

LABORATORY TEST REPORT

TEST: FCC 47 CFR 1.1310 Maximum Permissible Exposure

MPE ASSESSMENT

For the VHF 50W Mobile Transceiver Type TMBB1B
FCC ID: CASTMBB1B
IC: 737A-TMBB1B

In accordance with

ANSI/IEEE Std C95.1, 1999

OET Bulletin 65 97-01 and Supplement C (Edition 01-01)

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Summary of Results:

Limit: Occupational/Controlled Exposure 30 - 300 MHz 1.0 mW/cm²

Antenna Gain	Antenna Position	Measurement Position	Result
2.15 dBi	Roof	A External: Side	COMPLIES
5.15 dBi	Roof	A External: Side	COMPLIES
2.15 dBi	Trunk	C External: Rear	COMPLIES
5.15 dBi	Trunk	C External: Rear	COMPLIES
2.15 dBi	Trunk	B External: 45 degrees	COMPLIES
5.15 dBi	Trunk	B External: 45 degrees	COMPLIES
2.15 dBi	Trunk	Internal: Centre Rear	COMPLIES
5.15 dBi	Trunk	Internal: Centre Rear	COMPLIES
2.15 dBi	Roof	Internal: Front Seat	COMPLIES
5.15 dBi	Roof	Internal: Front Seat	COMPLIES
2.15 dBi	Roof	Internal: Back Seat	COMPLIES
5.15 dBi	Roof	Internal: Back Seat	COMPLIES

See Appendix A for details of the measurement positions.

Operating and Exposure Conditions:

Operating Conditions: Mobile transmitter using vehicle mounted antennas only.
Exposure conditions: Occupational/Controlled Exposure (operator).
General Population/Uncontrolled (passengers and bystanders)
Safe Distance: Recommended minimum lateral safe distance from the antenna: 90 cm

Limit:

Occupational/Controlled Exposure: 30 - 300 MHz: 1.0 mW/cm²
General population/Uncontrolled Exposure: 30 - 300 MHz: 0.2 mW/cm²

Recommended Antennas:

Antenna Type	Antenna Gain
Monopole ($\lambda/4$ antenna)	2.15 dBi
Monopole ($5/8\lambda$ antenna)	5.15 dBi

Measurement Guidance:

Federal Communications Commission OET Laboratory Division
KDB 447498 v04, 643646 DR02.

Per definition of a mobile device a minimum separation distance of 20 cm is required.

The minimum separation distances required to install an antenna on a vehicle must be larger than those tested for compliance and must be disclosed separately to antenna installers and radio operators to ensure compliance. A separation distance based on MPE evaluation (measurement or computer modelling) that is smaller than the estimated MPE distance may be used if it is applicable for the antenna installation conditions.

A mid-sized sedan was used for the testing so that the results can be applied to a larger vehicle resulting in conservative exposure conditions. The roof antenna position tested is closer to bystanders than if it were mounted centrally (as recommended in the installation instructions) in order to ensure that even on small vehicle the separation distance is more conservative than the tested distance and to allow a test position that conforms to the requirements of KDB 643646 DR02.

Test Results:

NAME OF TEST: TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046

GUIDE: TIA/EIA-603D 2.2.1

MEASUREMENT PROCEDURE:

1. The Equipment Under Test (EUT) was connected to an RF power meter using a coaxial attenuator with an impedance of 50 Ohms.
2. The unmodulated output power was measured.

MEASUREMENT RESULTS:

Transmit Frequency:	164.3875	MHz
Supply Voltage:	13.8	Volts
Measured Output Power:	4.9	Watts
Measurement Uncertainty (dB):	± 0.5	dB

The MPE results are scaled to simulate results from a 50 watts transmitter. A margin of 20% is added to the rated power output of 50 watts giving 60 watts and a 50% duty cycle is applied (ref KDB 447498v04).

