Application for Certification
For a GPS Positioning System

Leica Geosystems, Inc.
15901 Hawthorne Blvd., Suite 430
Lawndale, CA 90260

GPS Positioning System

FCC ID: QOHSR20

REPORT # RV58074A-003

This report was prepared in accordance with the requirements of the FCC Rules and Regulations Part 2, Subpart J, 2.1033, and Part 15.247 and other applicable sections of the rules as indicated herein.

Prepared By:

DNB Engineering, Inc.
5969 Robinson Avenue
Riverside, CA 92503

18 December 2004

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Paragraph numbers in this report follow the application section numbers found in the FEDERAL COMMUNICATIONS COMMISSION Rules and Regulations, Part 2, Subpart J for Certification of electronic equipment.

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1.0 ADMINISTRATIVE DATA

1.1 Certifications and Qualifications

I certify that DNB Engineering, Inc conducted the tests performed in order to obtain the technical data presented in this application. Also, based on the results of the enclosed data, I have concluded that the equipment tested meets or exceeds the requirements of the Rules and Regulations governing this application.

1.2 Measurement Repeatability Information

The test data presented in this report has been acquired using the guidelines set forth in FCC Part 2.1031 through 2.1057, Part 15. The test results presented in this document are valid only for the equipment identified herein under the test conditions described. Repeatability of these test results will only be achieved with identical measurement conditions. These conditions include: The same test distance, EUT Height, Measurement Site Characteristics, and the same EUT System Components. The system must have the same Interconnecting Cables arranged in identical placement to that in the test set-up, with the system and/or EUT functioning in the identical mode of operation (i.e. software and so on) as on the date of the test. Any deviation from the test conditions and the environment on the date of the test may result in measurement repeatability difficulties.

All changes made to the EUT during the course of testing as identified in this test report must be incorporated into the EUT or identical models to ensure compliance with the FCC regulations.

C. L. Payne III (Para. 1.1)
Sr Engineering Manager
Riverside Facility.
DNB Engineering, Inc.
Tel. (951) 637-2630
FAX (951) 637-2704

2.1033 (b) (1) Application for Certification

Name of Applicant:		Leica Geosystems, Inc. 15901 Hawthorne Blvd., Suite 430 Lawndale, CA 90260
FRN Number:		0007707755
Applicant is:	X	Manufacturer
Vendor		
Licensee		
Prospective Licensee		
Other		
Name of Manufacturer		Leica Geosystems, Inc.
Description:		GPS Positioning System
Part Number:		GS20 or SR20
Anticipated Production Quantity:		Multiple Units
Frequency Band:		2402 - 2480 GHz
Rated Power:		96 μW (-10 dBm)
Type of Signal:		FHSS
Hopping Channels:		32 Non-Overlapping Channels
Max Data Rate:		230 kbps

2.1033 (b) (2) FCC Identifier

2.1033 (b) (3) Installation and Operating Instructions

Review attached file: SR20_User_V1_1en

2.1033 (b) (4) Brief Description of Circuit Function

Theory of Operation Confidential: Review attached file: SR20-freq

2.1033 (b) (5) Block Diagram

Block diagram confidential: review attached file: SR20_HWBLOCK_V2.0

2.1033 (b) (6) Report of Measurements

15.207 Conducted Emissions (General Provisions)

Test Procedure:

To measure conducted emissions, the EUT was set upon a wooden table in the shielded enclosure. AC power was fed into the EUT from the Artificial Mains Network. With the Artificial Mains Network connected to an HP 8568B Spectrum Analyzer, and using the HP 9825 Computer/Controller and the HP 85864B EMI Measurement Software, the spectrum was searched from 0.15 - 30 MHz for emissions emanating from the EUT.

Frequency of emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 - 0.5	66 to 56*	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

* Decreases with the logarithm of the frequency.

EUT operating conditions: Running software as supplied by the manufacturer

Note: This device is a hand held battery operated device, conducted emissions are not applicable

Test Set-Up:

15.209 Radiated Emissions (General Provisions)

Test Procedure:

The EUT was measured on an open area test site (OATS).

A measuring distance of at least 3 m shall be used for measurements at frequencies up to 1 GHz. For frequencies above 1 GHz, any suitable measuring distance may be used. The equipment size (excluding the antenna) shall be less than 20 % of the measuring distance.

Sufficient precautions shall be taken to ensure that reflections from extraneous objects adjacent to the site do not degrade the measurement results, in particular:

