

1 MAXIMUM PERMISSIBLE EXPOSURE (MPE)

1.1 Standard Applicable

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

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm ²) | Averaging Time (minute) |
|---|-------------------------------|-------------------------------|-------------------------------------|-------------------------|
| 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 |
| 300-1500 | / | / | F/1500 | 30 |
| 1500-15000 | / | / | 1.0 | 30 |

F = frequency in MHz

* = Plane-wave equipment power density

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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Maximum Permissible Exposure (MPE) Evaluation (worst case)

| 802.11b Main | | | | | | |
|--------------|-----------------|-----------|-------------------------|------------------------|--------------------|--------|
| CH | Frequency (MHz) | Data Rate | Peak Output Power (dBm) | Peak Output Power (mW) | Limit | RESULT |
| 1 | 2412 | 1 | 19.25 | 84.14 | 1 Watt = 30.00 dBm | PASS |
| 6 | 2437 | 1 | 19.33 | 85.70 | 1 Watt = 30.00 dBm | PASS |
| 11 | 2462 | 1 | 19.41 | 87.30 | 1 Watt = 30.00 dBm | PASS |

| 802.11b Main | | | | | | |
|--------------|-----------------|-----------|-------------------------|------------------------|--------------------|--------|
| CH | Frequency (MHz) | Data Rate | Avg. Output Power (dBm) | Avg. Output Power (mW) | Limit | RESULT |
| 1 | 2412 | 1 | 16.82 | 48.08 | 1 Watt = 30.00 dBm | PASS |
| 6 | 2437 | 1 | 16.99 | 50.00 | 1 Watt = 30.00 dBm | PASS |
| 11 | 2462 | 1 | 16.98 | 49.89 | 1 Watt = 30.00 dBm | PASS |

MPE Prediction (802.11b 2412~2462)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = Power density P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

| | | |
|---|-----------|-----------|
| Max. output power including tune-up tolerance1: | 16.99 | (dBm) |
| Max. output power including tune-up tolerance1: | 50.003453 | (mW) |
| Duty cycle: | 98.92 | (%) |
| Maximum Pav : | 49.463416 | (mW) |
| Peak Antenna gain (Maximum): | 3.22 | (dBi) |
| Peak Antenna gain (linear): | 2.0989399 | (numeric) |
| Prediction distance: | 20 | (cm) |
| Prediction frequency: | 2437 | (MHz) |
| MPE limit for uncontrolled exposure at prediction | 1 | (mW/cm^2) |
| Power density at predication frequency at 20 (cm) | 0.021 | (mW/cm^2) |

Measurement Result

The predicted power density level at 20 cm is 0.021 mW/cm².

This is below the uncontrolled exposure limit of 1 mW/cm² at 2437MHz.

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Maximum Permissible Exposure (MPE) Evaluation (worst case)

802.11n_HT20M MIMO

| CH | Frequency (MHz) | Data Rate | Peak Output Power (dBm) | | Total Peak Output Power (dBm) | Total Peak Output Power (mW) | Limit | RESULT |
|----|-----------------|-----------|-------------------------|-------|-------------------------------|------------------------------|--------------------|--------|
| | | | CH 0 | CH 1 | | | | |
| 1 | 2412 | MCS8 | 17.10 | 21.05 | 22.52 | 178.64 | 1 Watt = 29.77 dBm | PASS |
| 6 | 2437 | MCS8 | 17.22 | 21.13 | 22.61 | 182.44 | 1 Watt = 29.77 dBm | PASS |
| 11 | 2462 | MCS8 | 17.06 | 21.06 | 22.52 | 178.46 | 1 Watt = 29.77 dBm | PASS |

802.11n_HT20M MIMO

| CH | Frequency (MHz) | Data Rate | Avg. Output Power (dBm) | | Avg. Output Power (dBm) | Avg. Output Power (mW) | Limit | RESULT |
|----|-----------------|-----------|-------------------------|-------|-------------------------|------------------------|--------------------|--------|
| | | | CH 0 | CH 1 | | | | |
| 1 | 2412 | MCS8 | 11.20 | 14.18 | 15.95 | 39.36 | 1 Watt = 29.77 dBm | PASS |
| 6 | 2437 | MCS8 | 11.29 | 14.20 | 15.99 | 39.76 | 1 Watt = 29.77 dBm | PASS |
| 11 | 2462 | MCS8 | 11.54 | 14.05 | 15.98 | 39.67 | 1 Watt = 29.77 dBm | PASS |

