

EMC TEST REPORT

COMPANY: Ban-Koe Companies (ID America)

PRODUCT(S): BARman, AXIOME

Test Report No: J20033594.011

APPROVED BY: Yuriy Litvinov _____

TEST ENGINEER: Norman Shpilsher _____

DATE: December 27, 2000

TOTAL PAGES: 15



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CONTENTS

| | | |
|------------|---|----|
| 1.0 | JOB DESCRIPTION | 1 |
| 2.0 | TEST SUMMARY | 2 |
| | 2.1 FCC 15.209 Radiated Emissions Limits | 3 |
| | 2.2 Example of Radiated Emissions Limits Calculation..... | 3 |
| | 2.3 Emissions Test Results..... | 4 |
| 3.0 | TEST EQUIPMENT | 5 |
| 4.0 | TEST CONFIGURATION | 6 |
| | 4.1 Support Equipment/Services..... | 6 |
| | 4.2 Sample Set-Up | 6 |
| | 4.3 Mode(s) of Operation..... | 6 |
| 5.0 | TEST PROCEDURES | 7 |
| | 5.1 Emissions Testing..... | 7 |
| | Appendix I - Emissions Test Data | 8 |
| | Appendix II - Configuration Photographs..... | 14 |



1.0 JOB DESCRIPTION

Equipment: BARman, AXIOME, CH-2035 CORCELLES Tag Reader

Equipment Serial No: 00026982

Voltage/Phase: 7.2VDC from internal battery in active mode, or
120VAC/60Hz through FW 6199 120VAC/15VAC Power Adapter and
AXIOME Base in charging mode.

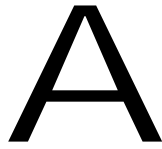
Customer: Ms. Brenda O'Connell
Ban-Koe Companies
9100West Bloomington Freeway
Minneapolis, MN 55431
Phone: 952-881-0634, Fax: 952-888-3344

Test Standard: CFR 47:1999, §15.209

Date Sample(s) Submitted: December 8, 2000

Test Work Started: December 15, 2000

Test Work Completed: December 20,2000

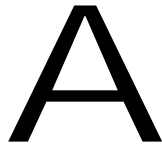


2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

| TEST STANDARD | TEST | COMMENTS |
|--------------------|--------------------|----------|
| Subpart C – 15.209 | Radiated Emissions | Pass |

Where comments other than “pass” are entered in the “comments” column, further details may be found in the TEST RESULTS section.



2.1 FCC 15.209 Radiated Emissions Limits

| FREQUENCY MHz | FIELD STRENGTH $\mu\text{V/m}$ | MEASURENENT DISTANCE m |
|------------------|-----------------------------------|---------------------------|
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 – 88 | 100 | 3 |
| 88 – 216 | 150 | 3 |
| 216 – 960 | 200 | 3 |
| Above 960 | 500 | 3 |

NOTE: In the emission tables above, the tighter limit applies at the band edges.

2.2 Example of Radiated Emissions Limits Calculation

The fundamental output power and harmonic emissions limits are outlined in paragraph 15.209.

The fundamental frequency field strength allowed at the distance of 3 meters was calculated to be 105.6 dB $\mu\text{V/m}$. The second harmonic field strength allowed at the distance of 3 meters was calculated to be 99.6 dB $\mu\text{V/m}$. The fourth harmonic field strength allowed at the distance of 3 meters was calculated to be 96.0 dB $\mu\text{V/m}$.

Calculation of the field strength of the fundamental frequency:

$$\text{Limit at 300m} = 20 \log (2400/F(\text{kHz}))$$

$$\text{Limit at 300m} = 20 \log (2400/126.25)$$

$$\text{Limit at 300m} = 20 \log (19.01) = 25.6 \text{ dB}\mu\text{V/m}$$

$$\text{Limit at 3m} = 25.6 \text{ dB}\mu\text{V/m} + \text{Distance Factor} = 25.6 \text{ dB}\mu\text{V/m} + 80 \text{ dB} = 105.6 \text{ dB}\mu\text{V/m}$$

