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Ke Mei Ou Lab Corp.
FEDERAL COMMUNICATIONS COMMISSION
Registration Number: 125782
INDUSTRY CANADA
Registration Number: IC4986

FCC TEST REPORT

Under
FCC 15 Subpart C, Paragraph 15.247: 2003
Frequency Hopping Spread Spectrum (FHSS)
Operating in 902 - 928 MHz Band

Prepared For :

Spatial Net, Inc.

3322 South Memorial Pkwy Ste 421, Huntsville, AL 35801

FCC ID: S58-HACLN96K02G
EUT: GIS/GPS Tracking Device
Model: HAC-LN96K02G

March 12, 2005

Report Type: Original Report
Test Engineer: Peter Lin
Test Date: January 3, 2005
Review By: _____ Apollo Liu / Manager

TABLE OF CONTENTS

1. General Information

1. 1 Notes

The test results of this report relate exclusively to the test item specified in 1.5. The KMO Lab does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the KMO Lab.

1. 2 Testing Laboratory

Ke Mei Ou Laboratory Co., Ltd.
7A, Jiaxiangge, Jiahuixincheng, No.3027, Shennan Rd., Futian, Shenzhen, Guangdong, P.R.China.
Tel: +86 755 83642690 Fax: +86 755 83297077
Email: kmo@kmolab.com
Internet: www.kmolab.com

Site on File with the Federal Communications Commission – United Sates
Registration Number: 125782
For 3 & 10 meter OATS

Site Listed with Industry Canada of Ottawa, Canada
Registration Number: IC4986
For 3 & 10 meter OATS

1. 3 Details of Applicant

Name : Spatial Net, Inc.
Address : 3322 South Memorial Pkwy Ste 421, Huntsville, AL 35801
Contact : Dr. Tian Wu / President
Tel : (256) 428 1800
Fax : (256) 882 0458

1. 4 Application Details

Date of Receipt of Application : December 8, 2004
Date of Receipt of Test Item : December 8, 2004
Date of Test : January 3~March 11, 2005

1. 5 Test Item

Manufacturer : See Applicant
Trade Name : Waalex
Model No. : HAC-LN96K02G
Description : GIS/GPS Tracking Device

Additional Information

Frequency : 902MHz~910MHz
Maximum Range : N/A
Number of Channels : 4
Transmitter Antenna : The transmitter is permanently attached with a removable external antennas. Antennas are connected to unique BNC/SMC-50JK RF coaxial connector.
Power Supply : DC 7.2V
Current Consumption : For receiving, current is <50mA, transmitting current is <500mA.
Modulation Type : Frequency Shift Keying (FSK)

1. 6 Test Standards

FCC 15 Subpart C, Paragraph 15.247: 2003

Note: All radiated measurements were made in all three orthogonal planes. The values reported are the maximum values.

2. Technical Test

2. 1 Summary of Test Results

The EUT has been tested according to the following specifications:

Standard	Test Type	Result	Notes
FCC Part 15, Paragraph 15.203	Antenna Requirement	PASS	Complies
FCC Part 15, Paragraph 15.107(a)	Conducted Test	PASS	Complies
FCC Part 15 Subpart C Paragraph 15.247(a)(1)	Provisions for Frequency Hopping Systems	PASS	Complies
FCC Part 15 Subpart C Paragraph 15.247(b)	Peak Output Power	PASS	Complies.
FCC Part 15 Subpart C Paragraph 15.247(b)(5) & FCC 1.1307, 1.1310 & FCC 2.1091, 2.1093	RF Exposure Limit	PASS	Complies
FCC Part 15 Subpart C Paragraph 15.247(c)	Band-Edge and RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	PASS	Complies.
FCC Part 15 Subpart C Paragraph 15.247(c), 15.209 & 15.205	Transmitter Spurious Radiated Emissions	PASS	Complies

* The digital circuit porting of the EUT has been tested and verified to comply with FCC Part 15, Subpart B., Class B Digital Devices and the associated Radio Receiver has also been tested and found to comply with FCC Part 15, Subpart B – Radio Receivers.

2. 2 Antenna Requirement

A. Regulation

FCC section 15.203, An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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 Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

B. Result

The transmitter is permanently attached with a removable external antennas. Antennas are connected to unique BNC/SMC-50JK RF coaxial connector which meets the requirements of this section for an unique antenna couple.

3. EUT Modifications

No modification by Ke Mei Ou Laboratory Co., Ltd.

4. Conducted Power Line Test

4. 1 Test Equipment

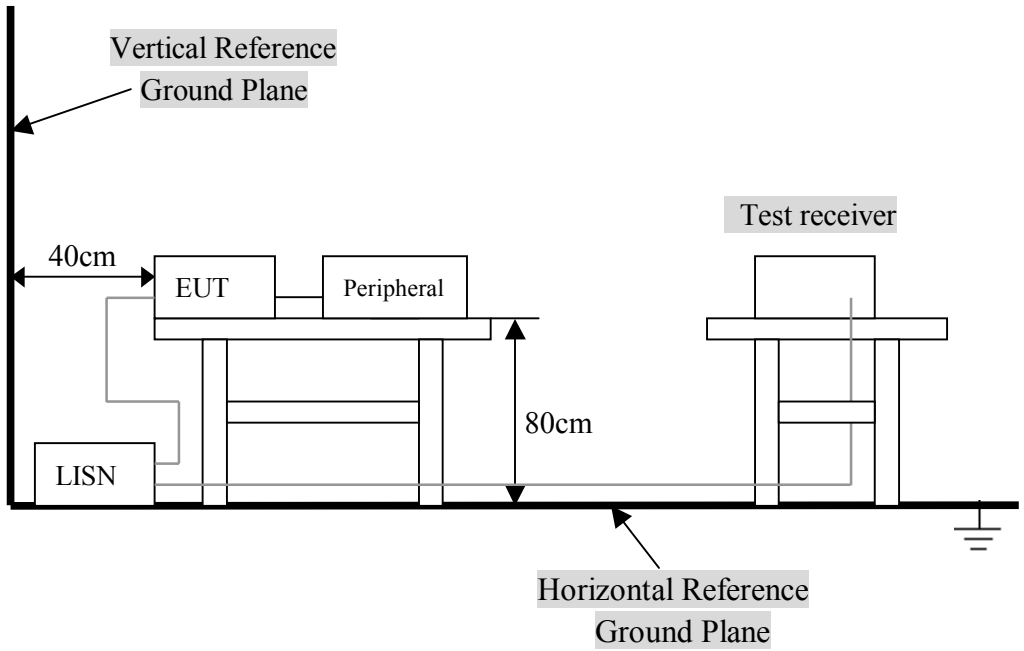
Please refer to Section 12 this report.

4. 2 Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission., the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4:2001 on conducted measurement. Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

4. 3 Test Setup



For the actual test configuration, Please refer to the related items – Photos of Testing.

4. 4 Configuration of the EUT

The EUT was configured according to ANSI C63.4-2001. EUT was used DC7.2V (Power by External Regulated DC Power Supply). The operation frequency is from 902MHz~910MHz. Enable the signal transmitted from the external antenna from EUT to receiver. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

Note:

1) Operating Modes: Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements. The EUT operates in normal Frequency Hopping mode for occupancy duration. and frequency separation.
2) Special Test Software & Hardware: Special firmware and hardware provided by the Applicant are installed to allow the EUT to operates in hopping mode or at each channel frequency continuously. For example, the transmitter will be operated at each of lowest, middle and highest frequencies individually continuously during testing.
3) Transmitter Test Antenna: The EUT is tested with the antenna fitted in a manner typical of normal intended use as an integral / non-integral antenna equipment as describe with the test results.
4) Frequency(ies) Tested: 902.3324MHz, 905.904MHz and 909.590MHz were pre-tested, The worst case one, was chosen for conducted emission test.
5) Above 1GHz, the 902.3324MHz, 905.904MHz and 909.590MHz were tested individually.
6) Normal Test Modulation: FSK
7) Modulating Signal Source: Internal

* Associated Antenna Descriptions: There are three antenna families,
(a): TLB-915-2.5J
(b): TLB-915-1200
The above antennas were selected for testing to represents the worst-case. Refer to antennas list exhibit for detailed specifications.

A. EUT

Device	Manufacturer	Model #	FCC ID
GIS/GPS Tracking Device	Spatial Net, Inc.	HAC-LN96K02G	S58-HACLN96K02G

B. Internal Devices

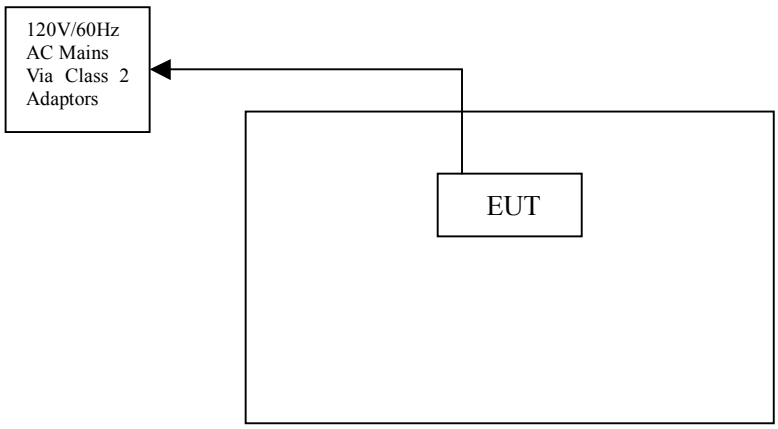
Device	Manufacturer	Model #	FCC ID
N/A			

C. Peripherals

Device	Manufacturer	Model # Serial #	FCC ID/ DoC	Cable
N/A				

4. 5 EUT Operating Condition

Operating condition is according to ANSI C63.4 - 2001.
A. Setup the EUT and simulators as shown on follow.
B. Enable RF signal and confirm EUT active.
C. Modulate output capacity of EUT up to specification.



4. 6 Conducted Power Line Emission Limits

FCC Part 15 Paragraph 15.207 (dBuV)		
Frequency Range (MHz)	**Class A QP/AV**	**Class B QP/AV**
0.15 – 0.5	79/66	66-56/56-46
0.5 – 5.0	73/60	56/46
5.0 - 30	73/60	60/50

NOTE ：In the above table, the tighter limit applies at the band edges.

4. 7 Conducted Power Line Test Result

Product	: GIS/GPS Tracking Device	Test Mode	: 902.3324MHz, TLB-915-1200
Test Item	: Conducted Emission Data	Temperature	: 25 ℃
Test Voltage	: DC 7.2V (Power by DC Power Supply)	Humidity	: 56%RH
Test Result	: **PASS**		

The frequency spectrum from 0.15 MHz to 30 MHz was investigated. All readings are quasi -peak values with a resolution bandwidth of 9 KHz.

- Temperature ： 26 ℃
- Humidity ： 53 % RH

CH4: 2468MHz

FCC Part 15 Paragraph 15.207							
Frequency (MHz)	**Emission (dBuV)**		**LINE/ NEUTRAL**	**Limit (dBuV)**		**Margin (dB)**	
	QP	**AV**		**QP**	**AV**	**QP**	**AV**
0.158	38.26	22.78	LINE	65.57	55.57	-27.31	-32.79
0.158	38.50	22.54	NEUTRAL	65.57	55.57	-27.07	-33.03
0.182	31.73	21.85	LINE	64.39	54.39	-32.66	-32.54
0.214	27.38	21.89	NEUTRAL	63.05	53.05	-35.67	-31.16
29.490	31.12	31.35	LINE	60.00	50.00	-28.88	-18.65
29.490	30.98	31.24	NEUTRAL	60.00	50.00	-29.02	-18.76

Note: NF = No Significant Peak was Found.

Note:

1.Uncertainty in conducted emission measured is <+/ -2dB.
2.The emission levels of other frequencies were very low against the limit.
3.All Reading Levels are Quasi-Peak and Average value.
4.Emission = Meter Reading + Factor; Factor = Insertion Loss + Cable Loss.
5.Margin Value = Emission Level - Limit Value.

Conducted Emission

EN55022

EUT: GIS/GPS Tracking Device

Manufacturer: Spatial Net, Inc.

