


MOTOROLA

CGISS EME Test Laboratory

 8000 West Sunrise Blvd
 Fort Lauderdale, FL. 33322

MPE Compliance Test Report

Date of Report:	August 13,2003
Report Revision(s):	Rev. O
Manufacturer:	Motorola
Product Description:	5-15W Motorcycle Transceiver 136-174MHz
Classification:	Occupational/Controlled Exposure
FCC ID:	AZ492FT3806
Device Model:	M20KSS9PW1AN
Test Period:	07/18/03, 08/12/03
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Note: Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with all applicable national and international reference standards and guidelines.

Signature on file

08/14/03

 Ken Enger
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 Date Approved

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REVISION HISTORY

Date	Revision	Comments
08/13/03	O	Initial release Prototype results

1.0 Product Description



FCC ID AZ492FT3806, model M20KSS9PW1AN is a mobile motorcycle transceiver that utilizes continuous carrier frequency modulation (FM). The modulation could be conventional analog voice, trunked analog voice, tone PL or C4FM digital modulation. Control channel data rates are 3600 and 9600 baud on the C4FM constant envelope carrier. This is not packet or duty cycle modulation configuration. The intended use of the radio is Push-To-Talk (PTT) while the device is properly installed in a motorcycle enclosure with an external antenna.

This device will be marketed to and used by employees solely for work-related operations, such as public safety agencies, e.g. police, fire and emergency medical. User training is the responsibility of these agencies, who can be expected to employ the usage instructions, safety information and operational cautions set forth in the user's manual, instructional sessions or other means. Motorola also makes available to its customers training classes on the proper use of two-way radios and wireless data devices. This device is classified as Occupational/Controlled Exposure. However, in accordance with FCC requirements, the by-stander external to the motorcycle is evaluated to the General Population/Uncontrolled Exposure Limits while the operator is evaluated to the Occupational/Controlled Exposure Limits. The transmit frequency band is 136-174MHz. The rated power of the device is 5-15 watts with a maximum conducted power output of 18 watts.

2.0 Offered Options and Accessories (see Appendix B for photos of antennas)

Antenna	Description
RAD4002ARB	136-144MHz, ¼ Wave, 51cm, 0 dBi
RAD4003ARB	144-150.8MHz, ¼ Wave, 48.1cm, 0 dBi
RAD4004ARB	150.8-162MHz, ¼ Wave, 44.6cm, 0 dBi
RAD4005ARB	162-174 MHz, ¼ Wave, 41.8cm, 0 dBi

3.0 Measurement Standards

By-stander measurements were performed according to FCC Limits Per 47 CFR 2.1091 (b) for General Population/Uncontrolled RF Exposure.

For frequencies ranging from 136-174MHz the MPE (Maximum Permissible Exposure) limit to electromagnetic energy in equivalent plane wave free-space power density is 0.20 mW/cm².

Operator measurements were performed according to FCC Limits Per 47 CFR 2.1091 (b) for Occupational/Controlled RF Exposure.

For frequencies ranging from 136-174 MHz the MPE (Maximum Permissible

Exposure) limit to electromagnetic energy in equivalent plane wave free-space power density is 1.0mW/cm².

4.0 Data Collection Consideration

Power density testing was performed with DUT (Device Under Test) installed on a Kawasaki 1000 motorcycle. The battery used to power the DUT measured 14.0 volts.

5.0 Measurement System Uncertainty Levels

The information below presents an estimate of the possible errors that are associated with the measurement system.

<u>Description</u>	<u>Error</u>
NARDA Survey Meter	± 3%
Repeatability Accuracy	± 7%

6.0 Method of Measurement

6.1 EME measurements made on motorcycle-mounted antennas (for reference, see Antenna Location Layout drawings in Appendix A)

6.1.1 By-stander EME assessment

With the survey meter and probe, take ten (10) measurements, at the standard test distance of 30 cm to the antenna, from the back of the vehicle in a vertical line and then average the results. These measurements are taken and recorded at every twenty (20) centimeters over a range starting at twenty (20) centimeters above ground and ending at 2.0 meters; this would be representative of a person standing next to the motorcycle when the device is transmitting.