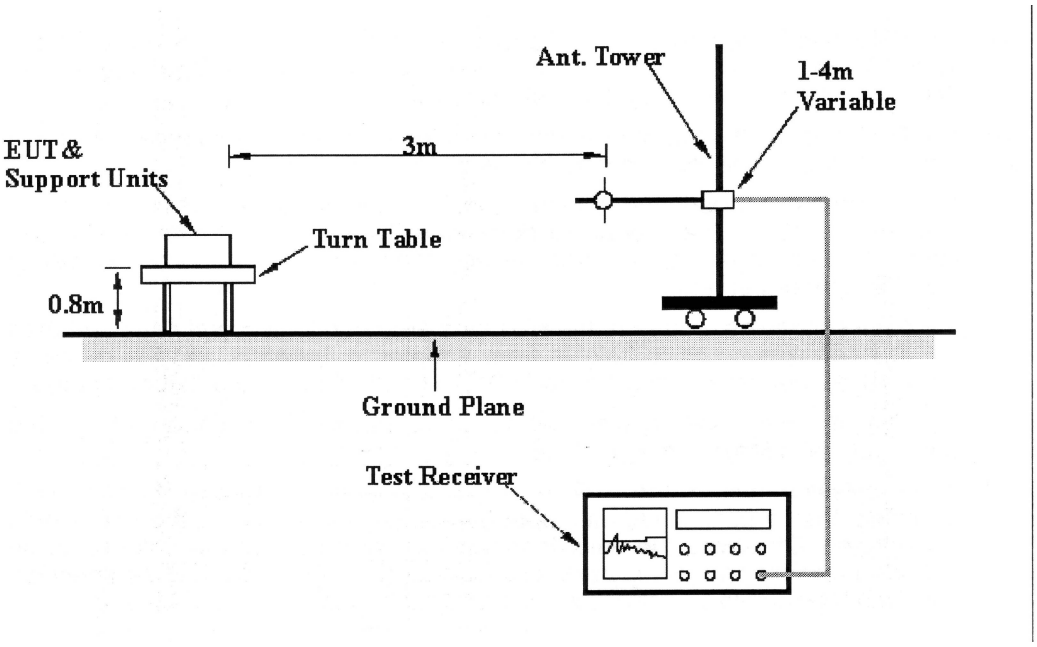
- no extraneous conducting objects having any dimension in excess of a quarter wavelength of the highest frequency tested shall be in the immediate vicinity of the site;

- all cables shall be as short as possible; as much of the cables as possible shall be on the ground plane or preferably below; and the low impedance cables shall be screened.

The EUT shall be placed upon a non-conductive table 1.5 meters above the ground plane and shall be placed in the "worst case" transmitting mode. The EUT shall be rotated 360 degrees to find the azimuth maxima. The receive antenna shall then be raised and lowered between 1 to 4 meters to find the maximum signal emanating from the EUT. This signal strength is then recorded on the data sheets.

Frequency (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measurement Distance (meters)
.0009 - 0.490	2400/F(kHz)	$20*(Log_{10}(2400/F(kHz))$	300
0.490 - 1.705	24000/F(kHz)	$20*(Log_{10}(24000/F(kHz))$	30
1.705 - 30.0	30	29.5	30
30 - 88	100	40.0	3
88 - 216	150	43.5	3
216 - 960	200	46.0	3
Above 960	500	54.0	3

	5969 Robinson Avenue Riverside, CA 92503 (951) 637-2630 FAX (951) 637-2704	**Radiated Emissions** (Spurious)	
DNB Job Number:	58074	Date: 19 Nov 2004	Specification
Customer:	Leica Geosystems, Inc.		[X] 15.209
Model Number:	GS20 (SR20)	Serial Number: Proto	
Description:	GPS Positioning System		
	Test Set Up		



5969 Robinson Avenue
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FAX (951) 637-2704

Radiated Emissions (Spurious)

DNB Job Number:	58074	Date: 19 Nov 2004	Specification
Customer:	Leica Geosystems, Inc.		[X] 15.209
Model Number:	GS20 (SR20)	Serial Number: Proto	
Description:	GPS Positioning System		

EUT is in conformance with FCC 15.209	X	YES		NO	Signed	*Tom Elders*

FREQ (Mhz)	Meter	Correction Factors			dBuV/m			Positions			
		Ant	Cbl	Amp	Corr	Lim	Delta	Typ	Tbl	Pl	Hgt
33.041	24.3	12.1	0.6	-24.3	12.7	30	-17.3	PK	270	H	4.00
66.544	29.1	9.1	1.0	-24.2	15	30	-15	PK	179	H	4.00
109.544	36.0	10.1	1.4	-24.2	23.3	30	-6.7	PK	0	H	4.00
221.044	23.7	14.6	2.2	-24.2	16.3	30	-13.7	PK	0	H	4.00
226.466	22.0	12.4	2.2	-24.2	12.4	30	-17.6	PK	164	H	1.49
275.966	27.4	12.6	2.4	-24.4	18	37	-19	PK	0	H	4.00
292.466	28.0	13.4	2.5	-24.4	19.5	37	-17.5	PK	0	H	4.00
299.722	24.2	13.8	2.5	-24.4	16.1	37	-20.9	PK	29	H	4.00
33.046	26.1	12.1	0.6	-24.3	14.5	30	-15.5	PK	204	V	1.00
66.046	28.4	9.1	1.0	-24.2	14.3	30	-15.7	PK	209	V	1.00
111.731	25.6	10.3	1.4	-24.2	13.1	30	-16.9	PK	360	V	1.00
222.783	28.8	14.7	2.2	-24.2	21.5	30	-8.5	PK	360	V	1.00
239.043	26.2	12.3	2.3	-24.3	16.5	37	-20.5	PK	140	V	1.00
273.757	27.8	12.6	2.4	-24.4	18.4	37	-18.6	PK	140	V	1.49
292.603	30.5	13.5	2.5	-24.4	22.1	37	-14.9	PK	140	V	1.49
299.659	30.4	13.8	2.5	-24.4	22.3	37	-14.7	PK	360	V	1.49
329.948	31.4	14.5	2.7	-24.5	24.1	37	-12.9	PK	165	V	1.49

