

TEST: FCC 47 CFR 1.1310 Maximum Permissible Exposure

ENVIRONMENTAL ASSESSMENT

On the T2020-543-F04 Mobile Transmitter

FCC ID: CASTEL0054

SN: 17045026

In accordance with

ANSI/IEEE Std C95.1, 1999
OET Bulletin 65 97-01

DATE: MAY 2001

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Operating and Exposure conditions:

Operating Conditions: Mobile transmitter using vehicle mounted antennas only
Exposure conditions: Occupational/Controlled.

Minimum Safe Distance calculations:

$$R = (P G / 4 \pi S)^{1/2}$$

Antenna Type: Monopole ($\lambda/4$ whip)
Antenna Gain: 2.15 dBi
Transmitter Power: 30 Watts (includes allowance for influence conditions)
Limit: 300 – 1500 MHz: $f/300 \text{ mW/cm}^2$
For $f = 468.78125 \text{ MHz}$, $s = 1.5626$
Power gain product: $30000 \times 1.64 = 49000.2 \text{ mW}$
Minimum safe distance: $(49000.2 / 4\pi \times 1.5626)^{1/2} = 50.1 \text{ cm}$

Antenna Type: Monopole ($5\lambda/8$ whip)
Antenna Gain: 5.15 dBi
Transmitter Power: 30 Watts (includes allowance for influence conditions)
Limit: 300 – 1500 MHz: $f/300 \text{ mW/cm}^2$
For $f = 468.78125 \text{ MHz}$, $s = 1.5626$
Power gain product: $30000 \times 3.27 = 98202.21 \text{ mW}$
Minimum safe distance: $(98202.21 / 4\pi \times 1.5626)^{1/2} = 70.7 \text{ cm}$

Maximum Power Factor:

Although the nominal transmitter power is 25 watts, under some circumstances it may exceed this by up to 5 watts. Results increased by factor of 30/measured TX power are also shown.

Test Results:

NAME OF TEST: TRANSMITTER OUTPUT POWER (CONDUCTED)

TEST CONDITIONS: Ambient Temperature 18°C
 Relative Humidity 55%
 Standard Voltage 13.8V DC

SPECIFICATION: FCC 47 CFR 2.1046

GUIDE: TIA/EIA-603 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:

Frequency: 468.78125MHz	Manufacturer's Rated Output Power: 25 W nominal
POWER (W)	26
Measurement Uncertainty (dB)	+0.63, -0.68

NAME OF TEST: ENVIRONMENTAL ASSESSMENT

TEST CONDITIONS: Ambient Temperature 18°C
 Relative Humidity 55%
 Standard Voltage 13.8V DC

SPECIFICATION: FCC 47 CFR 1.1310

GUIDE: ANSI/IEEE Std C95.1, 1999, OET Bulletin 65 97-01

Test Method:

The antenna is mounted on a ground plane which is placed on a non metallic turntable 1.35 m high and clear of nearby objects. Peak power density readings are taken at 0.2m vertical increments using a calibrated isotropic probe at the calculated safe distance from the antenna. The measurement equipment is operated remotely using fibre optics to reduce field perturbations.

Test Distance metres	0.5 m (distance for $\lambda/4$ whip)		0.71 m (distance for $5\lambda/8$ whip)	
	Power Density, mW/cm ²		Power Density, mW/cm ²	
Probe Height metres	Result for 26 Watts TX power.	Result for 30 watts TX power (calc).	Result for 26 Watts TX power.	Result for 30 watts TX power (calc).
0.2	0.053	0.061	0.037	0.042
0.4	0.058	0.067	0.043	0.050
0.6	0.066	0.076	0.060	0.069
0.8	0.056	0.065	0.043	0.049
1.0	0.063	0.073	0.025	0.029
1.2	0.092	0.106	0.031	0.035
1.4	0.117	0.135	0.084	0.096
1.6	0.203	0.234	0.113	0.130
1.8	0.203	0.234	0.126	0.145
2.0	0.113	0.130	0.189	0.218

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

Test Distance, m	0.5 (distance for $\lambda/4$ whip)	0.71 (distance for $5\lambda/8$ whip)
Body part	Average Power Density, mW/cm ²	Average Power Density, mW/cm ²
Whole Body Probe Height 0.2 to 2.0m	0.118	0.086
Upper Body Probe Height 1.0 to 2.0m	0.130	0.093
Lower Body Probe Height 0.2 to 0.8m	0.067	0.052

Limit, Occupational/controlled exposure:

300 – 1500 MHz: $f/300$ mW/cm²
for 468.78 MHz: 1.56 mW/cm²

Test Equipment Used:

Power Meter:	Rohde and Schwarz NRVS	s/n 841954/005
Isotropic Probe	Holaday HI-422	s/n 95661
Antenna Mast	Tait	
Turntable	Tait	
TEM cell	Rohde and Schwarz S Line	s/n338232/003
Signal Generator	Agilent E4422B	s/nGB40050320
Linear Amplifier	Amplifier Research 25A250	s/n20444

Information to be placed in Installation manual:

Antenna Installation

WARNING

To comply with FCC RF exposure limits, this product must be installed using either a 2.15 dBi or a 5.15 dBi gain antenna. This antenna must not be mounted at a location such that any person or persons can come closer than the minimum safe distance to the antenna. The minimum safe distance is 0.9 metres or 35 inches.

Information to be placed in User's Guide:

Safety Training Information

FCC RF exposure limits

WARNING

- This product generates Radio Frequency energy during transmissions. It is classified by the FCC as suitable for Occupational Use in controlled environments.
- It must only be used with authorised accessories and antennas.
- The operator must ensure that the minimum safe distance of 0.9 metres (35 inches) between persons and the antenna is not exceeded during transmissions.
- Do not exceed a duty cycle ratio of 50% transmit mode to standby or receive modes. The radio is in transmit mode when the PTT button on the microphone is pressed and the "TX" indicator in the display window shows.

END