Calculation of the field strength of the second harmonic emissions:

$$\text{Limit at 300m} = 20 \log (2400/F(\text{kHz}))$$

$$\text{Limit at 300m} = 20 \log (2400/252.5)$$

$$\text{Limit at 300m} = 20 \log (9.505) = 19.6 \text{ dB}\mu\text{V/m}$$

$$\text{Limit at 3m} = 19.6 \text{ dB}\mu\text{V/m} + \text{Distance Factor} = 19.6 \text{ dB}\mu\text{V/m} + 80 \text{ dB} = 99.6 \text{ dB}\mu\text{V/m}$$

Calculation of the field strength of the fourth harmonic emissions:

$$\text{Limit at 30m} = 20 \log (24000/F(\text{kHz}))$$

$$\text{Limit at 300m} = 20 \log (24000/505)$$

$$\text{Limit at 300m} = 20 \log (47.5) = 33.5 \text{ dB}\mu\text{V/m}$$

$$\text{Limit at 3m} = 33.5 \text{ dB}\mu\text{V/m} + \text{Distance Factor} = 33.5 \text{ dB}\mu\text{V/m} + 40 \text{ dB} = 73.5 \text{ dB}\mu\text{V/m}$$

The limit was extrapolated with Distance Extrapolating Factor. According to FCC 15.31(f)(2) at frequencies below 30MHz the Distance Extrapolating Factor is 40 dB/decade; for measurement distance 3m Distance Factor is 80dB below 0.49 MHz and 40dB above 0.49MHz and below 30MHz.



2.3 Emissions Test Results (see Appendix I)

No modifications were installed on the unit(s) during the emissions testing.

Radiated emissions at Fundamental Frequency and Spurious Frequencies comply with FCC 15.209 limits (See Table 1 and Graphs 1, 2, and 3).

Fundamental Frequency occupied frequency range from 0.1237 to 0.1288 MHz (See Graph 4). The nearest restricted bands of operation per FCC 15.205 are from 0.090 to 0.110MHz and from 0.495 to 0.505MHz.

Field Strength Calculation

The field strength is calculated by adding the emissions reading on the EMI Receiver to the factors associated with preamplifiers (if any), antennas and cables. A sample calculation is included below.

$$FS = RA + AF + CF$$

Where FS = Field Strength in dBì V/m
RA = Receiver Amplitude (including preamplifier) in dBì V
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB

DF = Distance Extrapolation Factor

Assume a receiver reading of 26.4 dBì V at frequency 0.126MHz is obtained. The antenna factor of 56.8 dB is added. The Cable Attenuation Factor was ignored because of very small value for measured frequencies. The net field strength for comparison to the appropriate emission limit is 83.2 dBì V/m.

The result was extrapolated with Distance Extrapolating Factor. According to FCC 15.31(f)(2) at frequencies below 30MHz the Distance Extrapolating Factor is 40 dB/decade; for measurement distance 3m DF is 80dB below 0.49 MHz and 40dB above 0.49MHz and below 30MHz.



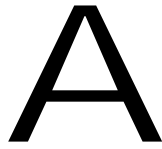
3.0 TEST EQUIPMENT

Receivers/Spectrum Analyzers

| DESCRIPTION | SERIAL NO. | LAST CAL DATE | CAL DUE | TICK IF USED |
|------------------------------------|------------|---------------------|------------|--------------------|
| HP85462A Receiver RF Section | 3325A00106 | 05/00 | 05/01 | X |
| HP85460A RF Filter Section | 3330A00109 | 05/00 | 05/01 | X |
| HP85462A Receiver RF Section | 3549A00306 | 12/00 | 12/01 | |
| HP85460A RF Filter Section | 3448A00276 | 12/00 | 12/01 | |
| Advantest Spectrum Analyzer R3271A | 55050084 | 05/00 | 05/01 | |

Antennas

| DESCRIPTION | SERIAL NO | LAST CAL DATE | CAL DUE | TICK IF USED |
|--|-----------|---------------------|------------|--------------------|
| Schaffner-Chase Bicono-Log Antenna | 2468 | 10/00 | 10/01 | |
| Schaffner-Chase Bicono-Log Antenna | 2630 | 03/00 | 03/01 | |
| A.H. Systems SAS-200/562B Loop Antenna | 215 | 11/00 | 11/01 | X |
| EMCO Horn Antenna 3115 | 9507-4513 | 09/99 | 09/00 | |
| EMCO Log Periodic Antenna 3146 | 9606-4515 | 04/00 | 04/01 | |



4.0 TEST CONFIGURATION (see Appendix II)

4.1 Support Equipment/Services

N/A

4.2 Sample Set-Up

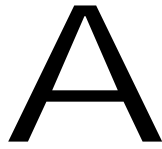
The EUT was set up as stand alone tabletop equipment. The EUT was removed from AXIOME Base and run with continuous transmitting mode of operation.

Cables

N/A

4.3 Mode(s) of Operation

The EUT was run continuously in transmitting mode with fundamental frequency 126.25kHz in “READ BADGEv” unit display mode: EUT is On, Down Arrow Key in Change? YES *NO* mode.



5.0 TEST PROCEDURES

5.1 Emissions Testing

Radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). All measurements were performed in 3m Anechoic Chamber. Preliminary scans were performed in the 3m Anechoic Chamber only to determine worst case modes. For each scan, the procedure for maximizing emissions in Appendices D and E were followed.

The test facility is a specially designed for 3m distance CISPR testing.

All test sites include a metal ground plane constructed of 22-gauge sheet metal. Each site contains a 2.5 meter diameter turntable for floor standing equipment, and a wooden table measuring 1.5 x 1.5 x 0.8 meters for table top equipment to facilitate testing, also it has heat and air conditioning systems to control environmental test conditions.

Measurements from 0.009 MHz to 30 MHz are taken with Loop antenna. The antenna was placed of a 1meter height, which meets FCC requirements. The antenna was rotated during testing in three antenna axes to obtain the maximum emissions from the EUT.

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APPENDIX I

EMISSIONS TEST DATA

**Radiated Emissions from 9kHz to 30MHz****Date:** 12-20-2000

Company: Ban-Koe Companies
Model: BARman Tag Reader, AXIOME, CH-2035 CORCELLES, s/n 00026982
Test Engineer: Norman Shpilsher
Special Config. Info: Continuous operation mode: "Read Badge"
Fundamental operating frequency 126kHz
Standard: CFR47, Part15, Subpart C, 15.209
Note: Measurement distance 3m with Loop antenna SAS 200/562B
Distance Factor 80dB from 9kHz to 490kHz, and 40dB from 490kHz to 30MHz.
The table shows the worst case radiated emissions.
All measurements were taken using a CISPR Peak detector with RBW 10kHz.

