SIMRAD
A KONGSBERG Company

REPORT FORM FOR TESTING TO ETS 300 225

RADIO EQUIPMENT AND SYSTEMS (RES)
Technical Characteristics and methods of measurement for survival craft portable VHF radiotelephone apparatus

Test Unit =	
Serial Number =	
Nominal Voltage =	7.2 Volts
Maximum Voltage =	10.7 Volts
Minimum Voltage =	6.0 Volts
Nominal Temperature =	20°C
Maximum Temperature =	55°C
Minimum Temperature =	-20°C
Channel 16 =	156.800MHz
Upper Frequency =	163.025MHz
Lower Frequency =	155.025MHz
Rated Output Power (RF) =	2.5 Watts
Channel Spacing =	25.0kHz
First IF Main Rx =	21.4MHz
Second IF Main Rx =	450.0kHz
Rated Audio Power =	.4 Watts
Rated Audio Load =	24 Ohms

The data in this report was obtained from report number 98520930 dated 10th September 1999.
This report was prepared by :-
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The Netherlands

SUMMARY OF TEST RESULTS

Serial No. 09/12/99

Clause No.	Description	Complies?	***Notes.***
8.1	Transmitter Effective Radiated Power	Yes	
8.2	Transmitter Radiated Spurious Emissions	Yes	*All other emissions below the measurable limit.*
8.3	Receiver Spurious Emissions	Yes	*All other emissions below maesurable limit.*
9.1	Transmitter Frequency Error	Yes	
9.2	Transmitter Output Power referred to ERP	Yes	
9.3	Transmitter Frequency Deviation	Yes	
9.4	Limiting Characteristic of Modulator	Yes	
9.5	Sensitivity of Modulator Including Microphone	Yes	
9.6	Transmitter Audio Frequency Response	Yes	
9.7	Transmitter Audio Frequency Distortion	Yes	
9.8	Transmitter Adjacent Channel Power	Yes	
9.9	Transmitter Residual Modulation	Yes	
9.10	Transmitter Transient Frequency Behaviour	Yes	*Values shown not exceeded during defined period*
10.1	Receiver AF Harmonic Distortion	Yes	
10.1	Receiver AF Output Power	Yes	
10.2	Receiver Audio Frequency Response	Yes	
10.3	Receiver Maximum Usable Sensitivity	Yes	
10.4	Receiver Co-Channel Rejection	Yes	
10.5	Receiver Adjacent Channel Selectivity	Yes	
10.6	Receiver Spurious Response Rejection	Yes	*All other responses greater than 90dB*
10.7	Receiver Intermodulation Response	Yes	
10.8	Receiver Blocking Response	Yes	
10.9	Receiver Amplitude Response of the Limiter	Yes	
10.10	Receiver Hum And Noise	Yes	

Ambient Temperature = 25°C

TRANSMITTER EFFECTIVE RADIATED POWER

Clause:- 8.1

Supply Voltage = 7.2 Volts

Upper Limit = 25.0 Watts

Lower Limit (Normal) = 0.25 Watts

TEST CONDITIONS		OUTPUT POWER (Watts)			Pass/Fail
		155.025MHz	156.850MHz	163.025MHz	
Tnom (20°C)	Vnom (7V)		1.5		Pass

REFERENCE GAIN		
1.0	1.0	#DIV/0!

Complies:- Yes

Ambient Temperature = 20°C

TRANSMITTER RADIATED SPURIOUS EMISSIONS 8.2

Supply Voltage = 7.2 Volts

Output Power = 2.5 Watts Limit = 0.25uW

Frequency of Spurious Emissions (MHz)	Spurious Emission Level (uW)			Pass / Fail
	155.025MHz	156.900MHz	163.025MHz	
313.800				
470.700		0.0150		Pass
627.600				
784.500				
941.400		0.0500		Pass
1098.300				
1255.200				

Notes: All other emissions below the measurable limit.

Complies:- Yes

Ambient Temperature = 20°C

RECEIVER RADIATED SPURIOUS EMISSIONS

Supply Voltage = 7.2 Volts Limit = 2.0nW

Frequency of Spurious Emissions (MHz)	Spurious Emission Level (nW)			Pass / Fail
	155.025MHz	156.800MHz	163.025MHz	
135.400MHz		0.050		Pass
270.800MHz				
406.200MHz				
541.600MHz				
677.000MHz				
812.400MHz				
947.800MHz				
1083.200MHz				

Notes: All other emissions below maesurable limit.