NAME OF TEST: MPE ASSESSMENT

SPECIFICATION: FCC 47 CFR 1.1310

MEASUREMENT METHOD:

Field strength measurements were performed for two antenna positions on a representative vehicle (Ford Mondeo 2001 four door sedan). See Appendix A for details.

External Field strength readings were taken at 20 cm intervals vertically over a height of 2 metres.

Internal field strength readings were recorded in the front and back seat locations in the areas where the highest field strength is found.

Passenger exposure was evaluated at ≤ 10 cm from the surface of seats and back of head position in the rear seat. Measurements were made in an area 40cm wide representing the head and upper and lower torso.

Spatial averaging is carried out to determine the MPE result (IEEE C95.1 3.29).

MEASUREMENT RESULTS:

See appendix A for antenna positions.

Calculations of average power (sum of results/number of results):

External to vehicle:

Probe Height (metres)	Power Density (mW/cm ²)					
	2.15 dBi antenna			5.15 dBi antenna		
	A	B	C	A	B	C
0.2	0.033	0.053	0.029	0.010	0.016	0.025
0.4	0.045	0.131	0.077	0.015	0.031	0.058
0.6	0.033	0.189	0.141	0.015	0.039	0.077
0.8	0.029	0.205	0.172	0.016	0.030	0.057
1.0	0.115	0.239	0.235	0.032	0.065	0.056
1.2	0.146	0.285	0.307	0.057	0.246	0.137
1.4	0.209	0.273	0.328	0.082	0.455	0.271
1.6	0.222	0.213	0.243	0.124	0.446	0.314
1.8	0.213	0.140	0.143	0.196	0.346	0.285
2.0	0.198	0.086	0.093	0.240	0.397	0.287
Average	0.124	0.181	0.177	0.079	0.207	0.157

Inside Vehicle:

Roof Mounted Antenna		
Internal Front Seat	Power Density (mW/cm ²)	
	2.15 dBi antenna	5.15 dBi antenna
Head	0.015	0.012
Upper torso	0.005	0.004
Lower torso	0.007	0.004
Average	0.009	0.007
Internal Back Seat	Power Density (mW/cm ²)	
	2.15 dBi antenna	5.15 dBi antenna
Head	0.055	0.018
Upper torso	0.021	0.008
Lower torso	0.010	0.011
Average	0.029	0.013

Trunk Mounted Antenna		
Internal Front Seat	Power Density (mW/cm ²)	
	2.15 dBi antenna	5.15 dBi antenna
Head	0.240	0.014
Upper torso	0.083	0.006
Lower torso	0.028	0.015
Average	0.117	0.011
Internal Rear Centre Seat	Power Density (mW/cm ²)	
	2.15 dBi antenna	5.15 dBi antenna
Head	1.300	0.044
Upper torso	0.618	0.065
Lower torso	0.556	0.070
Average	0.825	0.059

Measurement Uncertainty:

Field Probe: ± 1 dB

Test Equipment Used:

Equipment	Type	Serial Number	Calibration Due
RF Power Sensor	11722A	2716A02037	18 October 2012
Modulation Analyser	HP8901B (Opt 002)	2441A00393	14 October 2012
Isotropic Field Probe	EP601	401WX01247	1 March 2014
Antenna Mast	Tait Ltd	-	-

Information to be placed in User/Installation manual:

§2.1033(c)(3) requires device operating and installation instructions to be submitted during equipment certification; instructions should include the minimum separation distance and other constraints required for the device and its antenna(s) to meet MPE limits.

Warning: RF Exposure Hazard

To comply with FCC RF exposure limits, mount the antenna at a location such that no person or persons can come closer than 35 inches (0.9m) to the antenna:

For radios with a transmit power >25 W:

VHF radios must be installed using an antenna mounted centrally on the vehicle roof, with a gain of 2.15dBi or 5.15dBi.

