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REVISION HISTORY

Date	Revision	Comments
10/29/09	0	Initial release

1.0 Product and System Description

FCC ID: AZ492FT7037, model M30TSS9PW1AN with G67 motorcycle option is a mobile transceiver that utilizes analog, APCO 25 & F2 digital two-way radio communications. The analog modulation scheme uses Frequency Modulation (FM). APCO 25 & F2 digital modes use C4FM of CQPSK family of modulation (Compatible 4-Level Frequency Modulation of Compatible Quadrature Phase Shift Keying). F2 is a TDMA protocol that allocates portions of the RF signal by dividing time into two slots (2 slots TDMA). Transmission from a unit or base station is accommodated in time-slot lengths of 30 milliseconds and frame lengths of 60 milliseconds. This product supports voice in analog mode, and both voice and data modes in digital mode.

The maximum duty cycle for TDMA is 1:2 (50%) and is controlled by software. The FM signal is continuous. However, because of hand shaking or Push-To-Talk (PTT) between users and/or base stations a conservative 50% duty cycle is applied. The TDMA mode was not tested because its duty cycle is inherently 50% and would include an additional 50% duty cycle for PTT.

The intended use of the radio is Push-To-Talk (PTT) while the device is properly installed on a motorcycle.

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 which 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.

Accordingly this product is classified as Occupational/Controlled Exposure. However, in accordance with FCC requirements, the bystanders are evaluated to the General Population/ Uncontrolled Exposure Limits, and the operator is evaluated to the Occupational/Controlled Exposure Limits.

(Note that "Bystanders" as used herein mean people other than operator)

2.0 Abbreviations / Definitions

APCO: Association of Public-Safety Communications Officials
C4FM: Compatible 4-Level Frequency Modulation
CNR: Calibration Not Required
CQPSK: Compatible Quadrature Phase Shift Keying
CW: Continues Wave
DUT: Device Under Test
F2: 2 slot Time Division Multiple Access
FM: Frequency Modulation
NA: Not Applicable
PTT: Push to Talk
TDMA: Time Division Multiple Access
MPE: Maximum Permissible Exposure
EME: Electromagnetic Energy

3.0 Additional Options and Accessories

NA

4.0 Measurement and Limit Standards

Measurements were performed according to the recommended guidelines in IEEE/ANSI C95.3-2002 and compared to FCC Limits Per 47 CFR 2.1091 (d) for General Population/Uncontrolled and Occupational/Controlled RF Exposure limits.

For test frequencies ranging from 136 - 174 MHz the MPE (Maximum Permissible Exposure) limit to electromagnetic energy in equivalent plane wave free-space power density is 0.20mW/cm² for General Population, and 1.0mW/cm² for Occupational.

5.0 Measurement System Uncertainty Levels

		Prob			
	Tol.	•		\boldsymbol{u}_i	
	(±	_			
	%)	Dist.	Divisor	(±%)	<i>v</i> _i
Measurement System					
Probe Calibration	6.0	Ν	1.00	6.0	∞
Survey Meter Calibration	3.0	Ν	1.00	3.0	∞
Hemispherical Isotropy	8.0	R	1.73	4.6	∞
Linearity	5.0	R	1.73	2.9	∞
Pulse Response	1.0	R	1.73	0.6	8
RF Ambient Noise	3.0	R	1.73	1.7	8
RF Reflections	8.0	R	1.73	4.6	∞
Probe Positioning	10.0	R	1.73	5.8	8
Test sample Related					
Antenna Positioning	3.0	Ν	1.00	3.0	8
Power drift	5.0	R	1.73	2.9	8
Combined Standard					
Uncertainty		RSS		12.2	∞
Expanded Uncertainty					
(95% CONFIDENCE					
LEVEL)		k=2		24	

Uncertainty Budget for Near Field Probe Measurements

6.0 Method of Measurement

6.1 MPE assessment for motorcycle-mounted antennas

(Refer to APPENDIX A for antenna location and test positions)

6.1.1 Bystander MPE assessment

MPE measurements for bystander conditions are determined by taking the average of (10) measurements in a 2m vertical line directly behind the vehicle with 20cm increments at the standard test distance of 60cm from the

antenna. The measurement probe is positioned orthogonal to antenna (typically parallel to ground with a vertically mounted antenna), and aimed directly at the antenna's axis while maintaining a twenty (20) centimeter separation distance between the probe sensor and reradiating structures. These measurements are representative of persons other than the operator standing next to the vehicle.

