HCT CO., LTD.

# CERTIFICATE OF COMPLIANCE

## FCC PART 15.231 Certification

**Applicant Name:**
HYUNDAI MOBIS CO., LTD.

**Address:**
80-9, MABOOK-RI, GUSEONG-EUP,
YONGIN-SHI,GYUNGGI-DO,449-912 SOUTH KOREA

**Date of Issue:**
July 21, 2010

**Test Site/Location:**
HCT.CO., LTD., San 136-1 Ami-ri, Bubal-eup, Icheon-si, Kyungki-do, Korea

**Test Report No.:** HCTR1007FR20

**HCT FRN:** 0005866421

| | |
|---|---|
| **FCC ID** | **: TQ8HM-T032** |
| **IC** | **: 5074A- HMT032** |
| **APPLICANT** | **: HYUNDAI MOBIS CO., LTD.** |

| | |
|---|---|
| **FCC Model(s):** | HM-T032 |
| **IC Model(s):** | HM-T032 |
| **EUT Type:** | Remote Keyless Entry |
| **Tx Frequency:** | 315.00 MHz (Tx) |
| **Type of Modulation:** | FSK |
| **Equipment Class:** | DSC - Part 15 Security / Remote Control Transmitter |
| **IC Equipment Category:** | RSS-210 Issue 7: Category I Equipment, annex 1 |
| **FCC Rule Part(s)** | Part 15 subpart C 15.231 |
| **IC Rule:** | RSS-210 Issue 7, RSS-GEN |
| **IC Registration No. :** | 5944A-1 |

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

**HCT.CO., LTD.** Certifies that no party to this application has been denied FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

Jong Seok Lee
Report prepared by
: Jong Seok Lee
Test engineer of RF Part

Approved by
: Sang Jun Lee
Manager of RF Part

# Version

| TEST REPORT NO. | DATE | DESCRIPTION |
|---|---|---|
| HCTR1007FR20 | July 21, 2010 | First Approval Report |
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# 1. GENERAL INFORMATION

| | |
|---|---|
| **Applicant:** | HYUNDAI MOBIS CO., LTD. |
| **Address:** | 80-9, MABOOK-RI, GUSEONG-EUP,<br>YONGIN-SHI,GYUNGGI-DO,449-912 SOUTH KOREA |
| **FCC ID:** | TQ8HM-T032 |
| **IC :** | 5074A- HMT032 |
| **EUT:** | Remote Keyless Entry |
| **FCC Model(s):** | HM-T032 |
| **IC Model(s):** | HM-T032 |
| **Date of Test:** | July 12, 2010 ~ July 16, 2010 |
| **Contact person:** | Name: Seung Keun, Jeon<br>Phone #: +82-31-288-5232<br>Fax #: +82-31-899-1788 |
| **Place of Tests:** | HCT.CO., LTD.,<br>San 136-1 Ami-ri, Bubal-eup, Icheon-si,<br>Kyungki-do, Korea (IC Recognition No. : IC 5944A-1) |

# 2. EUT DESCRIPTION

| | |
|---|---|
| **Type** | Remote Keyless Entry |
| **Model Name** | HM-T032 |
| **Power Source** | DC 3 V (Lithium Battery) |
| **Tx Frequency** | 315.00 MHz (Tx) |
| **Type of Modulation** | FSK |
| **Antenna** | Antenna type : PCB Pattern Antenna |

# 3. TEST METHODOLOGY

The measurement procedure described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2003) and FCC Public Notice DA 00-705 dated March 30, 2000 entitled “Filing and Measurement Guidelines for Transmitter for Remote Keyless Entry System” were used in the measurement of the **HYUNDAI MOBIS CO., LTD. Remote Keyless Entry FCC ID: TQ8HM-T032**

## 3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

## 3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.205, 15.207, 15.209 and 15.231 under the FCC Rules Part 15 Subpart C.

## 3.3 GENERAL TEST PROCEDURES

**Conducted Emissions**

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4. (Version :2003) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

**Radiated Emissions**

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4. (Version: 2003)

## 3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under engineering test mode condition and the EUT staying in continuous transmitting mode.

# 4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

# 5. FACILITIES AND ACCREDITATIONS

## 5.1 FACILITIES

The open area test site and conducted measurement facility used to collect the radiated data are located at the 254-1,Maekok-Ri, Hobup-Myun, Ichon-Si, Gyunggi-Do, 467-701, KOREA. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2003) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated June 10, 2009(Registration Number: 90661)

## 5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

# 6. ANTENNA REQUIREMENTS

**According to FCC 47 CFR §15.203:**

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

* The antennas of this E.U.T are permanently attached.