15.247 (a,1) Channel Spacing

Test Procedure:

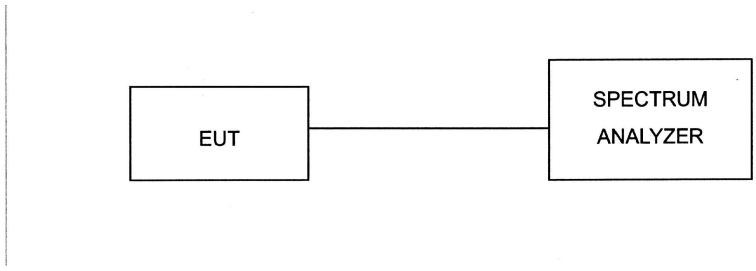
The transmitter output was connected to the spectrum analyzer. The 20db bandwidth of the fundamental frequency was measured with a 100kHz RBW and a 100kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than the peak power minus 20dB. This value was then compared to two adjacent channels to determine the channel spacing.

Requirement: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

EUT operating conditions:

The software provided by the client to enable the EUT to transmit continuously at the low, mid, and upper channels respectively.

Test Set Up:



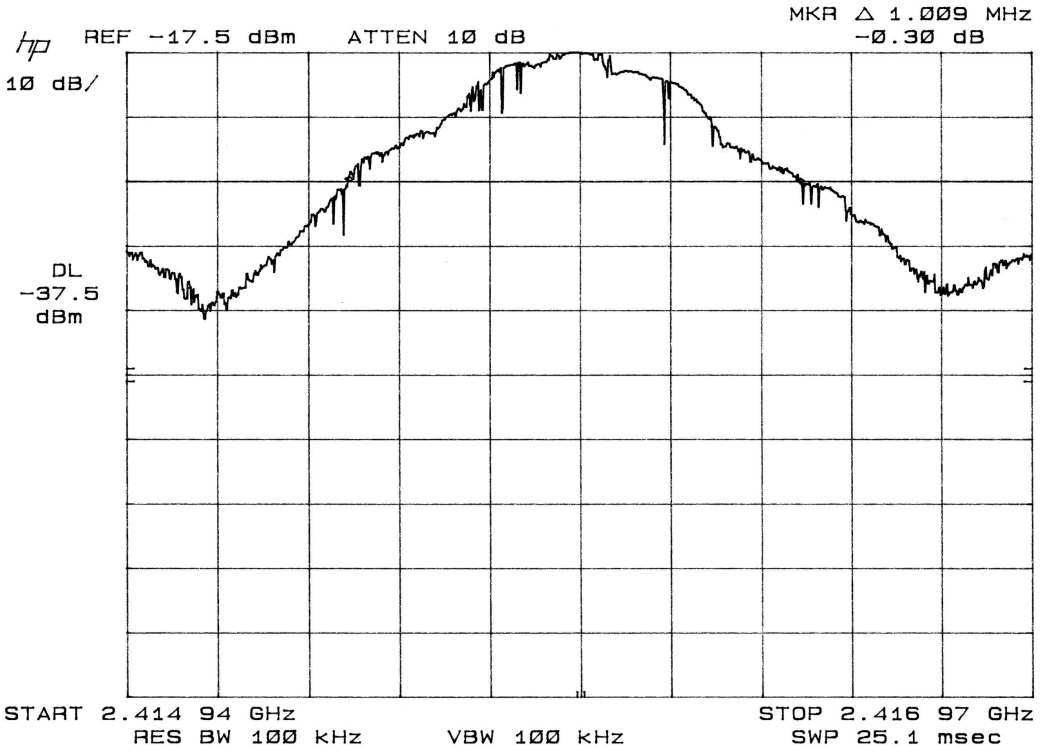
	5969 Robinson Avenue Riverside, CA 92503 (951) 637-2630 FAX (951) 637-2704	**20 dB Emission Bandwidth**

DNB Job Number:	58074	Date: 22 Nov 2004	**Conformance Standard**
Customer:	Leica Geosystems, Inc.		
Model Number:	GS20 (SR20)	Serial Number: Proto	FCC Part 15
Description:	GPS Positioning System		**Clause** 15.247(a1)

Environmental Conditions		
Ambient Temperature	Relative Humidity	Barometric Pressure
22 °C	30 %	102.4 kPa

EUT performed within the requirements of the applicable standard [X] Yes [ ] No *Tom Elders*

Channel	Chl Freq (MHz)	20dB BW (MHz)
1	2414.94	1.009

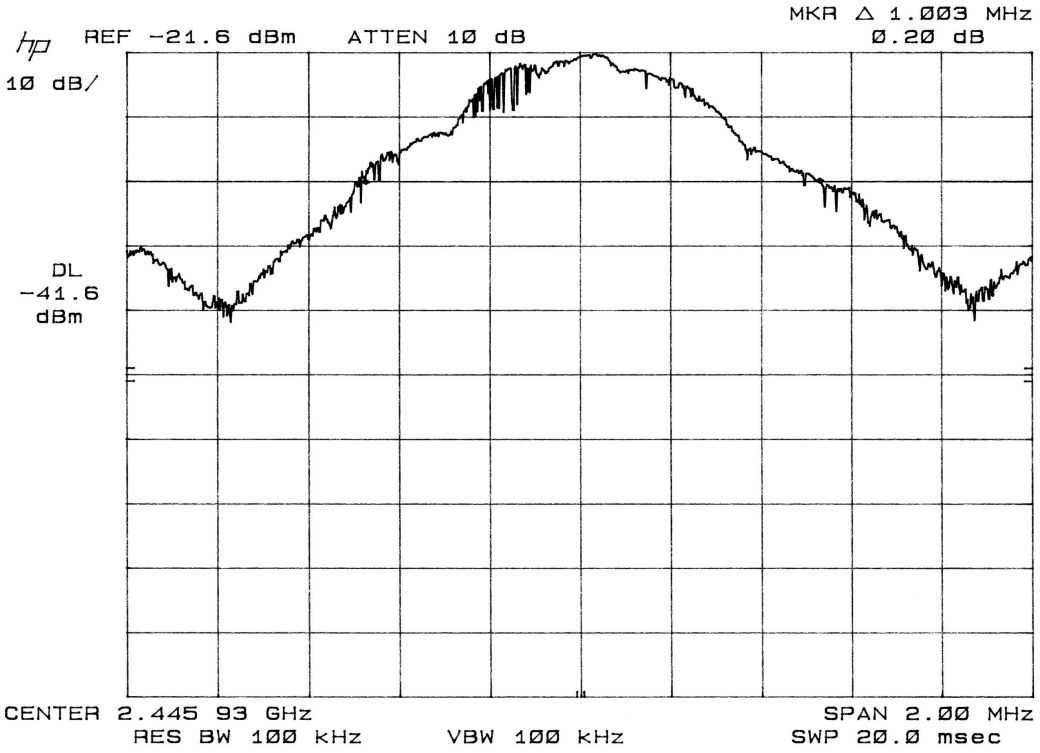


	5969 Robinson Avenue Riverside, CA 92503 (951) 637-2630 FAX (951) 637-2704	**20 dB Emission Bandwidth**	
DNB Job Number:	58074	Date: 22 Nov 2004	**Conformance Standard** FCC Part 15
Customer:	Leica Geosystems, Inc.		
Model Number:	GS20	Serial Number: Proto	
Description:	GPS Positioning System		**Clause** 15.247(a1)

Environmental Conditions		
Ambient Temperature	Relative Humidity	Barometric Pressure
22 °C	30 %	102.4 kPa

EUT performed within the requirements of the applicable standard [X] Yes [ ] No *Les Payne*

Channel	Chl Freq (MHz)	20dB BW (MHz)
16	2445.93	1.003

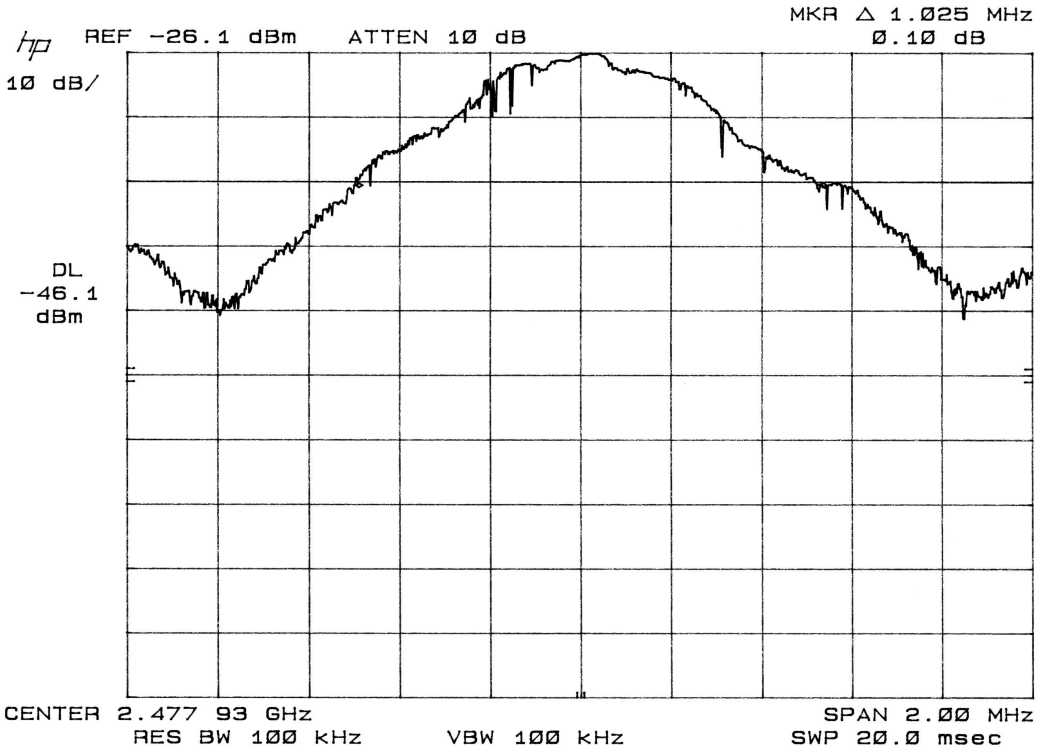


	5969 Robinson Avenue Riverside, CA 92503 (951) 637-2630 FAX (951) 637-2704	**20 dB Emission Bandwidth**	
DNB Job Number:	58074	Date: 22 Nov 2004	**Conformance Standard** FCC Part 15
Customer:	Leica Geosystems, Inc.		
Model Number:	GS20 (SR20)	Serial Number: Proto	
Description:	GPS Positioning System		**Clause** 15.247(a1)

Environmental Conditions		
Ambient Temperature	Relative Humidity	Barometric Pressure
22 °C	30 %	102.4 kPa

EUT performed within the requirements of the applicable standard [X] Yes [ ] No *Tom Elders*

Channel	Chl Freq (MHz)	20dB BW (MHz)
32	2447.93	1.025



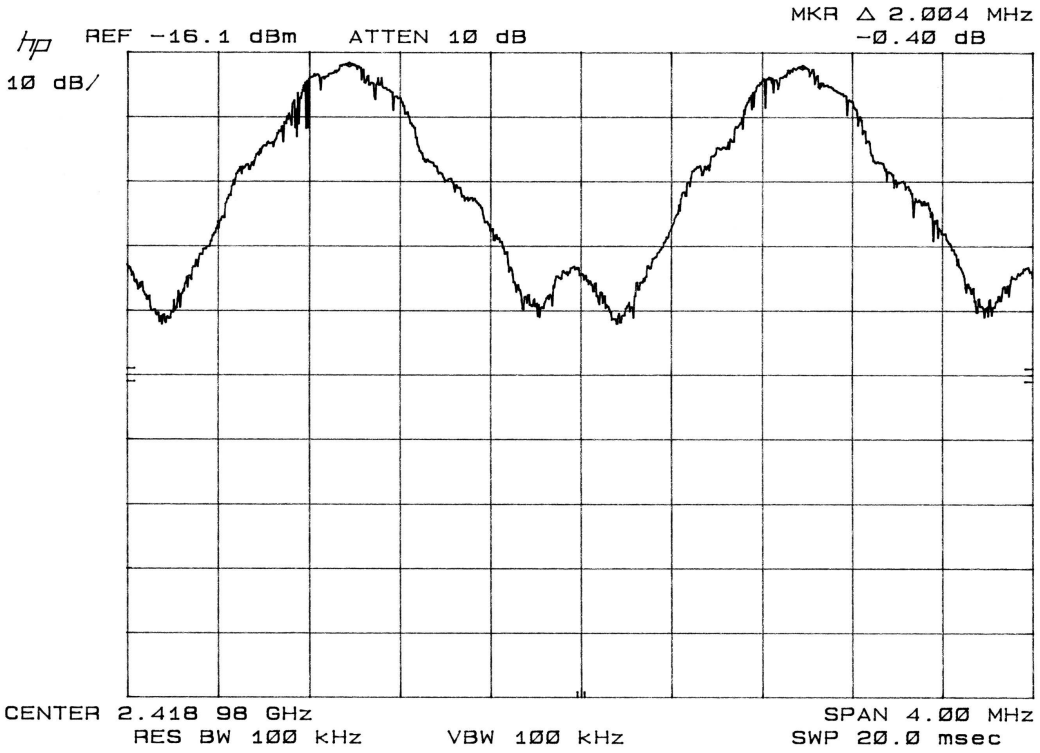
	5969 Robinson Avenue Riverside, CA 92503 (951) 637-2630 FAX (951) 637-2704	**Channel Spacing**

DNB Job Number:	58074	Date: 22 Nov 2004	**Conformance Standard**
Customer:	Leica Geosystems, Inc.		
Model Number:	GS20 (SR20)	Serial Number: Proto	FCC Part 15
Description:	GPS Positioning System		**Clause** 15.247(a1)

Environmental Conditions		
Ambient Temperature	Relative Humidity	Barometric Pressure
22 °C	30 %	102.4 kPa

EUT performed within the requirements of the applicable standard [X] Yes [ ] No *Tom Elders*

Channels	Center Freq (MHz)	Chl Spacing (MHz)	Min Lim (MHz)	Pass/Fail
2 - 3	2418.98	2.004	1.025	Pass



15.247 (a,1,iii) Channel Occupancy

Test Procedure:

The transmitter output was connected to the spectrum analyzer with a 100kHz RBW and a 100kHz VBW. The spectrum analyzer was placed in max hold until all channels having sufficient time to be plotted. The analyzer was the placed in zero frequency span in the center of a channel and the on time single pulse width was measured and recorded. The period of the pulse train was then measured and recorded. The occupancy in a 0.4 times the number of hopping channels window was then recorded.