6.1.2 Operator MPE assessment

MPE measurements for operator conditions are performed by taking the following (3) measurements at the standard test distance of 30cm from 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). The measurement probe is positioned orthogonal to antenna (typically parallel to ground with a vertically mounted antenna), and aimed directly at the antenna's axis while maintaining a twenty (20) centimeter separation distance between the probe sensor and reradiating structures. The (3) results are then averaged.

7.0 Test Site

The test site is the Motorola open area test site located at 8000 W. Sunrise Blvd., Plantation, FL. 33322.

8.0 Measurement System/Equipment

			Calibration
Equipment Type	Model #	SN	Date
Motorcycle	2005 Kawasaki KZ1000		
Survey Meter / Probe – E-Field	ETS Model HI-2200 /	86887 / 83370	12/04/08
(Electric Field)	ETS Model E100		
Survey Meter / Probe – H-Field	ETS Model HI-2200 /	86887 / 84225	01/13/09
(Magnetic Field)	ETS Model H200		

ETS equipments measured for E-field is in mW/cm2 for E-field.

ETS equipments measured for H-field is in A/m, the final results for H-field is converted to mW/cm2.

9.0 **DUT Output Power**

Power density measurements were performed with the test frequencies and associated power levels presented in the table below.

Test Frequencies (MHz)	Measured Initial Power (W)
136.0125	17.6
147.4	17.7
155	17.6
173.4	18.0
173.9875	17.6

10.0 Test Set-Up Description

All antennas listed on the cover page of this report were considered in order to develop the test plan for this product.

Assessments were performed with DUT (Device Under Test) installed on a test vehicle, while engine was at idle, at the specified distances and test locations indicated in sections 6.0, 11.0, and the APPENDIX A.

11.0 Test Results Summary

The tables below summarized the MPE measurement results for each test configuration: antenna (model and description), antenna gain, TX frequency, maximum output power, initial power, E/H field measurements, probe frequency cal factor, test positions (BS-Bystander, OP-Operator), average over body results, calculated power density results, max calculated power density results, % of the applicable FCC specification limits.

MPE results for this motorcycle radio are based on 50% duty cycle which is in accordance with the User Manual instructions.

Below is an explanation of how the MPE results are calculated.

Bystander - 10 measurements are averaged over the body (*body_avg*). Operator - 3 measurements are averaged over the body (*body_avg*). The Average over Body test methodology is consistent with IEEE/ANSI C95.3-2002 guidelines.

Therefore;

 $Pwr_density_calc = body_avg*(probe_frequency_cal_factor)^2*duty_cycle$

 $Pwr_density_max_calc = pwr_density_calc * \frac{max_output_power}{initial_output_power}$

Note1; For initial output power> max_output_power; max_output_power / initial output power = 1

Note2: The probe frequency cal factors used for MPE evaluation of this product are based on the worse case. Note 3: The calibration certificate's frequency cal factors were determined by measuring V/m for E-field probe and A/m for H-field probe. The results presented herein are power density (mW/cm²) and therefore the cal factors were squared as indicated in the formula above.

Note 4: The H-field measurements were done in A/m. Therefore the calculated power density results were converted to mW/cm^2 using the formula: $mW/cm^2 = (A/m)^2 * 37.699$.

