



TEST REPORT NO: RU1140/5838
COPY NO: .2.....
ISSUE NO: 1
FCC ID: G2X-6460401

**REPORT ON THE CERTIFICATION TESTING OF A
TUNSTALL ELECTRONICS LIMITED
RADIO OUTPUT MODULE
WITH RESPECT TO
THE FCC RULES CFR 47, PART 15.231
INTENTIONAL RADIATOR SPECIFICATION**

TEST DATE: 13th October 2004 – 14th October 2004

TESTED BY: D WINSTANLEY

APPROVED BY: P GREEN
EMC PRODUCT
MANAGER

DATE: 15/11/04

Distribution:

- Copy Nos:
1. TUNSTALL ELECTRONICS LIMITED
 2. FCC EVALUATION LABORATORIES
 3. TRL EMC

THIS DOCUMENT MAY BE REPRODUCED ONLY IN ITS ENTIRETY AND WITHOUT CHANGE



CONTENTS

	PAGE
CERTIFICATE OF CONFORMITY & COMPLIANCE	3
APPLICANT'S SUMMARY	4
EQUIPMENT TEST CONDITIONS	5
TESTS REQUIRED	5
TEST RESULTS	6-9

ANNEX

PHOTOGRAPHS	A
PHOTOGRAPH No. 1: Test setup	
PHOTOGRAPH No. 2: Transmitter front view	
PHOTOGRAPH No. 3: Transmitter rear view	
PHOTOGRAPH No. 4: Transmitter PCB track side	
PHOTOGRAPH No. 5: Transmitter PCB component side	
APPLICANT'S SUBMISSION OF DOCUMENTATION LIST	B
BAND OCCUPANCY PLOT(s)	C
TRANSMITTER ON TIME PLOT(s)	D

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: G2X-6460401

PURPOSE OF TEST: Certification

TEST SPECIFICATION: FCC RULES CFR 47, Part 15.231

TEST RESULT: Compliant to Specification

EQUIPMENT UNDER TEST: Radio Output Module

EQUIPMENT SERIAL No: Engineering Sample

ITU EMISSION CODE: 349kF1D

PRODUCT USE: Alarm/Help Call

CARRIER EMISSION: 3981.1 μ V/m @ 3m

ANTENNA TYPE: Integral

ALTERNATIVE ANTENNA: Not applicable

CHANNEL SPACING: Wideband

NUMBER OF CHANNELS: 1

FREQUENCY GENERATION: SAW Resonator ☐ Crystal ☐ Synthesiser ☒

MODULATION METHOD: Amplitude ☐ Digital ☒ Angle ☐

POWER SOURCE(s): 3Vdc

TEST DATE(s): 13th October 2004 – 14th October 2004

ORDER No(s): 258234

APPLICANT: Tunstall Electronics Limited

ADDRESS: Whitley Lodge
Whitley Bridge
Yorkshire
DN14 0HR

TESTED BY: _____ D WINSTANLEY

APPROVED BY: _____ P GREEN
EMC PRODUCT
MANAGER

APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT):	Radio Output Module
SERIAL NUMBER OF EUT:	Engineering Sample
PURPOSE OF TEST:	Certification
TEST SPECIFICATION(s):	FCC RULES CFR 47, Part 15.231
TEST RESULT:	COMPLIANT Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
APPLICANT'S CATEGORY:	MANUFACTURER <input checked="" type="checkbox"/> IMPORTER <input type="checkbox"/> DISTRIBUTOR <input type="checkbox"/> TEST HOUSE <input type="checkbox"/> AGENT <input type="checkbox"/>
APPLICANT'S ORDER No(s):	258234
APPLICANT'S CONTACT PERSON(s):	Mr R Cooper
E-mail address:	R_cooper@tunstall.co.uk
APPLICANT:	Tunstall Electronics Limited
ADDRESS:	Whitley Lodge Whitley Bridge Yorkshire DN14 0HR
TEL:	+44 (0) 1977 661234
FAX:	+44 (0) 1977 662452
MANUFACTURER:	Tunstall Electronics Limited
EUT(s) COUNTRY OF ORIGIN:	United Kingdom
TEST LABORATORY:	TRL EMC
UKAS ACCREDITATION No:	0728
TEST DATE(s)	13 th October 2004 – 14 th October 2004
TEST REPORT No:	RU1140/5838