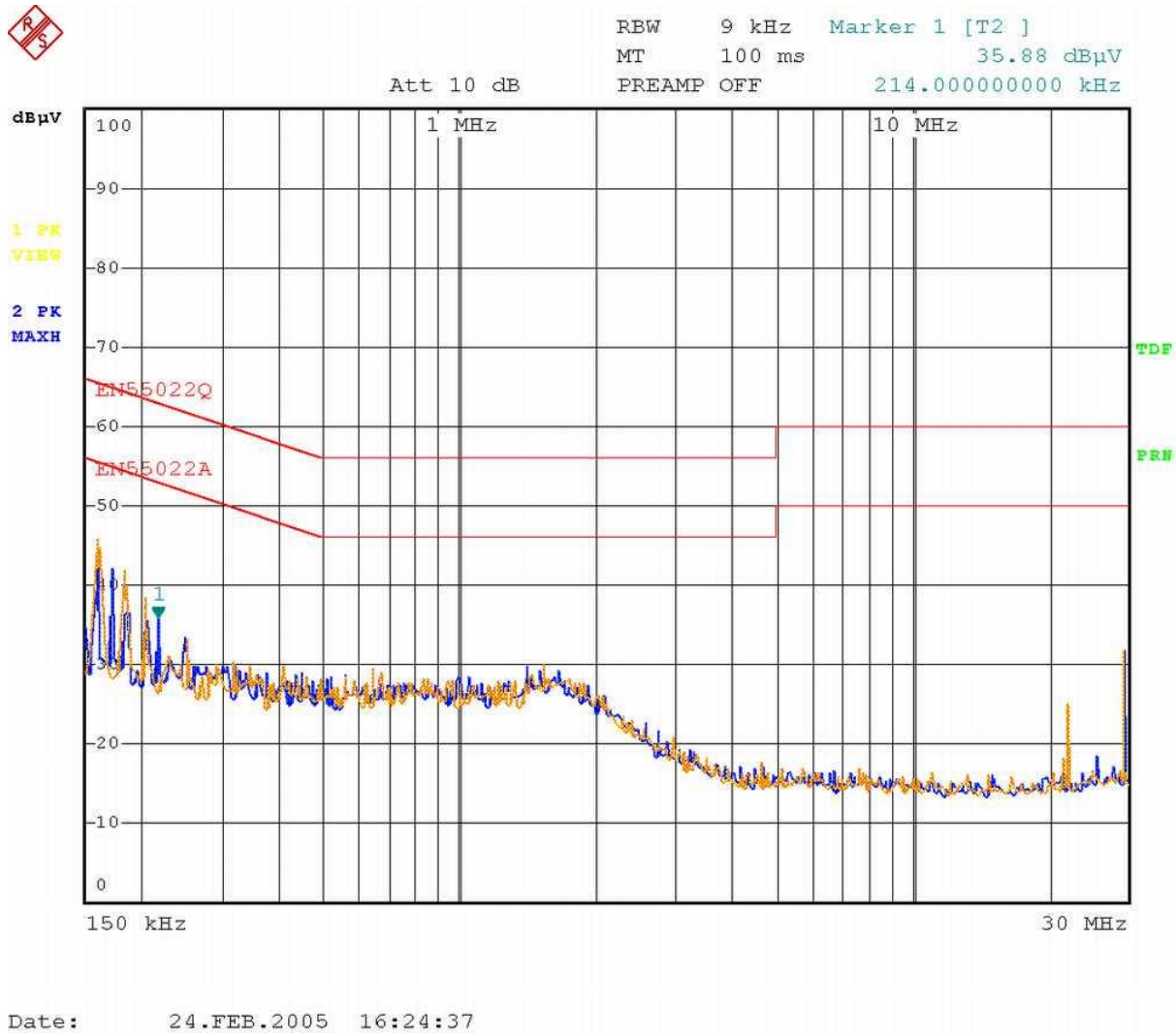
Operating Condition: Transmitter

Test Site: Ke Mei Ou Laboratory

Operator: Peter Lin

Test Specification: LINE&NEUTRAL

Comment:



5. Provisions for Frequency Hopping Systems

5. 1 Test Equipment

Please refer to Section 12 this report.

5. 2 Test Procedure

Refer to FCC 15.247(a)(1), ANSI C63.4 and Public Notice DA 00-705

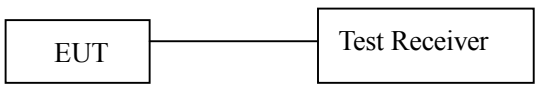
Carrier Frequency Separation:
The hopping function of the EUT is enabled. Use the spectrum analyzer setting as follows:
a. Span = Wide enough to capture the peaks of two adjacent channels
b. RBW = 1% of the span
c. VBW≥RBW
d. Sweep = Auto
e. Detector = Peak
f. Trace = Max hold

Number of hopping frequency:
The hopping function of the EUT is enabled. Use the spectrum analyzer setting as follows:
a. Span = The frequency band of operation
b. RBW = 1% of the span
c. VBW≥RBW
d. Sweep = Auto
e. Detector = Peak
f. Trace = Max hold

Time of Occupancy (Dwell Time):
The hopping function of the EUT is enabled. Use the spectrum analyzer setting as follows:
a. Span = 0 Hz centered on a hopping channel
b. RBW = 1 MHz
c. VBW≥RBW
d. Sweep = As necessary to capture the entire dwell time per hopping channel
e. Detector = Peak
f. Trace = Max hold

20 dB Bandwidth:
Use the spectrum analyzer setting as follows:
a. Span = approximately 2 to 3 time the 20 dB bandwidth, centered on a hopping channel
b. RBW = 1% of the 20 dB bandwidth
c. VBW≥RBW
d. Sweep = Auto
e. Detector = Peak
f. Trace = Max hold

5. 3 Test Setup



The EUT was connected to a test receiver through a 50 ohm RF cable.

5. 4 Configuration of the EUT

Same as section 4.4 of this report

5. 5 EUT Operating Condition

Same as section 4.5 of this report.

5. 6 Limit

FCC 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidth of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

FCC 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.

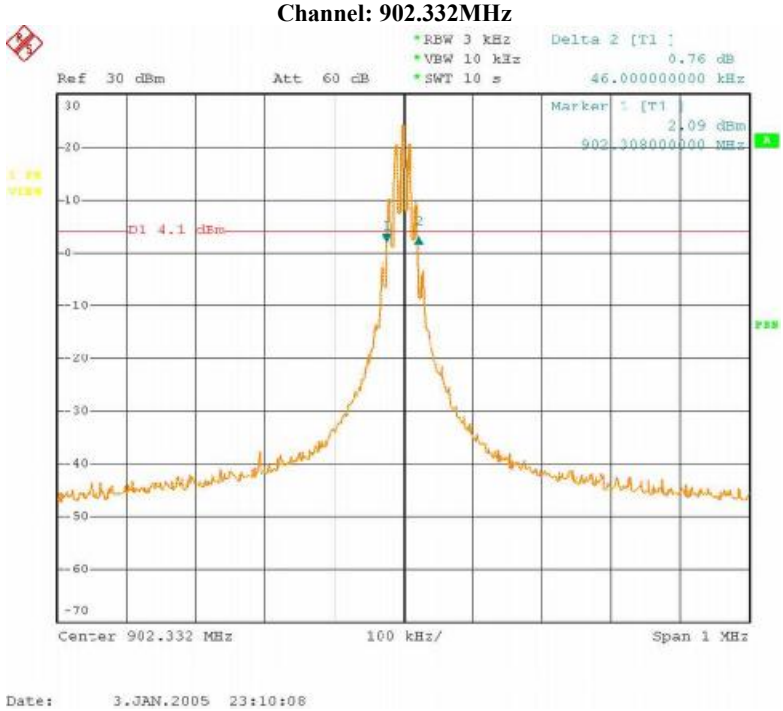
5. 7 Test Result

A. 20 dB BW of The Hopping Channel

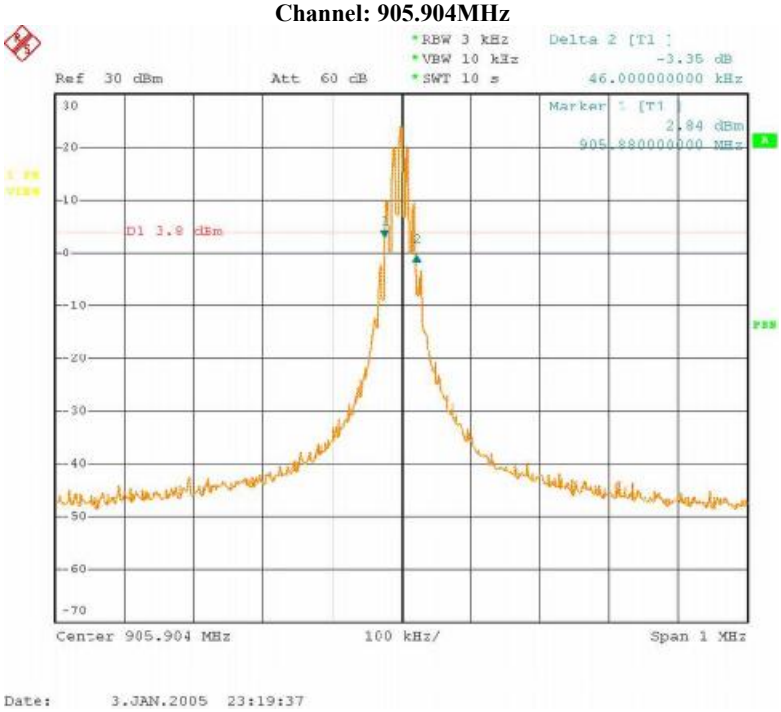
Product	: GIS/GPS Tracking Device	Test Mode	: 902MHz~910MHz
Test Item	: 20 dB BW of The Hopping Channel	Temperature	: 25 ℃
Test Voltage	: DC 7.2V (Power by DC Power Supply)	Humidity	: 56%RH
Test Result	: **PASS**		

Test Item	FCC Limit	Measured Values
20 dB BW of the hopping channel	500 kHz maximum	46kHz

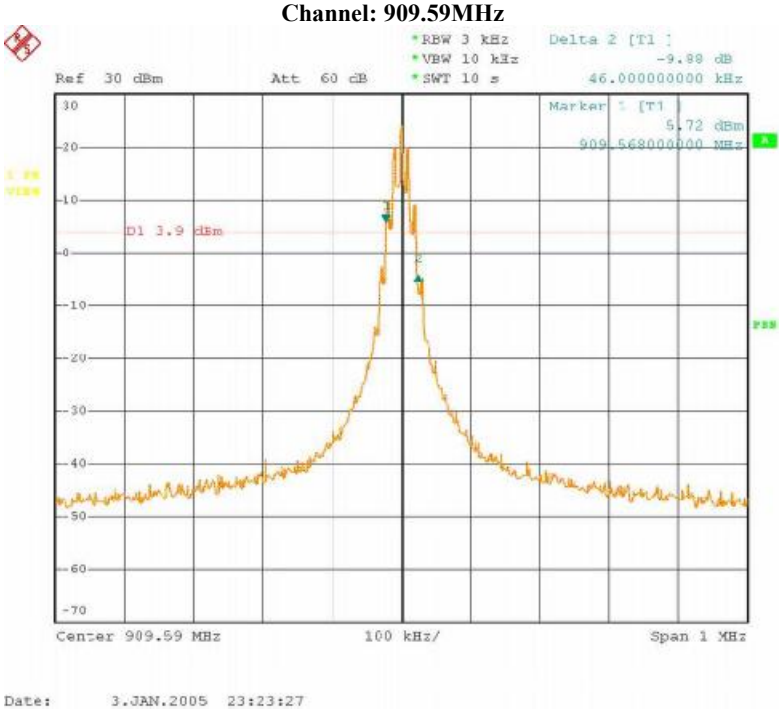
Channel: 902.332MHz



Channel: 905.904MHz



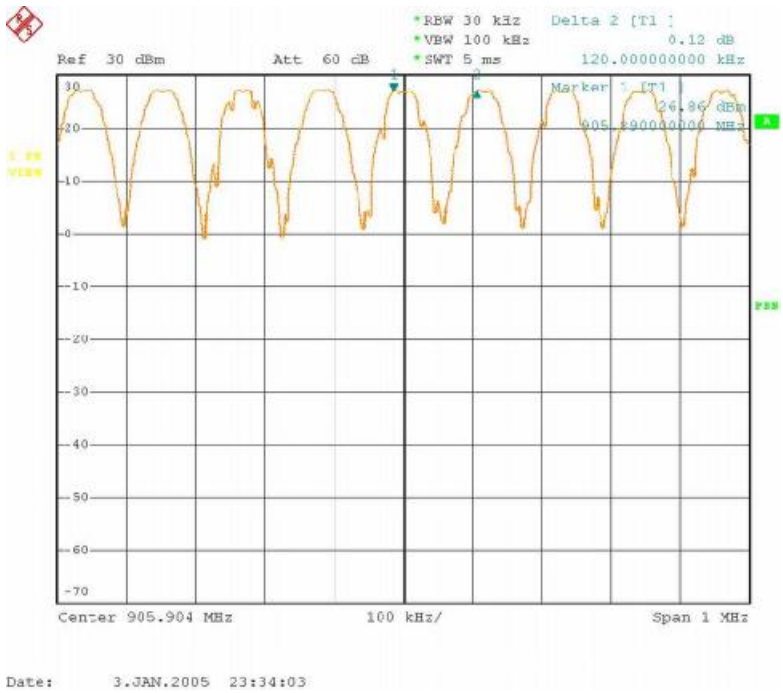
Channel: 909.59MHz



B. Channel Hopping Frequency Separation

Product	: GIS/GPS Tracking Device	Test Mode	: 905.904MHz
Test Item	: Channel Hopping Frequency Separation	Temperature	: 25 ℃
Test Voltage	: DC 7.2V (Power by DC Power Supply)	Humidity	: 56%RH
Test Result	: **PASS**		

Test Item	FCC Limit	Measured Values
Channel Hopping Frequency Separation	Minimum of 25KHz or 20dB BW whichever is greater	120kHz

