# ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LICENSED TRANSMITTER

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|---|---|
| **Test Report No.** | **: E14NR-087** |
| **AGR No.** | **: A149A-236** |
| **Applicant** | **: Airpoint Co., Ltd.** |
| **Address** | **: MIGUN TECHNO WORLD 2-CHA, 533-1, Yongsan-dong, Yuseong-gu, Daejeon, 305-500, South Korea** |
| **Manufacturer** | **: Airpoint Co., Ltd.** |
| **Address** | **: MIGUN TECHNO WORLD 2-CHA, 533-1, Yongsan-dong, Yuseong-gu, Daejeon, 305-500, South Korea** |
| **Type of Equipment** | **: ICS Repeater System** |
| **FCC ID.** | **: WYFAWE43LC20CG** |
| **Model Name** | **: IRES-1900US20-20 CG-Prototype** |
| **Serial number** | **: N/A** |
| **Total page of Report** | **: 9 pages (including this page)** |
| **Date of Incoming** | **: October 16, 2014** |
| **Date of issue** | **: November 14, 2014** |

## SUMMARY

The equipment complies with the regulation; **FCC Part 24 Subpart E, B2I Part 20 Industrial Booster**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

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# Revision History

| Issued Report No. | Issued Date | Revisions | Effect Section |
|---|---|---|---|
| E14NR-087 | November 14, 2014 | Initial Issue | All |
| | | | |
| | | | |



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# 1. VERIFICATION OF COMPLIANCE

| | |
|---|---|
| APPLICANT | : Airpoint Co., Ltd. |
| ADDRESS | : MIGUN TECHNO WORLD 2-CHA, 533-1, Yongsan-dong, Yuseong-gu, Daejeon, 305-500, South Korea |
| CONTACT PERSON | : Jung-nam, Lim / Research Manager |
| TELEPHONE NO | : +82-42-484-5460 |
| FCC ID | : WYFAWE43LC20CG |
| MODEL NAME | : IRES-1900US20-20 CG-Prototype |
| SERIAL NUMBER | : N/A |
| DATE | : November 14, 2014 |

| | |
|---|---|
| EQUIPMENT CLASS | **B2I- Part 20 Industrial Booster** |
| EQUIPMENT DESCRIPTION | ICS Repeater System |
| THIS REPORT CONCERNS | Original Grant |
| MEASUREMENT PROCEDURES | ANSI C95.1 or KDB 447498 |
| TYPE OF EQUIPMENT TESTED | Pre-Production |
| KIND OF EQUIPMENT AUTHORIZATION REQUESTED | Certification |
| EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S) | FCC Part 24 Subpart E |
| MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE | No |
| FINAL TEST WAS CONDUCTED ON | 10 m, Semi Anechoic Chamber |

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.



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# 2 GENERAL INFORMATION

## 2.1 Product Description

The Airpoint Co., Ltd., Models IRES-1900US20-20 CG-Prototype (referred to as the EUT in this report) are ICS Repeater System . The product specification described herein was obtained from product data sheet or user's manual.

| | | |
|---|---|---|
| DEVICE TYPE | | ICS Repeater System |
| LIST OF EACH OSC. or CRY. FREQ.(FREQ. >= 1 MHz) | | 38.4 MHz |
| EMISSION DESIGNATOR | | F9W(CDMA 2000, 1xEVDO),<br>G7D(LTE:QPSK), D7W(LTE:16QAM, 64QAM) |
| OPERATING FREQUENCY | Downlink | 1 975 MHz ~ 1 995 MHz |
| | Uplink | 1 895 MHz ~ 1 915 MHz |
| CHANNEL SEPARATION | | CDMA 2000 (1.25 MHz), 1xEVDO (1.25 MHz),<br>LTE (5 MHz, 10 MHz, 15 MHz) |
| RF OUTPUT POWER | | 43 dBm (Downlink), 30 dBm (Uplink) |
| ELECTRICAL RATING | | DC -48 V |
| OPERATING TEMPERATURE | | -10 ℃ ~ 50 ℃ |

## 2.2 Alternative type(s)/model(s); also covered by this test report.

-. None

# 3. EUT MODIFICATIONS

-. None



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# 4. MAXIMUM PERMISSIBLE EXPOSURE

## 4.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment are f/1500 mW/cm² the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm² the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm² exposure is calculated as follows:

$E = \sqrt{(30 * P * G)} / d$, and $S = E^2 / Z = E^2 / 377$, because 1 mW/cm² = 10 W/m²

Where

S = Power density in mW/cm², Z = Impedance of free space, 377 Ω

E = Electric filed strength in V/m, G = Numeric antenna gain, and d = distance in meter

Combing equations and rearranging the terms to express the distance as a function of the remaining variable

$d = \sqrt{(30 * P * G) / (377 * S)}$

Changing to units of mW and cm, using P (mW) = P (W) / 1 000, d (cm) = 100 * d (m)

$d = 0.282 * \sqrt{(P * G) / S}$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in mW/cm²

## 4.2 Calculated MPE Safe Distance

### 4.2.1 TEST Result(Downlink/CDMA)

According to above equation, the following result was obtained.

| Peak Output Power | | Antenna Gain (dBi) | | Safe Distance | Power Density (mW/cm²) | FCC Limit |
|---|---|---|---|---|---|---|
| (dBm) | (mW) | Log | Linear | (cm) | @ 300 cm Separation | (mW/cm²) |
| 43.07 | 20 276.8 | 17.0 | 50.12 | 284.282 | 0.899 | 1 |

According to above table, safe distance, $D = 0.282 * \sqrt{20\ 276.8 * 50.12} = 284.282$ cm.

