Excellence in Compliance Testing

Certification Test Report

FCC ID: X6P-QSYNC433AM
IC: 8832A-QSYNC433AM

FCC Rule Part: 15.231
IC Radio Standards Specification: RSS-210

ACS Report Number: 12-0527.W06.1A

Manufacturer: HomeRun Holdings
Model: QSYNC-433AM

Test Begin Date: December 12, 2012
Test End Date: December 17, 2012

Report Issue Date: February 8, 2013

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Prepared by:

Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This report contains 19 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210.

1.2 Product description

The QSYNC-433AM is a TCP/IP to 433 MHz bridge for controlling QMotion shades.

Frequency Range: 433.92 MHz
Operating channels: 1
Modulation: ASK (OOK)
Operating Voltage: 6VDC (Via AC Mains Powered DC Supply)

Manufacturer Information:
HomeRun Holdings Corp.
6370 Mt. Pleasant St. NW
North Canton OH 44720
USA

Test Sample Serial Number(s): FCC/CE 1

Test Sample Condition: The test sample was provided in working order with no visible defects.

1.3 Test Methodology and Considerations

The EUT was tested for radiated emissions in two orientations which represent normal intended operation.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 200612-0. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Registration Number: 511277
Industry Canada Lab Code: IC 4175A-1
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

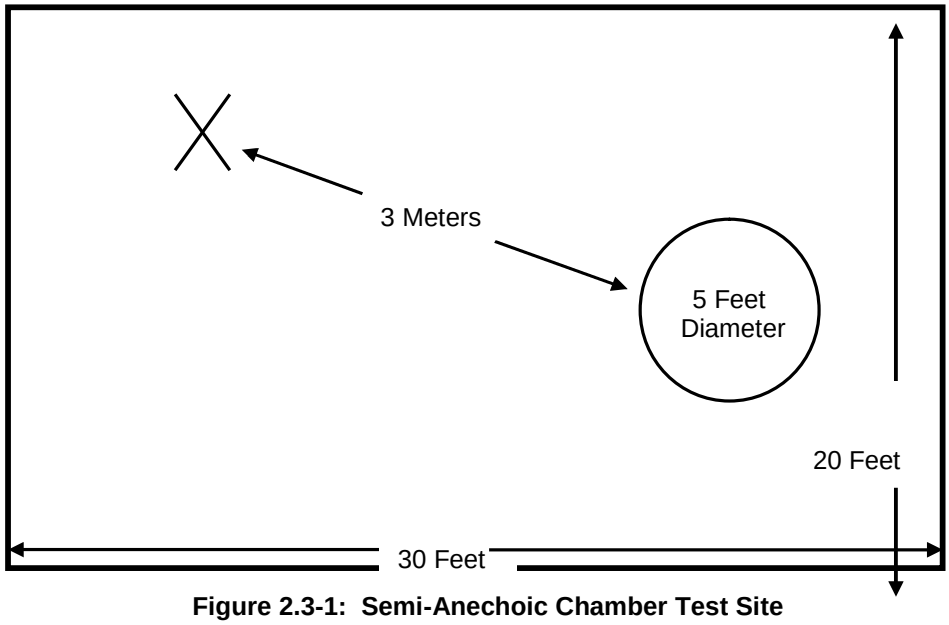

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

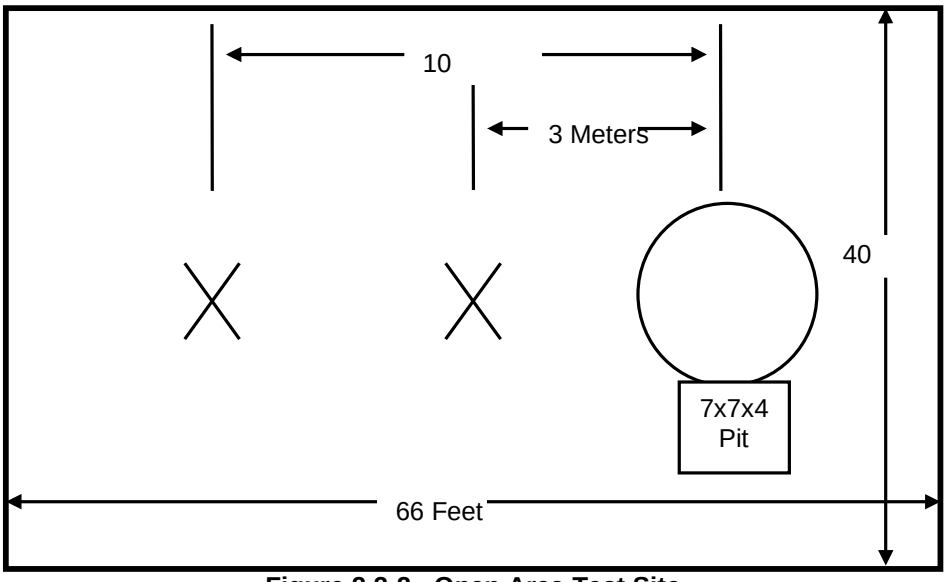

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal ground reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 4.1.3-1:

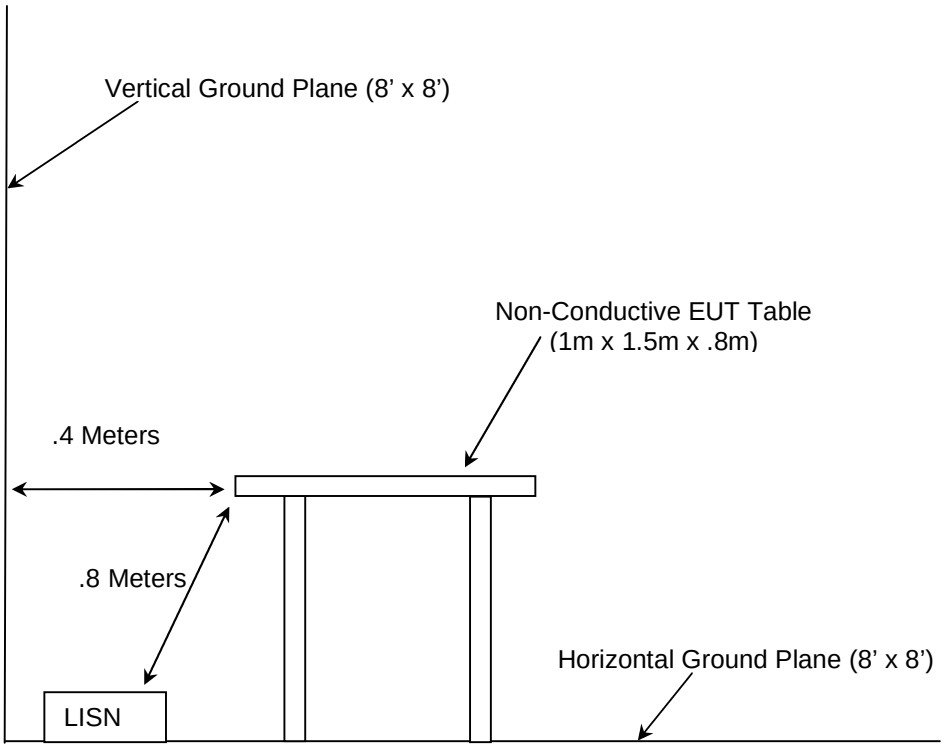

Figure 2.4-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2012
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2012
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8, Dec 2010
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3, Dec 2010.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
1	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	833771/007	8/2/2012	8/2/2014
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	8/2/2012	8/2/2014
22	Agilent	8449B	Amplifiers	3008A00526	8/2/2012	8/2/2013
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/27/2011	4/27/2013
40	EMCO	3104	Antennas	3211	2/11/2011	2/11/2013
73	Agilent	8447D	Amplifiers	2727A05624	9/28/2012	9/28/2013
152	EMCO	3825/2	LISN	9111-1905	7/31/2012	7/31/2014
168	Hewlett Packard	11947A	Attenuators	44829	2/1/2012	2/1/2013
193	ACS	OATS cable Set	Cable Set	193	7/3/2012	1/3/2013
211	Eagle	C7RFM3NFNM	Filters	HLC-700	11/7/2012	11/7/2013
213	TEC	PA 102	Amplifiers	44927	8/21/2012	8/21/2013
277	Emco	93146	Antennas	9904-5199	8/24/2012	8/24/2014
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	8/1/2012	8/1/2013
291	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	None	11/20/2012	11/20/2013
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	4/2/2012	4/2/2013
324	ACS	Belden	Cables	8214	6/26/2012	6/26/2013
329	A.H.Systems	SAS-571	Antennas	721	6/24/2011	6/24/2013
331	Microwave Circuits	H1G513G1	Filters	31417	7/2/2012	7/2/2013
338	Hewlett Packard	8449B	Amplifiers	3008A01111	8/2/2012	8/2/2013
343	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	NA	4/2/2012	4/2/2013
412	Electro Metrics	LPA-25	Antennas	1241	7/27/2012	7/27/2014
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	11/20/2012	11/20/2013
430	RF Cables	SMS-290AW-480-SMS	Cables	NA	4/2/2012	4/2/2013
486	Hewlett Packard	8591E	Analyzers	3543A04709	6/20/2012	6/20/2013
RE90	Agilent	E7404A	Analyzers	US40240143	11/28/2012	11/28/2013

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item #	Manufacturer	Equipment Type	Model Number	Serial Number
1	D-Link	Ethernet Router	DIR-655	F35F5B2034593
2	Dell	Laptop Computer	PP18L	N/A
3	Dell	Laptop Power Supply	PA-1650-05D2	CN-0F7970-71615-55M-6BF4
4	V-INFINITY	DC Power Supply	EPS060100	N/A

