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DATE: 26 December 2013

I.T.L. (PRODUCT TESTING) LTD.

FCC Radio Test Report

for

Galcon Bakarim Agricultural Cooperative Society Ltd.

Equipment under test:

Two Way Radio System (G2W) Concentrator

AMGR0C03A

Written by: _____

R. Pinchuck, Documentation

Approved by: _____

A. Sharabi, Test Engineer

Approved by: _____

I. Raz, EMC Laboratory Manager

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Measurement/Technical Report for Galcon Bakarim Agricultural Cooperative Society Ltd.

Two Way Radio System (G2W) Concentrator

AMGR0C03A

FCC ID: SZ8G2W3GA

This report concerns:	Original Grant: X Class I Change: Class II Change:
Equipment type:	Spread Spectrum Transmitter
Limits used:	47CFR15 Section 15.247

Measurement procedure used is Public Notice: DA 00-705 Filing and Measurement guidelines for Frequency Hopping spread spectrum Systems and ANSI C63.4-2003.

Application for Certification prepared by:

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Applicant for this device: (different from "prepared by")

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1. General Information

1.1 Administrative Information

Manufacturer:	Galcon Bakarim Agricultural Cooperative Society Ltd.
Manufacturer's Address:	Kibbutz Kfar Blum Upper Galilee D.N. 12150 Israel Tel:+972-4-690-0222 Tel: +972-4-690-2727
Manufacturer's Representative:	Amir Eisen
Equipment Under Test (E.U.T):	Two Way Radio System (G2W) Concentrator
Equipment Model No.:	AMGR0C03A
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	10.06.2012
Start of Test:	10.06.2012
End of Test:	02.04.2013
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15 Subpart C

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025B-1.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

AMGR0C03 is a radio concentrator unit, it connect to Galcon controller on the one side and transmit command to the G2W units and transmit status and signals from the units to the controller.
Concentrator:
The concentrator acts as the system manager. The concentrator transmits, via radio communication, the controller's commands to all the field units, and returns the various inputs of the field units to the controller. The concentrator is connected to RF antennas and cables. The concentrator is equipped with a backup battery which lasts for at least 24 hours.
The concentrator can be installed in one of two ways:
Installed close to the controller, at a distance of not more than 10 meters, using direct communication (RS-232).
Installed at a distance of not more than 30 meters, using an RS-485 adaptor.
Concentrator Connections:
Connect the concentrator to two FG9023 antennas with RF cables. Do not bend the cables below a radius of 30 cm. Always keep 60 cm distances between antennas.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in Public Notice: DA 00-705 Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems and ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing September 3, 2009).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Conducted Emission
Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) 0.15 – 30 MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 3.6 dB
Note: See ITL Procedure No. PM 198.

Radiated Emission
Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 5.2 dB
Note: See ITL Procedure No. PM 198.

2. System Test Configuration

2.1 Justification

Unit was tested on the table connected to 2 antennas at installation position. Both antennas working in diversity mode, not transmitting at the same time, and both connected to the same RF chain.

2.2 Special Accessories

No special accessories were needed in order to achieve compliance.

2.3 Equipment Modifications

No modifications were needed in order to achieve compliance

2.4 Configuration of Tested System

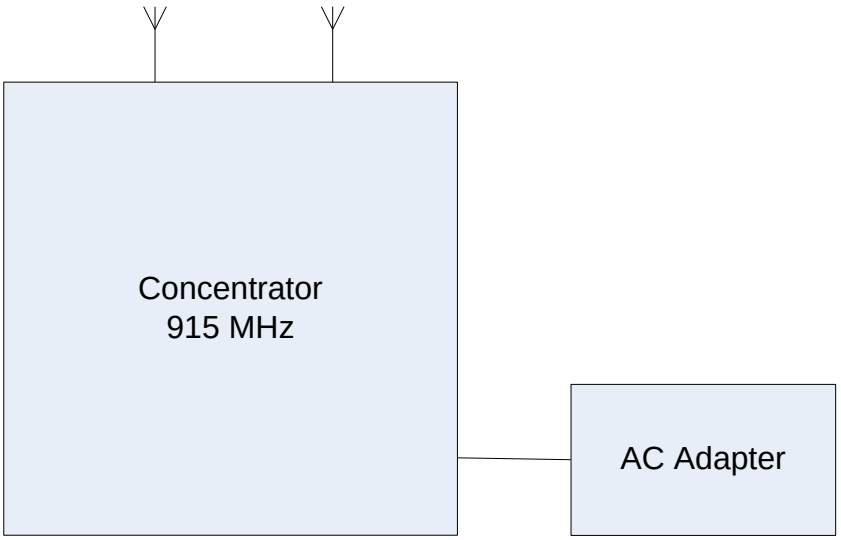

Figure 1. Configuration of Tested System

3. Conducted and Radiated Measurement Test Set-up Photo

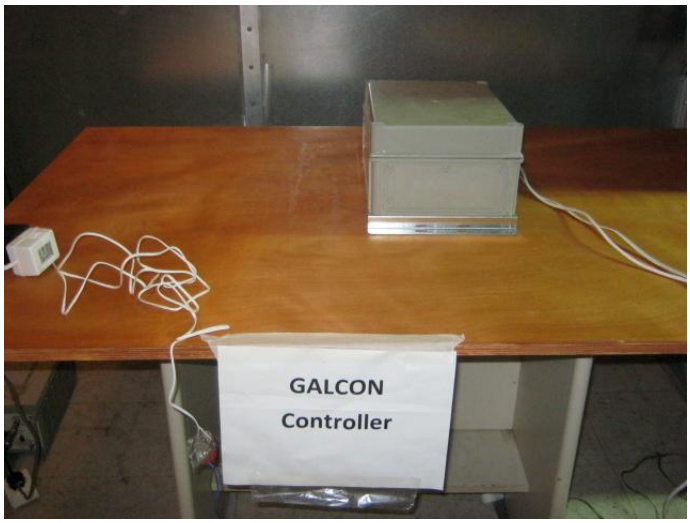

Figure 2. Conducted Emission Test

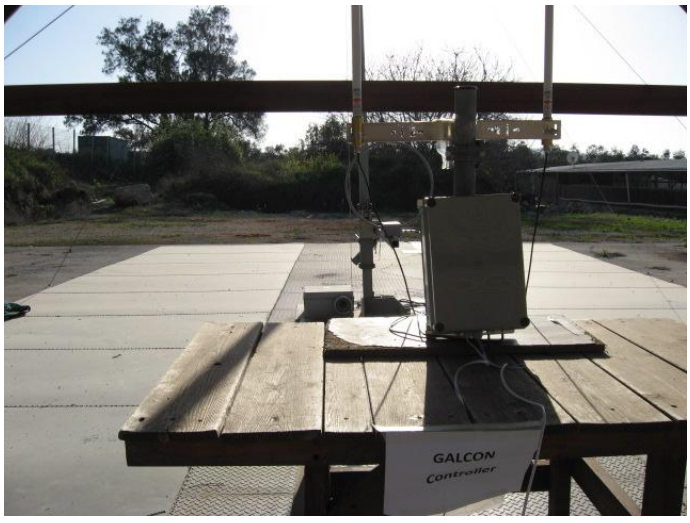

Figure 3. Radiated Emission Test

Figure 4. Radiated Emission Test

Figure 5. Radiated Emission Test

Figure 6. Radiated Emission Test

4. Conducted Emission

4.1 Test Specification

F.C.C., Part 15, Subpart C

4.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 3.1. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall.