Duty Cycle = (On time/Period of pulse train)

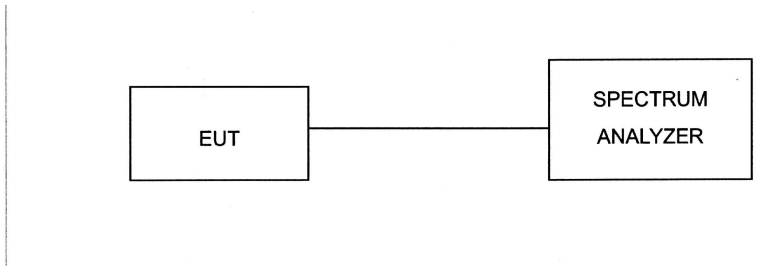
Occupancy = Transmit time * Duty cycle of transmitter

Requirement: The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

EUT operating conditions:

The software provided by the client to enable the EUT to transmit continuously at the low, mid, and upper channels respectively.

Test Set Up:

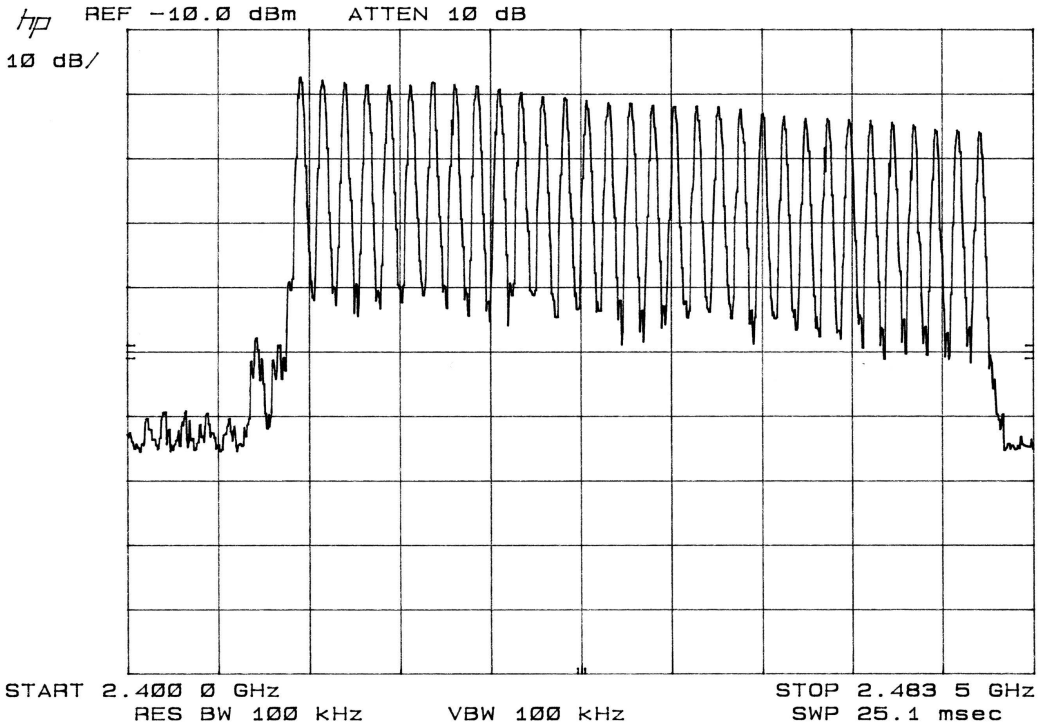


	5969 Robinson Avenue Riverside, CA 92503 (951) 637-2630 FAX (951) 637-2704	**Number of Channels**	
DNB Job Number:	58074	Date: 22 Nov 2004	**Conformance Standard** FCC Part 15
Customer:	Leica Geosystems, Inc.		
Model Number:	GS20 (SR20)	Serial Number: Proto	
Description:	GPS Positioning System		**Clause** 15.247(a1,iii)

Environmental Conditions		
Ambient Temperature	Relative Humidity	Barometric Pressure
22 °C	30 %	102.4 kPa

EUT performed within the requirements of the applicable standard [X] Yes [ ] No *Tom Elders*

Frequency Span	Number of non-overlapping channels	Min number of non-overlapping channels	Pass/Fail
2400.0 - 2483.5 MHz	32	15	Pass



