FCC 15.247

EMI MEASUREMENT AND TEST REPORT

For

Intermec Technologies Corporation

550 Second Street SE, m/s GR05
Cedar Rapids, Iowa 52401

FCC ID: EHARFID915IM5

This Report Concerns:	Equipment Type:
☒ Original Report	Intellitag RFID Radio

Test Engineer:	Ming Jin
Report No.:	R0410087
Test Date:	2004-10-25
Reviewed By:	Daniel Deng /
Prepared By:	Bay Area Compliance Laboratory Corporation (BACL) 230 Commercial Street Sunnyvale, CA 94085 Tel: (408) 732-9162 Fax: (408) 732 9164

Note: The test report is specially limited to the above company and the product model only. It may not be duplicated without prior written consent of Bay Area Compliance Laboratory Corporation. This report **must not** be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the US Government.

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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Intermec Technologies Corporation's* product, FCC ID: *EHARFID915IM5, Model: IF4 (for the Chassis) & IM5 (for the PCB)* or the "EUT" as referred to this report is an FHSS Intellitag RFID Radio which measures approximately 218mmL x 135mmW x 67mmH. The EUT operates at the frequency range of 902.5– 927.5MHz, with maximum output power of 1.00W.

** The test data gathered are from typical production sample, serial number: 0011B, provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *Intermec Technologies Corporation* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC 15.247 rules for the FHSS:

- Maximum Peak Output Power
- Hopping Channel Separation
- Number of Hopping Frequency Used
- 20 dB Bandwidth
- Dwell Time on Each Channel
- 100 kHz Bandwidth of Band Edge
- Conducted Emission
- Spurious Emission
- Radiated Emission
- Antenna Requirement

Related Submittal(s)/Grant(s)

No Related Submittals

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2001& TIA/EIA-603.

Test Facility

The Open Area Test site used by BACL Corp. to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the test methods and procedures set forth in ANSI C63.4-2001& TIA/EIA-603.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234.

The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22:2002,Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to ANSI C63.4-2001 & TIA/EIA-603.

The final qualification test was performed with the EUT operating at normal mode.

Block Diagram

Please refer to Exhibit D.

Equipment Modifications

No modifications were made to the EUT.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Dell	Notebook	TS30G	N/A	DOC

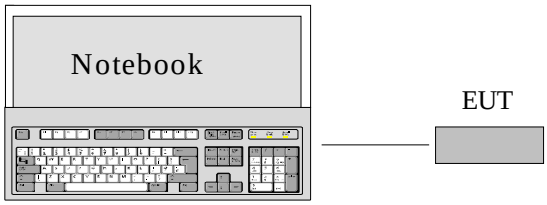
Power Supply Information

Manufacturer	Description	Model	Serial Number	FCC ID
Magtech	Adapter	SPU24-104	N/A	DoC

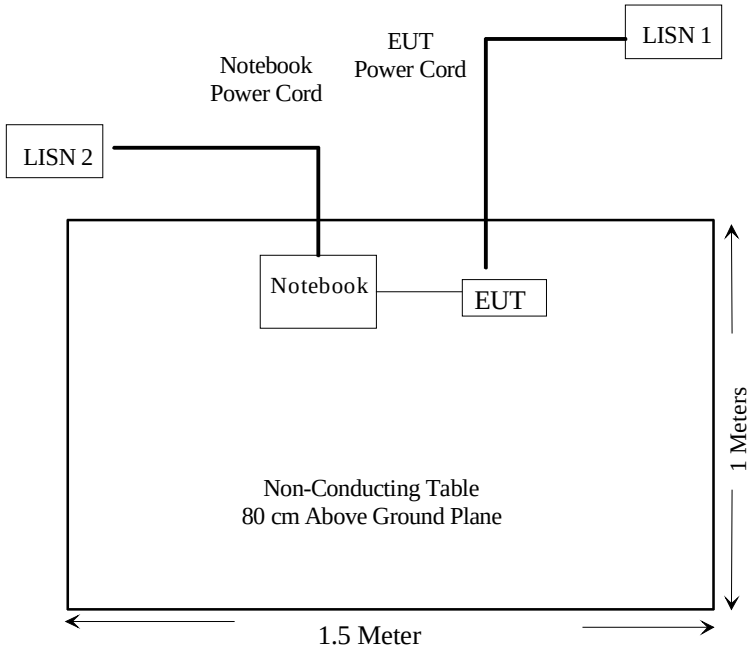
Interface Ports and Cabling

Cable Description	Length (M)	From	To
Cable	0.5	RSS232 Port / EUT	RSS232 Port / PC

Configuration of Test System



Test Setup Block Diagram



SUMMARY OF TEST RESULTS FOR FCC PART 15

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Compliant
§ 15.205	Restricted Bands	N/A
§15.207 (a)	Conducted Emission	Compliant
§15.209	Radiated Emission	Compliant
§15.247 (a) (1)	Hopping Channel Separation	Compliant
§15.247 (a) (1)	Channel Bandwidth	Compliant
§15.247 (a) (1) (iii)	Number of Hopping Frequencies Used	Compliant
§15.247 (a) (1) (iii)	Dwell Time of Each Frequency within a 10 Second Period of time (0.4 x Number of Channel)	Compliant
§15.247 (b) (1)	Maximum Peak Output Power	Compliant
§ 15.247 (b)(4) § 2.1093	RF Safety Requirements	Compliant
§ 15.247 (c)	100 kHz Bandwidth of Frequency Band Edge	Compliant
	Spurious Emission at Antenna Port	Compliant

ANTENNA REQUIREMENT

According to § 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.

And according to § 15.247 (1), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

There are 3 types and total of 5 antennas used with the device:

1. a) circular polarized panel, 9dBi, SMA connnector;
   b) Cushcraft Circular Polarized Panel, 7dBi, TNCconnector
2. a) Huber Suhner vertical polarized linear planar antenna, 8dBi, N Connector
   b) Intermec Programming Antenna Assembly, 8dBi, N connector
3. Sinclair vertical polarized linear dipole antenna, 7.1dBi, N connector.

§15.207(a) - CONDUCTED EMISSION

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ±2.4 dB.

Test Setup

The measurement was performed at shield room, using the same setup per ANSI C63.4 – 2001 measurement procedure. The specification used was FCC Class B limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The Notebook PC was connected with LISN-1.

Spectrum Analyzer Setup

The spectrum analyzer was set to investigate the spectrum from 150 kHz to 30MHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	LISN	ESH2-Z5	871884/039	2004-03-28
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2004-05-06
Fluke	Calibrated Voltmeter	189	18485-38	2004-07-18

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Test Procedure

During the conducted emission test, the power cord of the host system was connected to the mains outlet of the LISN-1.

Maximizing procedure were performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Qusi-Peak readings are distinguished with an “QP”. Average readings are distinguished with an “Ave”.

Environmental Conditions

Temperature:	25° C
Relative Humidity:	32%
ATM Pressure:	1018 mbar

The testing was performed by Ming Jin on 2004-10-15.

Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC Conducted limit for a Class B device, with the *worst* margin reading of:

-7.5 dB at **15.400 MHz** in the **Neutral** conductor

Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency MHz	Amplitude dBμV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
15.400	42.5	Ave	Neutral	50	-7.5
15.400	40.5	Ave	Line	50	-9.5
0.205	56.3	Qp	Line	66	-9.7
0.205	45.9	Ave	Line	56	-10.1
0.205	43.1	Ave	Neutral	56	-12.9
0.205	52.8	Qp	Neutral	66	-13.2
15.400	44.7	Qp	Neutral	60	-15.3
15.400	44.2	Qp	Line	60	-15.8
1.370	25.0	Ave	Neutral	50	-25.0
0.720	20.1	Ave	Line	46	-25.9
0.720	26.2	Qp	Line	56	-29.8
1.370	30.2	Qp	Neutral	60	-29.8

Plot of Conducted Emissions Test Data

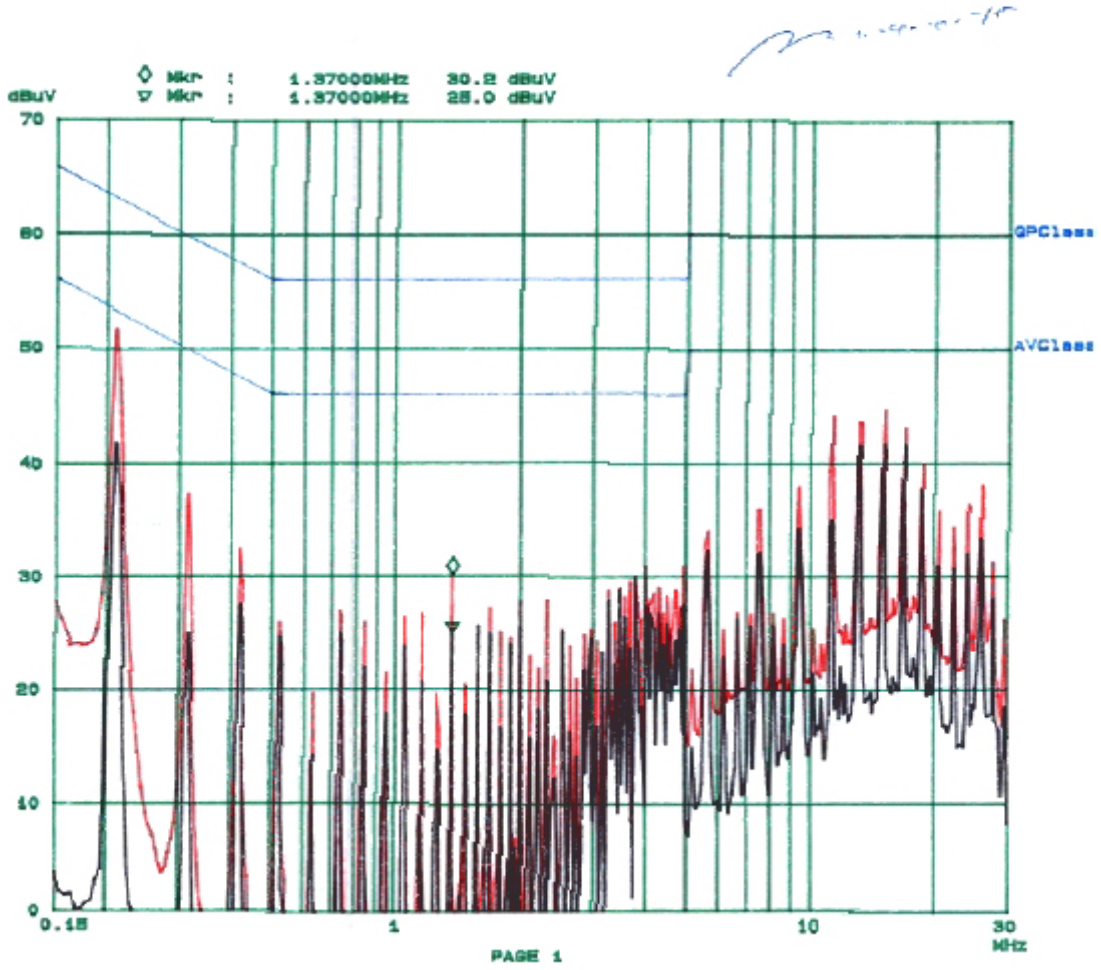
Plot(s) of Conducted Emissions Test Data is presented in the following page as reference.