Complies:- Yes

Ambient Temperature =

TRANSMITTER FREQUENCY ERROR Clause:- 9.1

Supply Voltage = 7.2 Volts

High Power = 2.5W Limit = 1.5kHz

TEST CONDITIONS		FREQUENCY ERROR (Hz)		
		155.025MHz	156.800MHz	163.025MHz
Tnom (20°C)	Vnom (7V)	-147	-174	
Tmax (55°C)	Vmin (6.0V)		388	
	Vmax(10.7V)		192	
Tmin (-20°C)	Vmin (6.0V)		-728	
	Vmax(10.7V)		-713	
Maximum Frequency Error		-147	388	
Minimum Frequency Error			-728	
Pass/Fail		Pass	Pass	

Notes:

Complies:- Yes

Ambient Temperature = 25°C

TRANSMITTER OUTPUT POWER - Hi

Clause:- 9.2

Upper Limit = 25.0 Watts

Lower Limit (Normal) = .25 Watts

Lower Limit (Extreme) = .25 Watts

TEST CONDITIONS		OUTPUT POWER (Watts)			Pass/Fail
		155.025MHz	156.850MHz	163.025MHz	
Tnom (20°C)	Vnom (7.2V)	1.5	1.5		Test
Tmax (55°C)	Vmin (6.0V)		1.7		Test
	Vmax(10.7V)		1.6		Test
Tmin (-20°C)	Vmin (6.0V)		1.3		Test
	Vmax(10.7V)		1.4		Test
		Carrier Power Referenced to ERP			
Tmax (55°C)	Vmin (6.0V)	0.0	1.7		Pass
	Vmax(10.7V)		1.6		Pass
Tmin (-20°C)	Vmin (6.0V)		1.3		Pass
	Vmax(10.7V)		1.4		Pass

Notes:
Complies:- Yes

Ambient Temperature = 25°C

TRANSMITTER OUTPUT POWER - Lo

Clause:- 9.2

Upper Limit = 1.0 Watts

Lower Limit (Normal) = .25 Watts

Lower Limit (Extreme) = .25 Watts

TEST CONDITIONS		OUTPUT POWER (Watts)			Pass/Fail
		155.025MHz	156.800MHz	163.025MHz	
Tnom (20°C)	Vnom (7.2V)	0.8	0.9		Test
Tmax (55°C)	Vmin (6.0V)		0.9		Test
	Vmax(10.7V)		0.9		Test
Tmin (-20°C)	Vmin (6.0V)		0.7		Test
	Vmax(10.7V)		0.7		Test
		Carrier Power Referenced to ERP			
Tmax (55°C)	Vmin (6.0V)	0.8	0.9		Pass
	Vmax(10.7V)		0.9		Pass
Tmin (-20°C)	Vmin (6.0V)		0.7		Pass
	Vmax(10.7V)		0.7		Pass