6.1.2 Operator EME assessment

While rotating survey meter probe through 180 degrees to ensure that the highest level is found, take the following (3) measurements at the standard test distance of 30cm towards the operators' seat area: scan the lower third of the antenna for a peak reading, scan the middle third of the antenna for a peak reading, and scan the top third (up to 2 meters from ground) for a peak reading. Average the (3) results.

7.0 Test Site

The test site is the Motorola Commercial Government Industrial Solution Sector (CGISS) world wide electromagnetic exposure (EME) open area test site located at 8000 W. Sunrise Blvd., Plantation, FL. 33322.

8.0 Measurement System/Equipment

The minimum equipment required will mainly consist of a test vehicle, radio frequency radiation test set consisting of an Electromagnetic Radiation Survey Meter, E-Field Test Probe, H-Field Test Probe and typical antenna configurations.

Below are the test equipment used to assess compliance:

- a) Automobile: Kawasaki 1000, motorcycle
- b) Survey Meter – NARDA Model 8718 (S/N 01108); Calibration date: 04/14/03
- c) E-Field (Electric Field) Probe – NARDA Model 8722B (SN13001) (300 kHz – 40 Ghz); Calibration date: 05/06/03
- d) H-field (Magnetic Field) Probe – NARDA Model 8731 (S/N03006) 10MHz – 300MHz), Calibration date 03/21/03

9.0 Test Unit Description

Power density measurements were performed on a 5-15 watt mobile motorcycle radio; model number M20KSS9PW1AN serial number 115. The frequency band of the mobile was 136-174 MHz; the test frequencies were 136.0125, 147.0125, 155.0125 and 173.9875MHz. The RAD4002ARB, RAD4003ARB, RAD4004ARB and RAD4005ARB mobile antennas listed in section 2.0 were used to assess MPE compliance.

10.0 Test Set-Up Description

Following are the standard mobile antenna test configurations used for this product. (for reference, see Antenna Location Layout drawings in Appendix A)

11.0 Test Results

Measurements were taken with the antenna located as illustrated in Appendix A. Below is the raw MPE data for all measured grid points. Results are based on a 50% duty cycle with the radio operating in accordance with the User Manual instructions. The bolded power density result represents the highest MPE results observed.

Raw MPE Data; Test Frequencies and measured Po:

136.0125 MHz (Po=18.6W), 147.0125 MHz (Po= 18.6W), 155.0125 MHz (Po= 18.6W), 173.9875 MHz (Po = 18.6 W)

Meter reads in % of controlled limit; controlled limit = 1.0mW/cm² for 136-174 MHz

(Cal factors presented herein are automatically accounted for in the meter used for assessments)

General Population MPE limits = 0.20mW/cm²

Occupational Population in MPE limits = 1.0mW/cm²

Operator Power Density (Pwr. Den. (cal.)) = (Avg.[over ant.]/1.5^{2/3} body ht.)/2

Max cal Operator Power Density (Pwr. Den. (cal.)) = (Pmax/Pintial)*(Avg.[over ant.]/1.5^{2/3} body ht.)/2

By-standard Power Density (Pwr. Den. (cal)) = Avg.[over body]/2

Max cal By-standard Power Density (Pwr. Den. (cal)) = (Pmax/Pintial)*(Avg.[over body]/2

Note: The average over the body test methodology is consistent with IEEE/ANSI C95.1-1999 guidelines

Table 1

Motorcycle Operator MPE Assessment @ 136.0125MHz								
Assessment condition	Antenna / Gain	Meas. Distance (cm)	E/H field	Calibration factor	Average over Antenna (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
Operator	RAD40002ARB / 0dBi	30	E	0.81	0.653	18.6	0.22	0.22
Measurement Grid								
Test position	Height (cm)	% of control limit						
1	Bottom 1/3	107.5%						
2	Middle 1/3	47.8%						
3	Top 1/3	40.5%						

Table 2

Motorcycle by-stander MPE Assessment @ 136.0125 MHz								
Antenna Location	Antenna / Gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
By-Stander	RAD40002ARB / 0dBi	30	E	0.81	0.381	18.6	0.19	0.19
Measurement grid								
Test Position	Height (cm)	% of Control limit	Test position	Height (cm)	% of control limit			
1	20	26.1%	6	120	59.4%			
2	40	24.5%	7	140	94.7%			
3	60	26.1%	8	160	69.9%			
4	80	15.1%	9	180	23.1%			
5	100	33.9%	10	200	8.1%			

Table 3

Motorcycle Operator MPE Assessment @ 147.0125MHz								
Assessment condition	Antenna / Gain	Meas. Distance (cm)	E/H field	Calibration factor	Average over Antenna (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
Operator	RAD40003ARB / 0dBi	30	E	0.82	0.994	18.6	0.33	0.33
Measurement Grid								
Test position	Height (cm)	% of control limit						
1	Bottom 1/3	163.4%						
2	Middle 1/3	79.5%						
3	Top 1/3	55.3%						

Table 4

Motorcycle by-stander MPE Assessment @ 147.0125 MHz								
Antenna Location	Antenna / Gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
By-Stander	RAD40003ARB / 0dBi	30	E	0.82	0.271	18.6	0.14	0.14
Measurement grid								
Test Position	Height (cm)	% of Control limit	Test position	Height (cm)	% of control limit			
1	20	16.2%	6	120	62.2%			
2	40	15.9%	7	140	50.0%			
3	60	9.3%	8	160	28.9%			
4	80	10.6%	9	180	13.9%			
5	100	59.5%	10	200	4.8%			

Table 5

Motorcycle Operator MPE Assessment @ 155.0125MHz								
Assessment condition	Antenna / Gain	Meas. Distance (cm)	E/H field	Calibration factor	Average over Antenna (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
Operator	RAD40004ARB / 0dBi	30	E	0.83	1.045	18.6	0.35	0.35
Measurement Grid								
Test position	Height (cm)	% of control limit						
1	Bottom 1/3	164.7%						
2	Middle 1/3	92.5%						
3	Top 1/3	56.4%						

Table 6

Motorcycle by-stander MPE Assessment @ 155.0125 MHz								
Antenna Location	Antenna / Gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
By-Stander	RAD40004ARB / 0dBi	30	E	0.83	0.248	18.6	0.12	0.12
Measurement grid								
Test Position	Height (cm)	% of Control limit	Test position	Height (cm)	% of control limit			
1	20	10.1%	6	120	58.1%			
2	40	8.4%	7	140	43.3%			
3	60	10.4%	8	160	21.7%			
4	80	15.3%	9	180	7.2%			
5	100	71.0%	10	200	2.6%			

Table 7

Motorcycle Operator MPE Assessment @ 173.9875MHz								
Assessment condition	Antenna / Gain	Meas. Distance (cm)	E/H field	Calibration factor	Average over Antenna (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
Operator	RAD40005ARB / 0dBi	30	E	0.86	1.461	18.6	0.49	0.49
Measurement Grid								
Test position	Height (cm)	% of control limit						
1	Bottom 1/3	260.7%						
2	Middle 1/3	125.4%						
3	Top 1/3	52.3%						

Table 8

Motorcycle by-stander MPE Assessment @ 173.9875 MHz								
Antenna Location	Antenna / Gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
By-Stander	RAD40005ARB / 0dBi	30	E	0.86	0.268	18.6	0.13	0.13
Measurement grid								
Test Position	Height (cm)	% of Control limit	Test position	Height (cm)	% of control limit			
1	20	11.3%	6	120	48.3%			
2	40	16.4%	7	140	30.1%			
3	60	26.8%	8	160	19.7%			
4	80	26.3%	9	180	7.1%			
5	100	78.1%	10	200	3.4%			

Table 9

Motorcycle Operator MPE Assessment @ 136.0125MHz								
Assessment condition	Antenna / Gain	Meas. Distance (cm)	E/H field	Calibration factor	Average over Antenna (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
Operator	RAD40002ARB / 0dBi	30	H	0.99	0.44	18.6	0.15	0.15
Measurement Grid								
Test position	Height (cm)	Pwr. Density (mW/cm ²)						
1	Bottom 1/3	0.57						
2	Middle 1/3	0.42						
3	Top 1/3	0.34						

