



TEST REPORT NO: RU1109/5651

COPY NO: .....

ISSUE NO: 2

**REPORT ON THE RADIO PERFORMANCE TESTING OF A  
TELEX COMMUNICATIONS Ltd  
Electro-Voice Model BPU-2 A UHF Beltpack Transmitter  
WITH RESPECT TO  
ETSI EN300 422-2 08/2000 SPECIFICATION**

TEST DATE: 20<sup>th</sup> May 2004 – 15<sup>th</sup> June 2004

TESTED BY: ..... J CHARTERS

APPROVED BY: ..... P GREEN  
EMC PRODUCT  
MANAGER

DATE: ..... 27/10/04 .....

Distribution:

- Copy Nos: 1. TELEX COMMUNICATIONS Ltd  
2. TRL Compliance Services Ltd

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



## CONTENTS

	<b>PAGE</b>
CERTIFICATE OF CONFORMITY & COMPLIANCE:	3
APPLICANT'S SUMMARY:	4
EQUIPMENT TEST CONDITIONS:	5
ESSENTIAL RADIO TEST SUITES:	6
TRANSMITTER:	6
RECEIVER:	6
TEST RESULTS:	7
TRANSMITTER:	15
RECEIVER:	15

## ANNEX

PHOTOGRAPHS:	A
PHOTOGRAPH No. 1: Equipment Under Test	
PHOTOGRAPH No. 2: Overview	
PHOTOGRAPH No. 3: Overview Battery Lid Open	
PHOTOGRAPH No. 4: Overview Back	
PHOTOGRAPH No. 5: PCB Top	
PHOTOGRAPH No. 6: PCB Bottom	
PHOTOGRAPH No.7: PCB Can Removed	
TEST EQUIPMENT LIST:	B
EMISSION GRAPH(s):	C
BAND OCCUPANCY :	D

### Notes:

1. Component failure during test: YES   
NO
2. If Yes, details of failure:
3. All measurement uncertainty calculations detailed in this report are carried out in accordance with ETR 028 (4), corresponding to an expansion factor  $k = 1.96$  providing for a 95% confidence level.
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**

PURPOSE OF TEST: Radio Performance Testing  
TEST SPECIFICATION(s): ETSI EN300 422-2 08/2000  
TEST RESULT: Compliant to Specification  
EQUIPMENT UNDER TEST: Electro-Voice Model BPU-2 A UHF Beltpack Transmitter  
EQUIPMENT SERIAL No: 001550  
BAND(s) OF OPERATION: 648.1MHz – 675.9MHz (Band A)  
ITU: EMISSION CODE(s): 200KF3E  
EQUIPMENT TYPE: Beltpack Transmitter  
EQUIPMENT USE: Studio and Outside Broadcast Communications  
TRANSMITTER Pnom: 17.40mW  
ANTENNA TYPE: Integral  
CHANNEL BANDWIDTH: 200kHz  
FREQUENCY GENERATION: SAW Resonator [ ] Crystal [ ] Synthesiser [X]  
MODULATION METHOD: Amplitude [ ] Digital [ ] Angle [X]  
POWER SOURCE(s): +9.0Vdc  
TEST DATE(s): 20<sup>th</sup> May 2004 – 15<sup>th</sup> June 2004  
ORDER No(s): 296609  
APPLICANT: TELEX COMMUNICATIONS Limited

TESTED BY: ..... J CHARTERS

APPROVED BY: ..... P GREEN  
EMC PRODUCT  
MANAGER

## APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT): Electro-Voice Model BPU-2 A UHF Beltpack Transmitter

EQUIPMENT TYPE: Beltpack Transmitter

SERIAL NUMBER(s) OF EUT: 001550

PURPOSE OF TEST: Radio Performance Testing

TEST SPECIFICATION(s): ETSI EN300 422-2 08/2000

TEST RESULT: COMPLIANT Yes   
No

APPLICANT'S CATEGORY: MANUFACTURER   
IMPORTER   
DISTRIBUTOR   
TEST HOUSE   
AGENT

APPLICANT'S ORDER No(s): 296609

APPLICANT'S CONTACT PERSON(s): Mr Charles Conner

APPLICANT: TELEX COMMUNICATIONS Ltd

ADDRESS: 8601 East Cornhusker Highway  
Lincoln, NE  
68505

TEL: +01 402-467-5321

FAX: +01 402-467-3279

MANUFACTURER: TELEX COMMUNICATIONS Ltd

EUT(s) COUNTRY OF ORIGIN: United States

TEST LABORATORY: TRL EMC

TEST DATE(s) 20<sup>th</sup> May 2004 – 15<sup>th</sup> June 2004

TEST REPORT No: RU1109/5651



## ESSENTIAL RADIO TEST SUITES

<b>TRANSMITTER TESTS</b>		Page Number
Transmitter Frequency Error		7
Transmitter Carrier Power – Conducted		8
Effective Radiated Power		9
Channel Bandwidth		12
Transmitter Spurious Emissions - Radiated	Operating	11
	Standby	14
 <b>RECEIVER TESTS</b>		
Receiver Spurious Emissions - Conducted		15
Receiver Spurious Emissions – Radiated		16

## TRANSMITTER TEST RESULTS

### TRANSMITTER FREQUENCY ERROR

RHnom	= 38%	Method	RTP50	[X]
			RTP50A	[ ]
			RTP70	[ ]
Tx Pnom	= 17.40mW			
Necessary Bandwidth	= 200kHz			

Channel		648.1 MHz	662.0 MHz	675.9 MHz
Tnom 16°C	Vnom	648.09957 MHz	661.99945 MHz	675.89950 MHz
Tmin	Vmin	648.09733 MHz	661.99760 MHz	675.89644 MHz
	Vmax	648.09751 MHz	661.99752 MHz	675.89646 MHz
Tmax	Vmin	648.09565 MHz	661.99525 MHz	675.89537 MHz
	Vmax	648.09560 MHz	661.99523 MHz	675.89547 MHz
Max Frequency Error	Normal	0.43kHz	0.55kHz	0.5kHz
	Extreme	4.40kHz	4.77kHz	4.63kHz
Limits Clause 8.1.3	Normal	Operating Frequency	Channel Bandwidths 100kHz,150kHz,200kHz	Channel Bandwidths 75kHz, 50kHz
		25MHz – 88MHz	3kHz	2kHz
	>88MHz – 300MHz	7kHz	3kHz	
	>300MHz – 1000MHz	10kHz	6kHz	
Extreme	>1GHz – 3GHz	25kHz	14kHz	
	25MHz – 88MHz	5kHz	3kHz	
	>88MHz – 300MHz	10kHz	5kHz	
>300MHz – 1000MHz	15kHz	7kHz		
>1GHz – 3GHz	32kHz	18kHz		
Measurement Uncertainty		±2.7 x 10 <sup>-7</sup> Hz [X] ;		±0.0002% ±200Hz [ ]