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

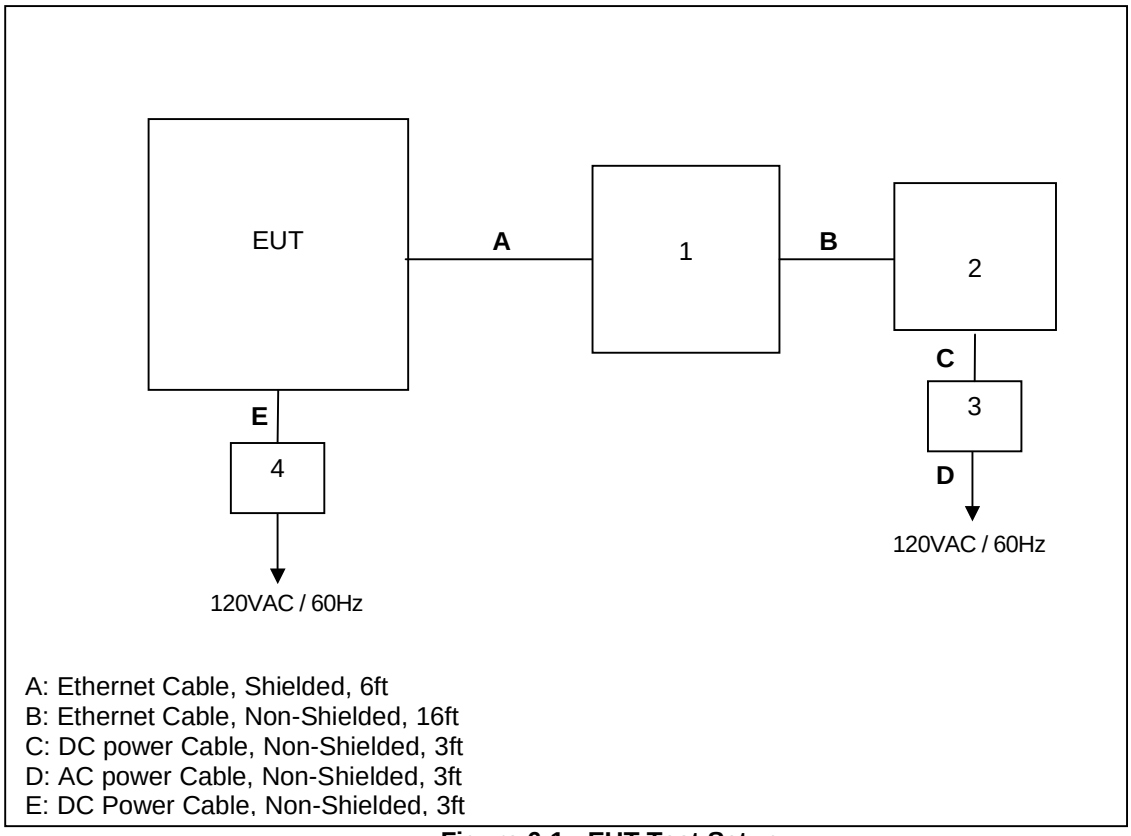

Figure 6-1: EUT Test Setup

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: CFR 47 Part 15.203

The antenna used for the QSYNC is a RP-SMA whip antenna. Its gain is 2.5dBi.

7.2 Power Line Conducted Emissions – FCC: CFR 47 Part 15.207/ IC: RSS-GEN 7.2.4

7.2.1 Measurement Procedure

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.2.2 Measurement Results

Results of the test are shown below in and Tables 7.2.2-1 to 7.2.2-2.

Table 7.2.2-1: Conducted EMI Results – Line 1

Check All That Apply to This Data
☒ Line 1 ☐ Line 2
☐ Line 3 ☐ Line 4
☐ To Ground ☒ Floating
☐ Telecom Port _____
☒ dBµV ☐ dBµA

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
8.43051	36.385	30.869	10.631	47.016	41.501	60	50	12.984	8.499
7.56859	36.817	30.76	10.609	47.425	41.368	60	50	12.575	8.632
7.24117	37.019	31.299	10.6	47.619	41.899	60	50	12.381	8.101
7.18243	36.039	29.751	10.598	46.637	40.349	60	50	13.363	9.651
0.307993	43.938	39.585	10.494	54.432	50.079	61.486	51.486	7.054	1.407
0.155165	38.379	30.256	10.429	48.808	40.685	65.852	55.852	17.045	15.167

Table 7.2.2-2: Conducted EMI Results – Line 2

Check All That Apply to This Data
☐ Line 1 ☒ Line 2
☐ Line 3 ☐ Line 4
☐ To Ground ☒ Floating
☐ Telecom Port _____
☒ dBµV ☐ dBµA

