Excellence in Compliance Testing

Certification Test Report

FCC ID: 2ABLX-QSYNC433FM
IC: 8832A-QSYNC433FM

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

ACS Report Number: 15-0317.W06.1A

Manufacturer: QMotion Incorporated
Model: QSYNC-433FM

Test Begin Date: August 17, 2015
Test End Date: August 22, 2015

Report Issue Date: August 28, 2015

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 17 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-433FM is a TCP/IP to 433MHz bridge for controlling Qmotion shades with Apple or Android mobile devices. Mobile devices can connect to a network over Wi-Fi and control any QSyncs that are found.

Frequency Range: 433.92 MHz
Operating channels: 1
Modulation: FSK
Operating Voltage: 120Vac / 60Hz
Antenna Type / Gain: Molded Whip / 2.5dBi

Manufacturer Information:
Qmotion Incorporated.
3400 Copter Rd.
Pensacola, FL 32514
USA

Test Sample Serial Number(s): FCC#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 in (3) orientations which represent normal intended operation.

Software power setting during test: 6A
Software version number during test: 1.1.2312

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
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:

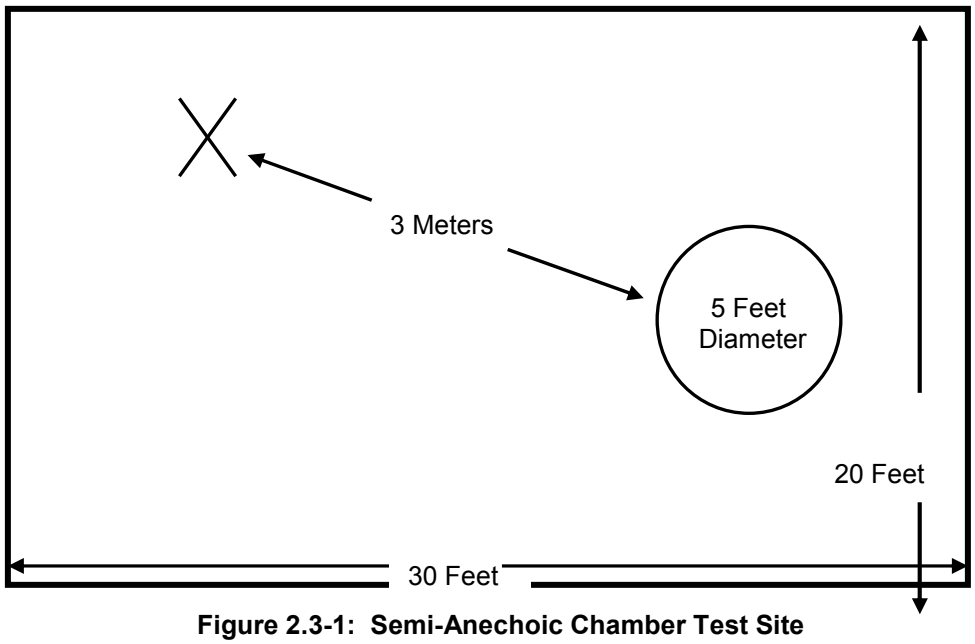


Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

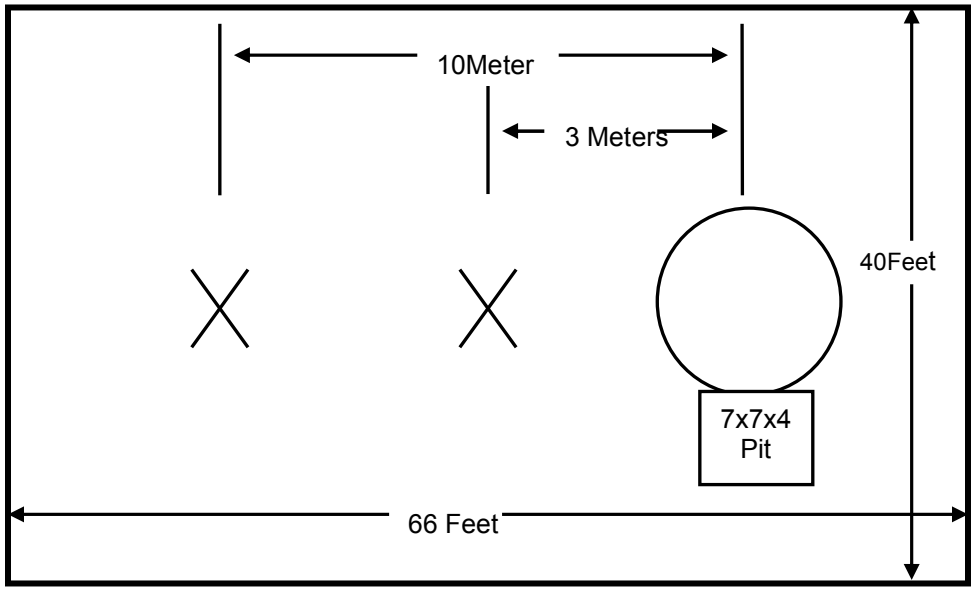


Figure 2.3-2: Open Area Test Site

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:

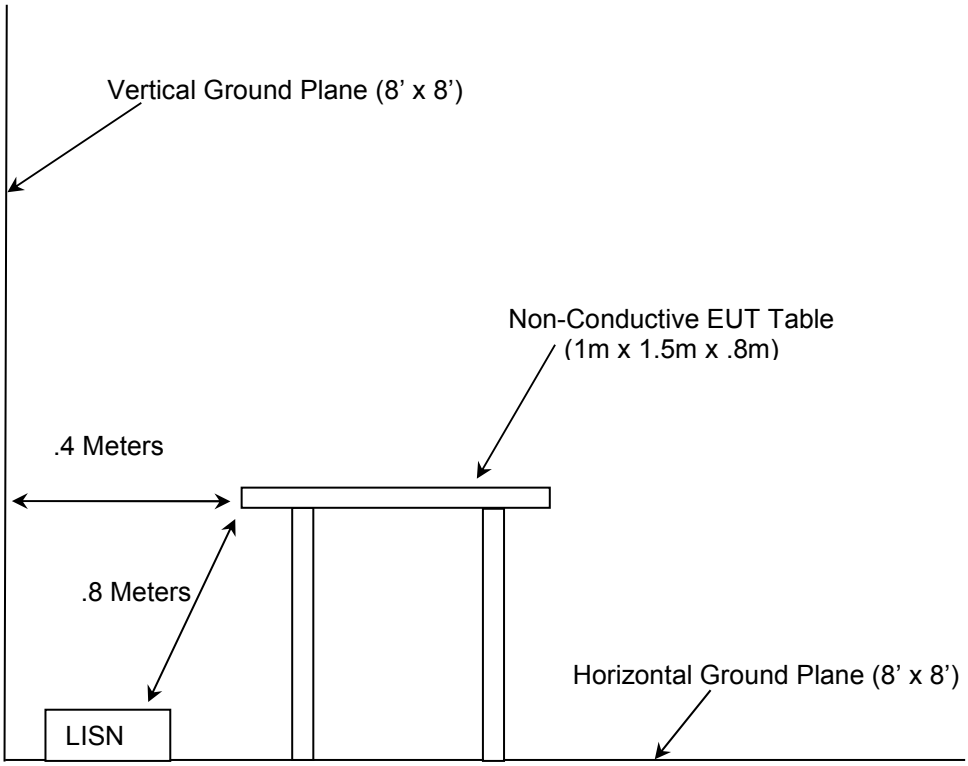


Figure 2.4-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2015
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2015
- Industry Canada Radio Standards Specification: RSS-210 – Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8, December 2010
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, Nov 2014.