MPE Prediction (802.11n-HT20 2412~2462)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = Power density P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

MIMO Gain: 3.22+3.01=6.23dBi

| | | |
|---|-----------|-----------------------|
| Max. output power including tune-up tolerance: | 15.99 | (dBm) |
| Max. output power including tune-up tolerance: | 39.719155 | (mW) |
| Duty cycle: | 87.59 | (%) |
| Maximum Pav : | 34.790008 | (mW) |
| Peak Antenna gain (Maximum): | 6.23 | (dBi) |
| Peak Antenna gain (linear): | 4.1975898 | (numeric) |
| Prediction distance: | 20 | (cm) |
| Prediction frequency: | 2437 | (MHz) |
| MPE limit for uncontrolled exposure at prediction | 1 | (mW/cm ²) |
| Power density at predication frequency at 20 (cm) | 0.029 | (mW/cm ²) |

Measurement Result

The predicted power density level at 20 cm is 0.029 mW/cm².

This is below the uncontrolled exposure limit of 1 mW/cm² at 2437MHz.

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Maximum Permissible Exposure (MPE) Evaluation (worst case)

802.11n_HT40M MIMO

| CH | Frequency (MHz) | Data Rate | Peak Output Power (dBm) | | Total Peak Output Power (dBm) | Total Peak Output Power (mW) | Limit | RESULT |
|----|-----------------|-----------|-------------------------|-------|-------------------------------|------------------------------|--------------------|--------|
| | | | CH 0 | CH 1 | | | | |
| 3 | 2422 | MCS8 | 18.18 | 21.24 | 22.98 | 198.81 | 1 Watt = 29.77 dBm | PASS |
| 6 | 2437 | MCS8 | 17.93 | 20.94 | 22.70 | 186.25 | 1 Watt = 29.77 dBm | PASS |
| 9 | 2452 | MCS8 | 18.06 | 21.11 | 22.86 | 193.10 | 1 Watt = 29.77 dBm | PASS |

802.11n_HT40M MIMO

| CH | Frequency (MHz) | Data Rate | Avg. Output Power (dBm) | | Avg. Output Power (dBm) | Avg. Output Power (mW) | Limit | RESULT |
|----|-----------------|-----------|-------------------------|-------|-------------------------|------------------------|--------------------|--------|
| | | | CH 0 | CH 1 | | | | |
| 3 | 2422 | MCS8 | 10.95 | 14.19 | 15.88 | 38.69 | 1 Watt = 29.77 dBm | PASS |
| 6 | 2437 | MCS8 | 11.14 | 14.27 | 15.99 | 39.73 | 1 Watt = 29.77 dBm | PASS |
| 9 | 2452 | MCS8 | 11.21 | 13.96 | 15.81 | 38.10 | 1 Watt = 29.77 dBm | PASS |

MPE Prediction (802.11n-HT40 2422~2452)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = Power density P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

MIMO Gain: 3.22+3.01=6.23dBi

| | | |
|---|-----------|-----------------------|
| Max. output power including tune-up tolerance: | 15.99 | (dBm) |
| Max. output power including tune-up tolerance: | 39.719155 | (mW) |
| Duty cycle: | 81.86 | (%) |
| Maximum Pav : | 32.5141 | (mW) |
| Peak Antenna gain (Maximum): | 6.23 | (dBi) |
| Peak Antenna gain (linear): | 4.1975898 | (numeric) |
| Prediction distance: | 20 | (cm) |
| Prediction frequency: | 2437 | (MHz) |
| MPE limit for uncontrolled exposure at prediction | 1 | (mW/cm ²) |
| Power density at predication frequency at 20 (cm) | 0.027 | (mW/cm ²) |

Measurement Result

The predicted power density level at 20 cm is 0.027 mW/cm².

This is below the uncontrolled exposure limit of 1 mW/cm² at 2437MHz.

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