Table 1: E-Field MPE data summary

Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	E/H Field	Probe Cal. Factor	Test Pos.	Avg. over Body (mW/ cm2)	Calc. P.D. (mW/ cm2)	Max Calc. P.D. (mW/ cm2)	% of Spec Limit	FCC Spec Limit (mW/ cm2)
RAD4002ARB (136 - 144 MHz)	2 15	136 0125	18	17.6	E	0.99	OP	1.00	0.50	0.51	51	1.0
	2.15	130.0123	10	17.0	L	0.77	01	1.00	0.50	0.51	51	1.0
$(136 144 \text{ MH}_7)$	2 15	136 0125	18	17.6	F	0.00	BS	0.17	0.00	0.00	44	0.2
(150 - 144 MITZ)	2.13	130.0123	10	17.0	Ľ	0.99	60	0.17	0.09	0.09	++	0.2
RAD4003ARB (144 -150.8 MHz)	2.15	147.4	18	17.7	Е	0.98	OP	0.91	0.45	0.46	46	1.0
RAD4003ARB (144 -150.8 MHz)	2.15	147.4	18	17.7	Е	0.98	BS	0.17	0.08	0.09	43	0.2
RAD4004ARB (150.8-162 MHz)	2.15	155	18	17.6	Е	0.97	OP	0.88	0.43	0.44	44	1.0
RAD4004ARB (150.8-162 MHz)	2.15	155	18	17.6	Е	0.97	BS	0.14	0.07	0.07	35	0.2
RAD4005ARB (162-174 MHz)	2.15	173.4	18	18	Е	0.94	OP	1.55	0.73	0.73	73	1.0
RAD4005ARB (162-174 MHz)	2.15	173.4	18	18	E	0.94	BS	0.11	0.05	0.05	27	0.2
RAD4005ARB (162-174 MHz)	2.15	173.9875	18	17.6	E	0.94	OP	1.70	0.80	0.82	82	1.0
RAD4005ARB (162-174 MHz)	2.15	173.9875	18	17.6	Е	0.94	BS	0.14	0.06	0.06	32	0.2

Table 2: H-Field MPE data summary

Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	E/H Field	Probe Cal. Factor	Test Pos.	Avg. over Body (mW/ cm2)	Calc. P.D. (mW/ cm2)	Max Calc. P.D. (mW/ cm2)	% of Spec Limit	FCC Spec Limit (mW/ cm2)
RAD4002ARB (136 - 144 MHz)	2.15	136.0125	18	17.6	Н	0.79	OP	0.77	0.31	0.31	31	1.0
RAD4002ARB (136 - 144 MHz)	2.15	136.0125	18	17.6	Н	0.79	BS	0.21	0.08	0.09	43	0.2
RAD4003ARB (144 -150.8 MHz)	2.15	147.4	18	17.7	Н	0.75	OP	0.77	0.29	0.30	30	1.0
RAD4003ARB (144 -150.8												
MHz)	2.15	147.4	18	17.7	Н	0.75	BS	0.21	0.08	0.08	41	0.2
RAD4004ARB (150.8-162 MHz)	2.15	155	18	17.6	Н	0.73	OP	0.70	0.26	0.26	26	1.0
RAD4004ARB (150.8-162 MHz)	2.15	155	18	17.6	Н	0.73	BS	0.16	0.06	0.06	31	0.2
RAD4005ARB (162-174 MHz)	2.15	173.4	18	18.0	Н	0.68	OP	0.70	0.24	0.24	24	1.0
RAD4005ARB (162-174 MHz)	2.15	173.4	18	18.0	Н	0.68	BS	0.10	0.03	0.03	17	0.2
RAD4005ARB (162-174 MHz)	2.15	173.9875	18	17.6	Н	0.68	OP	0.77	0.26	0.27	27	1.0
RAD4005ARB (162-174 MHz)	2.15	173.9875	18	17.6	Н	0.68	BS	0.14	0.05	0.05	24	0.2

12.0 Conclusion

The assessments for this device operating at 136-174MHz frequency were performed with an output power range as indicated in section 9. The maximum allowable output power is equal to the upper limit of the final test factory transmit power specification of 18W. The highest power density results scale to the maximum allowable power output is 0.09mW/cm^2 for bystander test position and 0.82mW/cm^2 for operator test position.