The E.U.T was powered from 115 V AC / 60 Hz via a 50 Ohm / 50 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, and using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

4.3 Test Results

JUDGEMENT: Passed by 30.26 dB

The EUT met the F.C.C. Part 15, Subpart C specification requirements.

The details of the highest emissions are given in

Figure 7 to Figure 10.

TEST PERSONNEL:

Tester Signature: _____ Date: 02.01.14

Typed/Printed Name: A. Sharabi

Conducted Emission

E.U.T Description	Two Way Radio System (G2W) Concentrator
Type	AMGR0C03A
Serial Number:	Not Designated

Specification:	F.C.C., Part 15, Subpart C
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	158 kHz	15.88	-49.68
2	Average	170 kHz	11.23	-43.72
2	Average	422 kHz	5.79	-41.61
1	Quasi Peak	426 kHz	8.80	-48.52
1	Quasi Peak	506 kHz	9.90	-46.09
2	Average	506 kHz	6.47	-39.52
1	Quasi Peak	926 kHz	8.50	-47.49
2	Average	1.15 MHz	5.77	-40.22
1	Quasi Peak	1.446 MHz	8.69	-47.30
2	Average	1.61 MHz	5.83	-40.17
2	Average	3.058 MHz	4.86	-41.13
1	Quasi Peak	3.566 MHz	9.57	-46.42
2	Average	4.686 MHz	5.35	-40.64
1	Quasi Peak	4.882 MHz	9.47	-46.52
1	Quasi Peak	8.666 MHz	15.74	-44.25
2	Average	8.85 MHz	8.27	-41.72
1	Quasi Peak	10.726 MHz	29.54	-30.46
2	Average	15.382 MHz	12.57	-37.42
2	Average	17.706 MHz	9.26	-40.73
1	Quasi Peak	26.434 MHz	11.76	-48.23

Date: 2.APR.2013 16:04:17

Figure 7. Detectors: Peak, Quasi-peak, Average

Note: QP Delta/Av Delta refer to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	Two Way Radio System (G2W) Concentrator
Type	AMGR0C03A
Serial Number:	Not Designated

Specification:	F.C.C., Part 15, Subpart C
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average

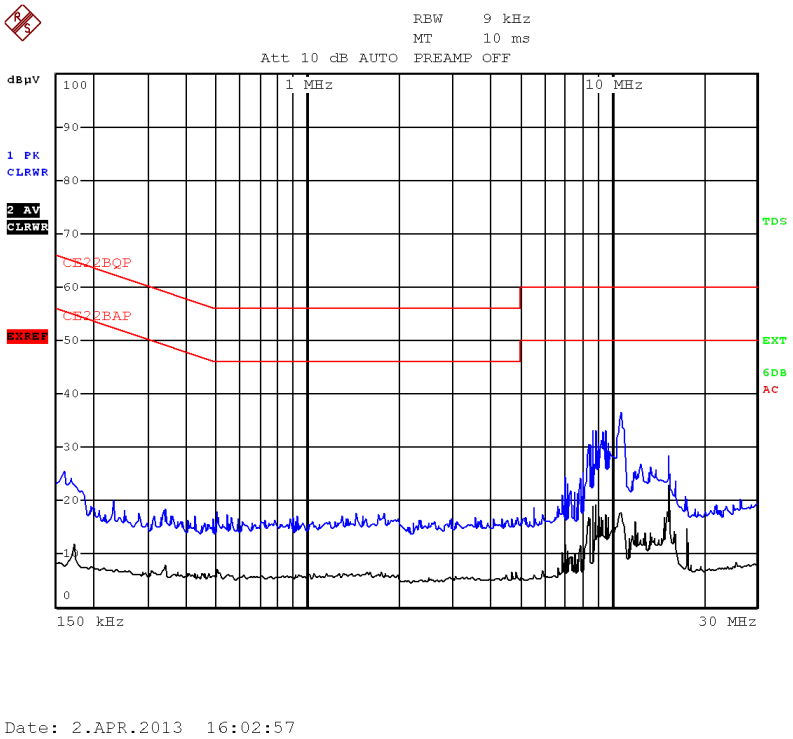

Figure 8. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description	Two Way Radio System (G2W) Concentrator
Type	AMGR0C03A
Serial Number:	Not Designated

Specification:	F.C.C., Part 15, Subpart C
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	162 kHz	14.94	-50.41
2	Average	170 kHz	10.55	-44.40
1	Quasi Peak	382 kHz	8.91	-49.32
2	Average	414 kHz	5.86	-41.70
1	Quasi Peak	494 kHz	8.95	-47.14
2	Average	638 kHz	5.66	-40.33
1	Quasi Peak	826 kHz	8.56	-47.43
2	Average	1.234 MHz	5.70	-40.29
2	Average	1.622 MHz	6.08	-39.91
1	Quasi Peak	1.814 MHz	8.75	-47.24
2	Average	2.502 MHz	4.68	-41.31
1	Quasi Peak	2.598 MHz	9.17	-46.82
1	Quasi Peak	4.842 MHz	12.52	-43.47
2	Average	4.846 MHz	6.21	-39.78
1	Quasi Peak	8.818 MHz	29.73	-30.26
2	Average	8.822 MHz	18.41	-31.58
1	Quasi Peak	10.782 MHz	29.11	-30.88
2	Average	10.794 MHz	18.37	-31.63
2	Average	17.706 MHz	7.62	-42.37
1	Quasi Peak	28.078 MHz	11.91	-48.08

Date: 2.APR.2013 16:09:13

Figure 9. Detectors: Peak, Quasi-peak, AVERAGE .