For getting power density at 300 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 20\ 276.8 * 50.12 / (4 * 3.14 * 300\text{^}2) = 0.899$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna



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### 4.2.2 TEST Result(Downlink/LTE 5 MHz)

According to above equation, the following result was obtained.

| Peak Output Power | | Antenna Gain (dBi) | | Safe Distance | Power Density (mW/cm²) | FCC Limit |
|---|---|---|---|---|---|---|
| (dBm) | (mW) | Log | Linear | (cm) | @ 300 cm Separation | (mW/cm²) |
| 43.09 | 20 370.4 | 17.0 | 50.12 | 284.937 | 0.903 | 1 |

According to above table, safe distance, D = 0.282 * $\sqrt{20\ 370.4 * 50.12}$ = 284.937 cm.

For getting power density at 300 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 20\ 370.4 * 50.12 / (4 * 3.14 * 300^2) = 0.903$

Where:

S = Power Density,
P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),
G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

### 4.2.3 TEST Result(Downlink/LTE 10 MHz)

According to above equation, the following result was obtained.

| Peak Output Power | | Antenna Gain (dBi) | | Safe Distance | Power Density (mW/cm²) | FCC Limit |
|---|---|---|---|---|---|---|
| (dBm) | (mW) | Log | Linear | (cm) | @ 300 cm Separation | (mW/cm²) |
| 43.02 | 20 044.7 | 17.0 | 50.12 | 282.650 | 0.889 | 1 |

According to above table, safe distance, D = 0.282 * $\sqrt{20\ 044.7 * 50.12}$ = 282.650 cm.

For getting power density at 300 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 20\ 044.7 * 50.12 / (4 * 3.14 * 300^2) = 0.889$

Where:

S = Power Density,
P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),
G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

### 4.2.4 TEST Result(Downlink/LTE 15 MHz)

According to above equation, the following result was obtained.

| Peak Output Power | | Antenna Gain (dBi) | | Safe Distance | Power Density (mW/cm²) | FCC Limit |
|---|---|---|---|---|---|---|
| (dBm) | (mW) | Log | Linear | (cm) | @ 300 cm Separation | (mW/cm²) |
| 43.04 | 20 137.2 | 17.0 | 50.12 | 283.302 | 0.893 | 1 |

According to above table, safe distance, D = 0.282 * $\sqrt{20\ 137.2 * 50.12}$ = 283.302 cm.

For getting power density at 300 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 20\ 137.2 * 50.12 / (4 * 3.14 * 300^2) = 0.893$

Where:

S = Power Density,
P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),
G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna



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### 4.2.5 TEST Result(Uplink/CDMA)

According to above equation, the following result was obtained.

| Peak Output Power | | Antenna Gain (dBi) | | Safe Distance | Power Density (mW/cm²) | FCC Limit |
|---|---|---|---|---|---|---|
| (dBm) | (mW) | Log | Linear | (cm) | @ 300 cm Separation | (mW/cm²) |
| 30.06 | 1 013.9 | 17.0 | 50.12 | 63.570 | 0.045 | 1 |

According to above table, safe distance, D = 0.282 * $\sqrt{1\ 013.9 * 50.12}$ = 63.570 cm.

For getting power density at 300 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 1\ 013.9 * 50.12 / (4 * 3.14 * 300\text{^}2) = 0.045$

Where:

S = Power Density,
P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),
G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

### 4.2.6 TEST Result(Uplink/LTE 5 MHz)

According to above equation, the following result was obtained.

| Peak Output Power | | Antenna Gain (dBi) | | Safe Distance | Power Density (mW/cm²) | FCC Limit |
|---|---|---|---|---|---|---|
| (dBm) | (mW) | Log | Linear | (cm) | @ 300 cm Separation | (mW/cm²) |
| 30.05 | 1 011.6 | 17.0 | 50.12 | 63.496 | 0.045 | 1 |

According to above table, safe distance, D = 0.282 * $\sqrt{1\ 011.6 * 50.12}$ = 63.496 cm.

For getting power density at 300 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 1\ 011.6 * 50.12 / (4 * 3.14 * 300\text{^}2) = 0.045$

Where:

S = Power Density,
P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),
G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

### 4.2.7 TEST Result(Uplink/LTE 10 MHz)

According to above equation, the following result was obtained.

| Peak Output Power | | Antenna Gain (dBi) | | Safe Distance | Power Density (mW/cm²) | FCC Limit |
|---|---|---|---|---|---|---|
| (dBm) | (mW) | Log | Linear | (cm) | @ 300 cm Separation | (mW/cm²) |
| 30.04 | 1 009.3 | 17.0 | 50.12 | 63.423 | 0.045 | 1 |

According to above table, safe distance, D = 0.282 * $\sqrt{1\ 009.3 * 50.12}$ = 63.423 cm.

For getting power density at 300 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 1\ 009.3 * 50.12 / (4 * 3.14 * 300\text{^}2) = 0.045$

Where:

S = Power Density,
P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),
G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna



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**4.2.8 TEST Result(Uplink/LTE 15 MHz)**

According to above equation, the following result was obtained.

| Peak Output Power | | Antenna Gain (dBi) | | Safe Distance | Power Density (mW/cm²) | FCC Limit |
|---|---|---|---|---|---|---|
| (dBm) | (mW) | Log | Linear | (cm) | @ 300 cm Separation | (mW/cm²) |
| 30.05 | 1 011.6 | 17.0 | 50.12 | 63.496 | 0.045 | 1 |

According to above table, safe distance, $D = 0.282 * \sqrt{1\ 011.6 * 50.12} = 63.496$ cm.

For getting power density at 300 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 1\ 011.6 * 50.12 / (4 * 3.14 * 300\text{^}2) = 0.045$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna



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