**Test Equipment Used:** TRL05, TRL11, TRLUH41, TRLUH177, TRL479  
Full description at Annex B:

**Remarks:**

**TRANSMITTER TEST RESULTS**

**TRANSMITTER CARRIER POWER - CONDUCTED**

RHnom	=	N/A	Method	RTP51	[ ]
				RTP91	[ ]
Tx Pnom	=	N/A			
Power Class	=	N/A			

Channel				
Tnom 15°C	Vnom	N/A	N/A	N/A
Tmin	Vmin	N/A	N/A	N/A
	Vmax	N/A	N/A	N/A
Tmax	Vmin	N/A	N/A	N/A
	Vmax	N/A	N/A	N/A
Max Relative Power	Normal & Extreme	N/A	N/A	N/A
Limits Clause 8.2.4	Normal & Extreme	50mW maximum power		
Measurement Uncertainty		±0.78dB [ ] ;	±1.5dB [ ]	

**Test Equipment Used:**  
Full description at Annex B

**Remarks:**        **Not applicable. The EUT has an integral antenna.**

## TRANSMITTER TEST RESULTS

### EFFECTIVE RADIATED POWER

RHnom = 38% Method RTP68 & 70  
 Tx Pnom = 17.40mW Declared power = 20.90mW  
 Distance = 3m  Polarisation Vertical =   
           = 10m                    Horizontal =

Channel		648.1 MHz	662.0 MHz	675.9 MHz
Tnom 16°C	Vnom	16.90mW*	17.40mW*	10.50mW*
Tmin	Vmin	8.91mW#	6.02mW#	5.75mW#
	Vmax	15.13mW#	10.00mW#	9.77mW#
Tmax	Vmin	10.23mW#	5.37mW#	5.25mW#
	Vmax	13.80mW#	7.94mW#	6.45mW#
Max Relative Power	Normal & Declared	-0.92dB	-0.79dB	-2.99dB
Limits Clause 8.2.4	Normal & Extreme	50mW maximum power ±3dB of the declared power limit		
Measurement Uncertainty		±4.2dB *		±1.9dB #

**Test Equipment Used:** TRL11, TRL05, TRLUH29, TRLUH28, TRL203, TRL254, TRL177, TRL41, TRL479  
 Full description at Annex B:

**Remarks:**

## TRANSMITTER TEST RESULTS

### TRANSMITTER CHANNEL BANDWIDTH

Tnom = 23°C Method RTP101 [X]  
 RTP55A [ ]  
 RHnom = 50%  
 Carrier Power = 17.40mW

Channel		648.1 MHz	662.0 MHz	675.9 MHz
EUT Carrier Power		16.90mW	17.40mW	10.50mW
AF Frequency Level @ -8 dB(lin)		0.1	0.2	0.9
AF Frequency Level @ + 12dB(lin)		-0.5	-0.1	0.1
Necessary Bandwidth		200kHz	200kHz	200kHz
Limits Clause 8.3.3	Channel Separation (kHz)	Fc-1MHz		-90dBc
		Fc-B		-80dBc
		Fc-B/2		-60dBc
	50	Fc-0.35		-20dBc
	75	Fc		0dBc
	100	Fc-0.35		-20dBc
	150	Fc+B/2		-60dBc
	200	Fc+B		-80dBc
		Fc+1MHz		-90dBc
Measurement Uncertainty		±0.44 dB [X] ;		±1.9 dB [ ]

**Test Equipment Used:** TRL05, TRL479, TRL122, TRL343, TRLUH196  
 Full description at Annex B:

**Remarks:** B = declared channel bandwidth  
 For spectrum analyser plots of necessary bandwidth see Annex D.

In order for the unit to meet the requirements of this section the following adjustments were made:  
 The variable resistor VR3 was changed to give the following resistance readings:  
 The measurement between the pin connecting to R27 and the pin connecting to ground = 30.6Ω  
 The measurement between the pin connecting to R40 and the pin connecting to ground = 32.4Ω  
 The measurement between the pin connecting to R27 and pin connecting to R40 = 39.8Ω



## TRANSMITTER TEST RESULTS

### TRANSMITTER SPURIOUS EMISSIONS – RADIATED – OPERATING

Tnom = 16°C <1GHz  
 = 28°C >1GHz

Method = RTP69

Channel = 662.0 MHz

RHnom = 38% <1GHz  
 = 30% >1GHz

Tx Pnom = 17.40mW

Spurious Frequency and Level >25MHz / <1GHz 4nW Bands		No significant emissions within 10dB of the limit	
Spurious Frequency and Level >25MHz / <1GHz 250nW Bands		No significant emissions within 10dB of the limit	
Spurious Frequency and Level >1GHz / <4GHz [ ] >1GHz / <12.75GHz [X] 1µW Bands		3310.0MHz 3972.0MHz 4634.0MHz	437.0nW 138.0nW 192.75nW
Limits Clause 8.4.3		<1000MHz	250nW
		>1000MHz	1µW
Measurement Uncertainty	>5.4GHz	±4.1dB	±1.0kHz
	>5.4GHz	±4.2dB	±1.0kHz

**Exterior Measurements:** Distance: 10.0 metres <48MHz [ ] 3.0 metres <1GHz [X]

**Interior Measurements:** Distance: 3.0 metres <48MHz [ ] 0.3 metres <1GHz [X]

**Test Equipment Used:** TRLUH75, TRLUH163, TRLUH04, TRLUH06, TRLUH28, TRLUH29,  
 Full description at Annex B: TRL203, TRL139, TRL279, TRLUH120

**Remarks:** Sensitivities: >9kHz / <30MHz = +36dBµV/m @3.0m  
 >30MHz / <1GHz = -106dBW erp @3.0m  
 >1GHz / <5.4GHz = -87dBW eirp @3.0m  
 <12.75GHz = -80dBW eirp @3.0m



## TRANSMITTER TEST RESULTS

### TRANSMITTER SPURIOUS EMISSIONS – RADIATED – STANDBY

Tnom = N/A

Method RTP69

RHnom = N/A

Channel =

Spurious Frequency and Level >25MHz / <1GHz 2nW Bands		Not applicable	Not applicable
Spurious Frequency and Level >1GHz / <4GHz [ ] >1GHz / <12.75GHz [ ] 20nW Bands		Not applicable	Not applicable
Limits Clause 8.4.3		<1000 MHz	2 nW
		>1000 MHz	20 nW
Measurement Uncertainty	<30MHz	±4.1dB	±1.0kHz
	>25MHz	±4.2dB	±1.0kHz

