

THRU Lab & Engineering.

477-6, Hager-Ri, Yoju-Up, Yoju-Gun

Kyunggi-Do, 469-803, Korea

T820318835092F820318835169 email thrukang@kornet.net

Test Report

Product Name: VHF MARINE RADIO

FCCID: MMANT3

THRU

Applicant:

Midland Radio Corporation

5900 Paretta Kansas City, MO 64120

Date Receipt: 11/13/2006

Date Tested: 12/06/ 2006

APPLICANT: Midland Radio Corporation

FCCID #: MMANT3

REPORT #: THRU-612002

COVER SHEET

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TEST REPORT:

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EXHIBITS INCLUDING:

BLOCK DIAGRAM
SCHEMATIC
PARTS LIST
USERS MANUAL
LABEL SAMPLE
LABEL LOCATION
EXTERNAL PHOTOGRAPHS
INTERNAL PHOTOGRAPHS
OPERATIONAL DESCRIPTION
TUNING PROCEDURE
TEST SET UP PHOTOGRAPHS

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TEST Equipment List sxd

No	Description	Manufacturer	Model No.	Serial No.	Due Cal.
1	Test Receiver	Rohde & Schwarz	ESVS10	830489/001	2007.04.23
2	Test Receiver	Rohde & Schwarz	ESHS 10	825832/014	2007.08.25
3	Test Receiver	Rohde & Schwarz	ESVS 10	826008/014	2006.05.24
4	Spectrum Analyzer	Hewlett Packard	8566B	2311A02394	2007.06.17
5	Spectrum Display	Hewlett Packard	85662A	2542A12429	2007.06.17
6	Quasi-peak Adapter	Hewlett Packard	85650A	2521A00887	2007.06.17
7	RF Preselector	Hewlett Packard	85685A	2648A00504	2007.06.17
8	Preamplifier	Hewlett Packard	8449B	3008A00375	2007.04.23
9	Preamplifier	Hewlett Packard	8447F	3113A05367	2007.05.09
10	Preamplifier	Hewlett Packard	8447F	2805A02570	2005.12.12
11	Preamplifier	A.H. Systems	PAM-0118	164	2007.04.01
12	Biconical Antenna	Eaton Corp.	94455-1	0977	2007.04.01
13	Biconical Antenna	EMCO	3104C	9111-2468	2006.06.07
14	Log Periodic Antenna	EMCO	3146	2051	2007.05.11
15	Log Periodic Antenna	EMCO	3146	8901-2320	2006.03.28
16	Horn Antenna	A.H. Systems	SAS-571	414	2007.03.17
17	Horn Antenna	A.H. Systems	SAS-571	781	2006.01.07
18	Loop Antenna	Rohde & Schwarz	HFH2-Z2.335.4711.52	826532/006	2007.01.31
19	Dipole Antenna	Rohde & Schwarz	VHAP	574	2007.12.12
20	Dipole Antenna	Rohde & Schwarz	VHAP	575	2007.12.12
21	Dipole Antenna	Rohde & Schwarz	UHAP	546	2007.12.12
22	Dipole Antenna	Rohde & Schwarz	UHAP	547	2007.12.12
23	Signal Generator	Rohde & Schwarz	SMS	872165/100	2006.04.23
24	Signal Generator	Rohde & Schwarz	SMX	825459/030	2007.06.15
25	Spectrum Monitor	Rohde & Schwarz	EZM	862304/007	None
26	Panorama Monitor	Rohde & Schwarz	EPN	883707/207	None
27	Spectrum Analyzer	Advantest Corp.	R3261C	61720208	2007.06.05
28	Spectrum Analyzer	Hewlett Packard	8591A	3205A02641	2007.12.12
29	LISN	EMCO	3825/2	9111-1912	2007.12.12
30	LISN	Solar	8012-50-R-24	8379121	2007.04.25
31	LISN	Kyoritsu	KNW-242	8-923-2	2007.05.28
32	Plotter	Hewlett Packard	7475A	2210A02802	None

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33	Modulation Analyzer	Hewlett Packard	8901B	3438A05094	2007.05.19
34	Waveform Generator	Hewlett Packard	33120A	US34001190	2007.05.23
35	Audio analyzer	Hewlett Packard	8903B	3011A12915	2007.05.23
36	Universal counter	Hewlett Packard	5343A	3020A02978	2007.05.23
37	Frequency Counter	Tektronic	CMC251	TW52489	2007.04.23
38	Temperature & Humidity Chamber	TABAI EZPEC CORP.	MC711P	112000492	2006.08.27
39	Antenna Mast	EMCO	1070-3	9109-1617	None
40	Turn Table	EMCO	1080-1,2	9203-1762	None
41	Positioning Controller	EMCO	1090	9111-1054	
42	Antenna Power Supply	Rohde & Schwarz	HZ-9	920127	None
43	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	881052	None
44	Coaxial Take-up Reel	EMCO	100817	9109-1684	None

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GENERAL INFORMATION

2.1033(c) MIDLAND RADIO CORPORATION will sell the FCC ID: MMANT3 VHF Marine transmitter in quantity, for use under FCC RULES PART 80.

TECHNICAL DESCRIPTION

2.1033(c)

(4) Type of Emission: 14K8G3E/14K8F3E
Bn = 2M + 2DK
M = 3000
D = 4.6KHz (Peak Deviation)
K = 1
Bn = 2(3.0K) + 2(4.6K)(1) = 14.8K

80.205 (a) ALLOWED AUTHORIZED BANDWIDTH = 20.00KHz.

2.1033(c)(6) Frequency Range: 156.025 – 157.425 MHz

2.1033(c)(7) Power Range and Controls: There is a user Power switch for High/Low Power. Maximum Output Power Rating: High 4.3 Watts, Low 0.68 Watt (16 CH), High 4.3 Watts, Low 0.68 Watt(88A CH) into a 50 ohm resistive load.