Note: QP Delta/Av Delta refer to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	Two Way Radio System (G2W) Concentrator
Type	AMGR0C03A
Serial Number:	Not Designated

Specification:	F.C.C., Part 15, Subpart C
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average

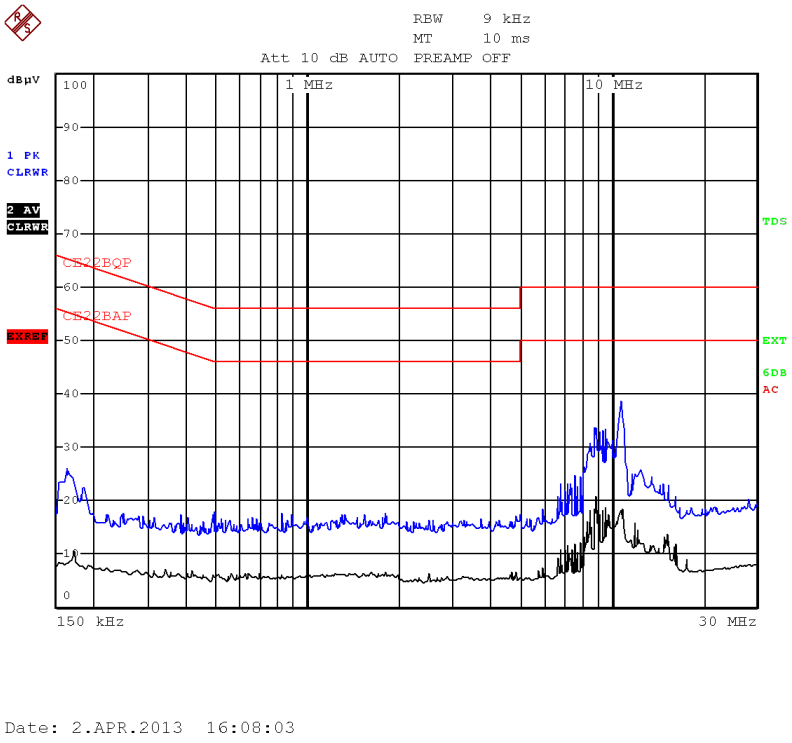

Figure 10. Detectors: Peak, Quasi-peak, AVERAGE .

4.4 Test Instrumentation Used, Conducted Measurement

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	EMCO	3810/2BR	1297	December 16, 2012	1 Year
Transient Limiter	HP	11947A	3107A03041	February 25, 2013	1 Year
EMI Receiver	Rohde & Schwarz	ESCI7	100724	December 27, 2012	1 Year

5. 20dB Minimum Bandwidth

5.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(a)(2)

5.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 10 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in Figure 3, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope. The E.U.T. was tested at Low and High channels.

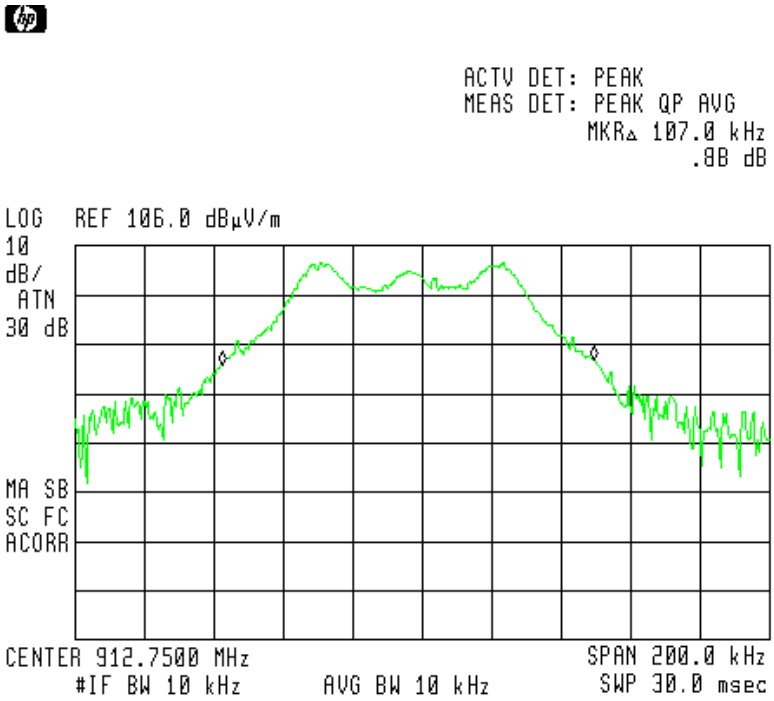

Figure 11. 912.750 MHz

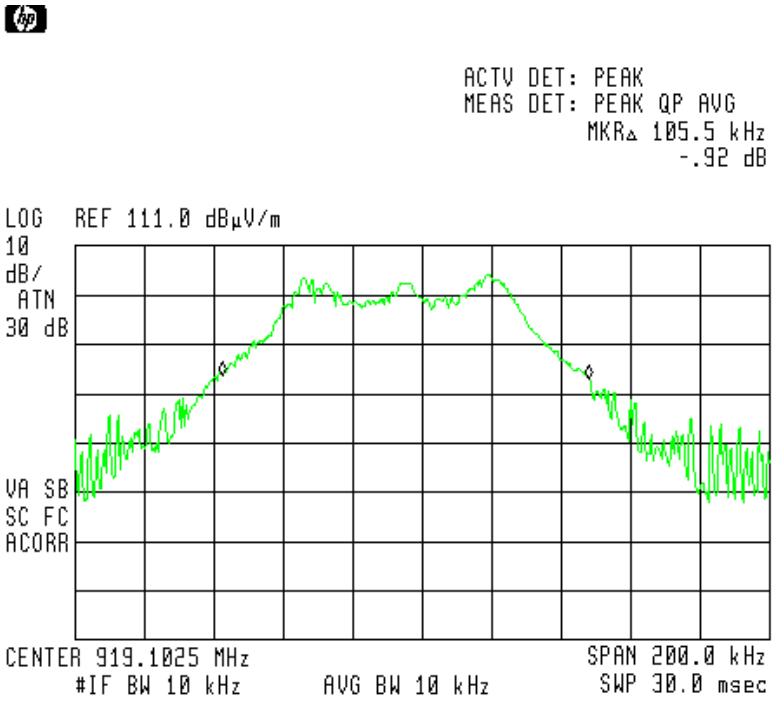

Figure 12. 919.103 MHz

5.3 Test Results

E.U.T Description: Two Way Radio System (G2W) Concentrator
Model: AMGR0C03A
Serial Number: Not Designated

Operation Frequency (MHz)	Bandwidth Reading (kHz)	Specification (kHz)
Low	107.0	<250
High	105.5	<250

Figure 13 Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 02.01.14

Typed/Printed Name: A. Sharabi

5.4 Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	809	April 2, 2013	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 14 Test Equipment Used

6. Number of Hopping Frequencies Section 15.247(a)(1)(i)

6.1 Test Specification

F.C.C., Part 15, Subpart C

6.2 Test Procedure

The E.U.T. was set to hopping mode.
The spectrum analyzer was set to the following parameters:

Band of Operation: 912-920 MHz
RBW: 30kHz
VBW: 3MHz
Detector Function: Peak
Trace: Maximum Hold

The number of hopping frequencies is 50 (See plots).