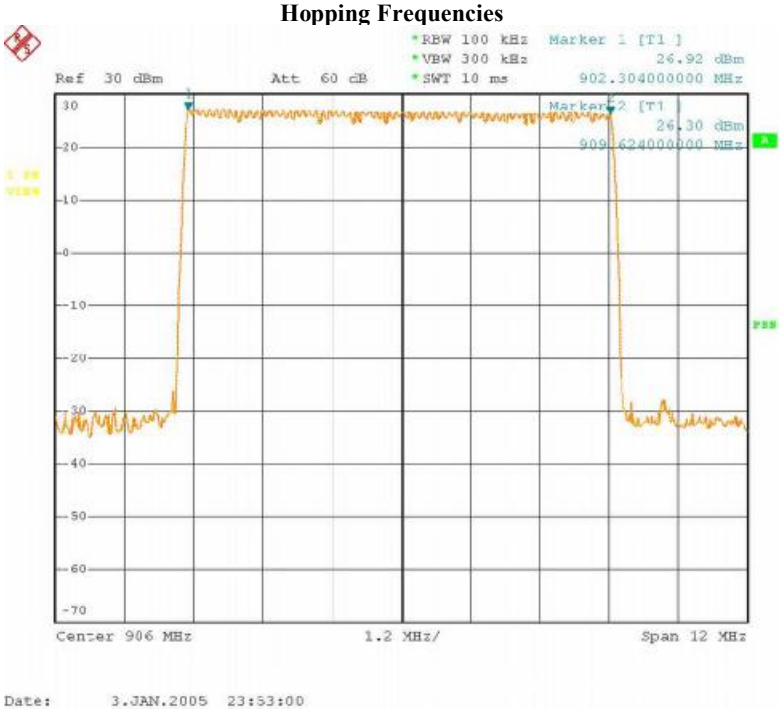


C. Number Hopping Frequencies

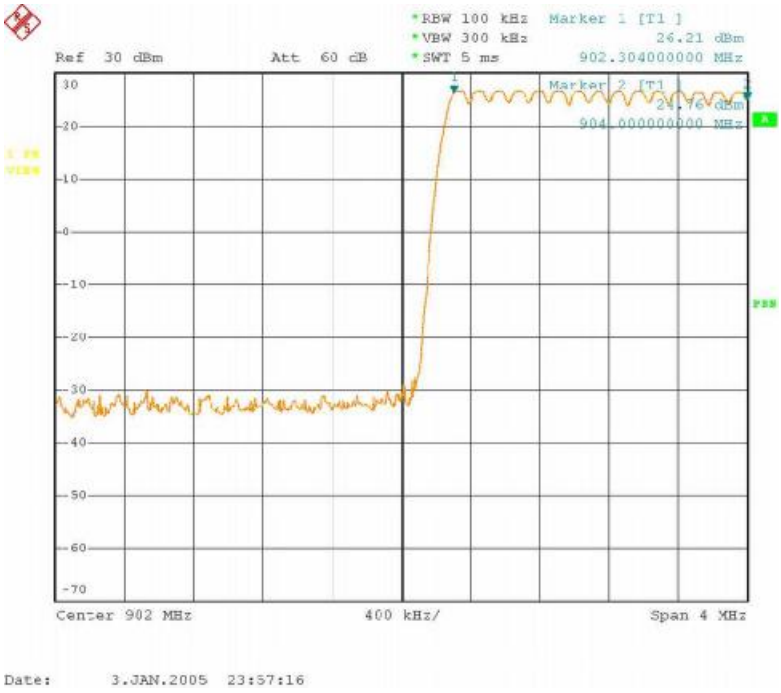
Product	: GIS/GPS Tracking Device	Test Mode	: 902MHz~910MHz
Test Item	: Number Hopping Frequencies	Temperature	: 25 ℃
Test Voltage	: DC 7.2V (Power by DC Power Supply)	Humidity	: 56%RH
Test Result	: **PASS**		

Test Item	FCC Limit	Measured Values
Number hopping frequencies	At least 25 hopping frequencies	64 hopping frequencies

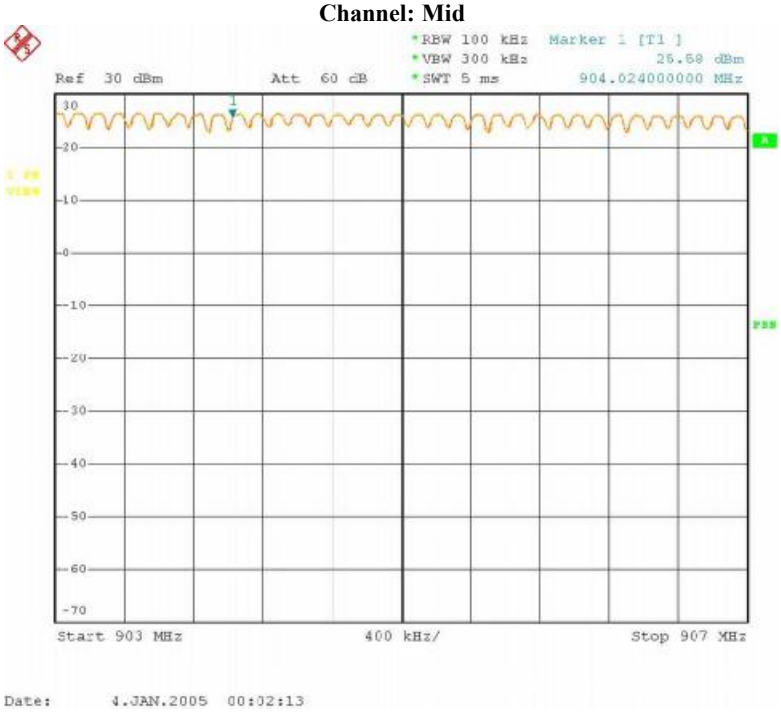
Hopping Frequencies



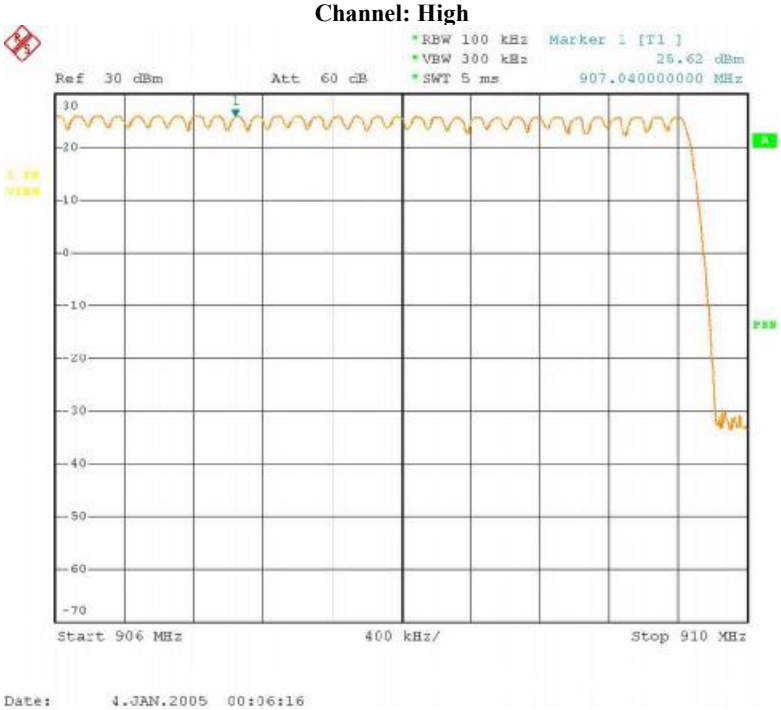
Channel: Low



Channel: Mid



Channel: High

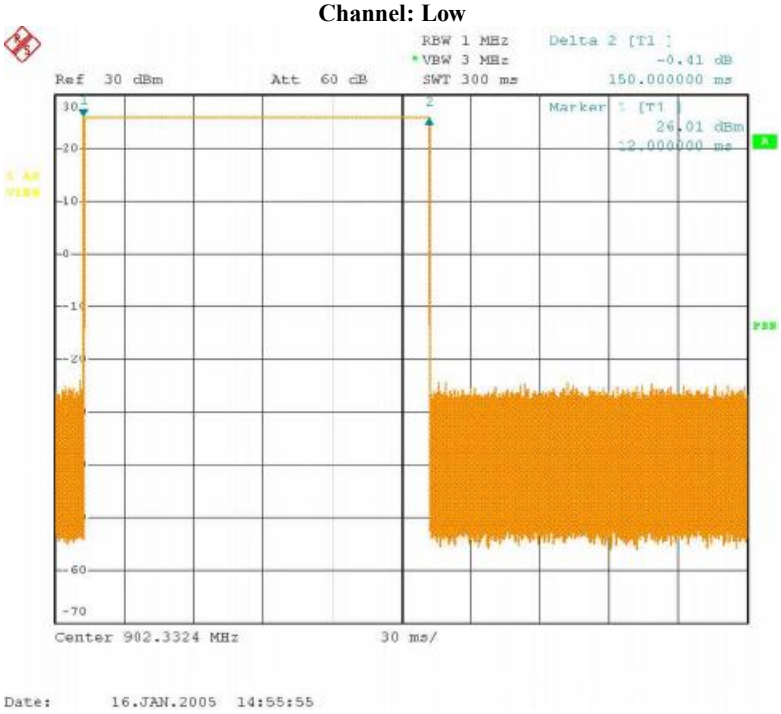


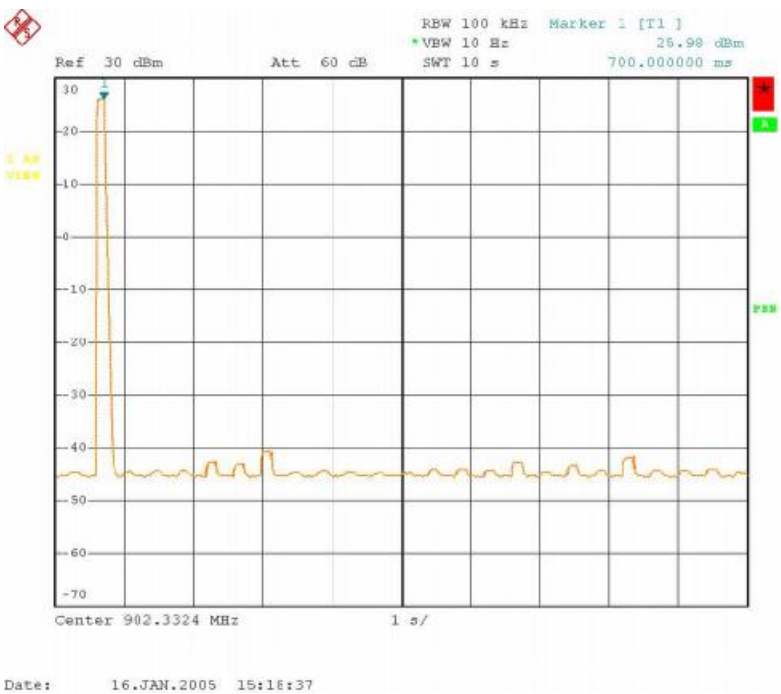
D. Average Time of Occupancy

Product	: GIS/GPS Tracking Device	Test Mode	: 902MHz~910MHz
Test Item	: Number Hopping Frequencies	Temperature	: 25 ℃
Test Voltage	: DC 7.2V (Power by DC Power Supply)	Humidity	: 56%RH
Test Result	: **PASS**		

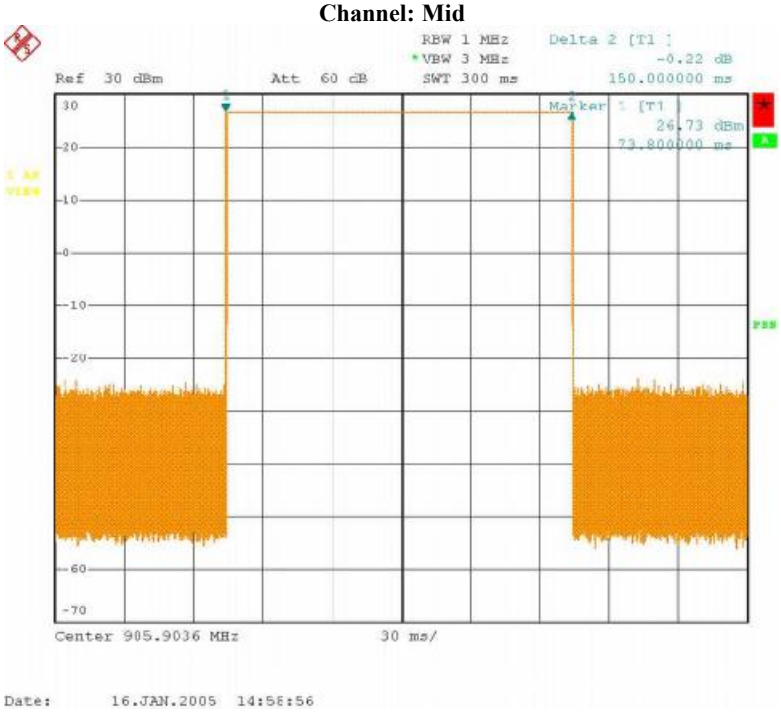
Test Item	FCC Limit	Measured Values
Average Time of Occupancy	Not greater than 0.4 seconds within 10 second period	150 ms within 10 second period

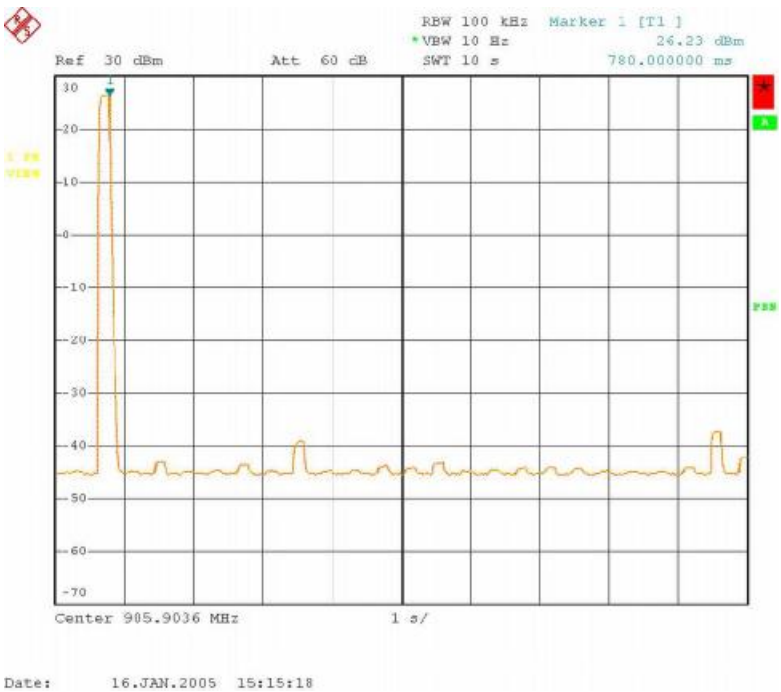
Channel: Low



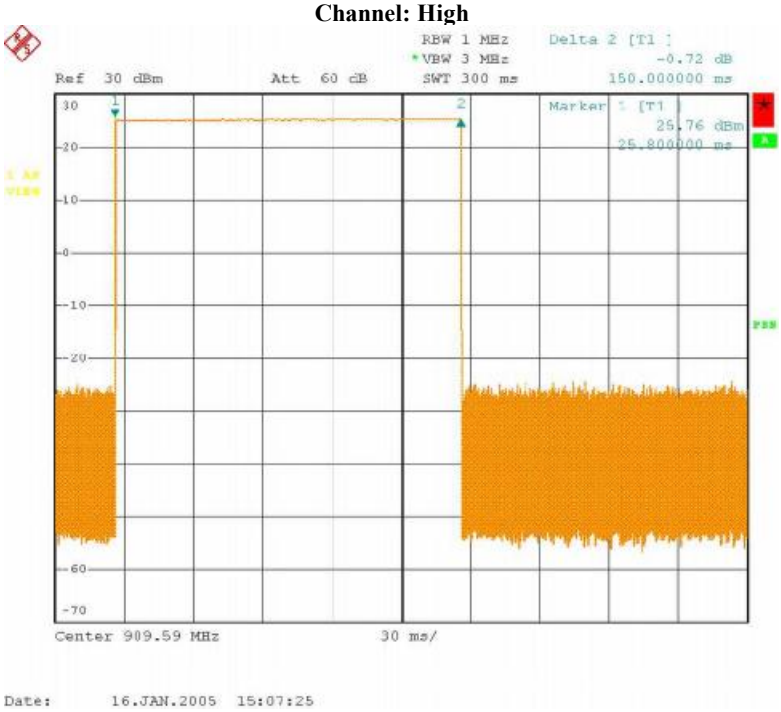


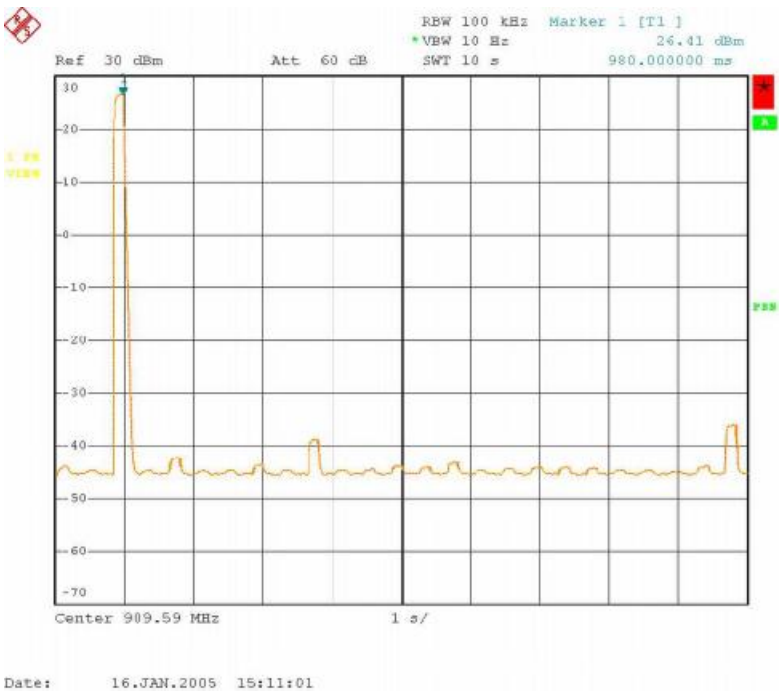
Channel: Mid


RBW 1 MHz
*VBW 3 MHz
SWT 300 ms
Delta 2 [T1]
-0.22 dB
150.000000 ms
Ref 30 dBm
Att 60 dB
Marker 1 [T1]
26.73 dBm
73.800000 ms
Center 905.9036 MHz
30 ms/
Date: 16.JAN.2005 14:58:56


RBW 100 kHz
*VBW 10 Hz
SWT 10 s
Marker 1 [T1]
26.23 dBm
780.000000 ms
Ref 30 dBm
Att 60 dB
Center 905.9036 MHz
1 s/
Date: 16.JAN.2005 15:15:18

Channel: High





6. Peak Output Power & Equivalent Isotropic Radiated Power (EIRP)

6. 1 Test Equipment

Please refer to Section 12 this report.

6. 2 Test Procedure

1) Duty Cycle measurements
Using a spectrum analyzer with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;

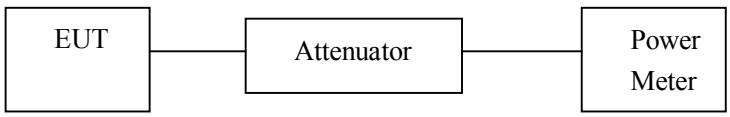
The duty cycle of the transmitter, x=Tx on/(Tx on + Tx off) with 0<x<1, is measured and recorded in the test report. For the purpose of testing. the equipment shall be operated with a duty cycle that is equal or more than 0.1.

2) Calculation of Peak and Average EIRP
The peak output power of the transmitter shall be determined using a wideband. Calibrated RF Peak Power Meter with the power sensor with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "P" (in dBm);

The Average EIRP shall be calculated from the above measured power output "A", the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:

Peak EIRP= P+G
Average EIRP = Peak EIRP + 10log(1/x)

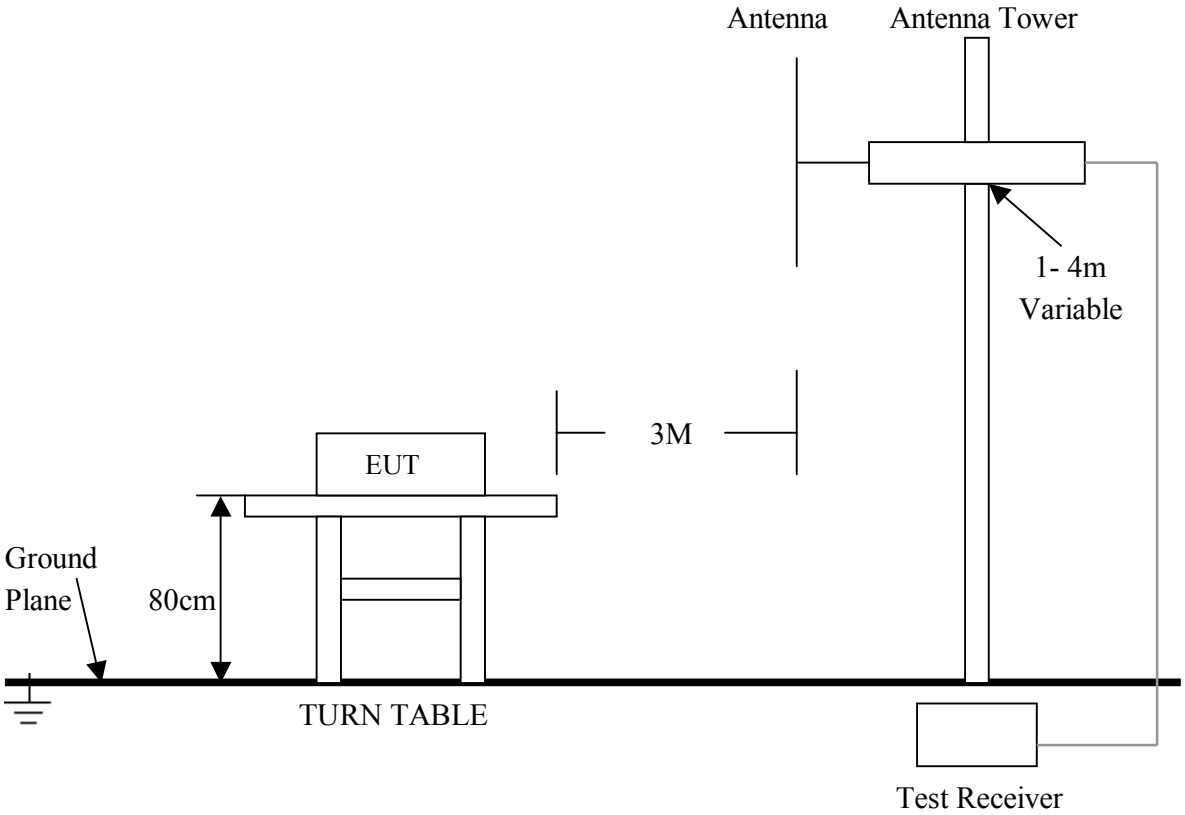
* The above shall be applied to the combination(s) of the radio device and its intended antenna(s).
* If the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
* The above method of measurement shall apply to both conducted and radiated measurements.
* The radiated measurements are performed at the Ke Mei Ou Laboratory Co., Ltd.
* The measurement shall be performed using normal operation of the equipment with modulation.



3) Substitution Method.
(a) The measurements was performed in the absence of modulation (un-modulated)
(b) Test was performed at listed 3m/10m open area test site.
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The dipole test antenna was used and tuned to the transmitter carrier frequency.
(e) The spectrum analyzer was tuned to transmitter carrier frequency. The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(f) The transmitter was rotated through 360' about a vertical axis until a higher maximum signal was received.
(g) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(h) The substitution dipole antenna and the signal generator replaced the transmitter and antenna under test in the same position, and the substitution dipole antenna was placed in vertical polarization. The test dipole antenna was lowered or raised as necessary to ensure that the maximum signal is stilled received.
(i) The input signal to the substitution antenna was adjusted in level until an equal or a known related level to that detected from the transmitter was obtained in the test receiver. The maximum carrier radiated power is equal to the power supply by the generator.
(j) The substitution antenna gain and cable loss were added to the signal generator level for the corrected ERP level.
(k) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
(i) Actual gain of the EUT's antenna is the difference of the measured ERP and measured RF power at the RF port. Correct the antenna gain if necessary.

Use the following spectrum analyzer settings:
*Span = approximately 5 times the 20 dB BW, centered on a hopping channel;
*RBW > 20 dB BW of the emission measured; *VBW = RBW; *Trace = max hold
*Allow the trace to stabilize; *Use the marker-to-marker function to set the marker to the peak of the emission.
*The indicated level is the peak output power (with the addition of the external attenuation and cable loss).
*The limit is specified in one of the subparagraph of this Section; *Submit this plot.
*A peak responding power meter may be used instead of a spectrum analyzer.

6. 3 Test Setup



For the actual test configuration , please refer to the related items – Photos of Testing

6. 4 Configuration of the EUT

Same as section 4.4 of this report

6. 5 EUT Operating Condition

Same as section 4.5 of this report.

6. 6 Limit

§15.247(b)(2): For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

§ 15.247(b)(4): If the antennas of directional gain greater than 6 dBi are used, the peak power from the intentional radiator shall be reduced below, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6. 7 Test Result

Product	: GIS/GPS Tracking Device	Test Mode	: 902MHz~910MHz
Test Item	: Peak Output Power & EIRP Power	Temperature	: 25 ℃
Test Voltage	: DC 7.2V (Power by DC Power Supply)	Humidity	: 56%RH
Test Result	: **PASS**		

Antenna: TLB-915-2.5J

Frequency (MHz)	Peak Output Power at Antenna Terminal (dBm)	Calculated EIRP (dBm)	Peak Output Power Limit (dBm)	EIRP Limit (dBm)	Result
902.332	28.63	31.13	30.0	36.0	**Pass**
905.904	28.59	31.09	30.0	36.0	**Pass**
909.590	28.60	31.10	30.0	36.0	**Pass**

Note: EIRP= (Peak Output Power at Antenna Terminal) + (Max. antenna gain) – (Cable loss).

Antenna: TLB-915-1200

Frequency (MHz)	Peak Output Power at Antenna Terminal (dBm)	Calculated EIRP (dBm)	Peak Output Power Limit (dBm)	EIRP Limit (dBm)	Result
902.332	28.63	30.78	30.0	36.0	**Pass**
905.904	28.59	30.74	30.0	36.0	**Pass**
909.590	28.60	30.75	30.0	36.0	**Pass**

Note: EIRP= (Peak Output Power at Antenna Terminal) + (Max. antenna gain) – (Cable loss).

7. RF Exposure Requirements

7. 1 Test Equipment

Please refer to Section 12 this report.

7. 2 Limit

According to FCC 15.247(b)(4) and 1.1307(b)(1), Systems operating under provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commissions guidelines. FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	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/f²)	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/f²)	30
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.

7. 3 Test Result

Product	: GIS/GPS Tracking Device	Test Mode	: 902MHz~910MHz
Test Item	: RF Exposure	Temperature	: 25 ℃
Test Voltage	: DC 7.2V (Power by DC Power Supply)	Humidity	: 56%RH
Test Result	: **PASS**		

Evaluation of RF Exposure Compliance Requirements MPE Prediction of MPE according to equation from page 19 of OET Bulletin 65, Edition 97-01	
RF Exposure Requirements	**Compliance with FCC Rules**
S=PG/4∏R2 Where: S=Power density P=Power input to antenna G=Power gain of the antenna relative to an isotropic radiator R=Distance to the center of radiation of the antenna	Maximum output power at antenna input terminal: 28.63 dBm = 729.46 mW Prediction distance: 20 cm Antenna gain (TLB-915-1200): 2.15 dBi Antenna gain (TLB-915-2.5J): 2.5 dBi Prediction frequency: 902MHz MPE limit for uncontrolled exposure at prediction frequency: 0.601 mW/cm^2 Power density at 20 cm: Antenna - TLB-915-1200: 0.312 mW/cm^2 Antenna - TLB-915-2.5J: 0.363 mW/cm^2

8. Transmitter Band-edge & Spurious Conducted Emission

8. 1 Test Equipment

Please refer to Section 12 this report.

8. 2 Test Procedure

For both conducted and radiated measurements, the spurious emissions were scanned from the lowest frequency generated by the EUT or 10 MHz whichever is lower to 10th harmonic of the highest frequency generated by the EUT

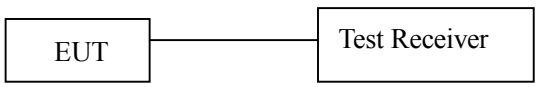
Band-Edge Compliance of RF Conducted Emissions:

Use the following spectrum analyzer settings:
*The radio was connected to the measuring equipment via a suitable attenuator.
*Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation.
*RBW = 1 % of the span
*VBW = RBW
*Sweep = auto
*Detector function = peak
*Trace = max hold
*Allow the trace to stabilize
*Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge
*Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission.
*The marker-delta value now displayed must comply with the limit specified
*Now, using the same instrument settings, enable the hopping function of the EUT
*Allow the trace to stabilize
*Follow the same procedure listed above to determine if any spurious emissions cause by the hopping function also comply with the specify limits.