2.1033(c)(8) DC Voltages and Current into Final Amplifier:

POWER INPUT

FINAL AMPLIFIER ONLY

High Low

Vce = 6 VDC Vce = 6 VDC

Ice = 0.55 A Ice = 0.44 A

Pin = 3.30 Watts Pin = 2.64 Watts

Function of each electron tube or semiconductor device or other active circuit device is included in the parts list exhibit.

2.1033(c)(9) Complete Circuit Diagrams: The circuit diagrams and block diagrams are included.

2.1033(c)(10) Instruction book. The instruction manual is included.

2.1033(c)(11) Tune-up procedure. The tune-up procedure is included.

2.1033(c)(9) Complete Circuit Diagrams: The circuit diagrams and block diagrams are included.

2.1033(c)(10) Instruction book. The instruction manual is included.

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2.1033(c)(11) Tune-up procedure. The tune-up procedure is included.
Description of all circuitry and devices provided for determining and stabilizing frequency is included in the circuit description

2.1033(c)(11) Digital modulation. This unit does NOT use digital modulation.

The data required by 2.1046 through 2.1055 is submitted below.

2.1046(a) **RF power output**
80.215 (e)(1)

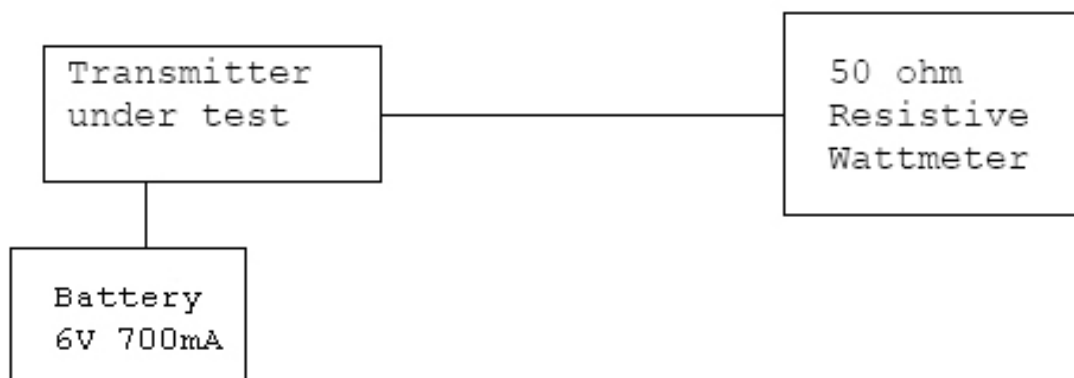
RF power is measured by connecting a 50 ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:

OUTPUT POWER:4.3 W Conducted METHOD (16CH)

0.68 W Conducted METHOD (16CH)

OUTPUT POWER:4.2 W Conducted METHOD (88A CH)

0.68 W Conducted METHOD (88A CH)



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2.1053(a)

Field strength of spurious emissions:

NAME OF TEST: CONDUCTED SPURIOUS EMISSIONS

REQUIREMENTS: Emissions must be $43 + 10\log(P_o)$ dB below the mean power output of the transmitter.

16 CH High : $43 + 10\log(4.3) = 49.33$

Low : $43 + 10\log(0.68) = 41.33$

88A CH High : $43 + 10\log(4.2) = 49.28$

Low : $43 + 10\log(0.66) = 41.20$

TEST DATA – Conducted

16CH-High

16CH-Low

frequency	dBc	Margin	dBm	frequency	dBc	Margin	dBm
156.8000	0	0		156.8000	0	0	
313.6000	61.33	12.00	-25.00	313.6000	58.23	16.90	-29.90
470.4000	66.03	16.70	-29.70	470.4000	67.53	26.20	-39.20
627.2000	66.83	17.50	-30.50	627.2000	69.43	28.10	-41.10
784.0000	66.23	16.90	-29.90	784.0000	68.33	27.00	-40.00
940.8000	66.73	17.40	-30.40	940.8000	69.53	28.20	-41.20
1097.6000	67.73	18.40	-31.40	1097.6000	69.03	27.70	-40.70
1254.4000	66.53	17.20	-30.20	1254.4000	65.03	23.70	-36.70
1411.2000	67.23	17.90	-30.90	1411.2000	68.93	27.60	-40.60
1568.0000	66.83	17.50	-30.50	1568.0000	58.38	17.05	-30.05

88A CH-High

88A CH-Low

frequency	dBc	Margin	dBm	frequency	dBc	Margin	dBm
157.4200	0	0		157.4200			
314.8400	60.98	11.70	-24.70	314.8400	58.90	17.70	-30.70
472.2600	65.98	16.70	-29.70	472.2600	67.20	26.00	-39.00
629.6800	67.08	17.80	-30.80	629.6800	69.30	28.10	-41.10
787.1000	66.28	17.00	-30.00	787.1000	69.00	27.80	-40.80
944.5200	66.18	16.90	-29.90	944.5200	69.10	27.90	-40.90
1101.9400	66.78	17.50	-30.50	1101.9400	69.20	28.00	-41.00
1259.3600	65.58	16.30	-29.30	1259.3600	64.50	23.30	-36.30
1416.7800	63.98	14.70	-27.70	1416.7800	68.80	27.60	-40.60
1574.2000	66.08	16.80	-29.80	1574.2000	68.30	27.10	-40.10

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TECHNICAL DATA:

- 80.203 (b) **External Controls:** The transmitter is capable of changing frequency between 156.05 – 157.425 MHz by external control. The available channels are shown in the User Manual description Channel List. These channels are preprogrammed by the manufacturer and change of frequency is inaccessible to the station operator.
- 80.203 (c) Five minutes continuous transmission test. An external timer digital clock was used to observe the duration of the un-modulated transmission. The transmitter turned off and the radio went to receive mode at 4 minutes, 58 seconds as displayed by the external digital clock.