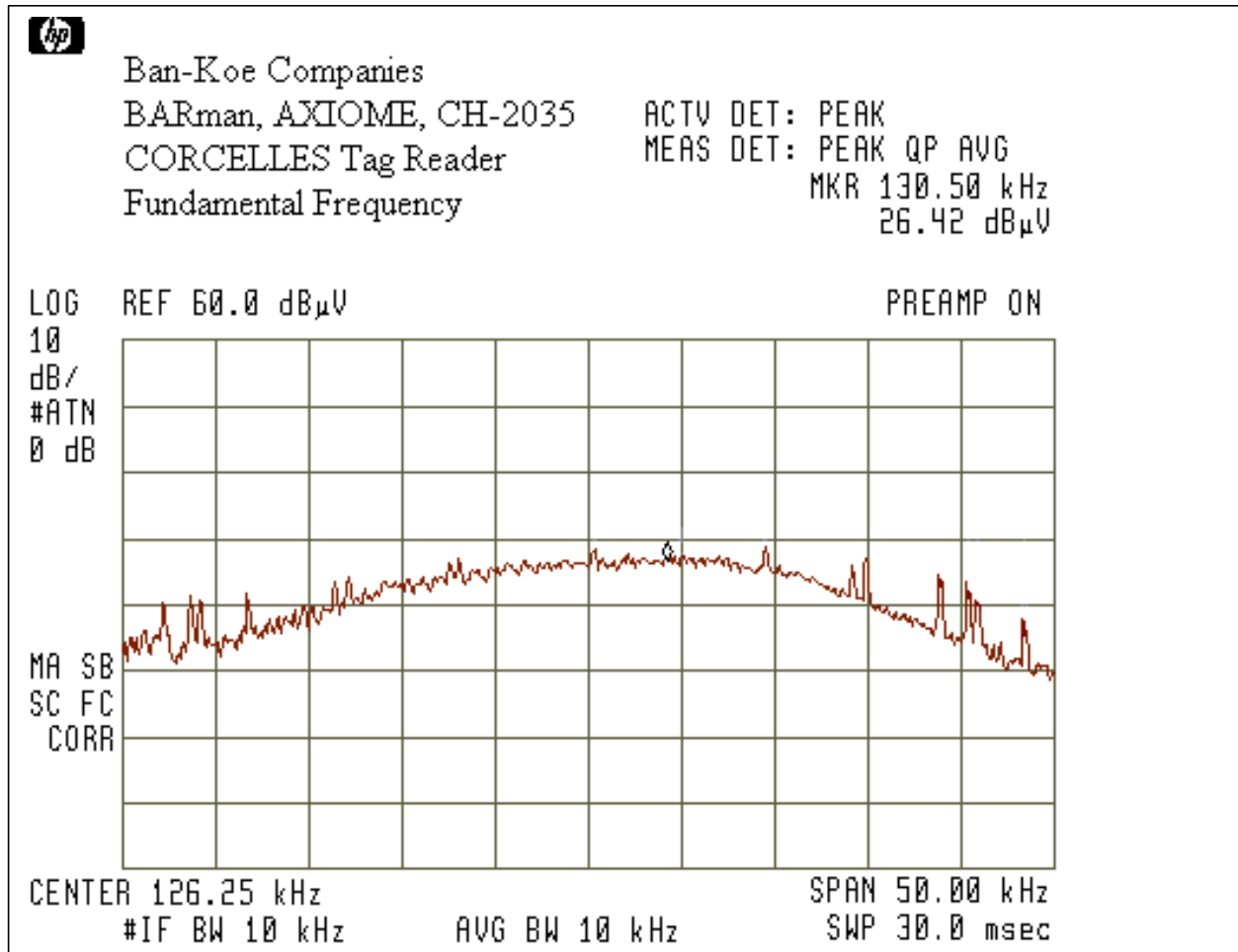
Table # 1

| Frequency MHz | Peak Reading dB μ V | Antenna Factor dB/m | Net at 3m. dB μ V | Distance Factor dB | 15.209 Limit dB μ V | Limit at 3m dB μ V | Margin dB | Comments |
|------------------|----------------------------|------------------------|--------------------------|-----------------------|----------------------------|---------------------------|--------------|----------|
| 0.126 | 26.4 | 56.8 | 83.2 | 80.0 | 25.6 | 105.6 | -22.4 | |
| 0.253 | 15.6 | 50.8 | 66.4 | 80.0 | 19.5 | 99.5 | -33.1 | |
| 0.379 | 12.6 | 47.1 | 59.7 | 80.0 | 16.0 | 96.0 | -36.4 | |
| 0.505 | 12.3 | 44.4 | 56.7 | 40.0 | 33.5 | 73.5 | -16.8 | 1 |
| 0.610 | 10.5 | 42.9 | 53.4 | 40.0 | 31.9 | 71.9 | -18.5 | |
| 0.631 | 8.9 | 42.6 | 51.5 | 40.0 | 31.6 | 71.6 | -20.1 | |
| 0.758 | 8.5 | 41.1 | 49.6 | 40.0 | 30.0 | 70.0 | -20.4 | |
| 0.770 | 12.9 | 40.9 | 53.8 | 40.0 | 29.9 | 69.9 | -16.0 | |
| 0.830 | 12.4 | 40.3 | 52.7 | 40.0 | 29.2 | 69.2 | -16.5 | |
| 0.884 | 6.8 | 39.8 | 46.6 | 40.0 | 28.7 | 68.7 | -22.1 | |
| 1.010 | 7.5 | 38.7 | 46.2 | 40.0 | 27.5 | 67.5 | -21.3 | |
| 1.136 | 6.3 | 38.0 | 44.3 | 40.0 | 26.5 | 66.5 | -22.2 | |
| 1.263 | 6.8 | 37.2 | 44.0 | 40.0 | 25.6 | 65.6 | -21.6 | |
| 0.900 | 16.5 | 39.6 | 56.1 | 40.0 | 28.5 | 68.5 | -12.4 | |
| 1.000 | 14.4 | 38.8 | 53.2 | 40.0 | 27.6 | 67.6 | -14.4 | |
| 1.490 | 14.2 | 35.9 | 50.1 | 40.0 | 24.1 | 64.1 | -14.1 | |
| 18.000 | 24.7 | -21.3 | 3.4 | 40.0 | 29.5 | 69.5 | -66.1 | |

Comments: 1. Restricted frequency band per FCC 15.205

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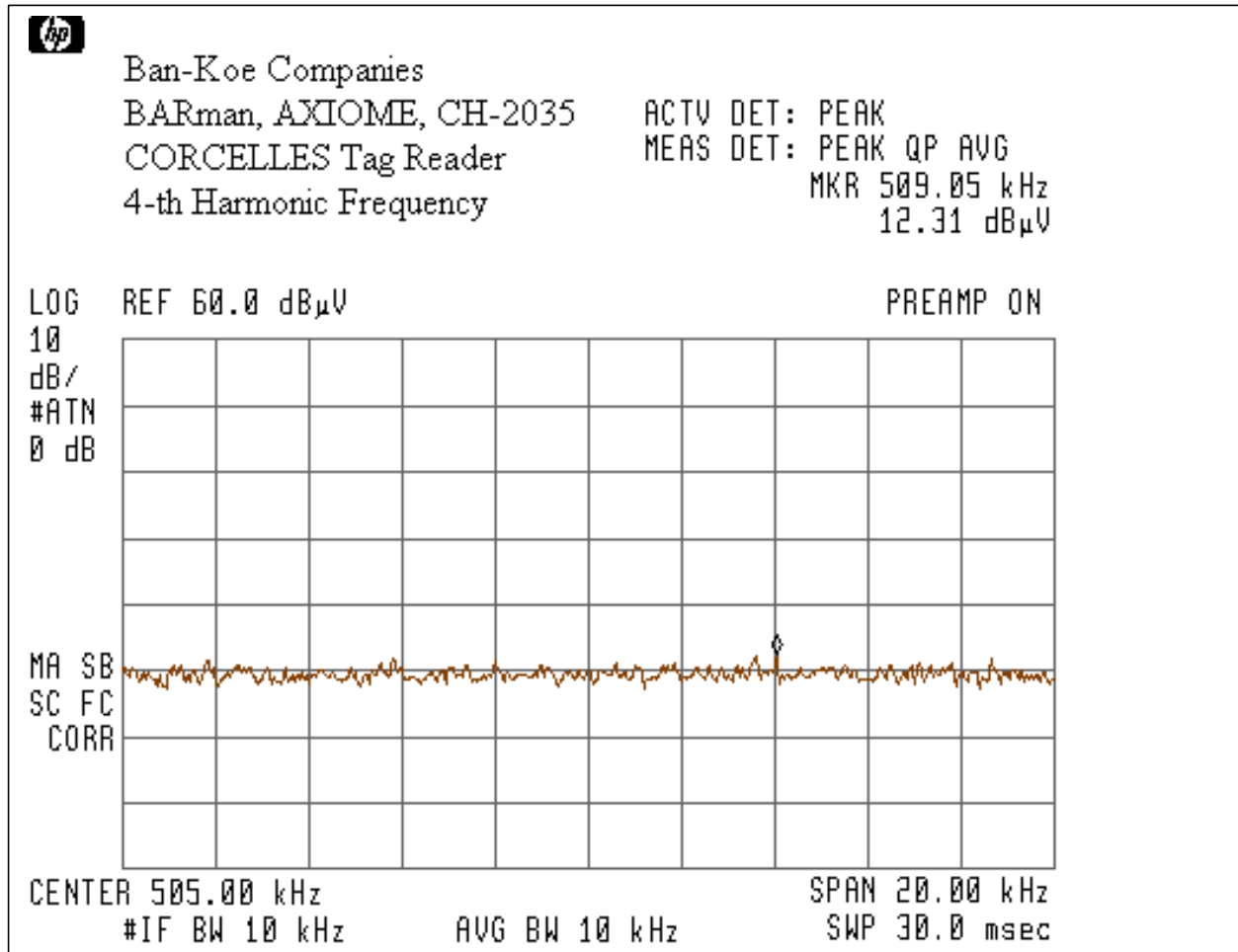
Graph #1
Frequency 0.12625MHz – Fundamental frequency



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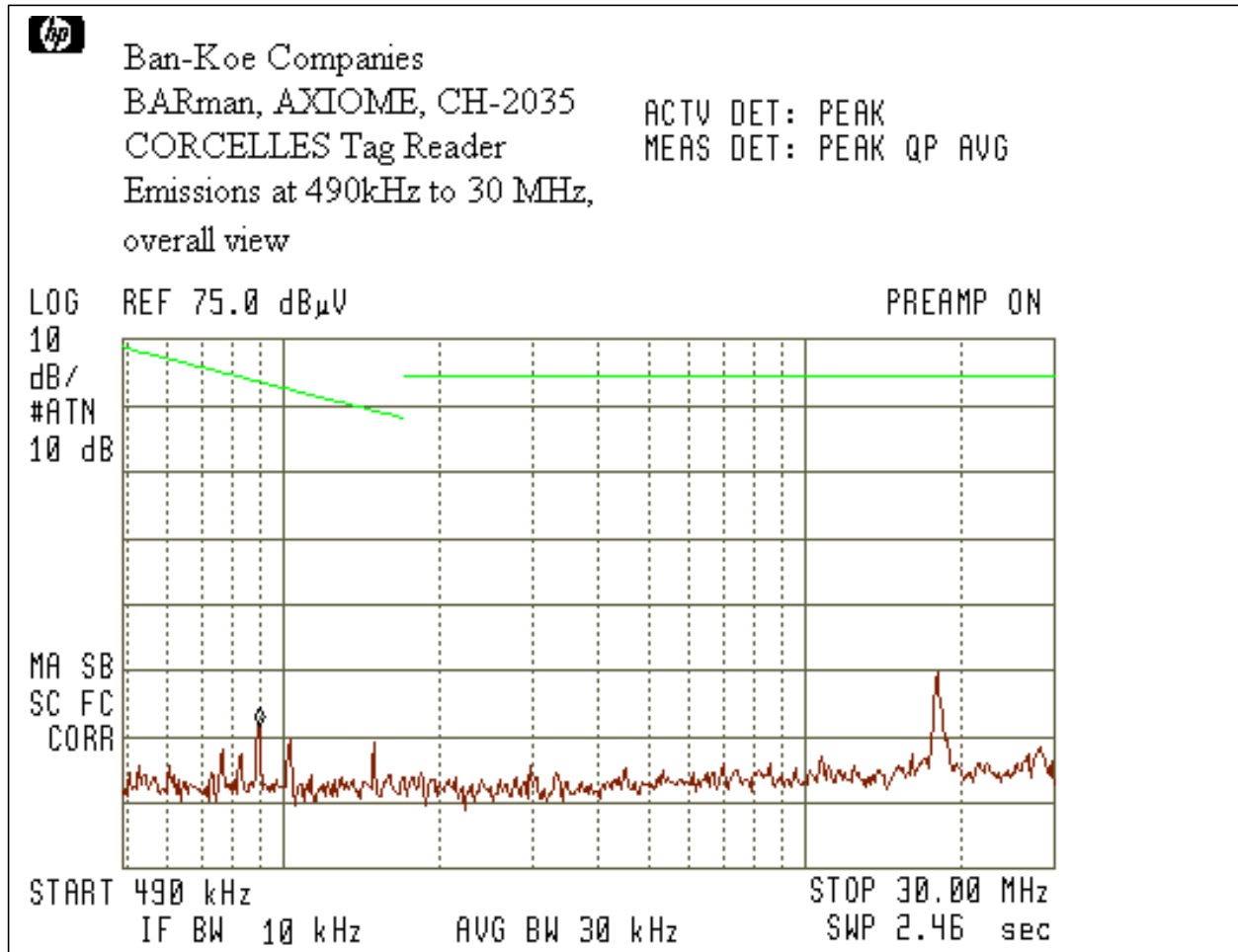
Graph #2

Frequency 0.505MHz – 4-th Harmonic frequency, Restricted frequency Band



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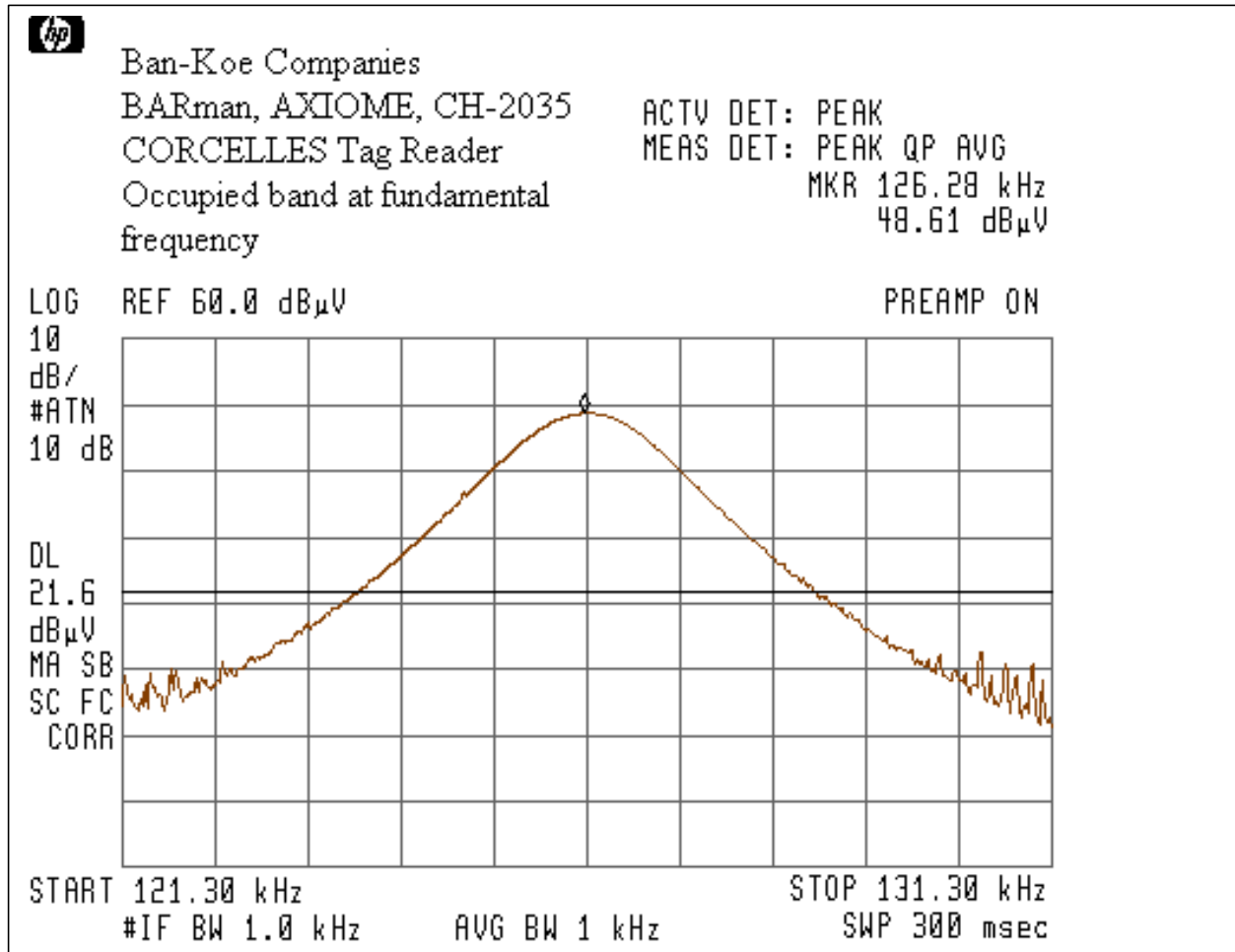
Graph #3
Frequency 0.490MHz – 30MHz, Overall view



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Graph #4

Frequency 0.12625MHz – Occupied band of the fundamental frequency



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APPENDIX II

CONFIGURATION PHOTOGRAPHS

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Radiated Emissions Test Configuration



Radiated Emissions Test Configuration