	=	15°C(<1GHz),	3m measurements @ fc	[X]
Relative humidity	=	67%(<1GHz),	10m measurements @ fc	[ ]
Conditions	=	Open Area Test Site (OATS)	30m measurements @ fc	[ ]
Supply voltage	=	+3.6Vdc	30m extrapolated from 3m	[ ]
Channel number	=	1	30m extrapolated from 10m	[ ]

FREQ. (MHz)	MEASUREMENT Rx. READING (dBµV)	CABLE LOSS (dB)	ANT FACTOR (dB/m)	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (µV/m)
433.9375	53.70	2.4	16.40	72.5	4216.96

Limit value @ fc	**4415.70 (µV/m)**	
Band occupancy @ -20dBc	**f lower**	**f higher**
	433.867397MHz	433.986387MHz
	Occupied Bandwidth	**Limit**
	118.99kHz	1.08MHz
Supervision Transmission	123.39ms every 301.76s	Pass See note 4
Transmitter on time during Change of state period	123.71ms every 11.74s x 4	Pass See note 4

For band occupancy see spectrum analyser plots – Annex D
For transmitter timing pulses see plots – Annex F

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 Duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds

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 orthagonal planes.
Maximum results recorded

The test equipment used for the Transmitter Intentional Emission – Radiated – Part 15.231 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	**X**
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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	
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	ESU	100081	UH377	**X**
RF SIGNAL GEN	HP	83630B	3722A00588	UH340	