Bay Area Compliance Laboratory Corp 15. Oct 04 12:05
Class B

EUT: IF4
Manuf: Intermec
Op Cond: Normal
Operator: Ming
Comment: N

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	10dBLN	OFF
1M	5M	10k	9k	QP+AV	1ms	10dBLN	OFF
5M	30M	100k	9k	QP+AV	1ms	10dBLN	OFF

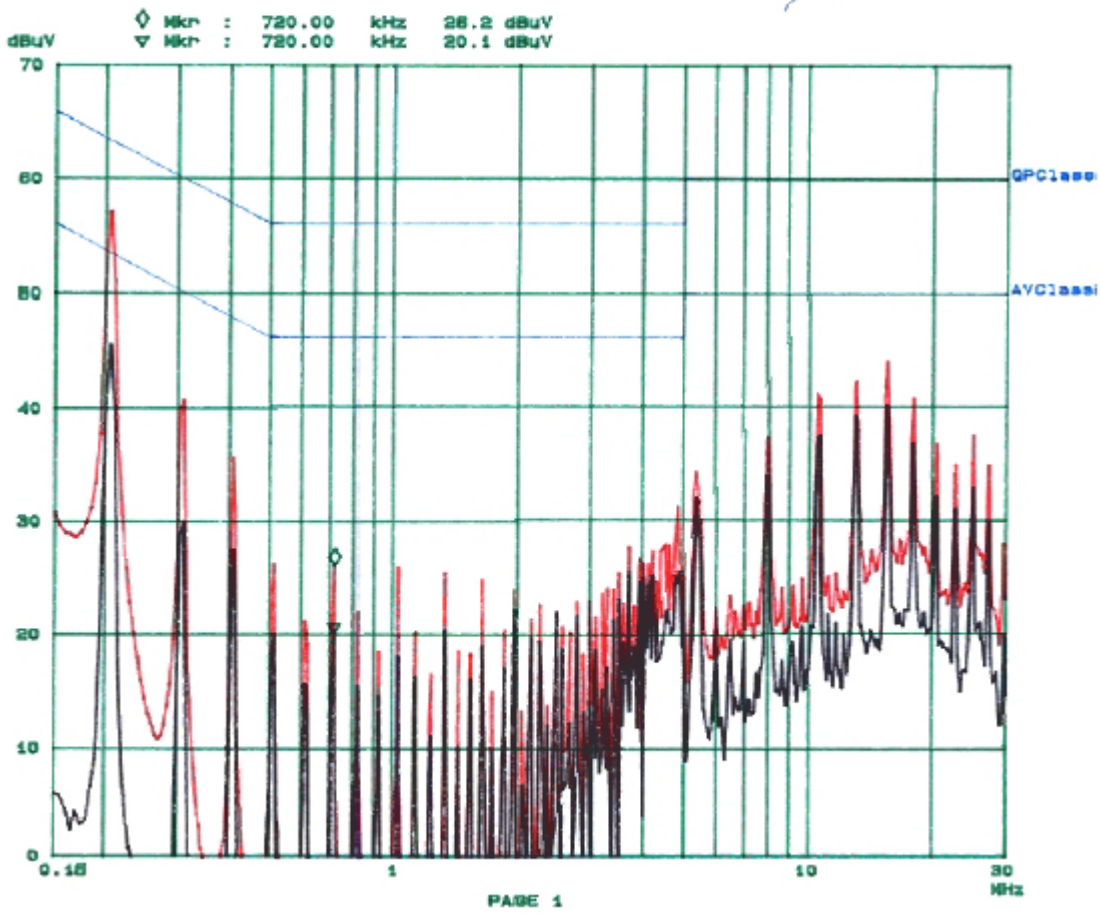


Bay Area Compliance Laboratory Corp 15. Oct 04 11:43
Class B

EUT: IF4
Manuf: Intermec
Op Cond: Normal
Operator: Ming
Comment: L

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	10dBLN	OFF
1M	5M	10k	9k	QP+AV	1ms	10dBLN	OFF
5M	30M	100k	9k	QP+AV	1ms	10dBLN	OFF



§15.205 & §15.209 - RADIATED EMISSION

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is $\pm$4.0 dB.

Test Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with ANSI C63.4-2001. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The EUT was connected with 120Vac/60Hz power source.

Spectrum Analyzer Setup

According to FCC Rules, 47 CFR §15.33 (a) (1), the system was tested to 25GHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Range	***RBW***	***Video B/W***
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Amplifier, Pre, microwave	8449B	3147A00400	2004-03-14
HP	Amplifier, Pre	8447E	1937A01057	2004-08-04
HP	Analyzer, Spectrum	8565EC	3946A00131	2004-06-30
ETS	Antenna, Biconical	3110B	9603-2315	2004-01-11
A.R.A.	Antenna, Horn, DRG	DRG-118/A	1132	2004-09-30
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	2455-261	2004-08-01
ETS	Antenna, logperiodic	3148	0004-1155	2004-10-11

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

Temperature:	24° C
Relative Humidity:	40%
ATM Pressure:	1015 mbar

The testing was performed by Ming Jin on 2004-10-15.

Test Procedure

For the radiated emissions test, both the laptop and all peripheral power cords were connected to the AC floor outlet since the power supply used in the laptop did not provide an accessory power outlet.

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 limits), and are distinguished with a "**Qp**" in the data table.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. - Class B Limit

Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.207, and 15.247, and had the worst margin of:

EUT and 7.1dBi (5dBd) Virtical Polarized Diple Antenna (AA -3140):

-6.0 dB at **1805.0000 MHz** in the **Vertical/Horizontal** polarization, Low Channel.

-6.3 dB at **1830.0000 MHz** in the **Vertical/Horizontal** polarization, Middle Channel.

-6.8 dB at **1855.0000 MHz** in the **Vertical/Horizontal** polarization, High Channel.

-3.3 dB at **870.87MHz** in the **Vertical** polarization, Unintentional Emission.

EUT and 8dBi Virtical Polarized Linear Planar Antenna (1309.17.0004):

-5.99 dB at **1805.0000 MHz** in the **Vertical/Horizontal** polarization, Low Channel.

-6.31 dB at **1830.0000 MHz** in the **Vertical/Horizontal** polarization, Middle Channel.

-6.77 dB at **1855.0000 MHz** in the **Vertical/Horizontal** polarization, High Channel.

-3.50 dB at **870.87MHz** in the **Vertical** polarization, Unintentional Emission.

EUT and 9dBi Circular Polarized Panel Antenna (25-175-A)

-6.0 dB at **1805.0000 MHz** in the **Vertical/Horizontal** polarization, Low Channel.

-6.2 dB at **1830.0000 MHz** in the **Vertical/Horizontal** polarization, Middle Channel.

-6.6 dB at **1855.0000 MHz** in the **Vertical/Horizontal** polarization, High Channel.

-2.3 dB at **870.87MHz** in the **Vertical** polarization, Unintentional Emission.

EUT with Load / Notebook, CW mode

-6.8 dB at **1805.0000 MHz** in the **Vertical/Horizontal** polarization, Low Channel.

-6.6 dB at **1830.0000 MHz** in the **Vertical/Horizontal** polarization, Middle Channel.

-6.7 dB at **1855.0000 MHz** in the **Vertical/Horizontal** polarization, High Channel.

-3.8 dB at **870.87MHz** in the **Vertical** polarization, Unintentional Emission.

Test Data, EUT and 7.1dBi (5dBd) Virtical Polarized Diple Antenna (AA -3140) @ 3Meter