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

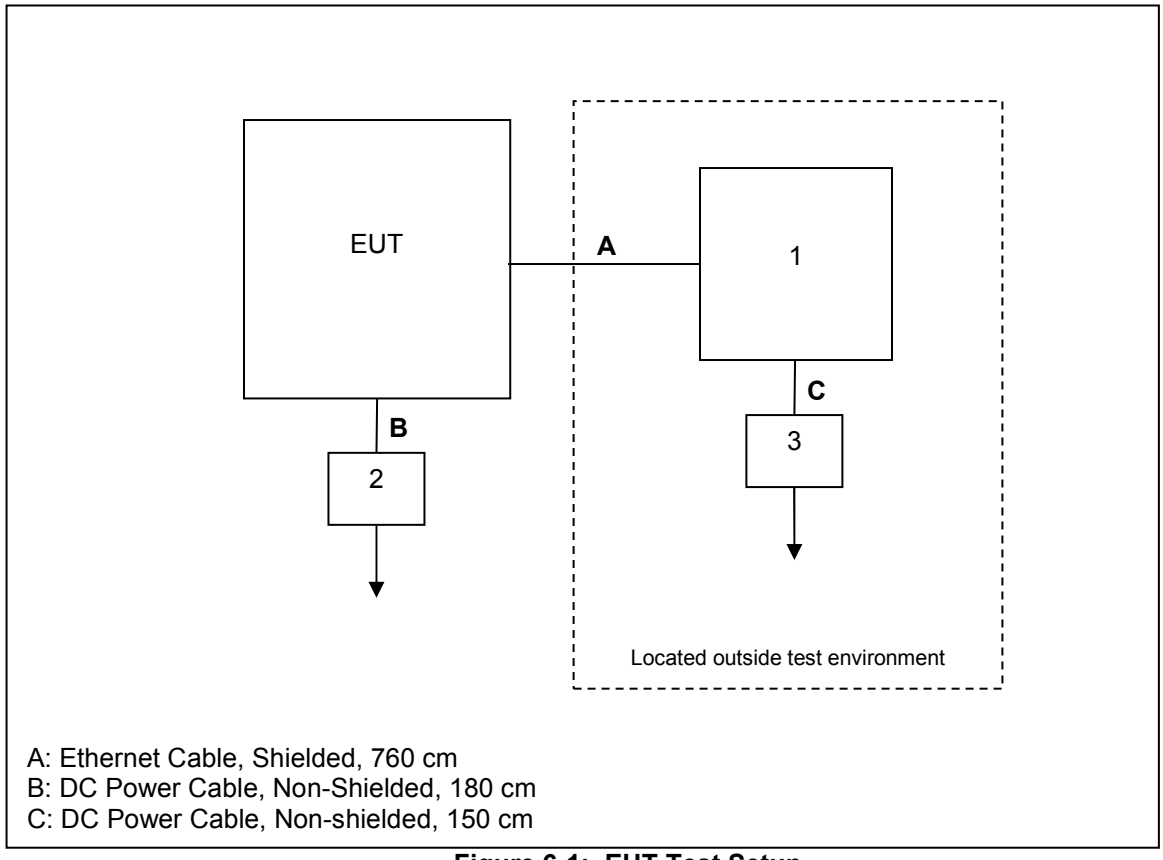
AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
1	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	833771/007	7/14/2015	7/14/2016
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	7/14/2015	7/14/2016
22	Agilent	8449B	Amplifiers	3008A00526	5/18/2015	5/18/2016
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/30/2015	4/30/2017
40	EMCO	3104	Antennas	3211	2/10/2015	2/10/2017
73	Agilent	8447D	Amplifiers	2727A05624	7/15/2015	7/15/2016
167	ACS	Chamber EMI Cable Set	Cable Set	167	10/28/2014	10/28/2015
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	3/3/2015	3/3/2016
340	Aeroflex/Weinschel	AS-20	Attenuators	7136	7/13/2015	7/13/2016
412	Electro Metrics	LPA-25	Antennas	1241	7/24/2014	7/24/2016
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	11/5/2014	11/5/2015
616	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	N/A	9/10/2014	9/10/2015
622	Rohde & Schwarz	FSV40	Analyzers	101338	7/15/2015	7/15/2016

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item #	Manufacturer	Equipment Type	Model Number	Serial Number
1	Netgear	Ethernet Router	WNR2000v5	3U814B5309321
2	V-INFINITY	Wall Wart Power Supply	EPS060100	N/A
3	Netgear	Wall Wart Power Supply	AD2015F23	N/A

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



A: Ethernet Cable, Shielded, 760 cm
B: DC Power Cable, Non-Shielded, 180 cm
C: DC Power Cable, Non-shielded, 150 cm

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 is a molded whip that is coupled to the EUT with a RP-SMA connector, thus satisfying Part 15.203. The antenna gain is 2.5dBi.