The MPE results for bystander presented herein demonstrate compliance to the applicable FCC General Population/ Uncontrolled RF Exposure limit.

The MPE results for operator presented herein demonstrate compliance to the applicable FCC Occupational Population/Controlled Exposure limit.

APPENDIX A Illustration of Antenna Locations and Test Positions

ANTENNA LOCATION DRAWING



APPENDIX B Meter/Probe Calibration Certificates



Cert I.D.: 70578 Lab Code 115844/1207.01 An ESCO Technologies Company 1301 Arrow Point Drive

Cedar Park, Texas 78613

(512) 531-6498



Track# \$000075131 Ltd Cal

Certificate of Calibration Conformance

The instrument identifed below has been individually calibrated in compliance with the following standard(s):

IEEE 1309 - 2005, Institute of Electrical and Electronics Engineers, Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas from 9 kHz to 40 GHz

Environment: Laboratory MTE is maintained in a temperature controlled environment with ambient conditions from 18 to 28 C, relative humidity less than 90%. The instrument under test has been calibrated in a suitable environment using an EMCO TEM Cell 5101C, GTEM! 5305 and an RF Shielded EMC Chamber which is conducive to maintaining accurate and reliable measurement quality.

Manufacturer:	ETS-Lindgren	Operating Range:	100kHz - 5GHz
Model Number:	E100	Instrument Type:	Isotropic Probe > 1 GHz
Serial Number/ ID:	00083370	Date Code:	
Tracking Number:	S000015131	Alternate ID:	
Date Completed:	04-Dec-08	Customer:	MOTOROLA INC. (FL)
Test Type:	Standard Field, Field S	Strength	
Calibration Uncertainty:	Std Field Method	10kHz - 18000 MHz, +/-0.7 dB, 26.5GHz - 40GH	lz,+/- 0.95 dB

k=2, (95% Confidence Level)

Test Remarks: Provided special data points per customer request.

Calibration Traceability: All Measuring and Test Equipment (M/TE) identified below are traceable to the National Institute for Standards and Technology (NIST). Calibration Laboratory and Quality System controls are compliant with ISO/IEC 17025-2005.

Make / Model / Na	quipment Us ame / S/N / R	ed: ecall Date			Condition of Instrument
Boonton	9200B	RF Voltmeter	280601AE	29-Sep-09	opon Receipt.
Hewlett Packard	437B	HP Power Meter	3125U12370	21-May-09	In Tolerance to Internal Quality Standards
Fluke	6060B	RF Signal Generator	5690204	20-May-09	On Release:
Marconi	2022	Signal Generator	119019/077	02-Oct-09	In Tolerance to Internal Quality Standards
Rohde & Schwarz	857.8008.0	Power Meter NRVD	828110/019	27-Dec-08	
Hewlett Packard	83620B	Signal Generator	3722A00541	19-Sep-09	

Calibration Completed By

Alan Schifferdecker, Calibration Technician

HIX an Attested and Issued on 04-Dec-08

Justin Tary Calibration Supervisor

This document provides traceability of measurements to recognized national standards using controlled processes at the ETS-Lindgren Calibration Laboratory. Uncertainties listed are derived from the methods described by NIST Tech Note 1297. This certificate and report may not be reproduced, except in full, without the written approval of ETS-Lindgren Calibration Laboratory in accordance with ISO/IEC 17025-2005, QAF 1127 (06/07)

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Frequency Response Calibration Factors Model E100 Serial Number 00083370 Date of Calibration 4 Dec 2008