*The E.U.T Complies with the requirement of §15.203

# 7. LIMITS AND TEST RESULT

## Summary of Test Results

| Report Section | FCC Part Section(s) | RSS-210 Section | Test Description | Test Result |
|---|---|---|---|---|
| TRANSMITTER MODE (TX) | | | | |
| 7.2, 7.3 | 15.231(a) | A1.1.1(a) | MAXIMUM MODULATION PERCENTAGE (M%)<br>LESS THAN 5 SECOND PLOT | PASS |
| 7.4 | 15.231(b) | A.1.1.2(1) | RADIATED EMISSIONS | PASS |
| 7.1 | 15.231(c) | A1.1.3 | 20dB BANDWIDTH | PASS |

## 7.1 20dB BANDWIDTH

### LIMIT

§15.231 (c) & IC RSS-210 Issue 6 A1.1.3
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz. the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

### TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer.

20dB Bandwidth The RBW is set to 100KHz. The VBW is set to 100KHz. The sweep time is coupled. Bandwidth is determined at the points 20 dB down from the modulated carrier.

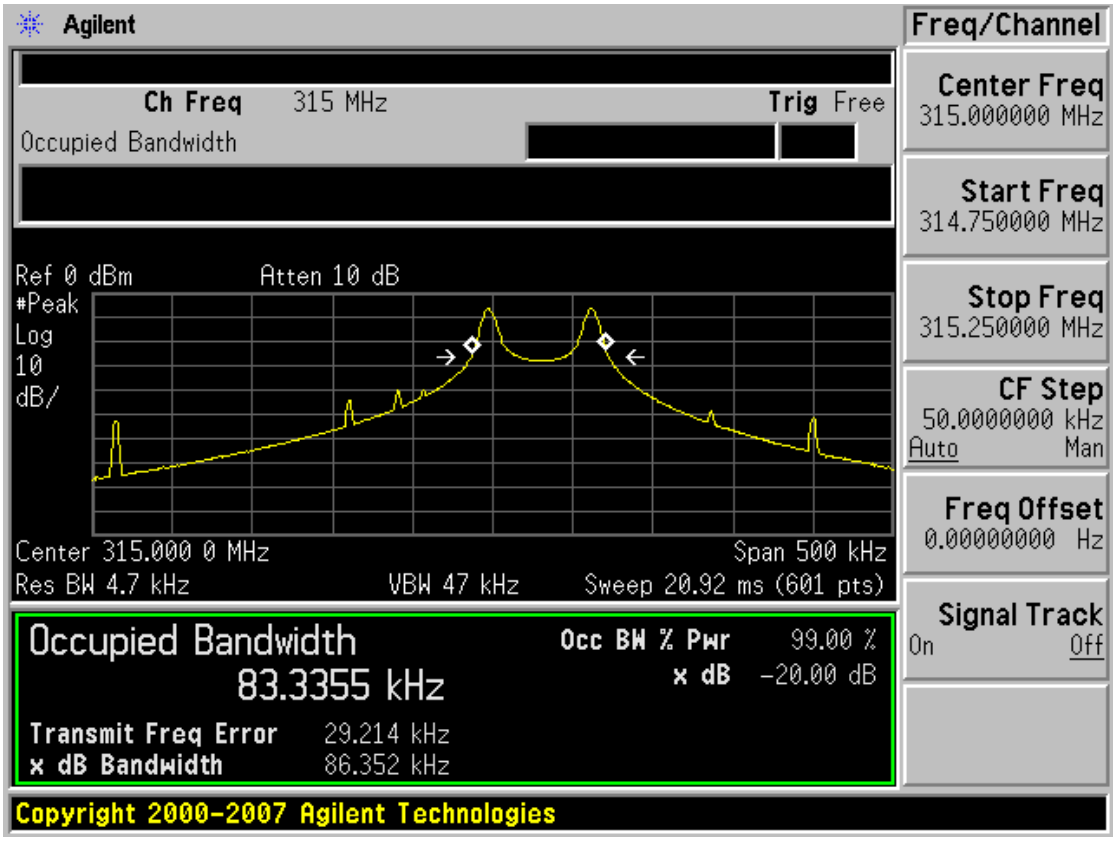
### RESULTS

NO non-compliance noted.

| Operating Frequency (MHz) | 20dB Bandwidth (KHz) | Limit (KHz) | Margin (KHz) |
|---|---|---|---|
| 315.00 | 86.352 | 787.5 | 701.148 |