ANNEX A

PHOTOGRAPHS

PHOTOGRAPH No. 1 **TEST SETUP**

PHOTOGRAPH No. 2 **OVERVIEW**

ANNEX B

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 C

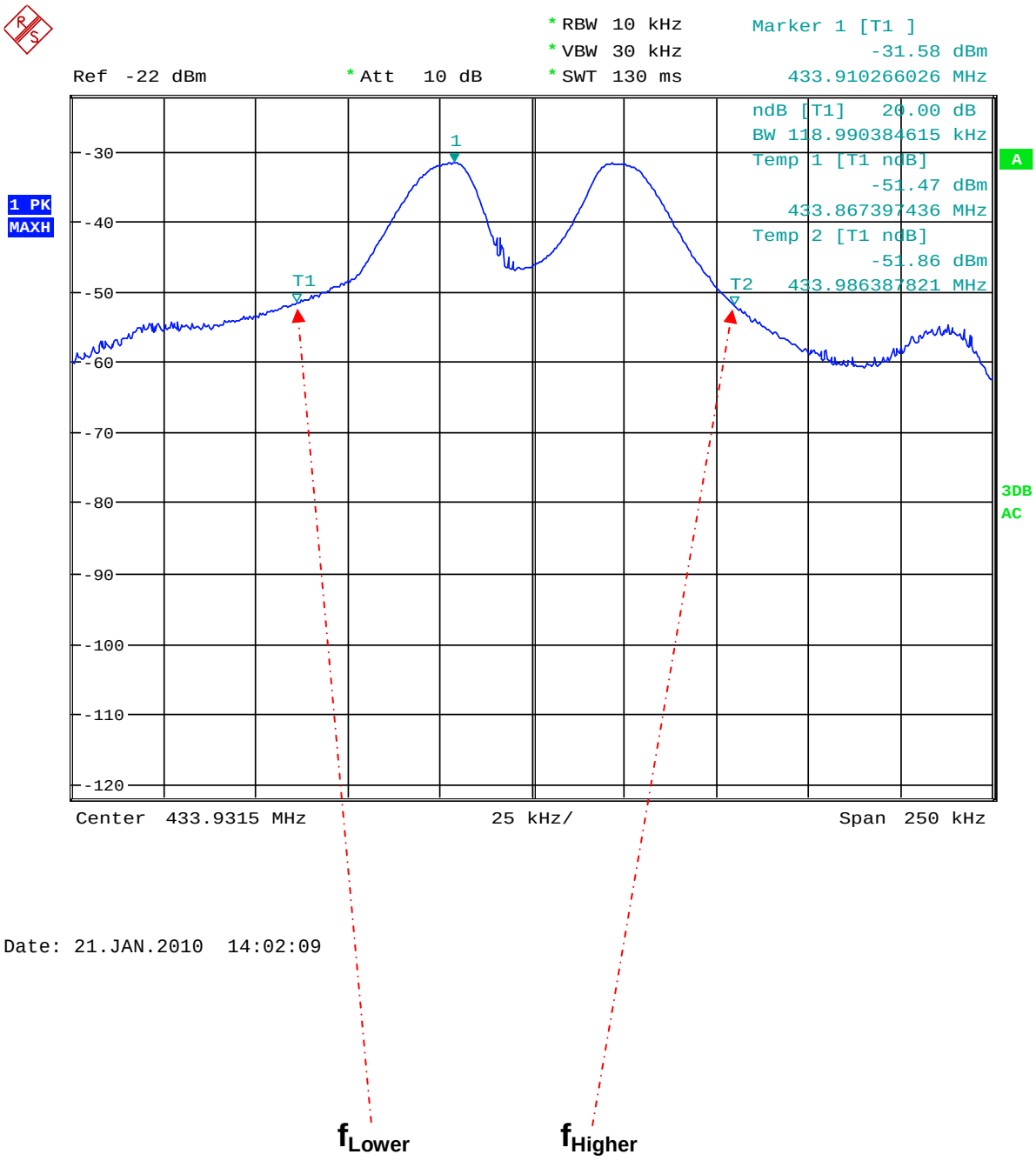
TEST EQUIPMENT CALIBRATION

TRL Number	Equipment Type	Manufacturer	Last Cal Calibration	Calibration Period	Due For Calibration
UH093	Bilog Antenna	Chase	03/06/2009	24	03/06/2011
L572	Pre Amplifier	HP	Calibrate in Use	L572	Pre Amplifier
UH377	Spectrum Analyser	R&S	09/11/2009	12	09/11/2010
L138	1-18GHz Horn	EMCO	23/05/2007	24	23/05/2009
UH122	Oscilloscope	Tektronics	10/12/2007	24	10/12/2009
UH186	Receiver	R&S	09/12/2008	12	09/12/2009
UH479	Spectrum Analyser	ANRITSU	02/10/2009	12	02/10/2010

