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HANDHELD MARINE RADIO

PER FCC PT 80 & IC RSS-182

TEST REPORT

APPLICANT	Navico APAC Limited
ADDRESS	3-5 Omega Street Building A Albany 0632 Auckland, New Zealand
FCC ID	RAYLHR80US
IC LABEL	IC: 4697A-LHR80U
TESTED MODEL	LHR-80U
FAMILY MODEL(S)	N/A
PRODUCT DESCRIPTION	Handheld Marine Radio
DATE SAMPLE RECEIVED	February 25, 2008
DATE TESTED	March 4, 2008
TESTED BY	Nam Nguyen
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	397AUT8TestReport.PDF
TEST RESULTS	☒ PASS ☐ FAIL

ACCREDITED
Certificate # 0955-01

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ATTESTATION

This equipment has been tested in accordance with the standards identified in the referenced test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

The test results relate only to the items tested.

Test Certificate #0955-01

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made by me or under my supervision, at Timco Engineering, Inc. located at 849 N.W. State Road 45, Newberry, Florida 32669 USA.

Authorized by: Mario de Aranzeta

Signature: On File

Function: Test Lab Supervisor / Engineer

Date: March 17, 2008

REPORT SUMMARY

Disclaimer	The test results related only to the items tested.
Purpose of Test	To show the DUT in compliance with FCC CFR 47 Part 80 and Industry Canada RSS-182 requirements for handheld marine radio.
Test Procedures	ANSI/TIA 603-C: 2004, FCC CFR 47 Part 80, ANSI C63.4: 2003 IC RSS-182
Related Approval(s)/ Report(s)	N/A

TEST ENVIRONMENT AND TEST SETUP

Test Facility	All tests were conducted by Timco Engineering Inc. located at 849 NW State Road 45, Newberry, FL 32669 USA
Laboratory Test Condition	Temperature: 26ºC Relative humidity: 50%.
Deviation from the standards	No deviation
Modification to the DUT	No modification was made.
Test Exercise (software etc.)	The DUT was placed in continuous transmitting mode of operation.
System Setup	No testing accessories. The DUT is a stand alone device.

DUT DESCRIPTION

Manufactured by	Navico APAC Limited
Product Description	Handheld Marine Radio
FCC ID	RAYLHR80US
IC Label	IC: 4697A-LHR80U
M/N	LHR-80U (representing the worst-case scenario)
Family M/Ns	N/A
Trade Name	Lowrance
S/N	N/A
Model Variance	N/A
Power Source	7.4V, 1800mAH
Accessories	Belt Clip Hand Strap Rubber Duck Antenna 7.4V Li-ion Battery Pack Desk Top Charger (Charging Cradle) AC 230V/DC 12V Wall Adapter (CE)
Test Item	Preproduction
Type of DUT	Portable

TECHNICAL SUMMARY

FCC Rule Part IC Rule Part	Item	Description
Pt 2.1033(c) (6) RSS-182	Operating Frequency	156.025 ~ 157.425 MHz
Pt 80.205 (a) RSS-182	Occupied Bandwidth	16 kHz
Pt 2.1033(c)(7) RSS-182	Power Range and Controls	There is a user power switch for High/Low Power. Maximum Output Power Rating: High 5 Watts, 1 Watt into a 50-ohm resistive load.
Pt 2.1033(c)(8) RSS-182	DC Voltages and Current into Final Amplifier	Power Input Final Amplifier Only High Low Vce = 7.40 V Vce = 6.60 V Ice = 1.50 A. Ice = 0.76 A Pin = 11.10 Watts Pin = 5.02 Watts
Pt 2.1046 Pt 80.215 (b)(2) RSS-182	Max. Output Pwr	High: 5 W Low: 1 W
Pt 80.205(a)	Modulation	FM
Pt 80.271(a)(6)	Antenna Socket	SMA
Pt 2.1033(c) Pt 80.205(a) (5)	Type of Emissions	Bn = 2(M) + 2DK M = 3000 D = 4900 K=1 Bn = 2(3000) + 2(4900) = 15.8 kHz
Pt 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 are inaccessible to the station operator.