Indicated			Antenna	Antenna		Correction Factor			FCC 15 Subpart C		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Comments
MHz	dBμV/m	Degree	Meter	H/V	dB	dB	dB	dBμV/m	dBμV/m	dB	
Low Channel											
902.5000	128.4	0	1.5	v	23.6	0.9	28.4	124.5			Fund/Peak
902.5000	128.4	0	1.5	h	23.6	0.9	28.4	124.5			Fund/Peak
1805.0000	57.1	0	1.5	v	25.3	1.9	36.3	48.0	54	-6.0	Ave
1805.0000	57.1	0	1.5	h	25.3	1.9	36.3	48.0	54	-6.0	Ave
2707.5000	40.9	0	1.5	v	29.0	2.4	35.5	36.8	54	-17.2	Ave
2707.5000	40.9	0	1.5	h	29.0	2.4	35.5	36.8	54	-17.2	Ave
1805.0000	57.9	0	1.5	v	25.3	1.9	36.3	48.8	74	-25.2	Peak
1805.0000	57.9	0	1.5	h	25.3	1.9	36.3	48.8	74	-25.2	Peak
2707.5000	45.4	0	1.5	v	29.0	2.4	35.5	41.3	74	-32.7	Peak
2707.5000	45.4	0	1.5	h	29.0	2.4	35.5	41.3	74	-32.7	Peak
Middle Channel											
915.0000	128.2	0	1.5	v	23.2	0.9	28.4	123.9			Fund/Peak
915.0000	128.2	0	1.5	h	23.2	0.9	28.4	123.9			Fund/Peak
1830.0000	56.8	0	1.5	v	25.3	1.9	36.3	47.7	54	-6.3	Ave
1830.0000	56.8	0	1.5	h	25.3	1.9	36.3	47.7	54	-6.3	Ave
2745.0000	40.5	0	1.5	v	29.0	2.4	35.5	36.4	54	-17.6	Ave
2745.0000	40.5	0	1.5	h	29.0	2.4	35.5	36.4	54	-17.6	Ave
1830.0000	57.6	0	1.5	v	25.3	1.9	36.3	48.5	74	-25.5	Peak
1830.0000	57.6	0	1.5	h	25.3	1.9	36.3	48.5	74	-25.5	Peak
2745.0000	45.1	0	1.5	v	29.0	2.4	35.5	41.0	74	-33.0	Peak
2745.0000	45.1	0	1.5	h	29.0	2.4	35.5	41.0	74	-33.0	Peak
High Channel											
927.5000	128.0	0	1.5	v	23.4	0.9	28.3	124.0			Fund/Peak
927.5000	128.0	0	1.5	h	23.4	0.9	28.3	124.0			Fund/Peak
1855.0000	56.3	0	1.5	v	25.3	1.9	36.3	47.2	54	-6.8	Ave
1855.0000	56.3	0	1.5	h	25.3	1.9	36.3	47.2	54	-6.8	Ave
2782.5000	40.3	0	1.5	v	29.0	2.4	35.5	36.2	54	-17.8	Ave
2782.5000	40.3	0	1.5	h	29.0	2.4	35.5	36.2	54	-17.8	Ave
1855.0000	57.4	0	1.5	v	25.3	1.9	36.3	48.3	74	-25.7	Peak
1855.0000	57.4	0	1.5	h	25.3	1.9	36.3	48.3	74	-25.7	Peak
2782.5000	44.9	0	1.5	v	29.0	2.4	35.5	40.8	74	-33.2	Peak
2782.5000	44.9	0	1.5	h	29.0	2.4	35.5	40.8	74	-33.2	Peak
Unintentional Emission											
870.87	48.26	90	1.5	v	22.4	0.5	28.5	42.7	46	-3.3	
119.25	52.2	270	1.5	v	11.5	0.8	28.6	35.9	43.5	-7.6	
979.68	45.17	30	1.6	v	23.9	0.3	28.1	41.3	54	-12.8	
46.49	44.8	30	1.5	v	11.1	0.2	28.9	27.2	40	-12.9	
94.02	46.9	110	1.5	h	10.1	0.2	28.7	28.5	43.5	-15.0	

Note:

FUND: Fundamental
AVG: Average

Test Data, EUT and 8dBi Virtical Polarized Linear Planar Antenna (1309.17.0004) @ 3Meter

Indicated			Antenna	Antenna		Correction Factor			FCC 15 Subpart C		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Comments
MHz	dBμV/m	Degree	Meter	H/V	dB	dB	dB	dBμV/m	dBμV/m	dB	
Low Channel											
902.5000	128.43	0	1.5	v	23.6	0.9	28.4	124.5			Fund/Peak
902.5000	128.43	0	1.5	h	23.6	0.9	28.4	124.5			Fund/Peak
1805.0000	57.15	0	1.5	v	25.3	1.9	36.3	48.0	54	-5.99	Ave
1805.0000	57.15	0	1.5	h	25.3	1.9	36.3	48.0	54	-5.99	Ave
2707.5000	40.93	0	1.5	v	29.0	2.4	35.5	36.8	54	-17.17	Ave
2707.5000	40.93	0	1.5	h	29.0	2.4	35.5	36.8	54	-17.17	Ave
1805.0000	57.96	0	1.5	v	25.3	1.9	36.3	48.8	74	-25.18	Peak
1805.0000	57.96	0	1.5	h	25.3	1.9	36.3	48.8	74	-25.18	Peak
2707.5000	45.42	0	1.5	v	29.0	2.4	35.5	41.3	74	-32.68	Peak
2707.5000	45.42	0	1.5	h	29.0	2.4	35.5	41.3	74	-32.68	Peak
Middle Channel											
915.0000	128.27	0	1.5	v	23.2	0.9	28.4	124.0			Fund/Peak
915.0000	128.27	0	1.5	h	23.2	0.9	28.4	124.0			Fund/Peak
1830.0000	56.83	0	1.5	v	25.3	1.9	36.3	47.7	54	-6.31	Ave
1830.0000	56.83	0	1.5	h	25.3	1.9	36.3	47.7	54	-6.31	Ave
2745.0000	40.53	0	1.5	v	29.0	2.4	35.5	36.4	54	-17.57	Ave
2745.0000	40.53	0	1.5	h	29.0	2.4	35.5	36.4	54	-17.57	Ave
1830.0000	57.64	0	1.5	v	25.3	1.9	36.3	48.5	74	-25.50	Peak
1830.0000	57.64	0	1.5	h	25.3	1.9	36.3	48.5	74	-25.50	Peak
2745.0000	45.16	0	1.5	v	29.0	2.4	35.5	41.1	74	-32.94	Peak
2745.0000	45.16	0	1.5	h	29.0	2.4	35.5	41.1	74	-32.94	Peak
High Channel											
927.5000	128.09	0	1.5	v	23.4	0.9	28.3	124.1			Fund/Peak
927.5000	128.09	0	1.5	h	23.4	0.9	28.3	124.1			Fund/Peak
1855.0000	56.37	0	1.5	v	25.3	1.9	36.3	47.2	54	-6.77	Ave
1855.0000	56.37	0	1.5	h	25.3	1.9	36.3	47.2	54	-6.77	Ave
2782.5000	40.34	0	1.5	v	29.0	2.4	35.5	36.2	54	-17.76	Ave
2782.5000	40.34	0	1.5	h	29.0	2.4	35.5	36.2	54	-17.76	Ave
1855.0000	57.46	0	1.5	v	25.3	1.9	36.3	48.3	74	-25.68	Peak
1855.0000	57.46	0	1.5	h	25.3	1.9	36.3	48.3	74	-25.68	Peak
2782.5000	44.95	0	1.5	v	29.0	2.4	35.5	40.9	74	-33.15	Peak
2782.5000	44.95	0	1.5	h	29.0	2.4	35.5	40.9	74	-33.15	Peak
Unintentional Emission											
870.87	48.09	90	1.5	v	22.4	0.5	28.5	42.5	46	-3.50	
119.25	52.13	270	1.5	v	11.5	0.8	28.6	35.9	43.5	-7.65	
979.68	46.25	30	1.6	v	23.9	0.3	28.1	42.3	54	-11.67	
46.49	44.61	30	1.5	v	11.1	0.2	28.9	27.0	40	-13.04	
94.02	47.32	110	1.5	h	10.1	0.2	28.7	28.9	43.5	-14.58	

Note:

FUND: Fundamental
AVG: Average

Test Data, EUT and 9dBi Circular Polarized Panel Antenna (25-175-A) @ 3Meter

Indicated			Antenna	Antenna		Correction Factor			FCC 15 Subpart C		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Comments
MHz	dBμV/m	Degree	Meter	H/V	dB	dB	dB	dBμV/m	dBμV/m	dB	
Low Channel											
902.5000	128.6	0	1.5	v	23.6	0.9	28.4	124.7			Fund/Peak
902.5000	128.6	0	1.5	h	23.6	0.9	28.4	124.7			Fund/Peak
1805.0000	57.1	0	1.5	v	25.3	1.9	36.3	48.0	54	-6.0	Ave
1805.0000	57.1	0	1.5	h	25.3	1.9	36.3	48.0	54	-6.0	Ave
2707.5000	40.9	0	1.5	v	29.0	2.4	35.5	36.8	54	-17.2	Ave
2707.5000	40.9	0	1.5	h	29.0	2.4	35.5	36.8	54	-17.2	Ave
1805.0000	57.9	0	1.5	v	25.3	1.9	36.3	48.8	74	-25.2	Peak
1805.0000	57.9	0	1.5	h	25.3	1.9	36.3	48.8	74	-25.2	Peak
2707.5000	45.4	0	1.5	v	29.0	2.4	35.5	41.3	74	-32.7	Peak
2707.5000	45.4	0	1.5	h	29.0	2.4	35.5	41.3	74	-32.7	Peak
Middle Channel											
915.0000	128.5	0	1.5	v	23.2	0.9	28.4	124.2			Fund/Peak
915.0000	128.5	0	1.5	h	23.2	0.9	28.4	124.2			Fund/Peak
1830.0000	56.9	0	1.5	v	25.3	1.9	36.3	47.8	54	-6.2	Ave
1830.0000	56.9	0	1.5	h	25.3	1.9	36.3	47.8	54	-6.2	Ave
2745.0000	40.7	0	1.5	v	29.0	2.4	35.5	36.6	54	-17.4	Ave
2745.0000	40.7	0	1.5	h	29.0	2.4	35.5	36.6	54	-17.4	Ave
1830.0000	57.8	0	1.5	v	25.3	1.9	36.3	48.7	74	-25.3	Peak
1830.0000	57.8	0	1.5	h	25.3	1.9	36.3	48.7	74	-25.3	Peak
2745.0000	45.2	0	1.5	v	29.0	2.4	35.5	41.1	74	-32.9	Peak
2745.0000	45.2	0	1.5	h	29.0	2.4	35.5	41.1	74	-32.9	Peak
High Channel											
927.5000	128.3	0	1.5	v	23.4	0.9	28.3	124.3			Fund/Peak
927.5000	128.3	0	1.5	h	23.4	0.9	28.3	124.3			Fund/Peak
1855.0000	56.5	0	1.5	v	25.3	1.9	36.3	47.4	54	-6.6	Ave
1855.0000	56.5	0	1.5	h	25.3	1.9	36.3	47.4	54	-6.6	Ave
2782.5000	40.6	0	1.5	v	29.0	2.4	35.5	36.5	54	-17.5	Ave
2782.5000	40.6	0	1.5	h	29.0	2.4	35.5	36.5	54	-17.5	Ave
1855.0000	57.6	0	1.5	v	25.3	1.9	36.3	48.5	74	-25.5	Peak
1855.0000	57.6	0	1.5	h	25.3	1.9	36.3	48.5	74	-25.5	Peak
2782.5000	45.1	0	1.5	v	29.0	2.4	35.5	41.0	74	-33.0	Peak
2782.5000	45.1	0	1.5	h	29.0	2.4	35.5	41.0	74	-33.0	Peak
Unintentional Emission											
870.87	49.30	90	1.5	v	22.4	0.5	28.5	43.7	46	-2.3	
119.25	52.4	270	1.5	v	11.5	0.8	28.6	36.1	43.5	-7.4	
46.49	45.3	30	1.5	v	11.1	0.2	28.9	27.7	40	-12.3	
979.68	45.09	30	1.6	v	23.9	0.3	28.1	41.2	54	-12.8	
94.02	47.5	110	1.5	h	10.1	0.2	28.7	29.1	43.5	-14.4	

Note:

FUND: Fundamental
AVG: Average

Test Data, EUT (module) with Load / Notebook, CW mode @ 3Meter

Indicated			Antenna	Antenna		Correction Factor			FCC 15 Subpart C		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Comments
MHz	dBμV/m	Degree	Meter	H/V	dB	dB	dB	dBμV/m	dBμV/m	dB	
Low Channel											
902.5000											Fund
902.5000											Fund
1805.0000	56.3	0	1.5	v	25.3	1.9	36.3	47.2	54	-6.8	Ave
1805.0000	56.3	0	1.5	h	25.3	1.9	36.3	47.2	54	-6.8	Ave
2707.5000	40.1	0	1.5	v	29.0	2.4	35.5	36.0	54	-18.0	Ave
2707.5000	40.1	0	1.5	h	29.0	2.4	35.5	36.0	54	-18.0	Ave
1805.0000	57.1	0	1.5	v	25.3	1.9	36.3	48.0	74	-26.0	Peak
1805.0000	57.1	0	1.5	h	25.3	1.9	36.3	48.0	74	-26.0	Peak
2707.5000	44.5	0	1.5	v	29.0	2.4	35.5	40.4	74	-33.6	Peak
2707.5000	44.5	0	1.5	h	29.0	2.4	35.5	40.4	74	-33.6	Peak
Middle Channel											
915.0000											Fund
915.0000											Fund
1830.0000	56.5	0	1.5	v	25.3	1.9	36.3	47.4	54	-6.6	Ave
1830.0000	56.5	0	1.5	h	25.3	1.9	36.3	47.4	54	-6.6	Ave
2745.0000	40.3	0	1.5	v	29.0	2.4	35.5	36.2	54	-17.8	Ave
2745.0000	40.3	0	1.5	h	29.0	2.4	35.5	36.2	54	-17.8	Ave
1830.0000	57.3	0	1.5	v	25.3	1.9	36.3	48.2	74	-25.8	Peak
1830.0000	57.3	0	1.5	h	25.3	1.9	36.3	48.2	74	-25.8	Peak
2745.0000	44.8	0	1.5	v	29.0	2.4	35.5	40.7	74	-33.3	Peak
2745.0000	44.8	0	1.5	h	29.0	2.4	35.5	40.7	74	-33.3	Peak
High Channel											
927.5000											Fund
927.5000											Fund
1855.0000	56.4	0	1.5	v	25.3	1.9	36.3	47.3	54	-6.7	Ave
1855.0000	56.4	0	1.5	h	25.3	1.9	36.3	47.3	54	-6.7	Ave
2782.5000	40.2	0	1.5	v	29.0	2.4	35.5	36.1	54	-17.9	Ave
2782.5000	40.2	0	1.5	h	29.0	2.4	35.5	36.1	54	-17.9	Ave
1855.0000	57.2	0	1.5	v	25.3	1.9	36.3	48.1	74	-25.9	Peak
1855.0000	57.2	0	1.5	h	25.3	1.9	36.3	48.1	74	-25.9	Peak
2782.5000	44.6	0	1.5	v	29.0	2.4	35.5	40.5	74	-33.5	Peak
2782.5000	44.6	0	1.5	h	29.0	2.4	35.5	40.5	74	-33.5	Peak
Unintentional Emission											
870.87	47.80	90	1.5	v	22.4	0.5	28.5	42.2	46	-3.8	
119.25	51.9	270	1.5	v	11.5	0.8	28.6	35.6	43.5	-7.9	
46.49	43.7	30	1.5	v	11.1	0.2	28.9	26.1	40	-14.0	
979.68	43.60	30	1.6	v	23.9	0.3	28.1	39.7	54	-14.3	
94.02	46.5	110	1.5	h	10.1	0.2	28.7	28.1	43.5	-15.4	

Note:

FUND: Fundamental
AVG: Average

§15.247 (a) (1) - HOPPING CHANNEL SEPARATION

Standard Applicable

According to §15.247(a)(1), frequency hopping system 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.

Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on a bench without connection to measurement instrument Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the Max-Hold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function, and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Model No.	Description	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

Temperature:	24° C
Relative Humidity:	40%
ATM Pressure:	1015 mbar

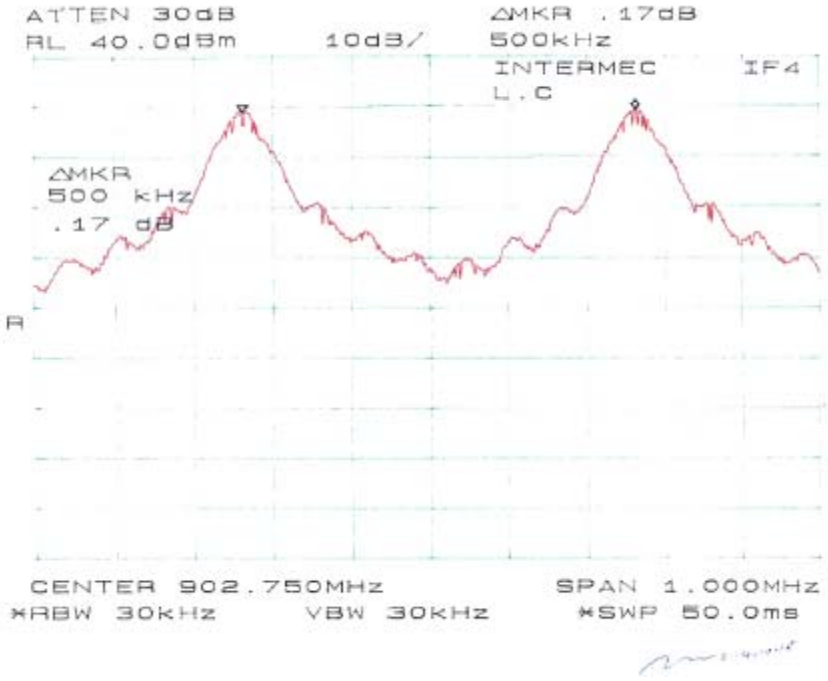
The testing was performed by Ming Jin on 2004-10-15.

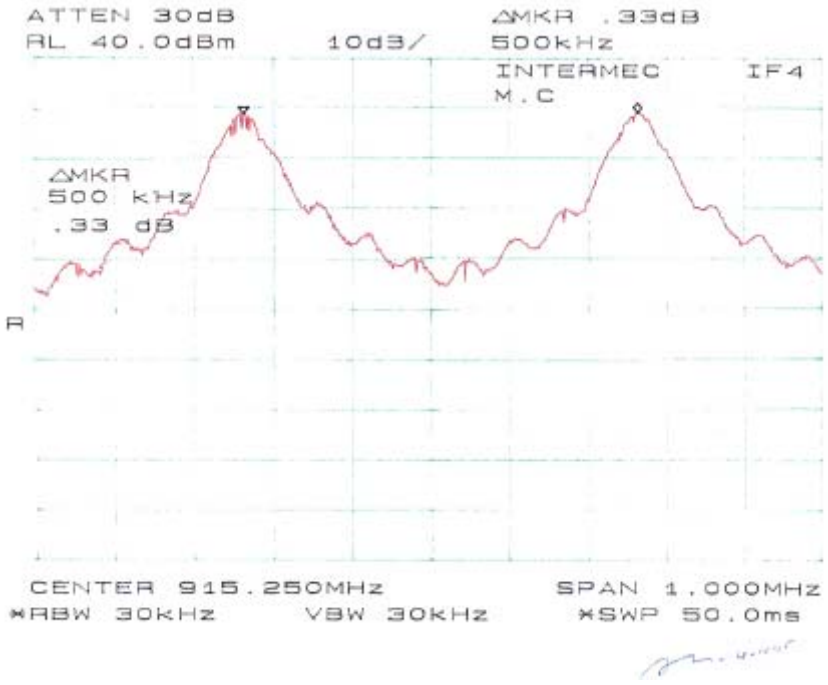
Measurement Results

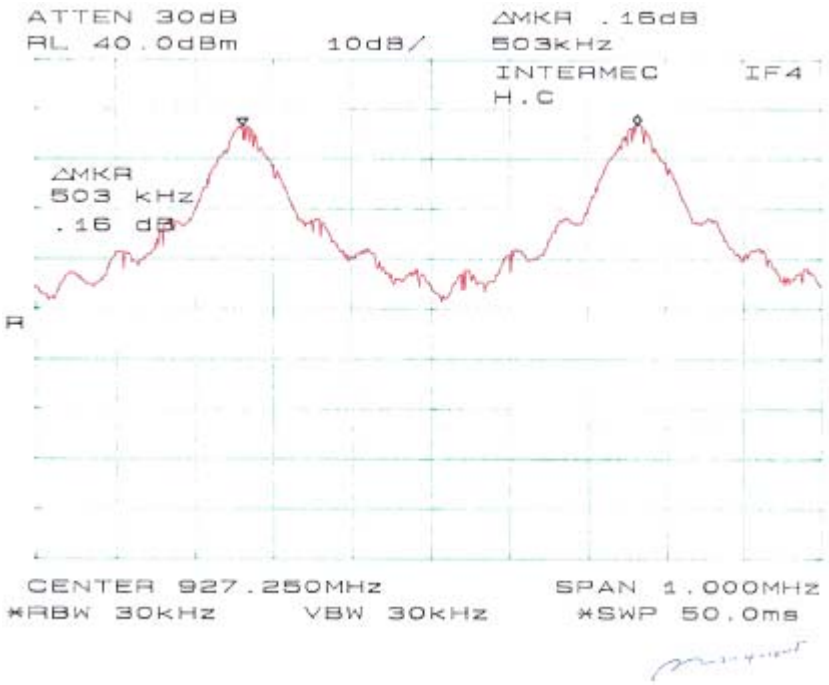
Channel	Frequency MHz	Channel Separation
Low	902.750	500 kHz
Mid	915.250	500 kHz
High	927.250	503 kHz

Plots of Hopping Channel Separation

Please refer to the following plots.