ANNEX D

BANDWIDTH PLOT

20dB Bandwidth plot

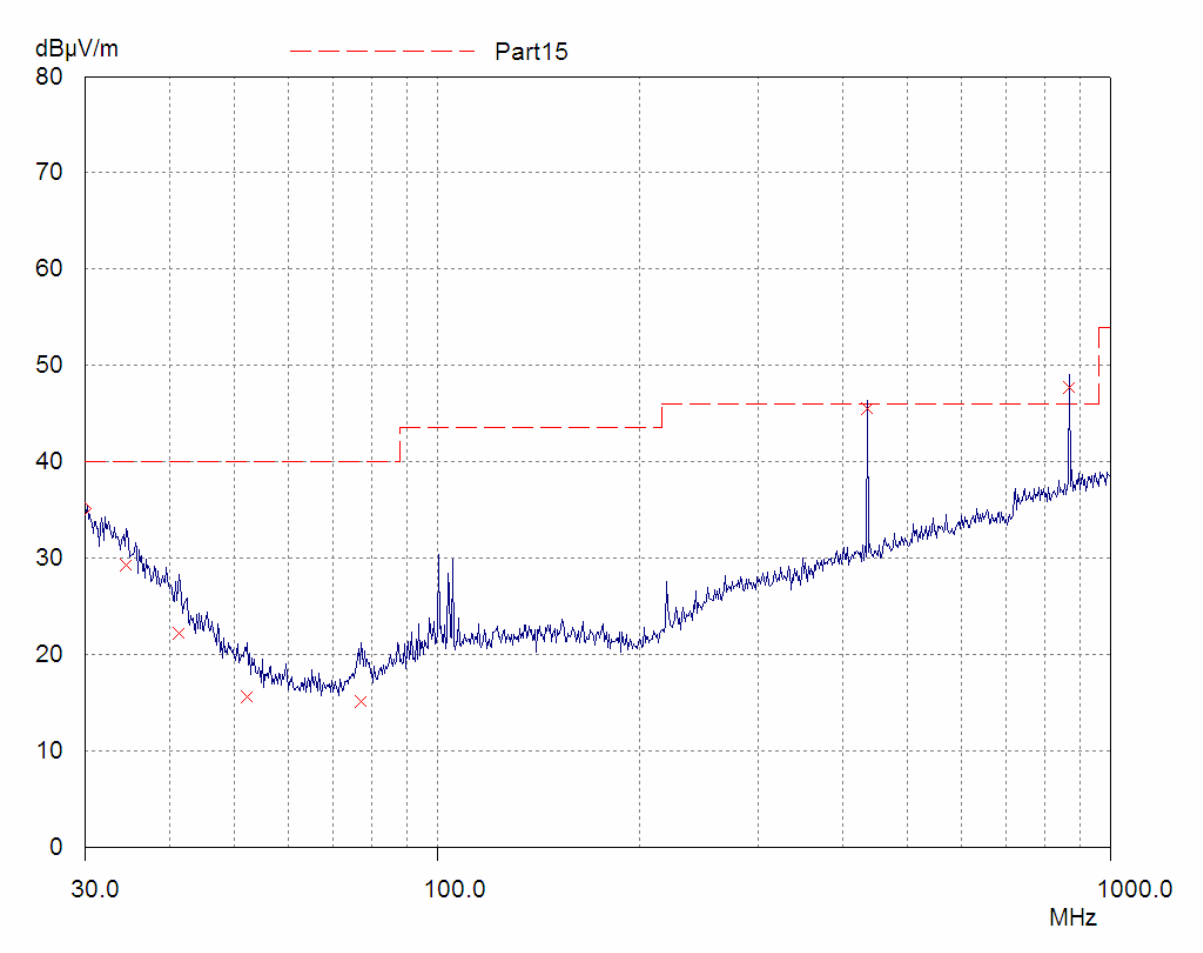


f_{Lower} = 433.867397MHz
f_{Higher} = 433.986387MHz
Occupied Bandwidth = 118.99kHz

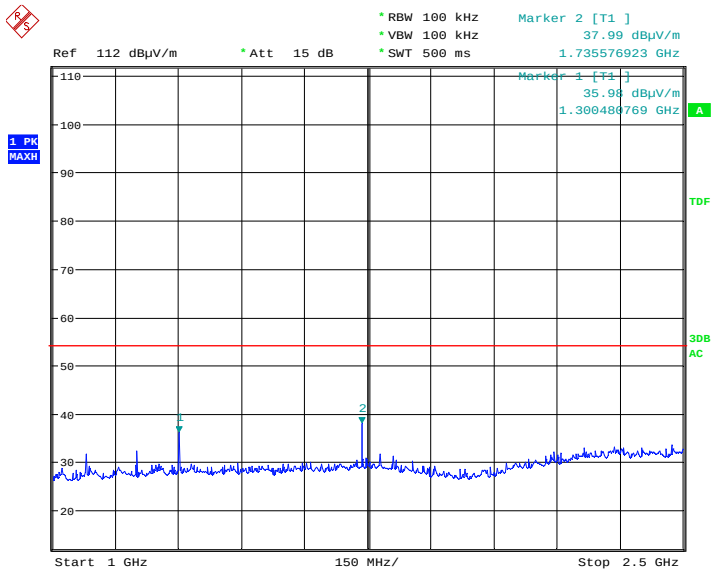
ANNEX E

EMISSIONS GRAPH(s)