[Continued]

FCC Rule Part IC Rule Part	Item	Description
Pt 80.203 (c)	Five minutes continuous transmission test.	The antenna was connected to a dummy load and the radio was locked in a transmit PTT mode. 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.
Pt 80.203 (n) Pt 80.225	DSC Capability	This radio has SC101 DSC capability in the 156 – 162 MHz band.
Pt 80.873 Pt 80.956 Pt 80.911 (a)	G3E Transmissions	This radio is capable of G3E emission on 156.300 and 156.800 MHz
Pt 80.911 (c)	Certified transmitting power	Not Applicable - Handheld Radio (With 13.6 VDC applied and with the radio connected to a 50 ohm resistive wattmeter, the output power was measured at 156.300 and 156.800 MHz with a measured reading of 25 Watts under normal speech modulation.)
Pt 80.911 (d)(2)	80.959	Not Applicable – Handheld Radio (With the power supply set to 13.6 VDC, and the output of the transmitter terminated in a 50 ohm matching artificial load, the transmitter output power was monitored over a 10-minute continuous operational period while in full power. The output power varied from the nominal 25 Watts output power to 24.8 Watts output power.)

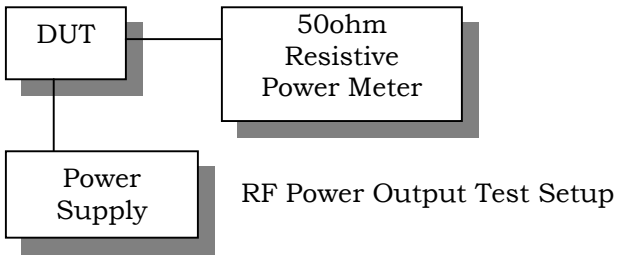
TEST EQUIPMENT

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 12/7/07	12/7/09
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 12/7/07	12/7/09
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 12/8/07	12/8/09
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 12/8/07	12/8/09
Antenna: Biconnical	Electro-Metrics	BIA-25	1171	CAL 7/18/07	7/18/09
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	CAL 12/1/06	12/1/08
Antenna: Double-Ridged Horn	Electro-Metrics	RGA-180	2319	CAL 12/29/06	12/29/08
LISN	Electro-Metrics	ANS-25/2	2604	CAL 10/5/06	10/5/08
Termaline Wattmeter	Bird Electronic Corporation	611	16405	CAL 3/15/07	3/15/09

TEST PROCEDURE

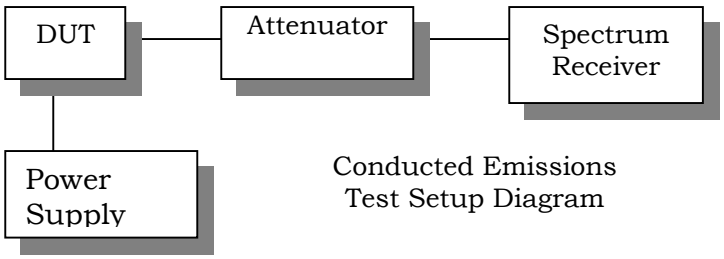
Power Line Conducted Interference
The procedure used was ANSI 63.4-2003 using a 50uH LISN. Both lines were observed with the DUT transmitting. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

RF Power Output
The RF power output was measured at the antenna feed point using a peak power meter. A 50-ohm, resistive wattmeter was connected to the RF output connector. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:



RF Power Output Test Setup

Spurious Emissions At Antenna Terminals (Conducted)
The carrier was modulated 100%. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz. The measurements were made in accordance with standard ANSI/TIA-603-C: 2004



Conducted Emissions
Test Setup Diagram

Radiation Interference
The test procedure used was ANSI/TIA-603-C: 2004 and ANSI C63.4-2003 using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

Modulation Characteristic

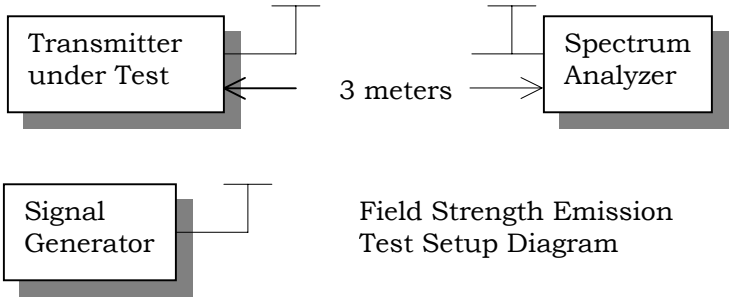
Audio frequency response
The audio frequency response was measured in accordance with ANSI/TIA 603-C: 2004.

Audio Low Pass Filter
The audio low pass filter for voice-modulated equipment was measured in accordance with ANSI/TIA 603-C: 2004.

Audio Input versus modulation
The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA 603-C: 2004. Curves are provided for audio input frequencies of 300, 1000, and 3000 Hz.

Frequency Stability
The frequency stability was measured per ANSI/TIA 603-C: 2004.

Field Strength of Spurious Emissions
The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per ANSI/TIA 603-C: 2004 using the substitution method.



Field Strength Emission Test Setup Diagram

TEST RESULT

RF POWER OUTPUT

Rule Part No.: Pt 2.1046(a), Pt 80.215, RSS-182

Requirements: Pt 80.215: 10 W
RSS-182: 5 W

Test Data: High Power = 5 W

Low Power = 1 W

MODULATION CHARACTERISTICS

Rule Parts No.: Pt 2.1047(a)(b), Pt 80, RSS-182

Requirements: A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 5000Hz shall be submitted.

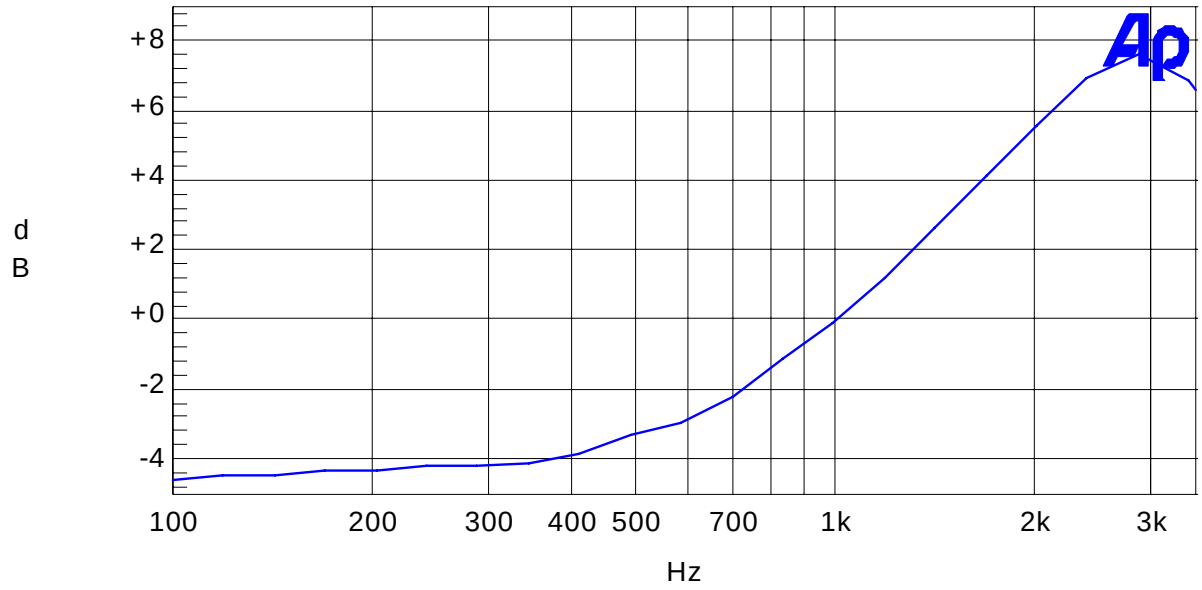
For voice modulated communication equipment, a curve or equivalent data showing audio low pass filter shall be submitted.

Audio input versus modulation cannot exceed 100%.

RSS-182: The audio-frequency band shall be limited to 3000 kHz.

Test Data:

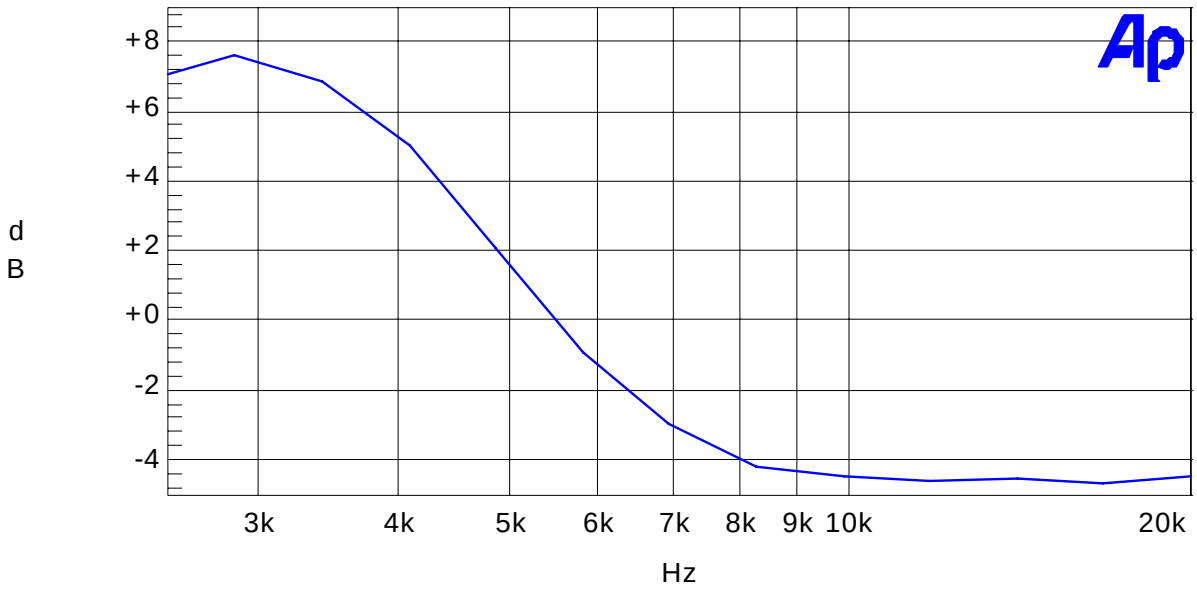
Audio Frequency Response Plot



Color	Line Style	Thick	Data	Axis
Blue	Solid	1	Anlr.Level A!Normalize	Left

MaxFreq.at1

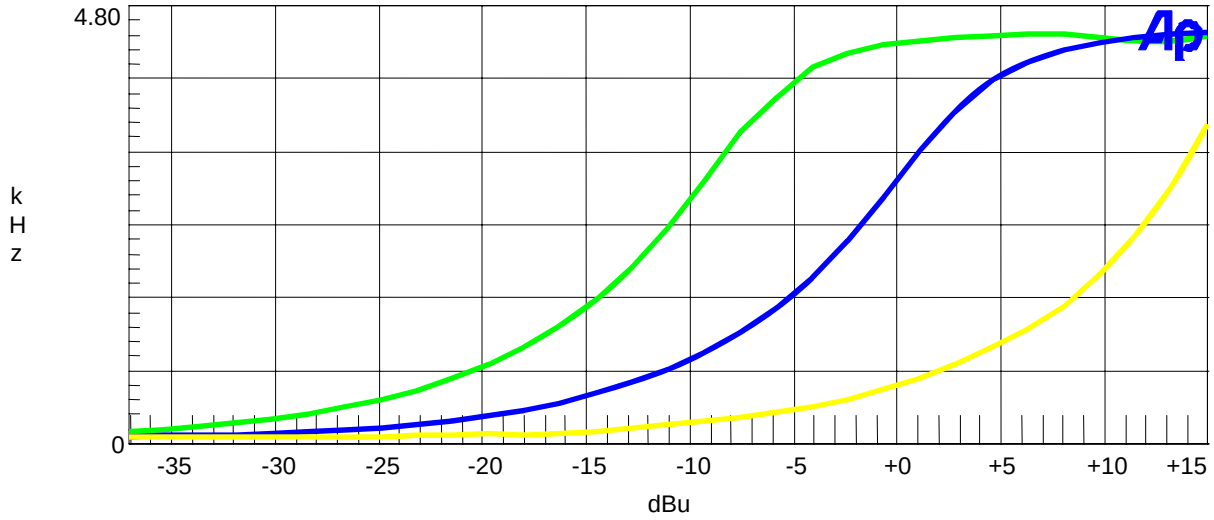
Audio Low Pass Filter



Color	Line Style	Thick	Data	Axis
Blue	Solid	1	Anlr.Level A!Normalize	Left