Table 10

Motorcycle by-stander MPE Assessment @ 136.0125 MHz								
Antenna Location	Antenna / Gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
By-Stander	RAD40002ARB / 0dBi	30	H	0.99	0.38	18.6	0.19	0.19
Measurement grid								
Test Position	Height (cm)	Pwr. Density (mW/cm ²)	Test position	Height (cm)	Pwr. Density (mW/cm ²)			
1	20	0.23	6	120	0.94			
2	40	0.19	7	140	0.45			
3	60	0.28	8	160	0.21			
4	80	0.54	9	180	0.00			
5	100	0.99	10	200	0.00			

Table 11

Motorcycle Operator MPE Assessment @ 147.0125MHz								
Assessment condition	Antenna / Gain	Meas. Distance (cm)	E/H field	Calibration factor	Average over Antenna (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
Operator	RAD40003ARB / 0dBi	30	H	0.98	0.61	18.6	0.20	0.20
Measurement Grid								
Test position	Height (cm)	Pwr. Density (mW/cm ²)						
1	Bottom 1/3	0.82						
2	Middle 1/3	0.67						
3	Top 1/3	0.34						

Table 12

Motorcycle by-stander MPE Assessment @ 147.0125 MHz								
Antenna Location	Antenna / Gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
By-Stander	RAD40003ARB / 0dBi	30	H	0.98	0.27	18.6	0.13	0.13
Measurement grid								
Test Position	Height (cm)	Pwr. Density (mW/cm ²)	Test position	Height (cm)	Pwr. Density (mW/cm ²)			
1	20	0.20	6	120	0.49			
2	40	0.15	7	140	0.30			
3	60	0.24	8	160	0.18			
4	80	0.50	9	180	0.00			
5	100	0.61	10	200	0.00			

Table 13

Motorcycle Operator MPE Assessment @ 155.0125MHz								
Assessment condition	Antenna / Gain	Meas. Distance (cm)	E/H field	Calibration factor	Average over Antenna (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
Operator	RAD40004ARB / 0dBi	30	H	0.98	0.61	18.6	0.20	0.20
Measurement Grid								
Test position	Height (cm)	Pwr. Density (mW/cm ²)						
1	Bottom 1/3	0.75						
2	Middle 1/3	0.64						
3	Top 1/3	0.44						

Table 14

Motorcycle by-stander MPE Assessment @ 155.0125 MHz								
Antenna Location	Antenna / Gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
By-Stander	RAD40004ARB / 0dBi	30	H	0.98	0.19	18.6	0.09	0.09
Measurement grid								
Test Position	Height (cm)	Pwr. Density (mW/cm ²)	Test position	Height (cm)	Pwr. Density (mW/cm ²)			
1	20	0.00	6	120	0.20			
2	40	0.20	7	140	0.10			
3	60	0.34	8	160	0.00			
4	80	0.46	9	180	0.00			
5	100	0.58	10	200	0.00			

Table 15

Motorcycle Operator MPE Assessment @ 173.9875MHz								
Assessment condition	Antenna / Gain	Meas. Distance (cm)	E/H field	Calibration factor	Average over Antenna (mW/cm ²)	Initial Power (W)	Pwr. Density cal (mW/cm ²)	Pwr. Density max cal (mW/cm ²)
Operator	RAD40005ARB / 0dBi	30	H	0.97	0.57	18.6	0.19	0.19
Measurement Grid								
Test position	Height (cm)	Pwr. Density (mW/cm ²)						
1	Bottom 1/3	0.69						
2	Middle 1/3	0.60						
3	Top 1/3	0.42						

Table 16

Motorcycle by-stander MPE Assessment @ 173.9875 MHz								
Antenna Location	Antenna / Gain	Meas. Distance (cm)	E/H Field	Calibration Factor	Average over Body (mW/cm²)	Initial Power (W)	Pwr. Density cal (mW/cm²)	Pwr. Density max cal (mW/cm²)
By-Stander	RAD40005ARB / 0dBi	30	H	0.97	0.37	18.6	0.18	0.18
Measurement grid								
Test Position	Height (cm)	Pwr. Density (mW/cm²)	Test position	Height (cm)	Pwr. Density (mW/cm²)			
1	20	0.22	6	120	0.96			
2	40	0.27	7	140	0.45			
3	60	0.36	8	160	0.20			
4	80	0.45	9	180	0.00			
5	100	0.76	10	200	0.00			

7.0 Conclusion

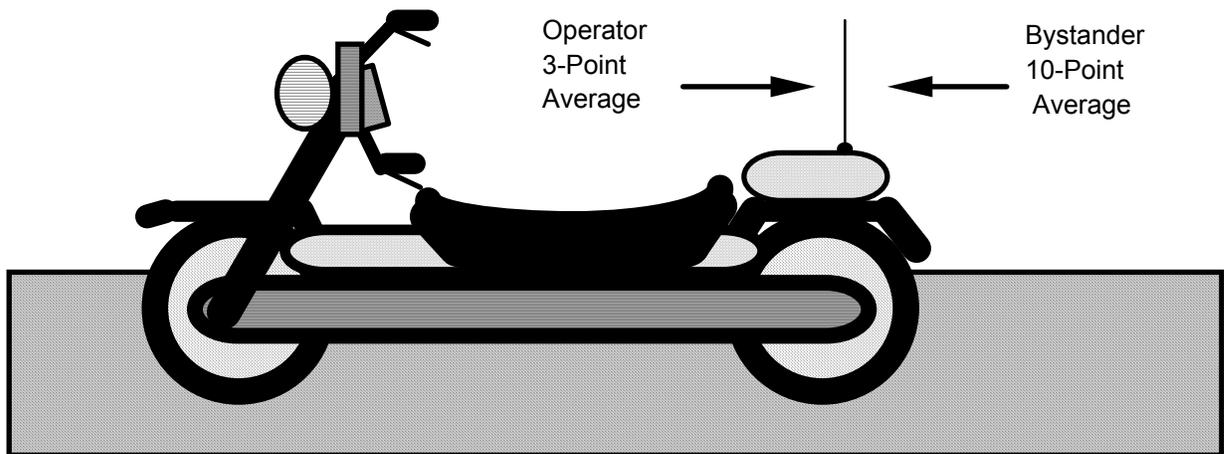
Depending on the test frequency, compliance assessments were performed with an output power range of 5-15W. The maximum RF power allowable will be equal to the upper limit of the final test factory transmit power specification of 18W. The highest power density result scaled to the maximum allowable power output is 0.19 mW/cm² for by-stander test position and 0.49 mW/cm² for operator test position

The by-stander measurement results clearly demonstrate compliance with the FCC Limits for the frequency band of 136-174MHz Per 47 CFR 2.1091 (d) for General Population/Uncontrolled (0.20 mW/cm²) RF Exposure.

The operator measurement results clearly demonstrate compliance with the FCC Limits for the frequency band of 136-174MHz Per 47 CFR 2.1091 (d) for Occupational Population/Controlled (1.0 mW/cm²) RF Exposure.

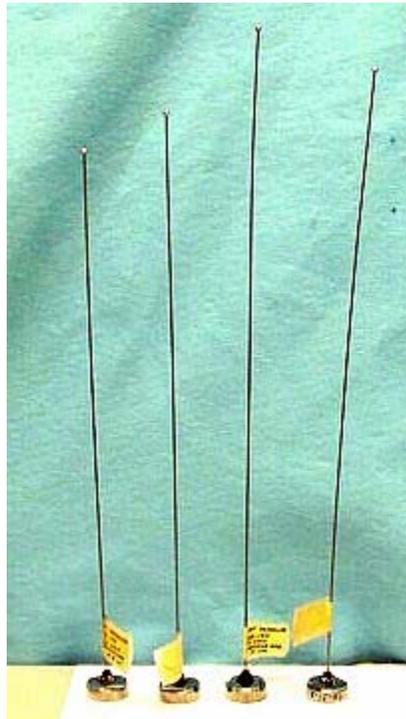
APPENDIX A

ANTENNA LOCATION DRAWING



APPENDIX B

Antenna photos



Antenna kit numbers, from left to right; RAD4005ARB, RAD4004ARB, RAD4003ARB and RAD4002ARB