A

June 15, 2000

re: ea97821

To Whom It May Concern:

SUBJECT:

The ‘final report’ submitted on 14 June 2000 contained minor editorial errors and a missing Trademark. Please find attached a revised final report.

Sincerely,

Robert F. Martin
Sr. Technical Manager
Intertek Testing Services

70 CODMAN HILL RD
BOXBOROUGH MA 01462
USA

Emissions Testing
Performed
on the
Harmonix Corporation
Communications Transceiver
Model: EK6HOC3JH-SGM

To

FCC Part 15 Subpart C, 15.255

Date of Test: May 24, 25 & 26, 2000

Report Number: J20013614
Revised 15 June 2000

Contact: Mr. Dana Wheeler

Table of Contents

I – Introduction and Summary

TO: Mr. David Russell

FROM: Michael J. Peters, Senior Project Engineer
DATE: May 24, 25 & 26, 2000
JOB #: J20013614

RE: Emissions Testing Performed on the Communications Transceiver, Model: EK6HOC3JH-SGM

On May 24, 25 & 26, 2000 we tested the Communications Transceiver, Model: EK6HOC3JH-SGM to determine if it was in compliance with the FCC Part 15 , Subpart C, Section 15.255. A Production version of the sample was received on Wednesday, May 24, 2000 in good condition. We found that the unit met the Part 15 requirements when tested as received.

The following table presents the results of testing at typical frequencies. Details can be found in the referenced sections of this report.

Test	Frequency (MHz)	Measurement	Requirement	Pass/ Fail	Section of FCC Rules	Section of Test Report
Fundamental Power Density	61,842.2	16.7pk/6.7ave uW/cm^2	18pk/9ave uW/cm^2	P	15.255(b)(2)	II
Rectricted Band Emissions	30-40000; >40000	Table 1-3 Section X		P	15.209/15.205	X
Line-conducted Emissions	0.45-30	Table 4 Section X		P	15.207	X
Antenna Conducted Emissions – Receiver	No removable antenna					
Antenna Conducted Emissions – Transmit	No removable antenna					
Frequency Deviation Temperature	59,162,828,479	+389,014Hz - 476,541Hz	10 MHz	P	15.255(f)	XII
Frequency Deviation Voltage	59,162,828,479	+120,230Hz -266,038Hz	10MHz	P	15.255(f)	XII

Modifications Required for Compliance

The following modifications were installed during compliance testing in order to bring the product into compliance (Please note that this list does not include changes made specifically by Harmonix Corporation prior to compliance testing):

1) A ferrite sleeve (Fair-Rite P/N: 0443164251) was placed around the power cord, internal t the device, in a straight through configuration.
2) 0.022 uF Y-capacitors were installed from each line to ground at the power input isolation block.
3) 0.1 uF X-capacitor was installed across each line at the power input isolation block.
4)

In summary, this report confirms that the Model: EK6HOC3JH-SGM is compliant with the FCC Part 15, Subpart C Section 15.255 requirements when production units conform to the initial sample. Please address all questions and comments concerning this report to Michael J. Peters, Senior Project Engineer.

II – Technical Requirements

15.1 Scope

The device is an intentional radiator intended to operate in accordance with 15.255 Operation in the band 59.05 to 64.0 GHz Of Part 15 of the FCC rules without a license.

15.15 General Technical Requirements

There are no controls accessible to the user that would cause the device to operate in violation of the FCC rules.

15.27 Special Accessories

No special accessories are necessary to meet compliance requirements.

15.37 Measurement Standards

The measurement procedures specified by ANSI C63.4:1992 were used to setup and test the device. See Section IV of this test report for detailed description of the test procedure.

15.33 Frequency range of measurement

The device was scanned for spurious and harmonic emissions from 30 MHz to 200 GHz.

15.35 Measurement detector functions and bandwidth

The following table illustrates the detector functions and bandwidth used to test the device.

No deviations to the following were made.

Frequency Range	Measurement Detector	Measurement Bandwidth
450 kHz to 30 MHz	Quasi-Peak	9 kHz
30 MHz to 1000 MHz	Quasi-Peak	120 kHz
1000 MHz to 200 GHz	Average	1 MHz

Note: The quasi-peak detector meets the requirements of CISPR 16.
An averaging factor was not used for the device.

15.25 Transition Provisions

Transition provisions were not applied to the device.
A separate receiver is not being certified with the device.
The device does not operate in the band 902-905 MHz.

15.201 Certification

The device is required to be certified in accordance with Part 2 of the FCC rules, Subpart J.

15.203 Antenna Requirements

The antenna is integral to the device and cannot be readily removed or replaced by the end-user.

15.204 External Radio Amplifier

The device is not an amplifier.

15.205 Restricted bands of operation

The emissions requirements below 40 GHz are the same as the general requirements of 15.209 which is the same as the requirement for emissions in restricted bands. Other than the fundamental emission, no other emissions were detected above 40 GHz.

Below 1000 MHz a quasi-peak detector was employed to measure emissions
Above 1000 MHz, peak measurements were performed and compared to the average requirement.

15.207 Conducted Limits

The device complies with the conducted emissions requirements when modified as described in the introduction.

15.209 Radiated emission limits; general requirements

Below 40 GHz, the device is required to comply with the general emissions requirements. All measurements below 40 GHz were compared with the requirement.

Detailed description of operation

The transmitter was tested using worst-case OC3 and OC12 modulation. The modulation was present during radiated emissions testing. For frequency stability and output power test, the modulation signal was removed and the un-modulated carrier was measured.

Justifications

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in C63.4 (1992).

The worst case bit sequence was applied during test.

For maximizing emissions, the system was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the radiated emissions data contained in this report

Radiated emissions were tested in the range of 30 MHz to 2.0 GHz.

For simplicity of testing, the unit was wired to transmit continuously.

15.255 Operation in the band 59.0 – 64.0 GHz

Restrictions on Operations

(a) Operation under the provisions of this section is not permitted for the following products:

(1) Equipment used on aircraft or satellites.

(2) Field disturbance sensors, including vehicle radar systems, unless the field disturbance sensors are employed for fixed operation. For the purposes of this section, the reference to fixed operation includes field disturbance sensors installed in fixed equipment, even if the sensor itself moves within the equipment.

The device is a low power communication device. It does not fall under either category 1) or 2) above.

(d) Only spurious emissions and transmissions related to a publicly-accessible coordination channel, whose purpose is to coordinate operation between diverse transmitters with a view towards reducing the probability of interference throughout the 59-64 GHz band, are permitted in the 59.0-59.05 GHz band.

The device does not operate in the 50.0 to 59.05 band. The lowest carrier frequency is 59.16 GHz.

Note: The 59.0-59.05 GHz is reserved exclusively for a publicly-accessible coordination channel. The development of standards for this channel shall be performed pursuant to authorizations issued under Part 5 of this chapter.

Field Strength

The following table summarized the field strength requirements for the devices operating in this band:

Type of Transmitter	Power Density		Test Distance (meters)
	Average(3) (mW/cm^2)	Peak (2) (mW/cm^2)	
NOT Field Disturbance Sensors	9	18	3
Fixed Field Disturbance Sensors (BW < 500 MHz) Frequency Range - 61.0 to 61.5 GHz Frequency Range – 59.0 to 61.0 & 61.5 to 64 GHz	 9 0.009	 18 0.018	 3 3
Fixed Field Disturbance Sensors Not operating under Paragraph 15.255 (b)(2)	 0.1 mW(1)	 9	 3

1) Output Power measurement (distance not applicable)

2) Peak power density shall be measured with an RF detector that has a detection bandwidth that encompasses the 59-64 GHz band and has a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

3) The average emission limits shall be calculated, based on the measured peak levels, over the actual time period during which transmission occurs.

The following Table summarize the results of field strength testing:

Antenna	Fundamental Frequency (MHz)	Measurement (mW/cm^2)		Limit (mW/cm^2)		Pass/ Fail	Table #	Test Distance (m)
		Peak	Avg	Peak	Avg			
Patch	59,162.0	2.3	1.1	18	9	Pass	1	3
Patch	61,380.0	3.6	1.4	18	9	Pass	1	3
Patch	63,597.0	3.0	1.0	18	9	Pass	1	3
Parabola	59,845.7	16.0	6.1	18	9	Pass	2	3
Parabola	61,842.2	16.7	6.7	18	9	Pass	2	3

Spurious Emissions

(b) Limits on spurious emissions:

(1) The power density of any emissions outside the 59.0-64.0 GHz band shall consist solely of spurious emissions.

(2) Radiated emissions below 40 GHz shall not exceed the general limits in Section 15.209 of this part.

(3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm^2 at a distance of 3 meters.

(4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

Spurious Emissions are summarized on Tables 1 through 3 in Section X of this report.
No emissions exceed the limits after modifications.

No emissions other than the fundamental were found >40GHz

Peak Output Power

(e) Except as specified below, the total peak transmitter output power shall not exceed 500 mW.

(1) Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter output power to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g. for frequency hopping devices).

(2) Peak transmitter output power shall be measured with an RF detector that has a detection bandwidth that encompasses the 59-64 GHz band and that has a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

(3) For purposes of demonstrating compliance with this paragraph, corrections to the transmitter output power may be made due to the antenna and circuit loss.

The output power of the transmitter is calculated based on the peak field strength readings from the previous section:

Antenna gain is calculated as:

$G = 4\pi A_e / \lambda^2$

Where,

G – Numeric gain, A_e – effective antenna area, λ - wavelength in meters

Using the actual area yields worst-case results (3”x5” = 0.0097 meters)

$G = 4\pi * (0.0097) / (300/59{,}162)^2 = 4{,}740.5$ (36.8 dB)

The Power is derived from the field strength by the following formula:

$P = (E*r)^2 / 30*G$

Where,

E – Field Strength in V/m, r – measurement distance in meters

The field strength is related to power density (s) by $s = E^2 / 377$

$P = ((377*s)^{1/2} * r)^2 / 30 * G$

$= ((377*2.3)^{1/2} * 3)^2 / 30 * 4{,}740.5 = 0.0549$ watts or 54.9 mW

Frequency Stability

(f) Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range -20 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

Since there is not specific frequency deviation tolerance other than the emission must stay in the band, the maximum frequency deviation is determined as follows using the transmitters side-band frequency:

Maximum Frequency Deviation = Side-band Frequency – Band Start Frequency
= 59010.0 – 59.0 = ±10 MHz

For the highest frequency, the separation from the band edge to the side-band frequency is greater so the 10 MHz will be used there as well.

Measurement results are found in Section XII of this test report.

Human Exposure to RF Fields

(g) Regardless of the power density levels permitted under this section, devices operating under the provisions of this section are subject to the radio frequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093 of this chapter, as appropriate. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

Statement of compliance can be found in the attached document “Part 15MPE.doc”.

Prohibition on external Phase-Locking Inputs

(h) Any transmitter that has received the necessary FCC equipment authorization under the rules of this chapter may be mounted in a group installation for simultaneous operation with one or more other

transmitter(s) that have received the necessary FCC equipment authorization, without any additional equipment authorization. However, no transmitter operating under the provisions of this section may be equipped with external phase-locking inputs that permit beam-forming arrays to be realized.

No provisions exist for external phase locking of this device.

Transmitter Identification Requirement

(i) Within any one second interval of signal transmission, each transmitter with a peak output power equal to or greater than 0.1 mW or a peak power density equal to or greater than 3 nW/cm 2 ,as measured 3 meters from the radiating structure, must transmit a transmitter identification at least once. Each application for equipment authorization must declare that the equipment contains the required transmitter identification feature and must specify a method whereby interested parties can obtain sufficient information, at no cost, to enable them to fully detect and decode this transmitter identification information. Upon the completion of decoding, the transmitter identification data block must provide the following fields.

1. FCC Identifier, which shall be programmed at the factory.

2. Manufacturer's serial number, which shall be programmed at the factory.

3. Provision for at least 24 bytes of data relevant to the specific device, which shall be field programmable. The grantee must implement a method that makes it possible for users to specify and update this data. The recommended content of this field is information to assist in contacting the operator.

Discussion of the transmitter identification feature is described in the attached documents "FCC Identifier.doc" and "FCC Letter.pdf".

Part 2

2.201 Emission Modulation and transmission characteristics

The emission designator is determined as follows

Bandwidth is measured to be:

The main carrier modulation is pulse modulation using a sequence of un-modulated pulses. Therefore the first symbol is '5'.

The modulating signal is a single channel of digital information without the use of a modulating sub-carrier. Therefore the second symbol is '2'.

The type of information transmitted is a combination of all information types described in FCC section 2.201. Therefore the third symbol is 'W'

The emissions designator is:

'52W'

2.1041 Measurement Procedures

Only the measurement procedures of Part 15 are required for this device. The device was not evaluated to the requirements of 2.1046 through 2.1057.

2.1091 Radiofrequency radiation exposure evaluation: Mobile Devices

A Maximum Radiated Exposure evaluation statement, with supporting calculations is contained in the attachment "Part 15 MPE.doc".

2.1093 Radiofrequency radiation exposure evaluation: Portable Devices

The device does not meet the definition of a portable device (That is it is not intended to operate within 20 cm of a persons body, it is used in a furnace and is magnetically activated inside the furnace) and is

therefore exempt from the requirements of this section.

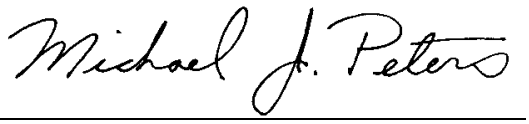
III - Attestation

LABORATORY MEASUREMENTS

Pursuant To
Part 15, Subpart C
For
Intentional Radiators

Company Name:	Harmonix Corporation
Address:	1755 Osgood Street Andover, MA 01845
Model:	EK6HOC3JH-SGM
Date of Test(s):	May 24, 25 & 26, 2000
Test Site Location:	INTERTEK TESTING SERVICES NA INC. 70 Codman Hill Road Boxborough, MA 01719
Site:	3C

We attest to the accuracy of this report:



Signature	Signature
Michael J. Peters	Robert F. Martin
Testing Performed By:	Reviewer
Senior Project Engineer	Chief EMC Engineer
Title	Title

IV - Site Description

Introduction

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C, General Requirements.

A. **Test Set-Up**: The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 (1992).

1. The test site is a Plastic/Fiberglass structure with a groundplane. The site has attenuation characteristics which meet the requirements of ANSI C63.4 (1992). Information on the site has been filed with the FCC as required by Rule 2.948. The address of the site is 70 Codman Hill Road, Boxborough, MA 01719.

2. Power to the site is nominal line voltage of 117 V_{AC} and 230 V_{AC}, 60 Hz.

3. The equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the groundplane. During the radiated emissions test, the turntable is rotated 360 degrees and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The antenna height and polarization are also varied during the search for maximum signal levels. The height of the antenna is varied from one meter to four meters. Body-worn, hand-held and small portable devices are mounted on a non-conductive box and emissions are investigated on three orthogonal axis.

4. Detector function for radiated emissions is in peak or quasi-peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings according to the following formula:

   Averaging Factor in dB = 20 LOG (duty cycle)

   The time period over which the duty cycle is measured is 100 msec. The worst-case (highest percentage on) duty cycle is used and described specifically in the data section. The duty cycle is measured by placing the spectrum analyzer in zero scan (receiver mode) and linear mode at maximum bandwidth (3 MHz at 3 dB down) and viewing the resulting time domain signal output from the analyzer on a Tektronix 465 Oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities.

5. Antennas used below 1000 MHz were EMCO Model 3142 Biconolog Antennas and Compliance Designe Inc. Model A100 tuned Dipole Antennas. For measurements between 1000 MHz and 18000 MHz above 1 GHz, an EMCO Model: 3115 Horn Antenna is used. The Antennas used are listed in the Test Equipment Summary.

6. The field strength measuring equipment used included:

V - Measurement Equipment

The following equipment was used to make measurements for emissions testing:

Description	Manufacturer	Model	Serial #	Cal Due
ANTENNA	EMCO	3142	9711-1223	10/12/2000
RECEIVER	HEWLETT PACKARD	8542E	3625A00188	01/19/2001
RF FILTER	HEWLETT PACKARD	85420E	3427A00177	01/19/2001
PREAMPLIFIER	MITEQ			
MIXER, 140-220GHZ	MILLITECH	MSH-05-8FDCSN 8807	017	
MIXER, 50-75GHZ	MILLITECH	MHB-15-R00W0 8203	019	
MIXER, 33-50GHZ	MILLITECH	MHB-22-R00W0 8203	013	
MIXER, 110-170GHZ	MILLITECH	MHB-06-R00WN 8807	022	
MIXER, 75-110GHZ	MILLITECH	MHB-10-R00W0 8203	015	
LISN	SOLAR ELECTRONICS	8012-50-R-24-BNC	865575	04/20/2001
HORN ANTENNA	EMCO	3115	9602-4675	11/04/2000

7. The frequency range to be scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency, or 40 GHz, whichever is lower. For line-conducted emissions, the range scanned is 450 kHz to 30 MHz.

8. The EUT is warmed up for 15 minutes prior to the test. AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new battery is used.

9. Conducted measurements were made as described in ANSI C63.4 (1992). An IF bandwidth of 9 kHz is used, and peak or quasi-peak detection is employed.

10. The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application No. 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report. Above 1000 MHz, a bandwidth of 1 MHz is generally used.

11. Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz (where no preamplifier is used), signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

12. For measurements made in the 9 kHz to 30 MHz range, a distance of 30 meters was used unless a good signal-to-noise ratio could not be obtained. In that case, a closer distance was used and that distance is so marked in the data table.

VI – Summary of Equipment Under Test

1	**Manufacturer**:	Harmonix Corporation
2	**Grantee**:	Harmonix Corporation
3	**Model No.**:	EK6HOC3JH-SGM
4	**Trade Name**:	GigaLINK™
5	**Serial No.**:	
6	**Date of Test**:	May 24, 25 & 26, 2000
7	**Frequencies to which device can be tuned**:	59.16 to 63.60 GHz
8	**Can customer tune device?**	NO
9	**Detailed description of operation pursuant to 15.209**:	See Section II - 15.209
10	**Applicable emissions limits**:	15.255, 15.209
11	**Additional Comments**:	

VII - Configuration Information

Equipment Under Test: Communications Transceiver

Model: EK6HOC3JH-SGM

Serial No.:

FCC Identifier:

Support Equipment:

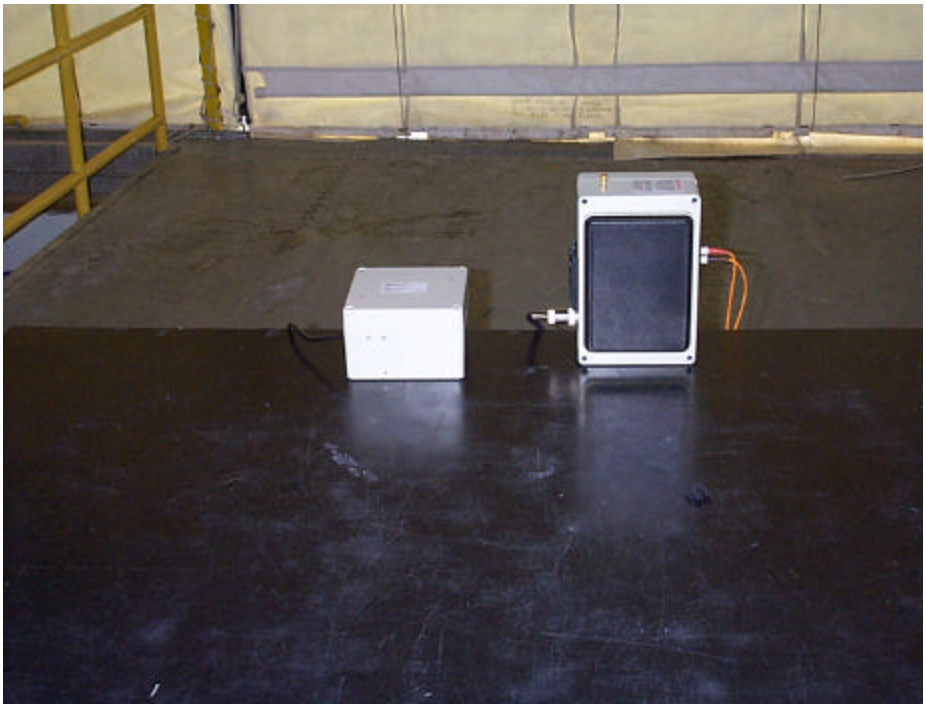
COMMS Analyzer		
* Remotely Located *	Manufacturer:	Hewlett Packard
	Model:	37717C
	Serial Number:	GB00000407
OC3port Plus		
* Remotely Located *	Manufacturer:	Fluke
	Model:	OC3P2S
	Serial Number:	7468001
ITE Power Supply		
* Remotely Located *	Manufacturer:	Ault Inc
	Model:	SW 108
	Serial Number:	Not Labeled
Power Supply		
	Manufacturer:	Harmonix
	Model:	Not Labeled
	Serial Number:	Not Labeled

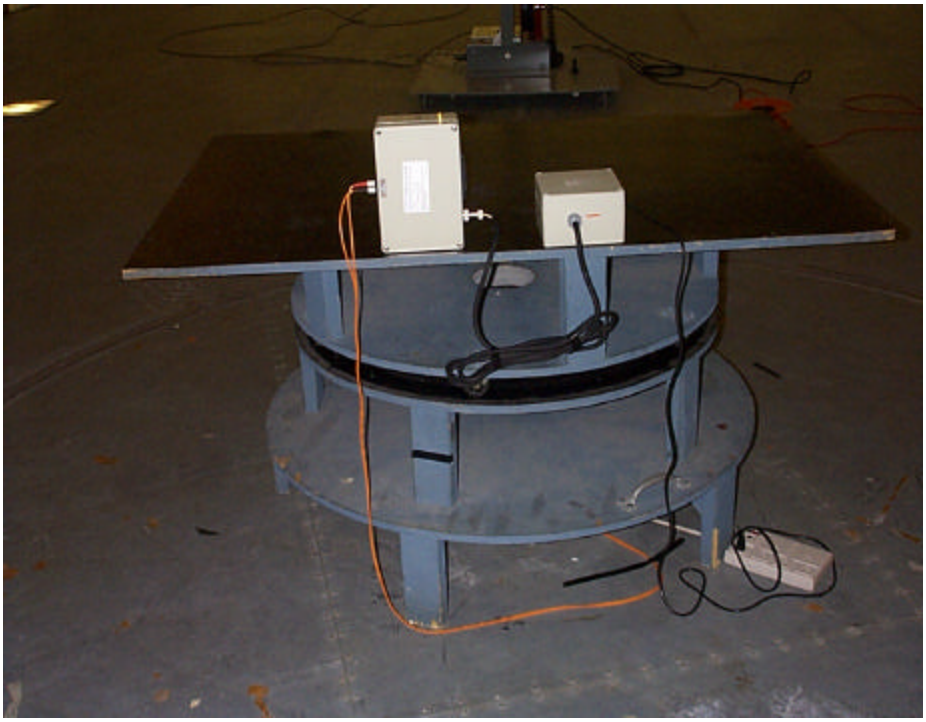
Cables:

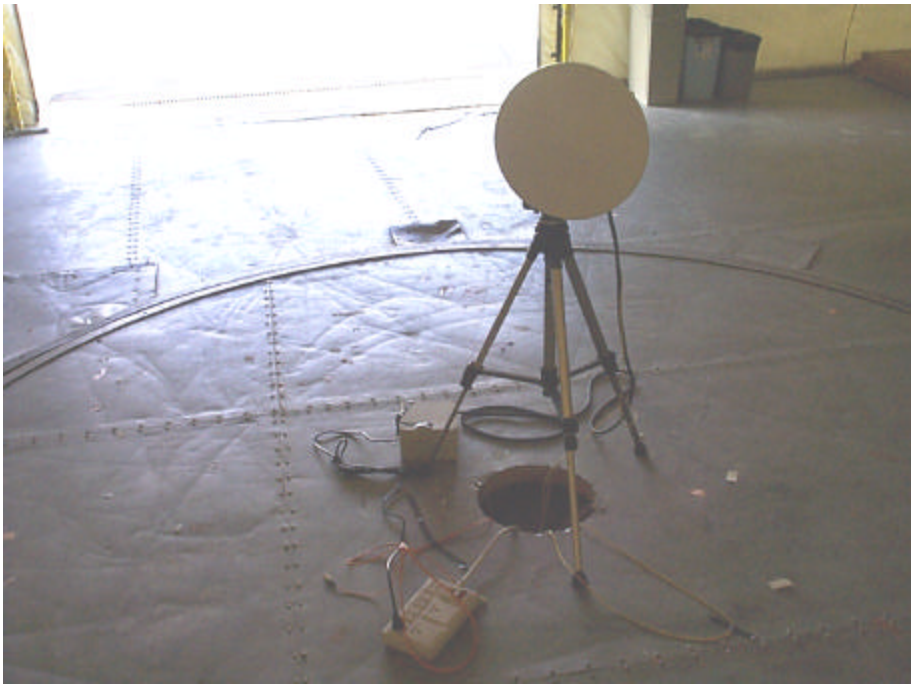
QTY	Description	Shield Description	Hood Description	Length (m)
2	Fiber-optic	Unshielded	Plastic	5
1	Power Cord	Unshielded	Plastic	2

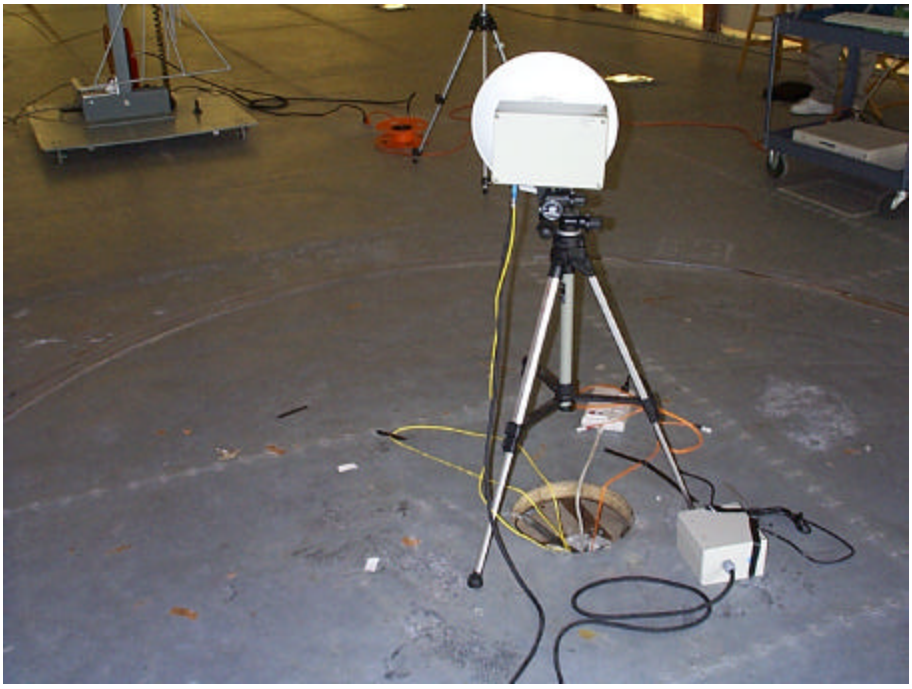
VIII - Configuration Photographs

Worst-Case Radiated Emissions

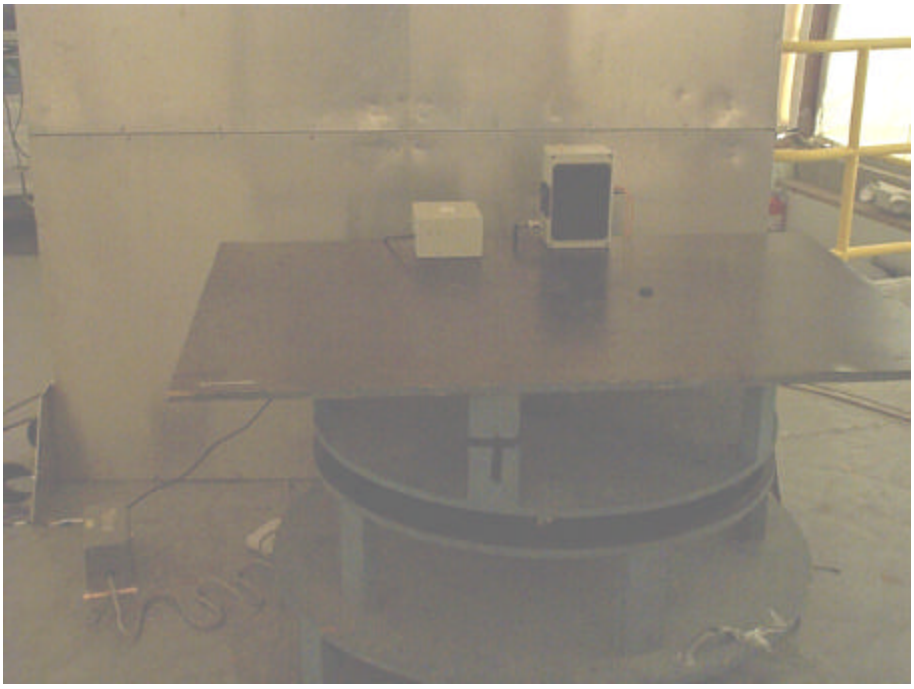




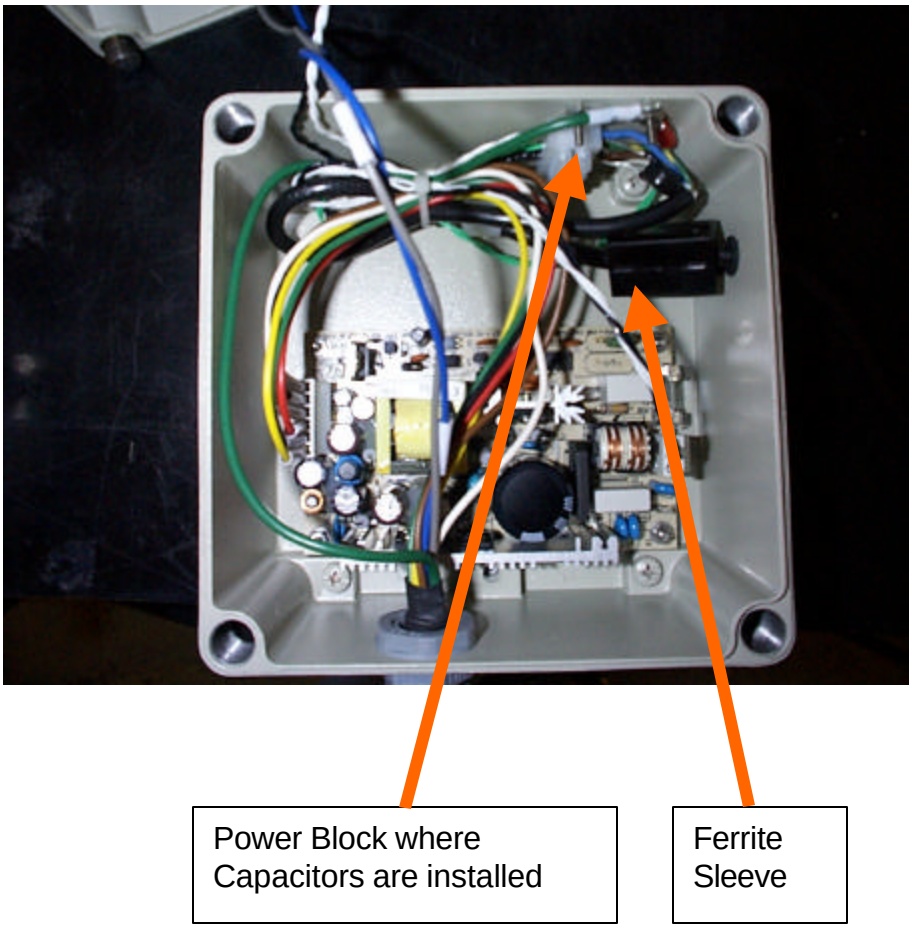




Worst-Case Line-Conducted Emissions



Photograph of Ferrite Sleeve Modification:



IX - Sample Calculation

The following is how net field strength readings were determined:

NF = RF + AF + CF + PF + DF

Where,

NF = Net Reading in dBµV/m
RF = Reading from receiver in dBµV/m
AF = Antenna Correction Factor in dB
CF = Cable Correction Factor in dB
PF = Preamplifier Correction Factor in dB
DF = Distance Factor in dB (using 20 dB/decade), from 3 to 1 meters 10.5 dB was added for measurements performed at 1 meter

To convert from dBµV/m to µV/m or mV/m the following was used:

$UF = 10^{(NF / 20)}$

Where,

UF = Net Reading in µV/m

MF = UF / 1000

Where,

MF = Net Reading in mV/m

Example:
For the fundamental field strength measurement at [Frequency] (distance = [d] meters) see table [x].

NF = NF = RF + AF + CF + PF + DF

$UF = xx^{(xx.x\ dB\mu V / 20)}$ = yyy,yyy µV/m

MF = yyy,yyy µV / 1000 = zz.z mV/m

X - Data Tables

Radiated Emissions / Interference

Table: 1

Company: **Harmonix**
Model: **Patch Antenna - SGM**
Job No.: **J20013614**
Date: 05/24/00
Standard: FCC Part 15, 15.255
Class: None Group: None
Notes: RBW=1MHz, VBW=7MHz

Tested by: Michael Peters
Location: Site 3C
Detector: TEK 2784
Antenna: Mixer + Horn (33-200)
PreAmp: None
Cable(s): 1.5 m High Frequency
Distance: **3.000** meters

	Ant. Pol. (V/H)	Frequency MHz	Reading dBm	Antenna Factor dB(1/m)	Cable Loss dB	Mixer Factor dB	Net dB(uV/m)	Net (uW/cm^2)	Limit (uW/cm^2)	Pass/ Fail
	MID Channel									
av	h	61380.090	61.4	40.945	0.8	23.0	126.1	1.092	9.0	Pass
pk		61380.090	64.7	40.9	0.8	23.0	129.4	2.334	18.0	Pass
	h	61224.530	34.6	40.9	0.8	23.0	99.3	0.002	9.0	Pass
	h	61069.160	34.2	40.9	0.8	23.0	98.9	0.002	9.0	Pass
	h	61516.500	FALSE	41.0	0.8	23.0				
	h	61540.000	37.6	41.0	0.8	23.0	102.4	0.005	9.0	Pass
	h	60913.450	26.0	40.9	0.8	23.0	90.7	0.000	9.0	Pass
	Low Channel									
av	h	59162.060	63.7	40.6	0.8	22.0	127.1	1.368	9.0	Pass
pk	h	59162.060	67.9	40.6	0.8	22.0	131.3	3.599	18.0	Pass
	h	59010.000	34.8	40.6	0.8	22.0	98.2	0.002	9.0	Pass
	h	59321.000	35.6	40.6	0.8	22.0	99.0	0.002	9.0	Pass
	High Channel									
av	h	63597.860	59.7	41.3	0.8	24.0	125.8	0.998	9.0	Pass
pk	h	63597.860	64.5	41.3	0.8	24.0	130.6	3.013	18.0	Pass
	h	63573.140	32.3	41.2	0.8	24.0	98.3	0.002	9.0	Pass
	h	63442.300	33.4	41.2	0.8	24.0	99.4	0.002	9.0	Pass
	Parabola Antenna May 25, 2000									

Radiated Emissions / Interference

Table: 2

Company: **Harmonix**
Model: **Parabolic Antenna - SGM**
Job No.: **J20013614**
Date: 05/25/00
Standard: FCC Part 15, 15.255
Class: None Group: None
Notes: RBW=1MHz, VBW=7MHz

Tested by: Michael Peters
Location: Site 3C
Detector: TEK 2784
Antenna: Mixer + Horn (33-200)
PreAmp: None
Cable(s): 1.5 m High Frequency
Distance: **3.000** meters

	Ant. Pol. (V/H)	Frequency MHz	Reading dBm	Antenna Factor dB(1/m)	Cable Loss dB	Mixer Factor dB	Net dB(uV/m)	Net (uW/cm^2)	Limit (uW/cm^2)	Pass/ Fail
	HIGH Channel									
	V	62024.000	FALSE	41.0	0.8	23.0				
av	V	61842.220	68.8	41.0	0.8	23.0	133.6	6.090	9.0	Pass
pk	V	61842.220	73.0	41.0	0.8	23.0	137.8	16.019	18.0	Pass
	V	62464.100	45.0	41.1	0.8	23.0	109.9	0.026	9.0	Pass
	V	61220.100	45.4	40.9	0.8	23.0	110.1	0.027	9.0	Pass
	LOW Channel									
av	V	59845.700	70.5	40.7	0.8	22.0	134.0	6.701	9.0	Pass
pk	V	59845.700	74.5	40.7	0.8	22.0	138.0	16.736	18.0	Pass
	V	60467.560	50.0	40.8	0.8	22.0	113.6	0.061	9.0	Pass
	V	59223.350	48.8	40.6	0.8	22.0	112.2	0.044	9.0	Pass

Radiated Emissions / Interference

Table: 3

Company: **Harmonix**
Model: **Patch Antenna - SGM**
Job No.: **J20013614**
Date: 05/24/00
Standard: FCC15
Class: B Group: None
Notes: Radiated Emissions from 30 MHz to 40 GHz
RBW 120 kHz < 1 GHz, 1MHz > 1GHz

Tested by: Michael Peters
Location: Site 3C
Detector: HP 8542E
Antenna: LOG1 7-2-99 H10
PreAmp: None
Cable(s): 3C-3m 3-1-00
Distance: **3** meters

	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	
bb	V	35.570	25.4	15.1	0.3	0.0	0.0	40.8	40.0	+0.8	*
	V	39.750	20.4	12.7	0.3	0.0	0.0	33.4	40.0	-6.6	
	Installed a 1/4" ferrite on the power (to AC mains) internal to the unit.										
bb	V	35.500	21.5	15.1	0.3	0.0	0.0	36.9	40.0	-3.1	
bb	V	56.350	19.6	7.8	0.5	0.0	0.0	27.9	40.0	-12.1	
bb	V	74.300	14.7	6.5	0.1	0.0	0.0	21.3	40.0	-18.7	
	V	155.710	20.7	8.7	0.5	0.0	0.0	29.9	43.5	-13.6	
	V	155.250	21.5	8.7	0.5	0.0	0.0	30.7	43.5	-12.8	
	V	137.600	14.4	7.4	0.4	0.0	0.0	22.1	43.5	-21.4	
	V	200.550	13.9	9.9	1.0	0.0	0.0	24.8	43.5	-18.7	
	V	181.250	16.9	9.9	0.8	0.0	0.0	27.6	43.5	-15.9	
	V	234.000	13.5	11.7	1.2	0.0	0.0	26.4	46.0	-19.6	
	V	267.380	13.7	12.7	1.3	0.0	0.0	27.7	46.0	-18.3	
	V	401.640	8.1	16.3	1.7	0.0	0.0	26.1	46.0	-19.9	
bb	V	3860.000	41.9	33.5	1.9	22.1	9.5	45.7	54.0	-8.3	
	V	28500.000	38.6	47.0	4.1	34.9	9.5	45.3	54.0	-8.7	

Conducted Emissions / Interference

Table: 4

Company: Harmonix
Model: Patch Antenna - SGM
Job No.: J20013614
Date: 05/25/00
Standard: FCC15
Class: B Group: None
Notes:
System Loss: Includes the Cable and LISN loss.

Tested by: Michael Peters
Location: Site 3C
Detector: HP 8542E
Cable(s): 3C-3m 3-1-00
Limiter: yes

INTIAL

Frequency MHz	Reading Side A dB	Reading Side B dB	Attenuator Factor dB	System Loss dB	Quasi-Peak Net dB(uV)	Quasi-Peak Limit dB(uV)	Quasi-Peak Margin dB	
0.483	31.1		20.0	0.9	52.0	48.0	+4.0	*
0.690	25.3		20.0	0.9	46.2	48.0	-1.8	
0.897	29.8		20.0	0.9	50.7	48.0	+2.7	*
2.829	29.6		20.0	0.9	50.5	48.0	+2.5	*
6.008	31.2		20.0	0.7	51.9	48.0	+3.9	*
26.660	32.8		20.0	0.1	52.9	48.0	+4.9	*
26.150	34.1		20.0	0.1	54.2	48.0	+6.2	

FINAL

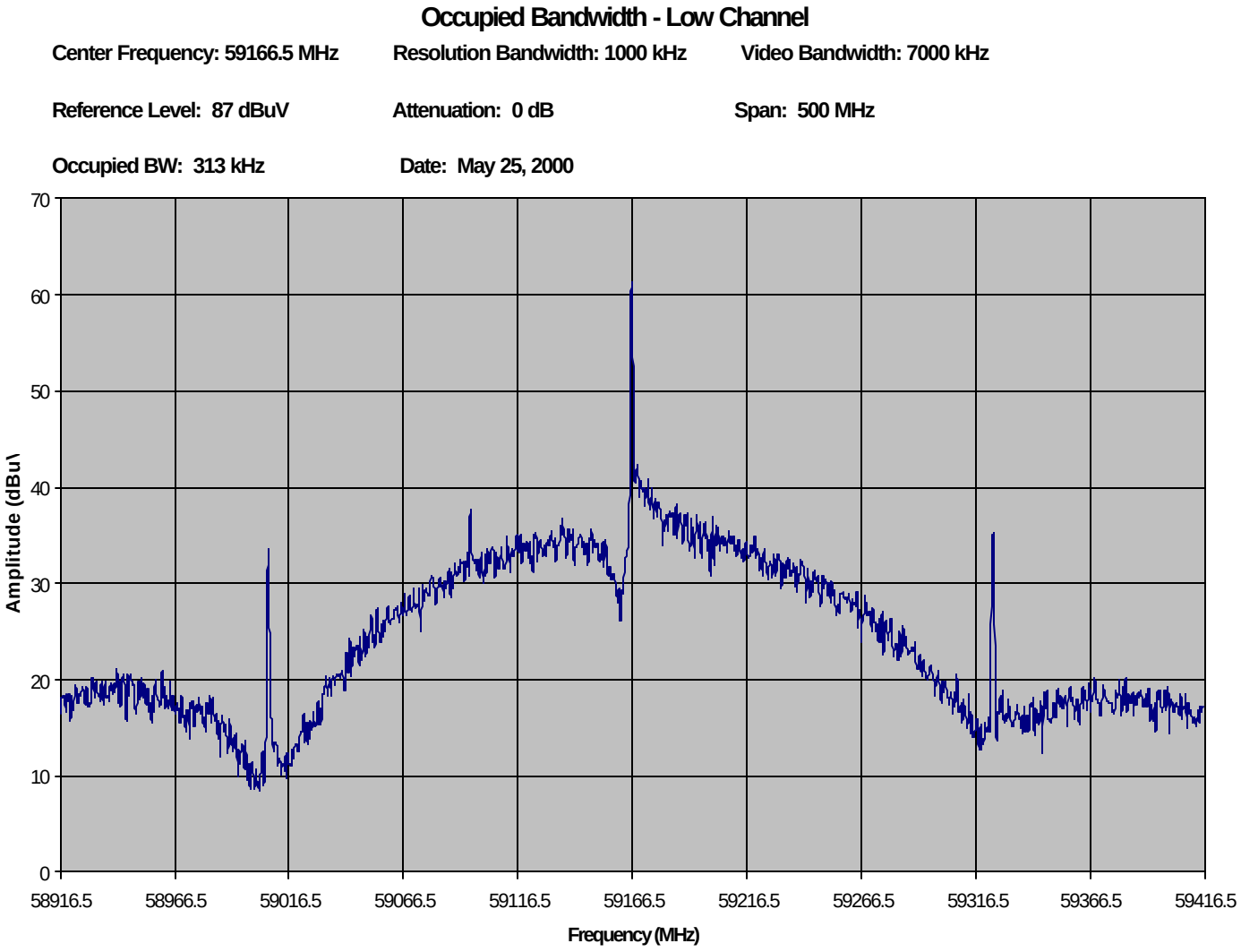
New Power Supply with 22,000 pF Y caps (and ferrite as installed yesterday)

Frequency MHz	Reading Side A dB	Reading Side B dB	Attenuator Factor dB	System Loss dB	Quasi-Peak Net dB(uV)	Quasi-Peak Limit dB(uV)	Quasi-Peak Margin dB
15.200	23.3	21.7	20.0	0.4	43.7	48.0	-4.3
15.320	22.2	22.3	20.0	0.4	42.7	48.0	-5.3
14.412	17.9	21.3	20.0	0.4	41.7	48.0	-6.3
15.917	22.3	23.6	20.0	0.4	44.0	48.0	-4.0
15.148	22.5	19.5	20.0	0.4	42.9	48.0	-5.1
8.925	14.4	20.2	20.0	0.7	40.9	48.0	-7.1
11.978	12.5	14.0	20.0	0.4	34.4	48.0	-13.6
14.575	21.4	20.3	20.0	0.4	41.8	48.0	-6.2

XII - Bandwidth

The following plot(s) show bandwidth measurements made.

For the Patch Antenna Radio

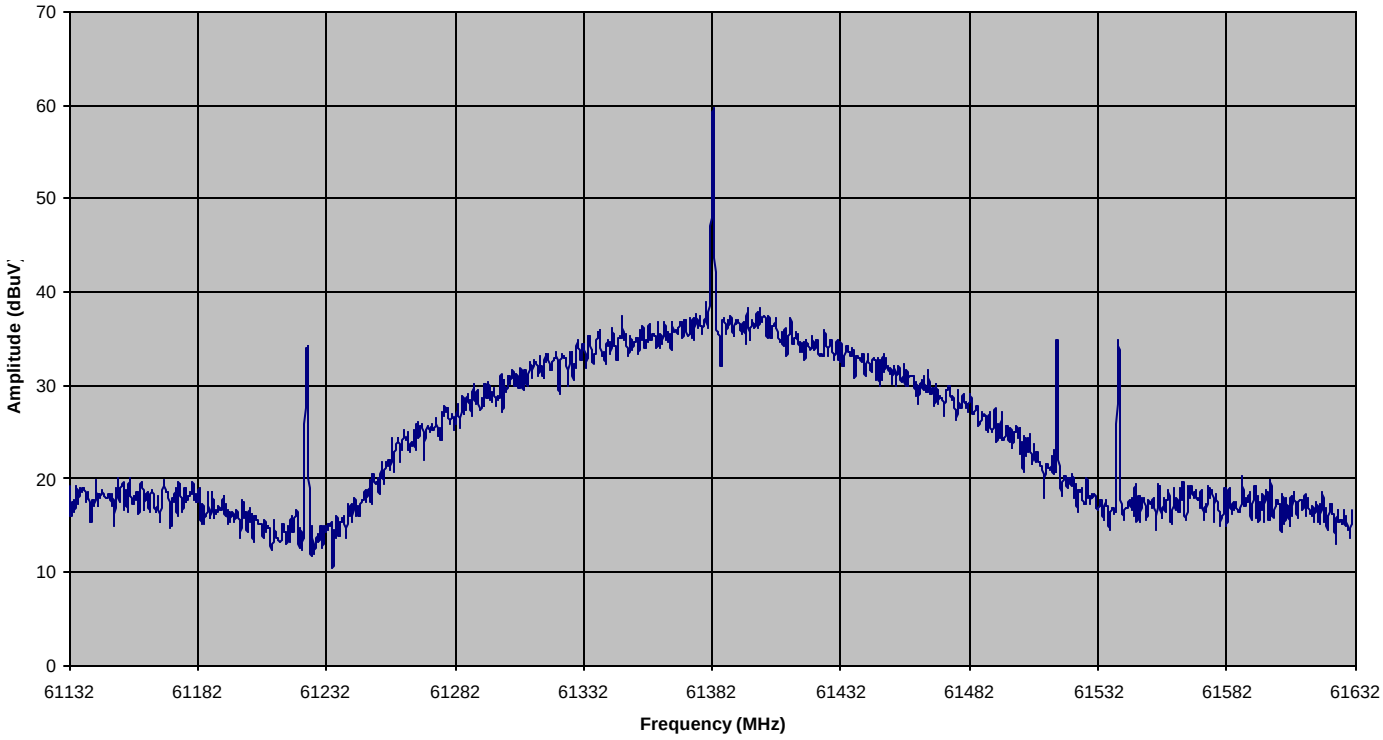


Occupied Bandwidth - Mid Channel

Center Frequency: 61382 MHz **Resolution Bandwidth: 1000 kHz** **Video Bandwidth: 7000 kHz**

Reference Level: 87 dBuV **Attenuation: 0 dB** **Span: 500 MHz**

Occupied BW: 315 kHz **Date: May 25, 2000**

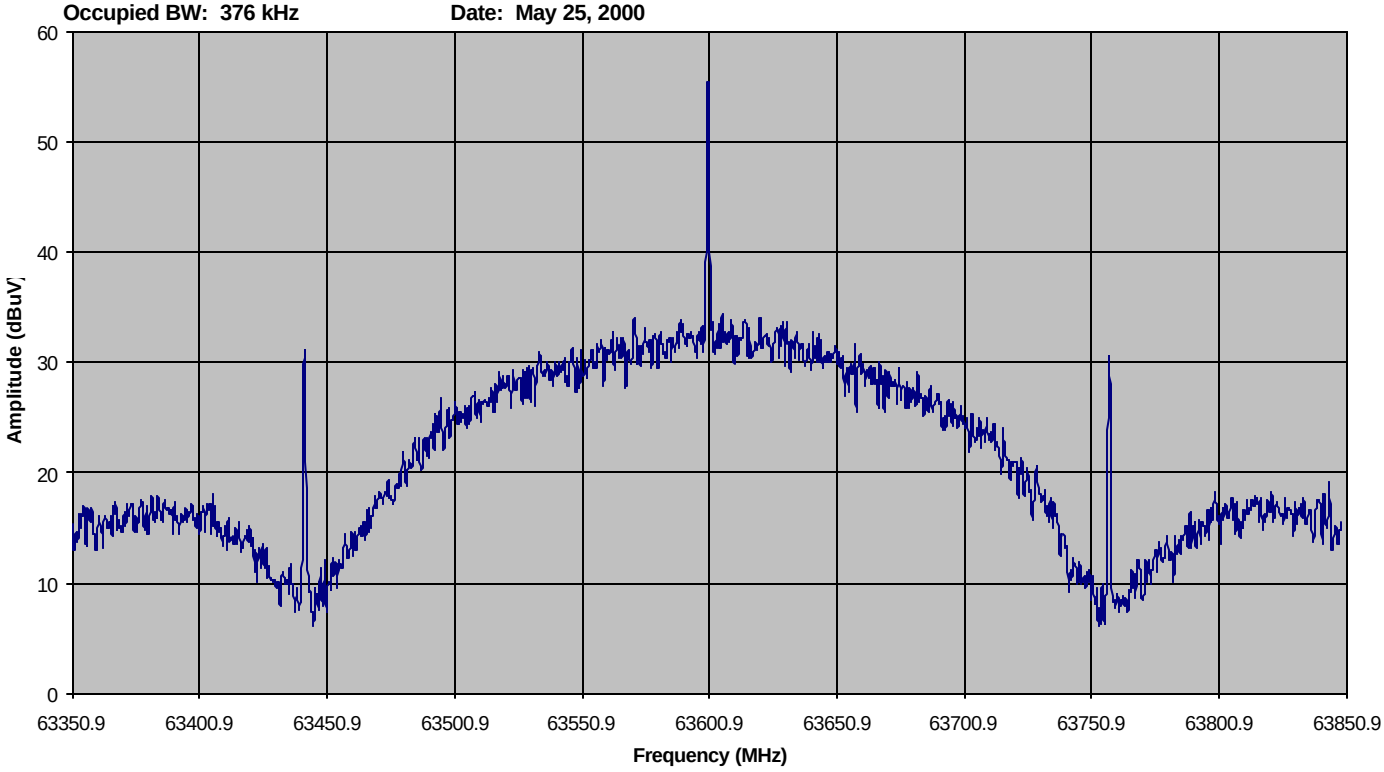


Occupied Bandwidth - High Channel

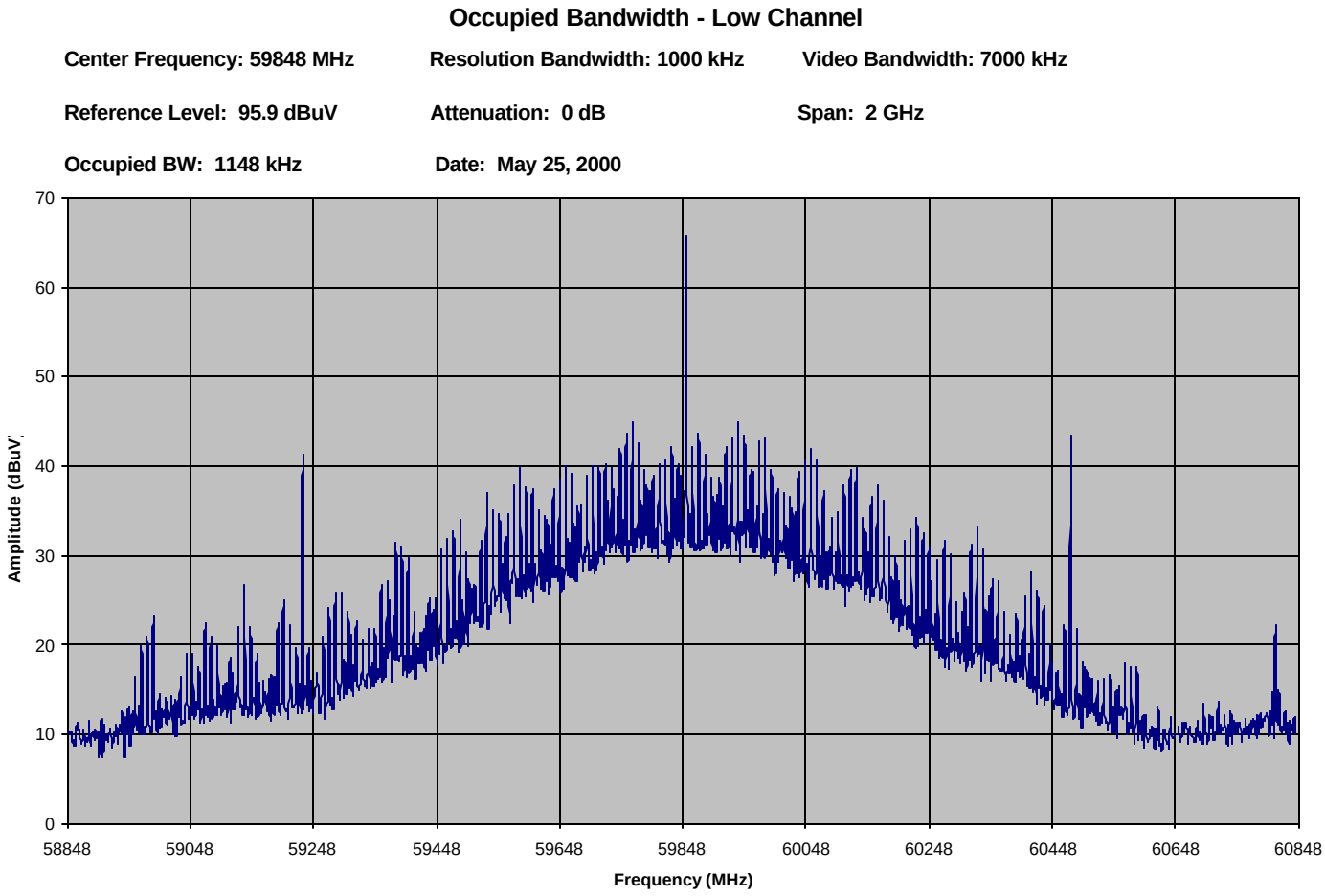
Center Frequency: 63600 MHz **Resolution Bandwidth: 1000 kHz** **Video Bandwidth: 7000 kHz**

Reference Level: 87 dBuV **Attenuation: 0 dB** **Span: 500 MHz**

Occupied BW: 376 kHz **Date: May 25, 2000**



Parabolic Antenna Radio

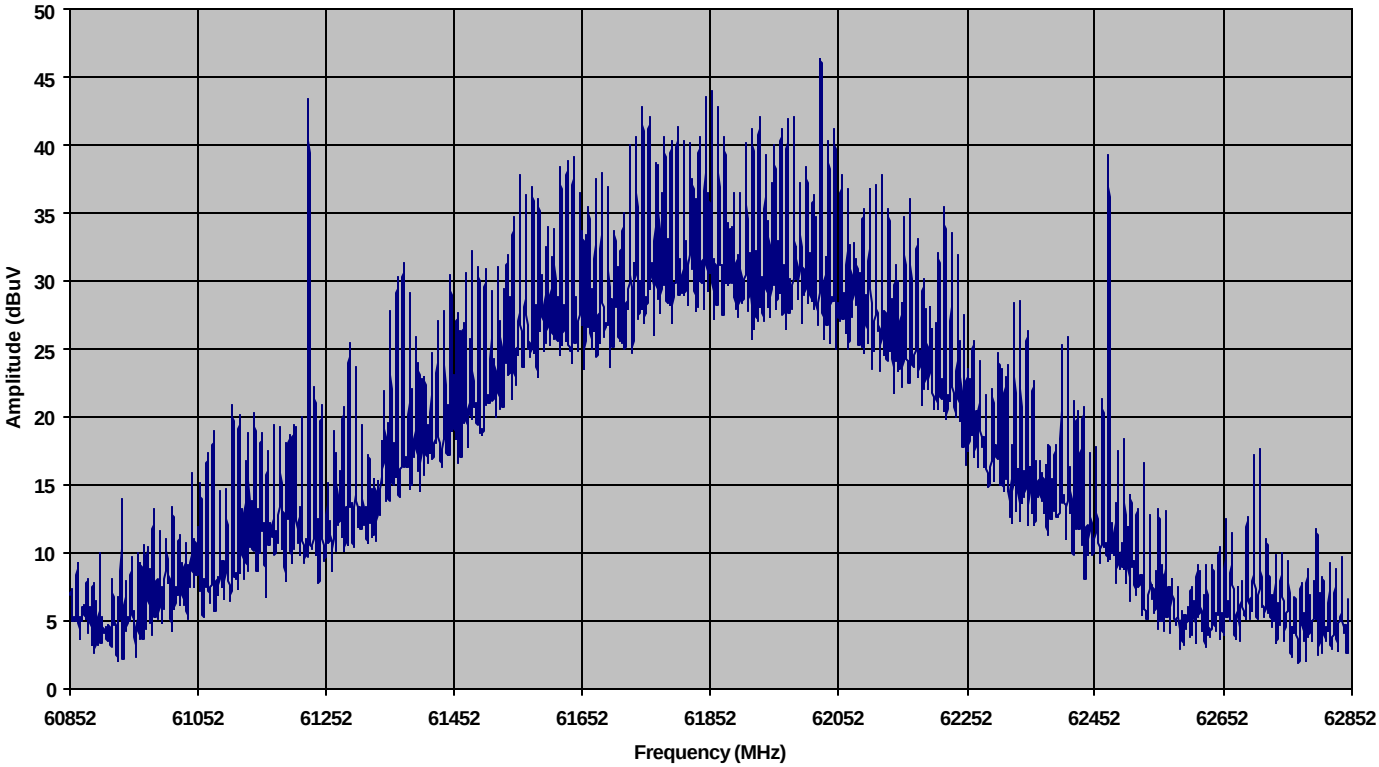


Occupied Bandwidth - Low Channel

Center Frequency: 61852 MHz Resolution Bandwidth: 1000 kHz Video Bandwidth: 7000 kHz

Reference Level: 87 dBuV Attenuation: 0 dB Span: 2 GHz

Occupied BW: 1256 kHz Date: May 25, 2000



XII - Frequency Deviation

Date of Test	May 26 & 29, 2000	Test Engineer	Michael Peters	
Test Site	Safety Lab	Temperature/Humidity	-20 to 50 °C	35 %

Frequency Stability over Temperature

Maximum Allowed Frequency Deviation:		10 MHz			
Temperature (°C)		**Reference Frequency (MHz)**	**Measured Frequency (MHz)**	**Deviation (Hz)**	**Pass/ Fail?**
-20	@ 0 min	59,162,828,479	59,163,286,596	-458,117	Pass
-20	@ 2 min	59,162,828,479	59,163,287,351	-458,872	Pass
-20	@ 5 min	59,162,828,479	59,163,296,242	-467,763	Pass
-20	@ 10 min	59,162,828,479	59,163,305,020	-476,541	Pass
20		59,162,828,479			
+50	@ 0 min	59,162,828,479	59,162,583,632	244,847	Pass
+50	@ 2 min	59,162,828,479	59,162,523,962	304,517	Pass
+50	@ 5 min	59,162,828,479	59,162,490,007	338,472	Pass
+50	@ 10 min	59,162,828,479	59,162,439,465	389,014	Pass

Frequency Stability over Voltage

Maximum Allowed Frequency Deviation:		10 MHz			
Rated Input Voltage:		120 VAC			
Voltage (VAC)		**Reference Frequency (MHz)**	**Measured Frequency (MHz)**	**Deviation (Hz)**	**Pass/ Fail?**
102	@ 0 min	59,162,828,479	59,163,094,517	-266,038	Pass
102	@ 2 min	59,162,828,479	59,163,076,843	-248,264	Pass
102	@ 5 min	59,162,828,479	59,163,032,101	-203,622	Pass
102	@ 10 min	59,162,828,479	59,162,954,073	-125,594	Pass
120		59,162,828,479			
138	@ 0 min	59,162,828,479	59,162,948,709	-120,230	Pass

138	@ 2 min	59,162,828,479	59,162,901,701	-73,222	Pass
138	@ 5 min	59,162,828,479	59,162,881,431	-52,952	Pass
138	@ 10 min	59,162,828,479	59,162,838,507	-10,028	Pass

Date of Test	May 26 & 29, 2000	Test Engineer	Michael Peters	
Test Site	Safety Lab	Temperature/Humidity	-20 to 50 °C	35 %

Frequency Stability over Temperature

Maximum Allowed Frequency Deviation:		10 MHz			
Temperature (°C)		**Reference Frequency (MHz)**	**Measured Frequency (MHz)**	**Deviation (Hz)**	**Pass/ Fail?**
-20	@ 0 min	63,598,076,053	63,598,145,509	-69,456	Pass
-20	@ 2 min	63,598,076,053	63,598,142,113	-66,060	Pass
-20	@ 5 min	63,598,076,053	63,598,145,443	-69,390	Pass
-20	@ 10 min	63,598,076,053	63,598,165,672	-89,619	Pass
20		63,598,076,053			
+50	@ 0 min	63,598,076,053	63,597,538,609	537,444	Pass
+50	@ 2 min	63,598,076,053	63,597,488,206	587,847	Pass
+50	@ 5 min	63,598,076,053	63,597,448,977	627,076	Pass
+50	@ 10 min	63,598,076,053	63,597,524,735	551,318	Pass

Frequency Stability over Voltage

Maximum Allowed Frequency Deviation:		10 MHz			
Rated Input Voltage:		120 VAC			
Voltage (VAC)		**Reference Frequency (MHz)**	**Measured Frequency (MHz)**	**Deviation (Hz)**	**Pass/ Fail?**
102	@ 0 min	63,598,076,053	63,598,041,400	34,653	Pass
102	@ 2 min	63,598,076,053	63,598,018,138	57,915	Pass
102	@ 5 min	63,598,076,053	63,597,983,159	92,894	Pass
102	@ 10 min	63,598,076,053	63,597,919,044	157,009	Pass
120		63,598,076,053			
138	@ 0 min	63,598,076,053	63,597,901,206	174,847	Pass
138	@ 2 min	63,598,076,053	63,597,863,001	213,052	Pass

138	@ 5 min	63,598,076,053	63,597,848,409	227,644	Pass
138	@ 10 min	63,598,076,053	63,597,817,169	258,884	Pass