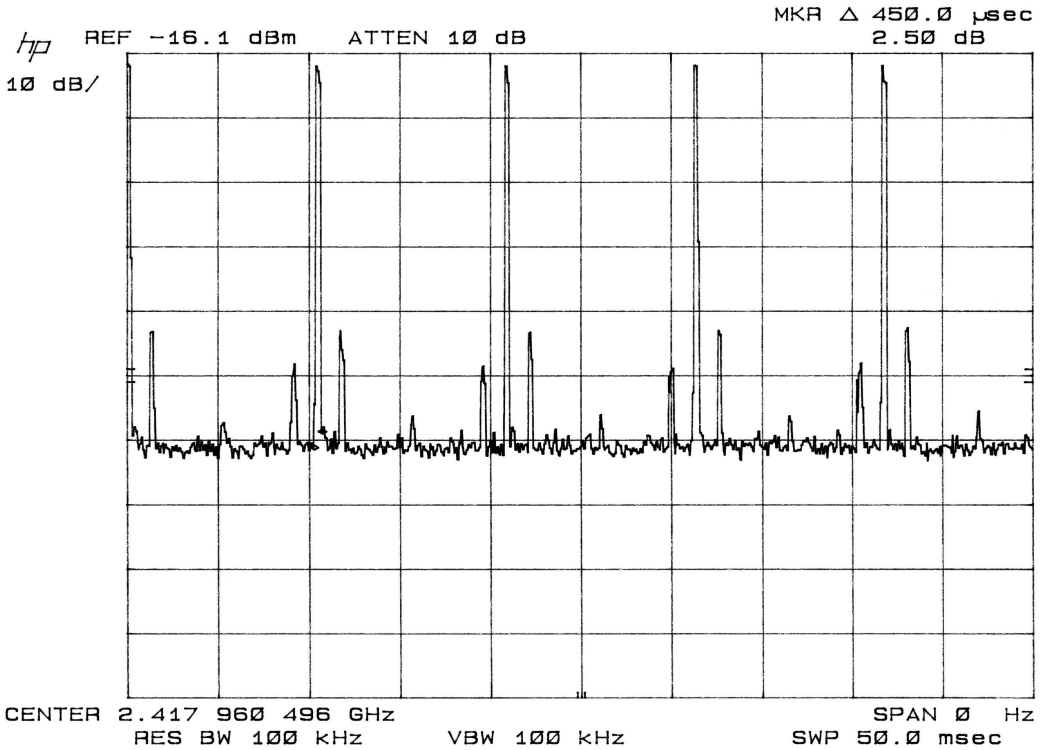
	5969 Robinson Avenue Riverside, CA 92503 (951) 637-2630 FAX (951) 637-2704	**Channel Occupancy**

DNB Job Number:	58074	Date: 22 Nov 2004	**Conformance Standard** FCC Part 15
Customer:	Leica Geosystems, Inc.		
Model Number:	GS20 (SR20)	Serial Number: Proto	
Description:	GPS Positioning System		**Clause** 15.247(a1,iii)

Environmental Conditions		
Ambient Temperature	Relative Humidity	Barometric Pressure
22 °C	30 %	102.4 kPa

EUT performed within the requirements of the applicable standard [X] Yes [ ] No *Tom Elders*

Center Frequency	Single Pulse Width
2417.96 MHz	450 micro seconds



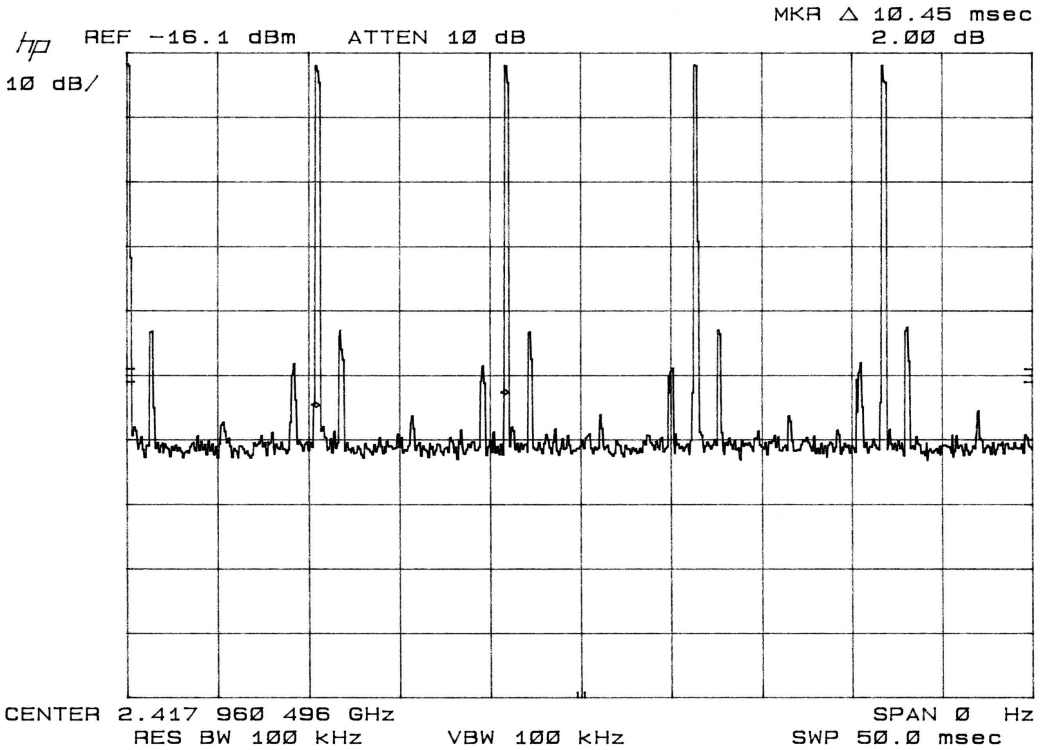
	5969 Robinson Avenue Riverside, CA 92503 (951) 637-2630 FAX (951) 637-2704	**Channel Occupancy**

DNB Job Number:	58074	Date: 22 Nov 2004	**Conformance Standard** FCC Part 15
Customer:	Leica Geosystems, Inc.		
Model Number:	GS20 (SR20)	Serial Number: Proto	
Description:	GPS Positioning System		**Clause** 15.247(a1,iii)

Environmental Conditions		
Ambient Temperature	Relative Humidity	Barometric Pressure
22 °C	30 %	102.4 kPa

EUT performed within the requirements of the applicable standard [X] Yes [ ] No *Tom Elders*

Center Frequency	Pulse width	Period width	Duty Cycle
2417.96 MHz	0.450	10.450	.043 (4.3%)



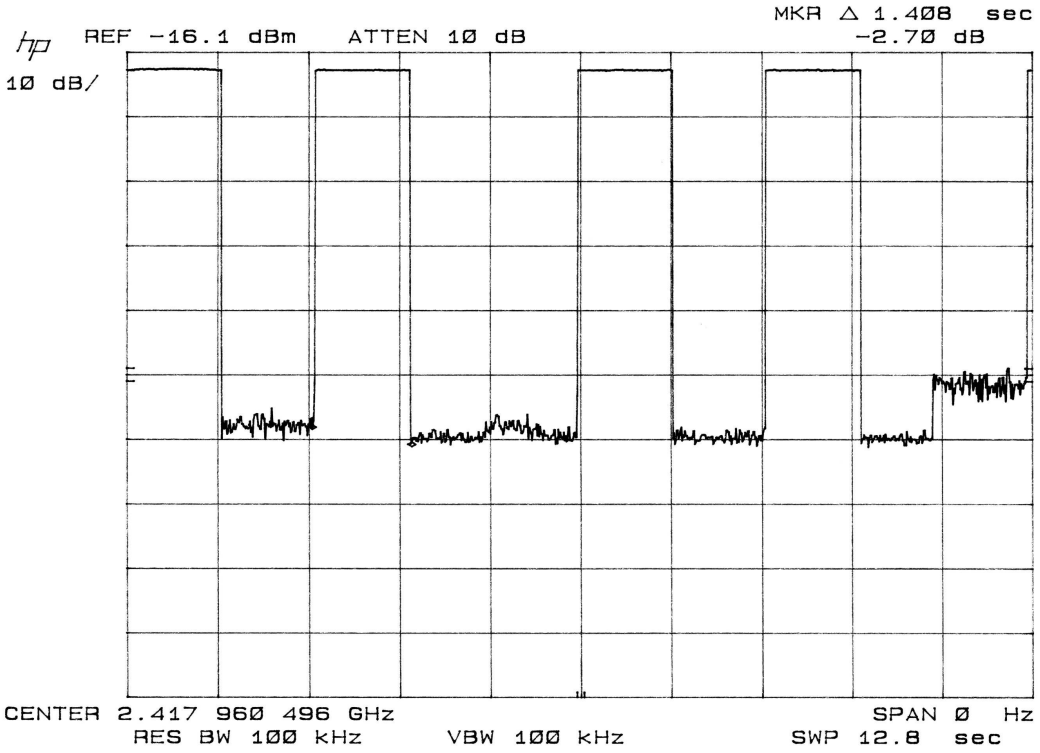
	5969 Robinson Avenue Riverside, CA 92503 (951) 637-2630 FAX (951) 637-2704	**Channel Occupancy**

DNB Job Number:	58074	Date: 22 Nov 2004	**Conformance Standard** FCC Part 15
Customer:	Leica Geosystems, Inc.		
Model Number:	GS20 (SR20)	Serial Number: Proto	
Description:	GPS Positioning System		**Clause** 15.247(a1,iii)

Environmental Conditions		
Ambient Temperature	Relative Humidity	Barometric Pressure
22 °C	30 %	102.4 kPa

EUT performed within the requirements of the applicable standard [X] Yes [ ] No *Tom Elders*

Center Frequency	Transmit Time	Duty Cycle	Occupancy	Limit	Pass/Fail
2417.96 MHz	5.6	.043	0.24	12.8	Pass



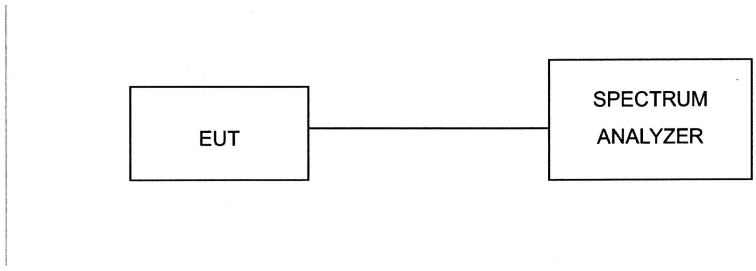
15.247 (a,2) 6 dB Emission Bandwidth

Test Procedure:

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measured with a 100kHz RBW and a 300kHz VBW. The 6dB bandwidth is defined as the total spectrum the power of which is higher than the peak power minus 6dB.

Requirement: The minimum 6dB bandwidth shall be at least 500kHz

EUT operating conditions:

The software provided by the client to enable the EUT to transmit continuously at the low, mid, and upper channels respectively.

Test Set Up: