HCT CO.,LTD

HCT CO., LTD.

CERTIFICATE OF COMPLIANCE

FCC Certification

Applicant Name:
HYUNDAI MOBIS CO., LTD.

Address:
80-9, Mabook-Dong, Giheung-Gu Yongin-shi
Gyunggi-Do, 446-912 South Korea

Date of Issue:
September 13, 2012

Test Site/Location:
HCT CO., LTD., 105-1, Jangam-ri, Majang-Myeon, Icheon-si, Kyunggi-Do, Korea

Test Report No.: HCTR1209FR02-1

HCT FRN: 0005866421

IC Recognition No.: 5944A-3

FCC ID	**: TQ8-RKE-3F05**
IC	**: 5074A-RKE3F05**
APPLICANT	**: HYUNDAI MOBIS CO., LTD.**

FCC Model(s):	RKE-3F05
IC Model(s):	RKE-3F05
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-GEN(Issue3, December 2010), RSS-210(Issue 8, December 2010)

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 subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

Report prepared by
: Jong Seok Lee
Test Engineer of RF Team

Approved by
: Sang Jun Lee
Manager of RF Team

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCTR1209FR02	September 10, 2012	- First Approval Report
HCTR1209FR02-1	September 13, 2012	-Add Signal information of Radiated device on Note(Page.18 and 20)

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1. GENERAL INFORMATION

Applicant:	HYUNDAI MOBIS CO., LTD.
Address:	80-9, Mabook-Dong, Giheung-Gu Yongin-shi Gyunggi-Do, 446-912 South Korea
FCC ID:	TQ8-RKE-3F05
IC :	5074A-RKE3F05
EUT:	Remote Keyless Entry
FCC Model(s):	RKE-3F05
IC Model(s):	RKE-3F05
Date of Test:	August 24, 2012 ~ August 29, 2012
Place of Tests:	HCT Co., Ltd. 105-1, Jangam-ri , Majang-Myeon, Icheon-si, Kyunggi-Do, 467-811, KOREA. (IC Recognition No. : 5944A-3)

2. EUT DESCRIPTION

Type	Remote Keyless Entry
Model Name	RKE-3F05
Power Supply	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 Testing Unlicensed Wireless Devices(ANSI C63.10-2009) 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: TQ8-RKE-3F05

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 15.207, 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 6.2 of ANSI C63.10. (Version :2009) 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 6.3 of ANSI C63.10. (Version: 2009)

3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

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 SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 105-1, Jangam-ri, Majang-Myeon, Icheon-si, Kyunggi-Do, 467-811, 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 March 02, 2011 (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

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%) 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 8 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.

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

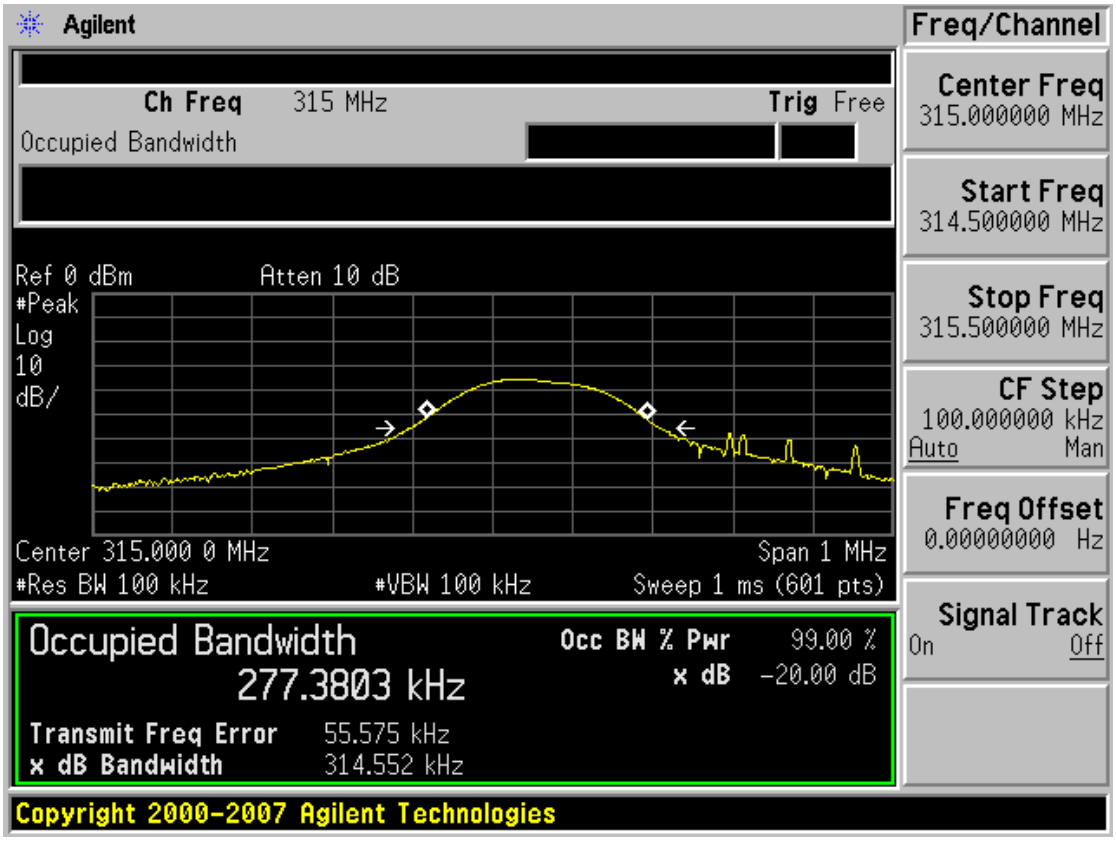
RESULTS

NO non-compliance noted.

Operating Frequency (MHz)	20dB Bandwidth (kHz)	OBW (kHz)	Limit (kHz)	Margin (kHz)	Pass / Fail
315	314.552	277.3803	787.5	472.948(20 dB BW)	Pass

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

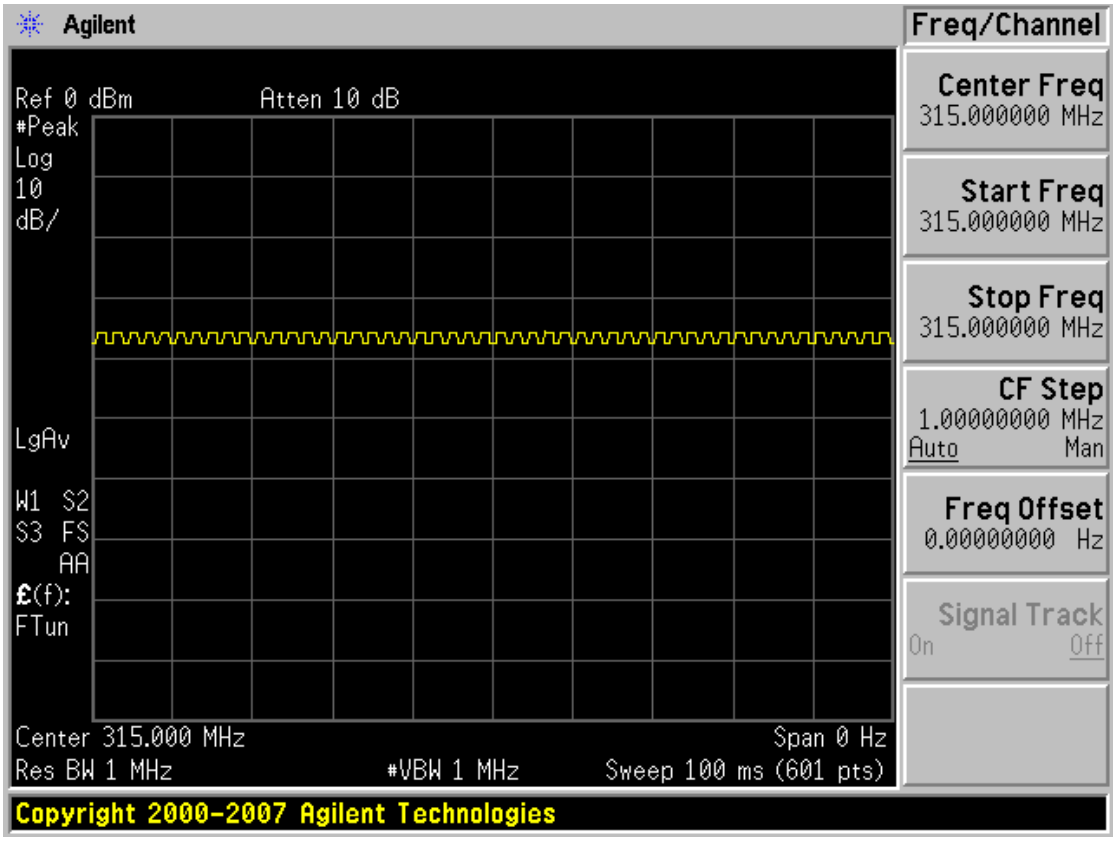
No non-compliance noted:

MAXIMUM MODULATION PERCENTAGE

One Period (ms)	Pulse Width (ms)	# of Pulses	Duty Cycle	% Duty Cycle
100	0.9833	50	0.49	49.165

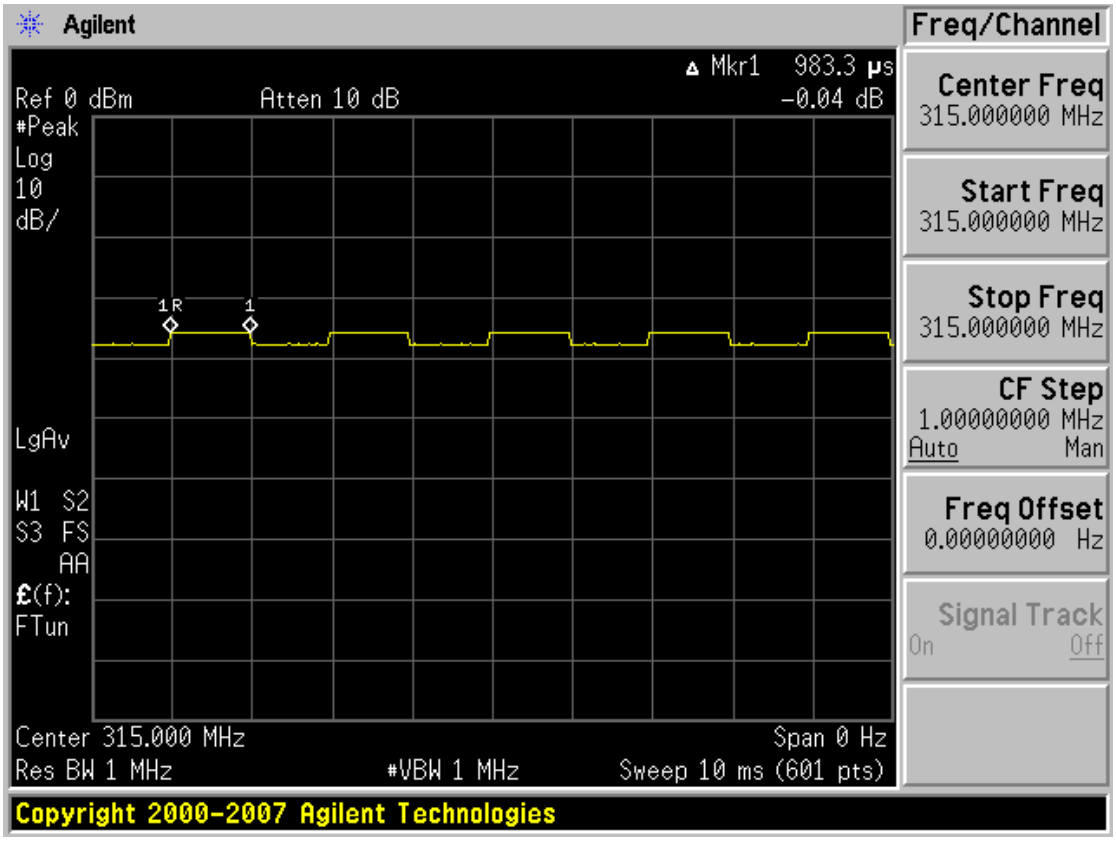
100 ms

▣ 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 1 MHz and the VBW is set to 1 MHz . The sweep time is set to 1 seconds and the span is set to 0 Hz.

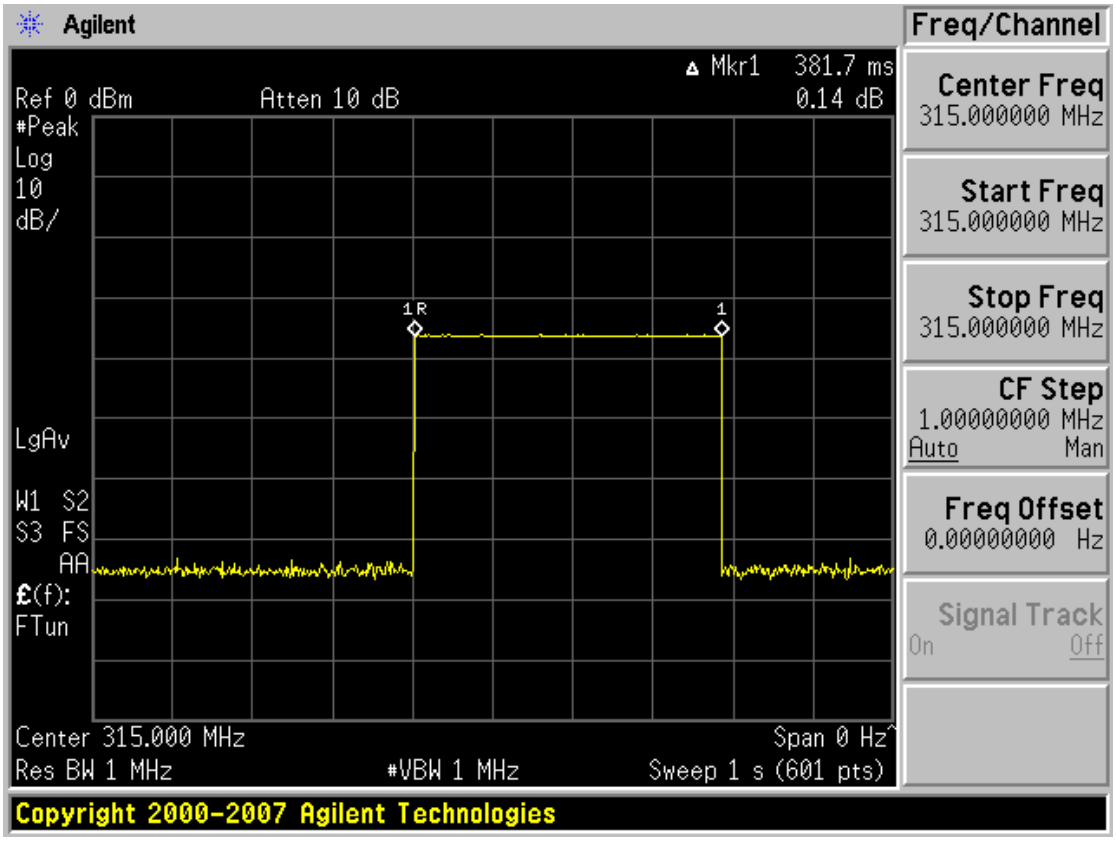
RESULTS

NO non-compliance noted.

Frequency (MHz)	Transmission time (ms)	Limit (Second)	Pass / Fail
315	381.7	5	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.

Fundamental 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.

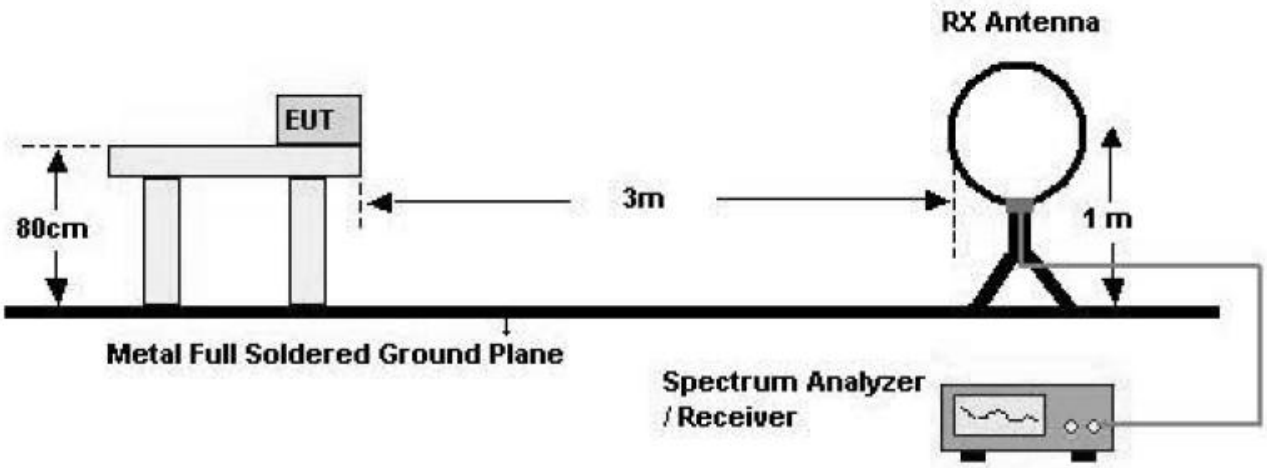
§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table ;

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

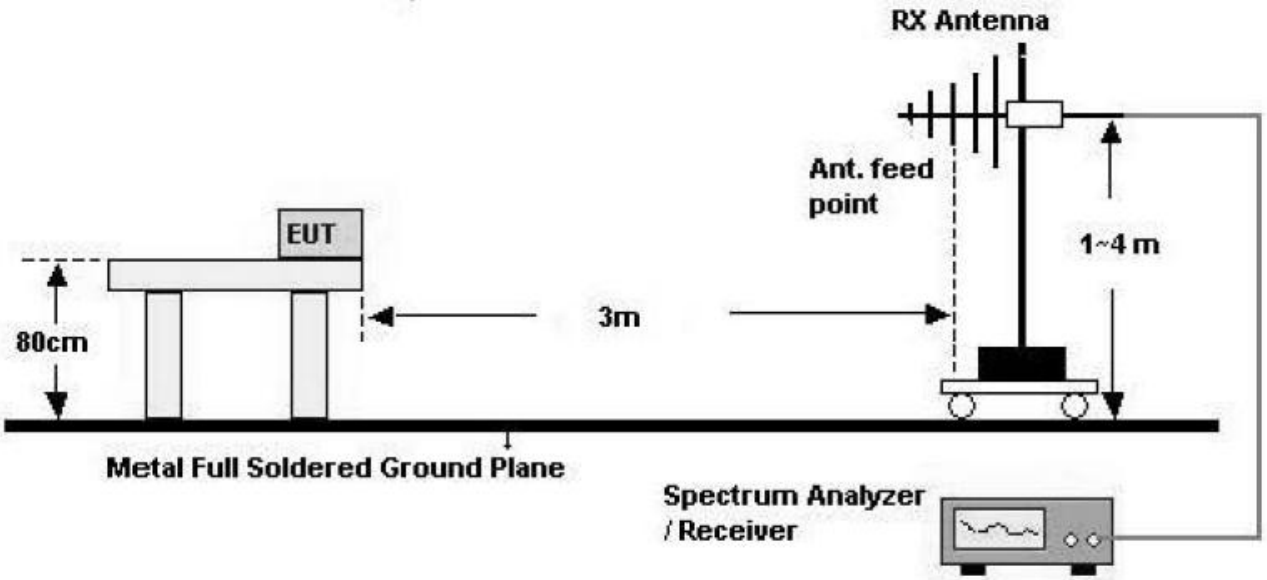
**** Except as provided in paragraph (g), fundamental emissions rom intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz However, operation within these frequency bands is permitted under other sections of this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

Test Configuration

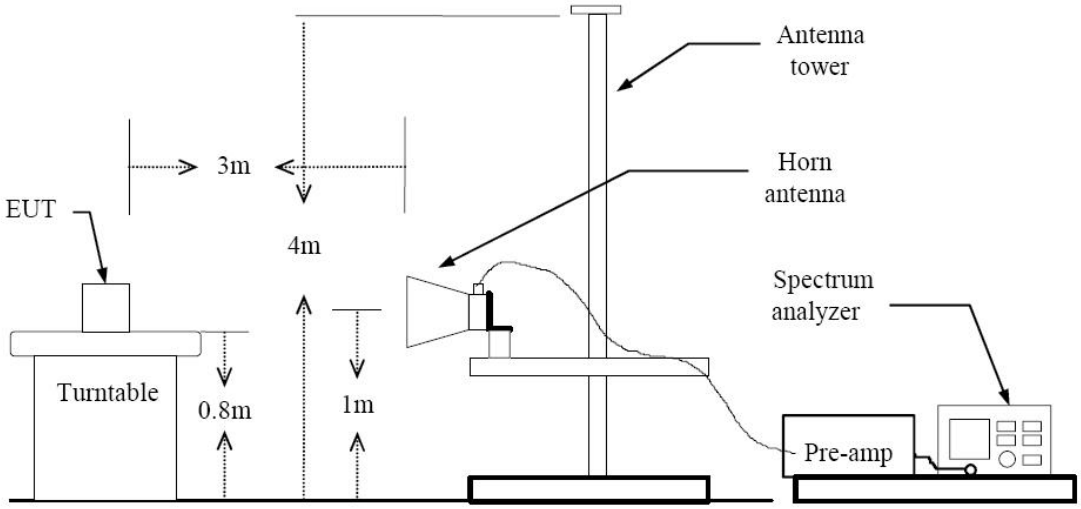
Below 30 MHz



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 -6.20 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%) = -6.20*

Frequency [MHz]	Reading dBuV	Ant. Factor dB/m	Cable Loss dB	Pol [H/V]	Height [m]	Azimuth [degrees]	Field Strength [dBuV/m]	Limit dBuV/m	Margin [dB]
AVERAGE data									
315	32.63	13.73	1.91	V	1.736	265.8	48.27	75.6	27.34
315	33.53	13.73	1.91	H	1.000	107.5	49.17	75.6	26.44
630	17.90	20.09	2.83	V	1.000	0.0	40.82	55.6	14.78
630	17.96	20.09	2.83	H	1.000	360.0	40.88	55.6	14.72
945	17.35	23.65	3.61	V	1.000	250.0	44.61	55.6	10.99
945	16.94	23.65	3.61	H	1.000	199.0	44.20	55.6	11.40
PEAK data									
315	38.83	13.73	1.91	V	1.736	265.8	54.47	95.6	41.14
315	39.73	13.73	1.91	H	1.000	107.5	55.37	95.6	40.24
630	24.10	20.09	2.83	V	1.000	0.0	47.02	75.6	28.58
630	24.16	20.09	2.83	H	1.000	360.0	47.08	75.6	28.52
945	23.55	23.65	3.61	V	1.000	250.0	50.81	75.6	24.79
945	23.14	23.65	3.61	H	1.000	199.0	50.40	75.6	25.20

Note :