UHF and 800 MHz radios must be installed using an antenna mounted either centrally on the vehicle roof with a gain of 2.15 dBi or 5.65 dBi, or centrally mounted on the trunk with a gain of 5.65 dBi.

For radios with a transmit power of 25W:

The radio must be installed using an externally mounted antenna with a gain of either 2.15 or 5.15 dBi.

Safety Training Information:

Radio frequency exposure information:

For your own safety and to ensure you comply with the United States Federal Communication Commission's (FCC) radio frequency (RF) exposure guidelines, and those from other administrations, please read the following information before using this radio.

Using this radio

You should use this radio only for work-related purposes (it is not authorized for any other use) and if you are fully aware of, and can exercise control over, your exposure to RF energy. To prevent exceeding RF exposure limits, you must control the amount and duration of RF that you and other people are exposed to.

It is also important that you:

- Do not remove the RF exposure label from the radio.
- Ensure this RF exposure information accompanies the radio when it is transferred to other users.
- Do not use the radio if you do not adhere to the guidelines on controlling your exposure to RF.

Controlling your exposure to RF energy

This radio emits radio frequency (RF) energy or radio waves primarily when calls are made. RF is a form of electromagnetic energy (as is sunlight), and there are recommended levels of maximum RF exposure.

To control your exposure to RF and comply with the maximum exposure limits for occupational/controlled environments, follow these guidelines:

- Do not talk (transmit) on the radio more than the rated transmit duty cycle. This is important because the radio radiates more energy when it is transmitting than when it is receiving.

Mobile radios only:

- While you are transmitting (talking or sending data) on the radio, you must ensure that there is always a distance of 35 inches (0.9 m) between people and the antenna. This is the minimum safe distance. For 110 W mobiles, the minimum safe distance is 44 inches (1.1 m).
- Use the radio only with Tait-approved antennas and attachments, and make only authorized modifications to the antenna otherwise you could damage the radio and violate FCC regulations.

Please refer to the following website for more information on what RF energy is and how to control your exposure to assure compliance with established RF exposure limits.

Website: <http://www.fcc.gov/oet/rfsafety/rf-faqs.html>

Appendix 1

Antenna Location and Test Positions:

Test Vehicle:

Ford Mondeo 2001 four door sedan, dimensions 480 cm long, 185 cm wide and 148 cm high.

Each test position must satisfy the following requirements (ref KDB643646 DR02 p13):

Criteria for bystanders:

- ≤ 90 cm from antenna.
- ≥ 20 cm from side of car.
- 15 cm multiple from antenna position.

Criteria for passengers:

- Passenger exposure must be evaluated at ≤ 10 cm from surface of seats.

Azimuth: Radials are referenced to 0 degrees, which is the bearing of the location with the shortest distance to the bystander.

Roof top Antenna Position:

70 cm from side of vehicle.

Bystander exposure:

Radial	Distance from antenna (including ≥ 20 cm clearance to side of car and rounded to 15 cm multiples)	Required distance from antenna	TEST REQUIRED
0 degrees	90 cm	≤ 90 cm	YES see A Fig 1
45 deg	120 cm	≤ 90 cm	NO (> 90 cm)
90 deg	200 cm to front of car	≤ 90 cm	NO (> 90 cm)
270 deg	220 cm to rear of car	≤ 90 cm	NO (> 90 cm)
315 deg	120 cm	≤ 90 cm	NO (> 90 cm)

Trunk mounted Antenna Position:

30 cm from rear of car on the centre of the trunk lid.

Bystander exposure:

Radial	Distance from antenna (including ≥ 20 cm clearance to side of car rounded to 15 cm multiples)	Required distance from antenna	TEST REQUIRED
0 degrees	60 cm to rear of car	≤ 90 cm	YES see C Fig 2
180 deg	470 cm to front of car	≤ 90 cm	NO (> 90 cm)
45 deg	75 cm to side of car	≤ 90 cm	YES see B Fig2