Number of Hopping Frequencies

E.U.T Description	Two Way Radio System (G2W) Concentrator
Type	AMGR0C03A
Serial Number:	Not Designated

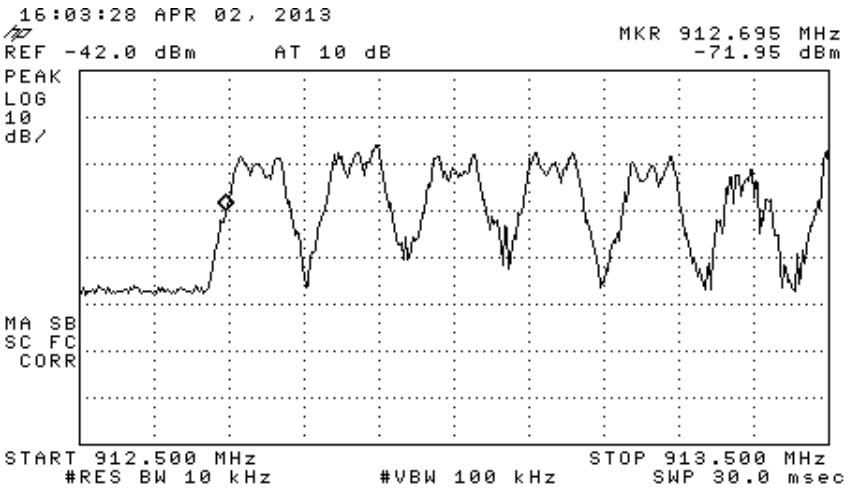

Figure 15. Number Of Channels

Number of Hopping Frequencies

E.U.T Description	Two Way Radio System (G2W) Concentrator
Type	AMGR0C03A
Serial Number:	Not Designated

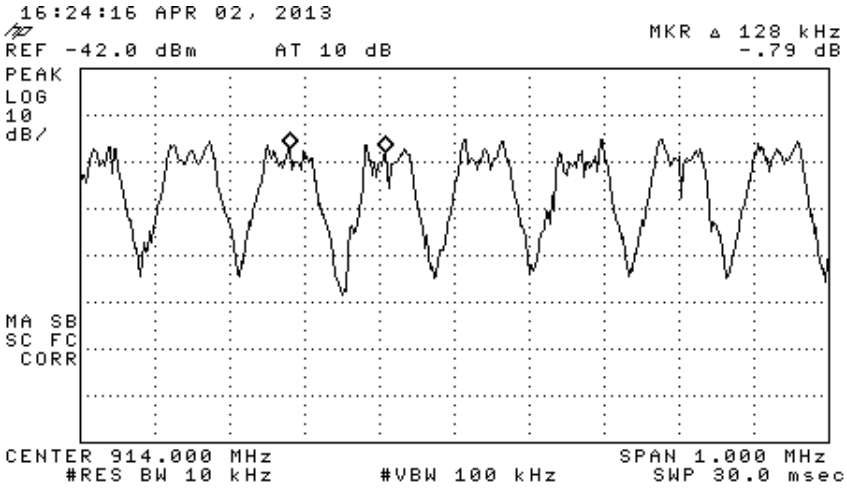

Figure 16. Number Of Channels

Number of Hopping Frequencies

E.U.T Description	Two Way Radio System (G2W) Concentrator
Type	AMGR0C03A
Serial Number:	Not Designated

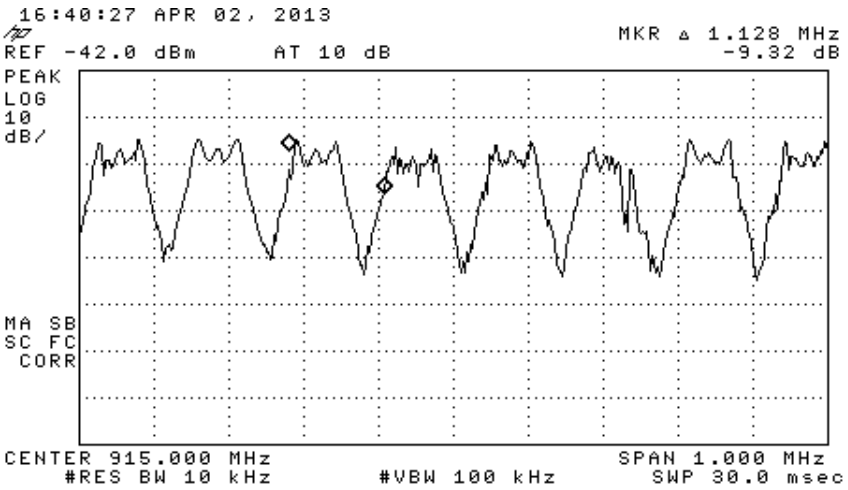

Figure 17. Number Of Channels

Number of Hopping Frequencies

E.U.T Description	Two Way Radio System (G2W) Concentrator
Type	AMGR0C03A
Serial Number:	Not Designated