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
7.96367	32.627	25.702	10.619	43.246	36.321	60	50	16.754	13.679
7.64465	34.549	26.933	10.611	45.159	37.544	60	50	14.841	12.456
7.55066	34.392	26.605	10.608	45	37.213	60	50	15	12.787
7.47622	34.592	26.189	10.606	45.198	36.795	60	50	14.802	13.205
7.20421	35.281	26.682	10.599	45.88	37.281	60	50	14.12	12.719
6.98701	33.997	25.881	10.593	44.59	36.475	60	50	15.41	13.525

7.3 Periodic Operation – FCC: CFR 47 15.231(a) / IC: RSS-210 A1.1.1

7.3.1 Test Methodology

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

The transmitter was activated automatically and was evaluated using a spectrum analyzer at zero span with a > 5 second sweep time.

7.3.2 Test Results

The transmitter ceased operation 1.71s after being activated. The results are shown in Figure 7.3.2-1.

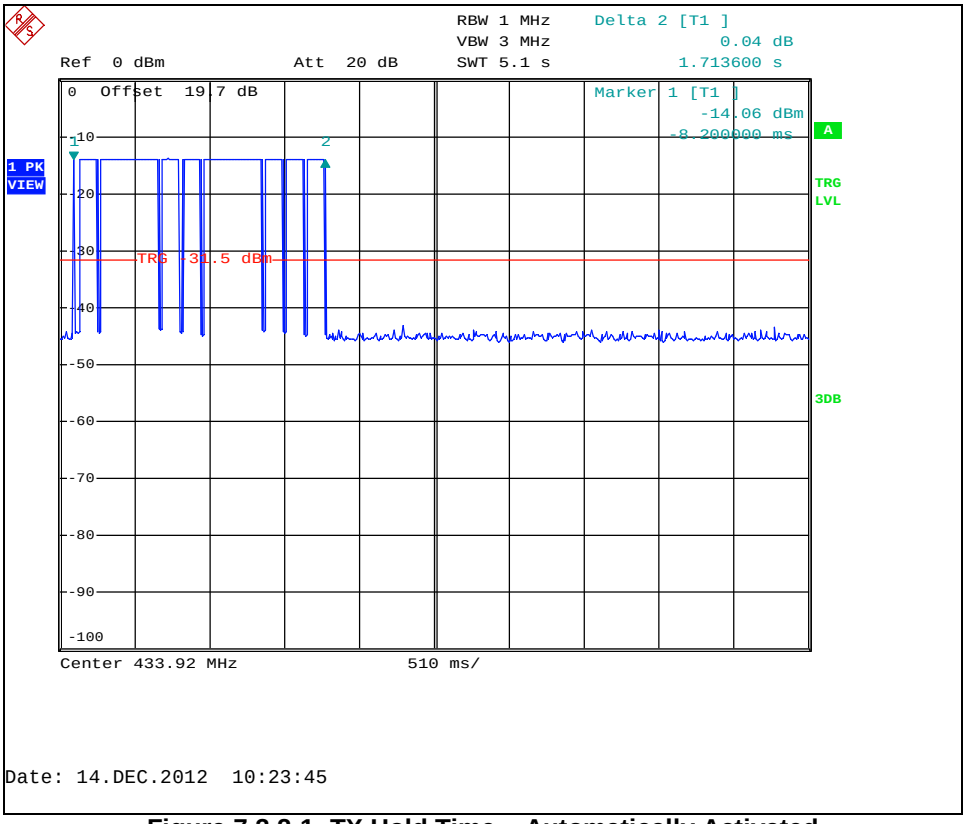

Figure 7.3.2-1: TX Hold Time – Automatically Activated

7.4 Occupied Bandwidth – FCC: CFR 47 15.231(c)(1) / IC: RSS-210 A1.1.3

7.4.1 Test Methodology

The RF output port of the EUT was directly connected to the input of the spectrum analyzer. The span of the spectrum analyzer display was set between two times and five times the occupied bandwidth (OBW) of the emission. The RBW of the spectrum analyzer was set to approximately 1 % to 5 % of the OBW. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

The occupied bandwidth measurement function of the analyzer was used for the 99% bandwidth. The span of the analyzer was set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth was set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth was set to 3 times the resolution bandwidth. A sampling detector was used.

7.4.2 Test Results

The 20dB and 99% bandwidths were measured as 6.03 kHz and 8.55 kHz respectively. 0.25% of the 433.92 MHz center frequency is equivalent to 1.085 MHz. Therefore the 20 dB and 99% bandwidths of the emission is less than 0.25% of the center frequency. The results are shown in Figure 7.4.2-1 and 7.4.2-2.

