



HCT CO., LTD.

Product Compliance Division

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CERTIFICATE OF COMPLIANCE FCC PART 15.247 Certification

Applicant Name:

MINERVA Co., Ltd.

401, Starwood Building, 5439-1, Sangdaewon-Dong,
Chungwon-Gu, Seongnam-Si, Kyonggi-Do, South
Korea

Date of Issue:

June 10, 2009

Test Site/Location:

HCT CO., LTD., San 136-1 Ami-ri, Bubal-eup, Icheon-si,
Kyungki-do, Korea

Test Report No.: HCT-RF09-0609

HCT FRN: 0005866421

IC Recognition No.: 5944A-1

FCC ID:

XBV-MKUR-300

APPLICANT:

MINERVA Co., Ltd.

Model(s):

MKUR-300

EUT Type:

UHF RFID Reader

Max. RF Output Power:

29.97 dBm (993.1 mW)

Frequency Range:

902.75 – 927.25 MHz

Modulation type

PR-ASK

FCC Classification:

FCC Part 15 Frequency Hopping Spread Spectrum Transceiver

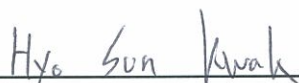
FCC Rule Part(s):

Part 15 subpart C 15.247

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. 862



Report prepared by

: Hyo Sun Kwak

Test engineer of RF Team



Approved by

: Sang Jun Lee

Manager of RF Team

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1. GENERAL INFORMATION

Applicant: MINERVA Co., Ltd.

Address: 401, Starwood Building, 5439-1, Sangdaewon-Dong,
Chungwon-Gu, Seongnam-Si, Kyonggi-Do, South Korea

FCC ID: XBV-MKUR-300

EUT: UHF RFID Reader

Model: MKUR-300

Date of Test: May 18, 2009 ~ June 03, 2009

Contact person: Name: Jeong Hun, Cha
Phone #: +82-31-703-4784
Fax #: +82-31-703-4785

2. EUT DESCRIPTION

Product	UHF RFID Reader
Model Name	MKUR-300
Power Supply	DC 12 V
Frequency Range	902.75 ~ 927.25 MHz
Transmit Power	29.97 dBm (993.1 mW)
Modulation Type	PR-ASK
Modulation Technique	FHSS
Number of Channels	50 Channels
Antenna Specification	Manufacturer: Sonovision Co., Ltd.. Antenna type: Patch Antenna Peak Gain : 5.39 dBi

- The EUT an UHF READER. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

47 CFR Part 15, Subpart C. (15.247)
ANSI C63.4 : 2003

All test items have been performed and recorded as per the above standards.

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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 Frequency Hopping Spread Spectrum Systems" were used in the measurement of the **MINERVA Co., Ltd.**

UHF RFID Reader FCC ID: XBV-MKUR-300

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 15.247 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 operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

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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, Kyoungki-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 July 6, 2006(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."

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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 is an antenna that uses a unique coupling.

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

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7. FCC PART 15.247 REQUIREMENTS

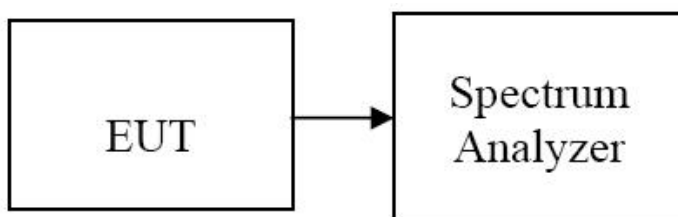
7.1 PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. For frequency hopping systems operating in the 902-928 MHz band, employing at least 50 hopping channels: 1 watt; and employing less than 50 hopping channels, but at least 25 hopping channels: 0.25 watt.
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. The Spectrum Analyzer is set to the peak detector mode.

1. Span = 5 MHz
2. RBW = 3 MHz
3. VBW = 3 MHz
4. Sweep = auto

TEST RESULTS

No non-compliance noted

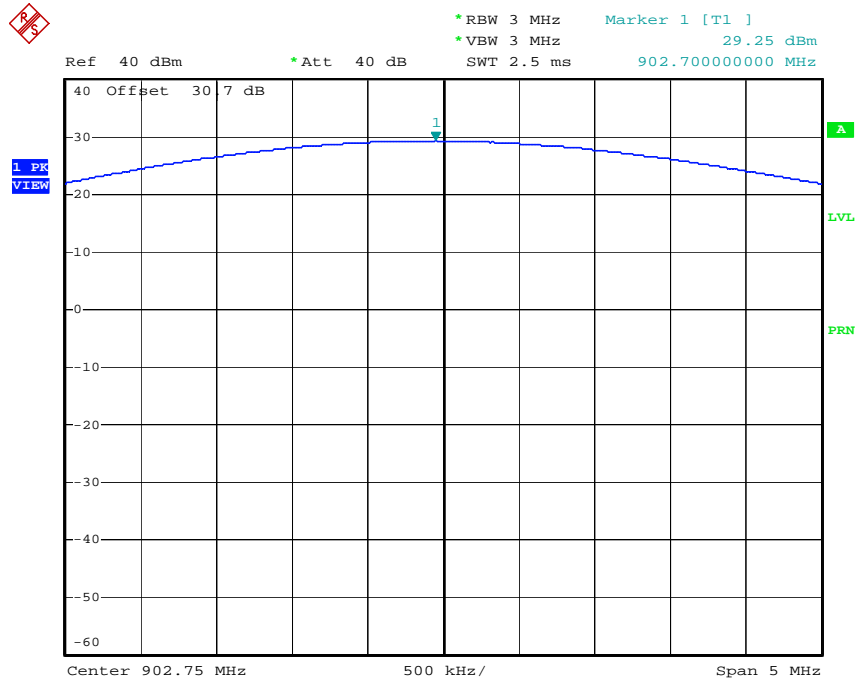
Test Data

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (W)	Result
Low	2402	29.25	841.4	1	PASS
Mid	2441	29.63	918.3		PASS
High	2480	29.97	993.1		PASS



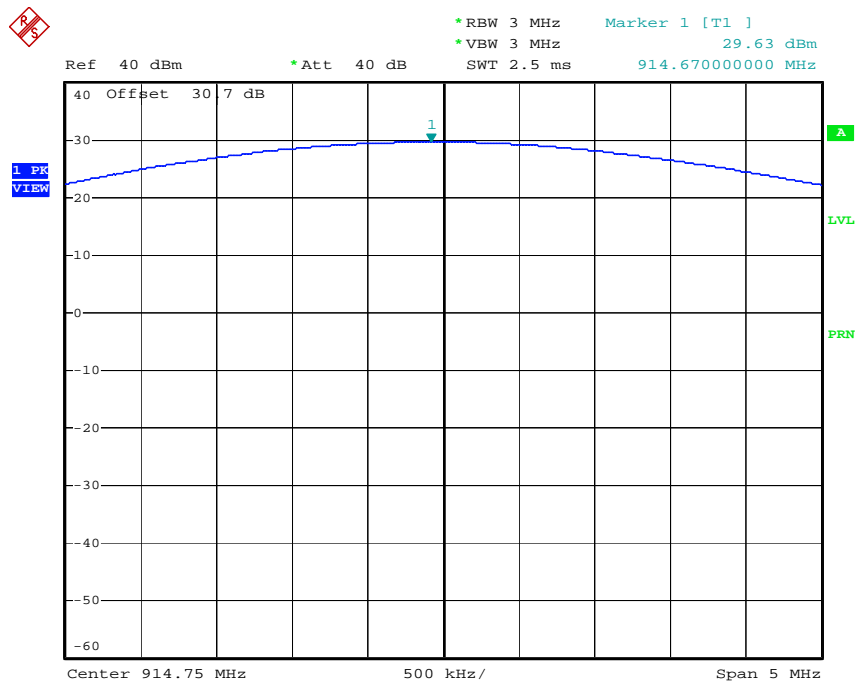
Test Plots

Peak Power (Low CH)



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Peak Power (Mid CH)

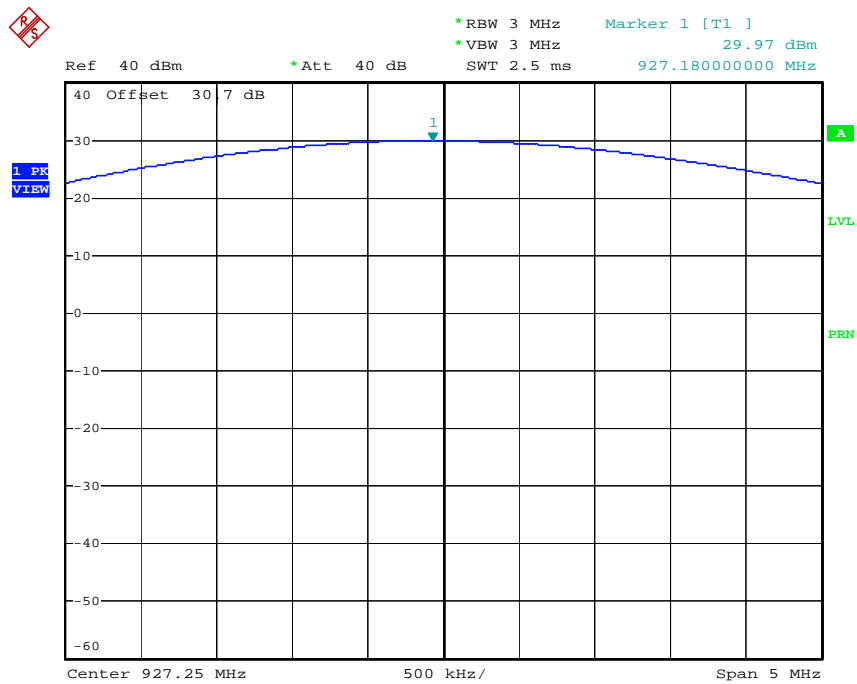


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Peak Power (High CH)



Date: 28.MAY.2009 17:43:11

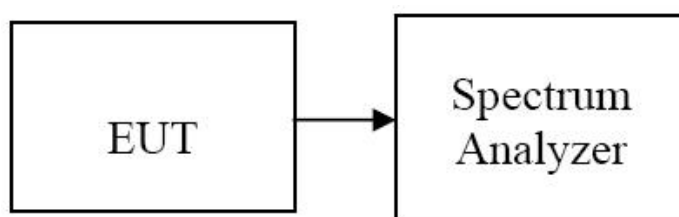
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7.2 BAND EDGES MEASUREMENT

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Configuration



TEST PROCEDURE

The spectrum analyzer is set to :

1. Span = 25 MHz
2. RBW = 100 kHz
3. VBW = 300 kHz
4. Sweep = auto
5. Detector Mode = Peak

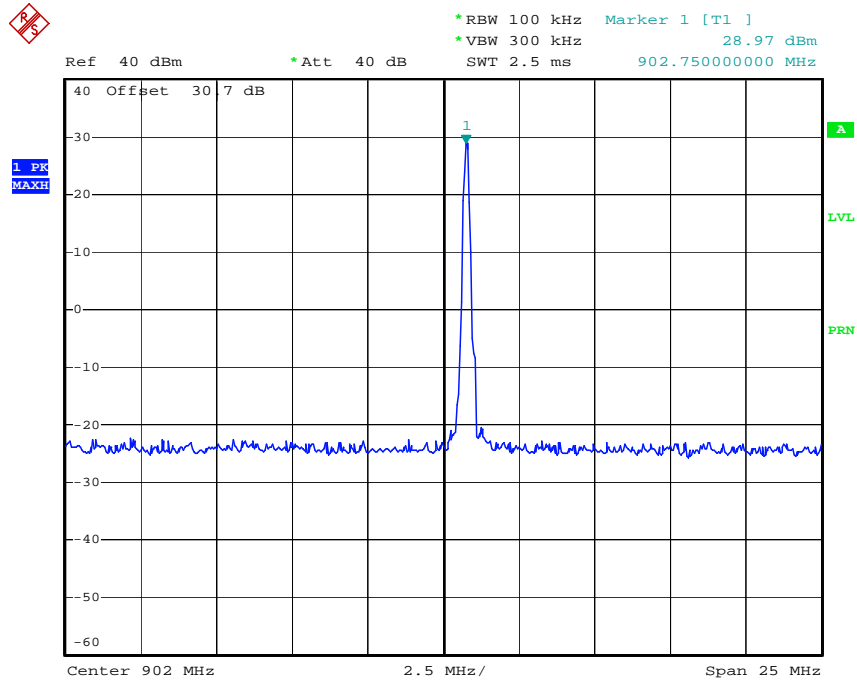
TEST RESULTS

See attached.



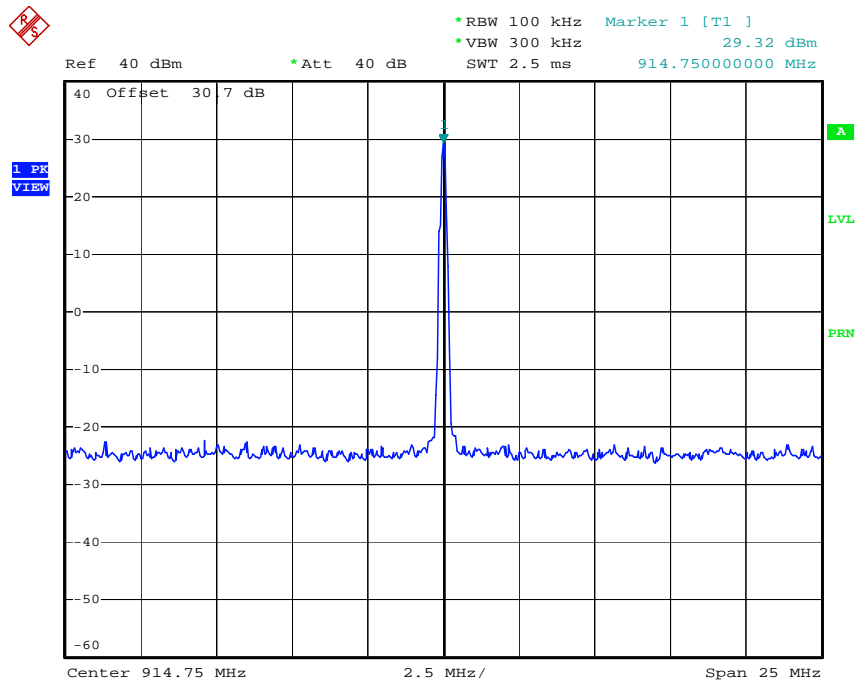
Test Data

Band Edges (Low- CH)



Date: 28.MAY.2009 19:09:19

Band Edges (Mid CH)

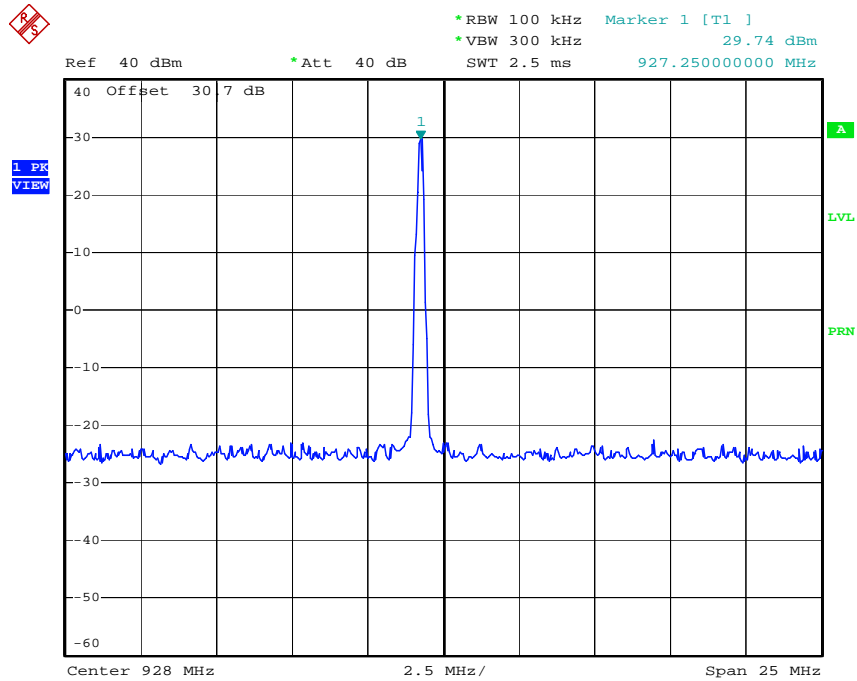


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Band Edges (High-CH)



Date: 28.MAY.2009 19:14:49

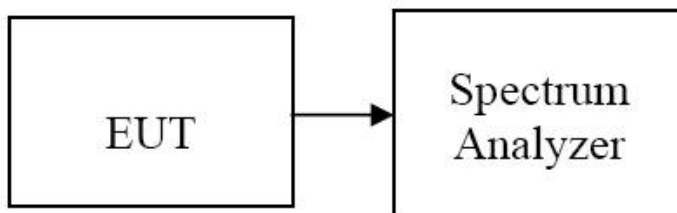
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7.3 HOPPING FREQUENCY SEPARATION

LIMIT

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

Test Configuration



TEST PROCEDURE

The spectrum analyzer is set to :

1. Span = 10 MHz
2. RBW = 100 kHz
3. VBW = 100 kHz
4. Sweep = auto

The trace was allowed to stabilize. The marker-delta function was used to determine the separation between the peaks of the adjacent channels.

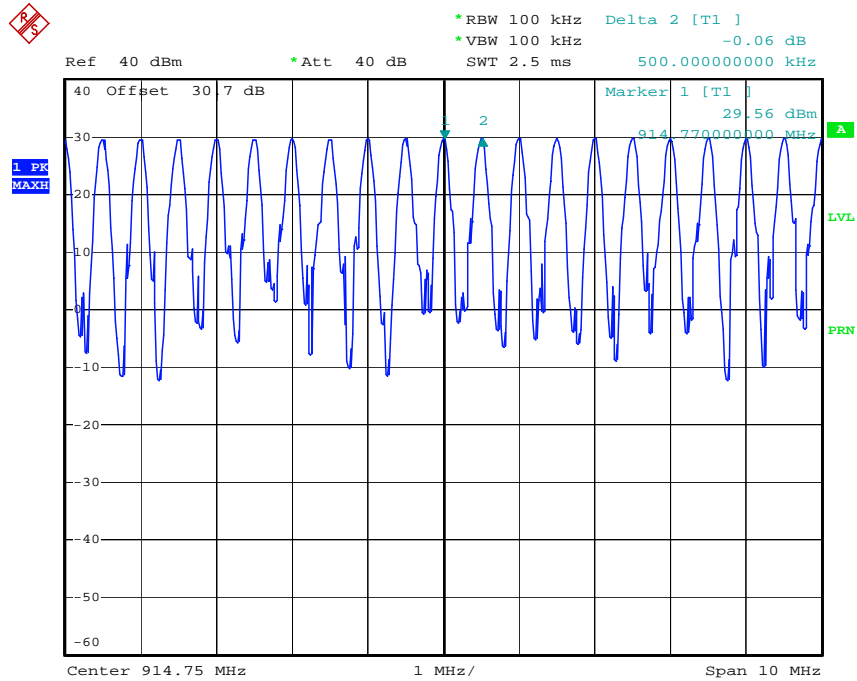
TEST RESULTS

No non-compliance noted



Test Plot

Measurement of Channel Separation



Date: 28.MAY.2009 18:49:31

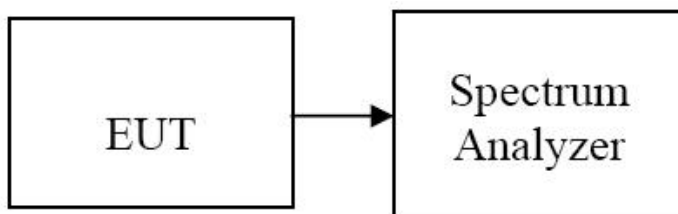
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7.4 20 dB BANDWIDTH

LIMIT

According to §15.247 (a) (1)(i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Test Configuration



TEST PROCEDURE

The spectrum analyzer is set to :

1. Span = 1 MHz
2. RBW = 10 kHz
3. VBW = 30 kHz
4. Sweep = auto

TEST RESULTS

No non-compliance noted

Test Data

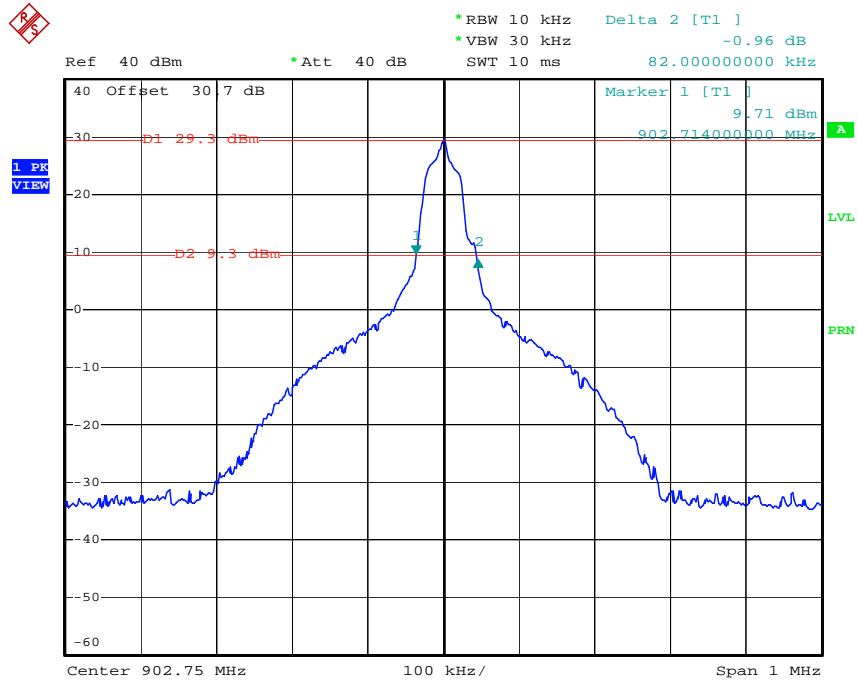
Channel	Frequency (MHz)	20 dB Bandwidth (KHz)	Limit (KHz)	Result
Low	902.75	82.0	500	PASS
Mid	914.75	80.0		PASS
High	927.25	80.0		PASS



Test Plot

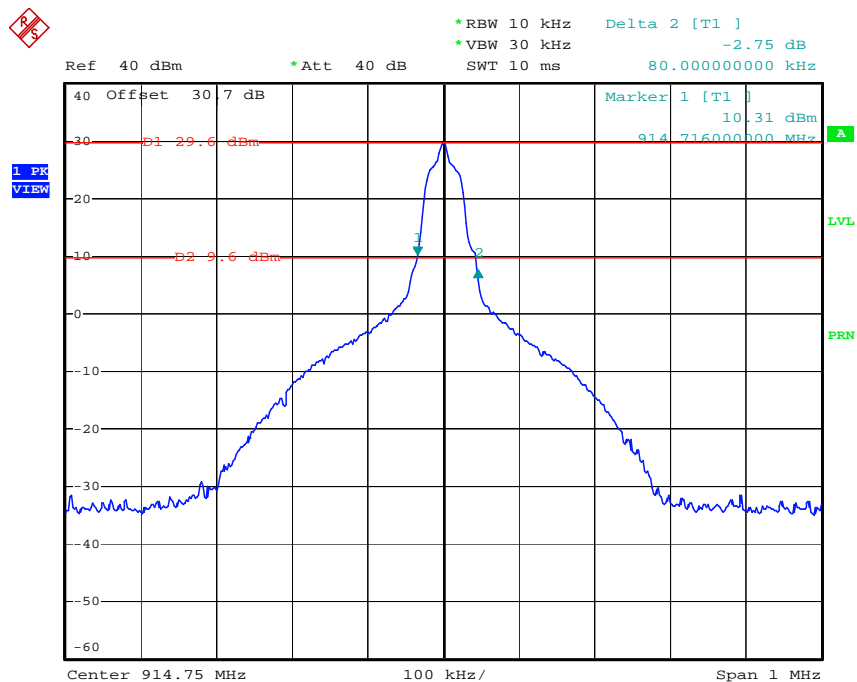
20 dB bandwidth

(Low CH)



Date: 28.MAY.2009 17:51:51

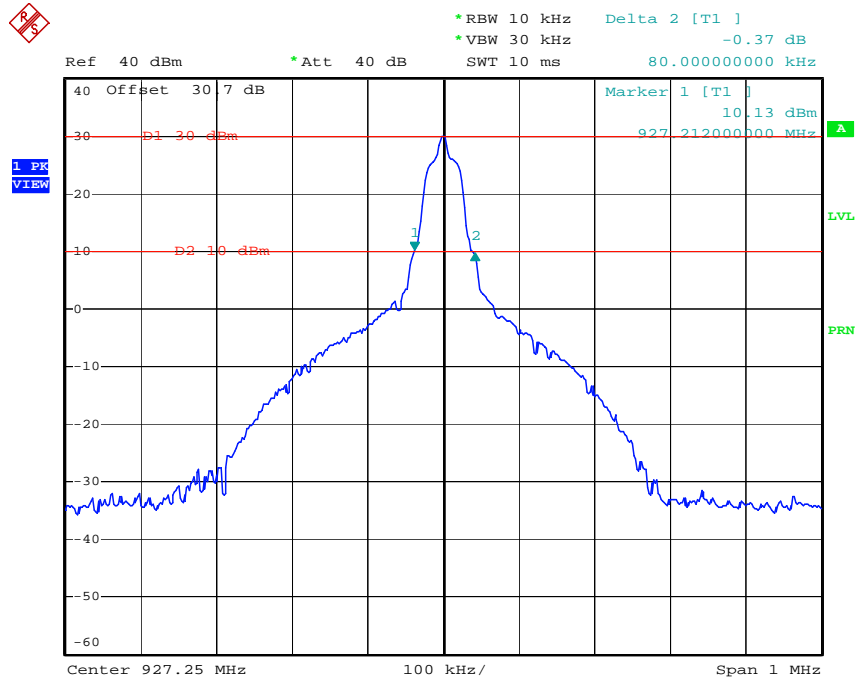
(Mid CH)



Date: 28.MAY.2009 17:55:42

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(High CH)



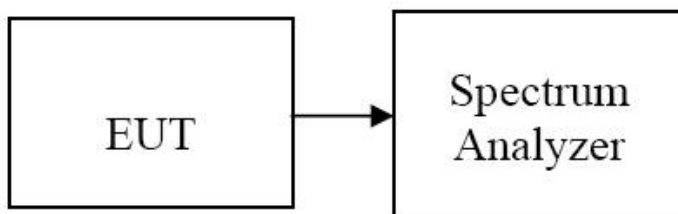
Date: 28.MAY.2009 18:02:45

7.5 NUMBER OF HOPPING FREQUENCY

LIMIT

According to §15.247 (a) (1) (i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

Test Configuration



TEST PROCEDURE

The Bluetooth frequency hopping function of the EUT was enabled. The spectrum analyzer was set to :

1. Span = the frequency band of operation (Start = 902 MHz, Stop = 928 MHz)
2. RBW = 300 kHz
3. VBW = 300 kHz
4. Sweep = auto

The trace was allowed to stabilize.

TEST RESULTS

No non-compliance noted

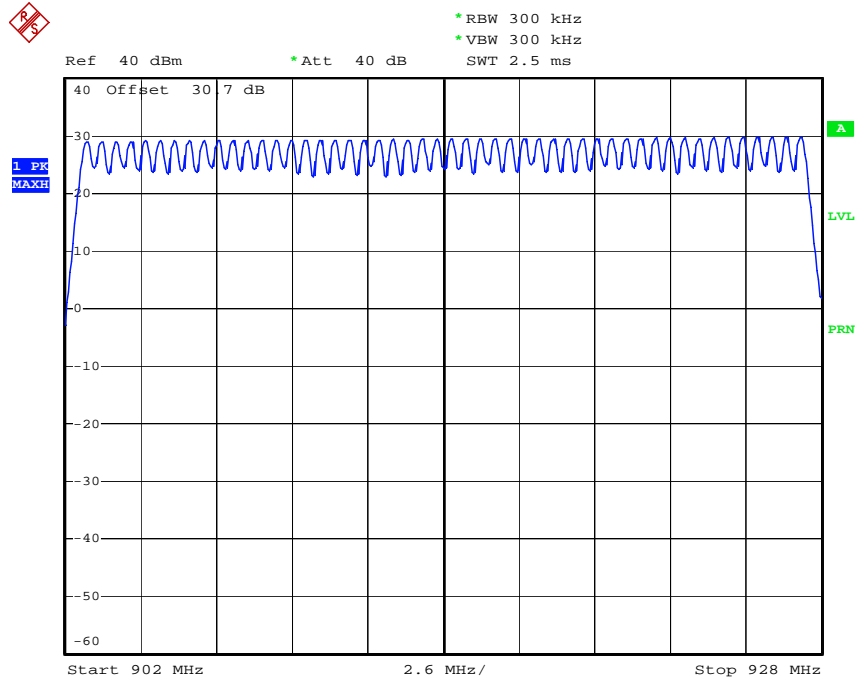
50 Channels observed.



Test Plot

Number of Channels

902 MHz – 928 MHz



Date: 28.MAY.2009 18:56:50

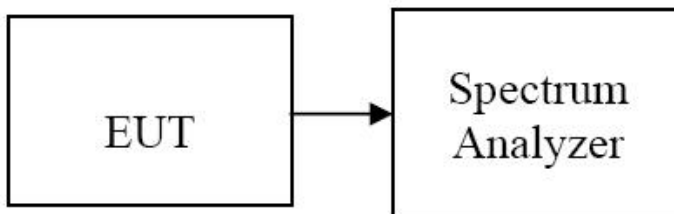
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7.6 AVERAGE TIME OF OCCUPANCY

LIMIT

According to §15.247 (a) (1) (i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

Test Configuration



TEST PROCEDURE

1. Span = zero span
2. RBW = 1 MHz
3. VBW = 1 MHz
4. Sweep = as necessary to capture the entire dwell time per channel

The marker-delta function was used to determine the dwell time.

TEST RESULTS

See the table.

Time of Occupancy = (Number of Bins showing Transmission) * (Dwell Time per bin)

Channel	Time of Occupancy	Limit (ms)	Result
Low	304	400	PASS
Mid	305		PASS
High	306		PASS

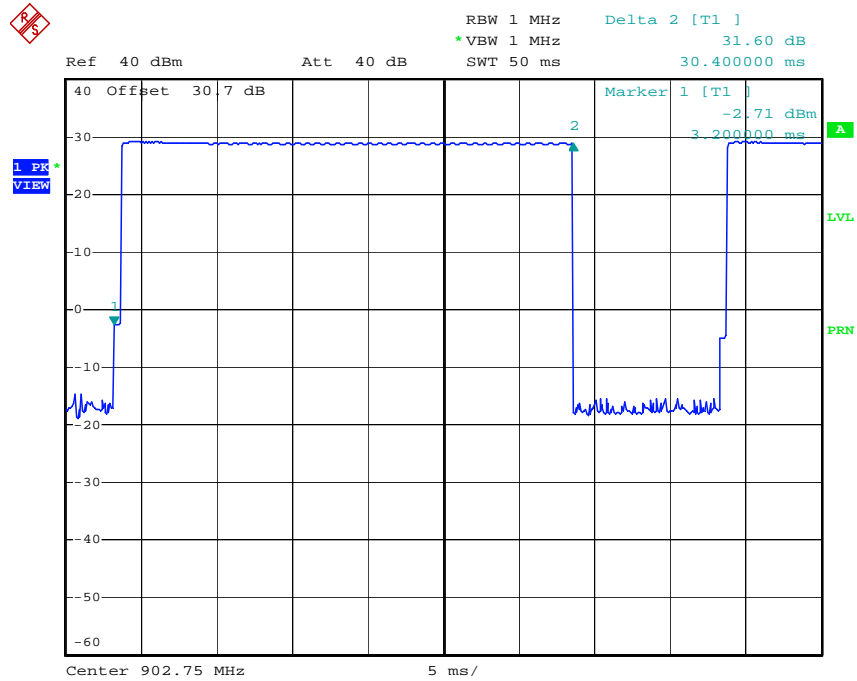
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Test Plots

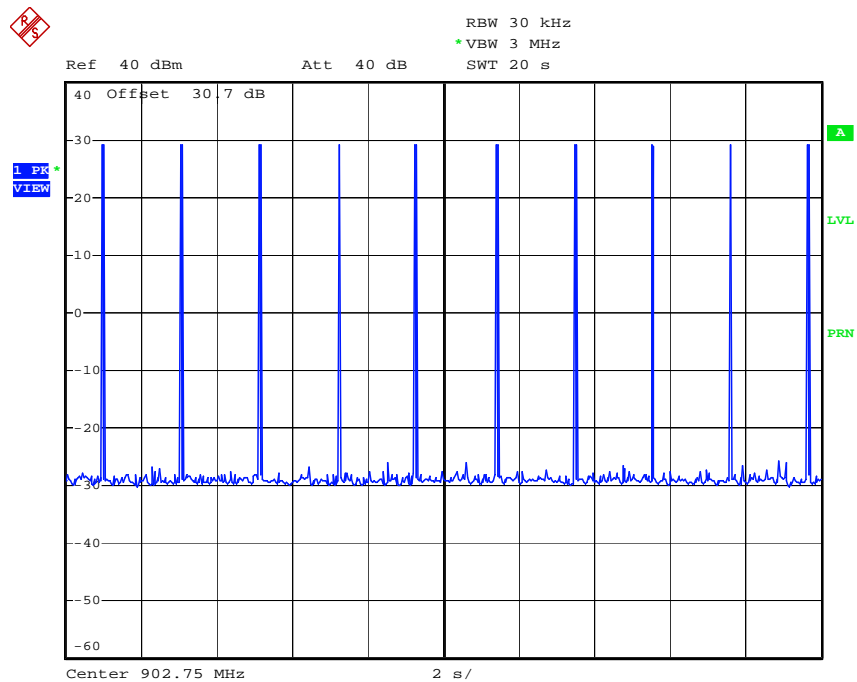
PULSE WIDTH AND OCCUPANCY

(Low CH)



Date: 4.JUN.2009 09:14:06

NUMBER OF PULSES IN 20 SEC



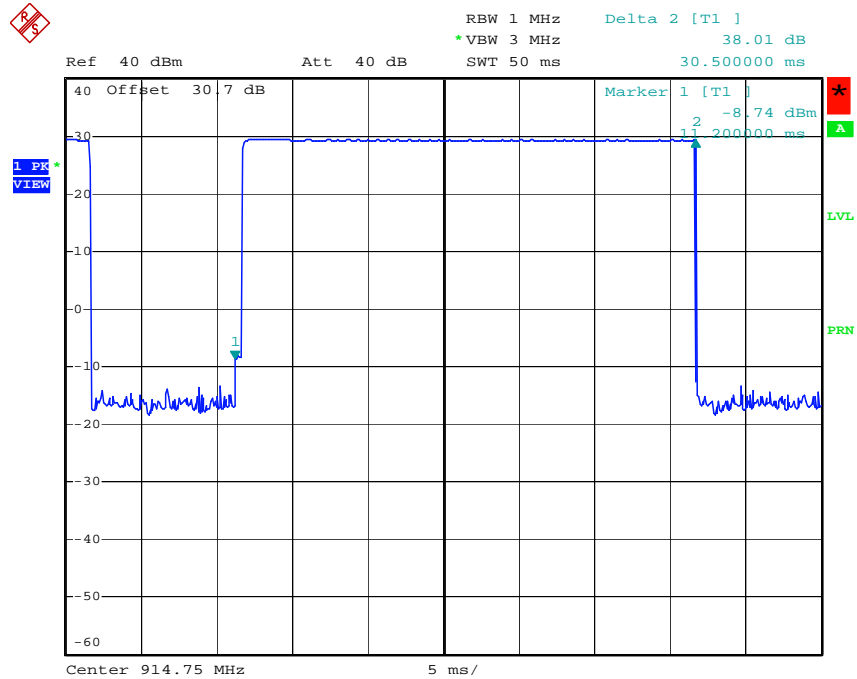
Date: 4.JUN.2009 09:11:50

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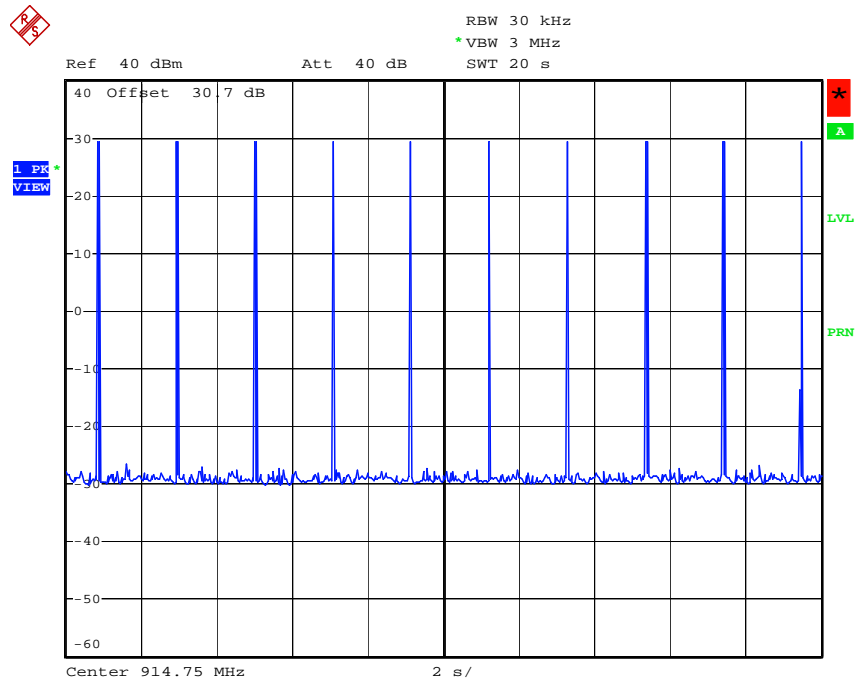
(Mid CH)

PULSE WIDTH AND OCCUPANCY



Date: 4.JUN.2009 09:26:19

NUMBER OF PULSES IN 20 SEC

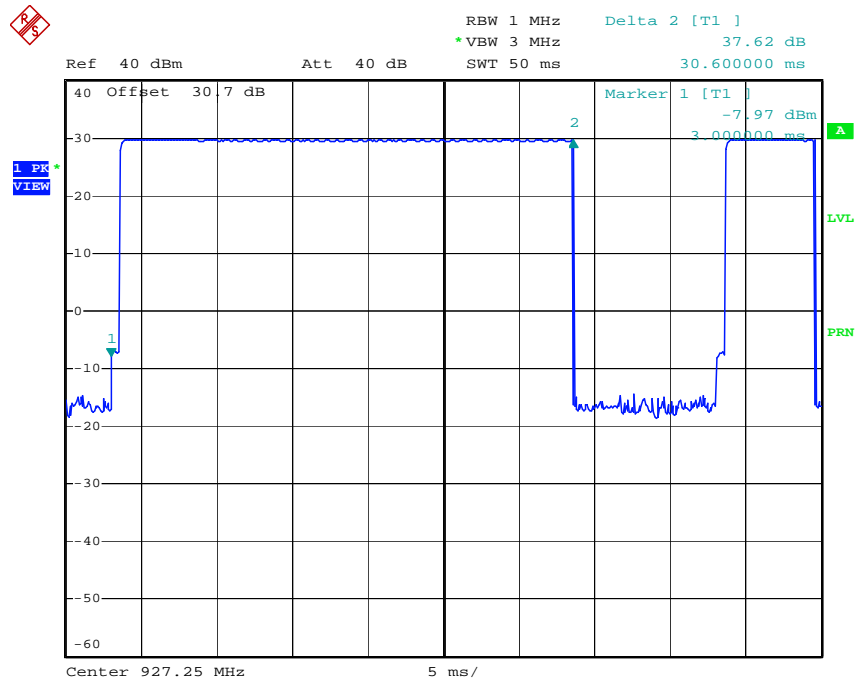


Date: 4.JUN.2009 09:23:23

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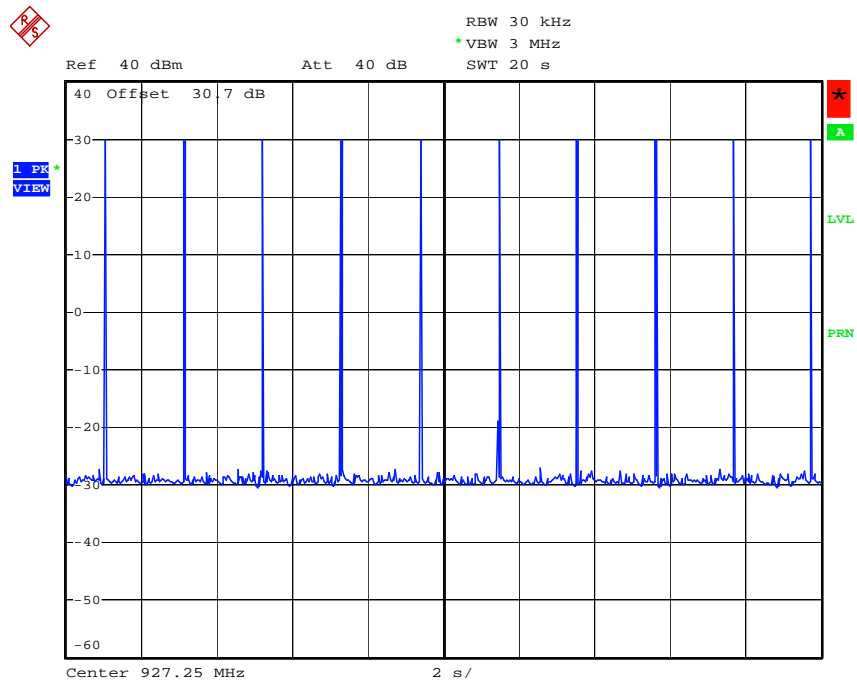


PULSE WIDTH AND OCCUPANCY (CH High)



Date: 4.JUN.2009 09:25:19

NUMBER OF PULSES IN 20 SEC



Date: 4.JUN.2009 09:24:21

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7.7 MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
(B) 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

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.



CALCULATIONS

Given

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

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of Power to mW and Distance to cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

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

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW/cm²

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10^{(P \text{ (dBm)} / 10)} \text{ and}$$

$$G \text{ (numeric)} = 10^{(G \text{ (dBi)} / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm²

Rearranging terms to calculate the power density at a specific distance yields

$$S = 0.0795 * 10^{((P + G) / 10)} / (d^2)$$

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LIMITS

From §1.1310 Table 1 (B), the maximum value of $S = f/1500 \text{ mW/cm}^2$

For the highest frequency of 927 MHz, $S = 0.61 \text{ mW/cm}^2$

RESULTS

No non-compliance noted:

Output Power (dBm)	Antenna Gain (dBi)	Power Density Limit (mW/cm ²)	MPE Distance (cm)
29.97	5.39	0.61	21.05

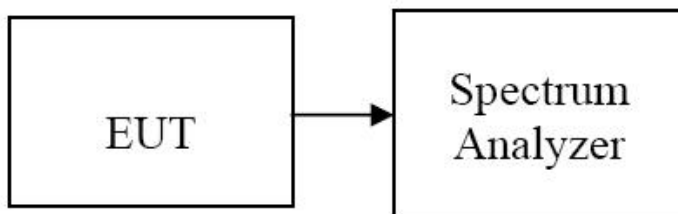
7.8 SPURIOUS EMISSIONS

7.8.1 Conducted Spurious Measurement

LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

Detector Mode is set to a peak detector Mode.

Measurements are made over the 30 MHz to 10 GHz range with the transmitter set to the lowest, middle, and highest channels.

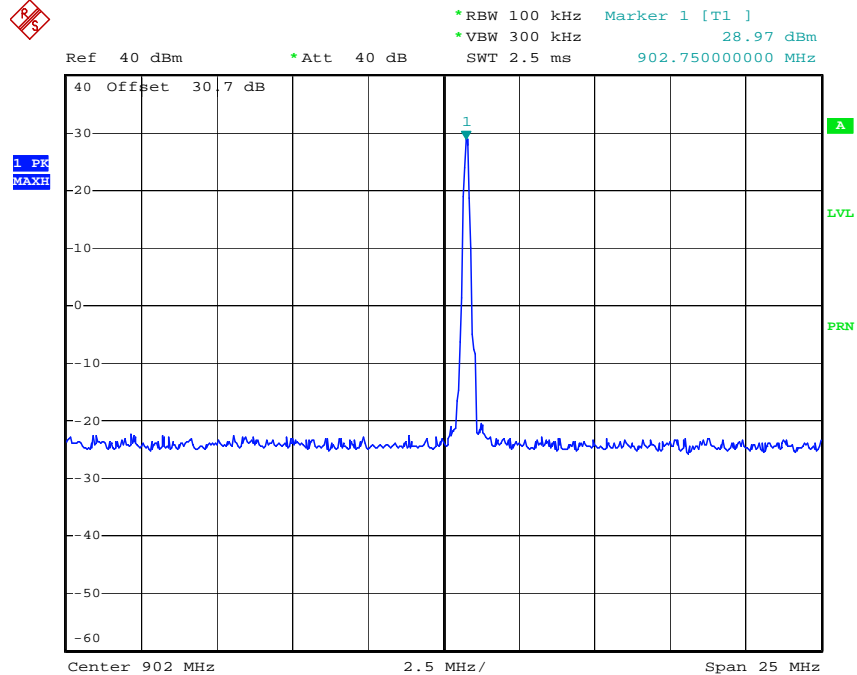
TEST RESULTS

No non-compliance noted

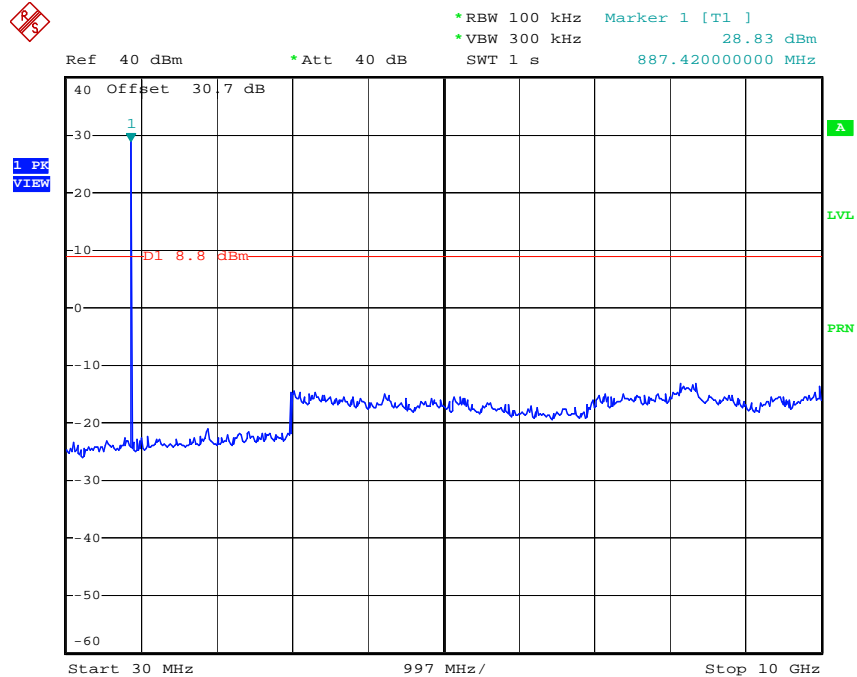


Test Plots

(Low CH)



Date: 28.MAY.2009 19:09:19

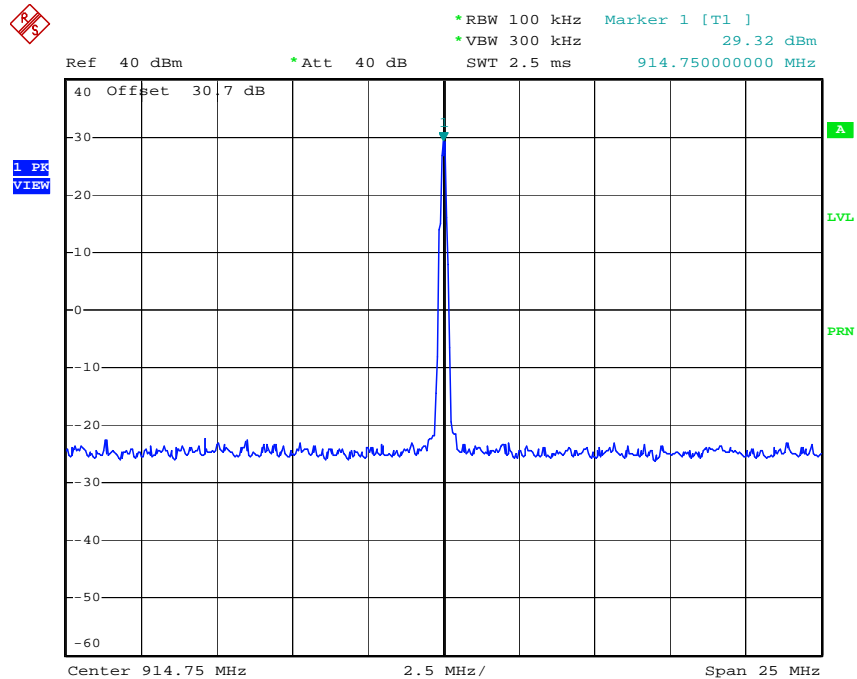


Date: 28.MAY.2009 19:11:29

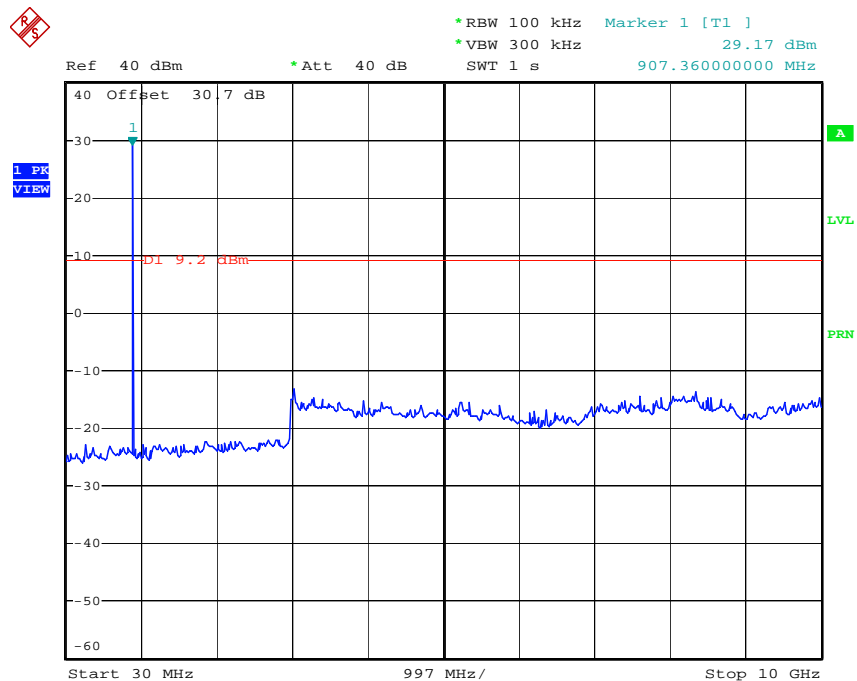
HCT PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT			www.hct.co.kr
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(Mid CH)



Date: 28.MAY.2009 19:13:58

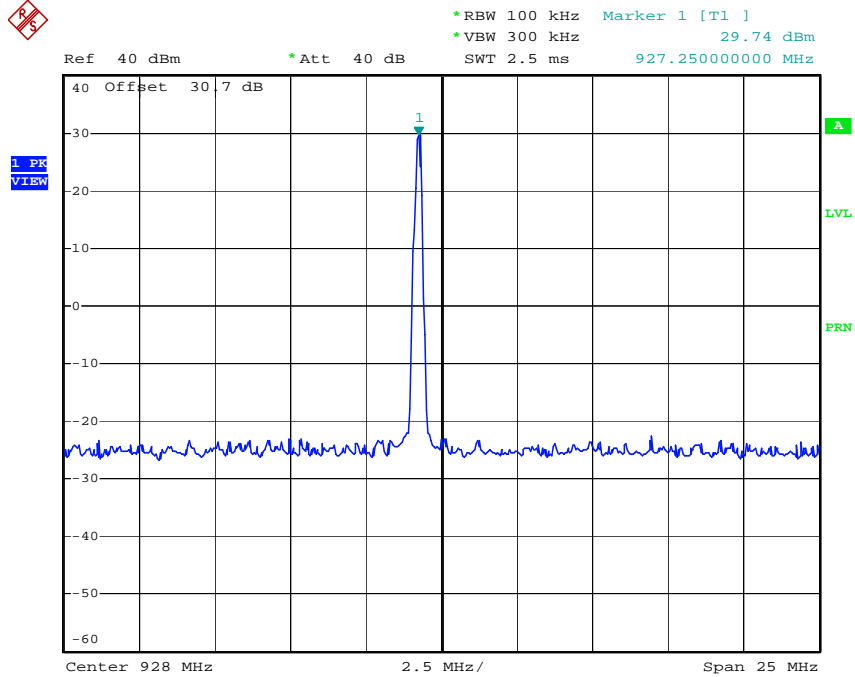


Date: 28.MAY.2009 19:12:41

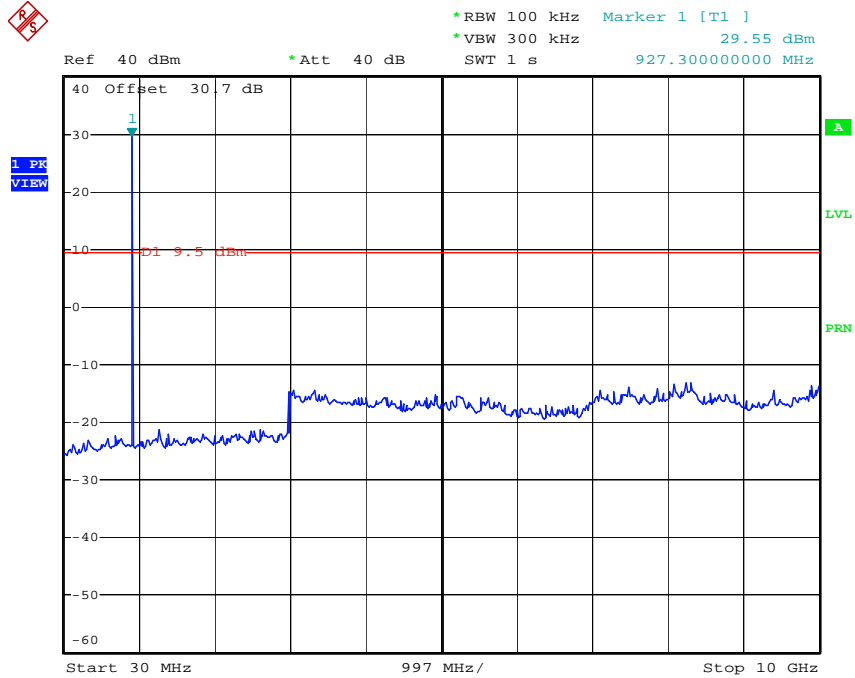
HCT PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT			www.hct.co.kr
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(High CH)



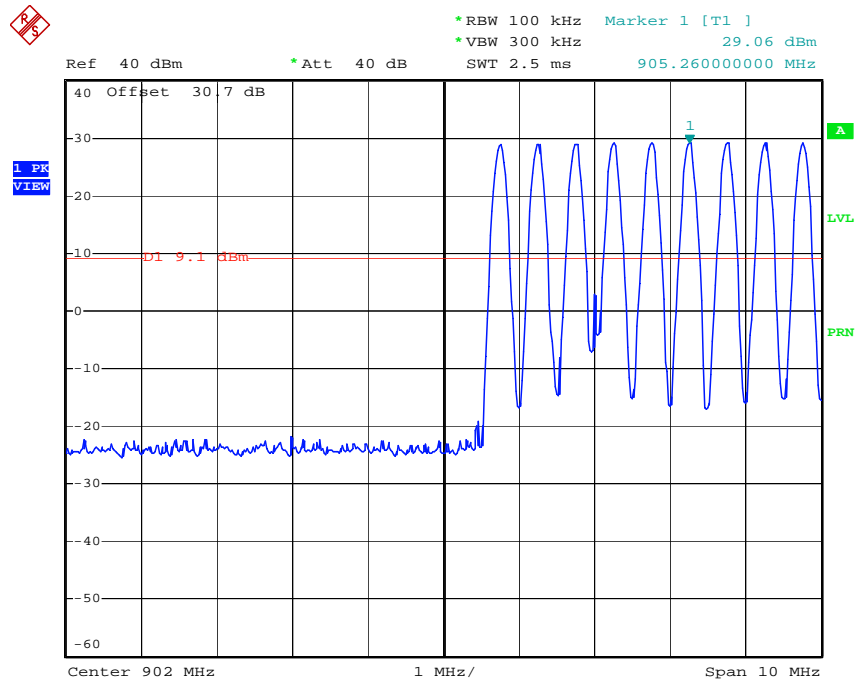
Date: 28.MAY.2009 19:14:49



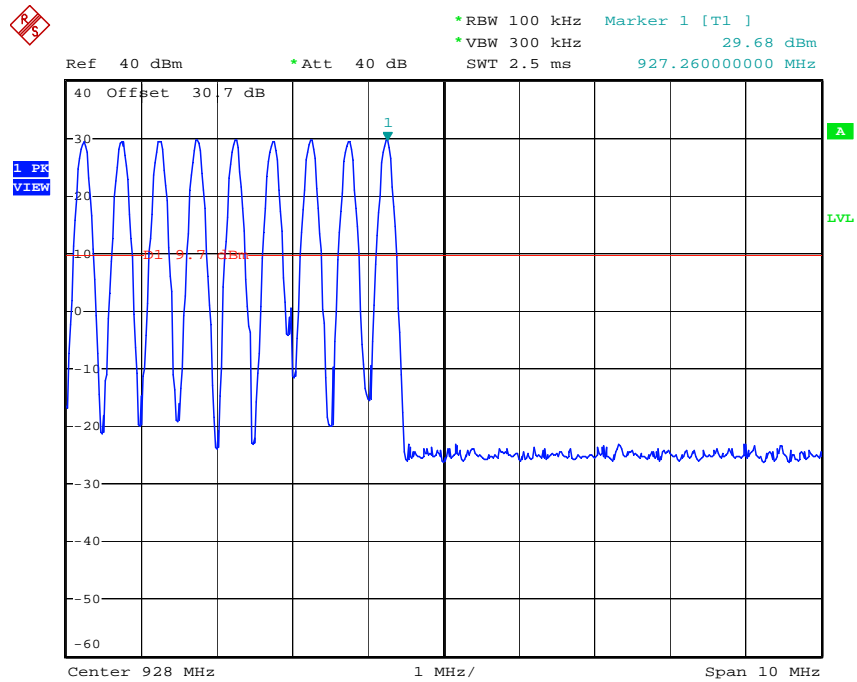
Date: 28.MAY.2009 19:15:51

HCT PT.15.247 TEST REPORT	FCC CERTIFICATION REPORT			www.hct.co.kr
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SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



Date: 28.MAY.2009 19:22:15



Date: 28.MAY.2009 19:23:28



7.8.2 Radiated Spurious Emissions

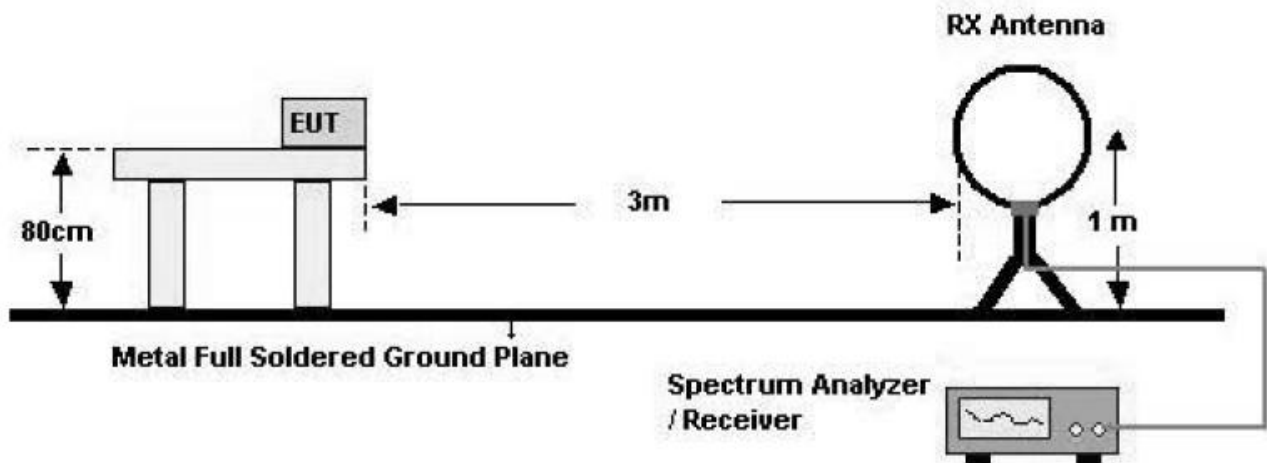
LIMIT

1. 20dBc in any 100kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed

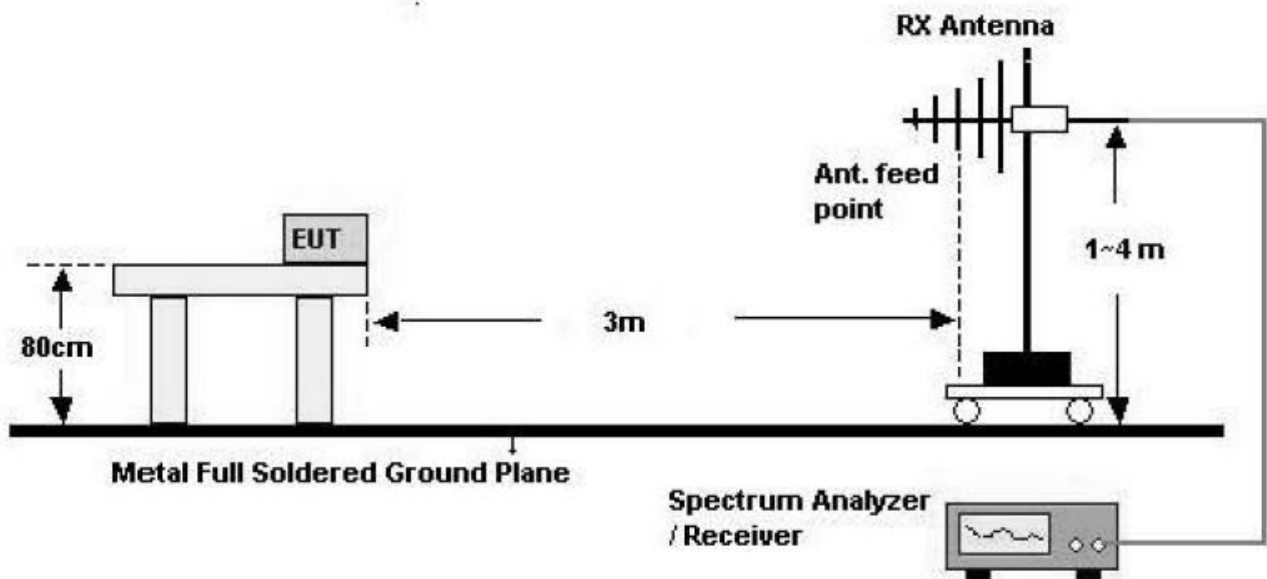
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

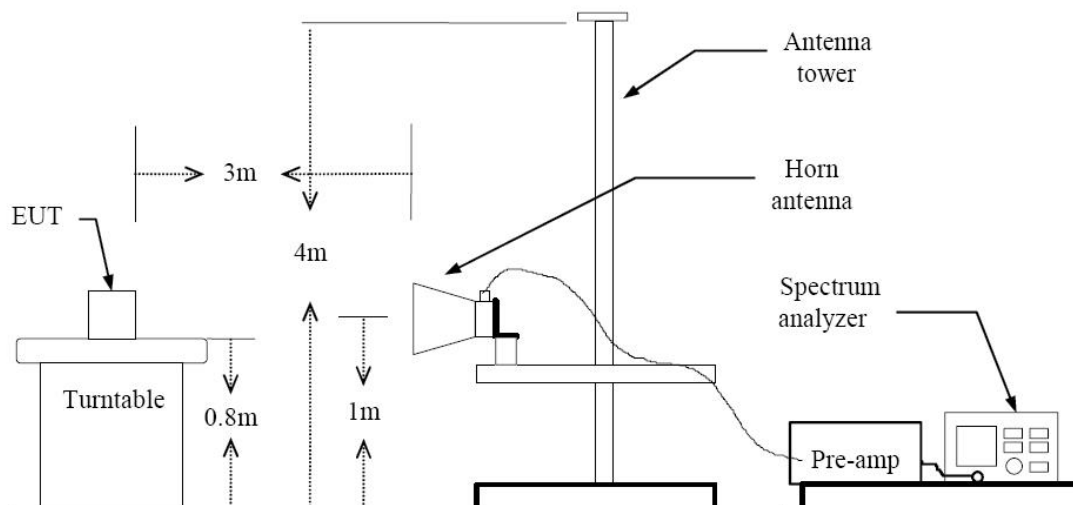
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8 m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.



TEST RESULTS

9 kHz – 30MHz

Operation Mode: Normal Link

Notes:

1. Measuring frequencies from 9 kHz to the 30MHz.
2. The reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
3. Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB)
4. Limit line = specific Limits (dBuV) + Distance extrapolation factor

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TEST RESULTS

Below 1 GHz

Operation Mode: Normal Link

Frequency MHz	Reading dB μ V	Ant. Factor dB/m	Cable Loss dB	Ant. POL (H/V)	Total dB μ V/m	Limit dB μ V/m	Margin dB
95.0	19.0	8.7	1.1	H	28.8	43.5	14.7
95.0	20.2	8.7	1.1	V	30.0	43.5	13.5
120.0	15.1	10.7	1.2	H	27.0	43.5	16.5
120.0	23.6	10.7	1.2	V	35.5	43.5	8.0
144.0	14.1	12.5	1.3	H	27.9	43.5	15.6
144.0	16.3	12.5	1.3	V	30.1	43.5	13.4
161.0	13.8	12.7	1.4	H	27.9	43.5	15.6
180.0	18.3	11.5	1.4	V	31.2	43.5	12.3
192.0	19.3	10.6	1.4	H	31.3	43.5	12.2
209.0	18.4	10.2	1.6	V	30.2	43.5	13.3

Notes:

1. Measuring frequencies from 30 MHz to the 1 GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.



Above 1 GHz

Operation Mode: CH Low

Frequency [MHz]	Reading dBuV	AN.+CL-AMP GAIN. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
1805.50	47.81	-12.63	V	35.18	74	38.82	PK
1805.50	41.05	-12.63	V	28.42	54	25.58	AV
2708.25	43.25	-8.81	V	34.44	74	39.56	PK
2708.50	33.47	-8.81	V	24.66	54	29.34	AV
3611.00	47.87	-4.99	V	42.88	74	31.12	PK
3611.00	40.80	-4.99	V	35.81	54	18.19	AV
1805.50	46.70	-12.63	H	34.07	74	39.93	PK
1805.50	36.10	-12.63	H	23.47	54	30.53	AV
2708.25	42.86	-8.81	H	34.05	74	39.95	PK
2708.50	31.87	-8.81	H	23.06	54	30.94	AV
3611.00	45.12	-4.99	H	40.13	74	33.87	PK
3611.00	34.51	-4.99	H	29.52	54	24.48	AV

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1 GHz – 10 GHz, RBW = 1 MHz, VBW = 1 MHz.
 - b. AV Setting 1 GHz – 10 GHz, RBW = 1 MHz, VBW = 10 Hz.

Operation Mode: CH Mid

Frequency [MHz]	Reading dBuV	AN.+CL-AMP GAIN. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
1829.50	45.63	-12.53	V	33.10	74	40.90	PK
1829.50	37.47	-12.53	V	24.94	54	29.06	AV
2744.25	42.01	-8.66	V	33.35	74	40.65	PK
2744.25	32.59	-8.66	V	23.93	54	30.07	AV
3659.00	47.12	-4.78	V	42.34	74	31.66	PK
3659.00	40.16	-4.78	V	35.38	54	18.62	AV
1829.50	42.92	-12.53	H	30.39	74	43.61	PK
1829.50	33.50	-12.53	H	20.97	54	33.03	AV
2744.25	41.60	-8.66	H	32.94	74	41.06	PK
2744.25	29.35	-8.66	H	20.69	54	33.31	AV
3659.00	44.71	-4.78	H	39.93	74	34.07	PK
3659.00	30.50	-4.78	H	25.72	54	28.28	AV

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1 GHz – 10 GHz, RBW = 1 MHz, VBW = 1 MHz.
 - b. AV Setting 1 GHz – 10 GHz, RBW = 1 MHz, VBW = 10 Hz.

Operation Mode: CH High

Frequency [MHz]	Reading dBuV	AN.+CL-AMP GAIN. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
1854.50	48.14	-12.43	V	35.71	74	38.29	PK
1854.50	42.27	-4.50	V	37.77	54	16.23	AV
2781.75	44.26	-8.50	V	35.76	74	38.24	PK
2781.75	35.90	-8.50	V	27.40	54	26.60	AV
3709.00	45.27	-4.57	V	40.70	74	33.30	PK
3709.00	35.79	-4.57	V	31.22	54	22.78	AV
1854.50	44.57	-12.43	H	32.14	74	41.86	PK
1854.50	38.73	-4.50	H	34.23	54	19.77	AV
2781.75	41.93	-8.50	H	33.43	74	40.57	PK
2781.75	32.17	-8.50	H	23.67	54	30.33	AV
3709.00	44.07	-4.57	H	39.50	74	34.50	PK
3709.00	32.05	-4.57	H	27.48	54	26.52	AV

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1 GHz – 10 GHz, RBW = 1 MHz, VBW = 1 MH.
 - b. AV Setting 1 GHz – 10 GHz, RBW = 1 MHz, VBW = 10 Hz.



7.8.3 Radiated Restricted Band Edge Measurements

Test Requirements and limit, §15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a) (See section 15.205(c)).

Operating Frequency 927 MHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dB μ V	dB /m	dB	(H/V)	dB μ V/m	dB μ V/m	dB
980.8	9.1	23.1	7.9	V	40.1	54	13.9
981.4	9.3	23.1	7.9	H	40.3	54	13.7

Notes:

1. Spectrum setting:

- Measuring frequencies from 30 MHz to the 1 GHz.
- Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.



7.9 POWERLINE CONDUCTED EMISSIONS

LIMIT

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolt (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.



Test Plot

Conducted emissions (Line 1 / Mid CH)

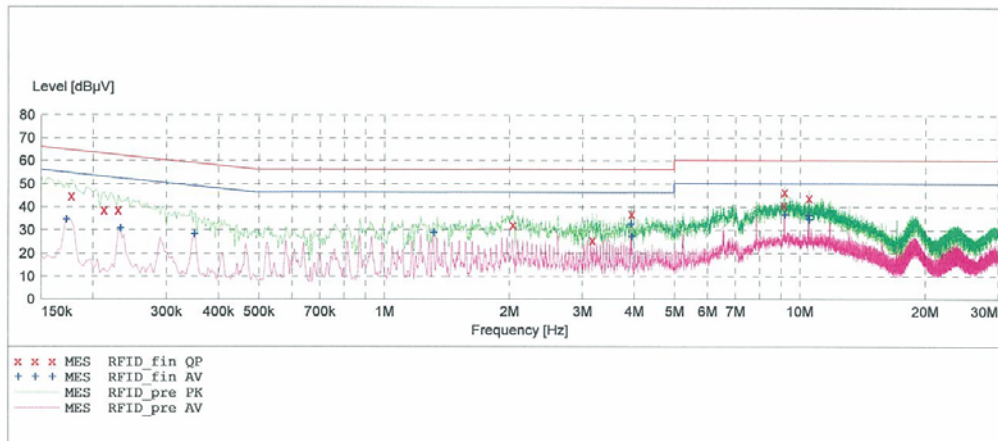
HCT

EMC TEST LAB.

EUT: MKUR-300
Manufacturer: MINERVA
Operating Condition: RF ON MODE
Test Site: SHIELD ROOM
Operator: KH, YOON
Test Specification: CISPR 22 CLASS B
Comment: H

SCAN TABLE: "CISPR 22 Voltage"

Short Description:		CISPR 22 Voltage				
Start	Stop	Step	Detector	Meas.	IF	Transducer
Frequency	Frequency	Width		Time	Bandw.	
150.1 kHz	500.0 kHz	2.5 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			
500.0 kHz	5.0 MHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			
5.0 MHz	30.0 MHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			



MEASUREMENT RESULT: "RFID_fin OP"

5/18/2009 6:58PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.177600	44.60	10.1	65	20.0	---	---
0.212600	38.50	10.1	63	24.6	---	---
0.230100	38.60	10.1	62	23.8	---	---
2.040000	32.00	10.4	56	24.0	---	---
3.176000	25.50	10.5	56	30.5	---	---
3.944000	36.90	10.6	56	19.1	---	---
9.168000	40.90	11.1	60	19.1	---	---
9.196000	46.50	11.1	60	13.5	---	---
10.512000	43.90	11.3	60	16.1	---	---

MEASUREMENT RESULT: "RFID_fin AV"

5/18/2009 6:58PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.172600	34.60	10.1	55	20.2	---	---
0.232600	30.70	10.1	52	21.7	---	---



MEASUREMENT RESULT: "RFID_fin AV"

(continued)

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.350100	28.30	10.1	49	20.7	---	---
1.312000	28.80	10.3	46	17.2	---	---
3.928000	32.40	10.6	46	13.6	---	---
3.944000	27.10	10.6	46	18.9	---	---
9.196000	36.80	11.1	50	13.2	---	---
10.476000	36.40	11.3	50	13.6	---	---
10.512000	34.50	11.3	50	15.5	---	---

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Conducted emissions (Line 2 / Mid CH)

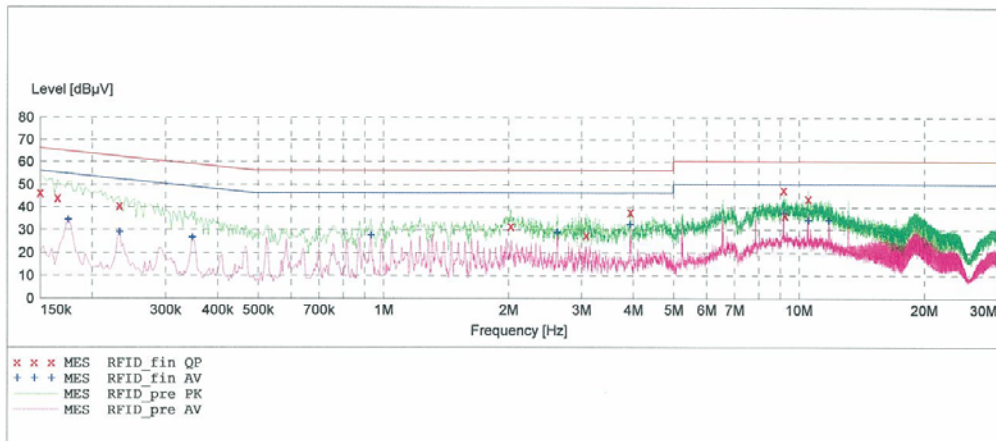
HCT

EMC TEST LAB.

EUT: MKUR-300
Manufacturer: MINERVA
Operating Condition: RF ON MODE
Test Site: SHIELD ROOM
Operator: KH, YOON
Test Specification: CISPR 22 CLASS B
Comment: N

SCAN TABLE: "CISPR 22 Voltage"

Short Description:			CISPR 22 Voltage			
Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
150.1 kHz	500.0 kHz	2.5 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			
500.0 kHz	5.0 MHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			
5.0 MHz	30.0 MHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			



MEASUREMENT RESULT: "RFID_fin QP"

5/18/2009 6:55PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.150100	46.30	10.1	66	19.7	---	---
0.165100	44.10	10.1	65	21.1	---	---
0.232600	40.60	10.1	62	21.8	---	---
2.028000	31.50	10.4	56	24.5	---	---
3.080000	27.60	10.5	56	28.4	---	---
3.940000	37.70	10.6	56	18.3	---	---
9.196000	47.60	11.1	60	12.4	---	---
9.260000	36.50	11.1	60	23.5	---	---
10.512000	43.80	11.3	60	16.2	---	---

MEASUREMENT RESULT: "RFID_fin AV"

5/18/2009 6:55PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.175100	34.60	10.1	55	20.1	---	---
0.232600	29.10	10.1	52	23.2	---	---



MEASUREMENT RESULT: "RFID_fin AV"

(continued)

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.347600	26.70	10.1	49	22.4	---	---
0.932000	27.80	10.2	46	18.2	---	---
2.620000	29.00	10.4	46	17.0	---	---
3.928000	32.30	10.6	46	13.7	---	---
9.196000	37.50	11.1	50	12.5	---	---
10.512000	34.30	11.3	50	15.7	---	---
11.780000	34.30	11.4	50	15.7	---	---

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8. LIST OF TEST EQUIPMENT

Manufacturer	Model / Equipment	Cal Interval	Calibration Due	Serial No.
Rohde & Schwarz	ESH2-Z5/ LISN	Annual	04/10/2010	861741/013
Rohde & Schwarz	ESH3-Z6/ LISN	Annual	06/13/2010	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	10/30/2009	375.8810.352
MITEQ	AMF-60-0010 1800-35-20P/AMP	Annual	05/20/2010	1200937
Schwarzbeck	BBHA 9120D/ Horn Antenna	Biennial	03/26/2010	147
Rohde & Schwarz	6502/Loop Antenna	Biennial	12/26/2009	9009-2536
Rohde & Schwarz	FSP30/Spectrum Analyzer	Annual	07/31/2009	839117/011
Agilent	E4416A /Power Meter	Annual	01/21/2010	GB41291412
Wainwright Instrument	WHF3.3/18G-10EF / High Pass Filter	Annual	06/28/2009	1
Hewlett Packard	11636B/Power Divider	Annual	12/24/2009	11377
DIGITAL	EP-3010 /DC POWER SUPPLY	Annual	01/07/2010	3110117