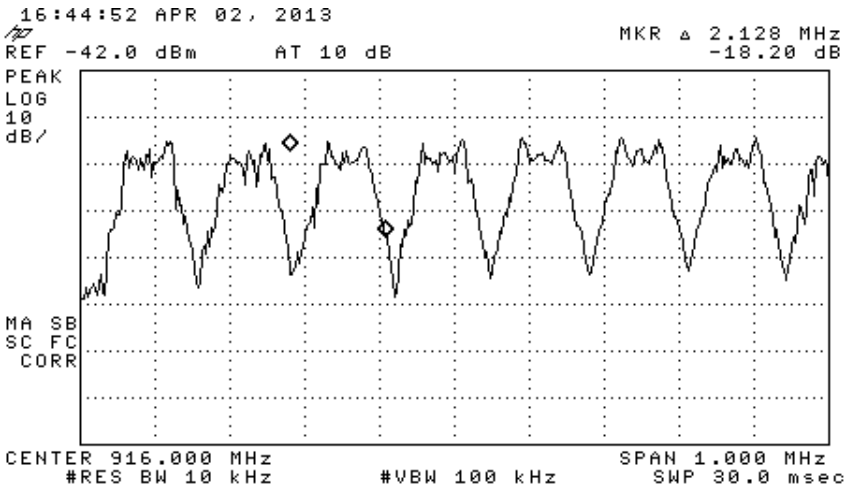

Figure 18. Number Of Channels

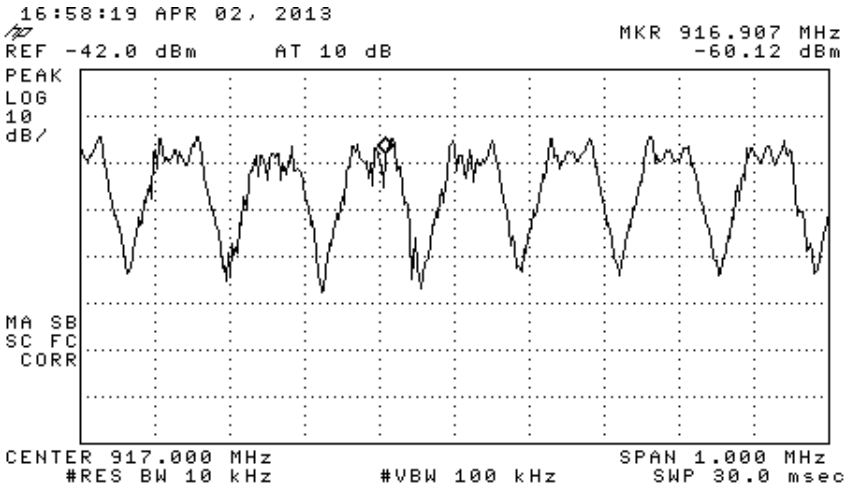

Figure 19. Number Of Channels

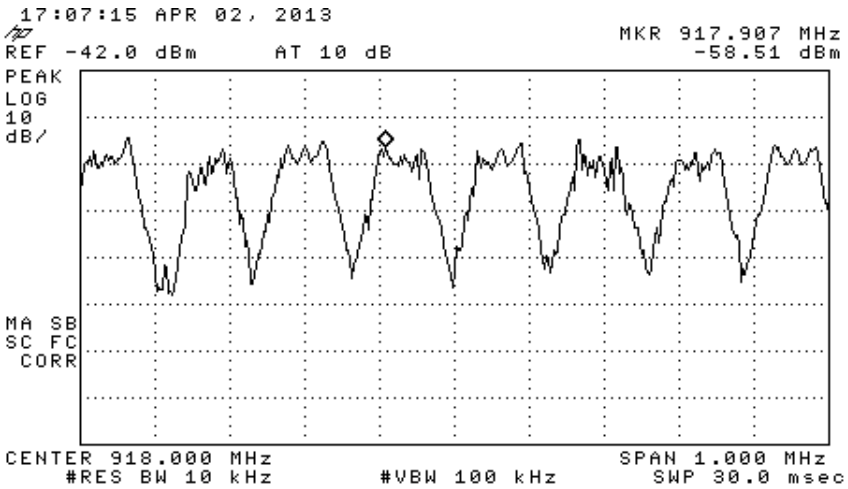

Figure 20. Number Of Channels

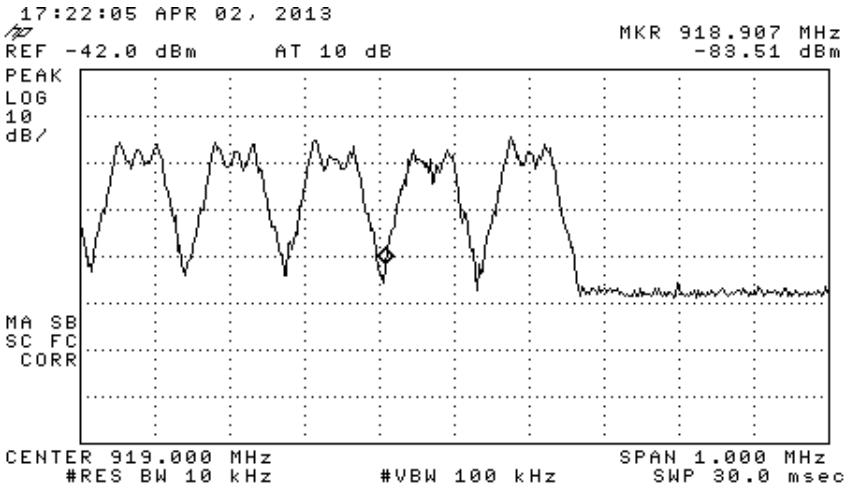

Figure 21. Number Of Channels

6.3 Results table

E.U.T. Description: Two Way Radio System (G2W) Concentrator
Model No.: AMGR0C03A
Serial Number: Not Designated
Specification: FCC Part 15, Subpart C, 15.247(a)(1)(i)

Number of Hopping Frequencies	Specification
50	>=50

Figure 22 Number of Hopping Frequencies

TEST PERSONNEL:

Tester Signature: _____ Date: 02.01.14

Typed/Printed Name: A. Sharabi

6.4 Test Instrumentation Used

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date.	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 2, 2013	1 year

7. Channel Frequency Separation

7.1 Test Specification

Specification: FCC Part 15, Subpart C, 15.247(a) (1)

7.2 Test procedure

The E.U.T. was set to hopping mode.
The spectrum analyzer was set to the following parameters:

RBW: 30kHz
VBW: 3MHz
Detector Function: Peak
Trace: Maximum Hold

The marker delta function to determine the separation between the peaks of the adjacent channels was used.

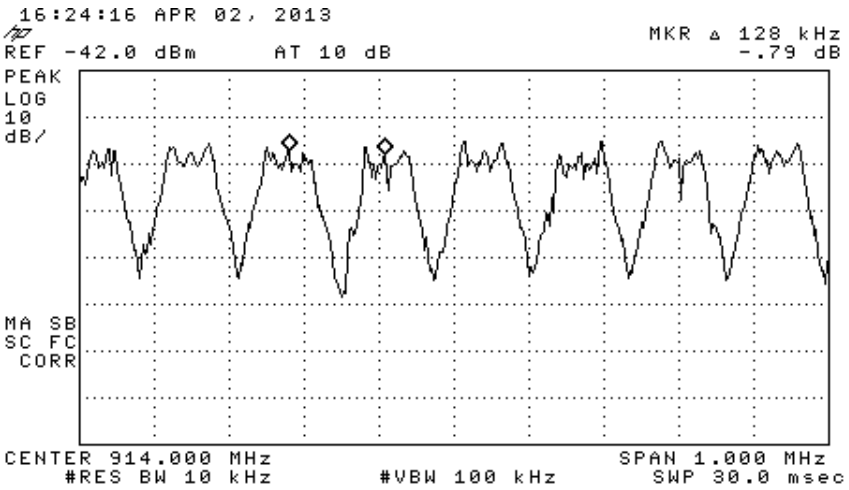

Figure 23. Separation

7.3 Results table

E.U.T. Description: Two Way Radio System (G2W) Concentrator
Model No.: AMGR0C03A
Serial Number: Not Designated
Specification: FCC Part 15, Subpart C, 15.247(a) (1)

Channel Frequency Separation (kHz)	Specification (kHz)	Margin (kHz)
128	>100	28

Figure 24 Channel Frequency Separation

JUDGEMENT: Passed by 28 kHz

TEST PERSONNEL:

Tester Signature: _____ Date: 02.01.14

Typed/Printed Name: A. Sharabi

7.4 Test Instrumentation Used

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date.	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 2, 2013	1 year

8. Radiated Power Output

8.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(b)(2)

8.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.
The transmitter unit operated with normal modulation. The EMI receiver was set to 120KHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization/

The worst case emissions were measured vertically.

The E.U.T. was tested at the Low and High channels with modulation.