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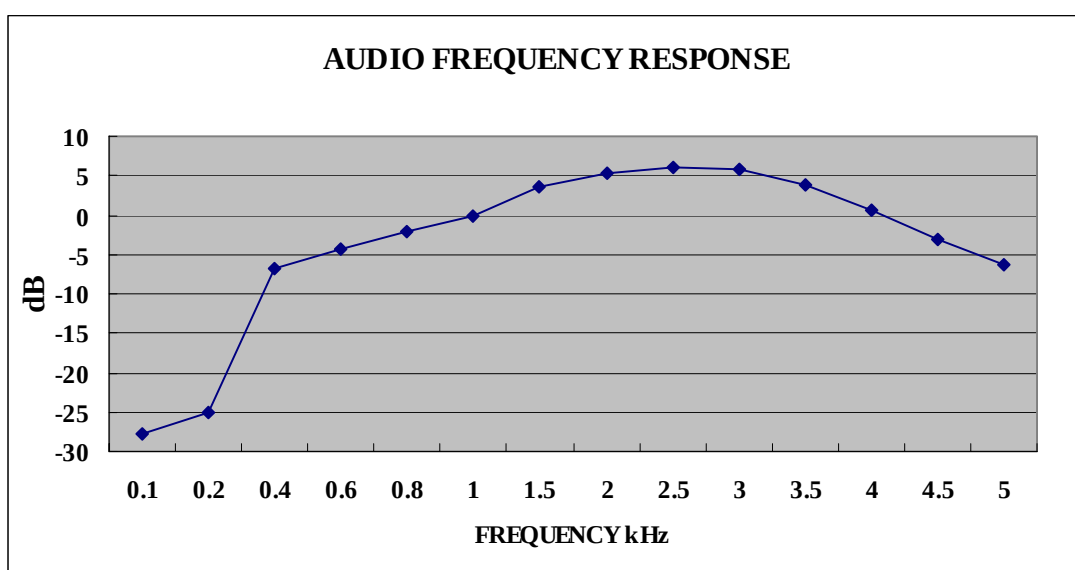
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2.1047 (a) Voice Modulation characteristics:

(b) AUDIO FREQUENCY RESPONSE

See the following plot.

Audio Frequency Response Plot



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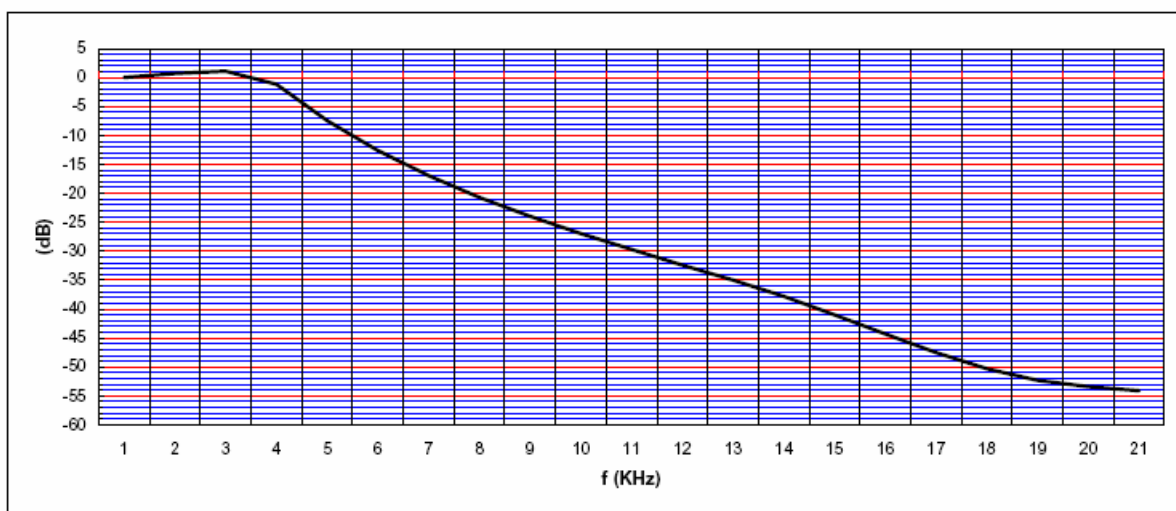
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2.1047(a) AUDIO LOW PASS FILTER

The audio low pass filter shown in the following plot.