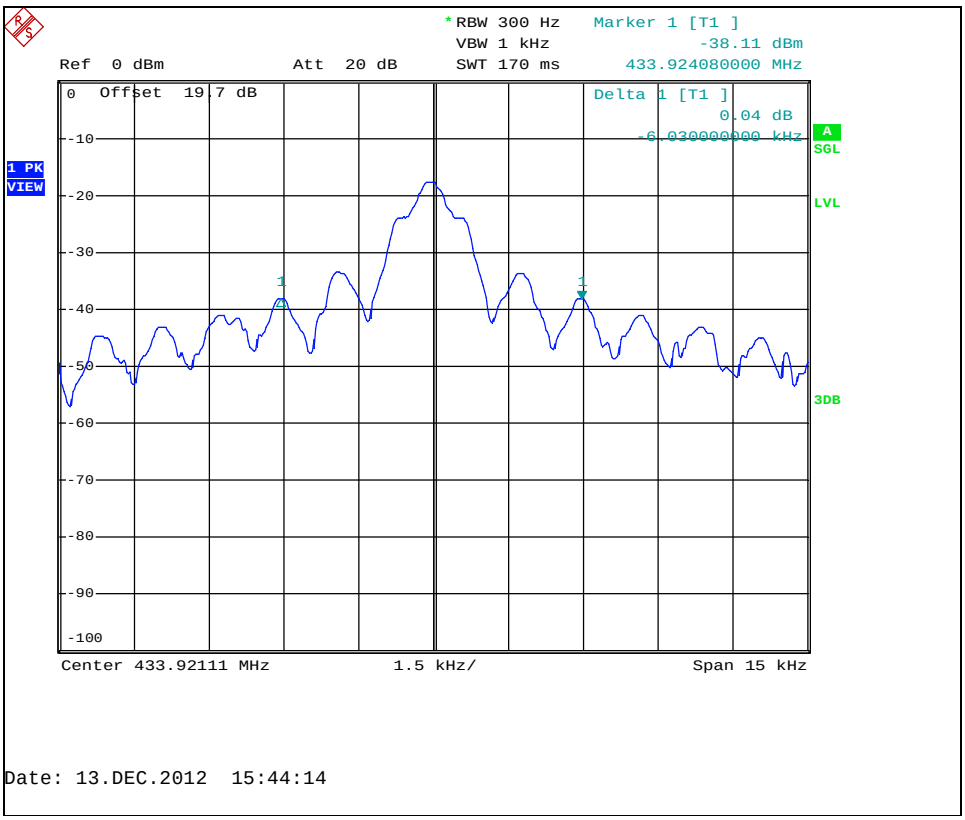

Figure 7.4.2-1: Occupied Bandwidth – 20 dB

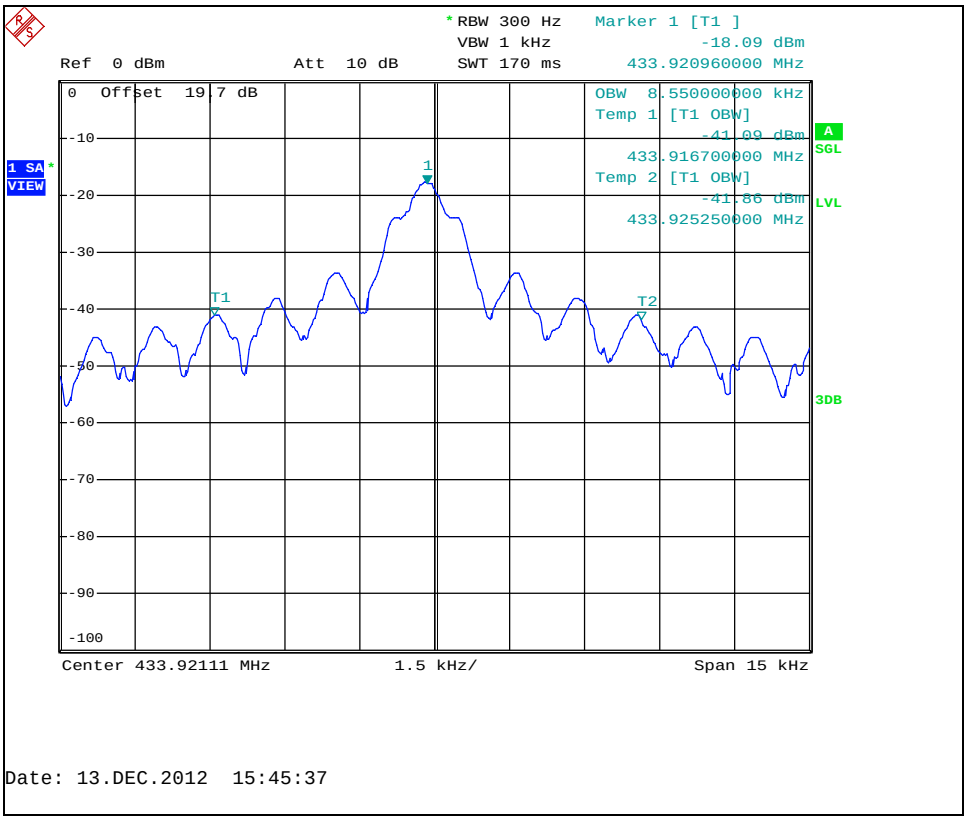

Figure 7.4.2-2: Occupied Bandwidth – 99%

7.5 Radiated Emissions – FCC: CFR 47 15.231(b) / IC: RSS-210 A1.1.2

7.5.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 5GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz. For frequencies above 1000MHz, average and peak measurements were made with RBW of 1 MHz and a VBW of 3 MHz.