ATTEN 30dB
RL 40.0dBm
10dB/
ΔMKR .16dB
503kHz
INTERMEC
H.C
IF4
ΔMKR
503 kHz
.16 dB
R
CENTER 927.250MHz
SPAN 1.000MHz
*RBW 30kHz
VBW 30kHz
*SWP 50.0ms

§15.247 (a) (1) - CHANNEL BANDWIDTH

Standard Applicable

According to §15.247(a)(l), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

Temperature:	24° C
Relative Humidity:	40%
ATM Pressure:	1015 mbar

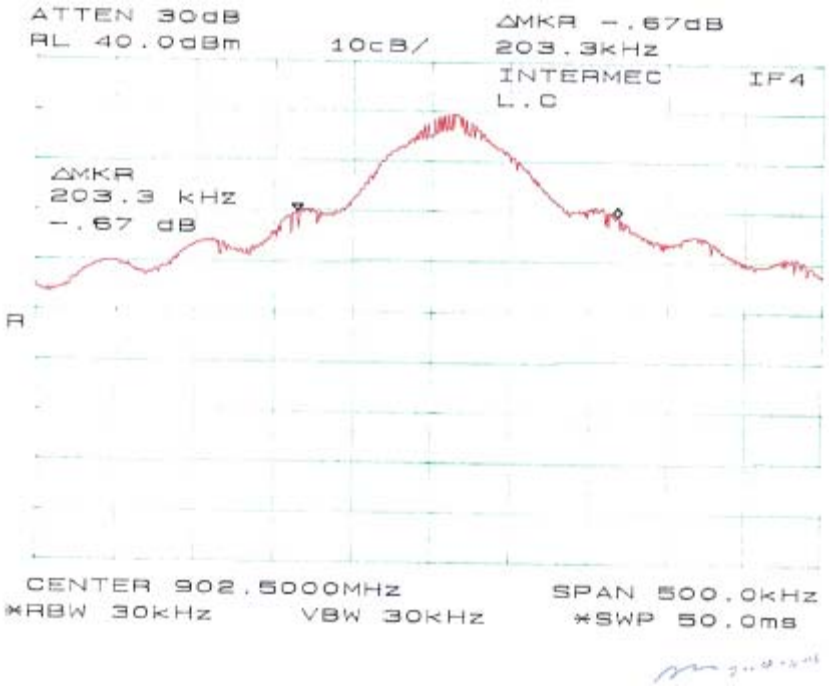
The testing was performed by Ming Jin on 2004-10-15.

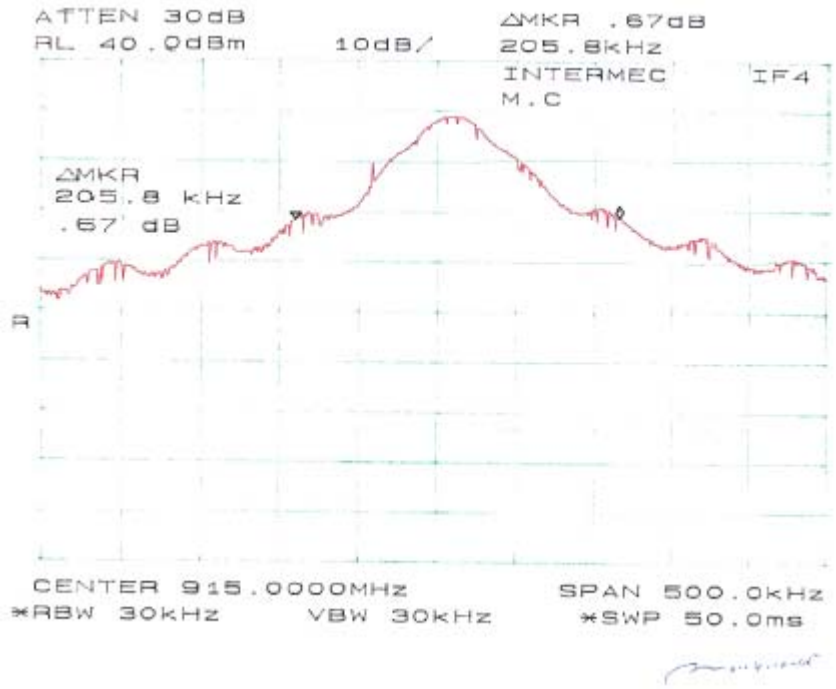
Measurement Result

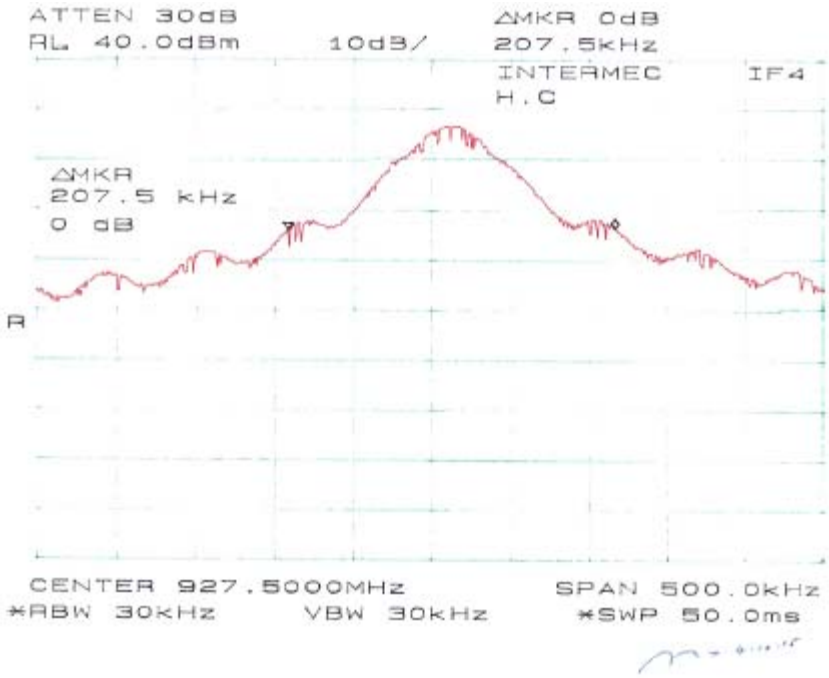
Channel	Frequency	Measurement (kHz)	Standard	Result
Low	902.500	203.3 KHz	≤ 1MHz	Compliant
Mid	915.000	205.8 KHz	≤ 1MHz	Compliant
High	927.500	207.5 KHz	≤ 1MHz	Compliant

Plot of Channel Bandwidth

Please see the following plots


ATTEN 30dB
RL 40.0dBm
10dB/
ΔMKR -.67dB
203.3kHz
INTERMEC
L.C
IF4
ΔMKR
203.3 kHz
-.67 dB
R
CENTER 902.5000MHz
*RBW 30kHz
VBW 30kHz
SPAN 500.0kHz
*SWP 50.0ms


ATTEN 30dB
RL 40.0dBm
10dB/
ΔMKR .67dB
205.8kHz
INTERMEC
M.C
IF4
ΔMKR
205.8 kHz
.67 dB
R
CENTER 915.0000MHz
*RBW 30kHz
VBW 30kHz
SPAN 500.0kHz
*SWP 50.0ms


ATTEN 30dB
RL 40.0dBm
10dB/
ΔMKR 0dB
207.5kHz
INTERMEC
H.C
IF4
ΔMKR
207.5 kHz
0 dB
R
CENTER 927.5000MHz
SPAN 500.0kHz
*RBW 30kHz
VBW 30kHz
*SWP 50.0ms

§15.247 (a) (1) (iii) - NUMBER OF HOPPING FREQUENCY USED

Standard Applicable

According to §15.247(a)(1)(iii), frequency hopping systems operating in the 902-928MHz band shall use at least 50 hopping frequencies.

Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the bench without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

*** Statement of Traceability: BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	24° C
Relative Humidity:	40%
ATM Pressure:	1015 mbar

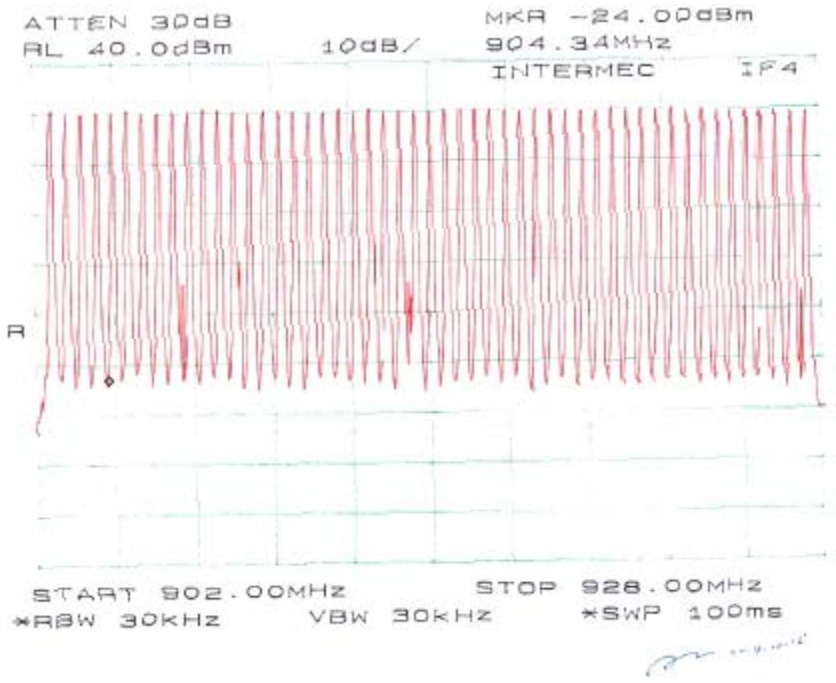
The testing was performed by Ming Jin on 2004-10-15.

Measurement Results

Measurement	Standard	Result
51	50	Compliant

Plots of Number of Hopping Frequency

Please refer to the attached plots.


ATTEN 30dB
RL 40.0dBm
10dB/
MKR -24.00dBm
904.34MHz
INTERMEC
IF4
R
START 902.00MHz
STOP 928.00MHz
*RBW 30kHz
VBW 30kHz
*SWP 100ms

§15.247 9 (a) (1) (iii) - DWELL TIME

Standard Applicable

According to §15.247 (a)(1)(i), the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

Temperature:	24° C
Relative Humidity:	40%
ATM Pressure:	1015 mbar

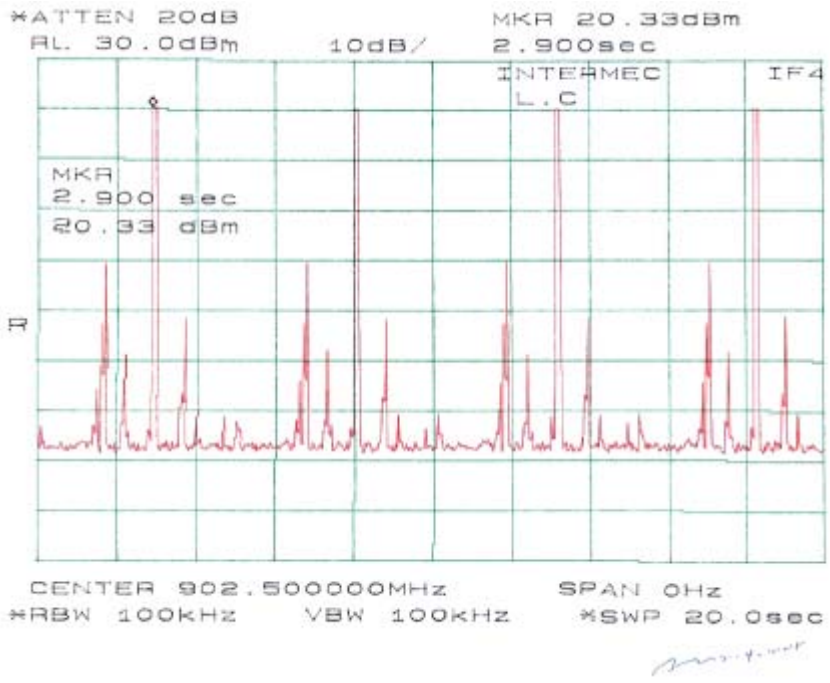
The testing was performed by Ming Jin on 2004-10-15.

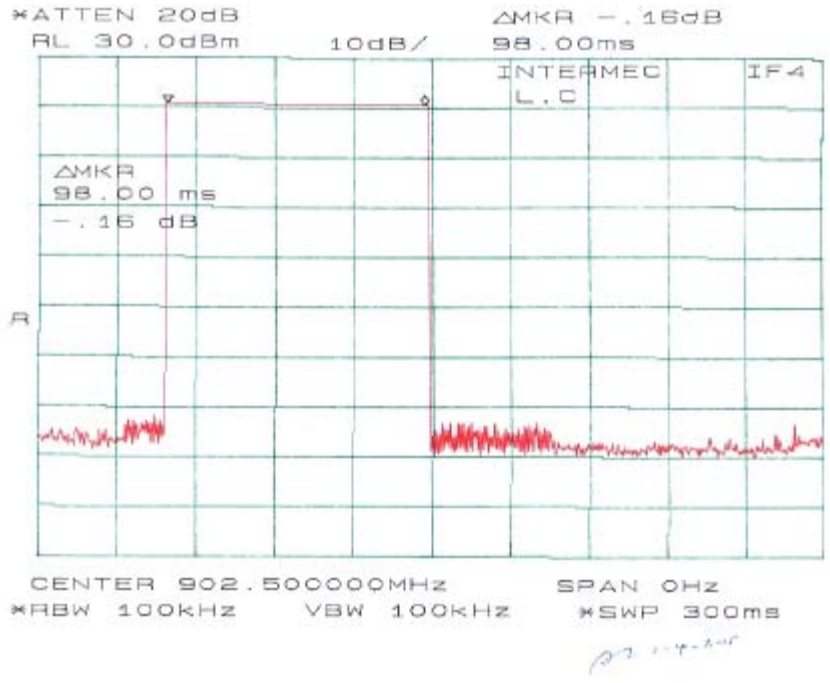
Measurement Results

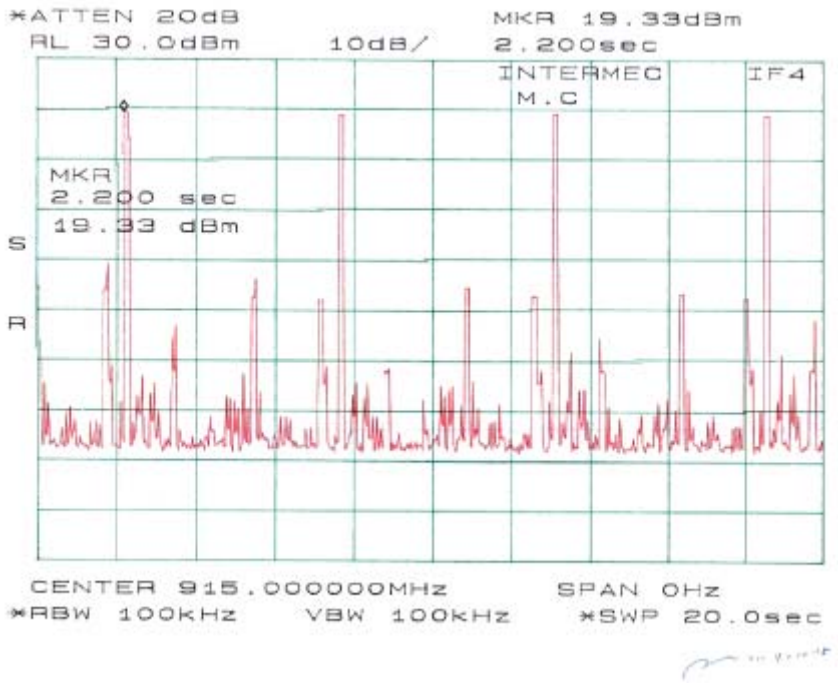
Low Channel: 4 x 98.0(ms) x [(51x0.4) / 20000 (ms)] = 0.3998 s < 0.4 s
Middle Channel: 4 x 98.0(ms) x [(51x0.4) / 20000 (ms)] = 0.3998 s < 0.4 s
High Channel: 4 x 98.0(ms) x [(51x0.4) / 20000 (ms)] = 0.3998 s < 0.4 s

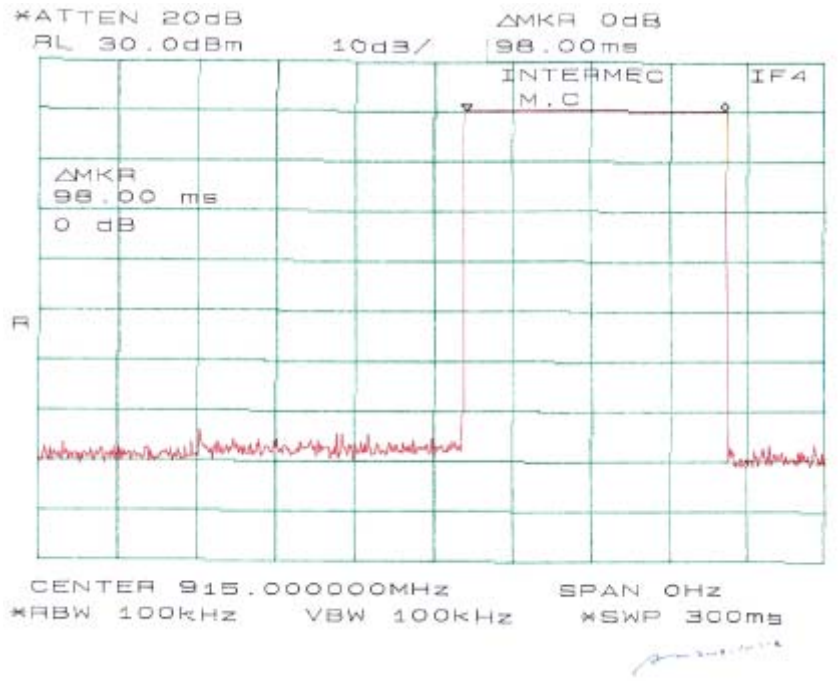
Plots of Dwell Time

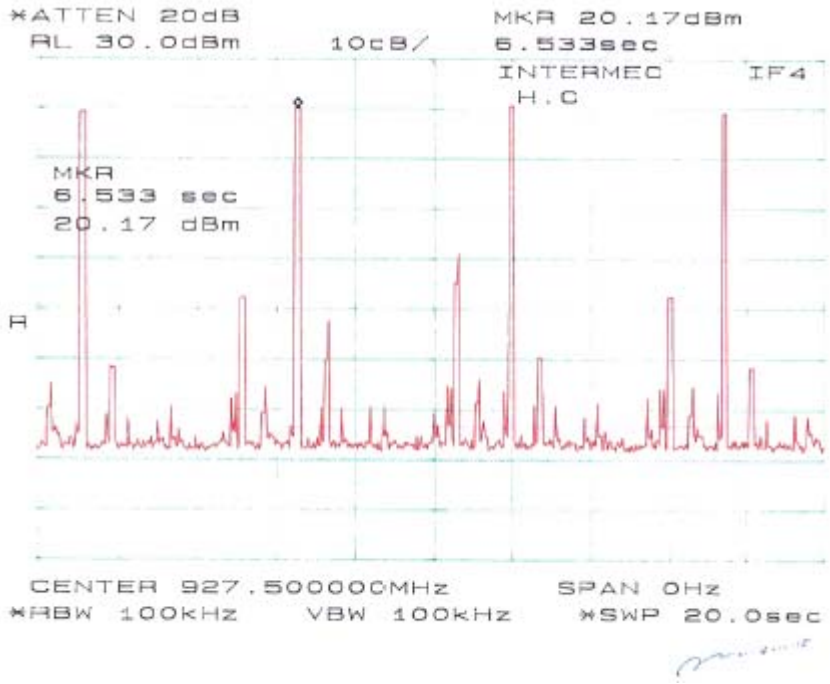
Please refer the following plots.

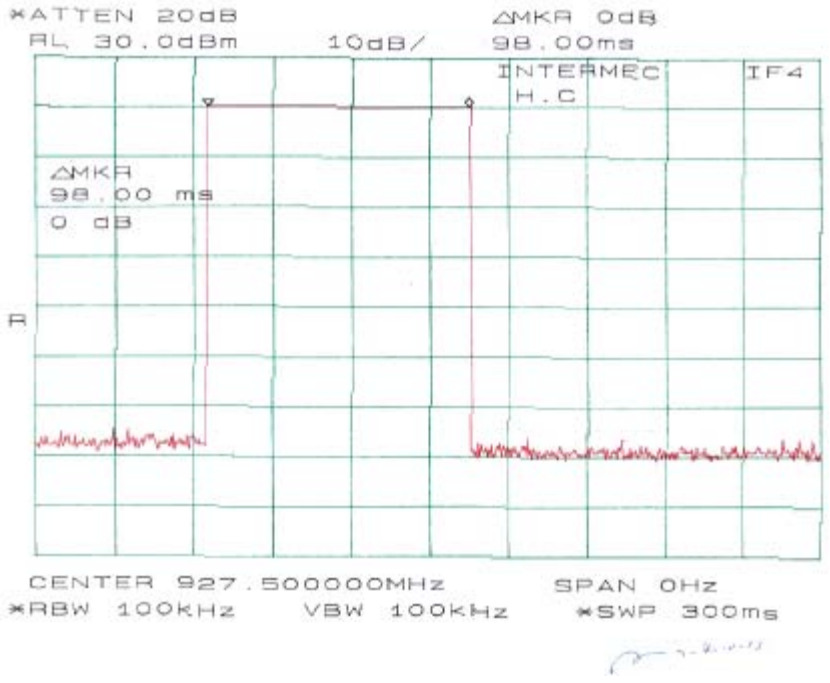

*ATTEN 20dB
RL 30.0dBm
10dB/
MKR 20.33dBm
2.900sec
INTERMEC
L.C
IF4
MKR
2.900 sec
20.33 dBm
R
CENTER 902.500000MHz
SPAN 0Hz
*RBW 100kHz
VBW 100kHz
*SWP 20.0sec


*ATTEN 20dB
RL 30.0dBm
10dB/
ΔMKR -.16dB
98.00ms
INTERMEC
L.C
IF4
ΔMKR
98.00 ms
-.16 dB
R
CENTER 902.500000MHz
SPAN 0Hz
*RBW 100kHz
VBW 100kHz
*SWP 300ms


*ATTEN 20dB
RL 30.0dBm
10dB/
MKR 19.33dBm
2.200sec
INTERMEC
M.C
IF4
MKR
2.200 sec
19.33 dBm
S
R
CENTER 915.000000MHz
SPAN 0Hz
*RBW 100kHz
VBW 100kHz
*SWP 20.0sec


*ATTEN 20dB
RL 30.0dBm
10dB/
ΔMKR 0dB
98.00ms
INTERMEC
M.C
IF4
ΔMKR
98.00 ms
0 dB
R
CENTER 915.000000MHz
SPAN 0Hz
*RBW 100kHz
VBW 100kHz
*SWP 300ms


*ATTEN 20dB
RL 30.0dBm
10dB/
MKR 20.17dBm
6.533sec
INTERMEC
H.C
IF4
MKR
6.533 sec
20.17 dBm
R
CENTER 927.500000MHz
SPAN 0Hz
*RBW 100kHz
VBW 100kHz
*SWP 20.0sec


*ATTEN 20dB
RL 30.0dBm
10dB/
ΔMKR 0dB
98.00ms
INTERMEC
H.C
IF4
ΔMKR
98.00 ms
0 dB
R
CENTER 927.500000MHz
SPAN 0Hz
*RBW 100kHz
VBW 100kHz
*SWP 300ms

§15.247 (b) (1) - MAXIMUM PEAK OUTPUT POWER

Standard Applicable

According to §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, as permitted under paragraph (a)(1)(i) of this section.

Measurement Procedure

1. Place the EUT on the turntable and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

Temperature:	24° C
Relative Humidity:	40%
ATM Pressure:	1015 mbar

The testing was performed by Ming Jin on 2004-10-15.

Measurement Result

Channel	Frequency	Output Power in dBm	Output Power in W	Standard	Result
Low	902.5	29.8	0.96	1 W	pass
Mid	915.0	30.0	1.00	1 W	pass
High	927.5	29.5	0.89	1 W	pass

Plots of Maximum Peak Output Power

Please refer to following plots.

§15.247 (c) - 100 KHZ BANDWIDTH OF BAND EDGES

Standard Applicable

According to §15.247(c), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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 §15.209(a) is not required.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

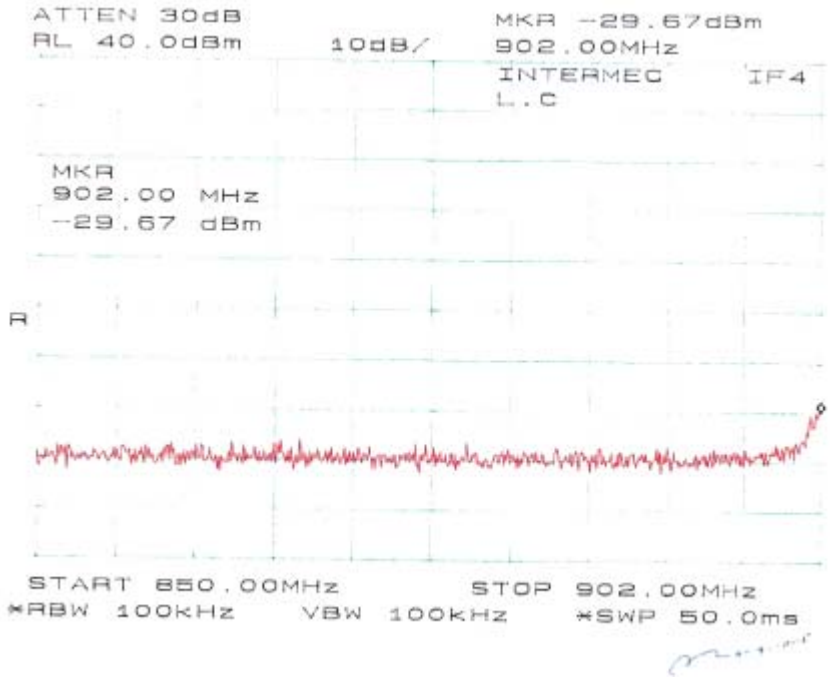
Environmental Conditions

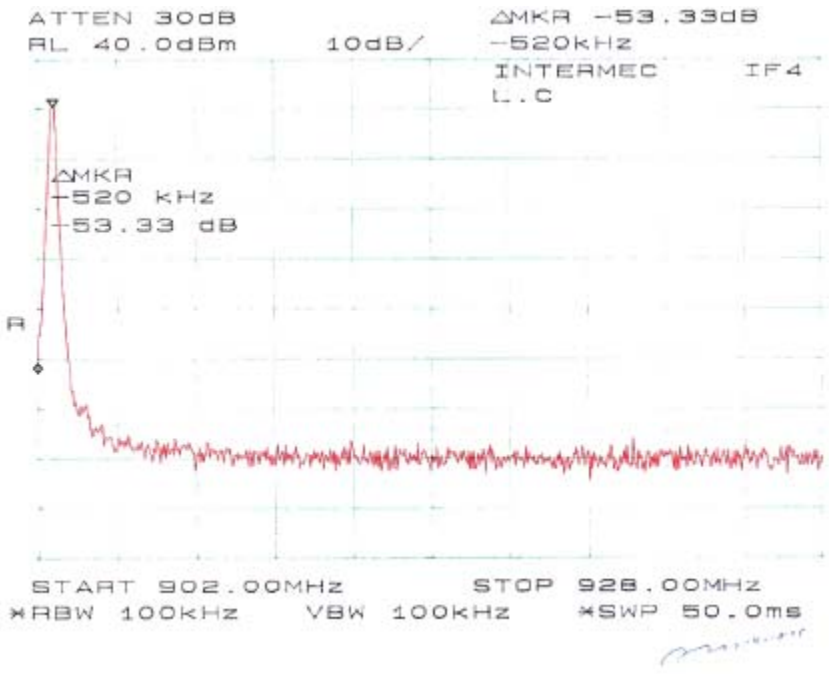
Temperature:	24° C
Relative Humidity:	40%
ATM Pressure:	1015 mbar

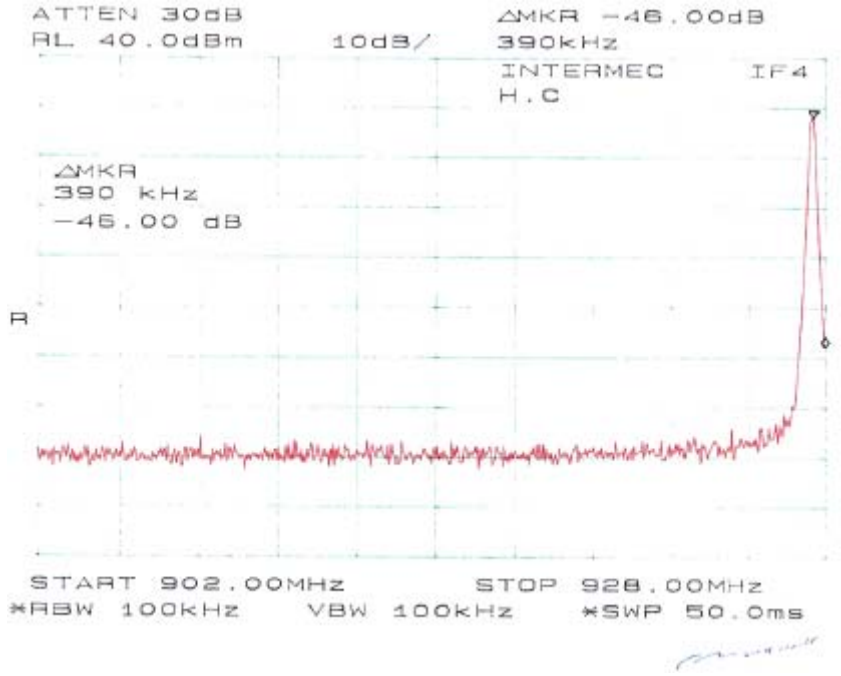
The testing was performed by Ming Jin on 2004-10-15.