Frequency (MHz)	Applied V/m	Pro	be Readin Y	9	×	Correction	i Factor	Ave
1.00	7.97	6.74	6.71	6.60	1.18	1.19	1.21	1.19
1.00	20.01	17.05	16.99	16.75	1.17	1.18	1.19	1.18
1.00	69.93	59.37	59.09	58.36	1.18	1.18	1.20	1.19
1.00	124.30	105.11	104.67	103.34	1.18	1.19	1.20	1.19
15.00	8.02	7.86	7.79	7.76	1.02	1.03	1.03	1.03
15.00	19.96	19.62	19.45	19.42	1.02	1.03	1.03	1.02
15.00	70.28	68.97	68.30	68.14	1.02	1.03	1.03	1.03
15.00	125.20	122.31	121.06	120.78	1.02	1.03	1.04	1.03
30.00	8.02	8.00	7.92	7.89	1.00	1.01	1.02	1.01
30.00	20.11	20.09	19.88	19.85	1.00	1.01	1.01	1.01
30.00	69.83	69.30	68.56	68.31	1.01	1.02	1.02	1.02
30.00	124.31	122.47	121.21	120.74	1.01	1.03	1.03	1.02
75.00	8.03	8.24	8.23	8.12	0.97	0.98	0.99	0.98
75.00	20.11	20.71	20.64	20.46	0.97	0.97	0.98	0.98
75.00	70.04	72.11	71.83	71.03	0.97	0.98	0.99	0.98
75.00	124.66	128.20	127.66	126.29	0.97	0.98	0.99	0.98
100.00	8.02	8.17	8.13	8.04	0.98	0.99	1.00	0.99
100.00	20.04	20.45	20.33	20.21	0.98	0.99	0.99	0.99
100.00	70.33	71.31	70.79	70.25	0.99	0.99	1.00	0.99
100.00	124.43	125.68	124.79	123.57	0.99	1.00	1.01	1.00
150.00	8.03	8.14	8.14	8.02	0.99	0.99	1.00	0.99
150.00	19.96	20.33	20.31	20.09	0.98	0.98	0.99	0.99
150.00	70.14	71.64	71.55	70.58	0.98	0.98	0.99	0.98
150.00	125.58	128.56	128.42	126.52	0.98	0.98	0.99	0.98
200.00	8.00	8.43	8.53	8.28	0.95	0.94	0.97	0.95
200.00	19.97	21.08	21.37	20.85	0.95	0.93	0.96	0.95
200.00	69.86	74.08	74.82	72.92	0.94	0.93	0.96	0.94
200.00	124.95	132.17	134.06	130.32	0.95	0.93	0.96	0.95
250.00	7.97	8.11	7.88	7.96	0.98	1.01	1.00	1.00
250.00	19.99	20.55	19.75	20.20	0.97	1.01	0.99	0.99
250.00	70.06	72.32	70.37	70.59	0.97	1.00	0.99	0.99
250.00	125.12	128.64	124.26	125.28	0.97	1.01	1.00	0.99
300.00	8.00	8.08	7.94	7.97	0.99	1.01	1.00	1.00
300.00	20.03	20.57	20.25	20.34	0.97	0.99	0.98	0.98
300.00	69.79	72.57	71.30	71.56	0.96	0.98	0.98	0.97
300.00	125.28	130.82	128.42	128.85	0.96	0.98	0.97	0.97
400.00	8.00	8.10	7.97	7.97	0.99	1.00	1.00	1.00
400.00	19.89	20.15	19.87	19.89	0.99	1.00	1.00	1.00
400.00	69.67	70.49	69.32	69.33	0.99	1.01	1.00	1.00
400.00	125.09	126.27	124.24	124.10	0.99	1.01	1.01	1.00
500.00	8.01	7.89	7.95	7.68	1.02	1.01	1.03	1.02
500.00	19.94	19.59	19.74	19.37	1.02	1.01	1.03	1.02
500.00	70.28	69.65	70.06	68.64	1.01	1.00	1.02	1.01
500.00	124.58	123.19	123.63	121.24	1.01	1.01	1.03	1.02
600.00	8.01	7.65	7.63	7.61	1.04	1.05	1.06	1.05
600.00	20.01	19.34	19.09	19.06	1.04	1.05	1.05	1.04
600.00	69.90	67.55	67.54	66.46	1.03	1.04	1.05	1.04
600.00	125.28	120.21	120.01	119.47	1.03	1.05	1.05	1.04

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Frequency Response Calibration Factors Model E100 Serial Number 00083370 Date of Calibration 4 Dec 2008

Frequency	Applied	Pri	obe Reading			Correction	Factor	
(MHz)	V/m.	X	Y	2	X	Ý	Z	Avg
700.00	7.96	7.56	7.35	7.42	1.05	1.08	1.07	1.07
700.00	20.10	19.21	18.63	18.87	1.05	1.08	1.06	1.06
700.00	70.26	67.25	65.16	65.96	1.05	1.08	1.07	1.06
700.00	125.09	119.09	115.24	116.69	1.05	1.09	1.07	1.07
800.00	8.04	7.34	7.28	7.22	1.10	1.10	1.11	1.10
800.00	20.02	18.38	18.27	18.07	1.09	1.09	1.11	1.10
800.00	69.85	64.15	63.68	63.03	1.09	1.10	1.11	1.10
800.00	124.82	113.69	112.90	111.64	1.10	1.10	1.12	1.11
900.00	7.97	7.70	7.78	7.56	1.03	1.02	1.05	1.04
900.00	20.03	19.42	19.58	19.07	1.03	1.02	1.05	1.03
900.00	70.21	67.77	68.79	66.47	1.04	1.02	1.06	1.04
900.00	124.81	119.63	120.40	117.19	1.04	1.04	1.06	1.05
1000.00	7.99	8.09	7.90	7.89	0.99	1.01	1.01	1.00
1000.00	19.92	20.17	19.63	19.74	0.99	1.01	1.01	1.00
1000.00	69.78	70.08	68.11	68.35	1.00	1.02	1.02	1.01
1000.00	124.80	124.87	120.11	120.41	1.01	1.04	1.03	1.02
2000.00	19.92	19.09	18.99	20.04	1.04	1.05	0.99	1.03
2450.00	20.38	19.27	18.50	17.75	1.06	1.10	1.15	1.10
3000.00	20.36	19.27	18.66	19.77	1.06	1.09	1.03	1.06
3500.00	20.02	21.99	21.67	19.57	0.91	0.92	1.02	0.95
4000.00	19.99	19.75	18.25	19.57	1.01	1.10	1.02	1.04
5000.00	19.97	14.40	13.92	15.38	1.39	1.43	1.30	1.37

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PROBE ROTATIONAL RESPONSE





Isotropic response measured in a 20 V/m field at 400 MHz

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CALIBRATION REPORT

х

Magnetic Field Sensor

Model	S/N
H200	00084225
HI-2200	00086887

As received, the instrument was found.

Within Tolerance Out of Tolerance (New Instrument)

Frequency Response

Frequency		Nominal			
Response		Field	Cal Factor*	Deviation	
	MHz	A/m	(Happlied/Hindicated)	dB	
1	13.56	0.08	1.06	-0.51	
2	27.12	0.08	1.02	-0.14	
3	100	0.08	0.96	0.39	
4	150	0.08	0.86	1.31	
5	175	80.0	0.82	1.69	

* Corrected magnetic field values (A/m) can be obtained by multiplying the Cal Factor with the indicated H field readings.

Linearity

Maximum linearity deviation is 0.03 dB

(measurements taken from 30 mA/m to 9 A/m at 27.12 MHz)

Test Conditions

Calibration performed at ambient room temperature: 23 ±3°C

The above sensor was calibrated to factory specifications. This calibration is performed per IEEE 1309 standard. All equipment used are traceable to US National Institute of Standards and Technology (NIST).

By Xellars 13-Jan-2009 Calibration Date:

Recommended calibration interval: 1 year

This calibration was performed by ETS-Lindgren, Cedar Park, TX.

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Corporate Headquarters • 1301 Arrow Point Drive • Cedar Park, Texas 78613 • USA Phone +1.512.531.6400 • Fax +1.512.531.6500 • info@ets-lindgren.com • www.ets-lindgren.com

APPENDIX C DUT Photos (Refer to Exhibit 7B)