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)	-	N/A

- | | | | |
|----|--|-----------------|----------|
| 2. | Product Use: | Alarm/Help Call | |
| 3. | Emission Designator: | 349kF1D | |
| 4. | Duty Cycle: | | < 1% |
| 5. | Transmitter bit or pulse rate and level: | | 1000 bps |
| 6. | Temperatures: | Ambient (Tnom) | 11°C |
| 7. | Supply Voltages: | Vnom | +3Vdc |
- Note: Vnom voltages are as stated above unless otherwise shown on the test report page
- | | | | |
|----|---------------------|--|-------------------|
| 8. | Equipment Category: | Single channel
Two channel
Multi-channel | [X]
[]
[] |
| 9. | Channel spacing: | Narrowband
Wideband | []
[X] |

TRANSMITTER TESTS

TRANSMITTER SPURIOUS EMISSIONS – RADIATED – PART 15.209 & 15.231(b)

Ambient temperature	=	11°C(<1GHz)	3m measurements <1GHz	[X]
Relative humidity	=	39% (<1GHz),	0.3m measurements >1GHz	[X]
Conditions	=	Open Area Test Site (OATS)	3m extrapolated from 0.3m	[X]
Supply voltage	=	+3Vdc		
Channel number	=	1		

Frequency Bands (MHz)	FREQ. (MHz)	MEAS. Rx. (dBµV)	CABLE LOSS (dB)	ANT FACT.	FIELD STRENGTH (dBµV/m)	EXTRAP. FACTOR (dB)	FIELD STRENGTH (µV/m)	Limit (µV/m)
30 - 88								
88 - 216								
216 - 960	624.0 936.0	28.7 22.15	3.0 4.0	20.5 24.95	52.2 51.1	- -	407.38 358.92	592 592
960 - 1000								
1000 - 5000	1560(R) 1872	29.25 29.22	0.89 0.87	25.8 26.9	55.94 56.99	20 20	62.66 70.71	500 592
Limits	1.705MHz to 30MHz		30µV/m @ 30m					
	30MHz to 88MHz		100µV/m @ 3m					
	88MHz to 216MHz		150µV/m @ 3m					
	216MHz to 960MHz		200µV/m @ 3m					
	960MHz to 1GHz		500µV/m @ 3m					
	1GHz to 5GHz		500µV/m @ 3m					

Notes:

- Results quoted are extrapolated as indicated
- Emissions were searched to: (x) 1000MHz inclusive, as per Part 15.33a
- Extrapolation factor 20dB from 0.3m to 3m, as per Part 15.31f
- Measurements >1GHz @ 0.3m as per Part 15.31f(1)
- Receiver detector >1GHz = CISPR, Quasi-Peak, 120kHz bandwidth
- Receiver detector >1GHz = Average, 1MHz resolution bandwidth
- New batteries used for battery powered products.
- (R) indicates frequency within restricted band from 15.205
- Due to the transmitted signal lasting only 1.71 seconds a unit with modified software, which allowed continuous transmission, was used during spurious emissions testing.
- Spurious limit level of 592 µV/m was calculated by reducing the fundamental limit level by 20 dB, as per 15.231(b)
- Only emissions within 20 dB's of the limit are recorded

Test Method:

- As per Radio – Noise Emissions, ANSI C63.4: 2001
- Measuring distances as Notes 1 to 4 above
- EUT 0.8 metre above ground plane
- 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 is shown overleaf:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
AE, LOOP, Z2, 9kHz - 30MHz	ROHDE & SCHWARZ	HFH2	881058 - 53	07	
HORN ANTENNA	EMCO	3115	9010-3580	138	
HORN ANTENNA	EMCO	3115	9010-3581	139	X
SPECTRUM ANALYSER	TEKTRONIX	2756P	B010109	164	
BICONE ANTENNA	CHASE	BBA9106	N/A	193	
ANTENNA, LOG PERIODIC 300MHz – 1GHz	CHASE	UPA6108	1061	203	
RECEIVER	ROHDE & SCHWARZ	ESHS20	837960/003	237	
ANTENNA, BICONE 20MHz - 300MHz	CHASE	VBA6106A	1193	251	
BILOG ANTENNA	CHASE	CBL6112	2098	274	
RECEIVER	ROHDE & SCHWARZ	ESVS10	837948/003	317	
RECEIVER	ROHDE & SCHWARZ	ESVS10	844594/003	352	
RECEIVER	ROHDE & SCHWARZ	ESHS10	844077/019	353	
V / UHF RECEIVER 20MHz - 1GHz	ROHDE & SCHWARZ	ESVS 20	838804 / 005	415	
BILOG ANTENNA	CHASE	CBL6111A	1618	191	X
RECEIVER	ROHDE & SCHWARZ	ESHS 10	830051/001	UH03	
RECEIVER	ROHDE & SCHWARZ	ESVS 10	825892/003	UH04	X
RANGE 1	TRL	3 METRE	N/A	UH06	X
AE, LOOP, Z2, 9kHz - 30MHz	ROHDE & SCHWARZ	HFH2	881058 - 53	07	
BILOG ANTENNA	CHASE	CBL6112	2129	UH93	
SPECTRUM ANALYSER	MARCONI	2386/2380	152076/004	UH120	
SPECTRUM ANALYSER	ROHDE & SCHWARZ	ESIB 7		630	X

TRANSMITTER TESTS

TRANSMITTER INTENTIONAL EMISSION – RADIATED – Part 15.231(b)

Ambient temperature	=	14°C(<1GHz),	3m measurements @ fc	[X]
Relative humidity	=	49%(<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 (dBµV)	CABLE LOSS (dB)	ANT FACTOR	FIELD STRENGTH (dBµV/m)	EXTRAP. FACTOR (dB)	FIELD STRENGTH (µV/m)
312	56.9	1.8	13.3	72	-	3981.1
Limit value @ fc			5916.6771 (µV/m)			
Band occupancy @ -20dBc			f lower		f higher	
During switched transmission			311.824 MHz		312.173 MHz	
During supervision transmission			311.822 MHz		312.172MHz	
Transmitter on time during switched transmission			1.71 Seconds			
Transmitter on time during supervision transmission			1.71 Seconds			

For band occupancy see spectrum analyser plots – Annex C

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 For transmitter shutdown time see Annex D
- 5 The transmitter sends a supervision transmission once every four hours for 1.71 second
- 6 Due to the transmitted signal lasting only 1.71 seconds a unit with modified software, which allowed continuous transmission, was used during the carrier power testing.

Test Method:

- 1 As per Radio – Noise Emissions, ANSI C63.4: 2001
- 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 tests is shown overleaf:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
AE, LOOP, Z2, 9kHz - 30MHz	ROHDE & SCHWARZ	HFH2	881058 - 53	07	
HORN ANTENNA	EMCO	3115	9010-3580	138	
HORN ANTENNA	EMCO	3115	9010-3581	139	
SPECTRUM ANALYSER	TEKTRONIX	2756P	B010109	164	
BICONE ANTENNA	CHASE	BBA9106	N/A	193	
ANTENNA, LOG PERIODIC 300MHz – 1GHz	CHASE	UPA6108	1061	203	
RECEIVER	ROHDE & SCHWARZ	ESHS20	837960/003	237	
ANTENNA, BICONE 20MHz - 300MHz	CHASE	VBA6106A	1193	251	
BILOG ANTENNA	CHASE	CBL6111A	1618	191	X
RECEIVER	ROHDE & SCHWARZ	ESVS10	837948/003	317	
RECEIVER	ROHDE & SCHWARZ	ESVS10	844594/003	352	
RECEIVER	ROHDE & SCHWARZ	ESHS10	844077/019	353	
V / UHF RECEIVER 20MHz - 1GHz	ROHDE & SCHWARZ	ESVS 20	838804 / 005	415	
BILOG ANTENNA	SCHAFFNER	CBL6112B	2761	431	
RECEIVER	ROHDE & SCHWARZ	ESHS 10	830051/001	UH03	
RECEIVER	ROHDE & SCHWARZ	ESVS 10	825892/003	UH04	X
RANGE 1	TRL	3 METRE	N/A	UH06	X
AE, LOOP, Z2, 9kHz - 30MHz	ROHDE & SCHWARZ	HFH2	881058 - 53	07	
BILOG ANTENNA	CHASE	CBL6112	2129	UH93	
SPECTRUM ANALYSER	MARCONI	2386/2380	152076/004	UH120	

ANNEX A
PHOTOGRAPHS

PHOTOGRAPH No. 1

TEST SETUP



PHOTOGRAPH No. 2

TRANSMITTER FRONT VIEW



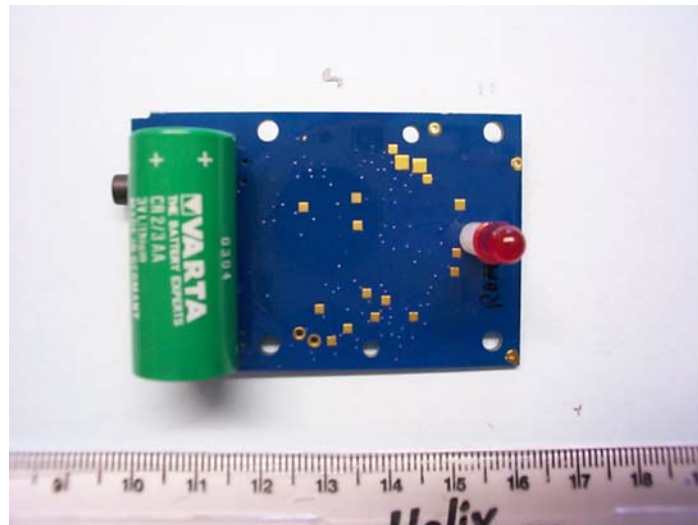
PHOTOGRAPH No. 3

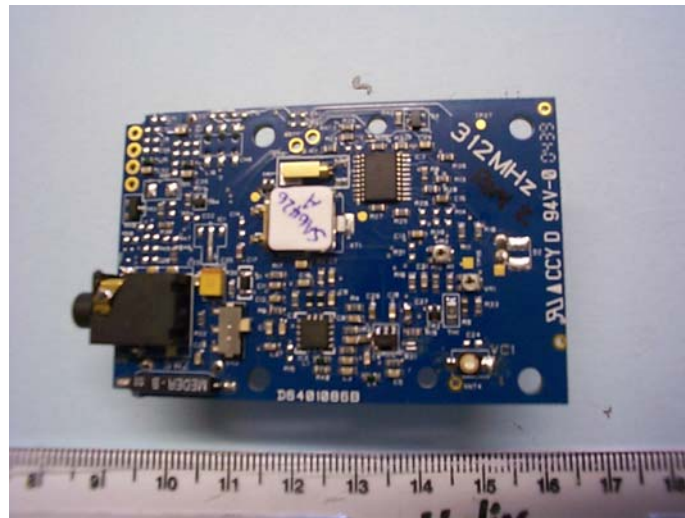
TRANSMITTER REAR VIEW



PHOTOGRAPH No. 4

TRANSMITTER PCB TRACK SIDE





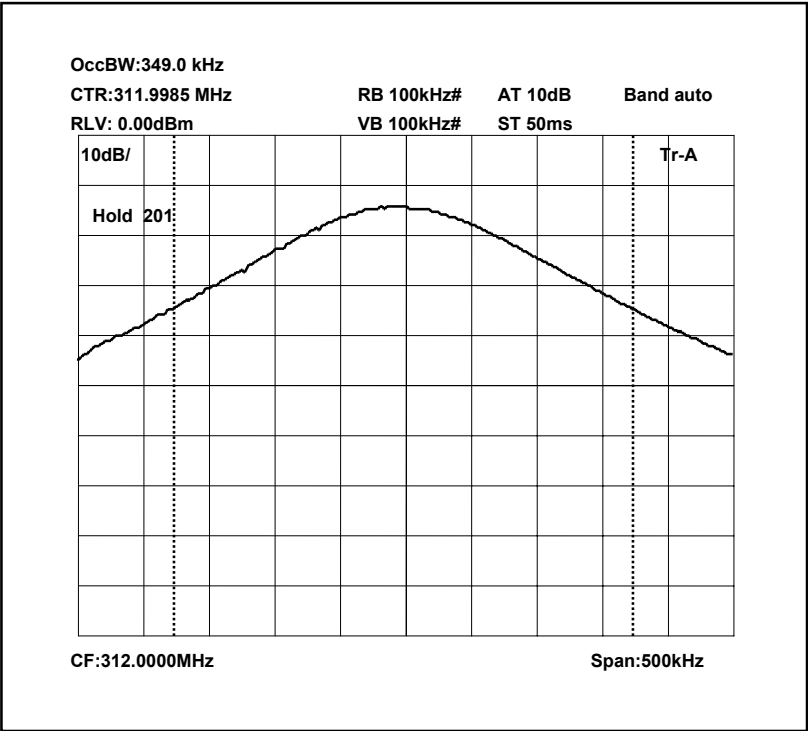
ANNEX B
APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

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)	-		[X]
e.	LABELLING	-	PHOTOGRAPHS	[X]
		-	DECLARATION	[]
		-	DRAWINGS	[]
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]

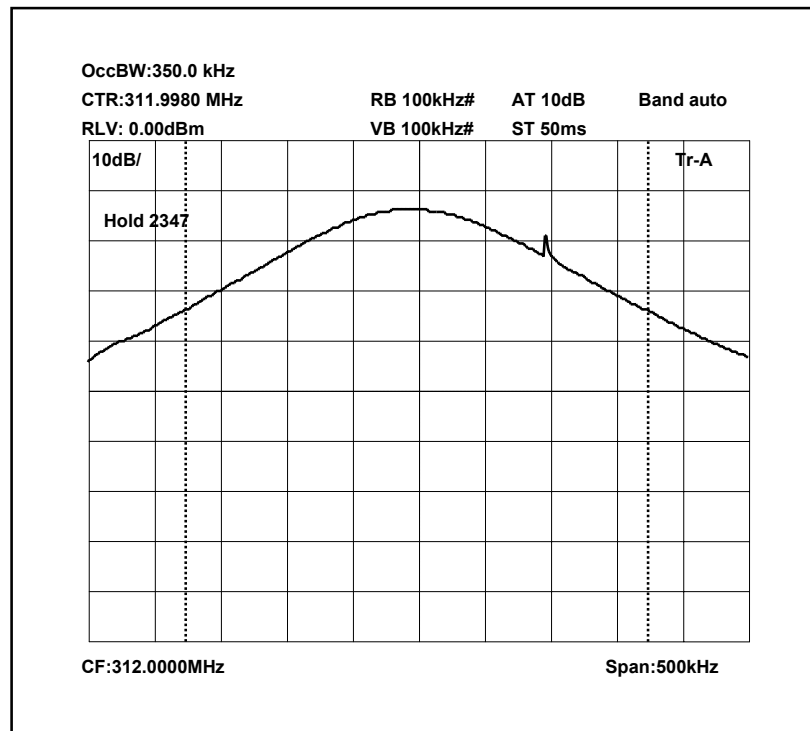
ANNEX C
BANDWIDTH PLOT(s)

SWITCHED INPUT BANDWIDTH PLOT



Occupied Bandwidth = 349 kHz
f lower = 311.824 MHz
f higher = 312.172 MHz

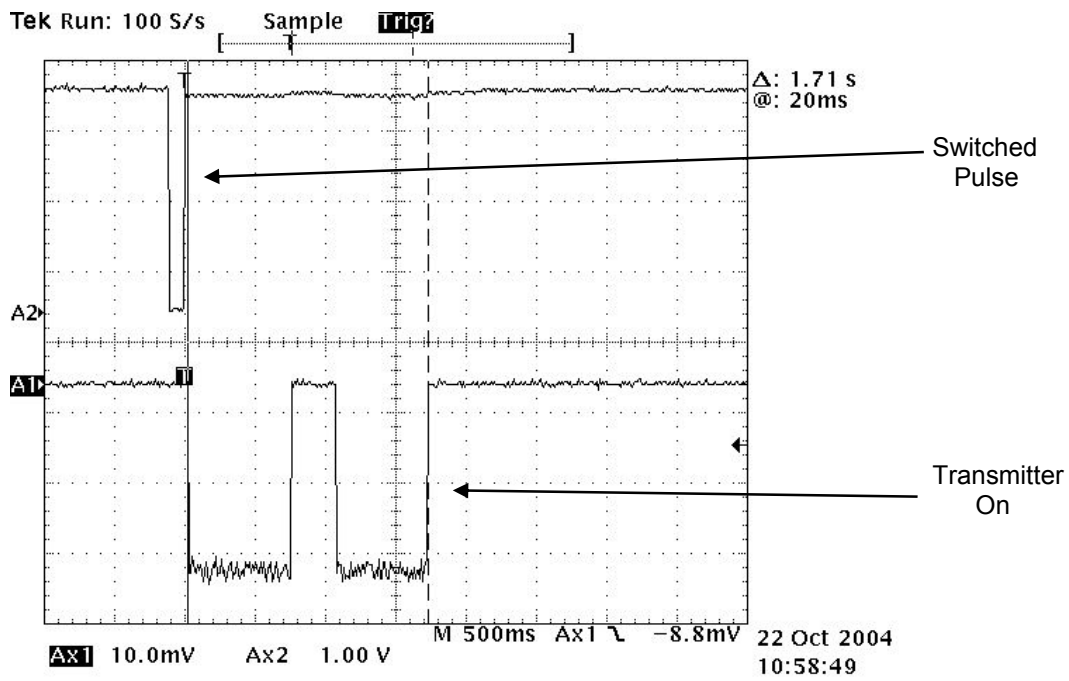
SUPERVISION TRANSMISSION BANDWIDTH PLOT



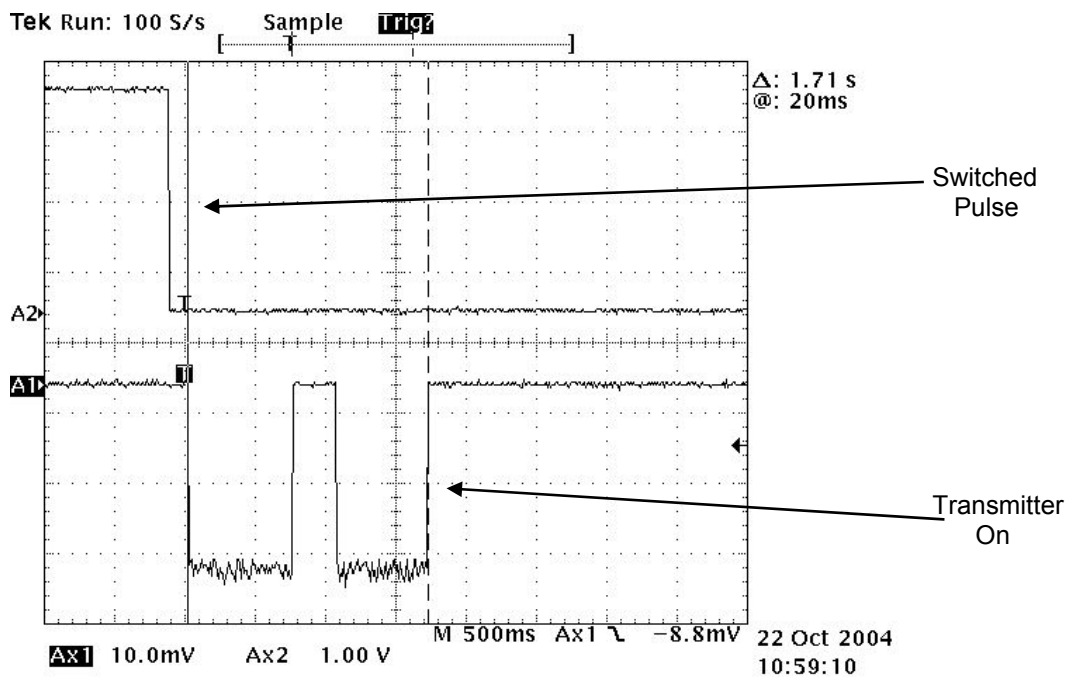
Occupied Bandwidth = 350 kHz
 f lower = 311.822 MHz
 f higher = 312.172 MHz

ANNEX D
TRANSMITTER ON TIME PLOT(s)

Transmitter On Time Switched Input Shorter Than Transmit Time



Transmitter On Time Switched Input Longer Than Transmit Time



Supervision Transmission On Time