MaxFreq.at1

Modulation Limiting plot: 3.0 KHz (Green), 1.0 KHz (Blue), and 300 Hz



Color	Line Style	Thick	Data	Axis
Green	Solid	3	Anlr.Level A	Left
Blue	Solid	3	Anlr.Level A	Left
Yellow	Solid	3	Anlr.Level A	Left

modulation limiting.at1

OCCUPIED BANDWIDTH

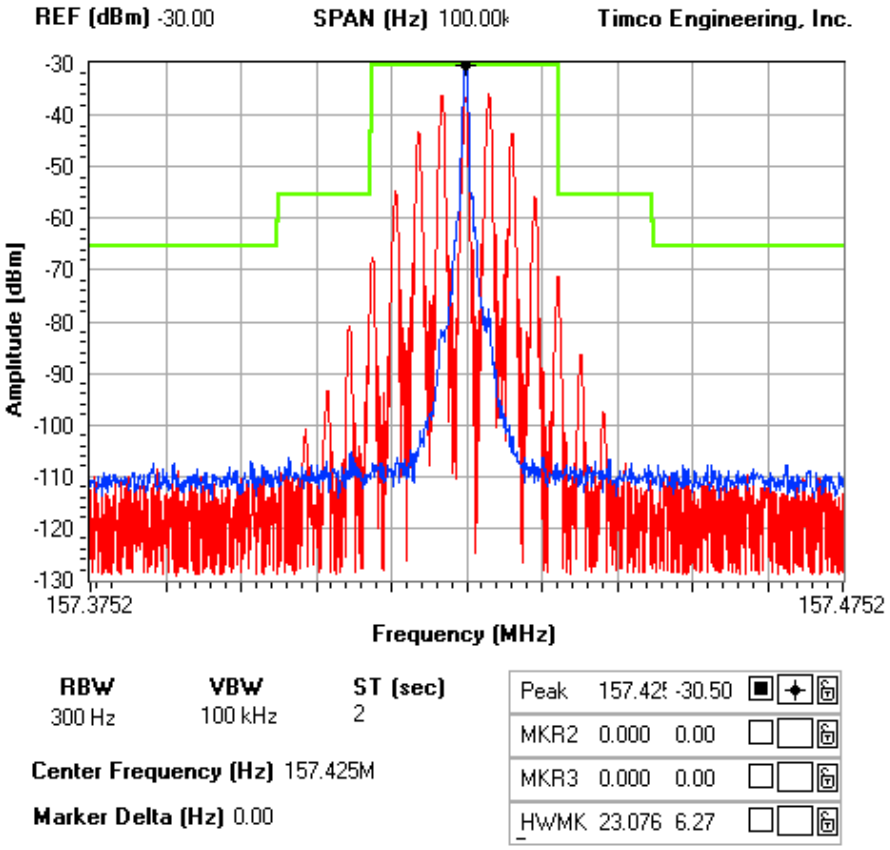
Rule Parts No: Pt 2.1049, Pt 80.213(b), RSS-182

Test Requirement:
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.

RSS-182: The nominal authorized channel bandwidth for voice is 16 kHz. For data modulation, an authorized bandwidth of 20 kHz is permitted.

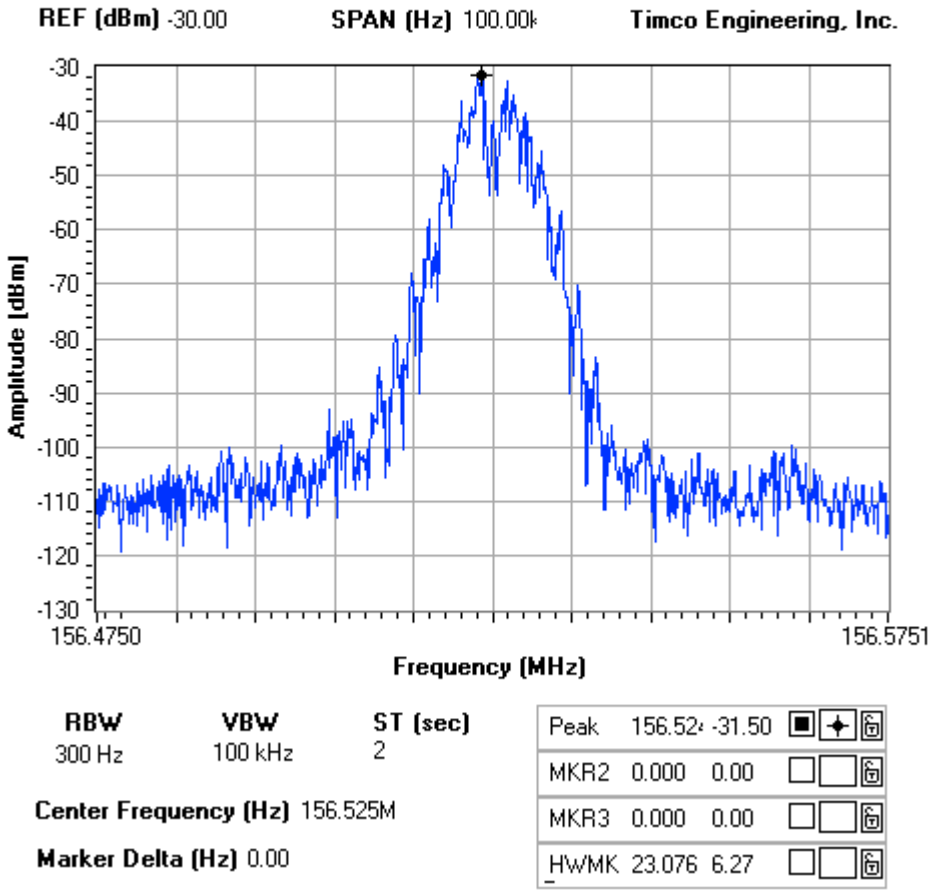
Test Data:

NOTES:
NAVICO APAC LIMITED - FCC ID: RAYLHR-80
OCCUPIED BANDWIDTH PLOT



NOTES:

NAVICO APAC LIMITED - FCC ID: RAYLHR-80
OCCUPIED BANDWIDTH PLOT -



SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Pt 2.1051(a), Pt 80.211(d)(2)

Requirements: High Power: 43 + 10log(Po)=43 + 10log(5)= 57 dB
Low Power: 43 + 10log(Po) = 43 + 10log(1) = 43 dB

Test Data:

5W

Emission Frequency MHz	dB Below Carrier (dBc)	Emission Frequency MHz	dB Below Carrier (dBc)
156.40	0	157.43	0
312.80	72	314.85	71.8
469.20	88.2	472.28	81.7
625.60	95.1	629.70	93.6
782.00	88.9	787.13	89.5
938.40	95.4	944.55	95.6
1094.80	Ne	1101.98	Ne
1251.20	Ne	1259.40	Ne
1407.60	Ne	1416.83	Ne
1564.00	Ne	1574.25	Ne

1 W

Emission Frequency MHz	dB Below Carrier (dBc)	Emission Frequency MHz	dB Below Carrier (dBc)
156.40	0	157.43	0
312.80	67.2	314.85	68.4
469.20	87.5	472.28	84.6
625.60	91	629.70	88.6
782.00	84.2	787.13	84.5
938.40	92.2	944.55	92.6
1094.80	Ne	1101.98	
1251.20	Ne	1259.40	
1407.60	Ne	1416.83	
1564.0	Ne	1574.25	

FIELD STRENGTH OF SPURIOUS EMISSIONS (RADIATED)

Rule Parts. No.: Part 2.1053

Requirements: High Power: 43 + 10log(Po)= 43 + 10log(5) = 57dB
Low Power: 43 + 10log(Po) = 43 + 10log(1) = 43 dB

Test Data:

5 W

Emission Frequency MHz	Ant. Polarity V/H	dB Below Carrier (dBc)	Emission Frequency MHz	Ant. Polarity V/H	dB Below Carrier (dBc)
156.40		0	157.43		0
312.80	V	99.34	314.85	V	100.14
469.20	V	93.41	472.28	V	92.03
625.60	V	78.05	629.70	V	78.02
782.00	V	93.72	787.13	V	92.53
938.40	V	86.58	944.55	V	85.27
1094.80	V	95.19	1101.98	V	96.55
1251.20	V	93.6	1259.40	V	92.45
1407.60	V	85.7	1416.83	V	84.35
1564.00	V	88.21	1574.25	V	89.71

1 W

Emission Frequency MHz	Ant. Polarity V/H	dB Below Carrier (dBc)	Emission Frequency MHz	Ant. Polarity V/H	dB Below Carrier (dBc)
156.40		0	157.43		0
312.80	V	93.95	314.85	V	95.35
469.20	V	91.22	472.28	V	87.94
625.60	V	72.36	629.70	V	74.03
782.00	V	87.03	787.13	V	85.34
938.40	V	80.89	944.55	V	80.68
1094.80	V	87.7	1101.98	V	89.36
1251.20	V	86.01	1259.40	V	86.16
1407.60	V	78.21	1416.83	V	0
1564.00	V	83.32	1574.25	V	0

FREQUENCY STABILITY

Rule Parts. No.: Pt 2.1055, Pt 80.209(a)

Requirements: Temperature range requirements: -30 to +50º C.
Voltage Variation +, -15%
±10.0 PPM or ±0.0010%

RSS-182: ±5.0 PPM or ±0.0005%

Test Data:

Full Battery, Frequency 156.400029 MHz

Test Voltage (Vdc) Test Temperature (ºC]	Frequency Stability	Unit [ppm]
-30	156.399603	-2.72
-20	156.399642	-2.47
-10	156.399897	-0.84
0	156.400067	0.24
10	156.400115	0.55
20	156.400029	0.00
30	156.399896	-0.85
40	156.399861	-1.07
50	156.400063	0.22

115% Voltage, Frequency 156.400029 MHz

20	156.400040	0.07

85% Voltage, Frequency 156.400029 MHz

20	156.400023	-0.04

POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: Part 15.207

Requirements:

Frequency (MHz)	Quasi Peak Limits (dBuv)	Average Limits (dBuV)
0.15 – 0.5	66 – 56 *	56 – 46 *
0.5 – 5.0	56	46
5.0 – 30	60	50
* Decreases with logarithm of frequency		

Test Data: N/A