Complies:- Yes

Ambient Temperature = °C

TRANSMITTER FREQUENCY DEVIATION

Clause:- 9.3

Supply voltage = 7.2 Volts

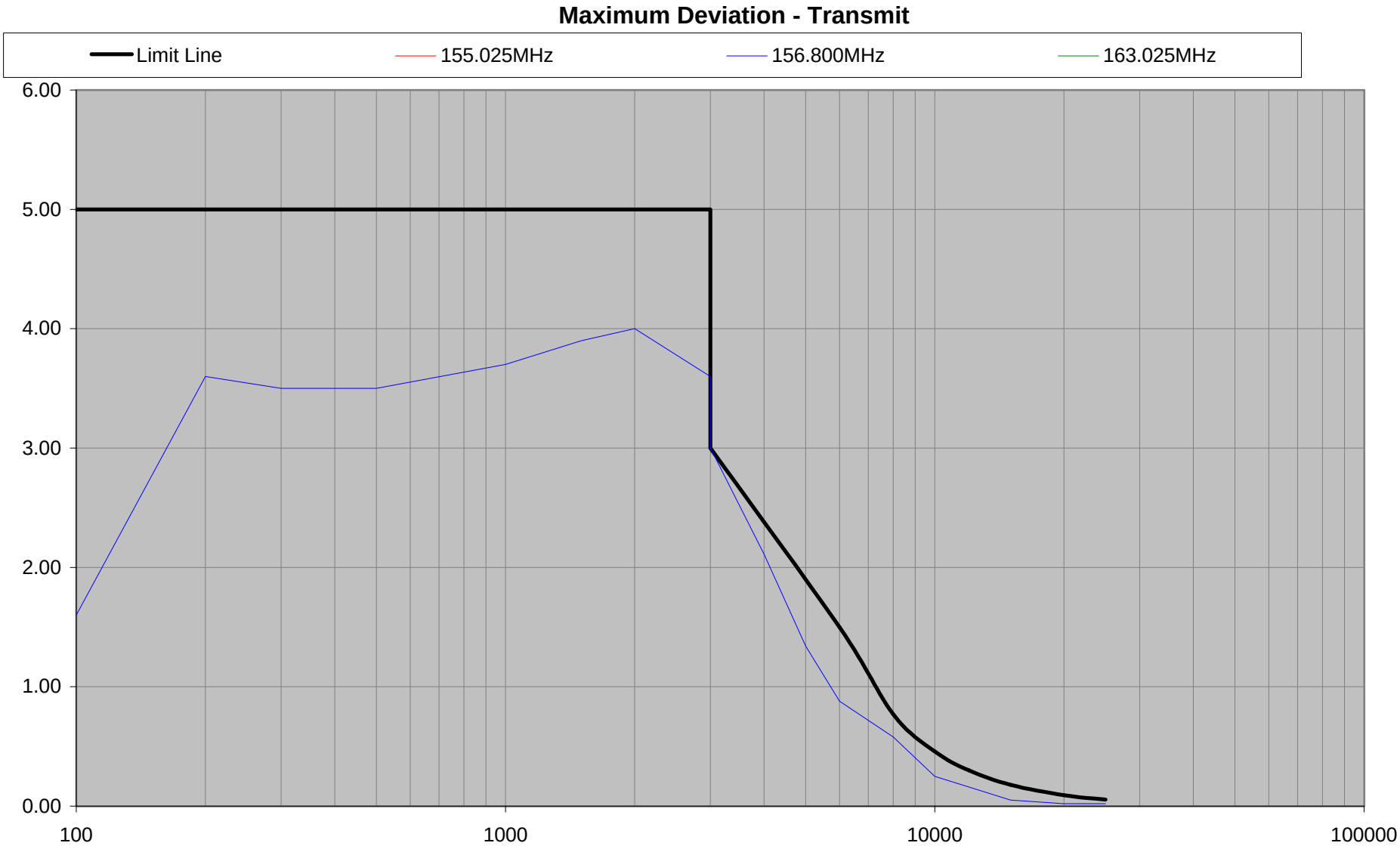
Output Power = 2.5 Watts

Modulation Frequency	Input Level	Limit	Maximum Deviation (kHz)			Pass/Fail
(Hz)			155.025MHz	156.800MHz	163.025MHz	
100	20db 3kHz	5.0kHz		1.6		Pass
200	20db 3kHz	5.0kHz		3.6		Pass
300	20db 3kHz	5.0kHz		3.5		Pass
400	20db 3kHz	5.0kHz				Test
500	20db 3kHz	5.0kHz		3.5		Pass
600	20db 3kHz	5.0kHz				Test
700	20db 3kHz	5.0kHz				Test
800	20db 3kHz	5.0kHz				Test
900	20db 3kHz	5.0kHz				Test
1000	20db 3kHz	5.0kHz		3.7		Pass
1500	20db 3kHz	5.0kHz		3.9		Pass
2000	20db 3kHz	5.0kHz		4.0		Pass
2500	20db 3kHz	5.0kHz				Test
3000	20db 3kHz	5.0kHz		3.6		Pass
3000	3kHz	Value @ 3kHz		3.00		Ref
3100	3kHz	Value @ 3kHz		2.90		Pass
4000	3kHz	Value @ 3kHz		2.11		Pass
5000	3kHz	Value @ 3kHz		1.34		Pass
6000	3kHz	1.5kHz		0.88		Pass
8000	3kHz	0.77		0.58		Pass
10000	3kHz	0.46		0.25		Pass
12000	3kHz	0.30		0.16		Pass
15000	3kHz	0.18		0.05		Pass
20000	3kHz	0.09		0.02		Pass
25000	3kHz	0.05		0.02		Pass

Notes:

Slope = 12.7dB/oct

Complies:- Yes


Maximum Deviation - Transmit
Limit Line
155.025MHz
156.800MHz
163.025MHz
6.00
5.00
4.00
3.00
2.00
1.00
0.00
100
1000
10000
100000

Ambient Temperature = 25°C

TRANSMITTER LIMITATION
CHARACTERISTICS OF THE MODULATOR

Clause:- 9.4

Supply voltage = 7.2 Volts

Output Power = 2.5 Watts

Upper Limit = 5.0kHz

Lower Limit = 3.5kHz

Input level =20db above 1kHz deviation at 1kHz

TEST CONDITIONS		Frequency Deviation (kHz)		
		155.025MHz	156.800MHz	163.025MHz
Tnom (20°C)	Vnom (7V)		-4.3	
Tmax (55°C)	Vmin (6.0V)		-4.6	
	Vmax(10.7V)		-4.6	
Tmin (-20°C)	Vmin (6.0V)		-3.9	
	Vmax(10.7V)		-3.9	
Maximum Deviation			-3.9	
Minimum Deviation			-4.6	
Pass/Fail			Pass	

Notes:

Complies:- Yes

Ambient Temperature = 20°C

Sensitivity of the modulator, including microphone

Supply voltage = 7.2 Volts

Upper Limit: 3.0kHz

Lower Limit: 1.5kHz

Power	155.025MHz	156.800MHz	163.025MHz	Pass / Fail
High		1.9kHz		Pass
Low		1.9kHz		Pass

Notes:

Complies:- Yes

Ambient Temperature = 20°C

TRANSMITTER AUDIO FREQUENCY RESPONSE

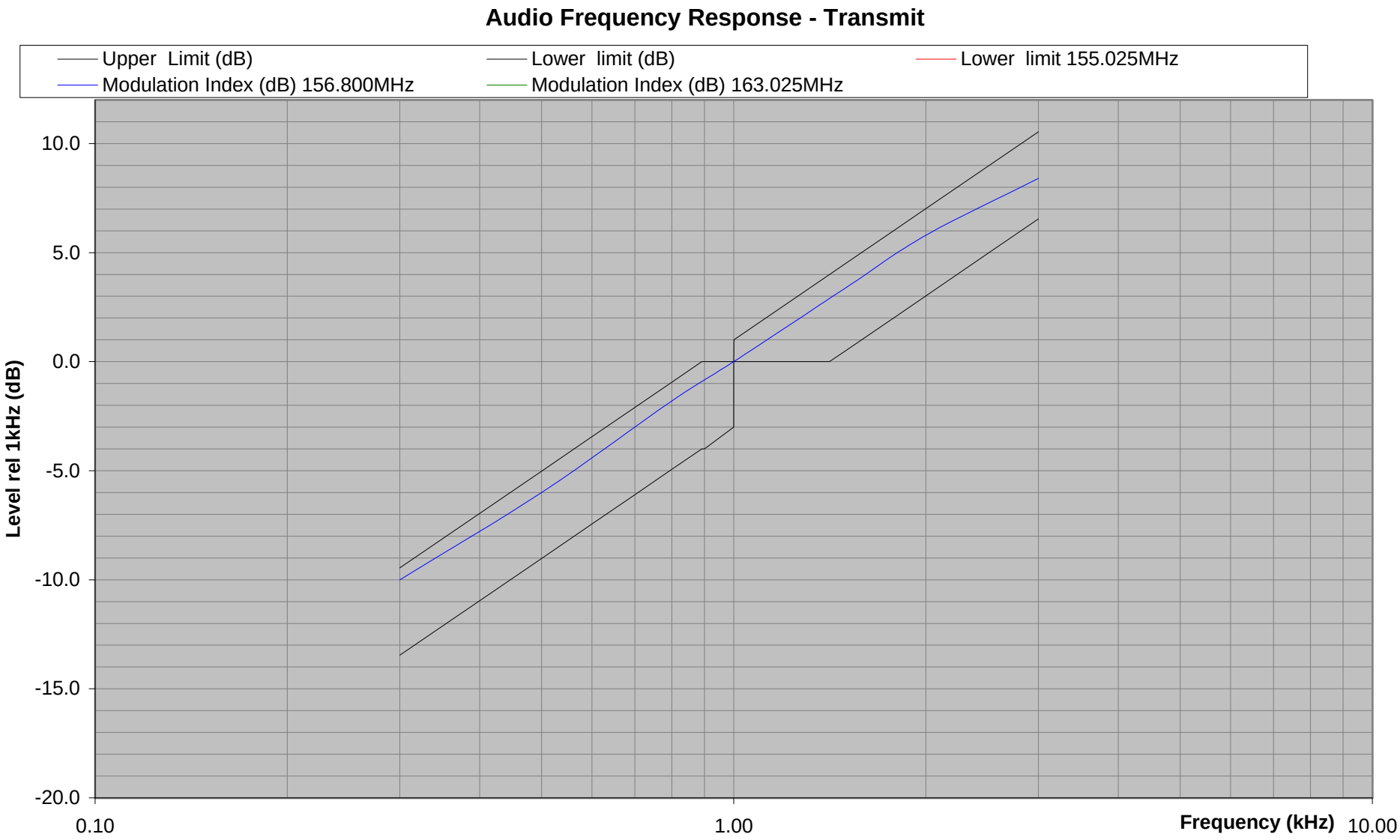
Clause:- 9.6

Supply Voltage = 7.2 Volts

Modulating Frequency (Hz)	Upper Limit (dB)	Lower limit (dB)	Modulation Index (dB)			Pass / Fail
			155.025MHz	156.800MHz	163.025MHz	
0.10						
0.20						
0.30	-9.5	-13.5		-10.0		Pass
0.40	-7.0	-11.0				
0.50	-5.0	-9.0		-6.0		Pass
0.60	-3.4	-7.4				
0.70	-2.1	-6.1				
0.80	-0.9	-4.9		-1.8		Pass
0.90		-4.0				
1.00	0.0	0.0		0.0		Pass
1.20						
1.50	4.5	0.5		3.4		Pass
1.80	6.1	2.1				
2.00	7.0	3.0		5.8		Pass
2.50	9.0	5.0				
3.00	10.5	6.5		8.4		Pass
4.00						
5.00						
6.00						
7.00						
8.00						
9.00						
10.00						

Notes:

Complies:- Yes


Audio Frequency Response - Transmit
Upper Limit (dB)
Lower limit (dB)
Lower limit 155.025MHz
Modulation Index (dB) 156.800MHz
Modulation Index (dB) 163.025MHz
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
Level rel 1kHz (dB)
0.10
1.00
10.00
Frequency (kHz)

Ambient Temperature = 25°C

TRANSMITTER AUDIO FREQUENCY DISTORTION Clause:- 9.7

Supply Voltage = 7.2 Volts

Output Power = 2.5 Watts Limit = 10%

		Modulation Frequencies (Hz)	AF Distortion (%)		
			155.025MHz	156.800MHz	163.025MHz
Tnom (20°C)	Vnom (7.2V)	300		1.3	
		500		1.8	
		1000		2.0	
Tmax (55°C)	Vmin (6.0V)	1000		1.6	
	Vmax(10.7V)			1.6	
Tmin (-20°C)	Vmin (6.0V)	1000		2.5	
	Vmax(10.7V)			2.5	
Pass/Fail				Pass	

Notes:

Complies:- Yes

Ambient Temperature = 20°C

TRANSMITTER ADJACENT CHANNEL POWER Clause:- 9.8

Supply Voltage = 7.2 Volts

Output Power = 2.5 Watts Limit = -70.0dB

But not less than 0.2uW

Measurement Offset	Adjacent Channel Power (dBc)			Pass / Fail
	155.025MHz	156.800MHz	163.025MHz	
Fn + 25kHz		-84.0		Pass
Fn - 25kHz		-83.9		Pass

Complies:- Yes

Ambient Temperature = °C

RESIDUAL MODULATION OF THE TRANSMITTER Clause:- 9.9

Supply Voltage = 7.2 Volts

Output Power = 2.5 Watts Limit = 40.0dB

Residual Modulation (dB)	155.025MHz	156.800MHz	163.025MHz	Pass/Fail
		54		Pass

Notes:

Complies:- Yes

Ambient Temperature = 20°C

TRANSMITTER TRANSIENT FREQUENCY BEHAVIOUR Clause:- 9.10

Supply Voltage = 7.2 Volts

Output Power = 2.5 Watts

Limit Period t1 (5ms) = 25.0kHz

Limit Period t2 (20ms) = 12.5kHz

Limit Period >t2 = 1.5kHz

Limit Period t3 (5ms) = 25.0kHz

Transient Period	Frequency Error (kHz)			Pass/Fail
	155.025MHz	156.800MHz	163.025MHz	
t1		12.50		Pass
t2		5.00		Pass
>t2		1.00		Pass
t3		1.00		Pass

Notes: Values shown not exceeded during defined period

Complies:- Yes

Turn on Transient
5ms/div
10kHz/div

Turn off Transient

Ambient Temperature = 20°C

RECEIVER HARMONIC DISTORTION AND RATED AUDIO FREQUENCY OUTPUT POWER

LOUDSPEAKER

Rated load = 24 Ohms Harmonic distortion Limit = 10%

Rated Power = .4 Watts *Required AF Voltage = 3.1 Volts*

Fn = 156.800MHz				Harmonic Distortion (%)			
TEST CONDITIONS		TEST SIGNAL LEVEL (dBuV)	Fmod (Hz)	Fn	Fn(-1.5kHz)	Fn (+1.5kHz)	Pass/Fail
Tnom (20°C)	Vnom (7.2V)	100	300	5.3			Pass
			500	3.8			Pass
			1000	2.4			Pass
Tmax (55°C)	Vmin (6.0V)	100	1000	3.4	2.9	2.9	Pass
	Vmax(10.7V)			3.3	2.7	2.9	Pass
Tmin (-20°C)	Vmin (6.0V)	100	1000	4.4	2.5	4.2	Pass
	Vmax(10.7V)			4.2	2.2	4.1	Pass

Notes:

Complies:- Yes

Ambient Temperature 20°C

RECEIVER HARMONIC DISTORTION AND RATED AUDIO FREQUENCY OUTPUT POWER

LOUDSPEAKER

Rated load = 24 Ohms Limit = .2 Watts

Fn = 156.800MHz				Output Power (W)			
TEST CONDITIONS		TEST SIGNAL LEVEL	Fmod (Hz)	Fn	Fn (-1.5kHz)	Fn (+1.5kHz)	Pass/Fail
Tnom (20°C)	Vnom (7.2V)	100	300	0.4			Pass
			500	0.4			Pass
			1000	0.4			Pass
Tmax (55°C)	Vmin (6.0V)	100	1000	0.5	0.4	0.4	Pass
	Vmax(10.7V)			0.4	0.4	0.5	Pass
Tmin (-20°C)	Vmin (6.0V)	100	1000	0.4	0.3	0.4	Pass
	Vmax(10.7V)			0.4	0.4	0.4	Pass

Notes:

Complies:- Yes

SUPPLEMENTARY TABLE FOR ENTRY OF RMS VOLTAGES.

Tnom (20°C)	Vnom (7.2V)	100	300 500 1000			
Tmax (55°C)	Vmin (6.0V) Vmax(10.7V)	100	1000			
Tmin (-20°C)	Vmin (6.0V) Vmax(10.7V)	100	1000			

Ambient Temperature = 20°C

RECEIVER MAXIMUM USEABLE SENSITIVITY

Limit under normal conditions = 6 dBuV

Limit under extreme conditions = 12 dBuV

TEST CONDITIONS		Receiver Sensitivity (dBm / dbuV)						Pass/Fail
		155.025MHz		156.800MHz		163.025MHz		
Tnom (20°C)	Vnom (7.2V)			-113.5	-0.5			Pass
Tmax (55°C)	Vmin (6.0V)			-115.4	-2.4			Pass
	Vmax(10.7V)			-114.8	-1.8			Pass
Tmin (-20°C)	Vmin (6.0V)			-107.0	6.0			Pass
	Vmax(10.7V)			-107.0	6.0			Pass

Notes:

Complies:- Yes

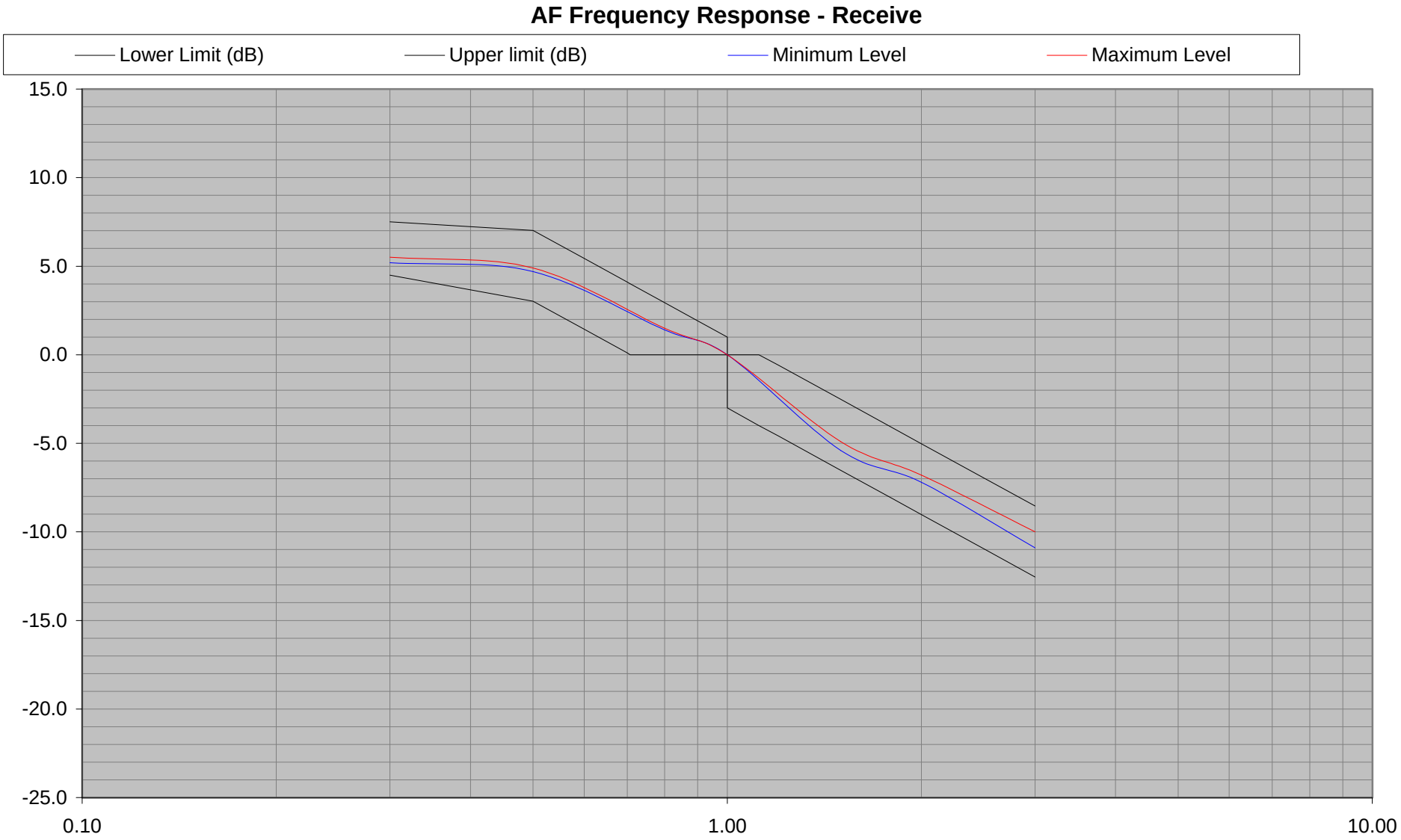
Ambient Temperature = 20°C

RECEIVER AUDIO FREQUENCY RESPONSE

Supply Voltage = 7.2 Volts

Modulating Frequency (Hz)	Lower Limit (dB)	Upper limit (dB)	Relative Audio Power									Pass / Fail
			155.025MHz			156.800MHz			163.025MHz			
			Fn	Fn -1.5	Fn +1.5	Fn	Fn -1.5	Fn +1.5	Fn	Fn -1.5	Fn +1.5	
0.10												
0.11												
0.12												
0.13												
0.15												
0.17												
0.20												
0.30	7.5	4.5				5.5	5.5	5.2				Pass
0.40												
0.50	7.0	3.0				4.9	4.9	4.7				Pass
0.60	5.4	1.4										
0.70	4.1	0.1										
0.80	2.9					1.5	1.5	1.4				Pass
0.90	1.9											
1.00	0.0	0.0				0.0	0.0	0.0				Pass
1.20	-0.6	-4.6										
1.50	-2.5	-6.5				-5.1	-4.9	-5.4				Pass
1.80	-4.1	-8.1										
2.00	-5.0	-9.0				-7.2	-7.2	-6.8				Pass
2.50	-7.0	-11.0										
3.00	-8.5	-12.5				-10.0	-10.4	-10.9				Pass
4.00												
5.00												
6.00												
7.00												
8.00												
9.00												
10.00												

Complies:- Yes


AF Frequency Response - Receive
Lower Limit (dB)
Upper limit (dB)
Minimum Level
Maximum Level
15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
0.10
1.00
10.00

Ambient Temperature = 20°C

RECEIVER CO - CHANNEL REJECTION RATIO

Supply Voltage = 7.2 Volts

Limit (upper) = 0.0dB

Limit (lower) = -10.0dB

Frequency of Unwanted Signal	Rejection Ratio (dB)			Pass/Fail
	155.025MHz	156.800MHz	163.025MHz	
Fn + 3kHz		-9.0		Pass
Fn + 1.5kHz		-8.8		Pass
Fn		-8.5		Pass
Fn - 1.5kHz		-8.2		Pass
Fn - 3kHz		-6.4		Pass

Notes:

Complies:- Yes

Ambient Temperature = 20°C

RECEIVER ADJACENT CHANNEL SELECTIVITY

Supply Voltage = 7.2 Volts

Limit under normal conditions = 70.0dB

Limit under extreme conditions = 60.0dB

Test Conditions		Ratio of Unwanted to Wanted Signal (dB)						Pass/Fail
		155.025MHz		156.800MHz		163.025MHz		
		Fn + 25kHz	Fn - 25kHz	Fn + 25kHz	Fn - 25kHz	Fn + 25kHz	Fn - 25kHz	
Tnom (20°C)	Vnom (7V)			75.5	74.3			Pass
Tmin (-20°C)	Vmax(10.7V)			73.7	75.6			Pass
	Vmin (6.0V)			74.2	75.3			Pass
Tmax (55°C)	Vmax(10.7V)			72.7	71.4			Pass
	Vmin (6.0V)			72.6	71.4			Pass

Notes:

Complies:- Yes

Ambient Temperature = 20°C

RECEIVER SPURIOUS RESPONSE REJECTION RATIO

Supply Voltage = 7.2 Volts Limit = 70.0dB

Frequency of Spurious Responses (MHz)	Relationship	Ratio (dB)			Pass / Fail
		155.025MHz	156.800MHz	163.025MHz	
21.4	IF		76		Pass
112.225	Image				
144.325	"Half IF"				
114.000	Image		72.2		Pass
146.100	"Half IF"		90		Pass
157.700	2nd Image		81		Pass
249.400	2nd harm LO				
384.800	3rd harm LO				
120.225	Image				
152.325	"Half IF"				
21.400	2nd Rx LO				

Notes: All other responses greater than 90dB

Complies:- Yes

Ambient Temperature = 20°C

RECEIVER INTERMODULATION RESPONSE

Supply Voltage = 7.2 Volts Limit (upper) = 68.0dB

Frequency of Unwanted Signal	Rejection Ratio (dB)			Pass/Fail
	155.025MHz	156.800MHz	163.025MHz	
Upper Side		70.2		Pass
Lower side		69.2		Pass

Notes:
Complies:- Yes

Ambient Temperature = 20°C

RECEIVER BLOCKING OR DESENSITISATION

Supply Voltage = 7.2 Volts Limit = 90 dBuV

Frequency of Unwanted Signal	Rejection Ratio (dB)			Pass/Fail
	155.025MHz	156.800MHz	163.025MHz	
Fn + 10MHz		94.4		Pass
Fn + 5MHz		94.4		Pass
Fn + 2MHz		92.9		Pass
Fn + 1 MHz		91		Pass
Fn - 1MHz		91.6		Pass
Fn - 2MHz		93.8		Pass
Fn - 5MHz		93		Pass
Fn - 10Mhz		94.8		Pass

Notes:

Complies:- Yes

Ambient Temperature = 20°C

AMPLITUDE RESPONSE OF THE RECEIVER LIMITER

Supply Voltage = 7.2 Volts Limit = 3.0dB

Channel	AF Output Power (dB)			Pass/Fail
	155.025MHz	156.800MHz	163.025MHz	
Signal + 6dBuV		0.0		
Signal+100dBuV		0.1		Pass

Notes:

Complies:- Yes

Ambient Temperature = 20°C

RECEIVER HUM AND NOISE

Supply Voltage = 7.2 Volts Limit = 40.0dB

	155.025MHz	156.800MHz	163.025MHz	Pass/Fail
Hum and Noise level(dB)		46.5		Pass

Notes:

Complies:- Yes