## 20dB BANDWIDTH

### ▣ RESULT PLOTS



## 7.2 MAXIMUM MODULATION PERCENTAGE (M%)

**LIMIT**

§15.35 (c) & IC RSS-Gen Issue 1 §4.3

**The measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative(provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 seconds interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.**

**TEST PROCEDURE**

**The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 100 KHz and the VBW is set to 100 KHz. The sweep time is coupled and the span is set to 0 Hz. The number of pulses is measured and calculated in a 100 ms scan.**

**CALCULATION**

**Average Reading = Peak Reading(dBuV/m)+20log (Duty Cycle), Where Duty Cycle is (# of pulses *pulse width)/100 or T**

**RESULTS**

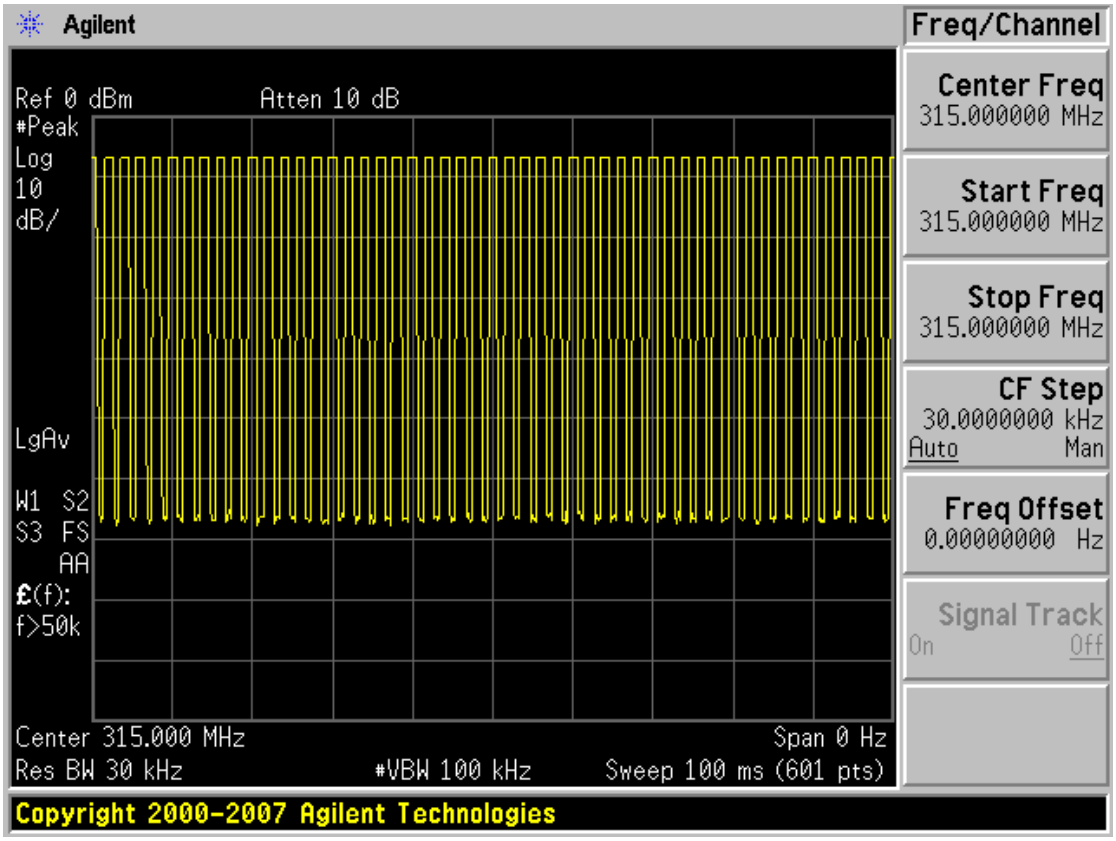
**No non-compliance noted:**

**MAXIMUM MODULATION PERCENTAGE**

| One Period (ms) | Pulse Width (ms) | # of Pulses | Duty Cycle | % Duty Cycle |
|---|---|---|---|---|
| 100 | 1.033 | 50 | 0.52 | 51.65 |

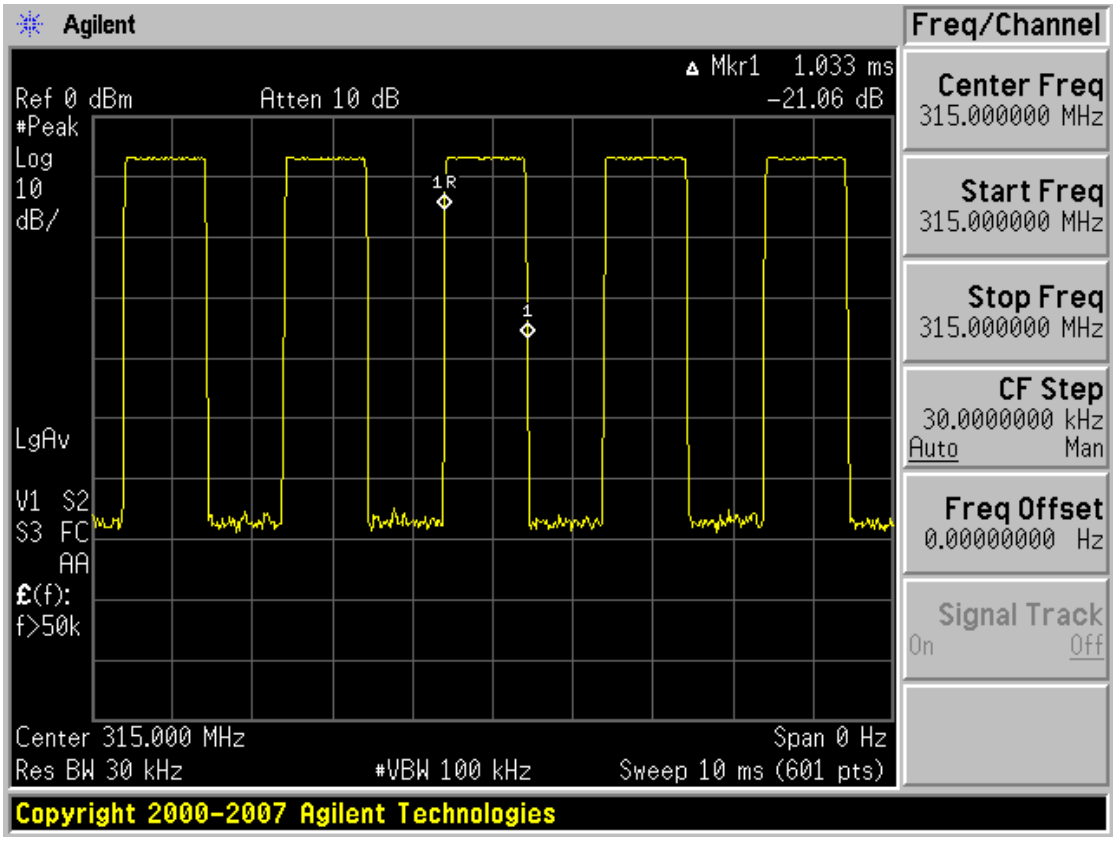
**100 ms**

## ▣ RESULT PLOTS



**PULSE WIDTH**

## ▣ RESULT PLOTS



## 7.3 LESS THAN 5 SECOND PLOT

**LIMIT**

§15.231 (a) (1) & RSS210 A1.1.1 (1)

**A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.**

**TEST PROCEDURE**

**The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 100 KHz and the VBW is set to 100 KHz . The sweep time is set to 1 seconds and the span is set to 0 Hz.**

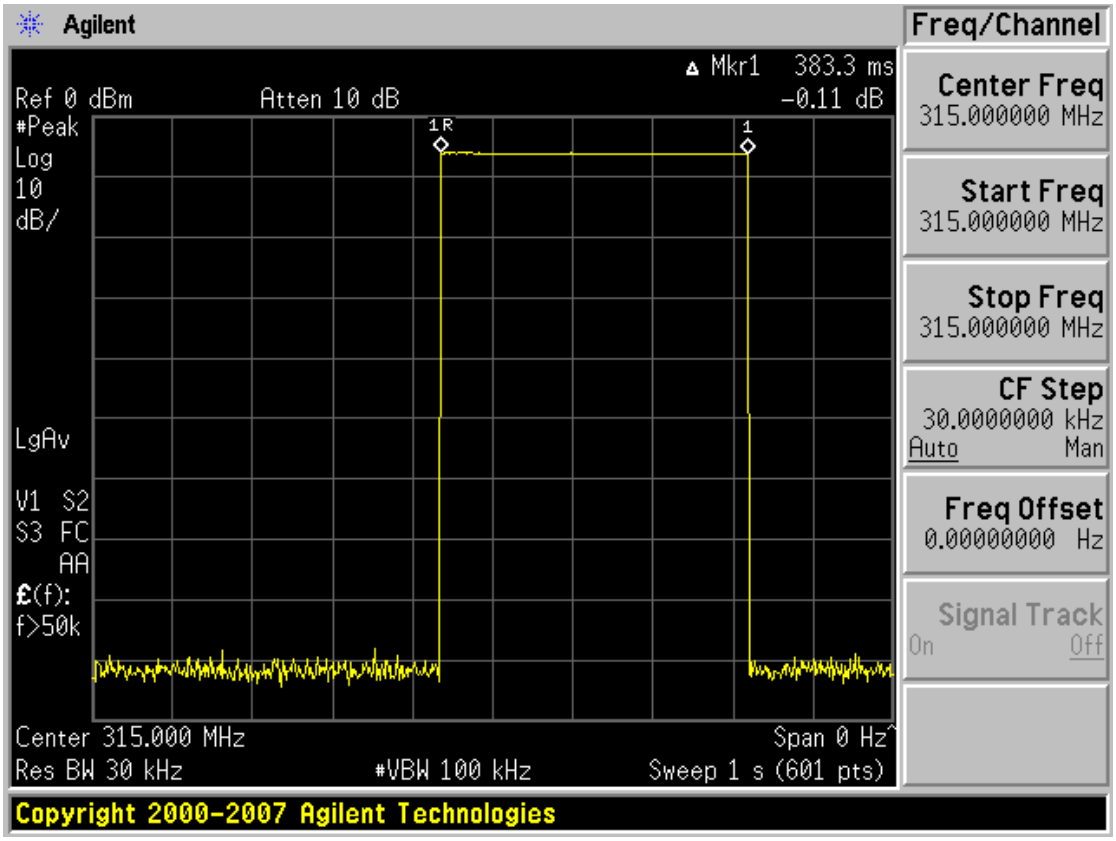
**RESULTS**

**NO non-complianc noted.**

| Frequency (MHz) | Transmission time (ms) | Limit (Second) | Remark |
|---|---|---|---|
| 315.00 | 383.3 | 5.00 | PASS |

**LESS THAN 5 SECONDS**

## ▣ RESULT PLOTS



## 7.4 RADIATED EMISSIONS

### 7.4.1 TRANSMITTER RADIATED SPURIOUS EMISSIONS

**LIMITS**

§15.231 (b) In addition to the provisions of §15.205, the field strength of emissions from Intentional radiators operated under this section shall not exceed the following.

| Fundametal Frequency (MHz) | Field Strength of fundamental (uV/m) | Field Strength of Spurious Emissions (uV/m) |
|---|---|---|
| 40.66 ~ 40.70 | 22.50 | 225 |
| 70 ~ 130 | 1250 | 125 |
| 130 ~ 174 | 1250 to 3750 ** | 125 to 375 ** |
| 174 ~ 260 | 3750 | 375 |
| 260 ~ 470 | 3750 to 12500 ** | 375 to 1250 ** |
| Above 470 | 12500 | 1250 |

**** Linear interpolations**

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

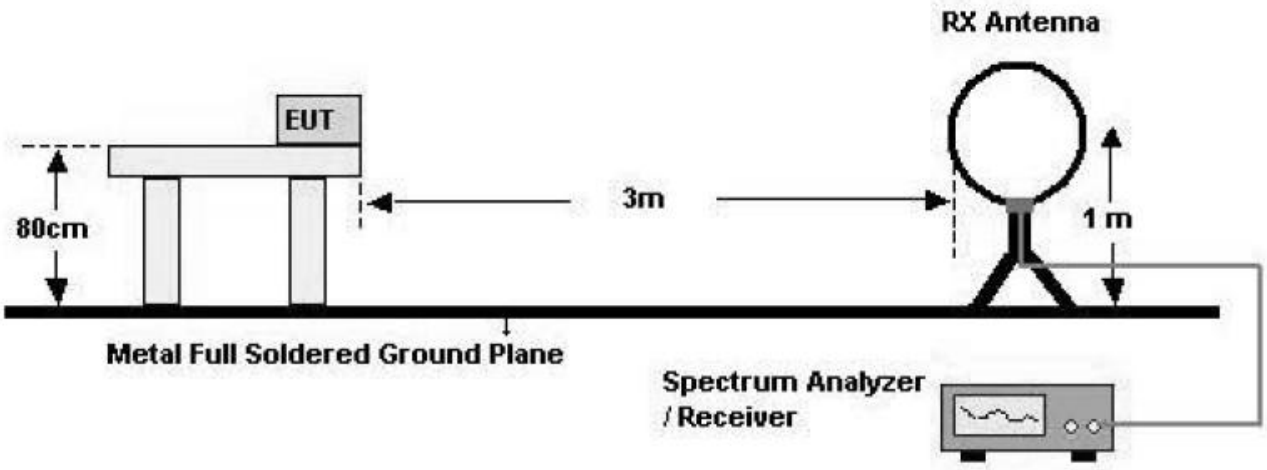
§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table ;

| Frequency (MHz) | Field Strength (uV/m) | Field Strength (dBuV/m) |
|---|---|---|
| 30-88 | 100 | 40.0 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46.0 |
| Above 960 | 500 | 54.0 |

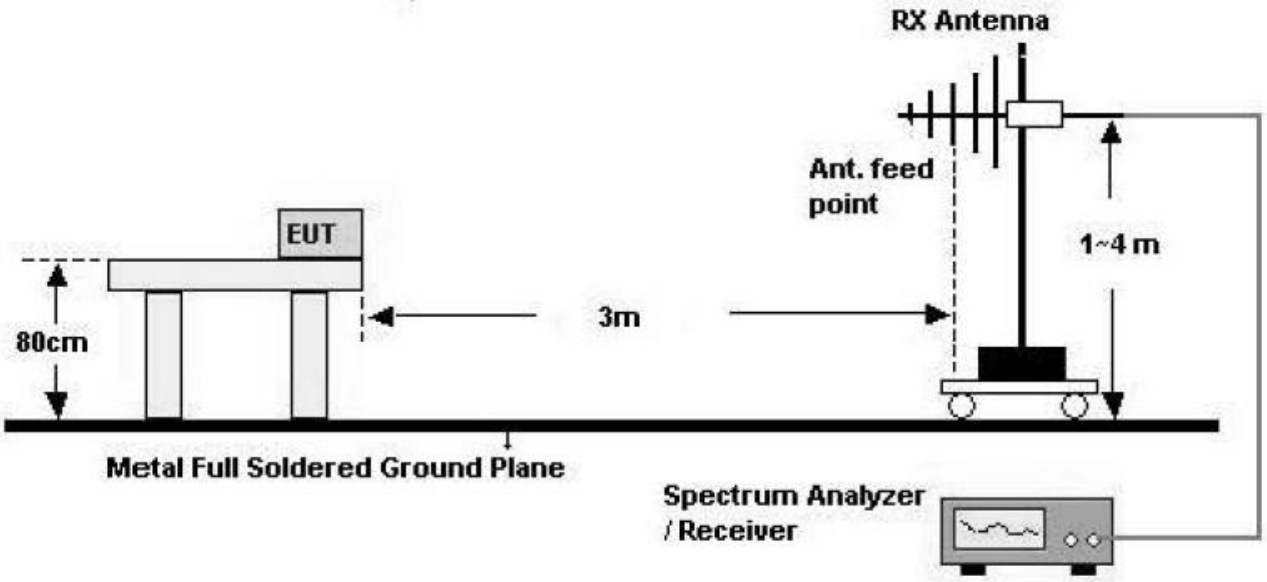
**** Except as provided in paragraph (g), fundamental emissions rom intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz However, operation within these frequency bands is permitted under other sections of this part, e.g., Sections 15.231 and 15.241**

## Test Configuration

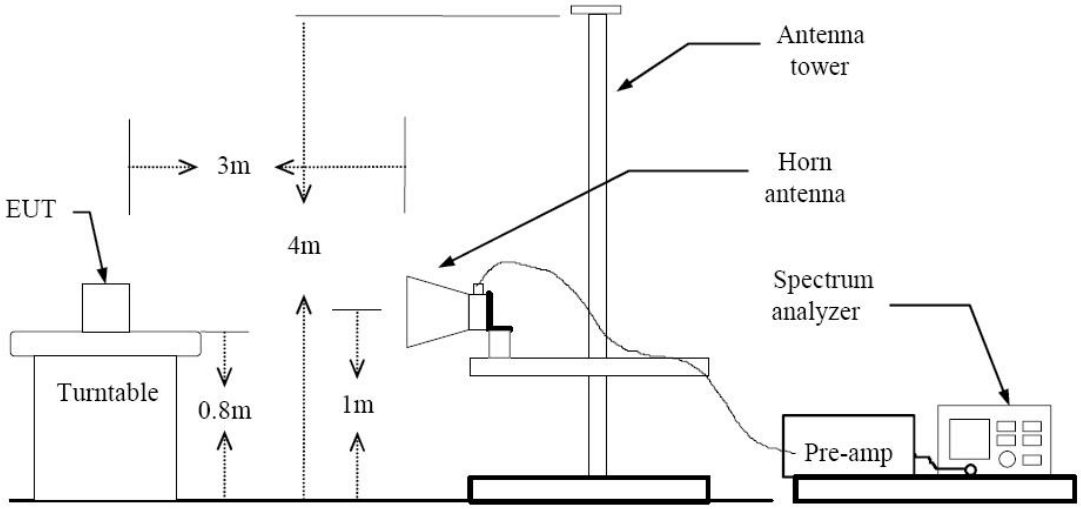
### Below 30 MHz




### 30 MHz - 1 GHz



**Above 1 GHz**




**TEST PROCEDURE**

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4 The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 KHz for peak detection measurements or 120 KHz or quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and -5.74 duty cycle for a average measurements.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

## 7.4.2 TEST RESULTS

### Below 1 GHz

**Table 1: Measured values of the Field strength**

*Av Reading = Pk Reading + 20*log(M%)*

*20*log(M%) = -5.74*

| Frequency [MHz] | Reading dBuV | Ant. Factor dB/m | Cable Loss dB | Pol [H/V] | Height [cm] | Azimuth [degrees] | Field Strength [dBuV/m] | Limit dBuV/m | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|
| **AVERAGE data** | | | | | | | | | |
| 315 | 55.0 | 13.4 | 1.9 | H | 109.9 | 167.8 | 70.27 | 75.6 | 5.33 |
| 315 | 34.6 | 13.4 | 1.9 | V | 100.1 | 226.2 | 49.85 | 75.6 | 25.75 |
| 630 | 21.2 | 20.0 | 2.7 | H | 150.0 | 195.4 | 43.90 | 55.6 | 11.7 |
| 630 | 10.5 | 20.0 | 2.7 | V | 100.0 | 184.0 | 33.15 | 55.6 | 22.45 |
| 945 | 19.5 | 23.7 | 3.6 | H | 100.0 | 207.3 | 46.78 | 55.6 | 8.82 |
| 945 | 11.9 | 23.7 | 3.6 | V | 113.3 | 204.2 | 39.17 | 55.6 | 16.43 |
| **PEAK data** | | | | | | | | | |
| 315 | 60.7 | 13.4 | 1.9 | H | 109.9 | 167.8 | 76.01 | 95.6 | 19.59 |
| 315 | 40.3 | 13.4 | 1.9 | V | 100.1 | 226.2 | 55.59 | 95.6 | 40.01 |
| 630 | 26.9 | 20.0 | 2.7 | H | 150.0 | 195.4 | 49.64 | 75.6 | 25.96 |
| 630 | 16.2 | 20.0 | 2.7 | V | 100.0 | 184.0 | 38.89 | 75.6 | 36.71 |
| 945 | 25.2 | 23.7 | 3.6 | H | 100.0 | 207.3 | 52.52 | 75.6 | 23.08 |
| 945 | 17.6 | 23.7 | 3.6 | V | 113.3 | 204.2 | 44.91 | 75.6 | 30.69 |

*Note*

**1. The antenna is manipulated through typical positions, polarity and length during the testing**

**2. The frequency range was scanned from 25 MHz to 4 GHz and the worst-case emissions are reported.**

**3. There is detected level above reference noise floor spectrum analyzer. Except above frequency**

## 7.4.3 TEST RESULTS

### Above 1 GHz

**Table 1: Measured values of the Field strength**

*Av Reading = Pk Reading + 20*log(M%)*

*20*log(M%) = -5.74*

| Frequency [MHz] | Reading dBuV | ※A.F.+CL-AMP G dB | Pol [H/V] | Height [cm] | Azimuth [degrees] | Field Strength [dBuV/m] | Limit dBuV/m | Margin [dB] |
|---|---|---|---|---|---|---|---|---|
| **AVERAGE data** | | | | | | | | |
| 1260 | 44.75 | -11.71 | V | 104.7 | 79.0 | 33.04 | 54 | 20.96 |
| 1575 | 53.07 | -11.22 | H | 101.5 | 103.0 | 41.85 | 54 | 12.15 |
| 1890 | 45.91 | -10.28 | V | 100.0 | 65.0 | 35.63 | 54 | 18.37 |
| 1890 | 52.48 | -10.28 | H | 101.1 | 271.7 | 42.20 | 54 | 11.8 |
| 2205 | 53.18 | -9.04 | H | 100.0 | 180.6 | 44.14 | 54 | 9.86 |
| 2835 | 51.76 | -6.24 | H | 100.0 | 135.7 | 45.52 | 54 | 8.48 |
| **PEAK data** | | | | | | | | |
| 1260 | 50.91 | -11.71 | V | 104.7 | 79.0 | 39.20 | 74 | 34.8 |
| 1575 | 59.75 | -11.22 | H | 101.5 | 103.0 | 48.53 | 74 | 25.47 |
| 1890 | 51.61 | -10.28 | V | 100.0 | 65.0 | 41.33 | 74 | 32.67 |
| 1890 | 58.26 | -10.28 | H | 101.1 | 271.7 | 47.98 | 74 | 26.02 |
| 2205 | 57.97 | -9.04 | H | 100.0 | 180.6 | 48.93 | 74 | 25.07 |
| 2835 | 58.38 | -6.24 | H | 100.0 | 135.7 | 52.14 | 74 | 21.86 |

*Note*

**1. The antenna is manipulated through typical positions, polarity and length during the testing**

**2. The frequency range was scanned from 25 MHz to 4 GHz and the worst-case emissions are reported.**

**3. There is detected level above reference noise floor spectrum analyzer. Except above frequency**

### 7.4.4 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor.

The basic equation with a sample calculation is as follows:

FS = RA + AF + CF

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

Assume a receiver reading of 21.5 dBuV is obtained. The Antenna Factor of 7.4 dB/m and a Cable Factor of 1.1 dB is added. The 30 dBuV/m value is mathematically converted to its corresponding level in uV/m.

FS = 21.5 + 7.4 + 1.1 = 30 dBuV/m

# 8. LIST OF TEST EQUIPMENT

| Manufacturer | Model / Equipment | Calibration Interval | Calibration Due | Serial No. |
|---|---|---|---|---|
| Rohde & Schwarz | ESH2-Z5/ LISN | Annual | 03/24/2011 | 861741/013 |
| Rohde & Schwarz | ESH3-Z6/ LISN | Annual | 03/05/2011 | 100329 |
| Schwarzbeck | VULB 9160/ TRILOG Antenna | Biennial | 12/18/2010 | 9160-3150 |
| HD | MA240/ Antenna Position Tower | N/A | N/A | 556 |
| EMCO | 1050/ Turn Table | N/A | N/A | 114 |
| HD GmbH | HD 100/ Controller | N/A | N/A | 13 |
| HD GmbH | KMS 560/ SlideBar | N/A | N/A | 12 |
| Rohde & Schwarz | ESH3-Z2/ PULSE LIMITER | Annual | 10/30/2010 | 375.8810.352 |
| MITEQ | AMF-6D-001180-35-20P/AMP | Annual | 05/20/2011 | 990893 |
| MITEQ | AFS44-00101800-35-20P-44-PS/AMP | Annual | 04/05/2011 | 1119544 |
| Schwarzbeck | BBHA 9120D/ Horn Antenna | Biennial | 09/23/2011 | 296 |
| Rohde & Schwarz | FSP30 / Spectrum Analyzer | Annual | 03/25/2011 | 839117/011 |
| Agilent | E4440A / Spectrum Analyzer | Annual | 06/09/2011 | US45303008 |
| Agilent | E4416A /Power Meter | Annual | 01/14/2011 | GB41291412 |
| Agilent | E9327A /POWER SENSOR | Annual | 07/28/2010 | MY4442009 |
| Wainwright Instrument | WHF3.3/18G-10EF / High Pass Filter | Annual | 06/25/2011 | 1 |
| Wainwright Instrument | WRCG2400/2483.5-2370/2520-60/14SS / Band Reject Filter | Annual | 07/24/2010 | 1 |
| Hewlett Packard | 11636B/Power Divider | Annual | 12/24/2010 | 11377 |
| DIGITAL | EP-3010 /DC POWER SUPPLY | Annual | 01/08/2011 | 3110117 |
| ITECH | IT6720 / DC POWER SUPPLY | Annual | 12/01/2010 | 010002156287001199 |
| TESCOM | TC-3000A / BLUETOOTH TESTER | Annual | 01/11/2011 | 3000A490112 |
| Rohde & Schwarz | CBT / BLUETOOTH TESTER | Annual | 06/24/2011 | 100422 |
| EMCO | 6502.LOOP ANTENNA | Biennial | 01/13/2012 | 9009-2536 |