7.2 Power Line Conducted Emissions – FCC: CFR 47 Part 15.207/ IC: RSS-GEN 8.8

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

Table 7.2.2-1: Conducted EMI Results Line 1

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
1.065430	---	35.07	46.00	10.93	L1	10.1
1.065430	44.92	---	56.00	11.08	L1	10.1
1.311523	---	29.29	46.00	16.71	L1	10.2
1.311523	43.81	---	56.00	12.19	L1	10.2
3.087475	---	25.30	46.00	20.70	L1	10.3
3.087475	38.69	---	56.00	17.31	L1	10.3
3.148397	---	25.53	46.00	20.47	L1	10.3
3.148397	39.09	---	56.00	16.91	L1	10.3
3.346593	---	27.18	46.00	18.82	L1	10.3
3.346593	40.33	---	56.00	15.67	L1	10.3
3.729960	---	26.07	46.00	19.93	L1	10.3
3.729960	39.55	---	56.00	16.45	L1	10.3

Table 7.2.2-2: Conducted EMI Results Line 2

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
1.169339	---	24.32	46.00	21.68	N	10.1
1.169339	43.50	---	56.00	12.50	N	10.1
1.273547	---	12.88	46.00	33.12	N	10.2
1.273547	28.81	---	56.00	27.19	N	10.2
1.310221	---	25.66	46.00	20.34	N	10.2
1.310221	42.65	---	56.00	13.35	N	10.2
3.286874	---	23.99	46.00	22.01	N	10.3
3.286874	39.51	---	56.00	16.49	N	10.3
3.525952	---	22.95	46.00	23.05	N	10.3
3.525952	39.47	---	56.00	16.53	N	10.3
3.662626	---	23.68	46.00	22.32	N	10.3
3.662626	40.12	---	56.00	15.88	N	10.3

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 manually 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 1.94s after being manually activated. The results are shown in Figure 7.3.2-1.

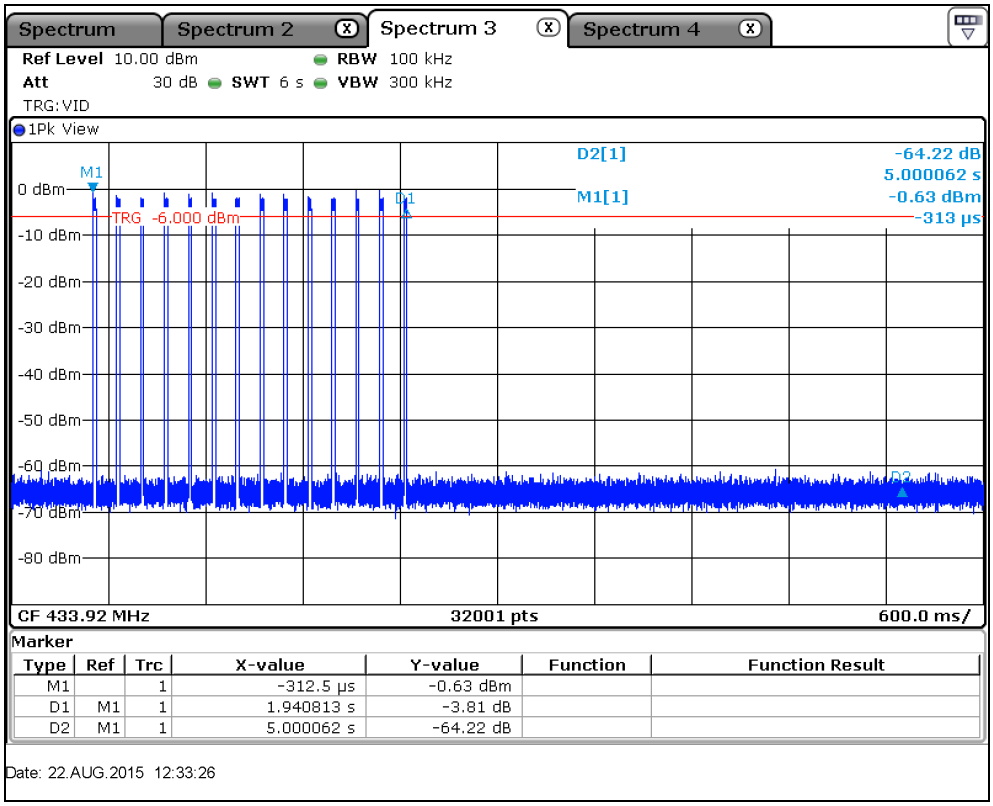


Figure 7.3.2-1: TX Hold Time

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

7.4.1 Test Methodology

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 spectrum analyzer was used to measure the 99% bandwidth. The span of the analyzer was set to capture all products of the modulation process, including the emission sidebands. The resolution bandwidth was set to 1% to 5% of the occupied bandwidth. The video bandwidth was set to 3 times the resolution bandwidth. A peak detector was used.

7.4.2 Test Results

0.25% of the 433.92 MHz center frequency is equivalent to 1.08 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 Table 7.4.2-1 and Figures 7.4.2-1 to 7.4.2-2.

Table 7.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
433.92	131.39	150.56

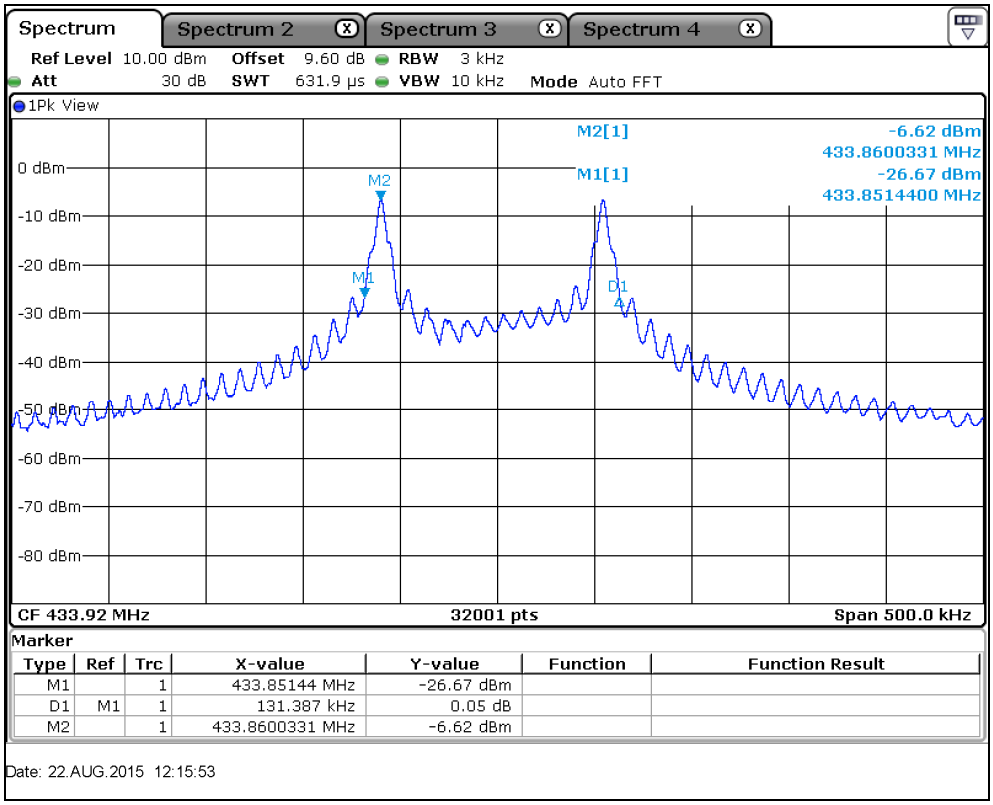


Figure 7.4.2-1: 20 dB Bandwidth

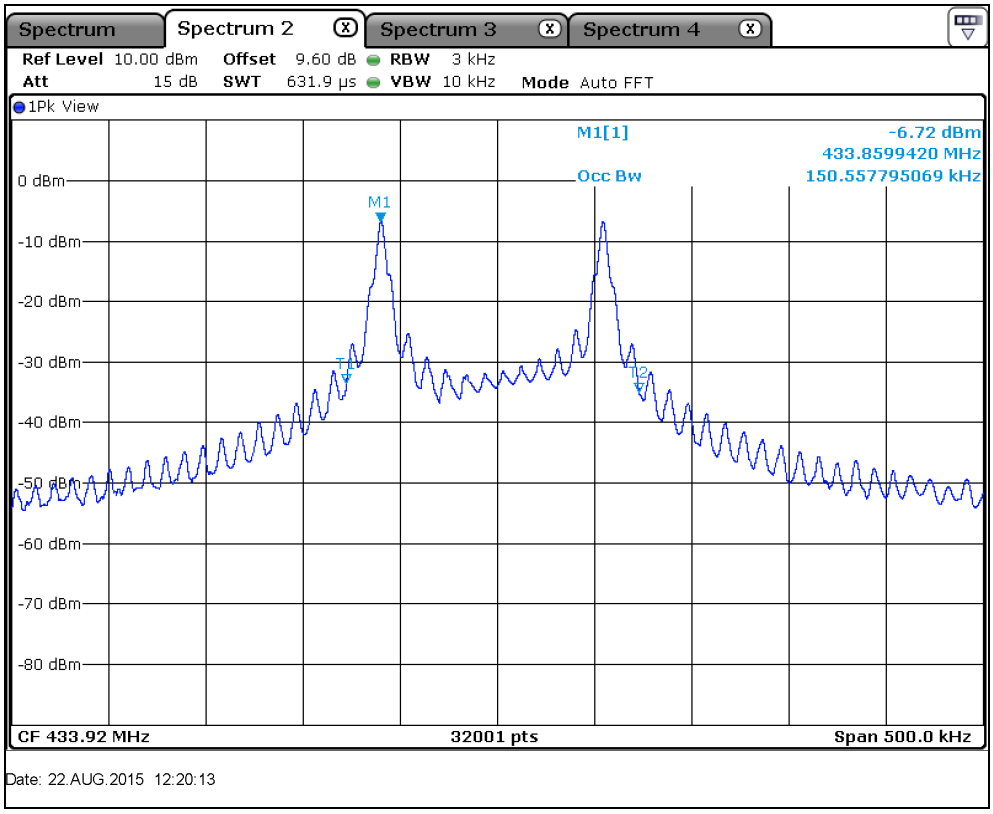


Figure 7.4.2-2: 99% Occupied Bandwidth

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, measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz. For frequencies above 1000MHz, 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 was configured to transmit continuous packet data and could not be operated at 100% duty, therefore peak measurements were 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 13.56 dB to account for the duty cycle of the EUT. The worst case duty cycle was determined to be 20.985%. The duty cycle correction factor is determined using the formula: 20log (20.985/100) = -13.56 dB. Determination of the duty cycle correction is included in the plots and justification below.

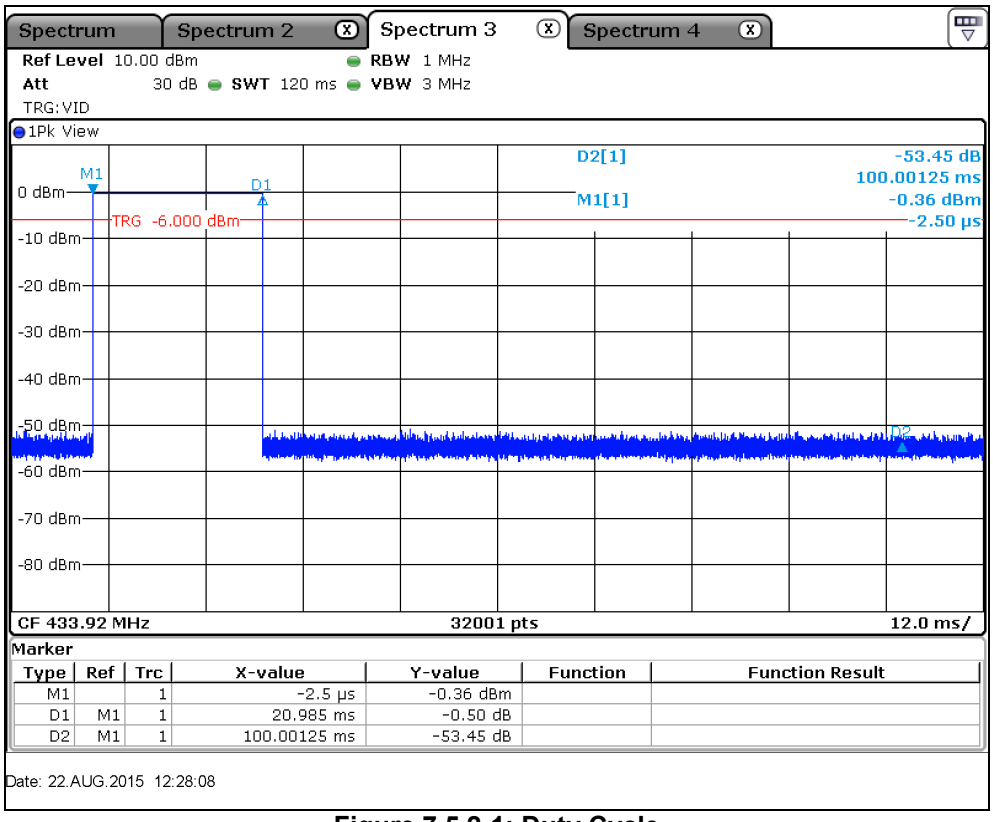


Figure 7.5.2-1: Duty Cycle

7.5.3 Test Results

Radiated spurious emissions are reported in Tables 7.5.3-1 through 7.5.3-3. 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	97.36	97.36	H	-6.76	90.60	77.04	100.8	80.8	10.2	3.8
433.92	95.83	95.83	V	-6.76	89.07	75.51	100.8	80.8	11.7	5.3
Spurious Emissions										
867.84	28.42	28.42	H	27.77	56.19	42.63	80.8	60.8	24.6	18.2
1301.76	47.72	47.72	H	-6.08	41.64	28.08	74.0	54.0	32.4	25.9
2169.6	50.10	50.10	H	-0.71	49.39	35.83	80.8	60.8	31.4	25.0
2169.6	49.57	49.57	V	-0.71	48.86	35.30	80.8	60.8	31.9	25.5
2603.52	49.27	49.27	H	1.60	50.87	37.31	80.8	60.8	29.9	23.5
2603.52	49.67	49.67	V	1.60	51.27	37.71	80.8	60.8	29.5	23.1

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	95.27	95.27	H	-6.76	88.51	74.95	100.8	80.8	12.3	5.9
433.92	97.96	97.96	V	-6.76	91.20	77.64	100.8	80.8	9.6	3.2
Spurious Emissions										
2169.6	52.19	52.19	H	-0.71	51.48	37.92	80.8	60.8	29.3	22.9
2169.6	48.27	48.27	V	-0.71	47.56	34.00	80.8	60.8	33.2	26.8
2603.52	48.38	48.38	H	1.60	49.98	36.42	80.8	60.8	30.8	24.4

Table 7.5.3-3: Radiated Emissions – Z 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	94.21	94.21	H	-6.76	87.45	73.89	100.8	80.8	13.4	6.9
433.92	94.11	94.11	V	-6.76	87.35	73.79	100.8	80.8	13.5	7.0
Spurious Emissions										
867.84	27.25	27.25	H	27.77	55.02	41.46	80.8	60.8	25.8	19.4
2169.6	50.97	50.97	H	-0.71	50.26	36.70	80.8	60.8	30.5	24.1
2169.6	52.01	52.01	V	-0.71	51.30	37.74	80.8	60.8	29.5	23.1

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: 97.36 - 6.76 = 90.60dBuV
Margin: 100.8dBuV – 90.60dBuV = 10.2dB

AVERAGE:
Corrected Level: 97.36 - 6.76 - 13.56 = 77.04dBuV
Margin: 80.8dBuV – 77.04dBuV = 3.8dB

8 CONCLUSION

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

END REPORT