Audio Low Pass Filter



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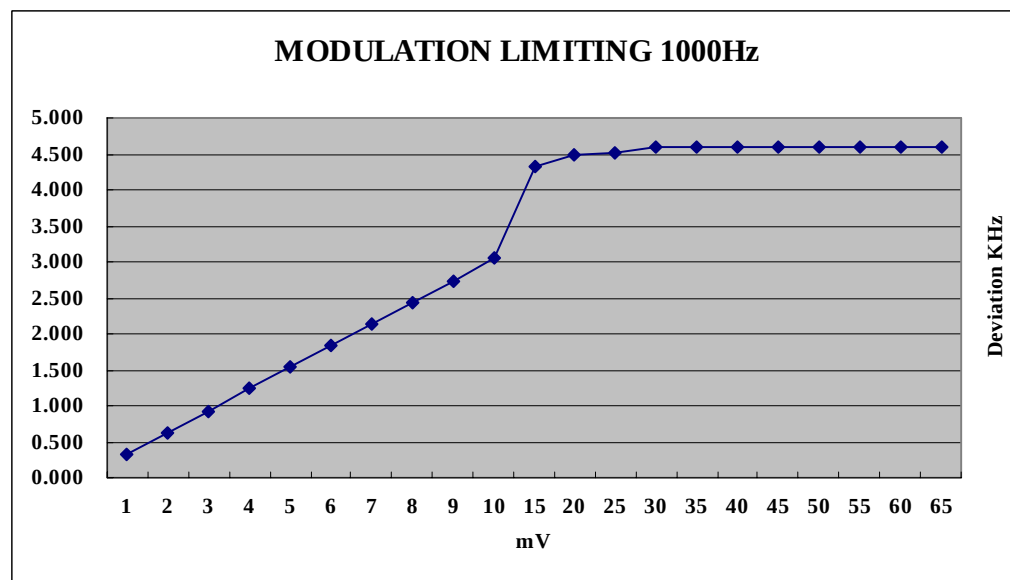
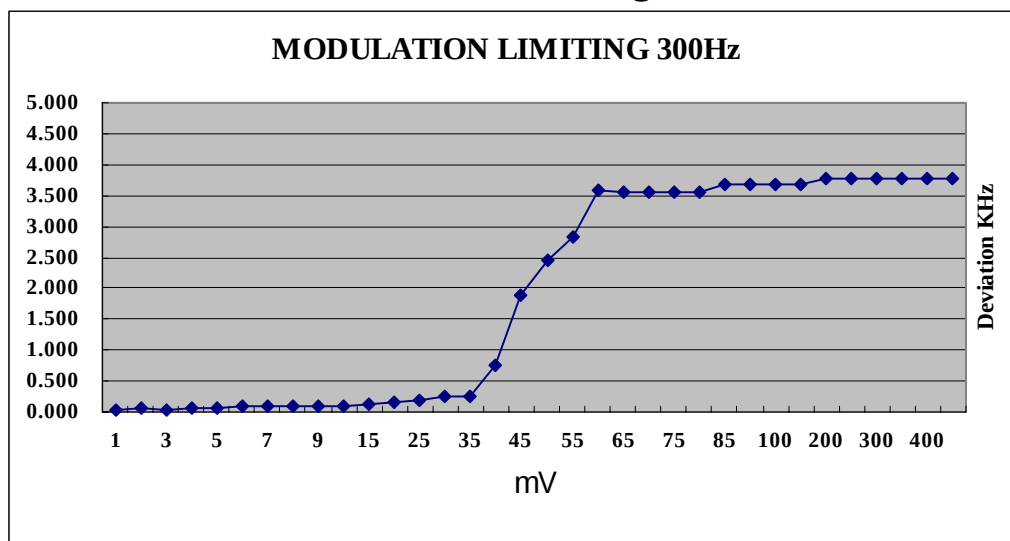
2.1047 (b)

Audio input versus modulation

80.213 (d)

A plot of the audio input versus deviation is shown in the following plots.

Modulation Limiting Plots



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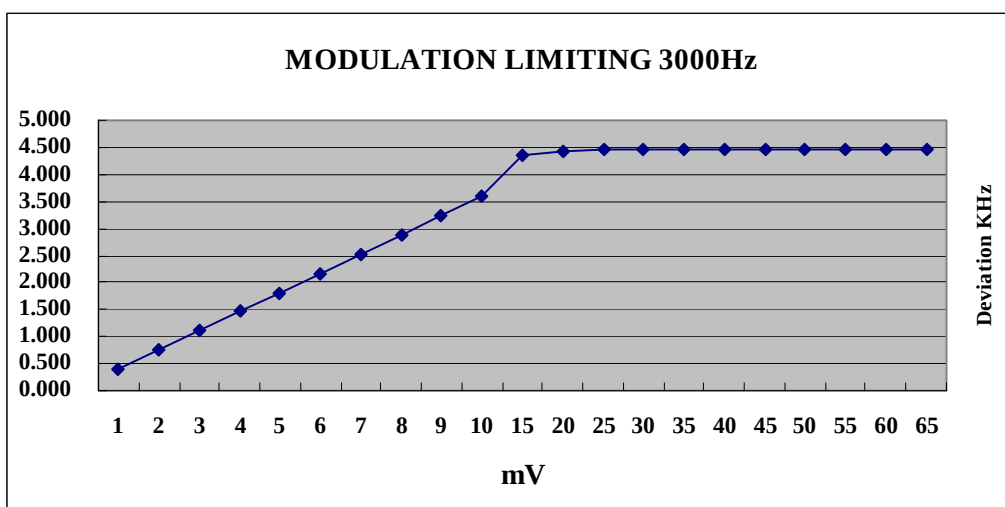
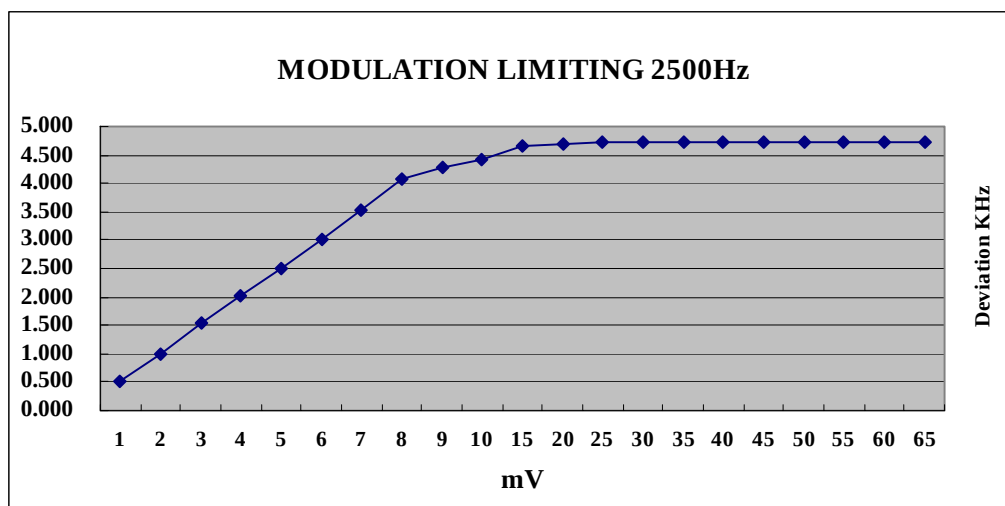
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2.1049(c)
80.213 (b)

Occupied bandwidth:

Data in the plots shows that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB.

On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35dB.

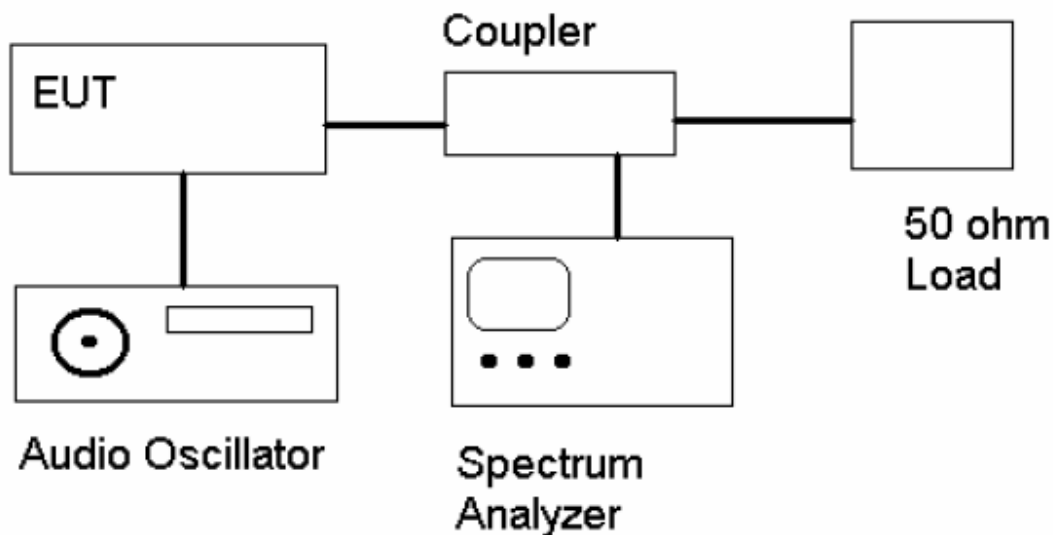
On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least $43 + \log(P)$ dB.

Radiotelephone transmitter with modulation limiter.

Test procedure: TIA/EIA-603 para 2.2.11, with the exception that various tones were used.

Test procedure diagram

OCCUPIED BANDWIDTH MEASUREMENT



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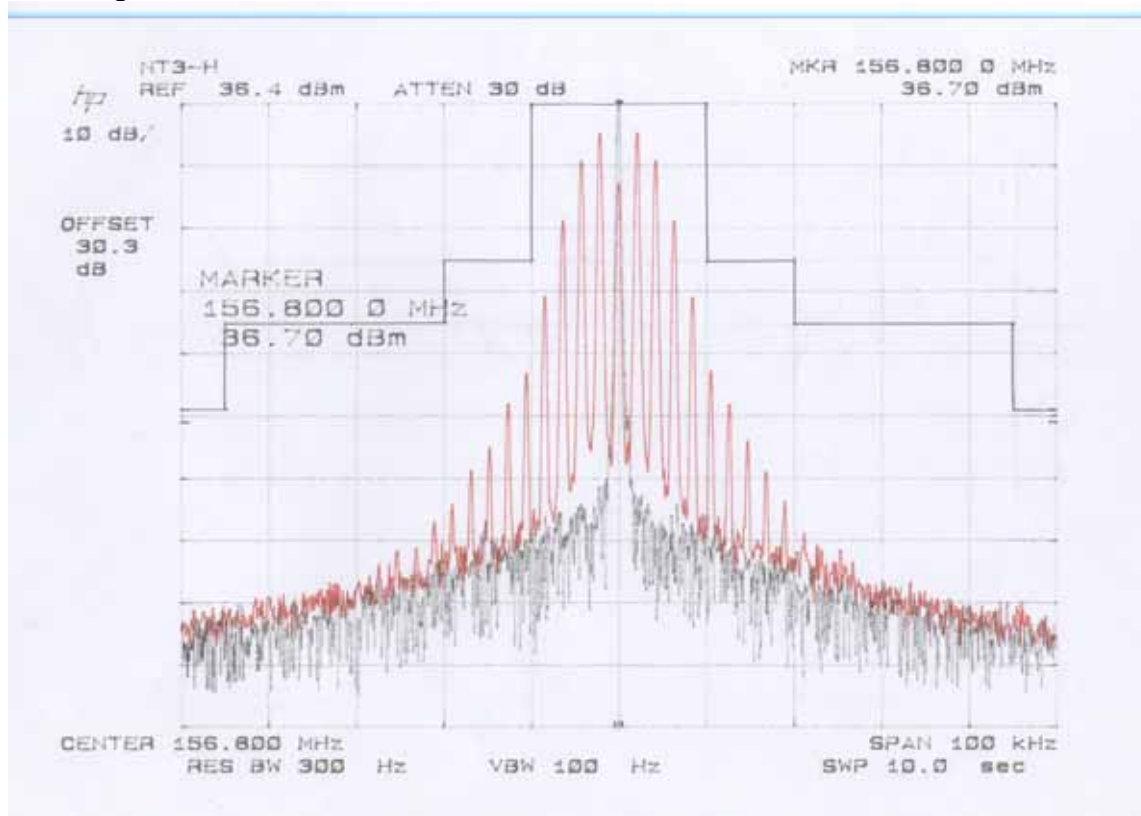
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OCCUPIED BANDWIDTH PLOT