Spurious RF Conducted Emissions:

Use the following spectrum analyzer settings:
*The radio was connected to the measuring equipment via a suitable attenuator.
*Span = wide enough to capture the peak level of the in-band-emission and all spurious emissions (e.g. harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
*RBW = 100 kHz
*VBW = RBW
*Sweep = auto
*Detector function = peak
*Trace = max hold
*Allow the trace to stabilize
*Set the marker on the any spurious emission recorded. The level displayed must comply with the limit specified in this Section.

8. 3 Test Setup



The EUT was connected to a test receiver through a 50 ohm RF cable.

8. 4 Configuration of the EUT

Same as section 4.4 of this report

8. 5 EUT Operating Condition

Same as section 4.5 of this report.

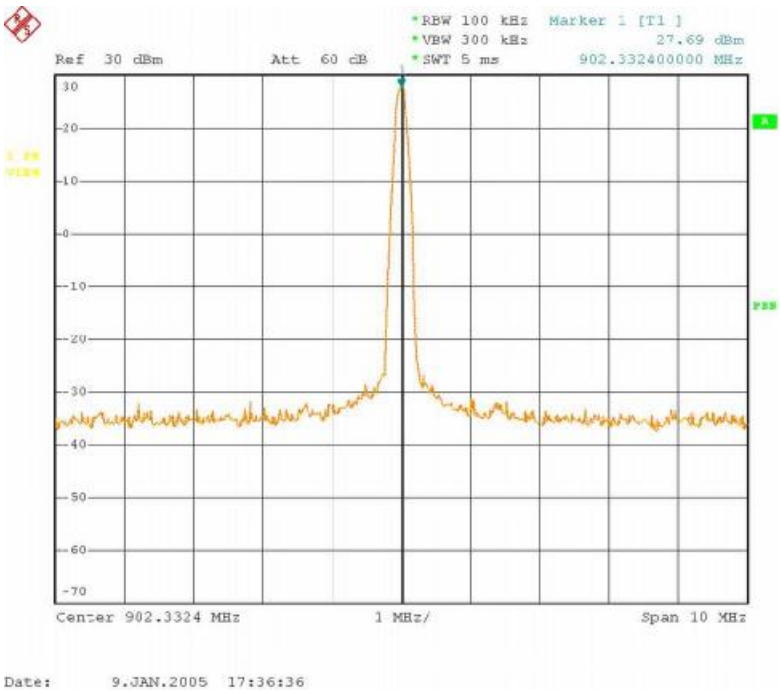
8. 6 Limit

In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the information sequence and the carrier frequency shall be at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of the desired power.

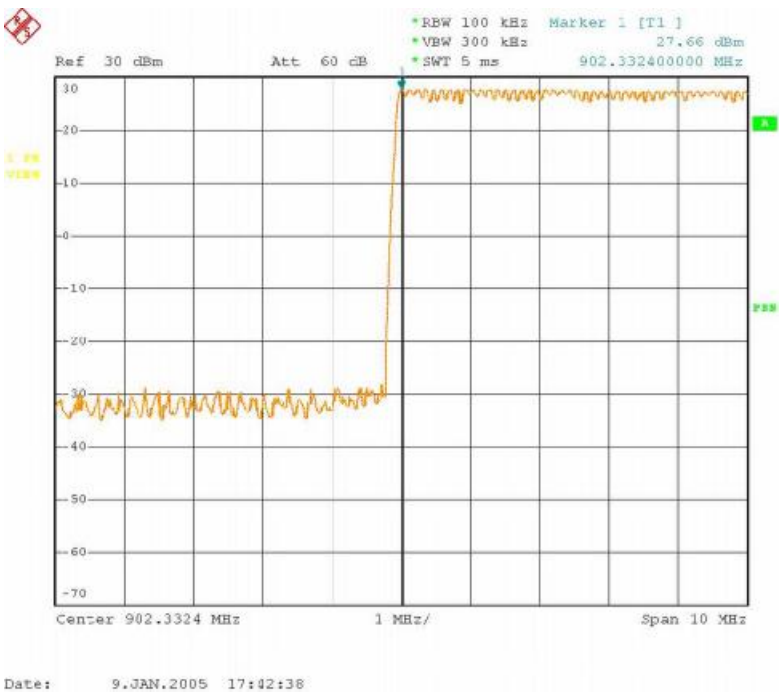
8. 7 Test Result

Product	: GIS/GPS Tracking Device	Test Mode	: 902MHz~910MHz
Test Item	: Band-Edge RF Conducted Emissions	Temperature	: 25 ℃
Test Voltage	: DC 7.2V (Power by DC Power Supply)	Humidity	: 56%RH
Test Result	: **PASS**		

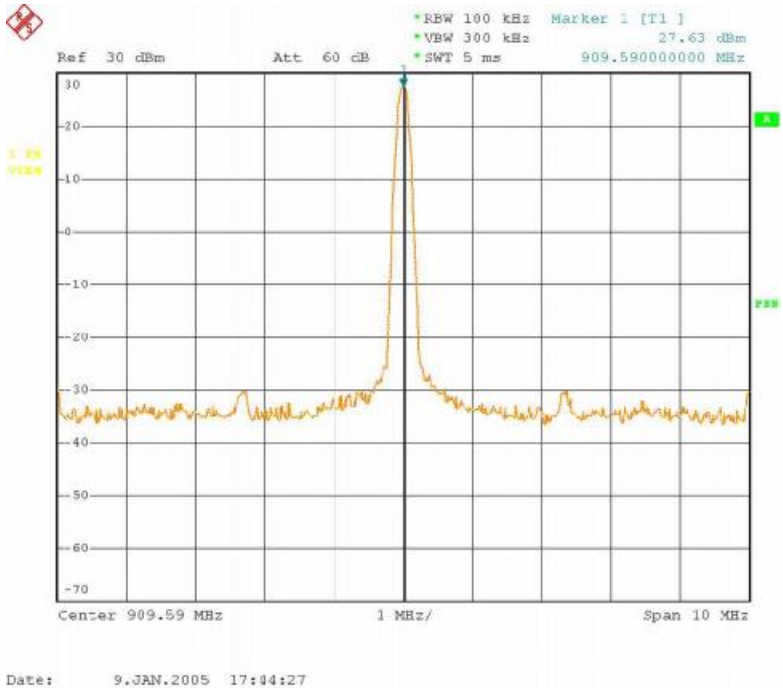
Channel: Low , Single Frequency Mode



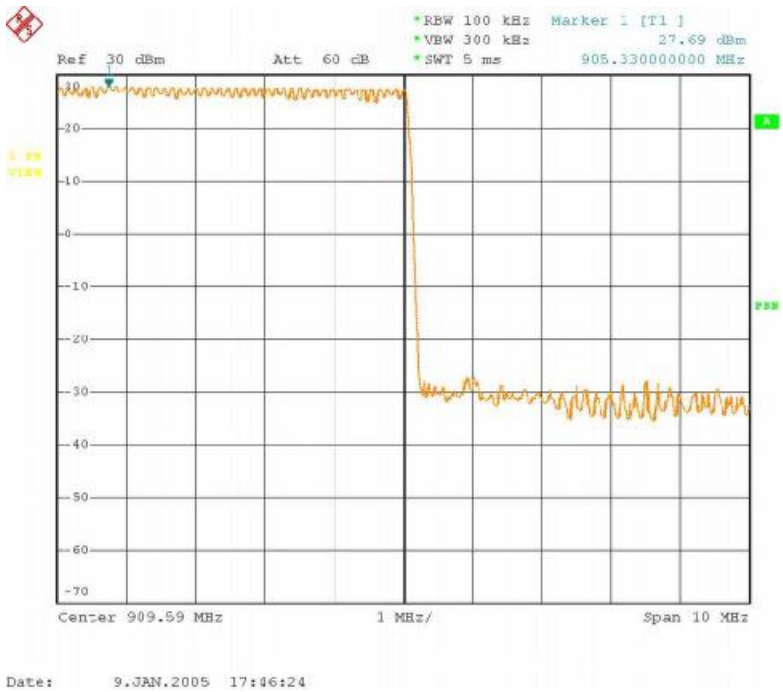
Channel: Low , Pseudorandom Channel Hopping Mode



Channel: High, Single Frequency Mode

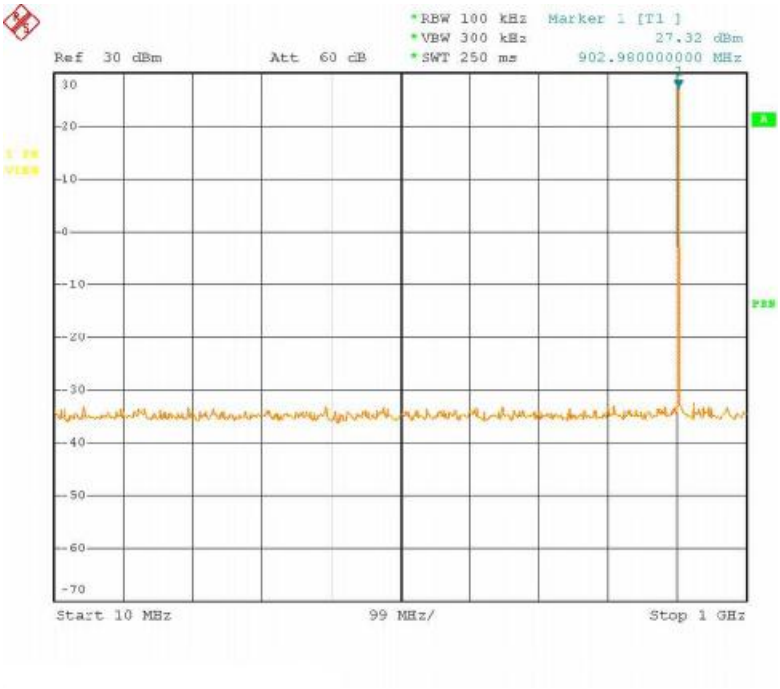


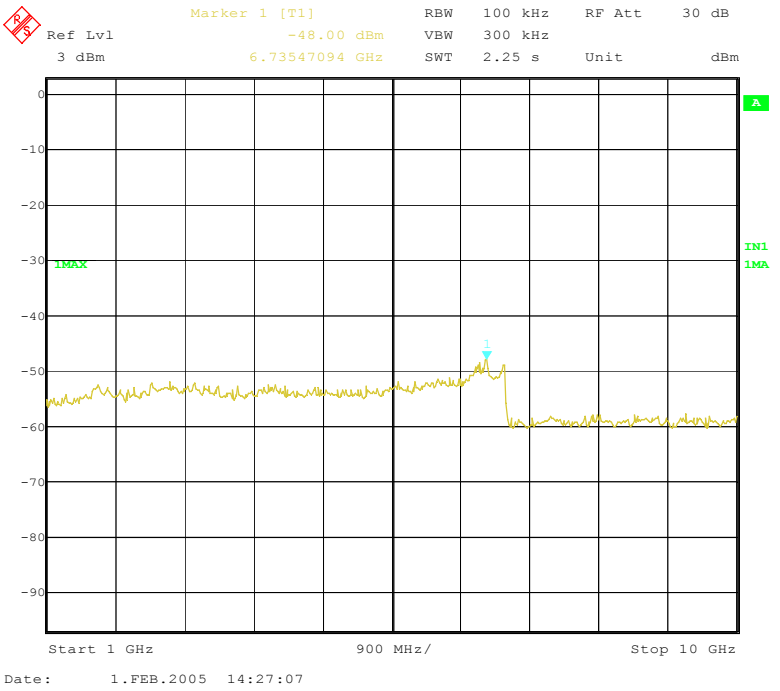
Channel: Low , Pseudorandom Channel Hopping Mode



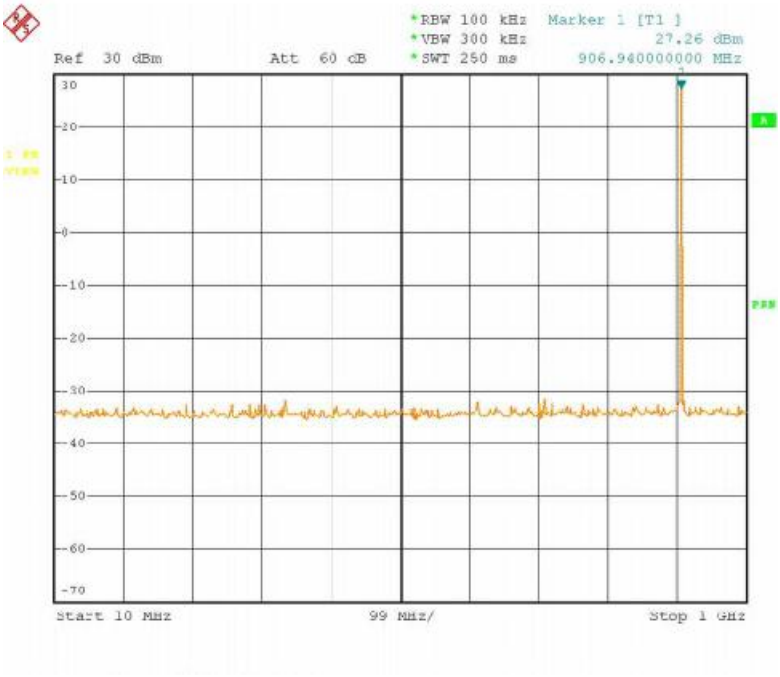
Product	: GIS/GPS Tracking Device	Test Mode	: 902MHz~910MHz
Test Item	: Spurious RF Conducted Emissions	Temperature	: 25 ℃
Test Voltage	: DC 7.2V (Power by DC Power Supply)	Humidity	: 56%RH
Test Result	: **PASS**		

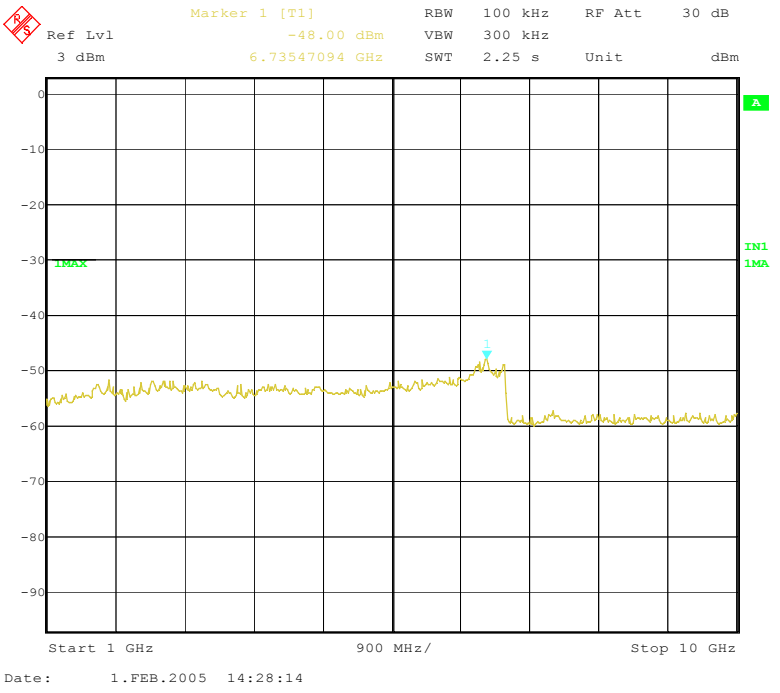
Channel: Low





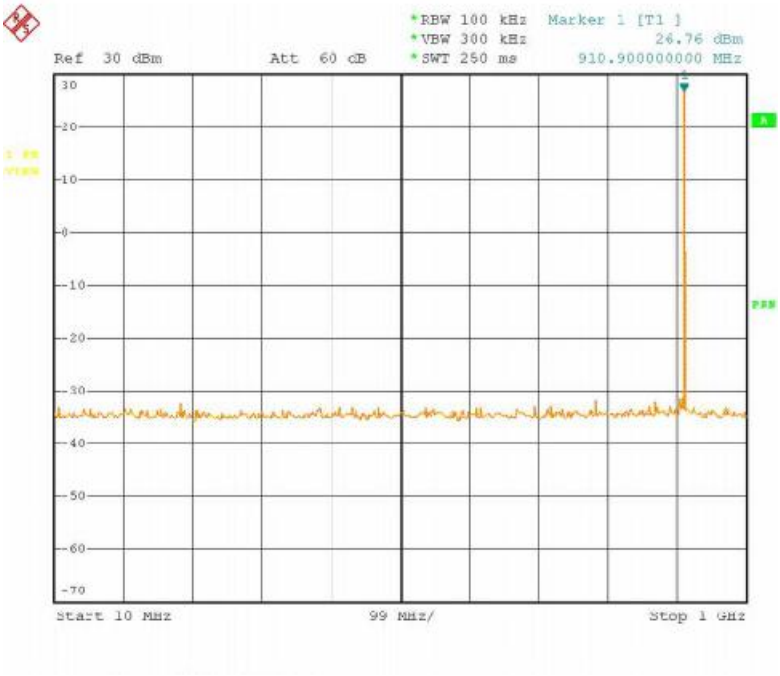
Channel: Mid

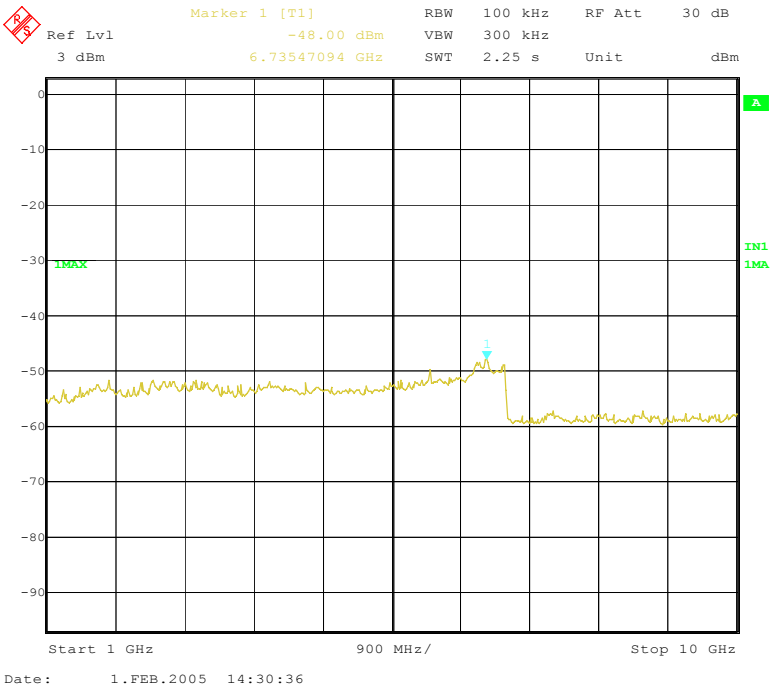




Date: 1.FEB.2005 14:28:14

Channel: High





9. Transmitter Spurious Radiated Emission at 3 Meters

9. 1 Test Equipment

Please refer to Section 12 this report.

9. 2 Test Procedure

1. The EUT was tested according to ANSI C63.4 - 2001. The radiated test was performed at Ke Mei Ou Laboratory .This site is on file with the FCC laboratory division, Registration No. 125782.
2. The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8 m. All set up is according to ANSI C63.4-2001.
3. The frequency spectrum from 30 MHz to 1 GHz was investigated. All readings from 30 MHz to 1 GHz are quasi-peak values with a resolution bandwidth of 120 KHz. All readings are above 1 GHz , peak values with a resolution bandwidth of 1 MHz . Measurements were made at 3 meters.
4. The antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency.
5. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "**QP**" in the data table.
6. The antenna polarization: Vertical polarization and Horizontal polarization.

9. 3 Test Setup

Please refer to section 6.3 this report

9. 4 Configuration of the EUT

Same as section 4.4 of this report

9. 5 EUT Operating Condition

Same as section 4.5 of this report.

9. 6 Limit

In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in section 15.209(a), which lesser attenuation.

All other emissions inside restricted bands specified in section 15.205(a) shall not exceed the general radiated emission limits specified in section 15.209(a)

Note:

Applies to harmonics/spurious emissions that fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

47 CFR § 15.237(c): The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in section 15.35 for limiting peak emissions apply.

FCC CFR 47, Part 15, Subpart C, Para, 15.205(a) – Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
10.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	(2)
13.36–13.41.			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
[2] Above 38.6

FCC 47 CFR, Part 15.209(a) – Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100**	3
88–216	150**	3
216–960	200**	3
Above 960	500	3

9. 7 Test Result

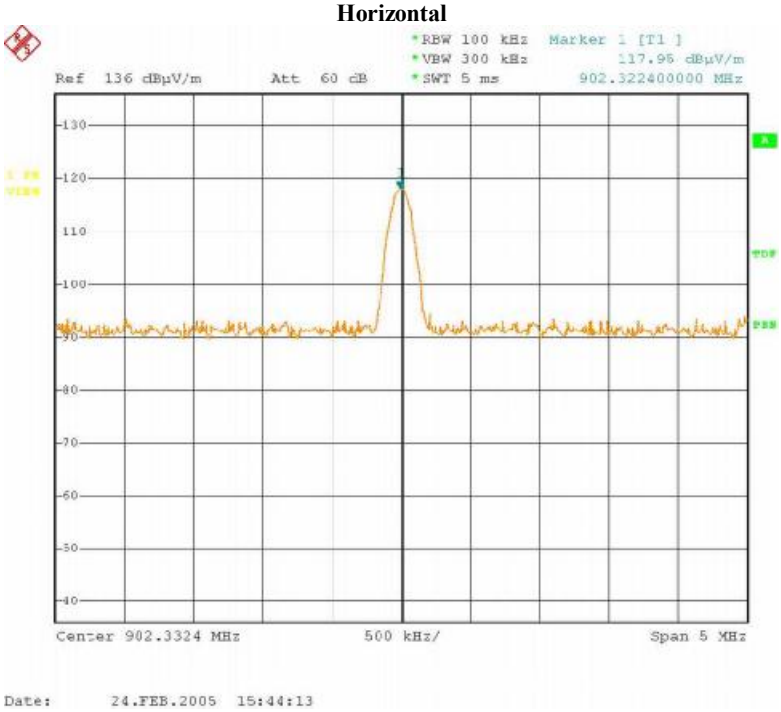
Product	: GIS/GPS Tracking Device	Test Mode	: TLB-915-1200
Test Item	: Spurious Radiated Emissions	Temperature	: 25 ℃
Test Voltage	: DC 7.2V (Power by DC Power Supply)	Humidity	: 56%RH
Test Result	: **PASS**		

CH1: 902.332MHz

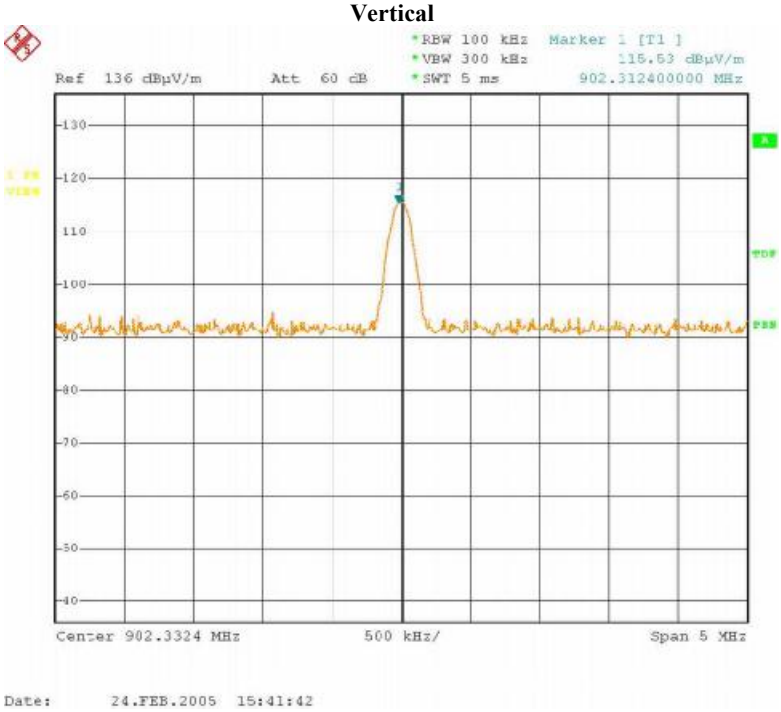
Freq. (MHz)	Emission (dBuV/m) Peak Detector	HORIZ / VERT	Limits (dBuV/m) Average	Margin (dB)
1804.664	46.33	HORZ	54.0	-7.67
1804.664	47.00	VERT	54.0	-7.00
2706.996	42.48	HORZ	54.0	-11.52
2706.996	41.89	HORZ	54.0	-12.11
3609.328	40.12	VERT	54.0	-13.88
3609.328	43.65	HORZ	54.0	-10.35
4511.660	42.10	HORZ	54.0	-11.90
4511.660	45.12	VERT	54.0	-8.88
5413.992	46.61	HORZ	54.0	-7.39
5413.992	43.80	VERT	54.0	-10.20

Note:
(1) All Reading Levels below 1GHz are Quasi-Peak, above are peak and average value.
(2) Emission Level = Reading Level + Probe Factor + Cable Loss.
(3) Receiver setting (Peak Detector) : RBW=1MHz; VBW=1MHz; Span=100MHz
(4) Receiver setting (AVG Detector): RBW=1MHz; VBW=30Hz; Span=20MHz
(5) The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Horizontal



Vertical



CH31: 905.90MHz

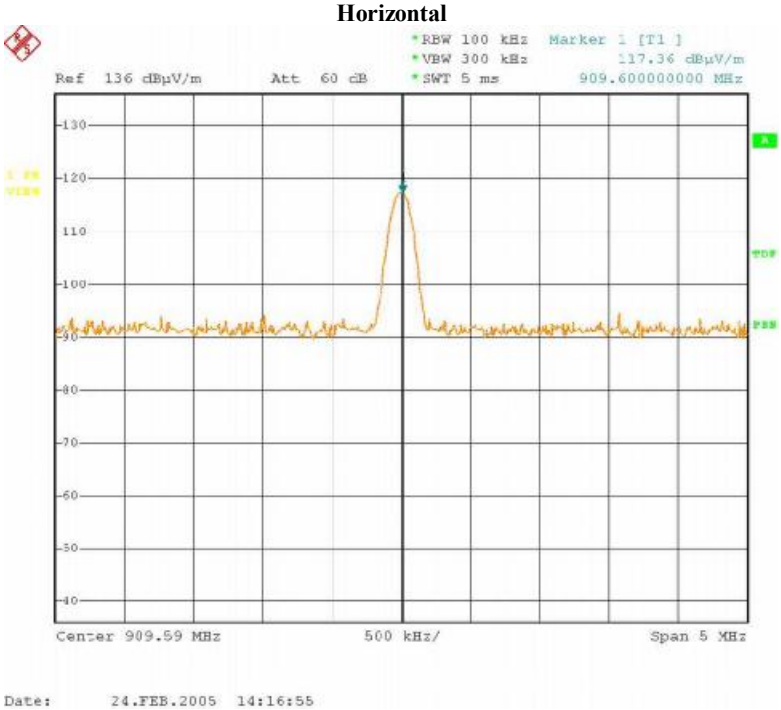
Freq. (MHz)	Emission (dBuV/m) Peak Detector	HORIZ / VERT	Limits (dBuV/m) Average	Margin (dB)
1811.800	36.61	HORZ	54.0	-17.39
1811.800	40.72	VERT	54.0	-13.28
2717.700	35.41	HORZ	54.0	-18.59
2717.700	40.06	HORZ	54.0	-13.94
3623.600	43.02	VERT	54.0	-10.98
3623.600	41.68	HORZ	54.0	-12.32
4529.500	43.61	HORZ	54.0	-10.39
4529.500	45.21	VERT	54.0	-8.79
5435.400	46.39	HORZ	54.0	-7.61
5435.400	49.51	VERT	54.0	-4.49

CH63: 909.590MHz

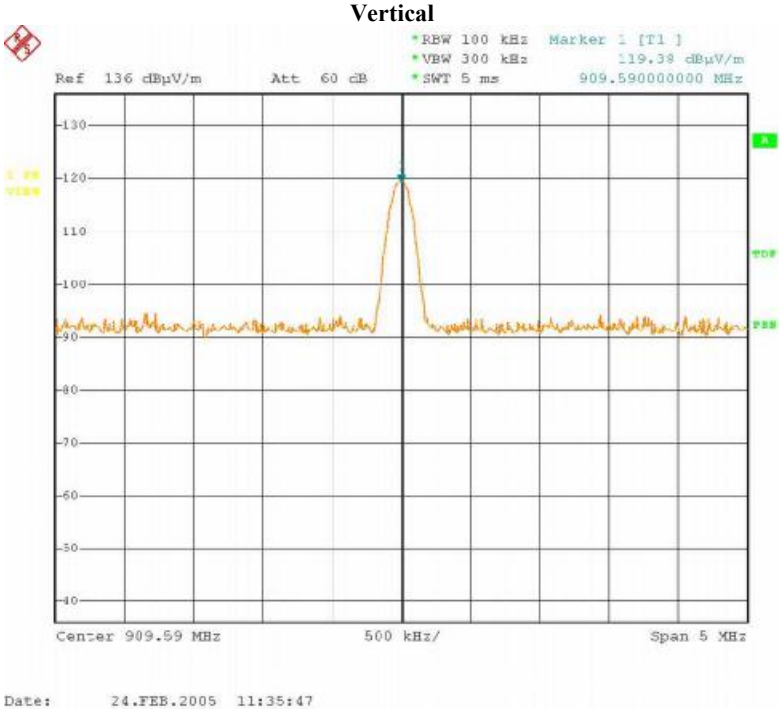
Freq. (MHz)	Emission (dBuV/m) Peak Detector	HORIZ / VERT	Limits (dBuV/m) Average	Margin (dB)
1819.180	51.20	HORZ	54.0	-2.80
1819.180	47.48	VERT	54.0	-6.52
2728.770	42.19	HORZ	54.0	-11.81
2728.770	48.41	HORZ	54.0	-5.59
3638.360	49.60	VERT	54.0	-4.40
3638.360	51.20	HORZ	54.0	-2.80
4547.950	50.10	HORZ	54.0	-3.90
4547.950	51.30	VERT	54.0	-2.70
5457.540	48.63	HORZ	54.0	-5.37
5457.540	49.42	VERT	54.0	-4.58

Note:
(1) All Reading Levels below 1GHz are Quasi-Peak, above are peak and average value.
(2) Emission Level = Reading Level + Probe Factor + Cable Loss.
(3) Receiver setting (Peak Detector) : RBW=1MHz; VBW=1MHz; Span=100MHz
(4) Receiver setting (AVG Detector): RBW=1MHz; VBW=30Hz; Span=20MHz
(5) The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Horizontal



Vertical



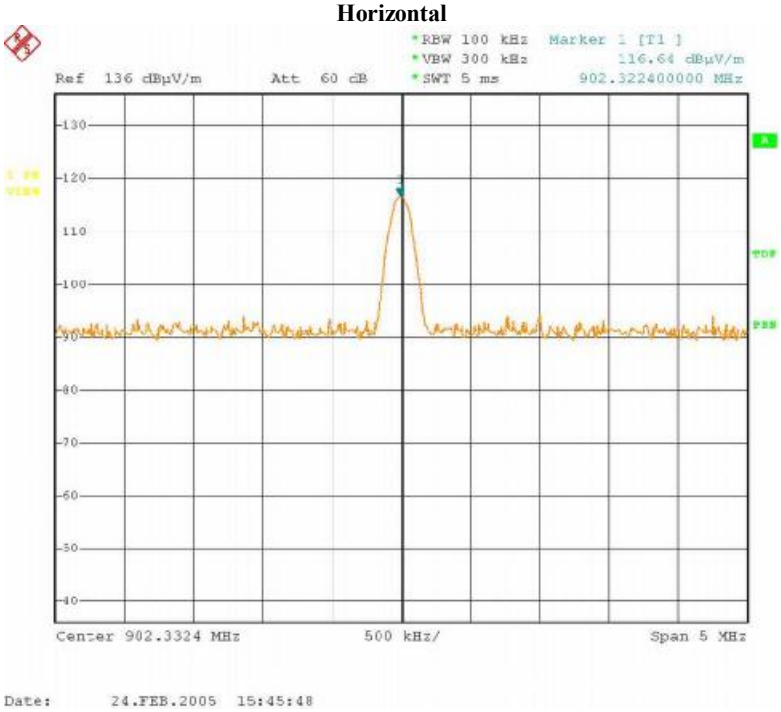
Product	: GIS/GPS Tracking Device	Test Mode	: TLB-915-2.5J
Test Item	: Spurious Radiated Emissions	Temperature	: 25 ℃
Test Voltage	: DC 7.2V (Power by DC Power Supply)	Humidity	: 56%RH
Test Result	: **PASS**		

CH1: 902.332MHz

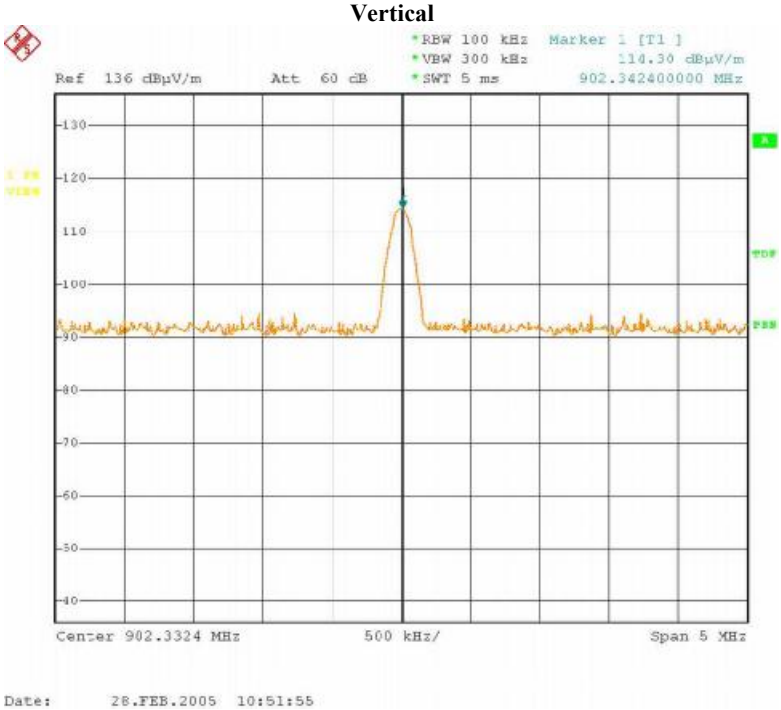
Freq. (MHz)	Emission (dBuV/m) Peak Detector	HORIZ / VERT	Limits (dBuV/m) Average	Margin (dB)
1804.664	42.79	HORZ	54.0	-11.21
1804.664	39.49	VERT	54.0	-14.51
2706.996	39.48	HORZ	54.0	-14.52
2706.996	41.89	HORZ	54.0	-12.11
3609.328	43.20	VERT	54.0	-10.80
3609.328	42.25	HORZ	54.0	-11.75
4511.660	42.12	HORZ	54.0	-11.88
4511.660	43.00	VERT	54.0	-11.00
5413.992	45.30	HORZ	54.0	-8.70
5413.992	43.90	VERT	54.0	-10.10

Note:
(1) All Reading Levels below 1GHz are Quasi-Peak, above are peak and average value.
(2) Emission Level = Reading Level + Probe Factor + Cable Loss.
(3) Receiver setting (Peak Detector) : RBW=1MHz; VBW=1MHz; Span=100MHz
(4) Receiver setting (AVG Detector): RBW=1MHz; VBW=30Hz; Span=20MHz
(5) The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Horizontal



Vertical



CH31: 905.90MHz

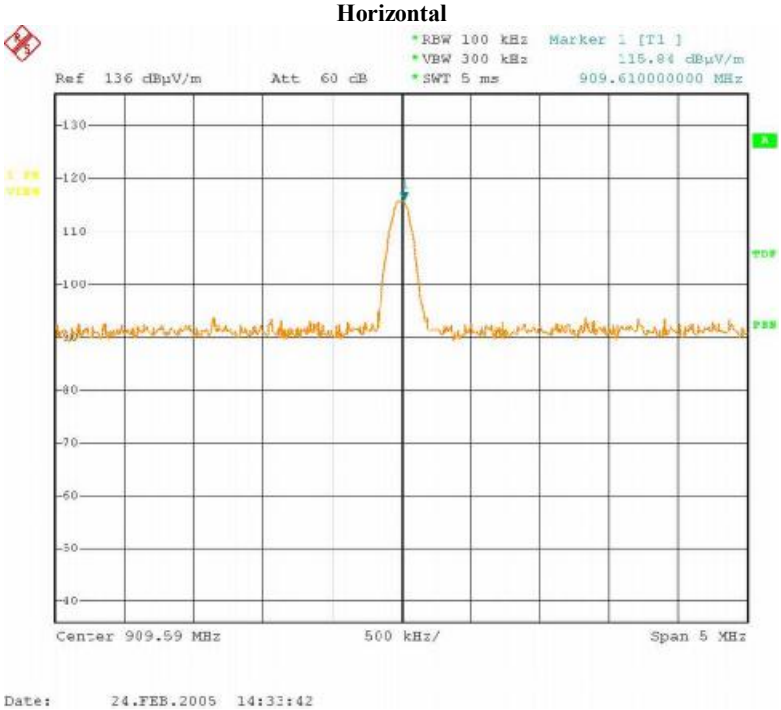
Freq. (MHz)	Emission (dBuV/m) Peak Detector	HORIZ / VERT	Limits (dBuV/m) Average	Margin (dB)
1811.800	45.46	HORZ	54.0	-8.54
1811.800	51.16	VERT	54.0	-2.84
2717.700	44.65	HORZ	54.0	-9.35
2717.700	50.49	HORZ	54.0	-3.51
3623.600	43.07	VERT	54.0	-10.93
3623.600	51.89	HORZ	54.0	-2.11
4529.500	49.87	HORZ	54.0	-4.13
4529.500	51.20	VERT	54.0	-2.80
5435.400	45.70	HORZ	54.0	-8.30
5435.400	49.30	VERT	54.0	-4.70

CH63: 909.590MHz

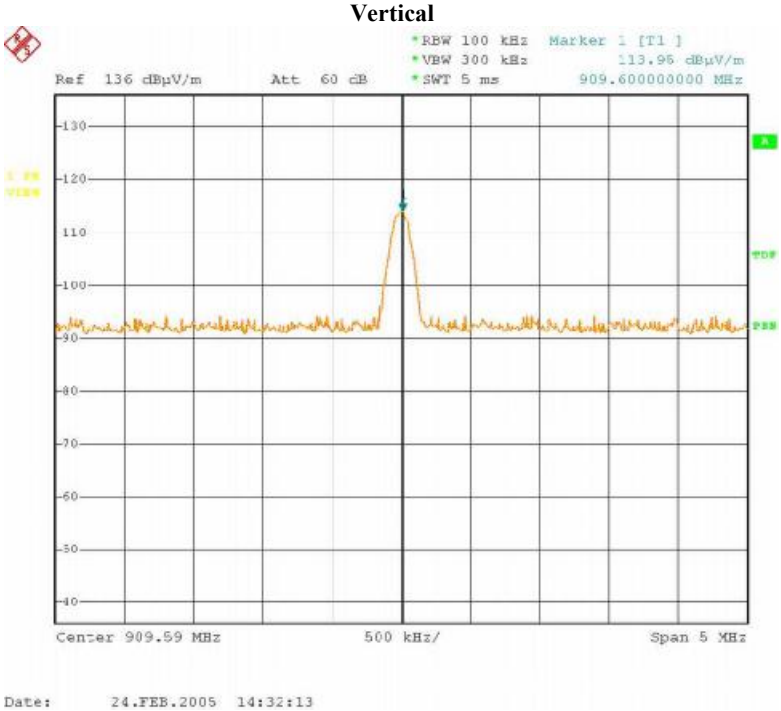
Freq. (MHz)	Emission (dBuV/m) Peak Detector	HORIZ / VERT	Limits (dBuV/m) Average	Margin (dB)
1819.180	44.61	HORZ	54.0	-9.39
1819.180	38.16	VERT	54.0	-15.84
2728.770	41.96	HORZ	54.0	-12.04
2728.770	43.26	HORZ	54.0	-10.74
3638.360	45.16	VERT	54.0	-8.84
3638.360	48.12	HORZ	54.0	-5.88
4547.950	47.65	HORZ	54.0	-6.35
4547.950	49.23	VERT	54.0	-4.77
5457.540	48.67	HORZ	54.0	-5.33
5457.540	48.71	VERT	54.0	-5.29

Note:
(1) All Reading Levels below 1GHz are Quasi-Peak, above are peak and average value.
(2) Emission Level = Reading Level + Probe Factor + Cable Loss.
(3) Receiver setting (Peak Detector) : RBW=1MHz; VBW=1MHz; Span=100MHz
(4) Receiver setting (AVG Detector): RBW=1MHz; VBW=30Hz; Span=20MHz
(5) The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Horizontal



Vertical



10. Photos of Testing

10. 1 EUT Test Photographs

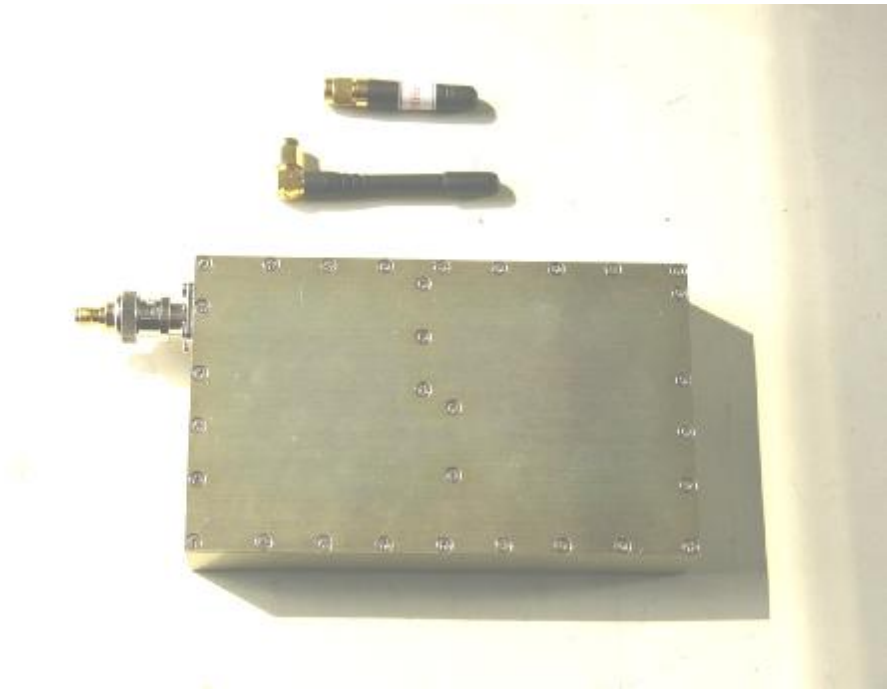
Conducted emission test view

Radiated emission test view – EUT with TLB-915-1200 Antenna

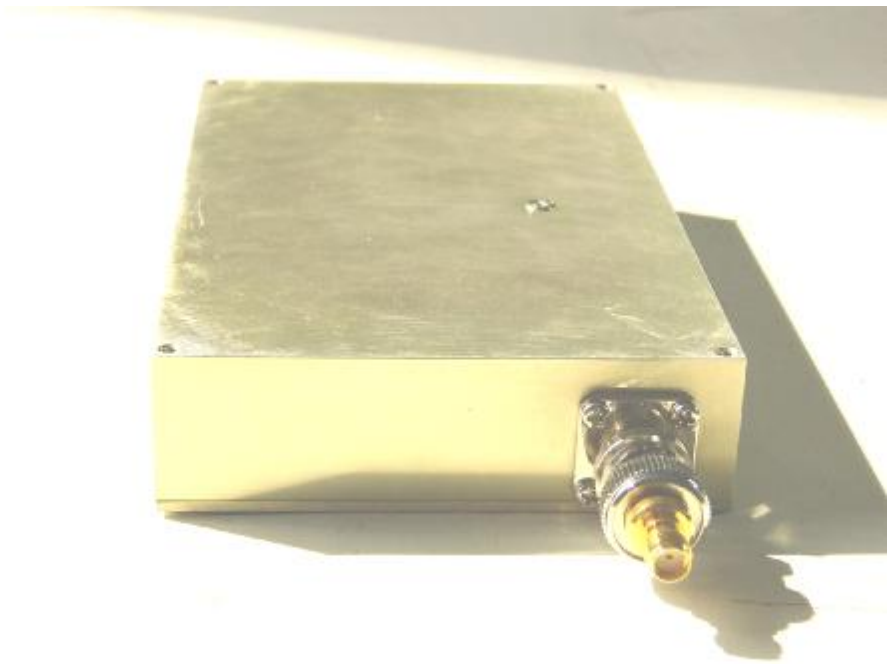
Radiated emission test view – EUT with TLB-915-2.5J Antenna

8. 2 EUT Detailed Photographs

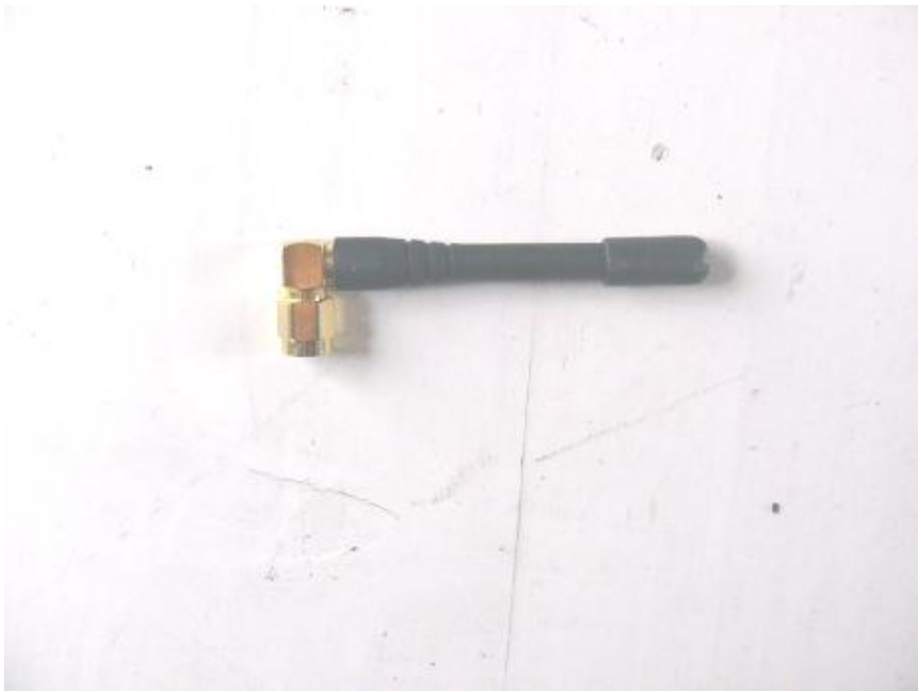
EUT top view



EUT bottom view

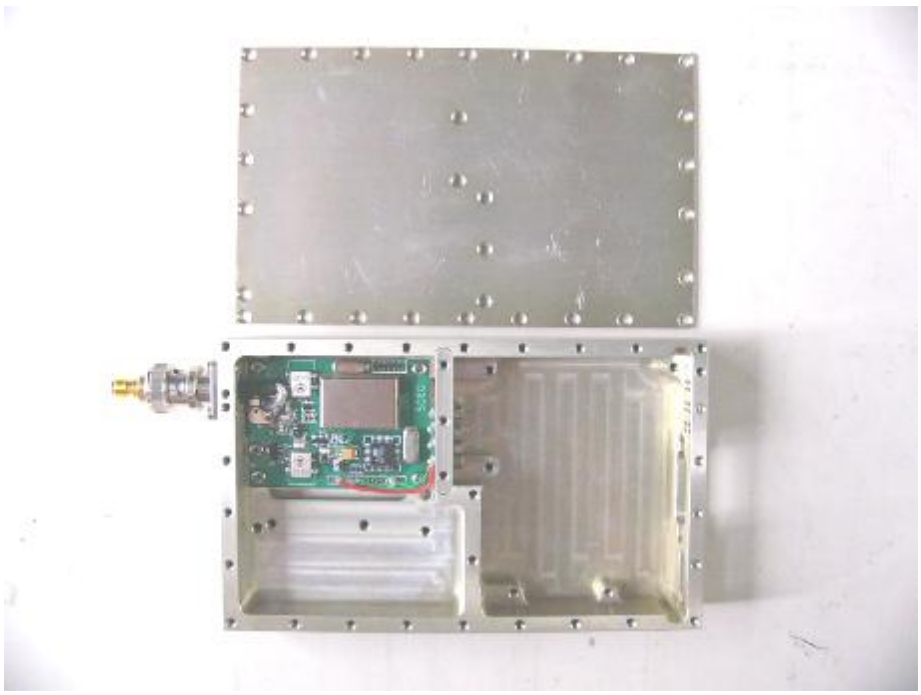


TLB-915-1200 Antenna

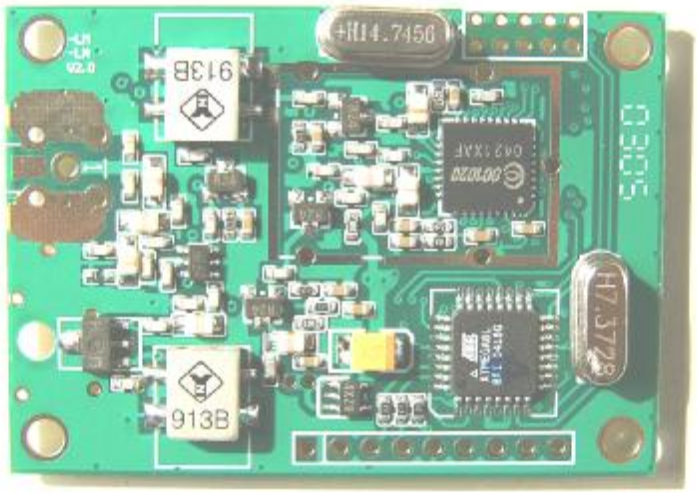


TLB-915-2.5J Antenna

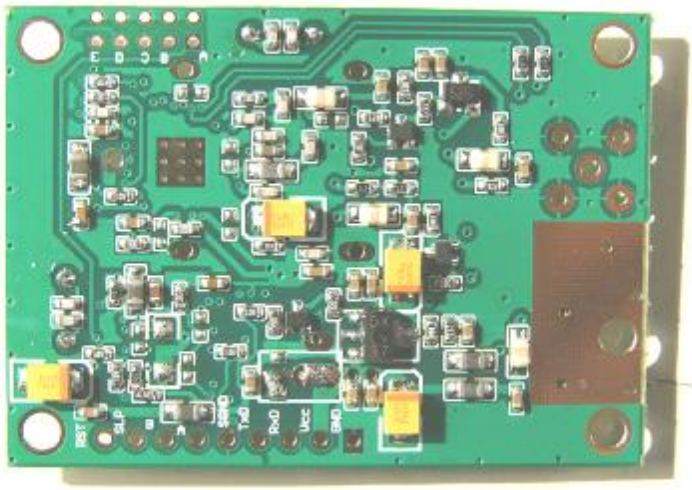
EUT inside whole view



Main & RF board component side



Main & RF board solder side



11. FCC ID Label

Labeling Requirements

FCC rules require the Original Equipment Manufacturer using the RF Module to place an appropriate label on the outside of the finished equipment. The label must be clearly visible and include the information shown below.

Contains Transmitter Module
FCC ID: S58-HACLN96K02G
WARNING:
This device complies with Part 15 of the FCC Rules.
Its operation is subject to the following conditions:
(1) This device may not cause harmful interference.
(2) This device must accept any received interference including interference that may cause undesired operation.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The Label must not be a stick-on paper label. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Proposed Label Location on EUT

EUT Bottom View/Proposed FCC ID Label Location

12. Test Equipment

The following test equipments were used during the radiated & conducted emission test:

Equipment/ Facilities	Manufacturer	Model #	Serial No.	Date of Cal.	Due Date
Turntable	KMO	KSZ001T	200306	NCR	NCR
Antenna Tower	KMO	KSZ002AT	200307	NCR	NCR
OATS	KMO	KSZSITE001	N/A	July 06, 2004	July 06, 2005
EMI Test Receiver	Rohde & Schwarz	ESPI3	100180	Oct.18, 2004	Oct.18, 2005
Signal Generator	Rohde & Schwarz	SMT03	100059	Feb.01, 2005	Feb.01, 2006
Signal Generator	FLUKE	PM5418+Y/C	LO747012	Feb 01, 2005	Feb 01, 2006
Signal Generator	FLUKE	PM5418TX	LO738007	Feb 01, 2005	Feb 01, 2006
Biconical Antenna	Rohde & Schwarz	HK116	EMC0502	Dec. 14,2004	Dec. 14,2005
Bilog Antenna	Chase	CBL6111C	2576	Feb.01, 2005	Feb.01, 2006
Ultra Broadband Antenna	Rohde & Schwarz	HL 562	100110	June.05, 2004	June.05, 2005
AMN	Rohde & Schwarz	ESH3-Z5	100196	Oct. 23,2004	Oct. 23, 2005
AMN	Rohde & Schwarz	ESH3-Z5	100197	Oct. 23,2004	Oct. 23, 2005
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	N/A	N/A	N/A
Absorbing Clamp	Rohde & Schwarz	MDS-21	N/A	Oct. 29,2004	Oct. 29,2005
KMO Shielded Room	KMO	KMO-001	N/A	N/A	N/A
EMI Test Receiver	Rohde & Schwarz	ESCS30	100003	Feb. 27, 2005	Feb.27, 2006
AMN	Rohde & Schwarz	ESH3-Z5	100002	Feb. 01, 2005	Feb.01, 2006
LISN	Kyoritsu	KNW-407	8-1441-8	Feb. 23, 2005	Feb.23, 2006
EMI Test Receiver	Rohde & Schwarz	ESI26	838786/013	Feb. 01, 2005	Feb.01, 2006
Bilog Antenna	Chase	CBL6112B	2591	Feb. 01, 2005	Feb.01, 2006
Horn Antenna	Rohde & Schwarz	HF906	100014	Feb. 01, 2005	Feb.01, 2006
Power Meter	Rohde & Schwarz	NRVD	100041	Feb. 01, 2005	Feb.01, 2006
Radio Communication Test Set	Rohde & Schwarz	CMS 54	846621/024	Feb 01, 2005	Feb 01, 2006
Modulation Analyzer	Hewlett-Packard	8901B	2303A00362	Feb 01, 2005	Feb 01, 2006
Temperature Chamber	TABAI	PSL-4GTW	N/A	Feb 06,2005	Feb 06, 2006
3m Semi-Anechoic Chamber	Albatross Projects	9mX6mX6m	N/A	Feb. 01, 2005	Feb.01, 2006