**Exterior Measurements:** Distance: 10.0 metres <48MHz [ ] 3.0 metres <1GHz [ ]

**Interior Measurements:** Distance: 3.0 metres <48MHz [ ] 0.3 metres <1GHz [ ]

#### Test Equipment Used:

Full description at Annex B:

**Remarks:** Not applicable. The EUT does not have a standby condition.

**RECEIVER TEST RESULTS**

**RECEIVER SPURIOUS EMISSIONS – CONDUCTED**

Tnom = N/A

Method RTP69

RHnom = N/A

Channel =

Spurious Frequency and Level >25MHz / <1GHz 2nW Bands		Not applicable	Not applicable
Spurious Frequency and Level >1GHz / <4GHz [ ] >1GHz / <12.75GHz [ ] 20nW Bands [ ]		Not applicable	Not applicable
Limits Clause 9.2		<1000MHz	2nW
		>1000MHz	20nW
Measurement Uncertainty	<5.4GHz	±1.5dB	±1.0kHz
	>5.4GHz	±1.9dB	±1.0kHz

**Test Equipment Used:**

Full description at Annex B:

**Remarks:** Not applicable. The EUT is a transmitter only.

**RECEIVER TEST RESULTS**

**RECEIVER SPURIOUS EMISSIONS – RADIATED**

Tnom = N/A

Method RTP69

RHnom = N/A

Channel = N/A

Spurious Frequency and Level >25MHz / <1GHz 2nW Bands		Not applicable	Not applicable
Spurious Frequency and Level >1GHz / <4GHz [ ] >1GHz / <12.75GHz [ ] 20nW Bands		Not applicable	Not applicable
Limits Clause 9.2		<1000MHz	2nW
		>1000MHz	20nW
Measurement Uncertainty	<30MHz	±4.1dB	±1.0kHz
	>25MHz	±4.2dB	±1.0kHz

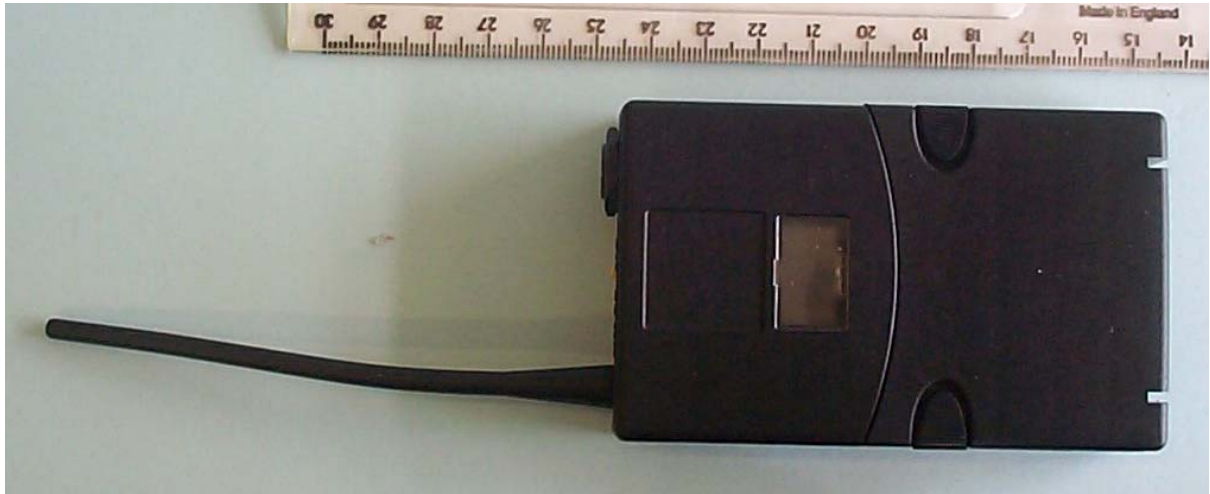
**Test Equipment Used:**

Full description at Annex B:

**Remarks:** Not applicable. The EUT is a transmitter only.

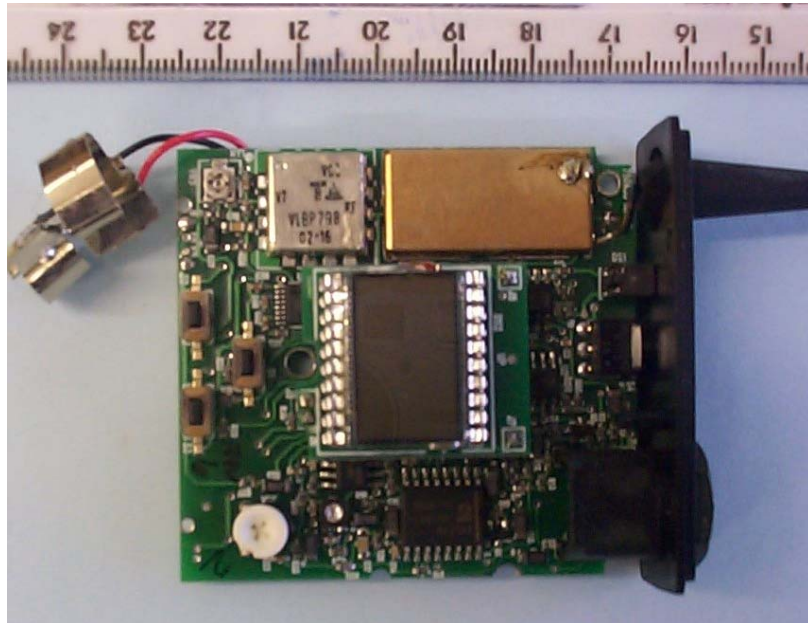
**ANNEX A**  
**PHOTOGRAPHS**





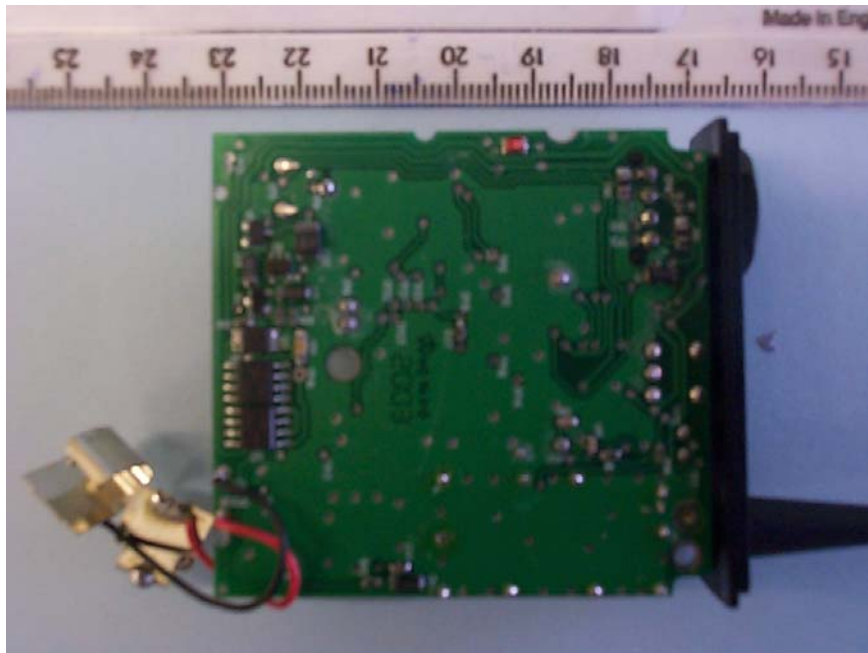


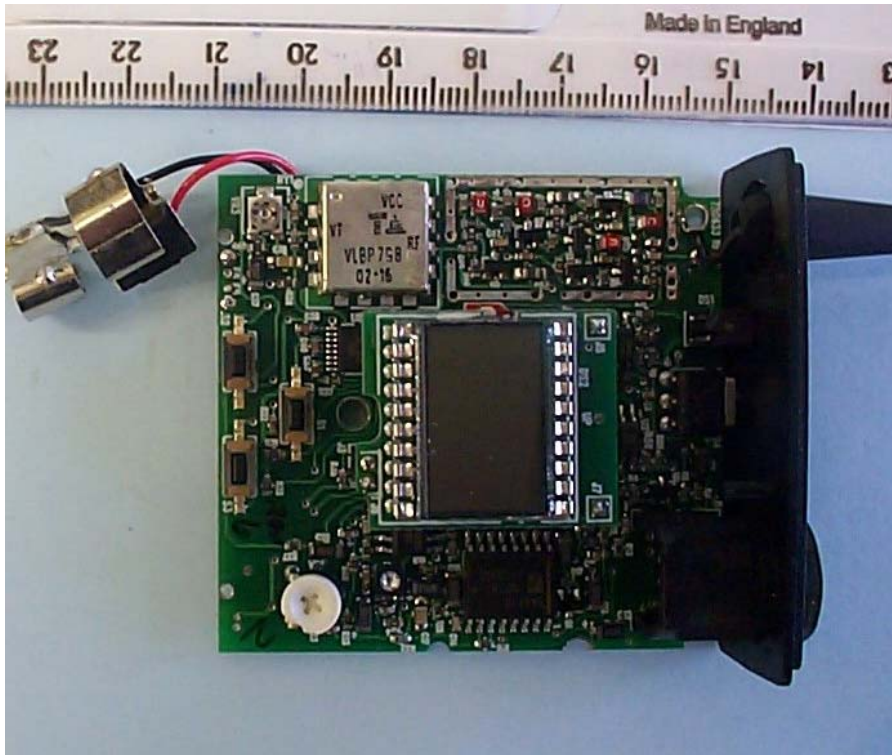




PHOTOGRAPH No. 6

PCB Bottom





**ANNEX B**  
**TEST EQUIPMENT LIST**

TEST EQUIPMENT LIST

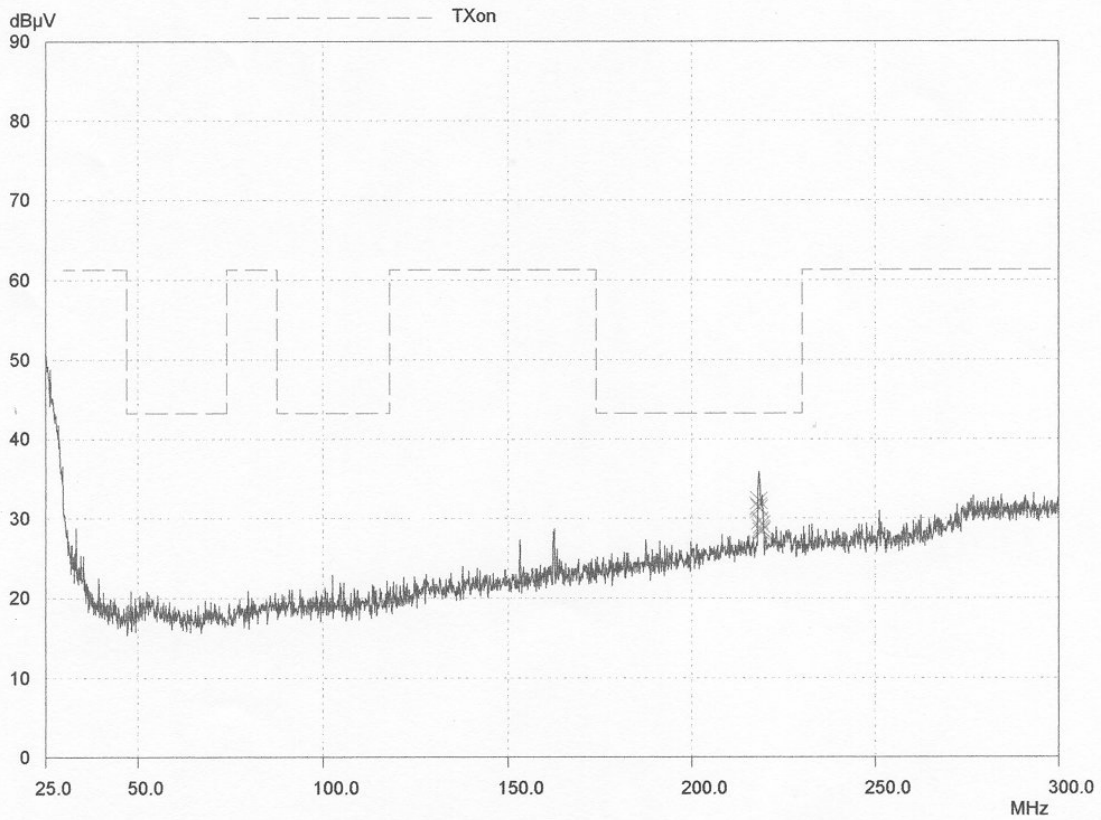
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No
RF ANALYSER, RADIO COMMS, 100kHz - 1GHz	R & S	CMTA 52	894715 / 003	05
LOOP ANTENNA 9kHz - 30MHz	R & S	HFH2	881058 - 53	07
RANGE 1 (3 - 30m)	TRL	N/A	N/A	08
ENVIRONMENTAL CHAMBER (temp)	SHARETREE	TCC125 - 815P	CS 203	11
AE, DRG HORN, 1GHz - 18GHz	EMCO	3115	9010 - 3580	138
RF ANALYSER, 10kHz - 60GHz	TEKTRONIX	2756P	B010109	164
GRAPH PLOTTER	ROLAND	DXY1100	BC19385	165
DATA CONVERTER	GREENWICH	GA234	N/A	166
RF SIGNAL GEN, LOW NOISE -90dBc, 10kHz - 5.4GHz	MARCONI	2042	119388 / 080	176
MULTIMETER (dig)	ISOTECH	IDM91	00606606	190
THERMOMETER & HYGROMETER	RS COMPONENTS	212 - 146	N/A	191
LF / HF RECEIVER, 9kHz - 30MHz	R & S	ESHS20	837960 / 003	237
RF SIGNAL GEN, LOW NOISE -90dBc, 10kHz - 5.4GHz	MARCONI	2042	119562 / 021	254
RF POWER METER	MARCONI	6960B	237012 / 015	282
COAX ATTN 2W 30dB, N, 50Ω DC 20GHz	WEINSCHEL	5848	BB7374	283A
V / UHF RECEIVER, 20MHz - 1GHz	R & S	ESVS10	837948 / 003	317
V / UHF RECEIVER, 20MHz - 1GHz	R & S	ESVS10	844594 / 0003	352
LF / HF RECEIVER, 9kHz - 30MHz	R & S	ESHS10	844077 / 019	353
V / UHF RECEIVER, 20MHz - 1GHz	R & S	ESVS20	838804 / 005	415
RF ANALYSER, RADIO COMMS, 400kHz - 1GHz	R & S	CMS54, with opts. B1,B5,B31	842509 / 022	420
LF / HF RECEIVER, 9kHz - 30MHz	R & S	ESHS10	830051 / 001	UH 03
LOOP ANTENNA 9kHz - 30MHz	R & S	HFH - Z2	892246 / 023	UH 23
RF ANALYSER, DC - 26.5GHz	MARCONI	2380	152089 / 009	UH 120
		2386	152076 / 044	

**ANNEX C**  
**EMISSION GRAPH(s)**

E-Field Radiation

EUT: BPU - 2 (Kit1)  
 Manuf: Telex Communications inc  
 Op Cond: Pre-Scan 30MHz - 300MHz  
 Operator: J Charters  
 Test Spec: ETS 300 422  
 Comment: Belt Pack On. Condenser Mic Connected.  
 Channel = 648.1MHz. Antenna Vertical

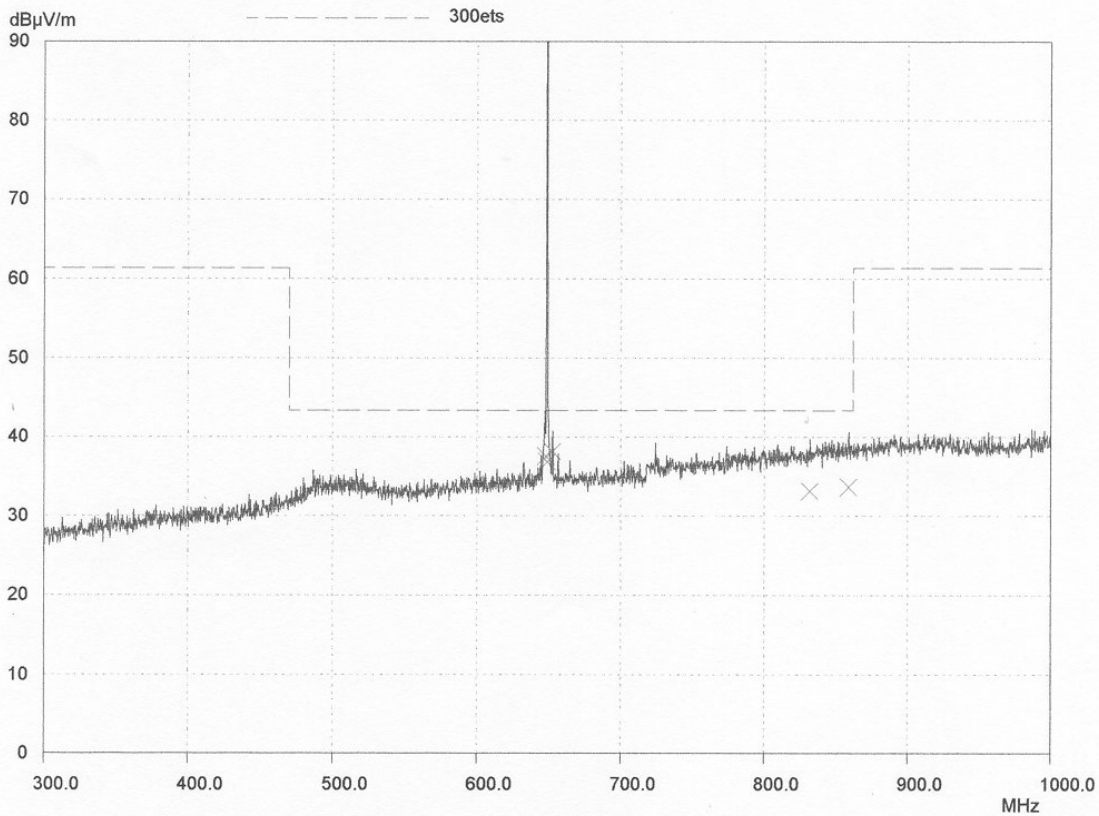
Scan Settings			(1 Range) Frequencies		Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
25MHz	300MHz	50kHz	120kHz	PK	2msec	Auto	ON	60dB	
Transducer	No.	Start	Stop	Name					
	22	25MHz	300MHz	BiconeUH29					
Final Measurement:		Detector:	X QP						
		Meas Time:	1sec						
		Peaks:	50						
		Acc Margin:	20 dB						



E-Field Radiation

EUT: BPU - 2 (Kit1)  
 Manuf: Telex Communications inc  
 Op Cond: Pre-Scan 300MHz - 1000MHz  
 Operator: J Charters  
 Test Spec: ETS 300 422  
 Comment: Belt Pack On. Condenser Mic Connected.  
 Channel = 648.1MHz. Antenna Vertical.

Scan Settings			(1 Range) Frequencies		Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
300MHz	1000MHz	50kHz	120kHz	PK	2msec	Auto	ON	60dB	
Transducer	No.	Start	Stop	Name					
1	19	300MHz	1000MHz	LOGUH28					
	20	25MHz	1000MHz	UH72Cable					
Final Measurement:		Detector:	X QP						
		Meas Time:	1sec						
		Peaks:	50						
		Acc Margin:	20 dB						



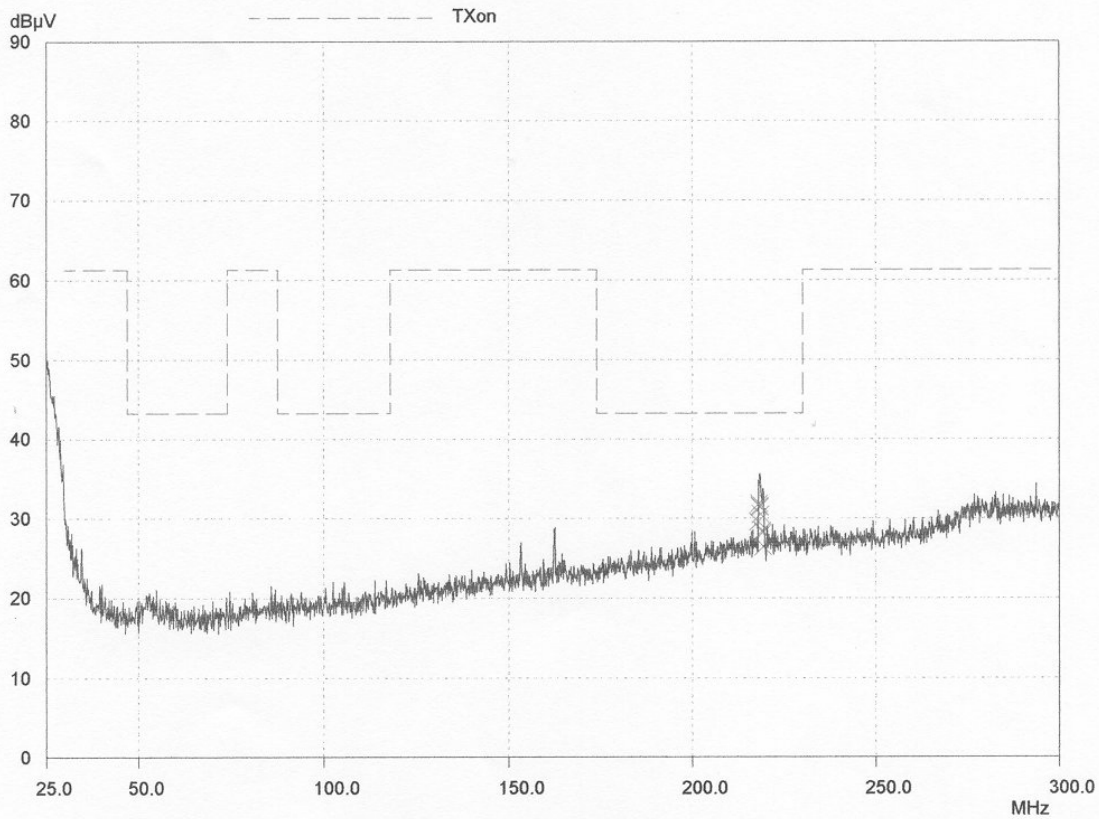
E-Field Radiation

EUT: BPU - 2 (Kit1)  
 Manuf: Telex Communications inc  
 Op Cond: Pre-Scan 30MHz - 300MHz  
 Operator: J Charters  
 Test Spec: ETS 300 422  
 Comment: Belt Pack On. Condenser Mic Conected.  
 Channel = 662.0MHz. Antenna Vertical

Scan Settings			(1 Range) Frequencies		Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
25MHz	300MHz	50kHz	120kHz	PK	2msec	Auto	ON	60dB	

Transducer	No.	Start	Stop	Name
	22	25MHz	300MHz	BiconeUH29

Final Measurement:      Detector: X QP  
                                  Meas Time: 1sec  
                                  Peaks: 50  
                                  Acc Margin: 20 dB



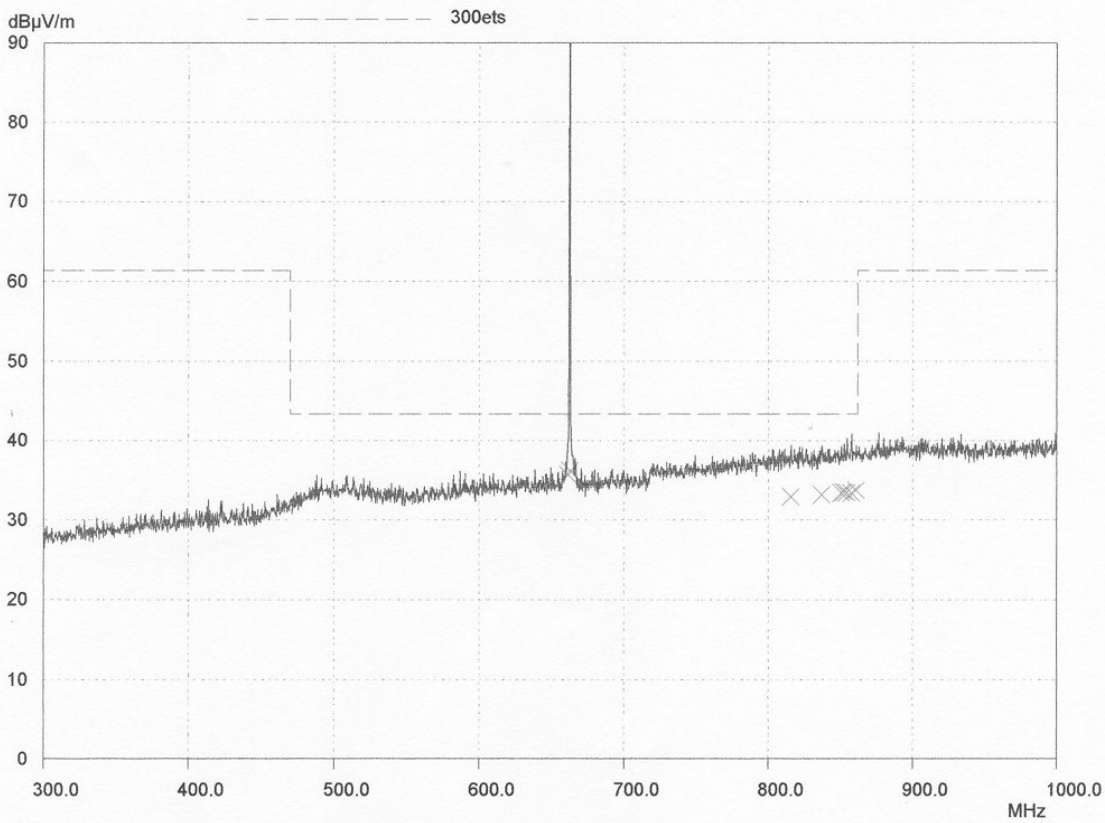
E-Field Radiation

EUT: BPU - 2 (Kit1)  
 Manuf: Telex Communications inc  
 Op Cond: Pre-Scan 300MHz - 1000MHz  
 Operator: J Charters  
 Test Spec: ETS 300 422  
 Comment: Belt Pack On. Condenser Mic Connected.  
 Channel = 662.0MHz. Antenna Vertical.

Scan Settings			(1 Range) Frequencies		Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
300MHz	1000MHz	50kHz	120kHz	PK	2msec	Auto	ON	60dB	

Transducer	No.	Start	Stop	Name
1	19	300MHz	1000MHz	LOGUH28
	20	25MHz	1000MHz	UH72Cable

Final Measurement:      Detector:      X QP  
                                  Meas Time:      1sec  
                                  Peaks:              50  
                                  Acc Margin:      20 dB



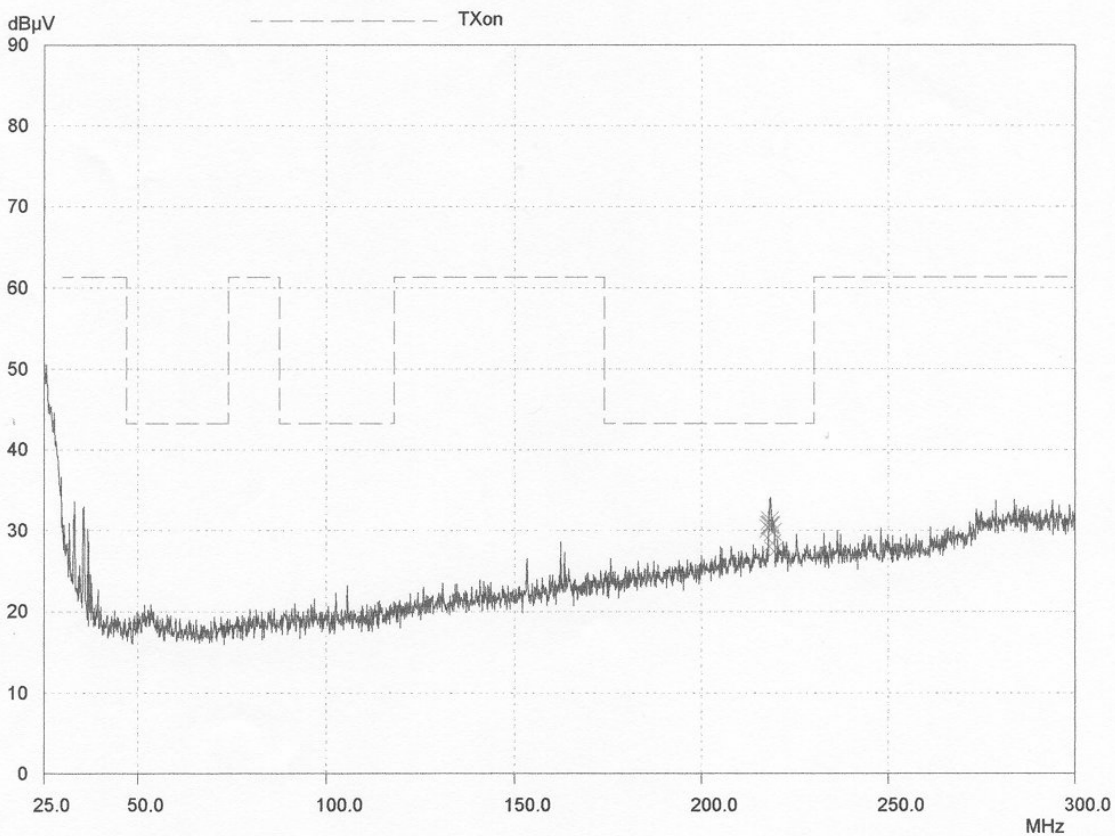
E-Field Radiation

EUT: BPU - 2 (Kit1)  
 Manuf: Telex Communications inc  
 Op Cond: Pre-Scan 30MHz - 300MHz  
 Operator: J Charters  
 Test Spec: ETS 300 422  
 Comment: Belt Pack On. Condenser Mic Connected.  
 Channel = 675.9MHz. Antenna Vertical

Scan Settings			(1 Range)				Receiver Settings			
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge		
25MHz	300MHz	50kHz	120kHz	PK	2msec	Auto	ON	60dB		

Transducer	No.	Start	Stop	Name
	22	25MHz	300MHz	BiconeUH29

Final Measurement:      Detector:      X QP  
                                  Meas Time:      1sec  
                                  Peaks:            50  
                                  Acc Margin:      20 dB



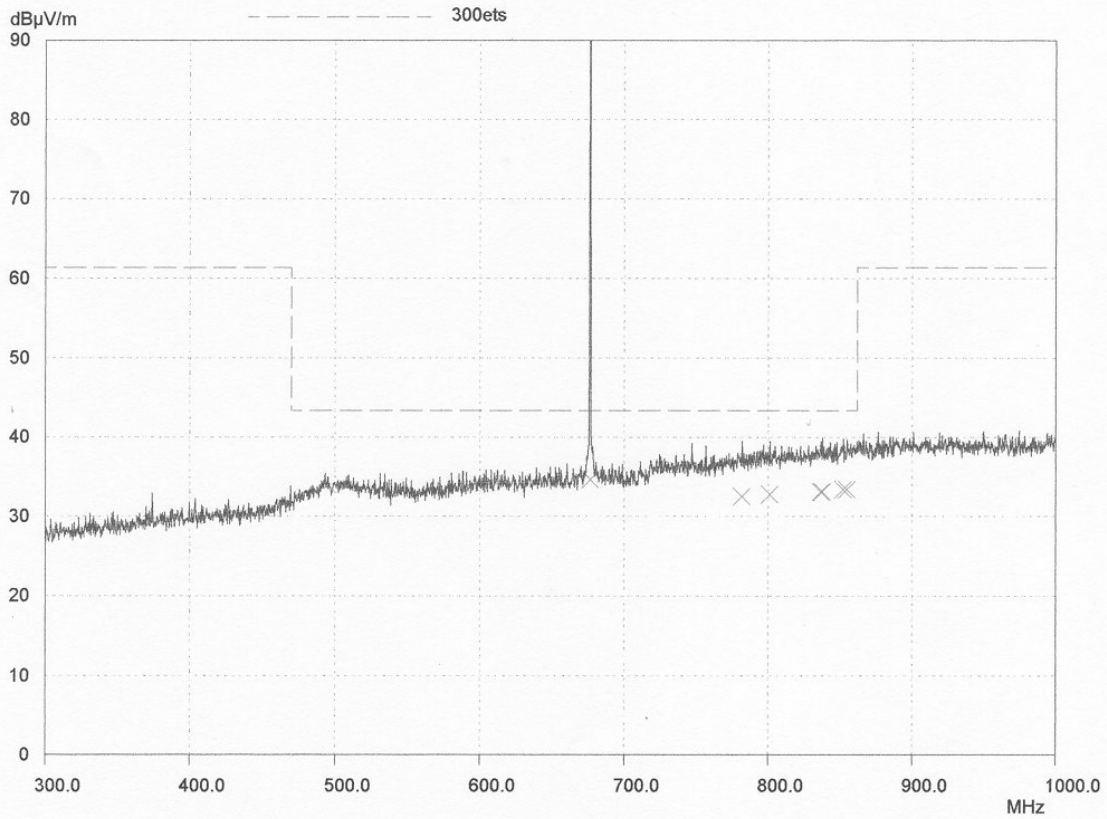
E-Field Radiation

EUT: BPU - 2 (Kit1)  
 Manuf: Telex Communications inc  
 Op Cond: Pre-Scan 300MHz - 1000MHz  
 Operator: J Charters  
 Test Spec: ETS 300 422  
 Comment: Belt Pack On. Condenser Mic Connected.  
 Channel = 675.9MHz. Antenna Vertical.

Scan Settings			(1 Range)		Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
300MHz	1000MHz	50kHz	120kHz	PK	2msec	Auto	ON	60dB	

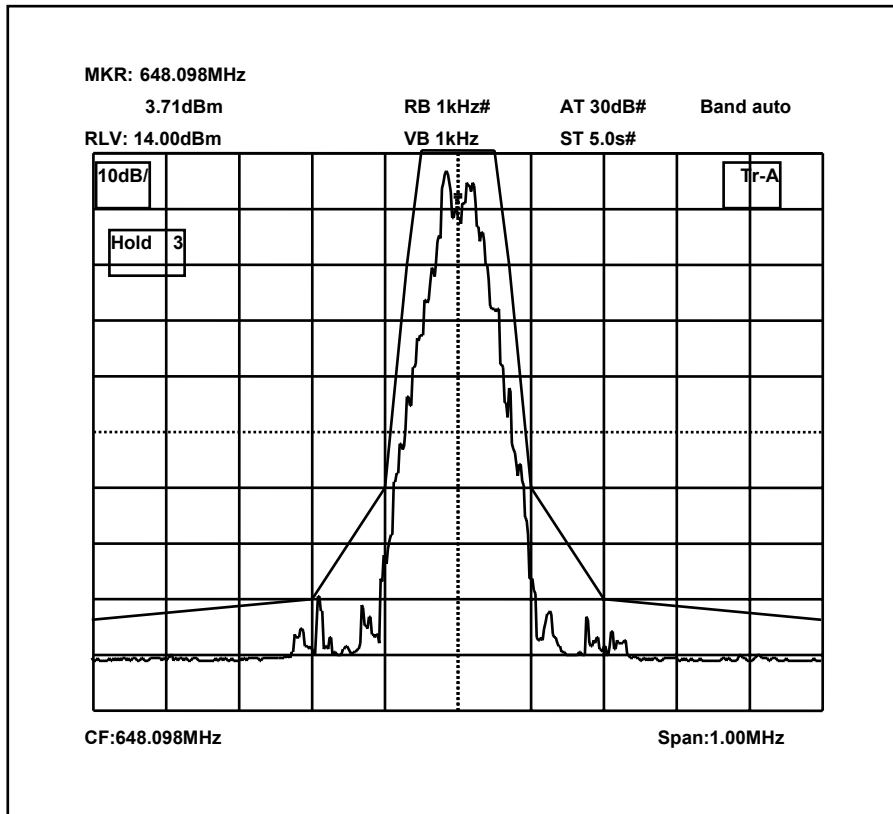
Transducer	No.	Start	Stop	Name
1	19	300MHz	1000MHz	LOGUH28
	20	25MHz	1000MHz	UH72Cable

Final Measurement:      Detector: X QP  
                                  Meas Time: 1sec  
                                  Peaks: 50  
                                  Acc Margin: 20 dB

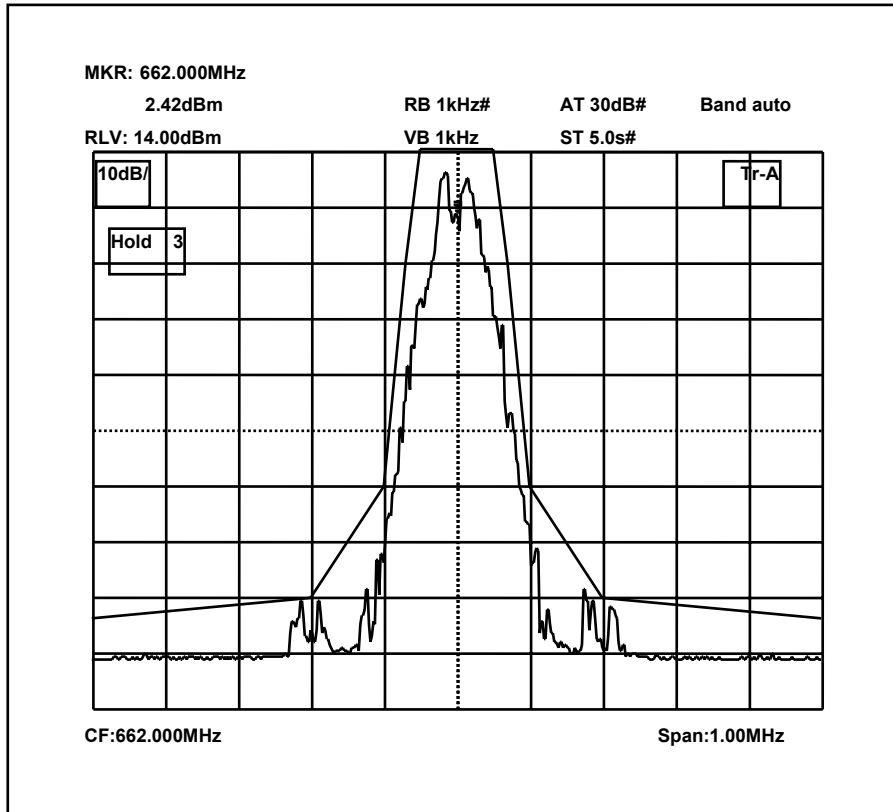


**ANNEX D**  
**MODULATION BANDWIDTH**

# Band Occupancy 648.1MHz



# Band Occupancy 662.0MHz



# Band Occupancy 675.9MHz