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

2. The frequency range was scanned from 30 MHz to 1 GHz and the worst-case emissions are reported.

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

4. Test condition is continuous TX mode, not pulse signal. So, we do not need PDCF.

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%) = -6.20*

Frequency [MHz]	Reading dBuV	※A.F.+CL-AMP G dB	Pol [H/V]	Height [m]	Azimuth [degrees]	Field Strength [dBuV/m]	Limit dBuV/m	Margin [dB]
AVERAGE data								
1260	48.49	-16.772	V	1.150	215.0	31.72	55.6	23.88
1260	48.99	-16.772	H	1.000	49.0	32.22	55.6	23.38
1575	49.22	-16.145	V	1.390	288.2	33.08	55.6	22.53
1575	48.68	-16.145	H	1.000	90.5	32.54	55.6	23.07
1890	49.38	-15.108	V	1.000	216.0	34.27	55.6	21.33
1890	49.35	-15.108	H	1.000	0	34.24	55.6	21.36
2205	47.49	-11.570	V	1.000	155.0	35.92	55.6	19.68
2205	47.82	-11.570	H	1.000	131.4	36.25	55.6	19.35
2520	48.30	-11.006	V	1.000	53.2	37.29	55.6	18.31
2520	47.60	-11.006	H	1.000	10.9	36.59	55.6	19.01
2835	48.23	-9.770	V	1.050	170.0	38.46	55.6	17.14
2835	47.85	-9.770	H	1.000	360.0	38.08	55.6	17.52
3150	47.04	-8.450	V	1.000	187.0	38.59	55.6	17.01
3150	46.75	-8.450	H	1.050	17.8	38.30	55.6	17.30
PEAK data								
1260	54.69	-16.772	V	1.150	215.0	37.92	75.6	37.68
1260	55.19	-16.772	H	1.000	49.0	38.42	75.6	37.18
1575	55.42	-16.145	V	1.390	288.2	39.28	75.6	36.33
1575	54.88	-16.145	H	1.000	90.5	38.74	75.6	36.87
1890	55.58	-15.108	V	1.000	216.0	40.47	75.6	35.13
1890	55.55	-15.108	H	1.000	0	40.44	75.6	35.16
2205	53.69	-11.570	V	1.000	155.0	42.12	75.6	33.48
2205	54.02	-11.570	H	1.000	131.4	42.45	75.6	33.15
2520	54.50	-11.006	V	1.000	53.2	43.49	75.6	32.11
2520	53.80	-11.006	H	1.000	10.9	42.79	75.6	32.81
2835	54.43	-9.770	V	1.050	170.0	44.66	75.6	30.94
2835	54.05	-9.770	H	1.000	360.0	44.28	75.6	31.32
3150	53.24	-8.450	V	1.000	187.0	44.79	75.6	30.81
3150	52.95	-8.450	H	1.050	17.8	44.50	75.6	31.10

Note:

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

2. The frequency range was scanned from 1 GHz to 4 GHz and the worst-case emissions are reported.

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

4. Test condition is continuous TX mode, not pulse signal. So, we do not need PDCF.

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	ENV216/ LISN	Annual	02/09/2013	100073
Schwarzbeck	VULB 9168/ TRILOG Antenna	Biennial	02/09/2013	200
Rohde & Schwarz	ESI 40 / EMI TEST RECEIVER	Annual	05/03/2013	831564103
Agilent	E4440A/ Spectrum Analyzer	Annual	05/02/2013	US45303008
Agilent	N9020A/ SIGNAL ANALYZER	Annual	07/31/2013	MY51110020
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	SCU-18/ Signal Conditioning Unit	Annual	09/19/2012	10094
MITEQ	AMF-6B-180265-35-10P / POWER AMP	Annual	04/16/2013	667624
CERNEX	CBL26405040 / POWER AMP	Annual	04/16/2013	19660
Schwarzbeck	BBHA 9120D/ Horn Antenna	Biennial	10/17/2013	937
Wainwright	WHK1.2/15G-10EF/H.P.F	Annual	05/02/2013	2
Rohde & Schwarz	FSP / Spectrum Analyzer	Annual	02/09/2013	839117/011
Agilent	E4416A /Power Meter	Annual	11/07/2012	GB41291412
Agilent	E9327A /POWER SENSOR	Annual	05/02/2013	MY4442009
Hewlett Packard	11636B/Power Divider	Annual	11/07/2012	11377
Hewlett Packard	11667B / Power Splitter	Annual	06/05/2013	05001
DIGITAL	EP-3010 /DC POWER SUPPLY	Annual	11/07/2012	3110117
EMCO	6502.LOOP ANTENNA	Biennial	01/11/2014	9009-2536
Agilent	8493C / Attenuator(10 dB)	Annual	07/30/2013	76649
WEINSCHEL	2-3 / Attenuator(3 dB)	Annual	11/07/2013	BR0617
CERNEX	CBLU1183540 / POWER AMP	Annual	07/27/2013	21691