



MPE TEST REPORT

Report Reference No..... : TRE1504001504 R/C.....:70967
FCC ID..... : XYH-MRM400
IC : 8759A-MRM400
Applicant's name..... : RCA Communications Systems
Address..... : 133 West Market Street Suite 227 Indianapolis IN USA
Manufacturer..... : RCA Communications Systems
Address..... : 133 West Market Street Suite 227 Indianapolis IN USA
Test item description : VHF Marine Two-Way Radio
Trade Mark : RCA
Model/Type reference..... : MRM400
Listed Model(s) : RS-507M
Standard : FCC Per 47 CFR 2.1091(b); KDB447498 v05r02
RSS-102
Date of receipt of test sample..... : Apr 7, 2015
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Result..... : PASS

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1. SUMMARY

1.1. Client Information

Applicant:	RCA Communications Systems
Address:	133 West Market Street Suite 227 Indianapolis IN USA
Manufacturer:	RCA Communications Systems
Address:	133 West Market Street Suite 227 Indianapolis IN USA

1.2. Product Description

Name of EUT	VHF Marine Two-Way Radio	
Trade Mark:	RCA	
Model/Type reference:	MRM400	
Listed Model(s):	RS-507M	
Power supply:	DC 13.80V	
Charger information:	/	
Battery information:	/	
Adapter information:	/	
Operation Frequency Range:	From 156.05MHz to 157.425MHz	
Rated Output Power:	High Power:25 Watts(43.98dBm)/Low Power:1 Watts(30.00dBm)	
Modulation Type:	FM for Analog Voice	
	FSK for Digital Data	
Channel Separation:	Analog Voice	25kHz
	Digital Data	25kHz
Antenna Type:	External	
Hard version:	6PD7-2008BMB	
Soft version:	M-2008BM-B0923	

Note: The product has the same digital working characters when operating in both two digitized voice/data mode. So only one set of test results for digital modulation modes are provided in this test report.

1.3. Test frequency list

Modulation Type	Channel Separation	Test Frequency (MHz)
Analog/FM	25kHz	156.05(CH1)
		156.8(CH16)
		157.425(CH88)

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above listed frequency for testing.

1.4. EUT operation mode

The EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test mode No.	Description of operation mode	Additional information
Op 1	FM+BW25kHz+TX	The equipment is set with FM modulation and 25kHz bandwidth at maximum rated power for transmitter, powered by DC 13.80V

1.5. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

●	Power Cable	Length (m) :	3.00
		Shield :	Unshielded
		Detachable :	Undetachable
○	Multimeter	Manufacturer :	/
		Model No. :	/

1.6. Modifications

No modifications were implemented to meet testing criteria.

2. TEST ENVIRONMENT

2.1. Address of the test laboratory

Shenzhen Huatongwei International Inspection Co., Ltd
Keji Nan No.12 Road, Hi-tech Park, Shenzhen, China
Phone: 86-755-26715686 Fax: 86-755-26748089

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2009) and CISPR Publication 22.

2.2. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

2.3. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen Huatongwei laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.57 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

2.4. Equipments Used during the Test

AC&DC Power Conducted Emission				
Name of Equipment	Manufacturer	Model	Serial Number	Last Cal.
Field Probe	AR	FW5004	300239	2014/11/1
Field Meter	AR	HI-605	00064170	2014/11/1

The calibration interval was one year.

3. Method of measurement

3.1. Applicable Standard

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

IEEE Std C95.1: 2005: "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz".

FCC OET Bulletin 65, Edition 97-01: "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields".

FCC Supplement C to OET Bulletin 65, Edition 01-01: "Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emission".

IEEE Std C95.3: 2002: "IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields with Respect to Human Exposure to Such Fields, 100 kHz – 300 GHz",

KDB447498 v05r02: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

According to RSS-102 Section 4:

For the purpose of this standard, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6.

3.2. Limit

FCC Part 1.1310:

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f ²	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f=frequency in MHz

*=Plane-wave equivalent power density

RSS-102:

RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Averaging Time (minutes)
0.003-1	280	2.19	-	6
1-10	280/f	2.19/f	-	6
10-30	28	2.19/f	-	6
30-300	28	0.073	2*	6
300-1500	$1.585 f^{0.5}$	$0.0042 f^{0.5}$	f/150	6
1500-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

RF Field Strength Limits for Controlled Use Devices (Controlled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Averaging Time (minutes)
0.003-1	600	4.9	-	6
1-10	600/f	4.9/f	-	6
10-30	60	4.9/f	-	6
30-300	60	0.163	10*	6
300-1500	$3.54 f^{0.5}$	$0.0094 f^{0.5}$	f/30	6
1500-15000	137	0.364	50	6
15000-150000	137	0.364	50	$616000/f^{1.2}$
150000-300000	$0.354 f^{0.5}$	$9.4 \times 10^{-4} f^{0.5}$	$3.33 \times 10^{-4} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.

* Based on nerve stimulation (NS).

** Based on specific absorption rate (SAR).

3.3. Calculating the Safe Distance

Before starting MPE measurements, we calculated the safe distance, R_{safe} using the following formula:

$$R_{\text{safe}} = \sqrt{\frac{P_{\text{max}} \cdot G_n \cdot \eta}{4\pi \cdot S}}$$

G_n : antenna gain (numeric)

P_{max} : maximum power input to the antenna (W)

S : power density limit (W/m²) respectively

η : duty cycle (decimal number), for these measurements $\eta = 0.5$

The results of R_{safe} calculations:

FCC Part 2.1091:

General Population/Uncontrolled Exposure

EUT antenna gain=3dBi

Op 1					
Test Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Antenna Gain (Numeric)	Power Density (mW/cm ²)	Safe Distance (cm)
156.05	44.06	25468.30	1.9953	0.2000	101
156.8	44.08	25585.86	1.9953	0.2000	101
157.425	44.08	25585.86	1.9953	0.2000	101

EUT antenna gain=3.5dBi

Op 1					
Test Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Antenna Gain (Numeric)	Power Density (mW/cm ²)	Safe Distance (cm)
156.05	44.06	25468.30	2.2387	0.2000	107
156.8	44.08	25585.86	2.2387	0.2000	107
157.425	44.08	25585.86	2.2387	0.2000	107

RSS-102:

General Public (Uncontrolled Environment)

EUT antenna gain=3dBi

Op 1					
Test Frequency (MHz)	Output Power (dBm)	Output Power (W)	Antenna Gain (Numeric)	Power Density (W/m ²)	Safe Distance (cm)
156.05	44.06	25.4683	1.9953	1.2910	125
156.8	44.08	25.5859	1.9953	1.2910	125
157.425	44.08	25.5859	1.9953	1.2910	125

EUT antenna gain=3.5dBi

Op 1					
Test Frequency (MHz)	Output Power (dBm)	Output Power (W)	Antenna Gain (Numeric)	Power Density (W/m ²)	Safe Distance (cm)
156.05	44.06	25.4683	2.2387	1.2910	133
156.8	44.08	25.5859	2.2387	1.2910	133
157.425	44.08	25.5859	2.2387	1.2910	133

Note:

Antenna Information:

Description	Gain	Mount Type	Model
Radome Material Fiberglass	3dBi	Roof	TQJ-GB-3-159.5V
Radome Material Fiberglass	3.5dBi	Roof	MA-F-3.5-162V-09A (MA-F09A)

3.4. Measurement Procedure

1. Polarization of the EUT's antenna was vertical, which is its polarization in actual use.
2. The EUT at the chosen modulation was set to transmit at the chosen frequency at maximum RF power and at 50% duty cycle (50% duty cycle is simulated either by lowering the radio's power by 3dB or by using a 3 dB pad on the output of the radio). During preliminary measurements, we set the distance between the power density probe and the investigated EUT's antenna equal to the average calculated Rsafe applicable either for controlled or uncontrolled environments.
3. Power density measurements were taken at different heights of the probe from the ground (0.1 to 2 meters) while rotating versus azimuth (from 0° to 360°) the antenna.
4. The azimuth between the probe and the antenna position corresponding to the highest MPE level was chosen as the "worst case" position for the final measurements.
5. For the final measurements, we adjusted the distance between the test probe and the tested antenna to the real safe distance, Rreal, such that the measured highest power density in the "worst case" position was the same or slightly less than the test limit.
6. The measurement results of final measurements conducted at the chosen azimuth and different heights of the probe above the ground are shown in Section 13.
7. Average values of power density were calculated for the imaginary whole human body (0.1–2.0 m), for the lower part of the body (0.1–0.9 m) and for the upper part of the body (1.0–2.0 m).

3.5. Test Results

MPE Data:

Measuring Antenna Height (cm)	FCC Part 2.1091		RSS-102	
	General Population/Uncontrolled Exposure		General Public (Uncontrolled Environment)	
	3dBi Antenna 101cm (mW/cm ²)	3.5dBi Antenna 107cm (mW/cm ²)	3dBi Antenna 125cm (W/m ²)	3.5dBi Antenna 133cm (W/m ²)
10	0.01	0.00	0.03	0.02
20	0.01	0.00	0.05	0.03
30	0.02	0.01	0.16	0.14
40	0.03	0.02	0.22	0.18
50	0.04	0.03	0.26	0.23
60	0.05	0.04	0.32	0.30
70	0.08	0.07	0.39	0.41
80	0.11	0.09	0.47	0.43
90	0.13	0.12	0.51	0.50
100	0.15	0.13	0.57	0.53
110	0.16	0.15	0.68	0.65
120	0.18	0.17	0.74	0.73
130	0.17	0.16	0.81	0.78
140	0.15	0.14	0.76	0.75
150	0.11	0.12	0.71	0.72
160	0.08	0.07	0.66	0.55
170	0.07	0.05	0.53	0.41
180	0.04	0.03	0.31	0.32
190	0.02	0.01	0.16	0.14
200	0.01	0.00	0.08	0.03

MPE for Body Parts:

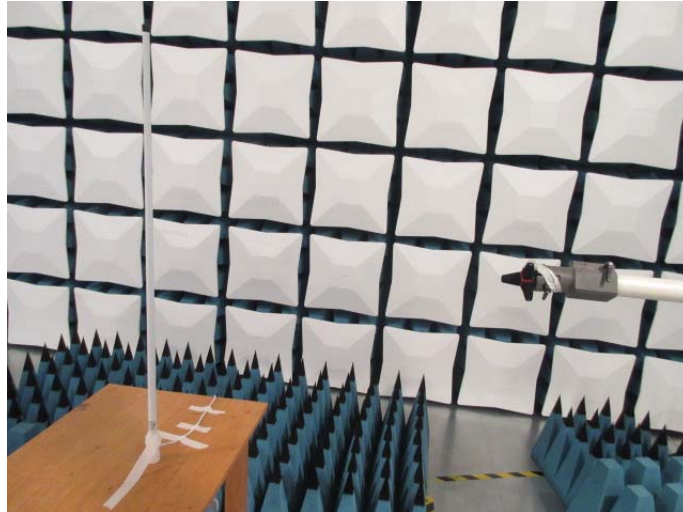
Part of the body / averaging points (m)	FCC Part 2.1091		RSS-102	
	General Population/Uncontrolled Exposure		General Public (Uncontrolled Environment)	
	3dBi Antenna 101cm (mW/cm ²)	3.5dBi Antenna 107cm (mW/cm ²)	3dBi Antenna 125cm (W/m ²)	3.5dBi Antenna 133cm (W/m ²)
Whole body (0.1 to 2.0)	0.14	0.11	0.72	0.68
Lower body (0.1 to 0.9)	0.07	0.06	0.69	0.66
Upper body (1.0 to 2.0)	0.15	0.13	0.75	0.71

3.6. Conclusion

1. The MPE measurements for uncontrolled environments shown in this report were conducted per the applicable FCC/IC Rules, Regulations and Guidance, and determined the minimum safe distances between a user and the EUT antennas gain.
2. The measured MPE are below the maximum allowed limits.
3. The User Manual shall include RF radiation safety warnings and the following:

Antenna	Safe Distance, R _{safe} , (cm)	
	FCC Part 2.1091	RSS-102
	General Population/Uncontrolled Exposure	General Public (Uncontrolled Environment)
TQJ-GB-3-159.5V (3dBi)	101	125
MA-F-3.5-162V-09A (MA-F09A) (3.5dBi)	107	133

3.7. Test Setup Photos of the EUT



.....End of Report.....