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

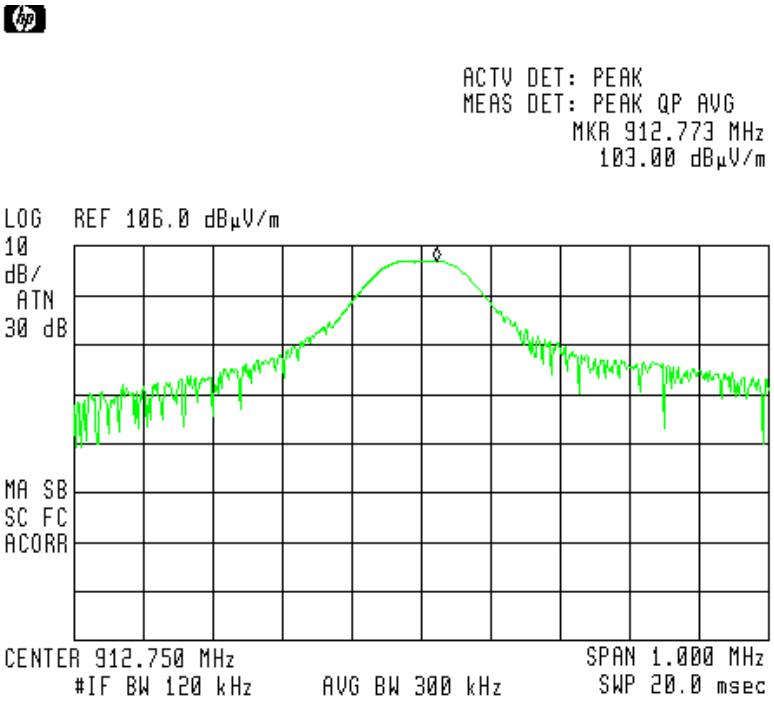

Figure 25 912.750 MHz

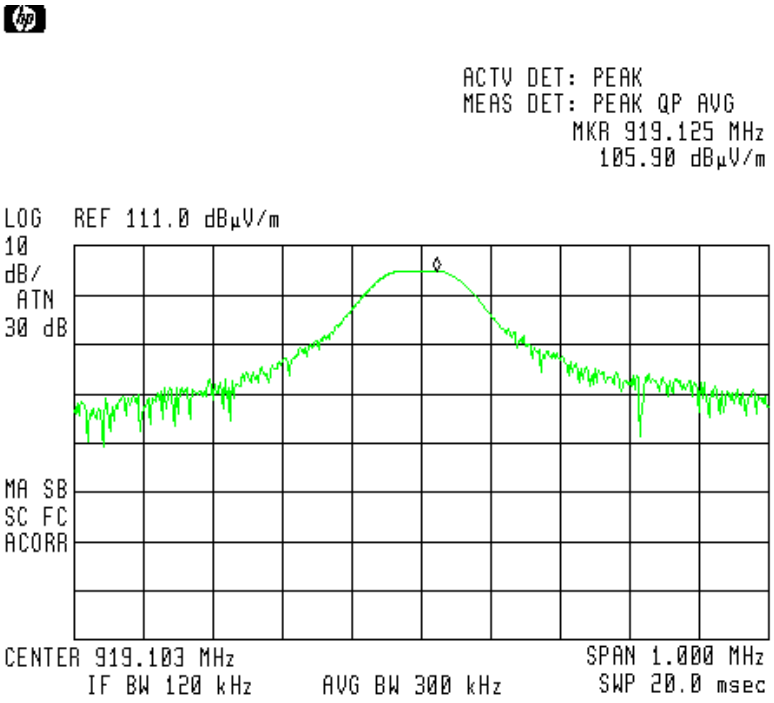

Figure 26 919.103 MHz

8.3 Results Calculation

E.U.T. Description: Two Way Radio System (G2W) Concentrator
Model No.: AMGR0C03A
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C

Frequency	E	E	Antenna Gain	Antenna Distance	Calculated Results	Limit	Margin
(MHz)	(dbµ V/m)	(V/m)	(dBi)	(m)	(mW)	(mW)	(mW)
912.773	103.00	0.141	1.995	3	2.98	1000	-997.02
919.125	105.90	0.197	1.995	3	5.83	1000	-994.17

Figure 27 Radiated Power Output Test Results Table

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 02.01.14

Typed/Printed Name: A. Sharabi

8.4 Test Equipment Used.

Radiated Maximum Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	809	April 2, 2013	1 year

Figure 28 Test Equipment Used

9. Dwell Time on Each Channel

9.1 Test Specification

FCC Part 15, Section 15.247(a)(1)(i)

9.2 Test Procedure

The E.U.T. was tested in radiated mode using the substitution antenna. The spectrum analyzer was set to 100 kHz RBW .

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 20 seconds

9.3 Test Results

The E.U.T met the requirements of the FCC Part 15, Section 15.247(a)(1)(i).

Additional information of the results is given in *Figure 29 to Figure 30.*

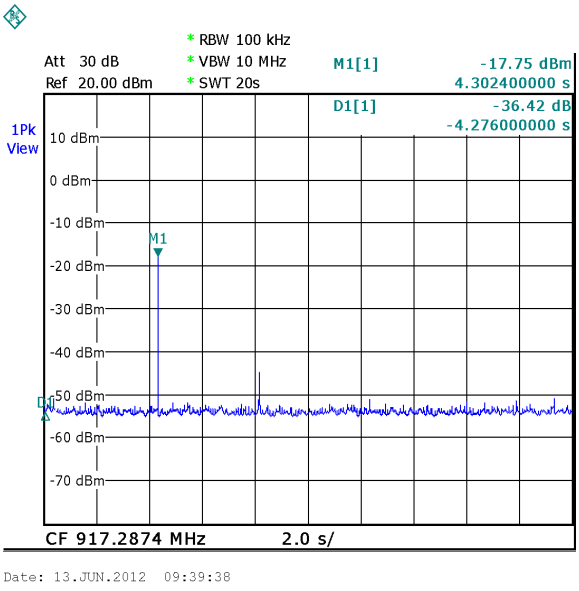

Figure 29 — Transmission within 20 sec

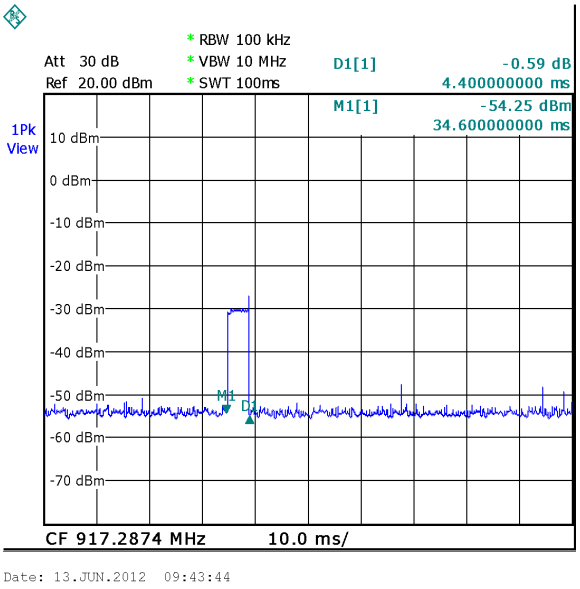

Figure 30 — Burst duration within 20sec

9.4 Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date.	Period
Spectrum Analyzer	HP	8564E	3442A00275	January 19, 2012	1 year

10. Band Edge

[In Accordance with section 15.247(d)]

10.1 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.
The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The EMI receiver was adjusted to the transmission channel at the maximum radiated level. The display line was set to 20 dBc and the EMI receiver was set to the band edge frequencies.

The E.U.T. was tested at the lower and the upper channels.

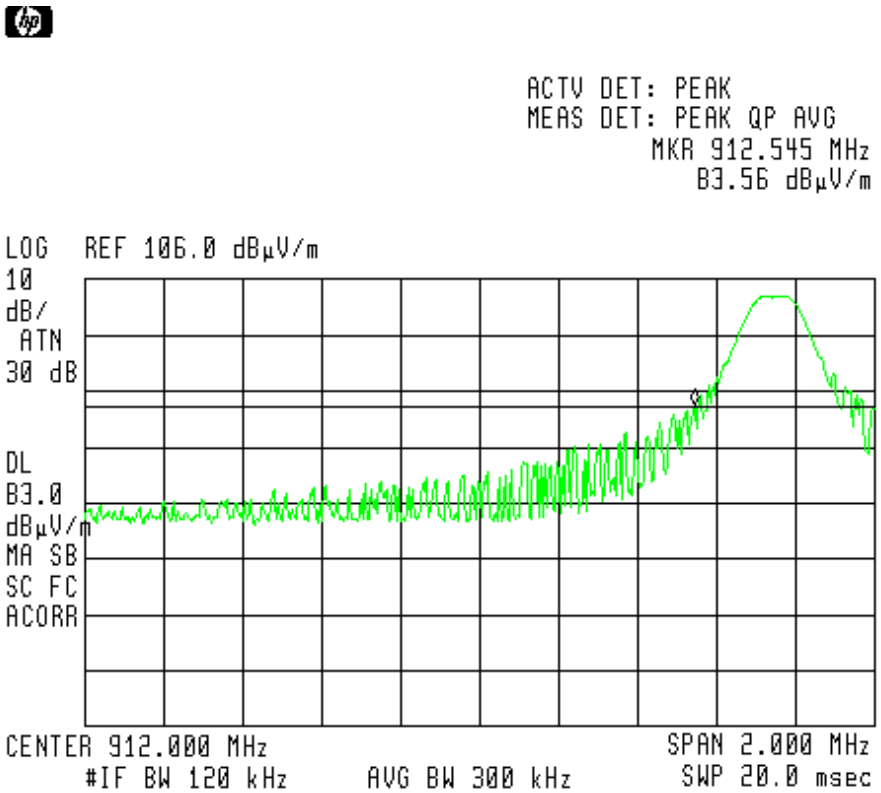

Figure 31 — 912.000 MHz

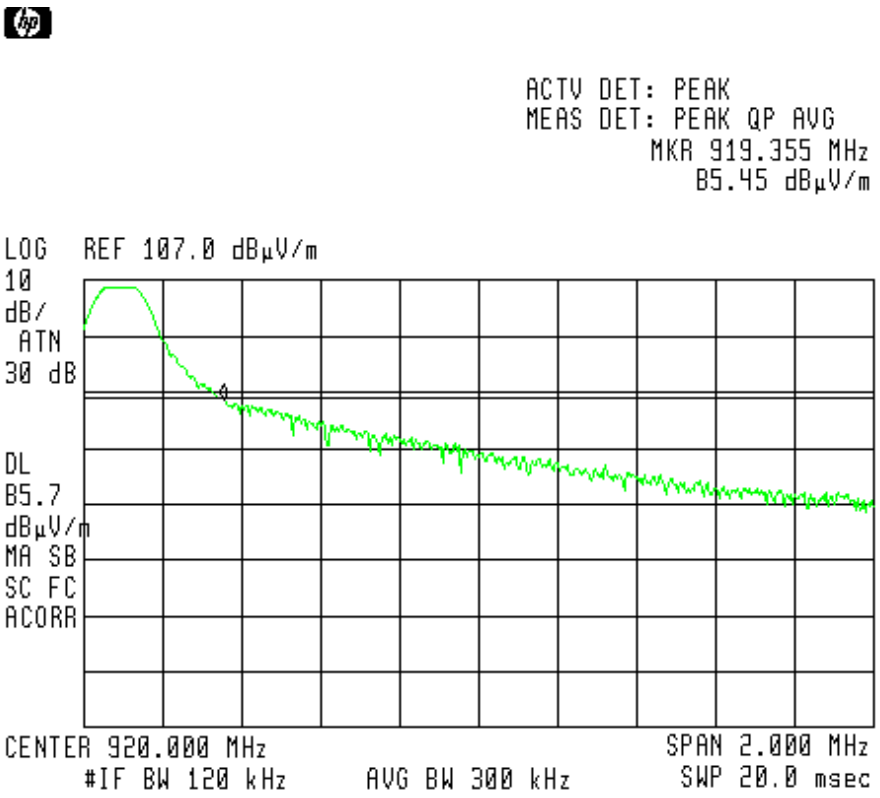

Figure 32 — 920.000 MHz

10.2 Results table

E.U.T. Description: Two Way Radio System (G2W) Concentrator
Model No.: AMGR0C03A
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C (15.247 (d))

Operation Frequency (MHz)	Specification (dBµV/m)	Frequency Reading at amplitude limit (MHz)	Margin (MHz)
912.000	83.0	912.545	0.545
920.00	85.7	919.355	0.645

Figure 33 Band Edge

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 02.01.14

Typed/Printed Name: A. Sharabi

10.3 Test Equipment Used.

Band edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	809	April 2, 2013	1 year

Figure 34 Test Equipment Used

11. Radiated Emission, 9 kHz – 30 MHz

11.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

11.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

The E.U.T. was tested in two operating channels, lowest and highest.

11.3 Measured Data

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

The results for all two channels were the same.

No signals were detected in the frequency range of 9 kHz – 30 MHz.

TEST PERSONNEL:

Tester Signature: _____ Date: 02.01.14

Typed/Printed Name: A. Sharabi

11.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 21, 2012	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

11.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS:	Field Strength [dBμv/m]
RA:	Receiver Amplitude [dBμv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

Example: FS = 30.7 dBμV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBμV

No external pre-amplifiers are used.

12. Spurious Radiated Emission 30 – 10000MHz

12.1 Test Specification

30 MHz-10000 MHz, F.C.C., Part 15, Subpart C

12.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground..

The frequency range 30 MHz-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 30-1000 MHz, the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.
In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.
The test distance was 3 meters.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was tested in two operating channels: lowest and highest.

12.3 Test Data

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification.
The results for all three operation channels were the same.

For the operation 912.733 MHz, the margin between the emission level and the specification limit is 8.0 dB in the worst case at the frequency of 2738.1 MHz, horizontal polarization.

For the operation 919.165 MHz, the margin between the emission level and the specification limit is 0.0 dB in the worst case at the frequency of 1838.3 MHz, horizontal polarization.

TEST PERSONNEL:

Tester Signature: _____ Date: 02.01.14

Typed/Printed Name: A. Sharabi

Radiated Emission

E.U.T Description	Two Way Radio System (G2W) Concentrator
Type	AMGR0C03A
Serial Number:	Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 10.0 GHz
Test Distance: 3 meters
Detector: Peak

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
912.733	1825.4	H	63.5	74.0	-10.5
912.733	1825.4	V	60.4	74.0	-13.6
912.733	2738.1	H	66.0	74.0	-8.0
912.733	2738.1	V	58.6	74.0	-15.4
919.165	1838.3	H	65.0	74.0	-9.0
919.165	1838.3	V	64.7	74.0	-9.3
919.165	2757.5	H	61.3	74.0	-12.7
919.165	2757.5	V	64.0	74.0	-10.0

Figure 35. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission

E.U.T Description: Two Way Radio System (G2W) Concentrator
Type: AMGR0C03A
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 1.0 GHz to 25.0 GHz
Test Distance: 3 meters
Detector: Average

Operation Frequency (MHz)	Freq. (MHz)	Polarity (H/V)	Duty Cycle Factor (dB)	Average /QP (dBµV/m)	Average / QP Specification (dB µV/m)	Average Margin (dB)
912.733	1825.4	H	-27.95	35.55	54.0	-18.45
912.733	1825.4	V	-27.95	32.45	54.0	-21.55
912.733	2738.1	H	-27.95	38.05	54.0	-15.95
912.733	2738.1	V	-27.95	30.65	54.0	-23.35
919.165	1838.3	H	-27.95	37.05	54.0	-16.95
919.165	1838.3	V	-27.95	36.75	54.0	-17.25
919.165	2757.5	H	-27.95	33.05	54.0	-20.95
919.165	2757.5	V	-27.95	36.05	54.0	-17.95

Figure 36. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

12.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1Year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	1Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Antenna Log Periodic	A.H. Systems	SAS-200/511	809	April 2, 2013	1 Year
Double Ridged Waveguide Horn Antenna	A.H. Systems	SAS 200/571	199	March 14, 2012	2 Years
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 21, 2012	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2012	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

13. Antenna Gain/Information

The antenna gain is 5.15 dBi.

Laird Technologies – Base Station Antennas

FG9023	902-928 MHz	915 MHz	3 dBd	25"	200 Watts

14. R.F Exposure/Safety

Typical use of the E.U.T. is as a system manager. It transmits via radio communication the controller's commands to all field units and returns the various inputs of the field units to the controller. The typical placement of the E.U.T. is wall or ceiling mounted. The typical distance between the E.U.T. and the user in the worst case application, is 1 m.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1310 Requirements

(a) FCC limits at 919.125 MHz is: f/1500 = 0.6127 $\frac{mW}{cm^2}$

(b) Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(c) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t- Transmitted Power 105.90 dbuV/m (Peak) = 0.00583W

G_T- Antenna Gain, 5.15 dBi = 3.27 numeric

R- Distance from Transmitter using 1 m worst case

(d) The peak power density is :

$$S_p = \frac{0.00583 \times 3.27}{4\pi(100)^2} = 1.517 \times 10^{-7} \frac{mW}{cm^2}$$

(e) This is below the FCC limit.

15. APPENDIX B - CORRECTION FACTORS

15.1 Correction factors for CABLE

**from EMI receiver
to test antenna
at 3 meter range.**

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.6
30.0	0.8
40.0	0.9
50.0	1.1
60.0	1.2
70.0	1.3
80.0	1.4
90.0	1.6
100.0	1.7
150.0	2.0
200.0	2.3
250.0	2.7
300.0	3.1
350.0	3.4
400.0	3.7
450.0	4.0
500.0	4.3
600.0	4.7
700.0	5.3
800.0	5.9
900.0	6.3
1000.0	6.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.3
1400.0	7.8
1600.0	8.4
1800.0	9.1
2000.0	9.9
2300.0	11.2
2600.0	12.2
2900.0	13.0

NOTES:

1. *The cable type is RG-214.*
2. *The overall length of the cable is 27 meters.*
3. *The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".*

15.2 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.

2. The overall length of the cable is 10 meters.

15.3 Correction factors for CABLE

**from spectrum analyzer
to test antenna above 2.9 GHz**

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.

2. The cable is used for measurements above 2.9 GHz.

3. The overall length of the cable is 10 meters.

15.4 Correction factors for CABLE

**from EMI receiver
to test antenna
at 10 meter range.**

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.8
30.0	0.9
40.0	1.2
50.0	1.4
60.0	1.6
70.0	1.8
80.0	1.9
90.0	2.0
100.0	2.1
150.0	2.6
200.0	3.2
250.0	3.8
300.0	4.2
350.0	4.6
400.0	5.1
450.0	5.3
500.0	5.6
600.0	6.3
700.0	7.0
800.0	7.6
900.0	8.0
1000.0	8.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	9.8
1400.0	10.0
1600.0	11.3
1800.0	12.2
2000.0	13.1
2300.0	14.5
2600.0	15.9
2900.0	16.4

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 34 meters.

3. The above data is located in file 34M10MO.CBL on the disk marked "Radiated Emissions Tests EMI Receiver".

12.6 Correction factors for LOG PERIODIC ANTENNA

Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

NOTES:

1. *Antenna serial number is 1038.*
2. *The above lists are located in file number 38M3O.ANT for a 3 meter range, and file number 38M100.ANT for a 10 meter range.*
3. *The files mentioned above are located on the disk marked "Radiated Emission Test EMI Receiver".*

15.5 Correction factors for LOG PERIODIC ANTENNA

Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. *Antenna serial number is 253.*
2. *The above lists are located in file number SAS3M0.ANT for a 3 meter range.*
3. *The files mentioned above are located on the disk marked "Antenna Factors".*

15.6 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
at 3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

NOTES:

1. Antenna serial number is 1041.

2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

15.7 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
10 meter range

FREQUENCY (MHz)	AFE (dB/m)
30.0	12.1
40.0	10.6
50.0	10.6
60.0	8.9
70.0	8.5
80.0	9.6
90.0	9.4
100.0	9.6
110.0	10.3
120.0	10.7
130.0	12.6
140.0	12.7
150.0	12.7
160.0	13.8
170.0	13.7
180.0	14.9
190.0	13.4
200.0	13.1
210.0	14.0
220.0	14.5
230.0	15.8
240.0	16.0
250.0	16.6
260.0	16.7
270.0	18.3
280.0	18.5
290.0	19.3
300.0	20.9

NOTES:

1. *Antenna serial number is 1041.*
2. *The above list is located in file 41BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".*

15.8 Correction factors for Double-Ridged Waveguide Horn

Model: 3115, S/N 29845
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			

15.9 Correction factors for ***Horn Antenna***

Model: SWH-28
at 1 meter range.

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4

15.10 Correction factors for Horn Antenna

Model: V637

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0

15.11 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2