16CH-High



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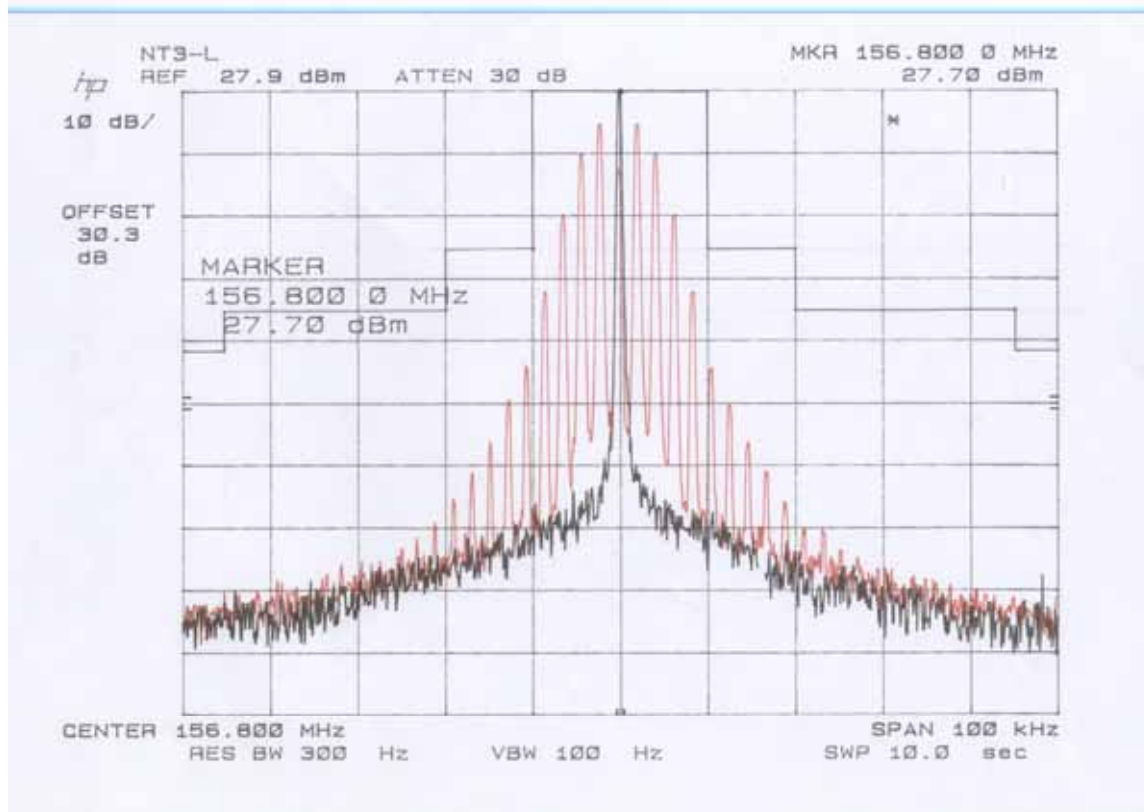
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16CH-Low



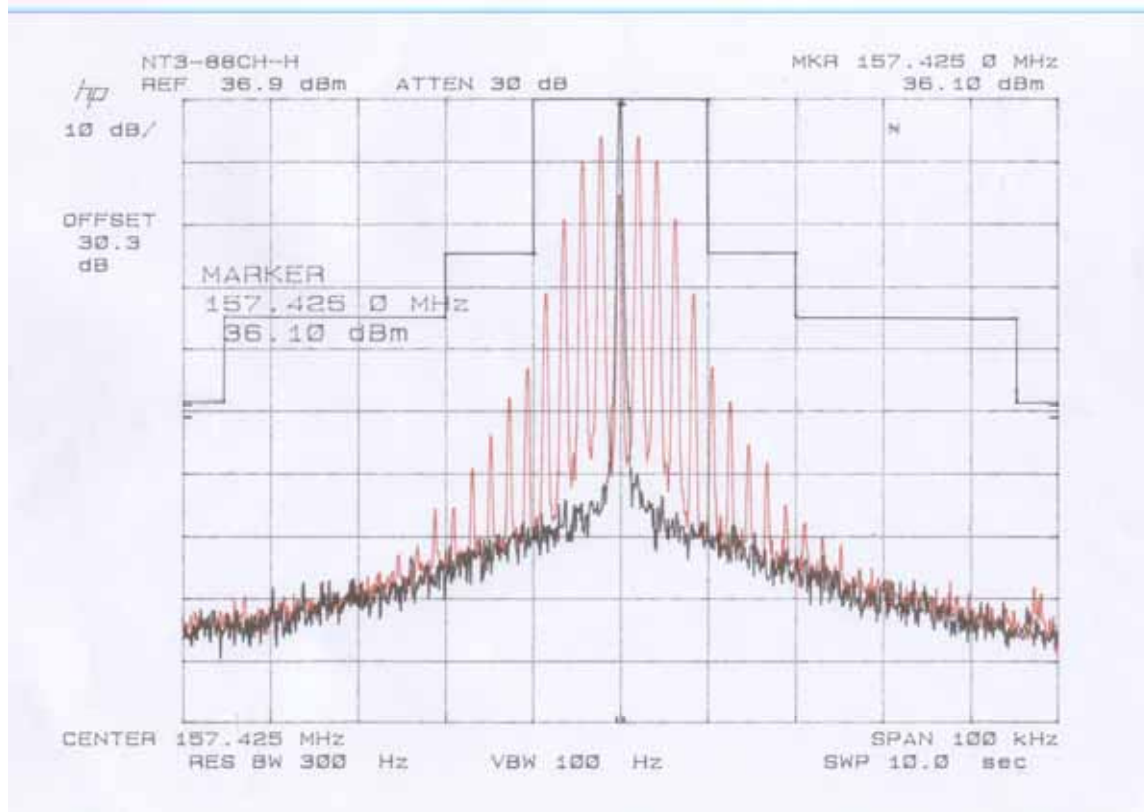
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88A CH-High



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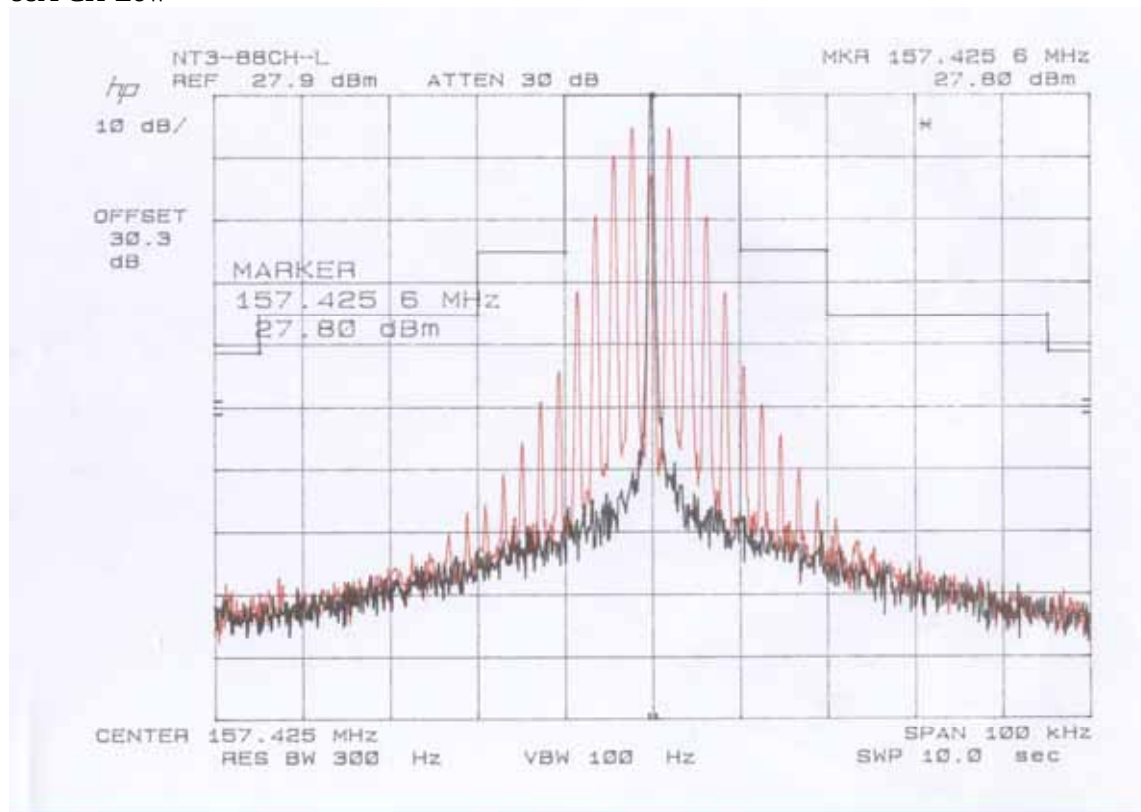
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88A CH-Low



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2.1053(a)

Field strength of spurious emissions:

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

REQUIREMENTS: Emissions must be $43 + 10\log(P_o)$ dB below the mean power output of the transmitter.

16 CH High : $43 + 10\log(4.3) = 49.33$

Low : $43 + 10\log(0.68) = 41.33$

88A CH High : $43 + 10\log(4.2) = 49.28$

Low : $43 + 10\log(0.66) = 41.20$

TEST DATA – Horizontal

16CH-High

16CH-Low

frequency	dBc	Margin	dBm	frequency	dBc	Margin	dBm
156.8000	0	0		156.8000	0	0	
313.6000	57.60	8.27	-21.27	313.6000	44.50	3.17	-16.17
470.4000	66.26	16.93	-29.93	470.4000	65.36	24.03	-37.03
627.2000	59.71	10.38	-23.38	627.2000	52.61	11.28	-24.28
784.0000	67.95	18.62	-31.62	784.0000	59.65	18.32	-31.32
940.8000	61.25	11.92	-24.92	940.8000	56.55	15.22	-28.22
1097.6000	62.98	13.65	-26.65	1097.6000	55.08	13.75	-26.75
1254.4000	61.71	12.38	-25.38	1254.4000	50.71	9.38	-22.38
1411.2000	65.04	15.71	-28.71	1411.2000	57.94	16.61	-29.61
1568.0000	61.96	12.63	-25.63	1568.0000	52.76	11.43	-24.43

88A CH-High

88A CH-Low

frequency	dBc	Margin	dBm	frequency	dBc	Margin	dBm
157.4200	0	0		157.4200			
314.8400	54.12	4.84	-17.84	314.8400	42.54	1.34	-14.34
472.2600	66.06	16.78	-29.78	472.2600	65.98	24.78	-37.78
629.6800	63.19	13.91	-26.91	629.6800	57.21	16.01	-29.01
787.1000	67.44	18.16	-31.16	787.1000	58.46	17.26	-30.26
944.5200	62.57	13.29	-26.29	944.5200	54.59	13.39	-26.39
1101.9400	61.30	12.02	-25.02	1101.9400	54.12	12.92	-25.92
1259.3600	61.33	12.05	-25.05	1259.3600	52.65	11.45	-24.45
1416.7800	63.26	13.98	-26.98	1416.7800	56.48	15.28	-28.28
1574.2000	59.91	10.63	-23.63	1574.2000	49.73	8.53	-21.53

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2.1053(a)

Field strength of spurious emissions:

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

REQUIREMENTS: Emissions must be $43 + 10\log(P_o)$ dB below the mean power output of the transmitter.

16 CH High : $43 + 10\log(4.3) = 49.33$

Low : $43 + 10\log(0.68) = 41.33$

88A CH High : $43 + 10\log(4.2) = 49.28$

Low : $43 + 10\log(0.66) = 41.20$

TEST DATA – Vertical

16CH-High

16CH-Low

frequency	dBc	Margin	dBm	frequency	dBc	Margin	dBm
156.8000	0	0		156.8000	0	0	
313.6000	61.10	11.77	-24.77	313.6000	52.50	11.17	-24.17
470.4000	75.66	26.33	-39.33	470.4000	68.16	26.83	-39.83
627.2000	62.11	12.78	-25.78	627.2000	51.51	10.18	-23.18
784.0000	68.25	18.92	-31.92	784.0000	60.85	19.52	-32.52
940.8000	57.75	8.42	-21.42	940.8000	56.35	15.02	-28.02
1097.6000	63.38	14.05	-27.05	1097.6000	52.88	11.55	-24.55
1254.4000	58.31	8.98	-21.98	1254.4000	49.41	8.08	-21.08
1411.2000	63.74	14.41	-27.41	1411.2000	55.64	14.31	-27.31
1568.0000	60.76	11.43	-24.43	1568.0000	53.76	12.43	-25.43

88A CH-High

88A CH-Low

frequency	dBc	Margin	dBm	frequency	dBc	Margin	dBm
157.4200	0	0		157.4200			
314.8400	60.72	11.44	-24.44	314.8400	50.74	9.54	-22.54
472.2600	70.16	20.88	-33.88	472.2600	66.38	25.18	-38.18
629.6800	64.49	15.21	-28.21	629.6800	57.11	15.91	-28.91
787.1000	68.74	19.46	-32.46	787.1000	58.16	16.96	-29.96
944.5200	62.07	12.79	-25.79	944.5200	54.39	13.19	-26.19
1101.9400	63.40	14.12	-27.12	1101.9400	53.82	12.62	-25.62
1259.3600	58.23	8.95	-21.95	1259.3600	48.35	7.15	-20.15
1416.7800	64.96	15.68	-28.68	1416.7800	54.88	13.68	-26.68
1574.2000	60.61	11.33	-24.33	1574.2000	50.53	9.33	-22.33

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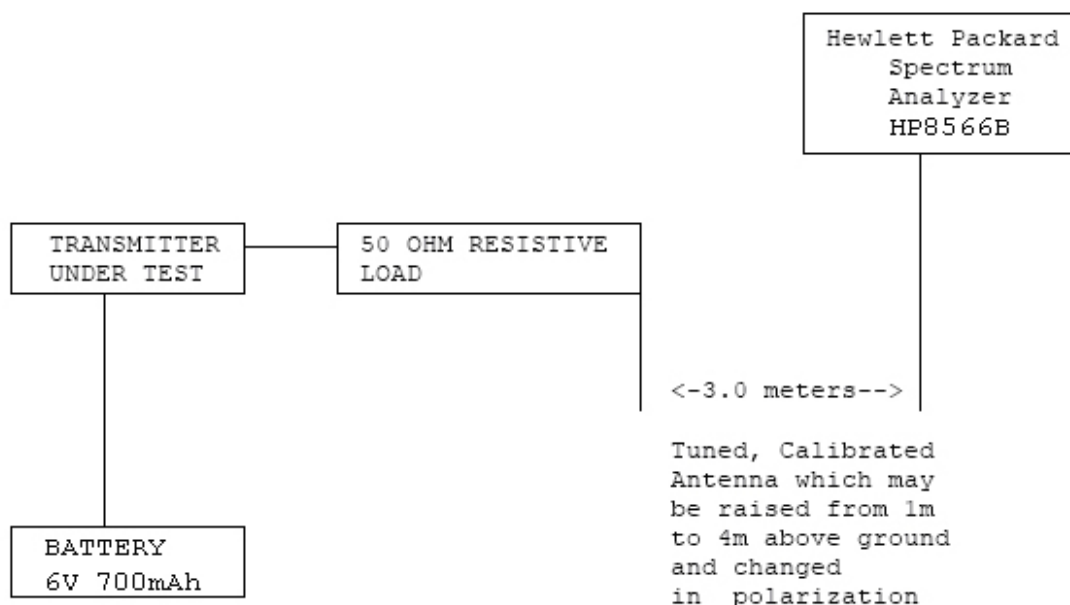
THRU Lab & Engineering.

477-6, Hager-Ri, Yoju-Up, Yoju-Gun

Kyunggi-Do, 469-803, Korea

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Method of Measuring Radiated Spurious Emissions



Equipment placed 80 cm above ground on a rotatable platform.

METHOD OF MEASUREMENT: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 to at least the tenth harmonic of the fundamental. This test was conducted per TIA/EIA STANDARD 603 using the substitution method. Measurements were made at the open field test site of THRU Lab & Engineering, located at 477-6, Hager-Ri, Yoju-Up, Yoju-Gun, Kyunggi-Do, 469-803, Korea

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Frequency stability:

2.1055(a)(2)

80.209 (a)

Temperature and voltage tests were performed to verify that the frequency remains within the 0.0010%, 10 ppm specification limit. The test was conducted as follows:
The transmitter was placed in the temperature chamber at 25°C and allowed to stabilize for one hour. The transmitter was keyed ON for one minute during which four frequency readings were recorded at 15 second intervals.

The worst case number was taken for temperature plotting. The assigned channel frequency was considered to be the reference frequency. The temperature was then reduced to -20°C after which the transmitter was again allowed to stabilize for one hour.

The transmitter was keyed ON for one minute, and again frequency readings were noted at 15 second intervals. The worst case number was recorded for temperature plotting.

This procedure was repeated in 10 degree increments up to + 50°C.

Readings were also taken at minus 15% of the battery voltage, which we estimate to be the battery endpoint.

MEASUREMENT DATA:

TEMPERATURE()	FREQUENCY(MHz)	PPM	LIMIT(PPM)
Reference	156.80000		
-20	156.80021	1.34	10.0
-10	156.80025	1.59	10.0
0	156.80030	1.91	10.0
10	156.80031	1.98	10.0
20	156.80029	1.85	10.0
30	156.79999	-0.06	10.0
40	156.79991	-0.57	10.0
50	156.79985	-0.96	10.0
End point of battery : 3.72V	156.80007	0.45	10.0

RESULTS OF MEASUREMENTS: The test results indicates that the EUT meets the requirements.

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