

REPORT OF MEASUREMENTS

GENERAL

Applicant: Ademco

Device: 10.525 GHz Field Disturbance Sensor

Models: Quest 2260 SN, Quest 2000, Quest 2200, Quest 2235, Quest 2260

Serial Number: N/A

FCC ID: CFSQ2260SN

Input Power Requirements: 9 to 13 VDC, 8 mA (12 VDC Nominal)

Rule Section: Part 15, Subpart C, Section 15.245

TEST METHODS PERFORMED

15.207(a) AC Line Conducted Emissions

15.245 (b) Radiated Emissions, Fundamental

15.245 (b)(1) Radiated Emissions, Harmonics

15.245 (b)(3) Radiated Emissions, Band Edges

15.245 (b)(3) Radiated Emissions, Spurious Emissions, 30 MHz to 52.625 GHz

TEST RESULTS

15.207(a) A commercially available 12 VDC AC Adapter manufactured by AULT, Inc, Model 3212-000-001 was connected to the device's DC input and the AC line conducted emissions were measured from 450 kHz to 30 MHz. The device was found to comply with the 250 microVolt limit specified throughout the range of the test.

15.245 (a) The device is an intentional radiator used as a field disturbance sensor.

15.245 (b) The device operates within the 10.500 to 10.550 GHz frequency band. The field strength of the fundamental emission did not exceed 2500 millivolts per meter, average.

15.245 (b)(1) The device does not produce harmonic emissions below 17.7 GHz.

- 15.245 (b)(1)(i) The device is intended to be used only within buildings and the field strength of harmonic emissions did not exceed 25.0 millivolts per meter.
- 15.245 (b)(2) All radiated emissions measurements were extrapolated to the specified 3 meter test distance.
- 15.245 (b)(3) The emissions radiated outside of the specified frequency band of 10.500 to 10.550 GHz did not exceed the general radiated emission limits of 15.209.
- 15.245 (b)(4) The requirements of 15.35 for averaging pulsed emissions and limiting peak emissions were met.

NOTES

- 15.31 (a)(b) All measurements were made in accordance with ANSI C63.4:1992.
- 15.31 (c) The device does not use swept frequency techniques.
- 15.31 (d) All testing was performed on Retlif Testing Laboratories Ronkonkoma, NY test site which has been listed with the FCC.
- 15.31 (e) Variation of the radiated signal level of the fundamental frequency component was performed with the supply voltage varied between 85 and 115% of nominal (12 VDC). This was also performed at 85% of the minimum and 115% of the maximum rated input voltage range.
- 15.31 (f)(1) Where testing was performed at distances other than the specified test distance, the obtained readings were extrapolated to the specified test distance using an inverse linear-distance extrapolation factor (20dB / decade) for measurements between 30 MHz and 52.625 GHz.
- 15.31 (f)(5) The device was rotated 360° in order to maximize the radiated emissions. The maximum field strength observed has been reported.
- 15.31 (g) All consumer accessible controls were adjusted in order to maximize emissions.
- 15.31 (m) The device operates at a single frequency of 10.525 GHz.
- 15.31 (o) All emissions within 20 dB of the specified limits have been reported unless otherwise stated.
- 15.33 (a)(2) The device operates above 10 and below 30 GHz at a frequency of 10.525 GHz. Therefore radiated emissions measurements were made from 30 MHz to 52.625 GHz, the fifth harmonic.

DUTY CYCLE

The device transmits for 14 microseconds for every 420 microsecond period. Dividing the on time by the period yields a duty cycle of 3.33 % or a correction factor of 29.4 dB as shown below:

$$\begin{aligned} \text{On Time} &= 14 \mu\text{Sec} \\ \text{Period} &= 420 \mu\text{Sec} \\ \text{Duty Cycle} &= 14/420 = 0.0333 = 3.33\% \\ \text{Correction Factor(dB)} &= 20 \log 0.0333 = 29.4 \text{ dB} \end{aligned}$$

TEST DISTANCES

In order to obtain adequate system sensitivity at the harmonic frequencies of interest, it was necessary to perform certain measurements at a distance less than 3 meters. Care was taken to ensure that all measurements were taken in the far field region. The antenna was determined to be in the far field IFF:

$$d \geq 2 D^2 / \lambda$$

Where: d = Test Distance
 D = Largest Antenna Length
 λ = Wavelength at the Frequency of Interest

Solving for d yields the minimum test distances shown in the table below. Also shown is the actual test distance utilized.

Frequency GHz	Minimum Test Distance Meters	Actual Test Distance Meters
10.525	2.7	3
21.050	1.5	2
31.575	1.0	1
42.100	0.5	1
52.625	0.7	1

SPECTRUM ANALYZER DESENSITIZATION CONSIDERATIONS

Due to the nature of the emissions being measured, care was taken to ensure that the resolution bandwidth of the spectrum analyzer was adequate to provide accurate peak field strength measurements. The following formula was utilized:

$$\text{Pulse Desensitization } (\delta) = 20 \log (\text{Pulsewidth} * \text{bandwidth} * 1.5)$$

Setting the above equal to zero and utilizing the 14 microsecond pulsewidth yields a minimum required bandwidth of 47.6 kHz. The 1 MHz bandwidth specified in ANSI C63.4 was utilized for all fundamental and harmonic measurements.

TEST DATA
RADIATED EMISSIONS, FUNDAMENTAL
15.245 (b)

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor
 FCC ID: CFSQ2260SN
 APPLICANT: Ademco
 TEST METHOD: Radiated Emissions, Fundamental
 SPECIFICATION: FCC Part 15, Section 15.245 (b)
 PERFORMED BY: P. Lananna
 DATE: 01/23/01

Field Strength of Fundamental

Frequency GHz	Antenna Position H / V	EUT Orientation X / Y / Z	Meter Reading dBuV	Antenna Factor +dB	Corrected Reading dBuV/m		Converted Reading mV/m	Peak Limit 3 Meters mV/m
10.525	H-1.0	X	108.1	30.0	138.1		8035.3	25,000
	V-1.3	X	90.2	30.0	120.2		1023.3	25,000
	H-1.0	Y	99.5	30.0	129.5		2985.4	25,000
	V-1.0	Y	100.7	30.0	130.7		3427.7	25,000
	H-1.5	Z	90.4	30.0	120.4		1047.1	25,000
	V-1.5	Z	102.8	30.0	132.8		4365.2	25,000

Detector Function: Peak
 Test Distance: 3 Meters
 Resolution Bandwidth: 1 MHz
 Video Bandwidth: 3 MHz

Average Strength of Fundamental

Frequency GHz	Antenna Position H / V	EUT Orientation X / Y / Z	Peak Meter Reading dBuV	Duty Cycle Factor +dB	Corrected Reading dBuV/m		Converted Reading mV/m	Av. Limit 3 Meters mV/m
10.525	H-1.0	X	138.1	-29.4	108.7		272.3	2,500
	V-1.3	X	120.2	-29.4	90.8		34.7	2,500
	H-1.0	Y	129.5	-29.4	100.1		101.2	2,500
	V-1.0	Y	130.7	-29.4	101.3		116.1	2,500
	H-1.5	Z	120.4	-29.4	91.0		35.5	2,500
	V-1.5	Z	132.8	-29.4	103.4		147.9	2,500

Detector Function: Peak / Duty Cycle Applied to Obtain Average Levels
 Test Distance: 3 Meters
 Resolution Bandwidth: 1 MHz
 Video Bandwidth: 3 MHz

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor

FCC ID:CFSQ2260SN

APPLICANT: Ademco

TEST METHOD: Radiated Emissions, Fundamental, Input Voltage Variation

SPECIFICATION: FCC Part 15, Section 15.245 (b), 15.31(e)

PERFORMED BY: P. Lananna

DATE: 01/23/01

Input Voltage Variation

Frequency GHz	Test Voltage % Nominal	Test Voltage VDC	Meter Reading dBuV	Antenna Factor +dB	Corrected Reading dBuV/m		Converted Reading mV/m	Peak Limit 3 Meters mV/m
10.525	85% (Vmin)	7.65	108.1	30.0	138.1		8035.3	25,000
	85% (Vnom)	10.2	108.1	30.0	138.1		8035.3	25,000
	100% (Vnom)	12.0	108.1	30.0	138.1		8035.3	25,000
	115% (Vnom)	13.8	108.1	30.0	138.1		8035.3	25,000
	115% (Vmax)	14.95	108.1	30.0	138.1		8035.3	25,000

Detector Function: Peak
Test Distance: 3 Meters
Resolution Bandwidth: 1 MHz
Video Bandwidth: 3 MHz

TEST DATA
RADIATED EMISSIONS, HARMONICS
15.245 (b)(1)

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor
 FCC ID:CFSQ2260SN
 APPLICANT: Ademco
 TEST METHOD: Radiated Emissions, Harmonics
 SPECIFICATION: FCC Part 15, Section 15.245 (b)(1)
 PERFORMED BY: P. LANANNA
 DATE: 01/23/01

Field Strength of Harmonics - Peak

Frequency GHz	Antenna Position & Distance H / V	EUT Orientation X / Y / Z	Meter Reading dBuV	Antenna Factor dB	Test Distance Correction dB	Corrected Reading dBuV/m	Converted Reading uV/m	Peak Limit at 3 Meters uV/m
21.1	H - 1.0	X	55.3	20.7	-3.5	72.5	4,217.00	250000.0
	V - 1.0	X	52.3	20.7	-3.5	69.5	2,985.40	
	H - 1.0	Y	49.0	20.7	-3.5	66.2	2,041.70	
	V - 1.0	Y	51.7	20.7	-3.5	68.9	2,786.10	
	H - 1.0	Z	57.5	20.7	-3.5	74.7	5,432.50	
	V - 1.0	Z	49.9	20.7	-3.5	67.1	2,264.60	
31.6	H - 1.0	X	48.7	35.8	-9.5	75.0	5,623.40	
	V - 1.0	X	45.0	35.8	-9.5	71.3	3,672.80	
	H - 1.0	Y	46.3	35.8	-9.5	72.6	4,265.80	
	V - 1.0	Y	45.8	35.8	-9.5	72.1	4,027.20	
	H - 1.0	Z	50.5	35.8	-9.5	76.8	6,918.30	
	V - 1.0	Z	48.0	35.8	-9.5	74.3	5,188.00	
42.1	H - 1.0	X	32.0	39.9	-9.5	62.4	1,318.2*	
	V - 1.0	X	32.0	39.9	-9.5	62.4	1,318.2*	
	H - 1.0	Y	32.0	39.9	-9.5	62.4	1,318.2*	250000.0

	V - 1.0	Y	32.0	39.9	-9.5	62.4	1,318.2*	250000.0
	H - 1.0	Z	32.0	39.9	-9.5	62.4	1,318.2*	
	V - 1.0	Z	32.0	39.9	-9.5	62.4	1,318.2*	
52.6	H -1.0	X	32.0	41.1	-9.5	63.6	1,513.6*	
	V - 1.0	X	32.0	41.1	-9.5	63.6	1,513.6*	
	H - 1.0	Y	32.0	41.1	-9.5	63.6	1,513.6*	
	V -1.0	Y	32.0	41.1	-9.5	63.6	1,513.6*	
	H - 1.0	Z	32.0	41.1	-9.5	63.6	1,513.6*	
	V - 1.0	Z	32.0	41.1	-9.5	63.6	1,513.6*	250000.0

* Denotes Minimum Sensitivity of Measurement System.

Field Strength of Harmonics - Average

Frequency GHz	Antenna Position H / V	EUT Orientation X / Y / Z	Peak Reading uV/m	Duty Cycle %		Average Reading uV/m	Limit at 3 Meters uV/m
21.050	H -1.0	X	72.5	-29.4		142.9	25,000
	V-1.0	X	69.5	-29.4		101.2	
	H - 1.0	Y	66.2	-29.4		69.2	
	V - 1.0	Y	68.9	-29.4		94.4	
	H - 1.0	Z	74.7	-29.4		184.1	
	V - 1.0	Z	67.1	-29.4		76.7	
31.575	H - 1.0	X	75.0	-29.4		190.5	
	V - 1.0	X	71.3	-29.4		124.5	
	H - 1.0	Y	72.6	-29.4		144.5	25,000

	V - 1.0	Y	72.1	-29.4		136.5	25,000
	H - 1.0	Z	76.8	-29.4		234.4	
	V - 1.0	Z	74.3	-29.4		175.8	
42.100	H - 1.0	X	62.4	-29.4		44.7*	
	V - 1.0	X	62.4	-29.4		44.7*	
	H - 1.0	Y	62.4	-29.4		44.7*	
	V - 1.0	Y	62.4	-29.4		44.7*	
	H - 1.0	Z	62.4	-29.4		44.7*	
	V - 1.0	Z	62.4	-29.4		44.7*	
52.625	H - 1.0	X	63.6	-29.4		51.3*	
	V - 1.0	X	63.6	-29.4		51.3*	
	H - 1.0	Y	63.6	-29.4		51.3*	
	V - 1.0	Y	63.6	-29.4		51.3*	
	H - 1.0	Z	63.6	-29.4		51.3*	
	V - 1.0	Z	63.6	-29.4		51.3*	25,000

Detector Function: Peak / Duty Cycle Applied to Obtain Average Levels
 Test Distance: As Specified for each frequency
 Resolution Bandwidth: 1 MHz
 Video Bandwidth: 3 MHz

TEST DATA
RADIATED EMISSIONS, BAND EDGES
15.245 (b)(3)

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor
FCC ID:CFSQ2260SN
APPLICANT: Ademco
TEST METHOD: Radiated Emissions, Band Edges
SPECIFICATION: FCC Part 15, Section 15.245 (b)(3)
PERFORMED BY: P. Lananna
DATE: 01/23/01

The emissions at the upper and lower band edge, 10.5 and 10.550 GHz, was attenuated 50 dB below the level of the fundamental. See attached plot.

TEST DATA
OCCUPIED BANDWIDTH
15.245 (b)

TEST DATA
RADIATED EMISSIONS, SPURIOUS
15.245 (b)(3)

TEST SAMPLE: 10.525 GHz Field Disturbance Sensor
 FCC ID: CFSQ2260SN
 APPLICANT: Ademco
 TEST METHOD: Spurious Emissions, 30 MHZ to 52.625 GHz
 SPECIFICATION: FCC Part 15, Section 15.245 (b)(3)
 PERFORMED BY: P. LANANNA
 DATE: 01/23/01

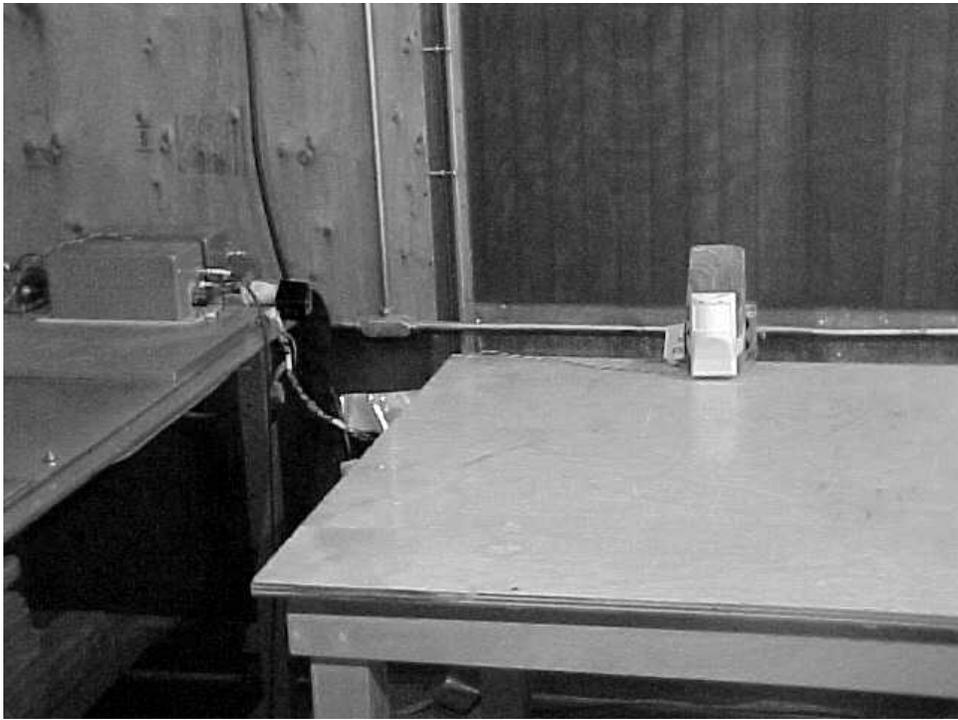
Frequency GHz	Antenna Distance Meters		Meter Reading dBuV	Antenna Factor +dB	Test Distance Correction -dB	Corrected Reading dBuV/m	Converted Reading uV/m	Limit at 3 Meters uV/m
0.030	3		-					100 QP
0.088	3		-					100 / 150
0.216	3		-					150 / 200
0.960	3		-					200 / 500
1.0	3		-					500
1.0	1		-					5000 Pk 500 Ave
52.625	1		-					5000 Pk 500 Ave

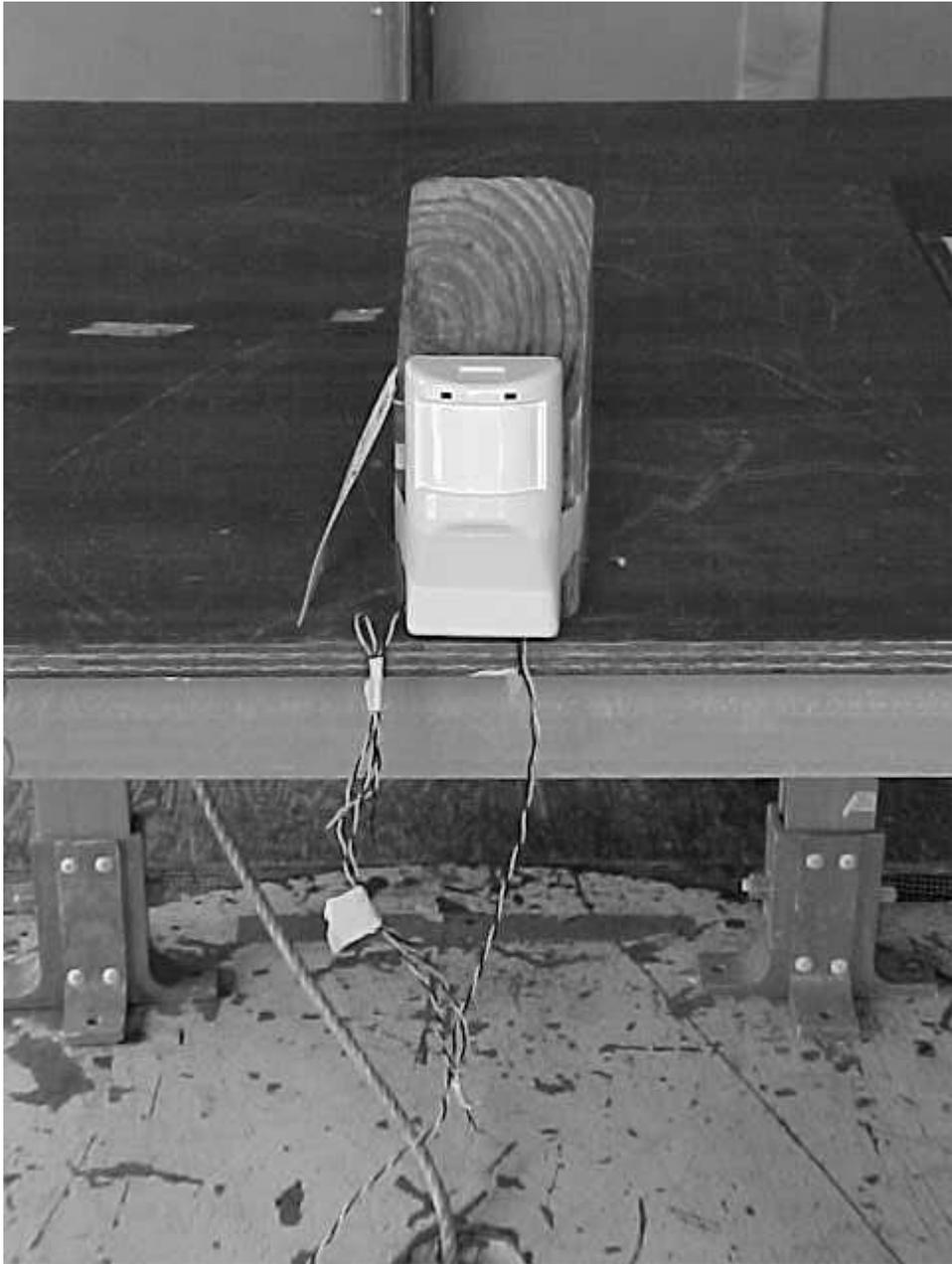
The frequency range was scanned from 30 MHZ to 52.625 GHz. No spurious emissions were observed within 20 dB of the specified limit in the 30 MHZ to 40 GHz range. No spurious emissions were observed within 10 dB of the specified limit above 40 GHz.

	For F < 1 GHz	For F > 1 GHz
Resolution Bandwidth:	100 kHz	1 MHz
Video Bandwidth:	300 kHz	3 MHz
Detector:	Quasi-Peak	Peak / Average

TEST DATA
AC LINE CONDUCTED EMISSIONS
15.207 (a)

TEST DATA
TEST SETUP PHOTOGRAPHS
Radiated and AC Line Conducted Emissions





EQUIPMENT LISTS

FCC 15.207, Conducted Emissions, 450 kHz to 30 MHz

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
078	LISN	Solar Electronics	10 kHz - 30 MHz	8028-50-TS24BN	04/27/2000	04/27/2001
091	Shielded Enclosure	Retlif	10 kHz - 1 GHz	Room 6	07/21/2000	07/21/2001
512	Graphics Plotter	Hewlett Packard	N/A	7470A	11/13/2000	11/13/2001
513	LISN	Solar Electronics	10 kHz - 30 MHz	8028-50-TS24BN	04/27/2000	04/27/2001
544	EMC Analyzer	Hewlett Packard	9.0 kHz - 1.8 GHz	8591EM	12/14/2000	12/14/2001
7017	Transient Limiter	Hewlett Packard	9kHz - 200MHz	11947A	04/25/2000	04/25/2001

FCC 15.245(a) Radiated Emissions, Fundamental and Harmonics

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
066	High Gain Horn Antenna	Microlab/FXR	8.2 GHz - 12.4 GHz	X638A	10/11/2000	10/11/2001
067	Open Area Test Site	Retlif	3 Meter	RNY	09/20/2000	09/20/2003
129E	High Gain Horn Antenna	Microlab/FXR	18 GHz - 26.5 GHz	K638A	09/18/2000	09/18/2001
129G	High Gain Horn Antenna	Microlab/FXR	26.5 GHz - 40 GHz	U638A	09/18/2000	09/18/2001
141	Spectrum Analyzer	Hewlett Packard	100 Hz - 40 GHz	8566B	08/03/2000	02/03/2001
141A	Graphics Plotter	Hewlett Packard	N/A	7470A	03/08/2000	03/08/2001
141B	Quasi-Peak Adaptor	Hewlett Packard	100 Hz - 1 GHz	85650A	08/02/2000	02/02/2001
420	Amplifier	Hewlett Packard	2.0 GHz - 18 GHz	11975A	09/29/2000	09/29/2001
421	Harmonic Mixer	Hewlett Packard	18 GHz - 26.5 GHz	11970K	09/29/2000	09/29/2001
421A	Harmonic Mixer	Hewlett Packard	26.5 GHz - 40 GHz	11970A	09/29/2000	09/29/2001
421B	Harmonic Mixer	Hewlett Packard	40 GHz - 60 GHz	11970U	09/29/2000	09/29/2001
543	Preamplifier	Hewlett Packard	1.0 GHz - 26.5 GHz	8449B	06/16/1999	06/16/2001

FCC15.209(a) Radiated Emissions, Spurious Case

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
066	High Gain Horn Antenna	Microlab/FXR	8.2 GHz - 12.4 GHz	X638A	10/11/2000	10/11/2001
067	Open Area Test Site	Retlif	3 Meter	RNY	09/20/2000	09/20/2003
128B	Double Ridge Guide	AEL	2 GHz - 18 GHz	H1498	06/27/2000	06/27/2001
129E	High Gain Horn Antenna	Microlab/FXR	18 GHz - 26.5 GHz	K638A	09/18/2000	09/18/2001
129G	High Gain Horn Antenna	Microlab/FXR	26.5 GHz - 40 GHz	U638A	09/18/2000	09/18/2001
133	Broadband Pre-Amplifier	Electro-Metrics	10 kHz - 1 GHz, 26dB	BPA-1000	06/13/2000	06/13/2001
141	Spectrum Analyzer	Hewlett Packard	100 Hz - 40 GHz	8566B	08/03/2000	02/03/2001
141A	Graphics Plotter	Hewlett Packard	N/A	7470A	03/08/2000	03/08/2001
141B	Quasi-Peak Adaptor	Hewlett Packard	100 Hz - 1 GHz	85650A	08/02/2000	02/02/2001
206B	6.0 dB Attenuator	Texscan	0 - 1.0 GHz	FP-50 - 6 dB	06/13/2000	06/13/2001
420	Amplifier	Hewlett Packard	2.0 GHz - 18 GHz	11975A	09/29/2000	09/29/2001
421	Harmonic Mixer	Hewlett Packard	18 GHz - 26.5 GHz	11970K	09/29/2000	09/29/2001
421A	Harmonic Mixer	Hewlett Packard	26.5 GHz - 40 GHz	11970A	09/29/2000	09/29/2001
421B	Harmonic Mixer	Hewlett Packard	40 GHz - 60 GHz	11970U	09/29/2000	09/29/2001
523	Biconilog	Electro-Mechanics	26 - 2000 MHz	3142B	06/08/2000	06/08/2001
543	Preamplifier	Hewlett Packard	1.0 GHz - 26.5 GHz	8449B	06/16/1999	06/16/2001
617	Interference Analyzer	Electro-Metrics	10 kHz - 1 GHz	EMC-30	01/17/2000	01/27/2001