KTL Test Report:	9R01480.1
Applicant:	Northern Airborne Technology Ltd. 1925 Kirscher Road Kelowna, B.C. V1Y 4N7
Equipment Under Test: (E.U.T.)	NT030B VHF Transceiver
FCC ID:	G0LNT030
In Accordance With:	**FCC Part 90, Subpart I** Private Land Mobile Transmitter
Tested By:	KTL Ottawa Inc. 3325 River Road, R.R. 5 Ottawa, Ontario K1V 1H2
Authorized By:	Russell M Grant R. Grant, RF Engineer
Date:	June 4, 99
Total Number of Pages:	37

Table of Contents

Table of Contents, continued

Section 1. Summary of Test Results

Manufacturer: Northern Airborne Technology Ltd.

Model No.: NT030B

Serial No.: 1172

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 90, Subpart I.

☒ New Submission ☒ Production Unit

☐ Class II Permissive Change ☐ Pre-Production Unit

T	N	B	Equipment Code

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.
See " Summary of Test Data".

NVLAP

NVLAP LAB CODE: 100351-0

TESTED BY: Wayne Clarke DATE: June 4/99
Wayne Clarke, Technologist

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	90.205	<300W	10W	Complies
Audio Frequency Response	TIA EIA-603.3.2.6		Graph	Complies
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6		Graph	Complies
Modulation Limiting	TIA EIA-603.3.2.6		Graph	Complies
Occupied Bandwidth	90.210		Graph	Complies
Spurious Emissions at Antenna Terminals	90.210	-13 dBm	Graph	Complies
Field Strength of Spurious Emissions	90.210			Complies
Frequency Stability	90.213	20 ppm	1.3 ppm	Complies
Transient Frequency Behavior	90.214	N/A		Not Applicable

Footnotes For N/A's:

Indoor Temperature: 22 °C
Humidity: 30 %

Outdoor Temperature: 20 °C
Humidity: 43 %

Section 2. General Equipment Specification

Transmitter

Supply Voltage Input:	Nominal 28 Vdc
Frequency Range:	34 – 49.995 MHz
Tunable Bands:	One
Necessary Bandwidth:	10.3 kHz
Type(s) of Modulation:	**F3E (Voice)** ☒ **F1D** ☐ **F2D** ☐ **D7W (QAM)** ☐ **Other** ☐
Data Rate(s)	Not Applicable
Internal/External Data Source:	Not Applicable
Emission Designator:	12K0F3E
Output Impedance:	50 ohm
RF Power Output (rated):	10W
Duty Cycle:	Rx 100%, Tx 20 %
Channel Spacing(s):	12.5 kHz
Operator Selection of Operating Frequency:	Preset Channels
Power Output Adjustment Capability:	None

Receiver

Frequency Range:	34 – 49.995 MHz
Tunable Bands:	One
Local Oscillator:	Not Applicable
1st IF:	20.8 MHz
2nd IF:	455 kHz
Operator Selection of Operating Frequency:	Preset Channels

Description of Modifications For Class II Permissive Change

NOT APPLICABLE

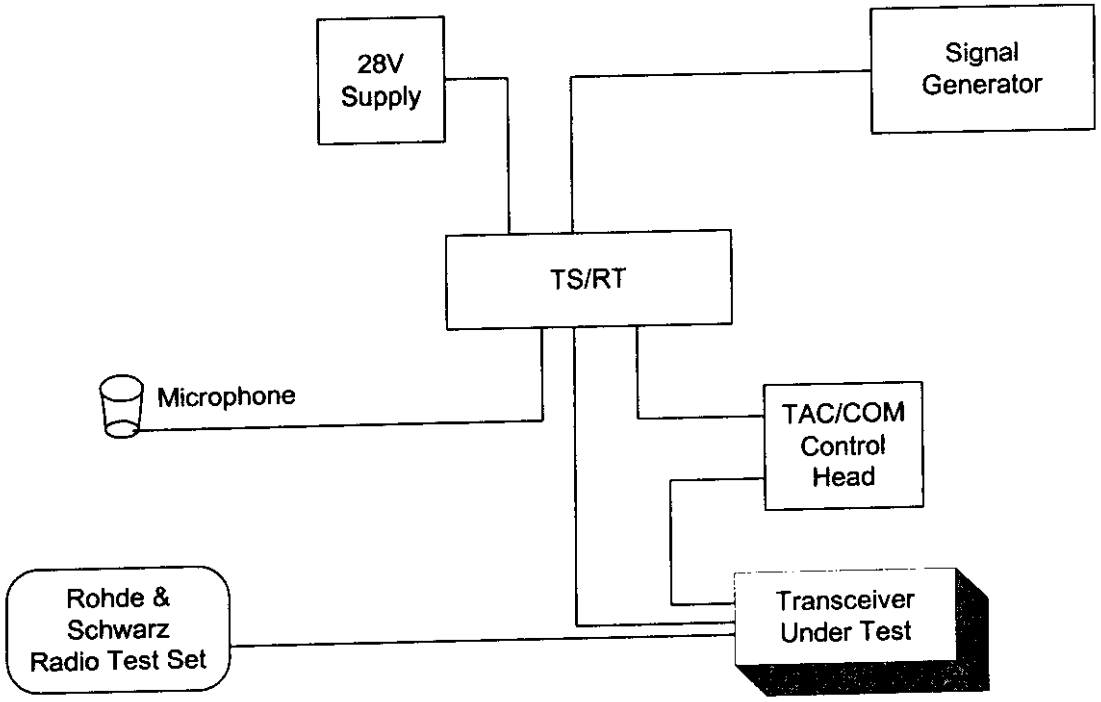
Modifications Made During Testing

NOT APPLICABLE

Theory of Operation

The E.U.T. is a fixed power output transceiver. It is operated by a TAC/COM control head.

System Diagram



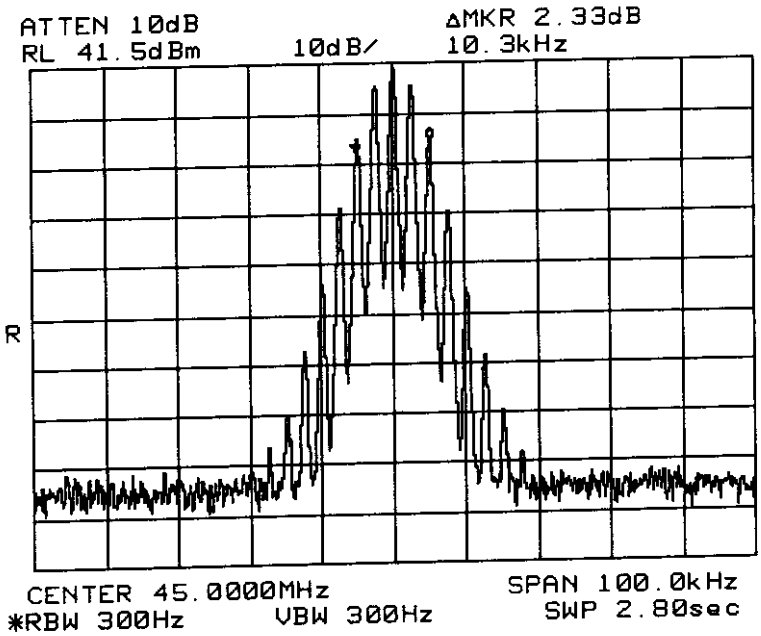
Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: Wayne Clarke	DATE: May 4, 1999

Test Results: Complies.

Measurement Data:

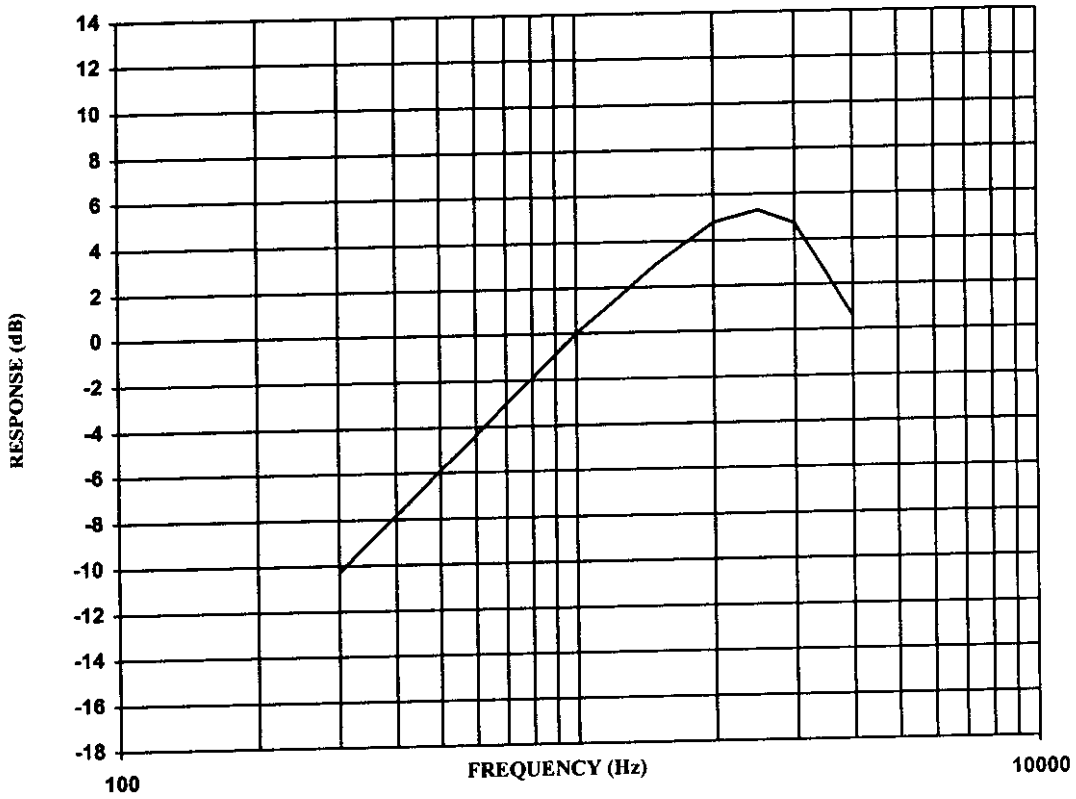
Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Measured/Rated (dB)
45.00	39.97	40.0	-0.03



99% POWER MEASUREMENT

Section 4. Audio Frequency Response

NAME OF TEST: Audio Frequency Response	PARA. NO.: 2.987(a)
TESTED BY: Wayne Clarke	DATE: May 6, 1999



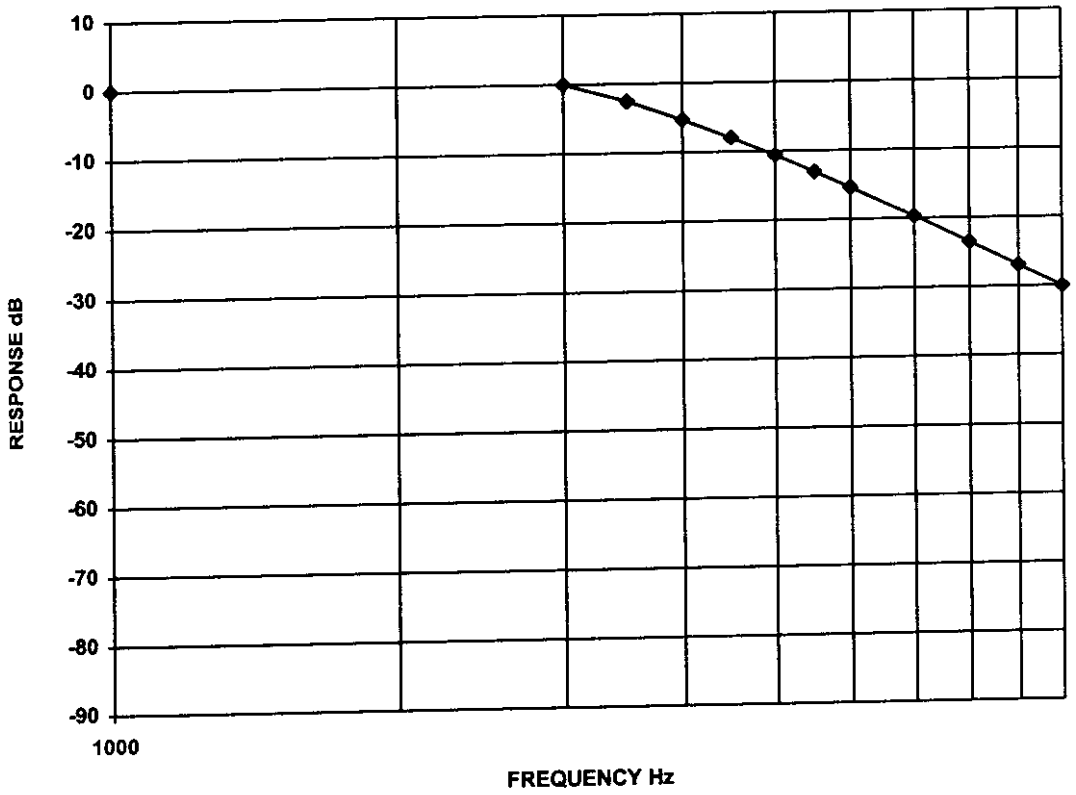
Audio Frequency Response

Frequency	300	500	900	1.0 k	1.5 k	1.8 k	2.0k	2.3 k	2.5 k	3.0 k	3.5 k	4 k
	-10.3	-5.9		0	3.0		4.8		5.3	4.7		0.6

Frequency	4.5 k	5 k	5.5 k	6 k	6.5 k	7 k	7.5 k	8 k	8.5 k	9 k	9.5 k	10 k
		-4.7										

Section 5. Audio Low-Pass Filter Response

NAME OF TEST: Audio Low-Pass Filter Response	PARA. NO.: 2.987(a)
TESTED BY: Wayne Clarke	DATE: May 6, 1999

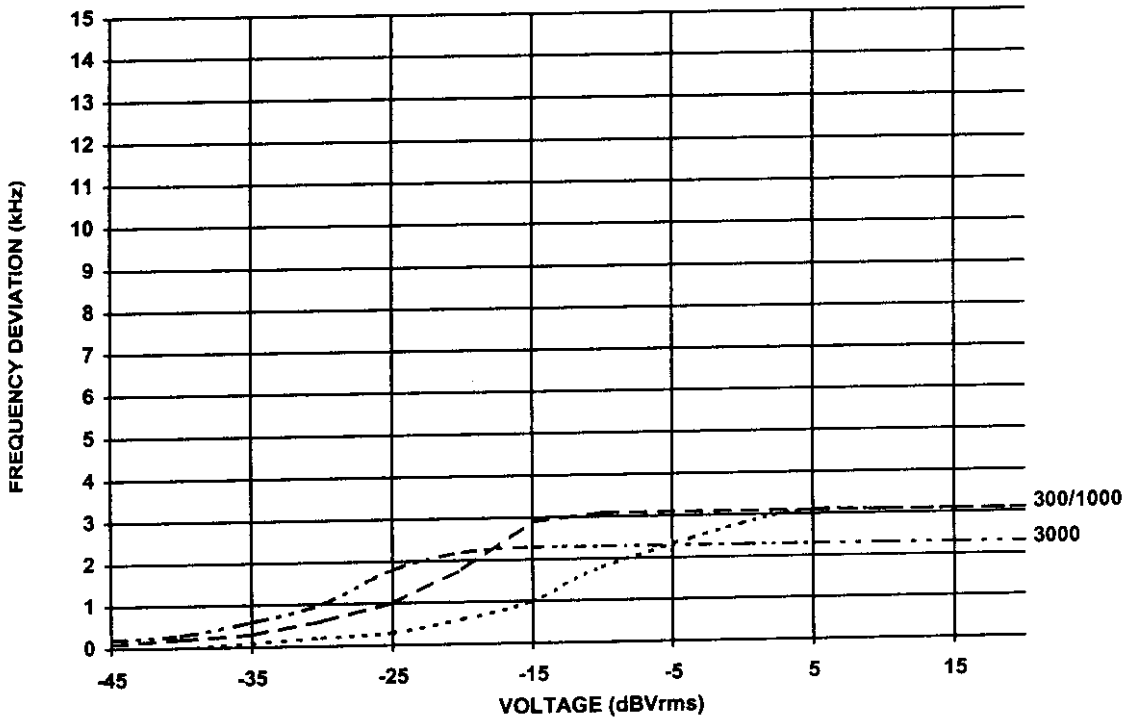


Audio Low-Pass Filter Response

Frequency	1k	3 k	3.5 k	4 k	4.5 k	5 k	5.5 k	6 k	7 k	8 k	9 k	10 k
		0	-2.5	-5.2	-7.9	-10.6	-13.1	-15.4	-19.7	-23.5	-26.9	-30.0

Section 6. Modulation Limiting

NAME OF TEST: Modulation Limiting	PARA. NO.: 2.987(b)
TESTED BY: Wayne Clarke	DATE: May 6, 1999



Input	-45	-40	-35	-30	-25	-20	-15	-10	0	5	10	15	20
300 Hz	0.0	0.0	0.1	0.2	0.3	0.6	1.0	1.8	2.8	3.1	3.1	3.1	3.1
1 kHz	0.1	0.2	0.3	0.6	1.0	1.8	2.9	3.1	3.1	3.1	3.1	3.1	3.1
3 kHz	0.2	0.3	0.6	1.0	1.8	2.2	2.3	2.3	2.3	2.3	2.3	2.3	2.3

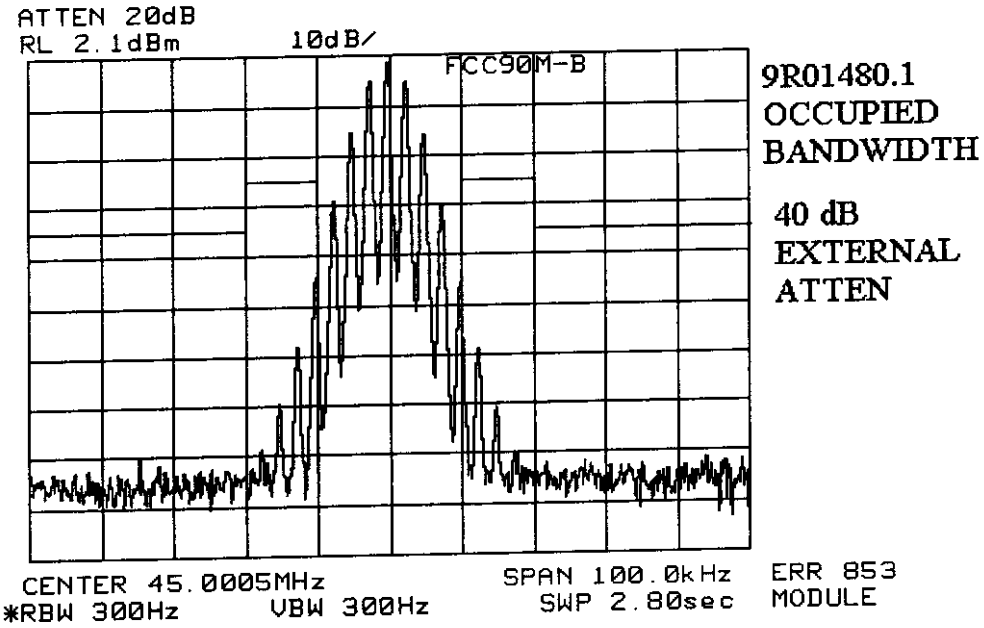
Maximum deviation for non-voice modulation _____ kHz.

Section 7. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: Wayne Clarke	DATE: May 6, 1999

Test Results: Complies.

Test Data: See attached graph(s).

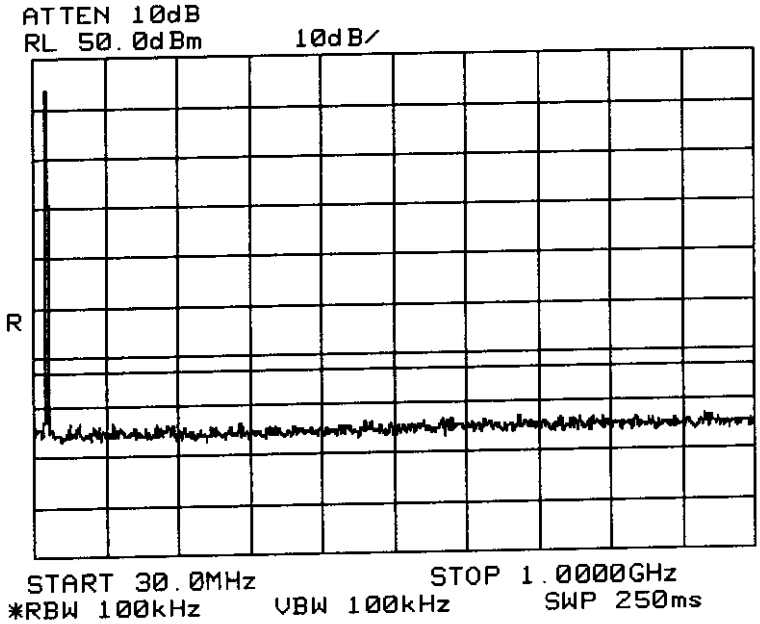

ATTEN 20dB
RL 2.1dBm
10dB/
FCC90M-B
9R01480.1
OCCUPIED
BANDWIDTH
40 dB
EXTERNAL
ATTEN
CENTER 45.0005MHz
*RBW 300Hz
VBW 300Hz
SPAN 100.0kHz
SWP 2.80sec
ERR 853
MODULE

Section 8. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: Wayne Clarke	DATE: May 6, 1999

Test Results: Complies.

Test Data: See attached graph(s).



SPURIOUS EMISSIONS AT ANTENNA TERMINAL

Section 9. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: Wayne Clarke	DATE: May 19, 1999

Test Results: Complies.

Test Data: There were no spurious emissions noted at 3 meters on the OATS.

Test Data - Radiated Emissions

Test Distance (meters) : 3		Range:		Receiver:		RBW(kHz):		Detector:			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBμV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)

NO SPURIOUS EMISSIONS DETECTED

Notes:
The spectrum was search up to the 10th harmonic of the fundamental frequency.
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole
* Includes cable loss when amplifier is not used.
** Includes cable loss.
( ) Denotes failing emission level.

Section 10. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
TESTED BY: Wayne Clarke	DATE: May 19, 1999

Test Results: Complies.

Measurement Data: See attached tables.

Measurement Data

TIME (MIN)	FREQUENCY (MHz)			
	-30°C	-20°C	-10°C	0°C
0.0	45 000 024	45 000 021	45 000 028	45 000 035
0.5	45 000 024	45 000 021	45 000 030	45 000 037
1.0	45 000 024	45 000 021	45 000 030	45 000 037
1.5	45 000 022	45 000 021	45 000 029	45 000 037
2.0	45 000 020	45 000 020	45 000 030	45 000 037
2.5	45 000 018	45 000 020	45 000 030	45 000 037
3.0	45 000 017	45 000 020	45 000 030	45 000 037

TIME (MIN)	FREQUENCY (MHz)			
	+10°C	+30°C	-+40°C	+50°C
0.0	45 000 017	45 000 035	44 999 986	44 999 947
0.5	45 000 018	45 000 035	44 999 985	44 999 945
1.0	45 000 018	45 000 034	44 999 984	44 999 945
1.5	45 000 018	45 000 033	44 999 982	44 999 944
2.0	45 000 018	45 000 031	44 999 981	44 999 943
2.5	45 000 018	45 000 028	44 999 980	44 999 941
3.0	45 000 018	45 000 025	44 999 979	44 999 940

Frequency Versus Supply Voltage

TIME (MIN)	23.8 VDC	28.0 VDC	32.2 VDC
0.0	45 000 017	45 000 004	44 999 993
0.5	45 000 017	45 000 004	44 999 993
1.0	45 000 016	45 000 003	44 999 993
1.5	45 000 015	45 000 002	44 999 992
2.0	45 000 014	45 000 000	44 999 992
2.5	45 000 013	44 999 999	44 999 991
3.0	45 000 012	44 999 998	44 999 990

Section 11. Transient Frequency Behaviour

NAME OF TEST: Transient Frequency Behaviour	PARA. NO.: 90.214
TESTED BY:	DATE:

Test Results: Complies/Does Not Comply.

Measurement Data: See attached graphs.

NOT APPLICABLE

Section 12. Test Equipment List

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.	
1 Year	Spectrum Analyzer	Hewlett Packard	8565E	FA000981	May 20/98	July 20/99	
	Plotter	Hewlett Packard	7470A	2308A30807	NCR	NCR	
1 Year	Spectrum Analyzer-1	Hewlett Packard	8566B	2311A02238	Oct. 22/98	Oct. 22/99	
1 Year	Spectrum Analyzer Display-1	Hewlett Packard	8566B	2314A04759	Oct. 22/98	Oct. 22/99	
1 Year	Quasi-peak adapter-1	Hewlett-Packard	85650A	2043A00302	Oct. 22/98	Oct. 22/99	
1 Year	Climate Chamber	Thermotron	SM-16C	15649-S	Aug. 7/98	Aug. 7/99	
1 Year	Attenuator	Narda	768-20	9507	July 24/98	July 24/99	
1 Year	Attenuator	Narda	765-20	9510	July 24/98	July 24/99	
1 Year	LISN	Tegam	95300-50	T-12855/56	July 24/98	July 24/99	
1 Year	LISN	Rohde & Schwarz	ESH2-Z5	890485/017	July 23/98	July 23/99	
	Biconilog Antenna	EMCO	3143	1038	NCR	NCR	
2 Year	Horn Antenna	EMCO #2	3115	4336	Oct. 30/97	Oct. 30/99	
2 Year	Horn Antenna	EMCO #1	3115	3132	Feb. 9/98	Feb. 9/00	
1 Year	Dipole Antenna Set	EMCO	3121C	1029	Nov. 18/98	Nov. 18/99	
1 Year	Dipole Antenna	Roberts Inst.	N/A	FA000747	June 8/98	June 8/99	
1 Year	Signal Generator	Hewlett Packard	8673B	2332A00378	July 22/98	July 22/99	
1Year	Frequency Counter	Hewlett Packard	HP5350A	2444A00135	Apr. 24/99	Apr. 24/00	
1 Year	Radio Communicator	R&S	CMTASY	840343/0B	Dec. 14/99	Dec. 14/00	
	HP Power Supply	Hewlett Packard	6274B	2713A-10106	NCR	NCR	

NA: Not Applicable
NCR: No Cal Required
COU: CAL On Use

ANNEX A

TEST METHODOLOGIES

NAME OF TEST: RF Power Output	**PARA. NO.: 2.985**

Minimum Standard: Para. No. 90.205(a). The maximum allowable station ERP is dependent upon the stations HAAT and required service area and will be authorized in accordance with Table 1 of 90.205(d).

Method Of Measurement:

Detachable Antenna:
The peak power at antenna terminals is measured using an in-line peak power meter. Power output is measured with the maximum rated input level.

Integral Antenna:
If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi$ $R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts
E = the maximum measured field strength in V/m
R = the measurement range (3 meters)
G = the numeric gain of the transmit antenna in relation to an isotropic radiator

NAME OF TEST: Audio Frequency Response **PARA. NO.: 2.987(a)**

Test Method: TIA/EIA-603

Minimum Standard: TIA/EIA-603, Para. 3.2.6 from 300 Hz to 3000 Hz. The transmitter audio frequency response shall have a nominal 6 dB per octave pre-emphasis characteristic.

NAME OF TEST: Audio Low-Pass Filter Frequency Response **PARA. NO.: 2.987(a)**

Test Method: TIA/EIA-603

Minimum Standard: TIA/EIA-603

NAME OF TEST: Modulation Limiting **PARA. NO.: 2.987(a)**

Test Method: TIA/EIA-603

Minimum Standard: TIA/EIA-603

NAME OF TEST: Occupied Bandwidth **PARA. NO.: 2.989**

Minimum Standard: Para. No. 90.210, see table 1 below for applicable mask.

Table 1

Frequency Band (MHz)	Mask for equipment with Low Pass Filter	Mask for equipment without Low Pass Filter
Below 25	A or B	A or C
25 - 50	B	C
72 - 76	B	C
150 - 174	B, D or E	C, D or E
150 Paging only	B	C
220 - 222	F	F
421 - 512	B, D or E	C, D or E
450 paging only	B	H
806 - 821/ 851 - 866	B	G
821 - 824/ 866 - 869	B	H
896 - 901/ 935 - 940	I	J
902 - 928	K	K
929 - 930	B	G
Above 940	B	C
All other bands	B	C

Test Method:

RBW: 1% of emission bandwidth in 0 - 1 GHz range. 1 MHz at frequencies above 1 GHz.
VBW: $\Rightarrow$ RBW

The spectrum is search up to 10 times the fundamental frequency.

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.993

Minimum Standard: Para. No. 90.210, see table 1 for applicable mask.

Calculation of Field Strength Limit

An example of attenuation requirement of 50 + 10 Log P is equivalent to -20 dBm (1×10^{-5} Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$GP/4\pi R^2 = E^2/120\pi$

For emissions ≤ 1 GHz:

G = 1.64 (Dipole Gain)
P = 10^{-5} Watts (Maximum spurious output power)
R = 3m (Measurement Distance)

$$E = \frac{\sqrt{30GP}}{R} = E = \frac{\sqrt{30 \times 1.64 \times 10^{-5}}}{3} = 0.00739 \text{ V / m} = 77.4 \text{ dB}\mu\text{V / m}$$

For emissions > 1 GHz:

G = 1 (Isotropic Gain)
P = 1×10^{-5} Watts (Maximum spurious output power)
R = 3m (Measurement Distance)

$$E = 77.4 - 20Log\sqrt{1.64} = 75.2 dB\mu V / m@3m$$

MASK	Spurious Limit	FS Limit Below 1 GHz	FS Limit Above 1 GHz
A,B,C,G,H,I	-13dBm	84.4 dBμV/m@3m	82.2 dBμV/m@3m
D,J	-20dBm	77.4 dBμV/m@3m	75.2 dBμV/m@3m
E,F,K	-25dBm	72.4 dBμV/m@3m	70.2 dBμV/m@3m

NAME OF TEST: Frequency Stability — PARA. NO.: 2.995

Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

Table 2

Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 - 901	0.1	1.5	1.5
902 - 928	2.5	2.5	2.5
929 - 930	1.5	-	-
935 - 940	0.1	1.5	1.5
1427 - 1435	300	300	300
Above 2450	-	-	-

NAME OF TEST: Transient Frequency Behaviour — PARA. NO.: 2.214

Minimum Standard:

Transient Frequency Behaviour for Equipment Designed to Operate on 25 kHz Channels

		Frequency ranges (MHz) All equipment					
	Maximum	Base station and portable radios			Mobile Radios		
Time intervals [1,2]	Frequency difference[3] (kHz)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t_1[4]	± 25	5.0	10.0	20.0	5.0	10.0	5.0
t_2	± 12	20.0	25.0	50.0	20.0	25.0	20.0
t_3[4]	± 25	5.0	10.0	10.0	5.0	10.0	5.0

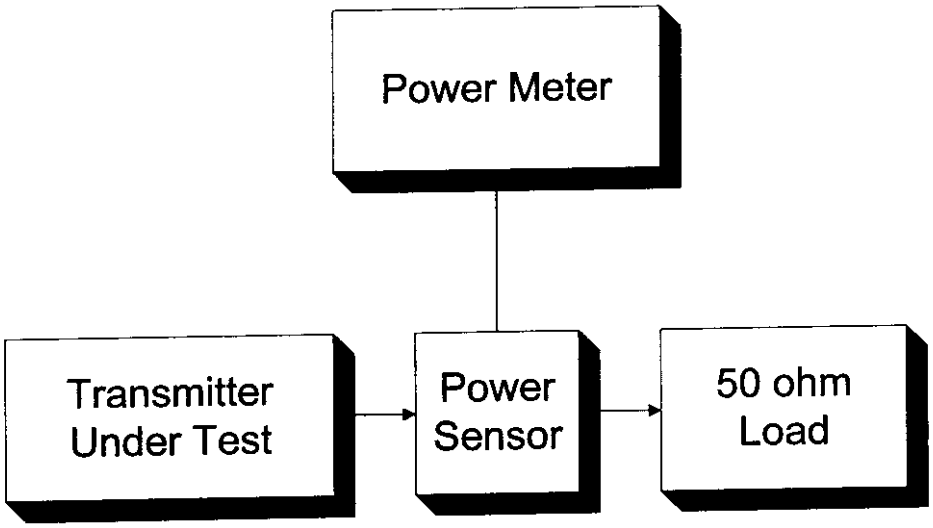
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz & 6.25 kHz Channels

	Maximum	Frequency ranges (MHz) All equipment		
Time intervals [1,2]	Frequency difference[3] (kHz)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t_1[4]	± 12.5 / ± 6.25	5.0	10.0	20.0
t_2	± 6.25 / ± 3.125	20.0	25.0	50.0
t_3[4]	± 12.5 / ± 6.25	5.0	10.0	10.0

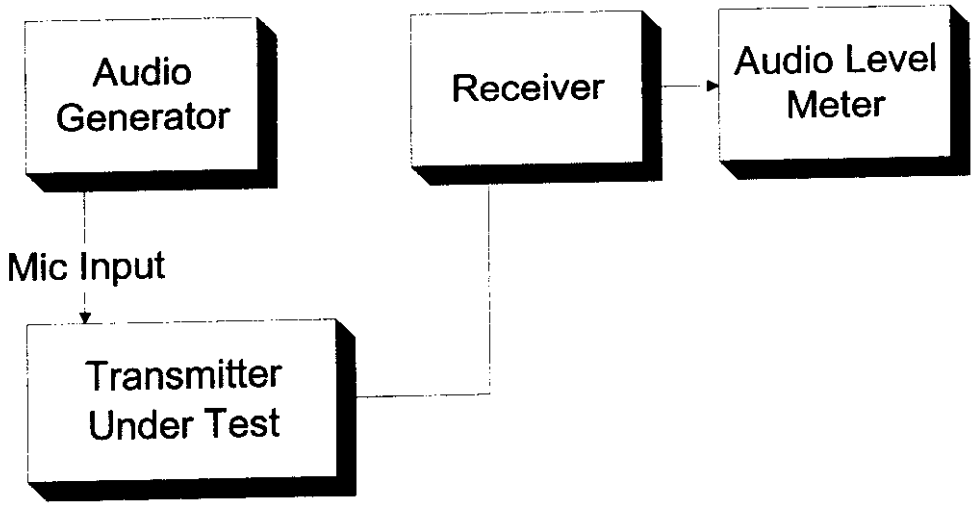
ANNEX B

TEST DIAGRAMS

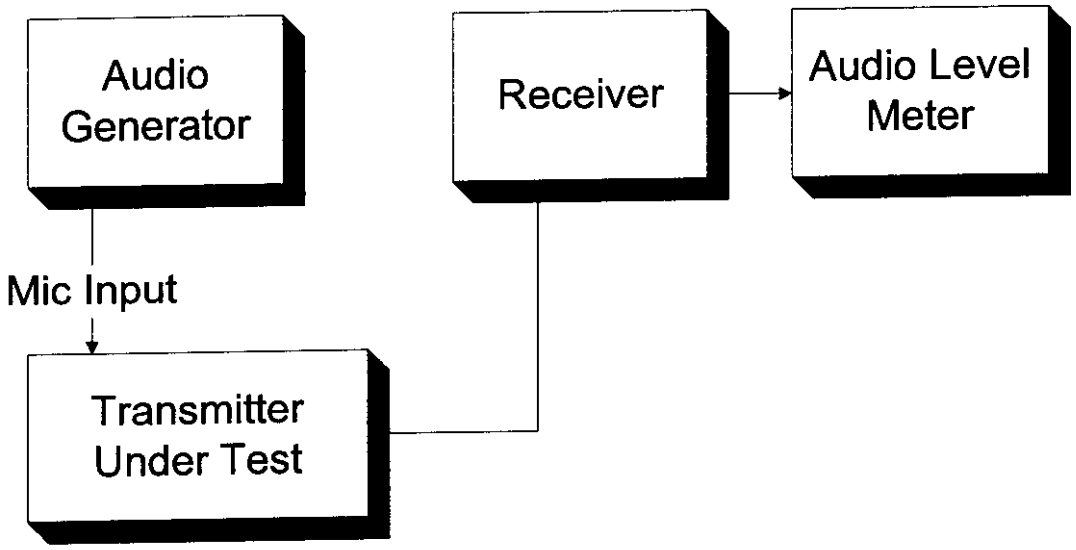
Para. No. 2.985 - R.F. Power Output



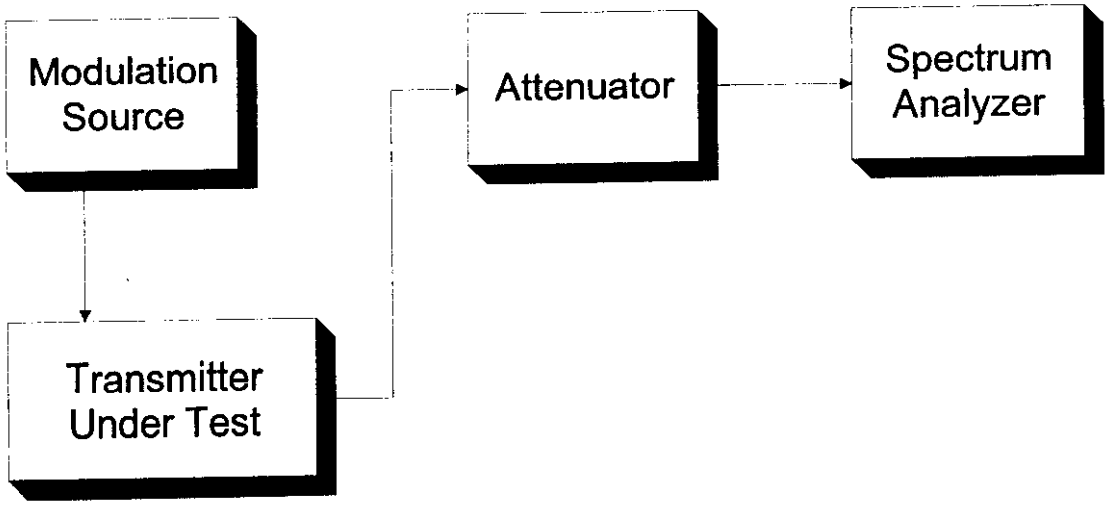
Para. No. 2.987(a) - Audio Frequency Response



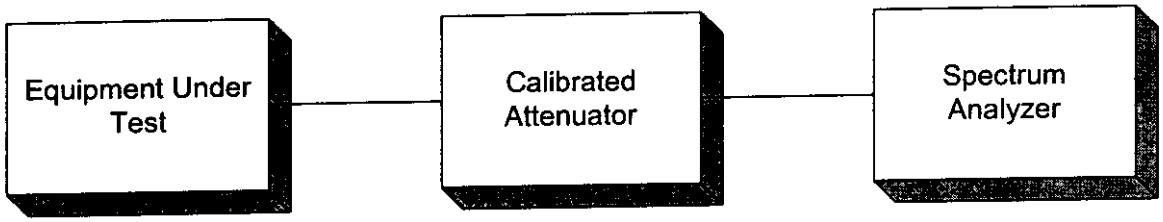
Para. No. 2.987(b) - Modulation Limiting



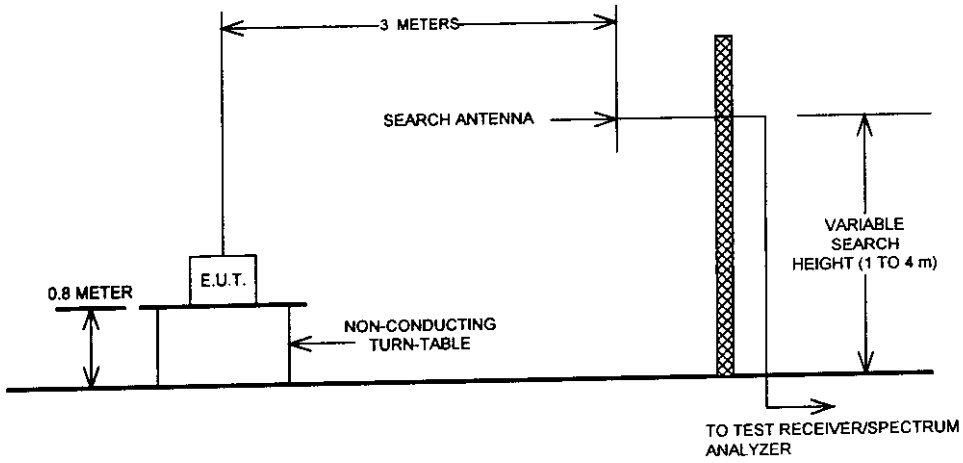
Para. No. 2.989 - Occupied Bandwidth



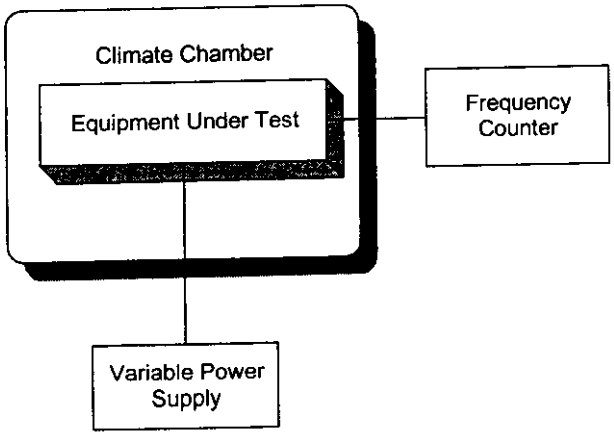
Para. No. 2.991 - Spurious Emissions at Antenna Terminals



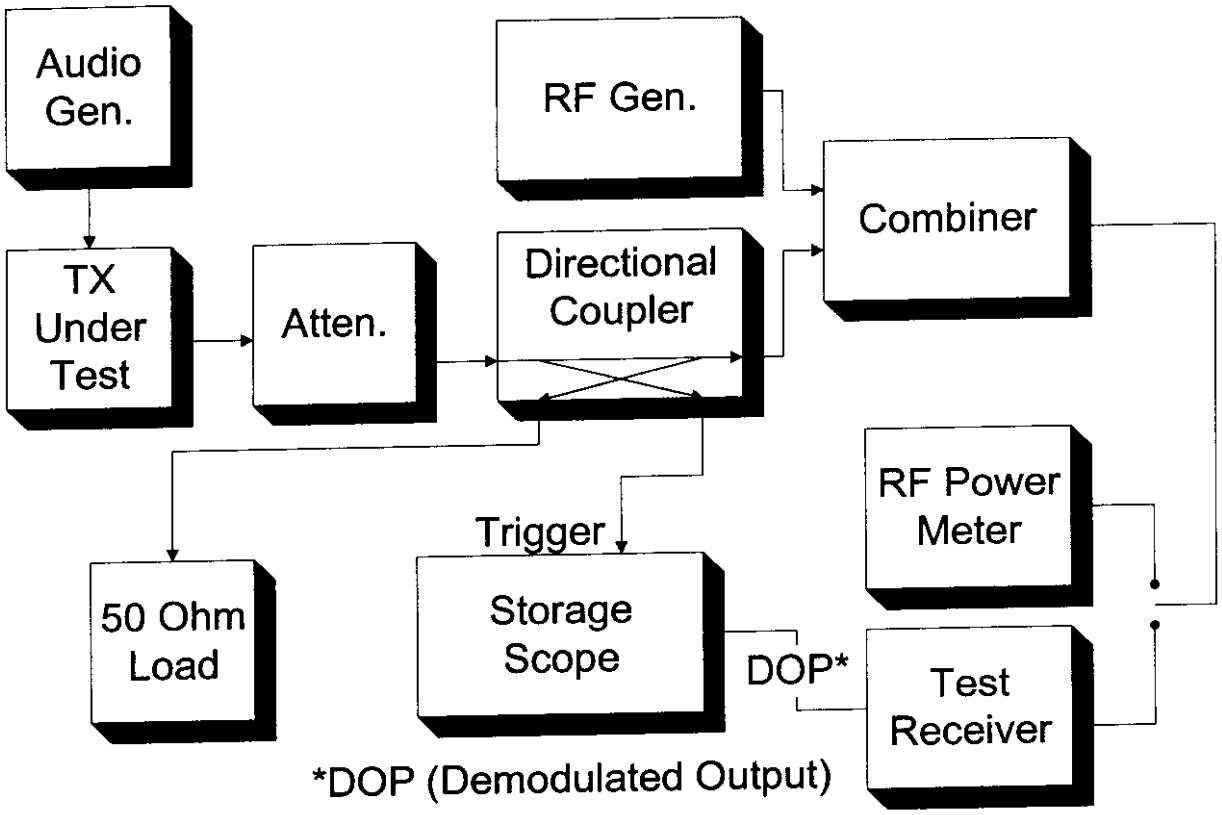
Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability



Para. No. 90.214 - Transient Frequency Behaviour



Voice

This measurement was made using measurement procedure TIA/EIA Land Mobile FM or PM Communications Equipment Measurement and Performance Standards TIA/EIA-603 February 1993 Telecommunications Industry Association (American National Standard ANSI/TIA/EIA-603-1992 Approved: October 27, 1992) Para. no. 2.2 Methods of Measurement for Transmitters Para. no. 2.2.19 Transient Frequency Behaviour (page no. 83).

Data

This measurement was made using measurement procedure TIA/EIA Digital C4FM/CQPSK Transceiver Measurement Methods TSB102.CAAA Para. no. 2.2.17 Transient Frequency Behaviour (page no. 74).