Radiated emissions 30MHz – 1GHz



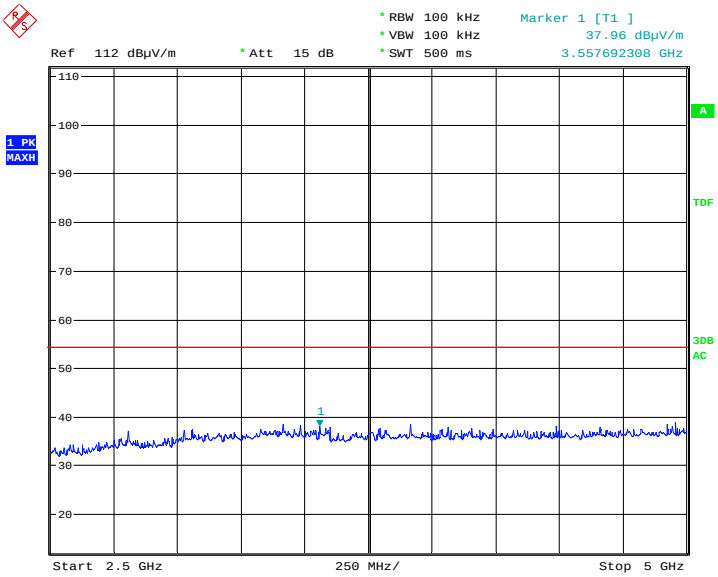
Radiated emissions 1GHz – 2.5GHz



54dbµV/m
Av Limit

Date: 18.JAN.2010 10:50:37

Radiated emissions 2.5GHz – 5GHz



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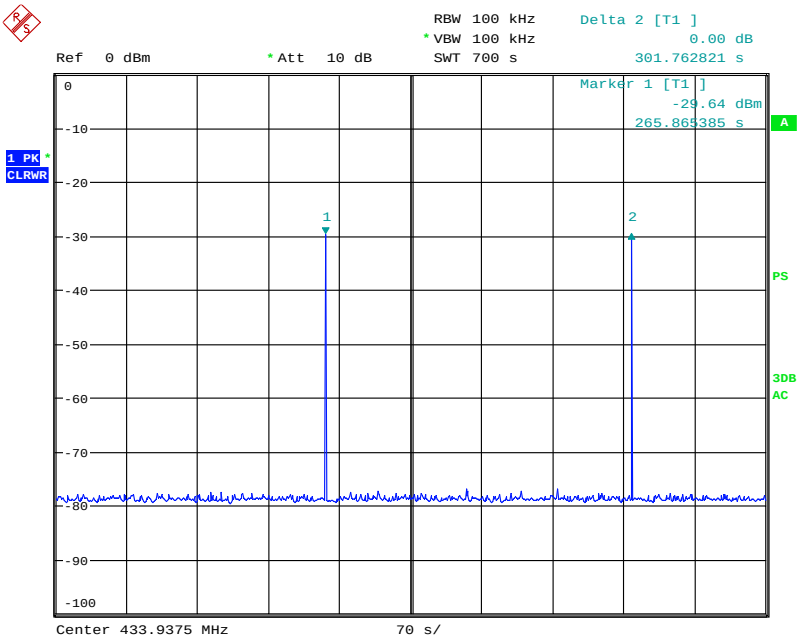
Av Limit

Date: 18.JAN.2010 10:48:31

ANNEX F

TRANSMITTER TIMING PULSES

SUPERVISION TRANSMISSION



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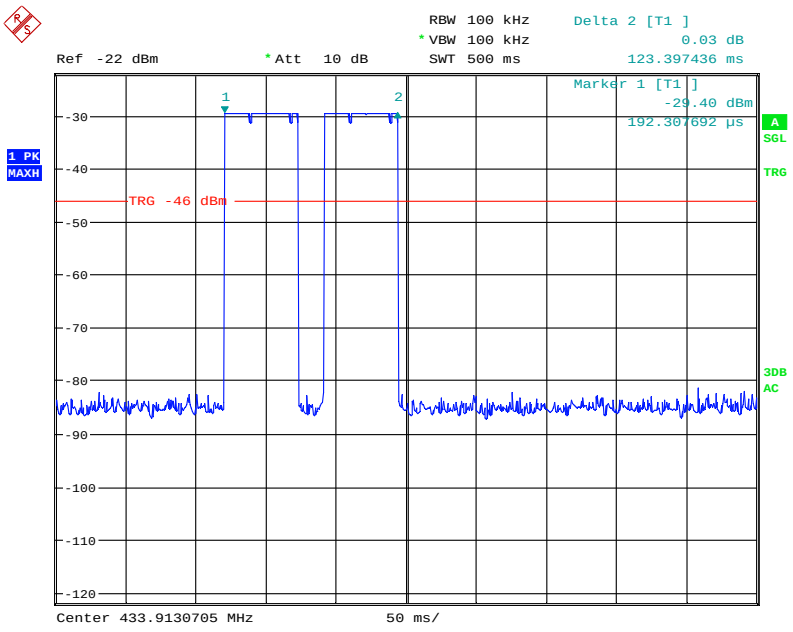
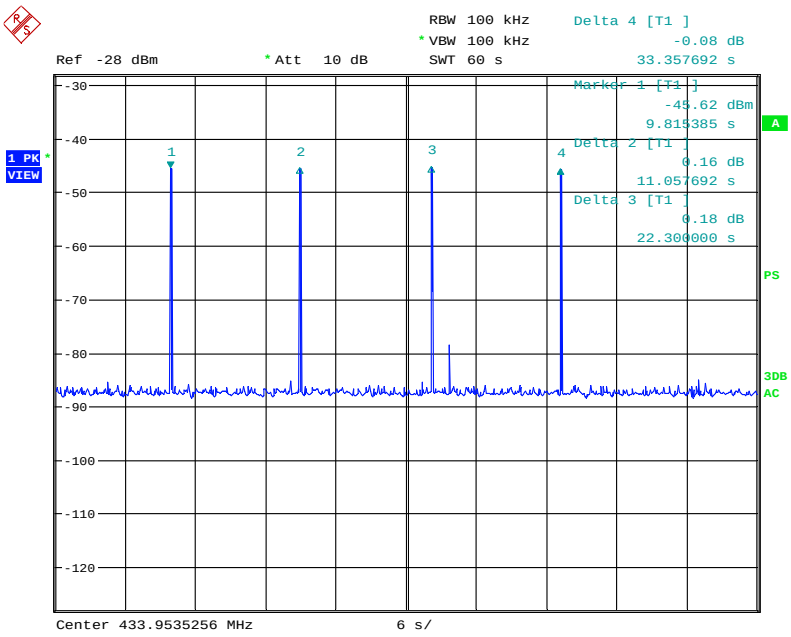