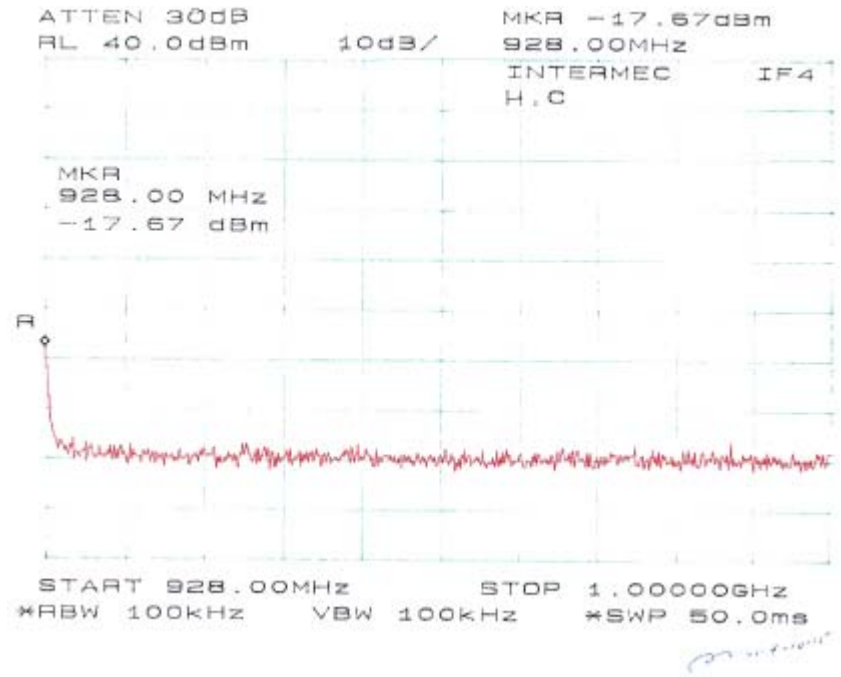
Plots of 100kHz Bandwidth of Band Edge

Please refer the following plots.


ATTEN 30dB
RL 40.0dBm
10dB/
MKR -29.67dBm
902.00MHz
INTERMEC
L.C
IF4
MKR
902.00 MHz
-29.67 dBm
R
START 850.00MHz
STOP 902.00MHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0ms


ATTEN 30dB
RL 40.0dBm
10dB/
ΔMKR -53.33dB
-520kHz
INTERMEC
L.C
IF4
ΔMKR
-520 kHz
-53.33 dB
R
START 902.00MHz
STOP 928.00MHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0ms


ATTEN 30dB
RL 40.0dBm
10dB/
ΔMKR -46.00dB
390kHz
INTERMEC
H.C
IF4
ΔMKR
390 kHz
-46.00 dB
R
START 902.00MHz
STOP 928.00MHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0ms


ATTEN 30dB
RL 40.0dBm
10dB/
MKR -17.67dBm
928.00MHz
INTERMEC
H.C
IF4
MKR
928.00 MHz
-17.67 dBm
R
START 928.00MHz
STOP 1.00000GHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0ms

SPURIOUS EMISSION AT ANTENNA PORT

Standard Applicable

According to §15.209 (f) and §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit.

Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

2. Position the EUT on a bench without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.

3. Set the SA on Max-Hold Mode, and then keep the EUT in transmitting mode. Record all the signals from each channel until each one has been recorded.

4. Set the SA on View mode and then plot the result on SA screen.

5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

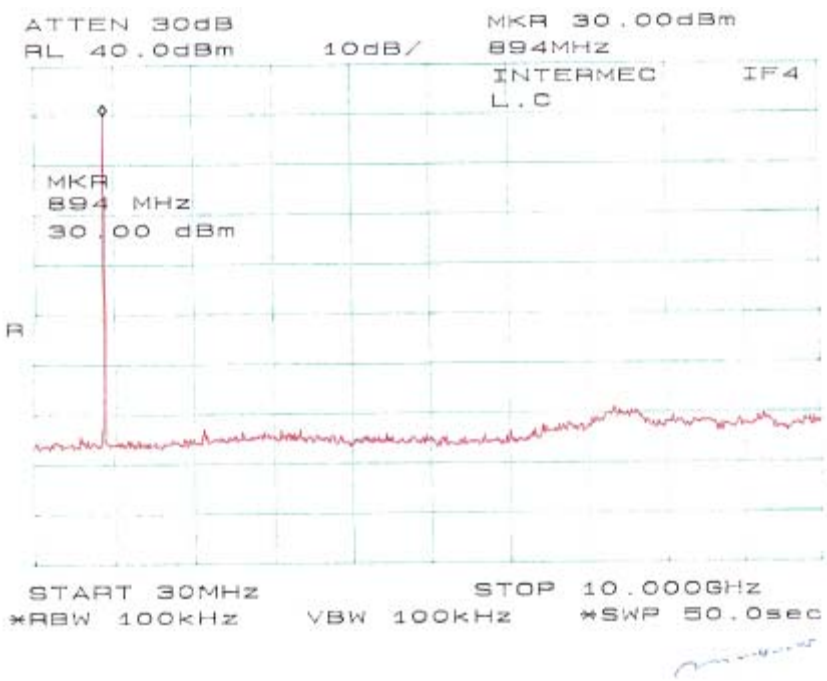
Environmental Conditions

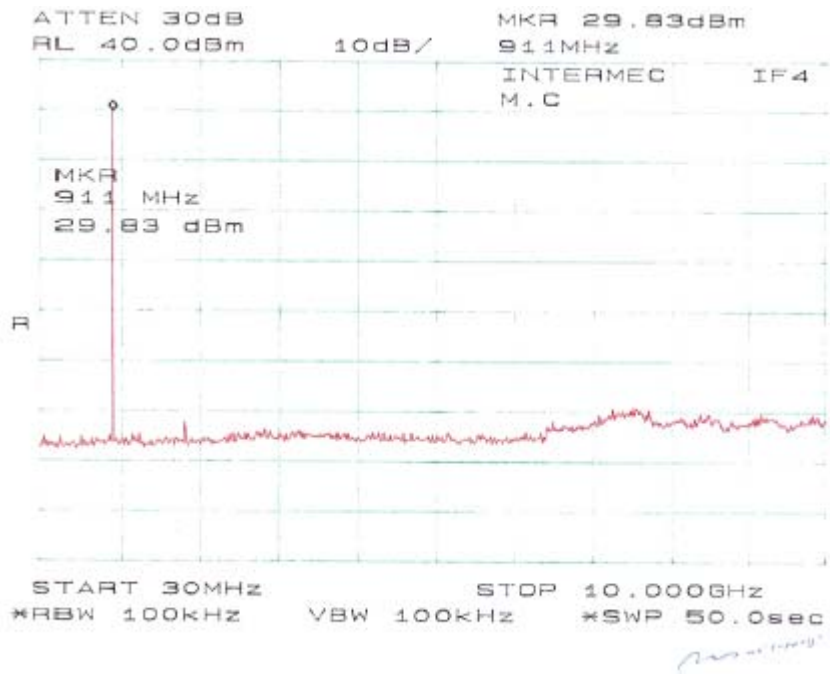
Temperature:	24° C
Relative Humidity:	40%
ATM Pressure:	1015 mbar

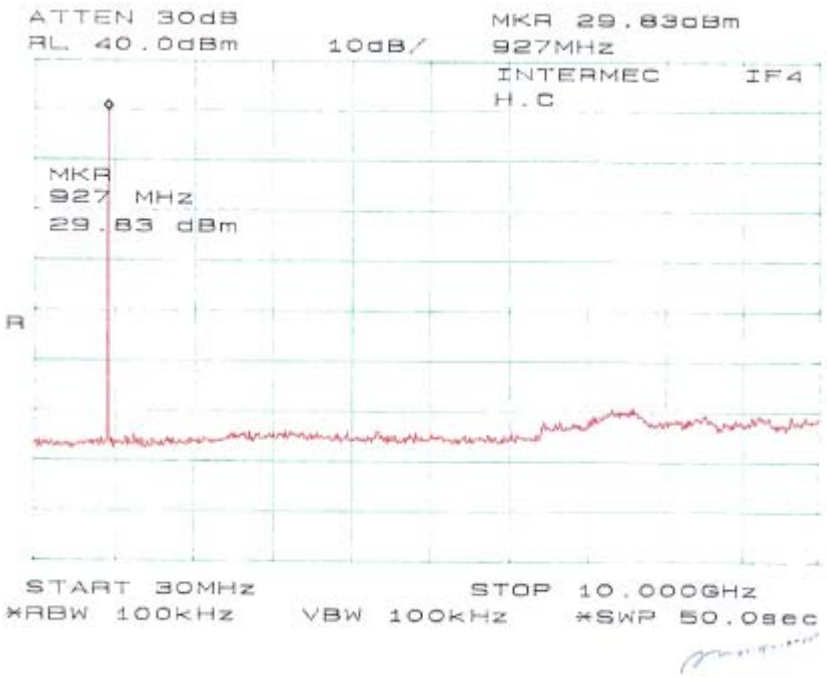
The testing was performed by Ming Jin on 2004-10-15.

Measurement Results

Please refer to the following plots.


ATTEN 30dB
RL 40.0dBm
10dB/
MKR 30.00dBm
894MHz
INTERMEC
IF4
L.C
MKR
894 MHz
30.00 dBm
R
START 30MHz
STOP 10.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0sec


ATTEN 30dB
RL 40.0dBm
10dB/
MKR 29.83dBm
911MHz
INTERMEC
IF4
M.C
MKR
911 MHz
29.83 dBm
R
START 30MHz
STOP 10.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0sec


ATTEN 30dB
RL 40.0dBm
10dB/
MKR 29.83dBm
927MHz
INTERMEC IF4
H.C
MKR
927 MHz
29.83 dBm
A
START 30MHz
STOP 10.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0sec