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EXHIBIT K: REPORT OF MEASUREMENTS [2.1033(B6)]

Test Report for FCC ID: CB2SAHL3

FCC Part 2.1031, Part 15 Subpart C(15.231)

Report #09800271F
Issued 1/14/00

TRANSMITTER MODEL VC4698 OF HOMELINK® III SERIES

Prepared for: Mr. David Blaker
Johnson Controls Interiors, LLC
One Prince Center
Holland, MI 49423

Test Date(s): December 5-22, 1999

data recorded by

Ted Chaffee, NCE
Test Engineer, AHD

witnessed by

David Blaker
Craig Harder

This report prepared by:

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Technical Manager/Test Engineer, AHD

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Statements Concerning this Report

Test Traceability:
The calibration of all measuring and test equipment and the measured data using this equipment are traceable to the National Institute for Standards and Technology (NIST).

Limitations on results:
The test results contained in this report relate only to the Item(s) tested. Any electrical or mechanical modification made to the test item subsequent to the test date shall invalidate the data presented in this report. Any electrical or mechanical modification made to the test item subsequent to this test date shall require an evaluation to verify continued compliance.

Limitations on copying:
This report shall not be reproduced, except in full, without the written approval of AHD.

Limitations of the report:
This report shall not be used to claim product endorsement by NVLAP, FCC, or any agency of the US Government.

Statement of Test Results Uncertainty: Following the guidelines of NAMAS publication NIS81 and NIST Technical Note 1297, the Measurement Uncertainty at a 95% confidence level is determined to be: ±3.6 dB

Manufacturer/Applicant [2.1033(b1)]

The manufacturer and applicant:

JOHNSON CONTROLS INTERIORS, LLC.
One Prince Center
Holland, Michigan 49423

Measurement/Test Site Facility & Equipment

Test Site [2.948, 2.1033(b6)]

The AHD test facility is centered on 9 acres of rural property near Sister Lakes, Michigan. The mailing address is 92723 M-152, Dowagiac, Michigan 49047. This test facility is NVLAP accredited (LabCode 200129-0). It has been fully described in a report filed with the FCC and Industry Canada. The report filed with the FCC is, dated November 5, 1996, was accepted by the FCC in a letter dated January 15, 1997, (31040/SIT 1300F2). The report filed with Industry Canada, dated August 11, 1998, was accepted via a letter dated September 1, 1998, (file:IC3161).

Measurement Equipment Used [2.947(d), 15.31(b)]

Equipment	Model	S/N	Last Cal Date	Calibration Interval
HP EMI Receiver system	HP 8546A			
RF Filter Section	HP-85460A	3448A00283	22-Jun-99	12 month
RF Receiver Section	HP-85462A	3625A00342	22-Jun-99	12 month
EMCO BiconiLog Antenna	3142	1077	07-Sep-99	12 months
(3-M) Type 129FF Ultra Flex LowLoss	RG58/U	9910-12	29-Oct-99	6 months
University of Mich Double Ridge Horn	0.2 - 5.0GHz	C	16-Mar-99	12 months
6 ft. Andrew DF4 Heliax		9912-02	13-Dec-99	12 months

Measurement Environment

The tests were performed with the equipment under test, and measurement equipment inside the all-weather enclosure. Ambient temperature was 22deg.C., the relative humidity 40%.