Date: 21.JAN.2010 15:10:59

CHANGE OF STATE TRANSMISSION
FULL TRANSMIT CHAIN



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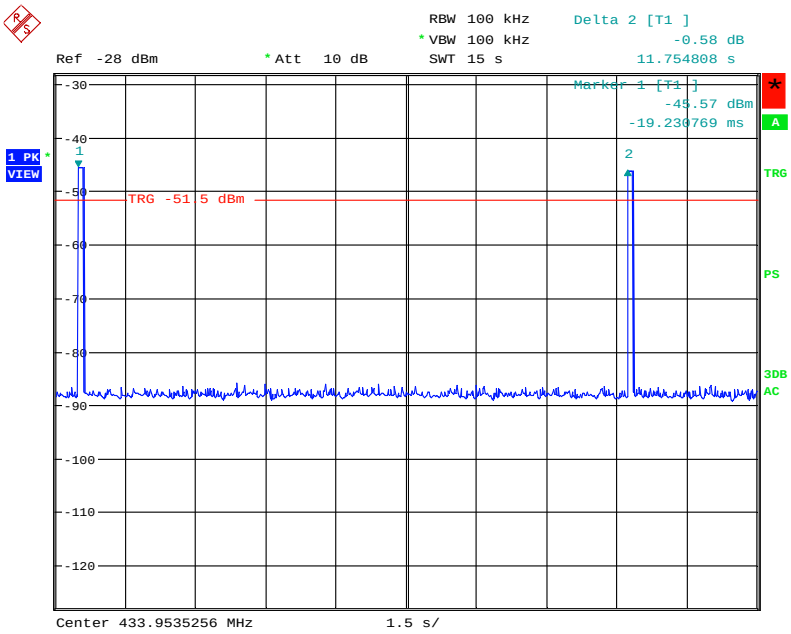
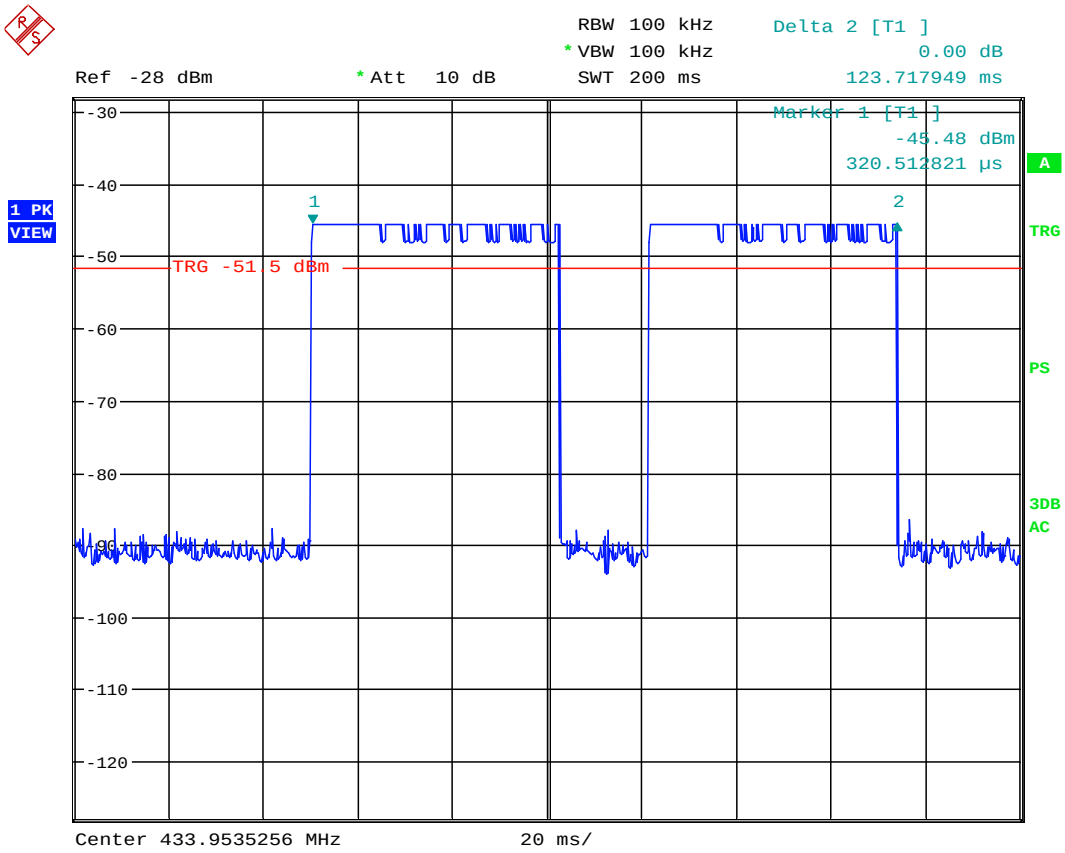
TIME BETWEEN TRANSMISSIONS



Date: 25.JAN.2010 14:27:37

TIME PERIOD OF ONE TRANSMISSION



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ANNEX G

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]