Further, compliance with the provisions of 15.205 was demonstrated using the measurement instrumentation specified in that section where applicable.

The EUT utilized pulsed modulation therefore peak measurements where corrected by the duty cycle for comparison to the average limits.

7.5.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 6.48 dB to account for the duty cycle of the EUT. The worst case duty cycle was determined to be 47.4%. The duty cycle correction factor is determined using the formula: 20log (47.4/100) = -6.48 dB. Determination of the duty cycle correction is included in the plots and justification below.

Period (T) = 100 ms
Number Pulses (N1) = 43
Pulse Width (T1) = 0.830 ms
Number Pulse (N2) = 7
Pulse Width (T2) = 1.67 ms ms
(N1*T1 + N2*T2)/T = ((43*0.830) + (7*1.670))/100 = 0.474
20*Log(0.474) = -6.48 dB Average Correction Factor

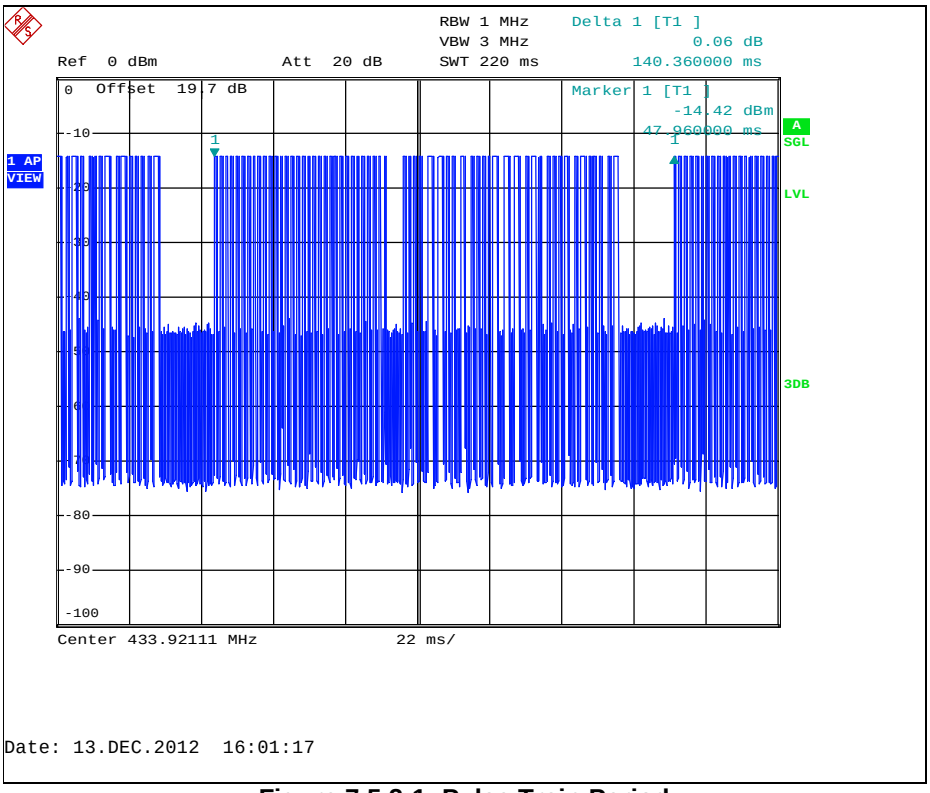

Figure 7.5.2-1: Pulse Train Period

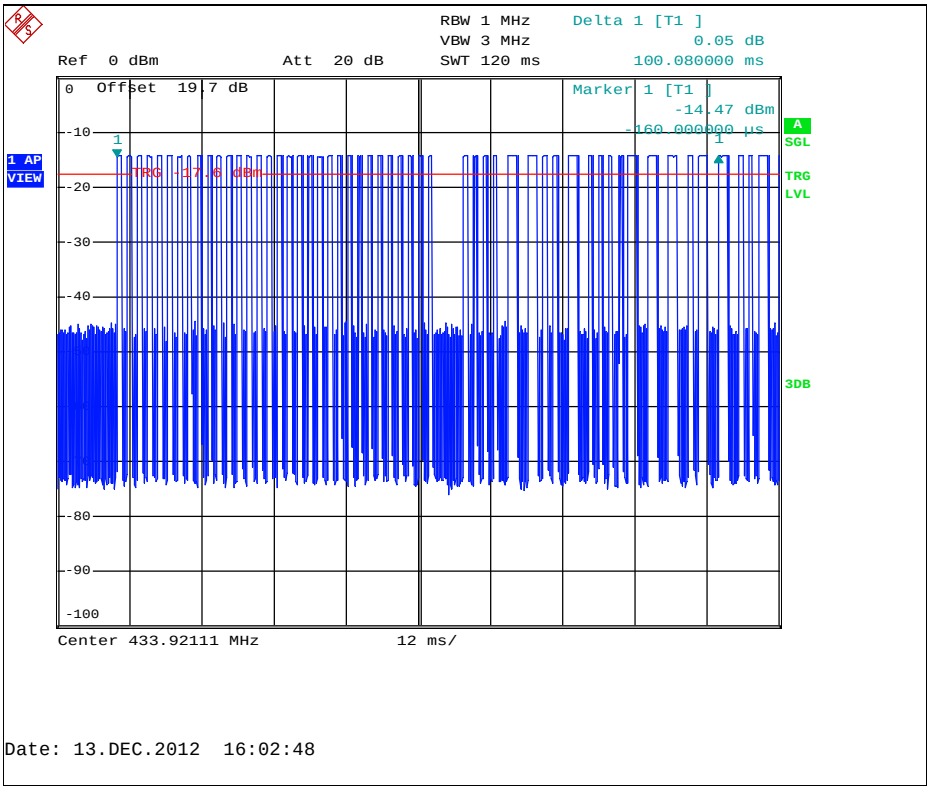

Figure 7.5.2-2: Duty Cycle - 100ms Period

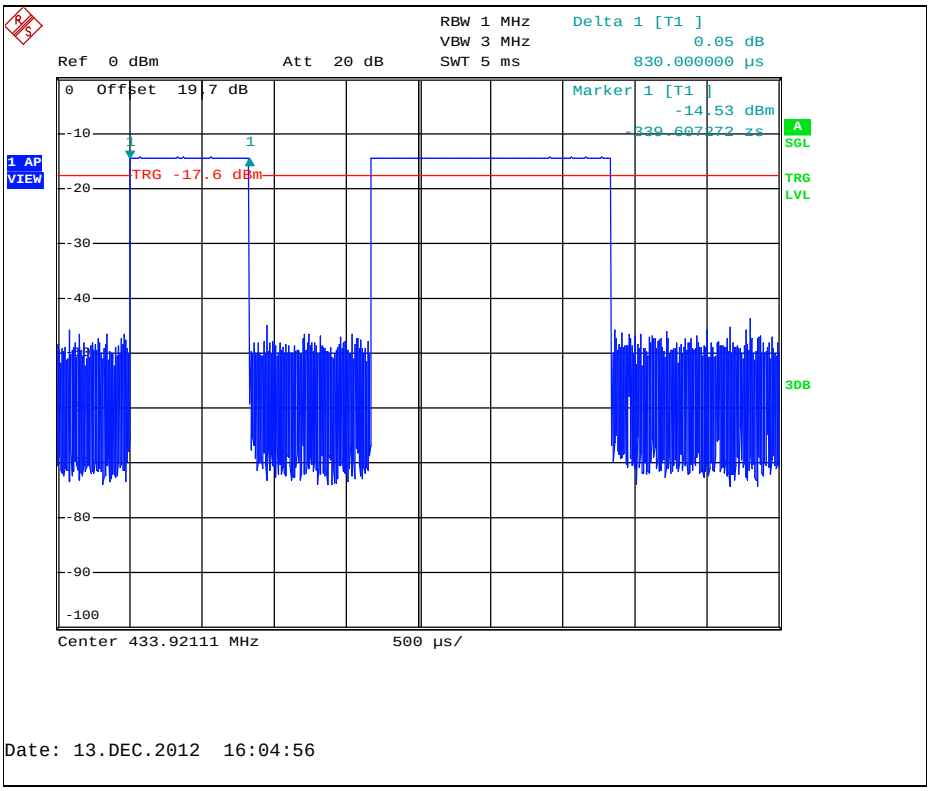

Figure 7.5.2-3: Duty Cycle – Pulse Width (T1)