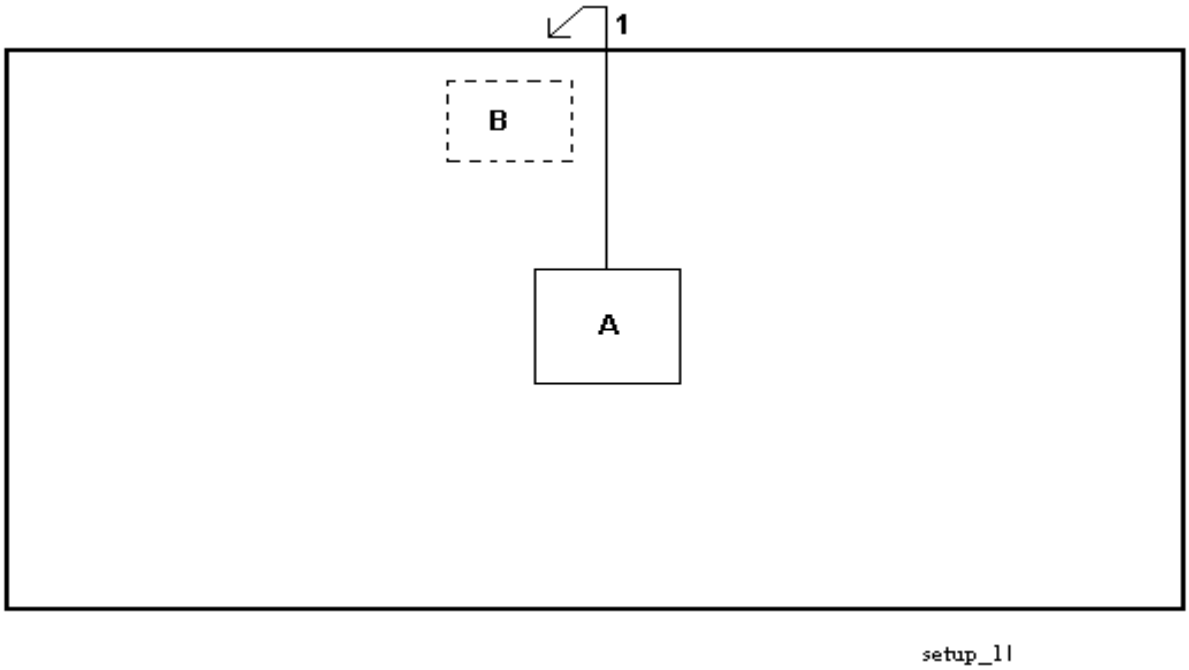
Tested Configuration /Setup: [2.1033(b8)]

Support Equipment & Cabling

Setup Diagram Legend	Description	Model	Serial No. / Part No.	EMC Consideration
A	[EUT] Universal Garage Door Opener	[JCI] VC4968	--	FCC ID: CB2SAHL3
B	12V DC Power Supply	[Kikusui] PAB 18-3	47263914	Located on the turntable base below the EUT table.
1	Power Supply Cable Harness	--	--	2 meters, Unshielded, lightly twisted pair of wires.

Setup Diagram

Note: Setup photographs are located in Attached Electronic File, Exhibit L.



BASIC EUT SETUP
(Legend designation is above)

Summary of Results:

1. This test series evaluated the Equipment Under Test, VC4968, to FCC Part 15, SubPart C.
2. The system tested is compliant to the requirement of CFR 47, FCC Part 15, SubPart C for periodic operation in the allowed frequency bands above 70MHz, (Part 15.231).
3. The equipment under test was received on December 9, 1999 and this test series commenced on December 9, 1999.
4. The line conducted emission testing does not apply to this product. The device is powered from a 12 volt automobile source.
5. The preliminary scan for spurious emissions conducted in a shielded room showed no observable spurious emissions other than the harmonics of the fundamental transmit frequency.
6. The frequencies selected for final evaluation include 288MHz, 310MHz, and 418MHz. This is in accordance with 47 CFR 15.31(m). The 310MHz was selected as a mid-range frequency because it is the predominant frequency used in controlling garage doors. Past correspondence with the FCC regarding the selection of frequencies and test setup can be found in Exhibit O.
7. Occupied Band Width of the transmitted signal, at the 20dB point, nearest the limit was measured to be 495KHz. This measurement occurred with the EUT transmitting at 288MHz with a pulse modulation of 80% duty cycle. This measurement is within the allowed 720KHz bandwidth.
8. The field strength level of the fundamental was measured for 288MHz, 310MHz, and 418MHz. The evaluation showed the emission nearest the limit occurred while operating at 418MHz with 500Hz pulsed modulation at a 30% duty cycle. The EUT was positioned on the ‘end’ and the receive antenna oriented in the vertical polarization. This signal was measured to be 1.2dB below the limit of 80.3dBuV/m (10,333uV/m).
9. The evaluation of the field strength levels of the harmonics showed the emission nearest the limit occurred while operating at 288MHz with 500Hz pulsed modulation at 30% duty cycle. The EUT was positioned on the ‘flat’; and the receive antenna oriented in the horizontal polarization. This signal, at 576MHz, was measured to be 7.7dB below the limit of 53.8dBuV/m (492uV/m).
10. Digital Spurious Emissions: The are no detectable spurious emissions associated with the digital portion of the VC4968.
11. The average value of the coarse tune pulses over a 100mSec time, nearest the limit, occurred at 418MHz. The measurement was determined to be 4000uV/m which is 8.2dB below the limit of 10,333uV/m..
12. The average value of the fine tune pulses over a 100mSec time, nearest the limit, occurred at 288MHz. The measurement was determined to be 653uV/m which is 17.5dB below the limit of 4917uV/m..

Changes made to achieve compliance

1. NONE

Standards Applied to Test: [2.1033(b6)]

ANSI C63.4 - 1992, Appendix I
CFR47 FCC Part 2, Part 15, SubPart C, 15.231 Intentional Radiator; SubPart B, Digital Device

Test Methodology: [2.1033(b6)]

The pictures in this report, showing test setups, indicate the agreed upon configuration of testing for this product-type. Refer to Exhibit O which contains correspondence with the FCC.

For the testing, the EUT was placed at the center of the table 80cm above the ground plane pursuant to ANSI C63.4 for stand-alone equipment. The 12volt supply harness was routed to the edge of the long side of the table then down to the power supply located on the turntable base.

The line conducted emission testing was not performed on this product. In its final configuration the product is powered from an automobile 12 volt system only.

Radiated

The system was placed upon a 1 x 1.5 meter non-metallic table 80cm above the open field site ground plane in the prescribed setup per ANSI C63.4, Figure 9(c).

The table sits upon a remote controlled turntable. The receiving antenna, located at the appropriate standards distance of 3 or 10 meters from the table center, is also remote controlled.

The principle settings of the EMI Receiver for radiated testing include:

IF Bandwidth:	120KHz for frequencies less than 1GHz.
	1 MHz for frequencies greater than 1GHz.
Detector Function:	Peak Mode
	The Average levels were determined mathematically based upon the duty cycle of the pulsed modulation of the transmitted signal.

At frequencies up to 1000MHz a BiconiLog broadband antenna was used for measurements.

At frequencies above 1000MHz a double-ridge Horn broadband antenna was used for measurements.

When using the Horn antenna the EUT position was raised to bring the EUT directly into the receive beam-width of the Horn antenna. Also, because the horn receive beamwidth is narrow and insensitive to the reflective component of the source emission, it was judged that the three orthogonal positions of the EUT and one polarization of the Horn antenna is sufficient to capture all the emission patterns of the EUT.

During the evaluation the EUT was transmitting continuously.

The turntable was rotated 360 degrees and the receiving antenna height varied from 1 to 4 meters to search out the highest emissions.

Preliminary tests were done at several transmit frequencies. The final measurements were made at a low band frequency (288MHz), a mid band frequency (310MHz), and a high band frequency (418MHz) pursuant to the requirements of 47CFR 15.31(m). At each frequency the EUT was placed in three orthogonal positions. At each position a 500Hz pulse modulation was adjusted to a 30%, 50%, and 80% duty cycle. At each duty cycle, measurements were taken with the receive antenna in vertical and horizontal positions.

The unit was evaluated up to the tenth harmonic of the fundamental as an intentional radiator, and up to 1000MHz as a digital device.

The orthogonal positions are:

Flat Side Edge

THE HP8546A EMI Receiver has stored in memory the antenna and coax correction factors used in this test. The resultant Field Strength (FS) in dBuV/m presented by the HP8546A is the summation in decibels (dB) of the Received Level (RF), the Antenna Correction Factor (AF), and the Cable Loss Factor (CF).

Formula 1: $FS(dBuV/m) = RF(dBuV) + AF(dB/m) + CF(dB)$

The resultant Field Strength measurement is recorded using the peak hold detector of the HP8546A.

This recorded peak level is further corrected, by calculation, to an average level by a factor determined by the duty cycle of the pulsed modulation. The duty cycle factor is determined as outlined in Appendix I4 of the standard ANSI C63.4:1992.

Formula 2: Average Level(uV/m) = [Peak Level(uV/m)] x [duty cycle factor].

Formula 2a: Average Level(dBuV/m) = Peak Level)dBuV/m) + duty cycle factor(dB).

The duty cycle factor to apply is determined for the duty cycles of 30%, 50% and 80% as follows.

For 30% (0.30): duty cycle factor(dB) = 20*Log(0.3) = -10.46
For 50% (0.50): duty cycle factor(dB) = 20*Log(0.5) = -6.02
For 80% (0.80): duty cycle factor(dB) = 20*Log(0.8) = -1.94

SAMPLE CALCULATION:

A measured peak level of 50% duty cycle pulse modulated signal is 500uV/m.
Calculated to dBuV/m is 20*Log(500) = 53.98dBuV/m Peak level.
Applying the duty cycle factor: Avg. Level(dBuV/m) = 53.98 - 6.02dB = 47.96dBuV/m.