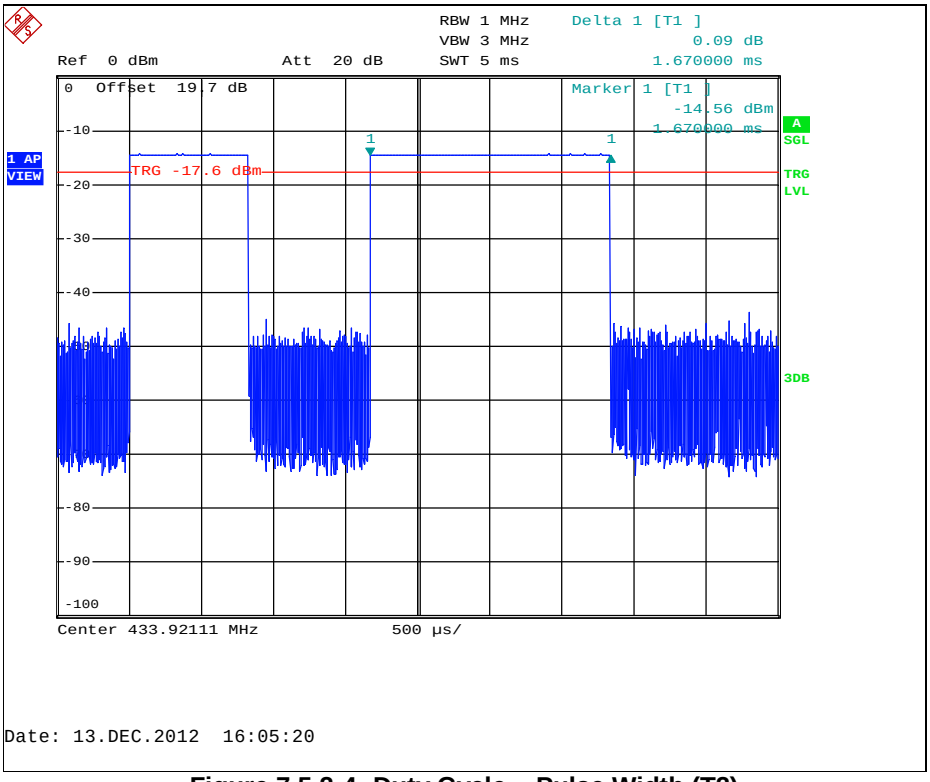

Figure 7.5.2-4: Duty Cycle – Pulse Width (T2)

7.5.3 Test Results

Radiated spurious emissions are reported in Tables 7.5.3-1 through 7.5.3-2. Emissions not reported were below the noise floor of the measurement system.

Table 7.5.3-1: Radiated Emissions – X Position

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Fundamental Emission										
433.92	86.67	86.67	H	-5.04	81.63	75.15	100.8	80.8	19.2	5.7
433.92	86.48	86.48	V	-5.04	81.44	74.96	100.8	80.8	19.4	5.9
Spurious Emissions										
1301.76	46.42	46.42	H	-6.28	40.14	33.66	74.0	54.0	33.9	20.3
1301.76	46.16	46.16	V	-6.28	39.88	33.40	74.0	54.0	34.1	20.6
1735.68	46.36	46.36	V	-2.89	43.47	36.99	80.8	60.8	37.3	23.8
2169.6	49.01	49.01	H	-0.24	48.77	42.29	80.8	60.8	32.0	18.5
2169.6	50.76	50.76	V	-0.24	50.52	44.04	80.8	60.8	30.3	16.8
2603.52	44.79	44.79	H	1.03	45.82	39.34	80.8	60.8	35.0	21.5
2603.52	44.96	44.96	V	1.03	45.99	39.51	80.8	60.8	34.8	21.3
3471.36	48.04	48.04	V	2.57	50.61	44.13	80.8	60.8	30.2	16.7

Table 7.5.3-2: Radiated Emissions – Y Position

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Fundamental Emission										
433.92	84.29	84.29	H	-5.04	79.25	72.77	100.8	80.8	21.5	8.1
433.92	90.16	90.16	V	-5.04	85.12	78.64	100.8	80.8	15.7	2.2
Spurious Emissions										
1735.68	45.86	45.86	V	-2.89	42.97	36.49	80.8	60.8	37.8	24.3
2169.6	49.90	49.90	H	-0.24	49.66	43.18	80.8	60.8	31.1	17.6
2169.6	53.82	53.82	V	-0.24	53.58	47.10	80.8	60.8	27.2	13.7
2603.52	45.19	45.19	H	1.03	46.22	39.74	80.8	60.8	34.6	21.1
2603.52	45.21	45.21	V	1.03	46.24	39.76	80.8	60.8	34.6	21.1
3471.36	48.13	48.13	V	2.57	50.70	44.22	80.8	60.8	30.1	16.6

7.5.4 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Fundamental Frequency (X Orientation)

PEAK:
Corrected Level: 86.67 - 5.04 = 81.63dBuV
Margin: 100.8dBuV – 81.63dBuV = 19.2dB

AVERAGE:
Corrected Level: 86.67 - 5.04 - 6.48 = 75.15dBuV
Margin: 80.8dBuV – 75.15dBuV = 5.7dB

8 CONCLUSION

In the opinion of ACS, Inc. the QSYNC-433AM manufactured by HomeRun Holdings met the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT