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MEASUREMENT REPORT FCC Part 15.209 / INDUSTRY CANADA RSS-210

Applicant Name:
OLYMPUS MEDICAL SYSTEMS CORP.
2951 Ishikawa-machi, Hachioji-shi
Tokyo, 192-8507 Japan

Date of Testing:
May 10, 2011
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
0Y1105100855-R4.S8Q

FCC ID:	S8QEC-S10
IC CERTIFICATION NO.:	4763B-ECS10
APPLICANT:	OLYMPUS MEDICAL SYSTEMS CORP.

Model(s): EC-Y0005
EUT Type: Olympus Capsule Endoscope System
Frequency: 315MHz
FCC Classification: Low Power Communications Device Transmitter (DXX)
FCC Rule Part(s): FCC Part 15 Subpart C (15.209)
IC Specification(s): RSS-210 Issue 8
IC Classification: Low Power Transmitter

*** This revised test report (S/N: 0Y1105100855-R4.S8Q) supersedes and replaces the previously issued test report on the same subject EUT for the same type of testing as indicated. Please discard or destroy the previously issued test report (S/N: 0Y1105100855-R3.S8Q) and dispose of it accordingly.**

The device bearing the FCC Identifier specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and has been tested in accordance with the measurement procedures specified in ANSI C63.4-2003 (See Test Report). These measurements were performed with no deviation from the standards. Test results reported herein relate only to the item(s) tested.

I authorize and attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

PCTEST certifies that no party to this application has been subject to a denial of Federal benefits that includes the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.


Randy Ortanez
President





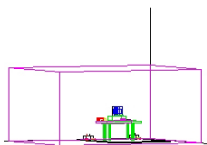
FCC ID: S8QEC-S10	 PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.209 MEASUREMENT REPORT (CERTIFICATION)	 OLYMPUS Your Vision. Our Future.	Reviewed by: Quality Manager
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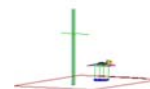
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MEASUREMENT REPORT

FCC Part 15.209 / RSS-210

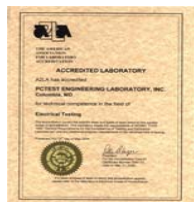


§ 2.1033 General Information



APPLICANT: OLYMPUS MEDICAL SYSTEMS CORP.
APPLICANT ADDRESS: 2951 Ishikawa-machi, Hachioji-shi
 Tokyo, 192-8507 Japan
TEST SITE: PCTEST ENGINEERING LABORATORY, INC.
TEST SITE ADDRESS: 6660-B Dobbin Road, Columbia, MD 21045 USA
FCC RULE PART(S): Part 15 Subpart C (15.209)
IC SPECIFICATION(S): RSS-210 Issue 8
MODEL: EC-Y0005
FCC ID: S8QEC-S10
Test Device Serial No.: 8290 ☐ Production ☒ Pre-Production ☐ Engineering
FCC CLASSIFICATION: Low Power Communications Device Transmitter (DXX)
DATE(S) OF TEST: May 10, 2011
TEST REPORT S/N: 0Y1105100855-R4.S8Q

Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21045, U.S.A.



- PCTEST facility is an FCC registered (PCTEST Reg. No. 90864) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (IC-2451).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (IC-2451) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

1.2 PCTEST Test Location

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity area, the Baltimore-Washington Internt'l (BWI) airport, the city of Baltimore and the Washington, DC area. (see Figure 1-1).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2003 on January 28, 2009.

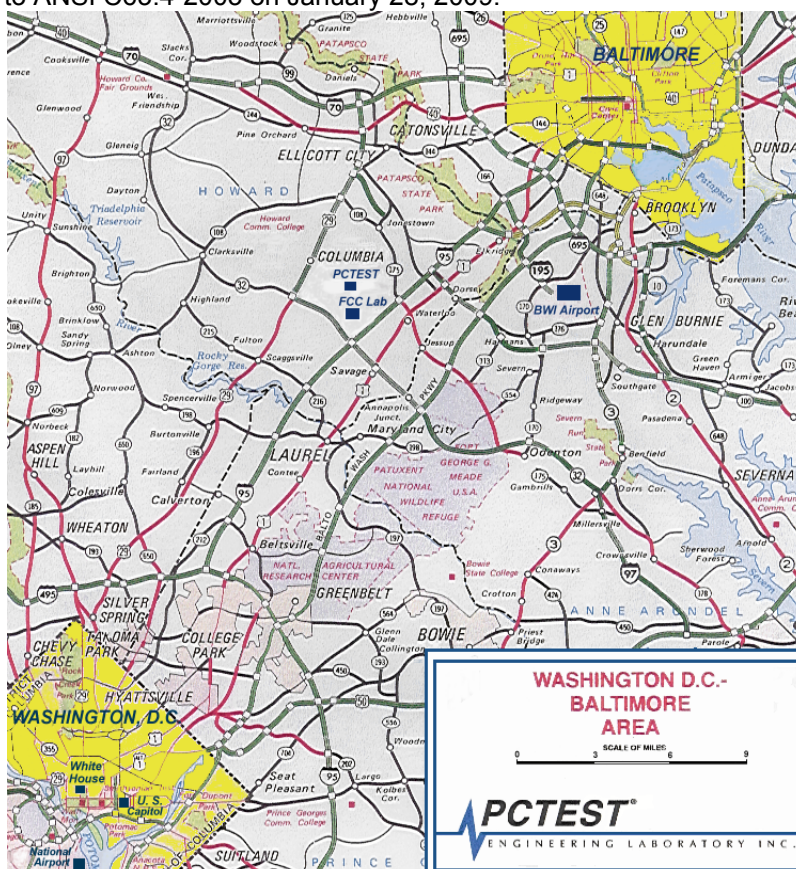


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Olympus Capsule Endoscope System FCC ID: S8QEC-S10**.

Manufacturer / Model	FCC ID	Description
Olympus / Model: EC-Y0005	S8QEC-S10	Olympus Capsule Endoscope System

Table 2-1. EUT Equipment Description

2.2 Operation Mode

The Olympus Model: EC-Y0005, FCC ID: S8QEC-S10 was set to continuously transmit at 315 MHz. The EUT was tested stand alone in body-simulating tissue material. Please see Section 9.0 for more information on the test setup.

2.3 EMI Suppression Device(s)/Modifications



No EMI suppression device(s) were added and no modifications were made during testing.

2.4 Labeling Requirements

Per 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the trade name and FCC ID must be displayed on the device per Section 15.19(b)(2).

Please see attachment for FCC ID label and label location.

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3.0 DESCRIPTION OF TEST

3.1 Evaluation Procedure

The measurement procedure described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2003) was used in the measurement of the **Olympus Capsule Endoscope System** FCC ID: S8QEC-S10.

Deviation from measurement procedure.....None

3.2 Radiated Emissions

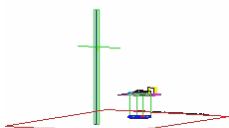


Figure 3-1. 3-Meter Test Site

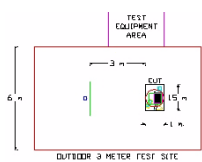


Figure 3-2. Dimensions of Outdoor Test Site

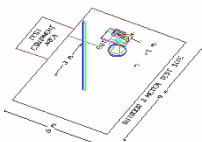


Figure 3-3. Turntable and System Setup

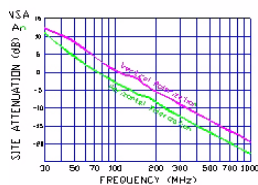


Figure 3-4. Normalized Site Attenuation Curves (H&V)

Preliminary measurements were made in a shielded anechoic chamber at 3-meter using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, and turntable azimuth with respect to the antenna was noted for each frequency found. The spectrum was scanned from 30 to 1000 MHz using a biconilog antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used. For measurements below 30MHz a magnetic loop antenna was used.

Final measurements were made outdoors at 3-meter test range using RobertsTM Dipole antennas or horn antennas (see Figure 3-1) for above 30MHz and a loop antenna for below 30MHz. The test equipment was placed on a wooden and plastic bench situated on a 1.5m x 2m area adjacent to the measurement area (see Figure 3-2). Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The detector function was set to CISPR quasi-peak mode and the bandwidth of the spectrum analyzer was set to 100kHz for frequencies below 1GHz or 1MHz for frequencies above 1GHz. Above 1GHz the detector function was set to average mode (RBW = 1MHz, VBW = 10Hz). Emissions below 30MHz were made with a RBW of 10kHz and a VBW of 10Hz.

The half-wave dipole antenna was tuned to the frequency found during preliminary radiated measurements. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1 x 1.5 meter table (see Figure 3-3). The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in the test setup photographs. Each EME reported was calibrated using the Agilent E8257D (250kHz – 20GHz) PSG Signal Generator. The Theoretical Normalized Site Attenuation Curves for both horizontal and vertical polarization are shown in Figure 3-4.

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4.0 ANTENNA REQUIREMENTS



Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- The antennas of the Olympus Capsule Endoscope System are **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The **Olympus Capsule Endoscope System FCC ID: S8QEC-S10** unit complies with the requirement of §15.203.

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5.0 SAMPLE CALCULATIONS

5.1 Radiated Emission Measurement Sample Calculation

@ 66.7 MHz

Class B limit = 100 $\mu\text{V/m}$ = 40.0 dB $\mu\text{V/m}$

Reading = - 76.0 dBm (calibrated level)

Convert to dB μV = - 76.0 + 107 = 31.0 dB μV

Antenna Factor + Cable Loss = 5.8 dB/m

Total = 36.8 dB $\mu\text{V/m}$



Margin = 36.8 - 40.0 = - 3.2 dB

= 3.2 dB below limit

Note:

$$\text{Level [dB}\mu\text{V]} = 20 \log_{10} (\text{Level } [\mu\text{V/m}])$$

$$\text{Level [dB}\mu\text{V]} = \text{Level [dBm]} + 107$$



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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	263-10dB	(DC-18GHz) 10 dB Attenuator	N/A		N/A	N/A
-	No. 166	(1000-26500MHz) Microwave RF Cable	N/A		N/A	N/A
-	No. 167	(100kHz - 100MHz) RG58 Coax Cable	N/A		N/A	N/A
Agilent	8447D	Broadband Amplifier	3/17/2011	Annual	3/17/2012	1937A03348
Agilent	8447D	Broadband Amplifier	3/17/2011	Annual	3/17/2012	2443A01900
Agilent	8449B	(1-26.5GHz) Pre-Amplifier	2/8/2011	Annual	2/8/2012	3008A00985
Agilent	85650A	Quasi-Peak Adapter	3/30/2011	Annual	3/30/2012	2043A00301
Agilent	8566B	(100Hz-22GHz) Spectrum Analyzer	3/30/2011	Annual	3/30/2012	2618A02866
Agilent	E4407B	ESA Spectrum Analyzer	4/6/2011	Annual	4/6/2012	US39210313
Agilent	E4448A	PSA (3Hz-50GHz) Spectrum Analyzer	11/30/2010	Annual	11/30/2011	US42510244
Agilent	E8257D	(250kHz-20GHz) Signal Generator	3/30/2011	Annual	3/30/2012	MY45470194
Agilent	N9020A	MXA Signal Analyzer	9/8/2010	Annual	9/8/2011	US46470561
Anritsu	ML2495A	Power Meter	10/13/2010	Annual	10/13/2011	941001
Emco	3115	Horn Antenna (1-18GHz)	10/14/2009	Biennial	10/14/2011	9704-5182
Emco	3115	Horn Antenna (1-18GHz)	4/8/2010	Biennial	4/8/2012	9205-3874
Emco	3116	Horn Antenna (18 - 40GHz)	9/9/2008	Triennial	9/9/2011	9203-2178
MiniCircuits	VHF-3100+	High Pass Filter	N/A		N/A	30721
Pasternack	PE2209-10	Bidirectional Coupler	N/A		N/A	N/A
Pasternack	PE7000-6	6 dB Attenuator	N/A		N/A	N/A
Sunol	DRH-118	Horn Antenna (1 - 18GHz)	5/14/2009	Biennial	5/14/2011	A050307
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	7/17/2009	Biennial	7/17/2011	A051107

Table 6-1. Annual Test Equipment Calibration Schedule

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7.0 TISSUE SIMULATING MIXTURE CHARACTERIZATION

The mixtures consist of a viscous gel using hydroxethylcellulose (HEC) gelling agent and saline solution (see Table 1). Preservation with a bacteriacide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of brain or muscle tissue. The mixture characterizations used for the tissue simulating liquids are according to the data by C. Gabriel and G. Hartsgrrove.

BRAIN & MUSCLE MIXTURE	PERCENTAGE @ 300 MHz (Muscle)
WATER	50.6
SUGAR	45
SALT	2.3
BACTERIACIDE	0.1
HEC	2.0

$$\sigma = 1$$

$$\varepsilon = 58.7$$



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8.0 ENVIRONMENTAL CONDITIONS

The temperature is controlled within range of 15°C to 35°C.

The relative humidity is controlled within range of 10% to 75%.

The atmospheric pressure is controlled within the range 86-106kPa (860-1060mbar).

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9.0 TEST DATA

9.1 Summary

Company Name: OLYMPUS MEDICAL SYSTEMS CORP.
 FCC ID: S8QEC-S10
 IC CERTIFICATION NO.: 4763B-ECS10
 Frequencies Examined: 315 MHz

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (Tx)						
2.1049	RSS-Gen 4.6.1	20 dB Bandwidth / Occupied Bandwidth	N/A	RADIATED	PASS	Section 9.2
15.209	RSS-210 [A2.6]	Radiated Emissions	Emissions must meet the radiated limits detailed in 15.209 + RSS-Gen		PASS	Section 9.3

Table 9-1. Summary of Test Results

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9.2 20dB Bandwidth Measurement

§2.1049

The 20dB bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

Frequency	Occupied Bandwidth
315 MHz	5325kHz

Table 9-2. 20dB Bandwidth Measurement

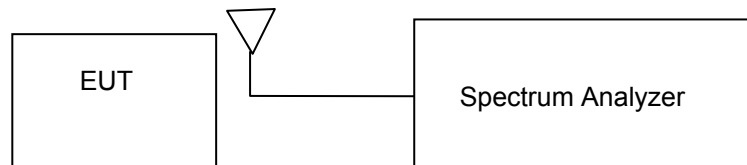


Figure 9-1. Test Instrument & Measurement Setup

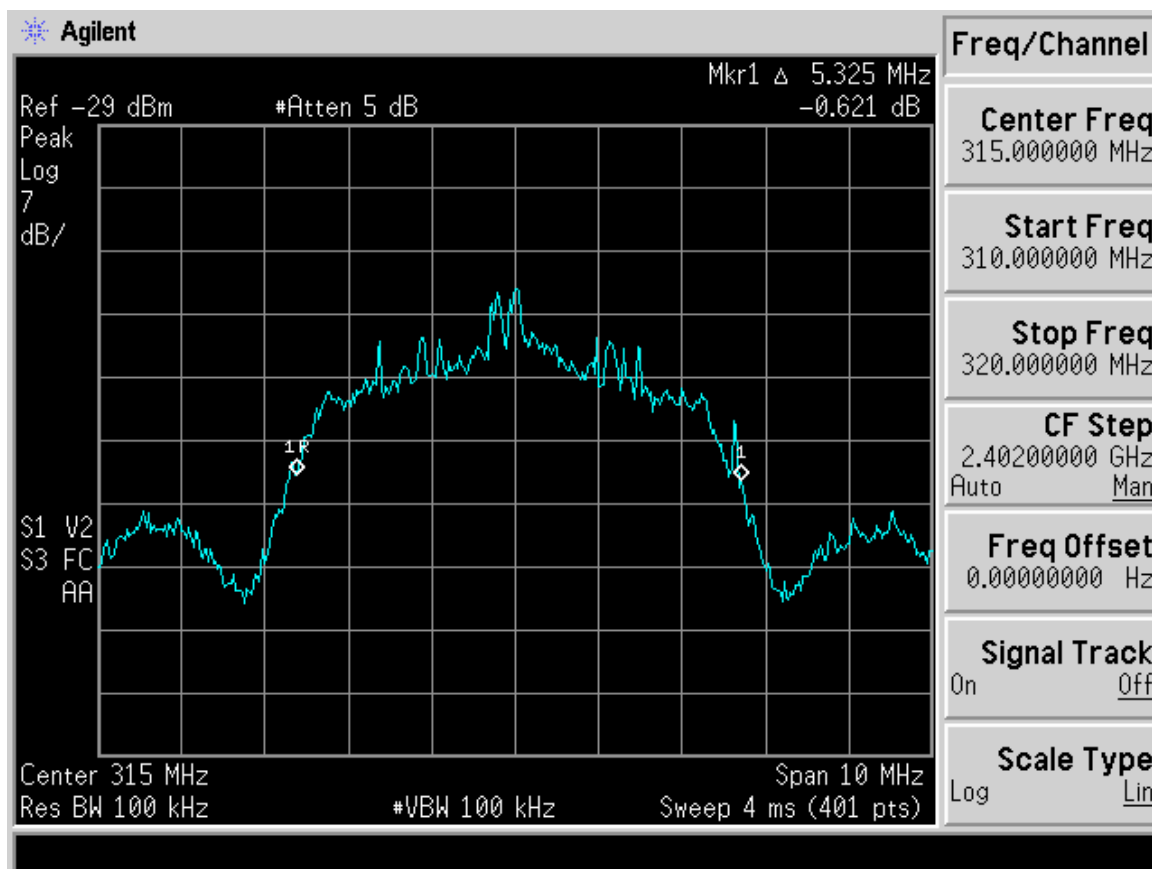


Figure 9-2. Occupied Bandwidth Plot

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9.3 Radiated Spurious Emission Measurements

§15.209, RSS-210 [A2.6]

The EUT was investigated from 9kHz up to the 1GHz. All measurements reported below were recorded with a spectrum analyzer employing a quasi-peak detector. All out-of-band emissions must not exceed the limits shown in Table 9-3 per Section 15.209. A loop antenna was used for searching for emissions below 30MHz.

Frequency	Field Strength [$\mu\text{V/m}$]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3



Table 9-3. Radiated Limits – Out of band

Sample Calculation

- Field Strength Level [$\text{dB}\mu\text{V/m}$] = Analyzer Level [dBm] + 107 + AFCL [dB] + Duty Cycle Correction [dB]

Notes:

- AFCL = Antenna Factor [dB] + Cable Loss [dB]

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Radiated Spurious Emission Measurements (cont.)

§15.209, RSS-210 [A2.6]

Tx Frequency 315 MHz



Measurement Distance: 3 Meters

Frequency [MHz]	Level [dBm]	AFCL [dB]	Pol [H/V]	Height [m]	Azimuth [degrees]	Field Strength [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
315	-82.10	16.57	H	1.3	190	41.47	46.02	-4.55
630	-106.06	22.83	H	1.4	70	23.77	46.02	-22.25
945	-106.65	26.77	V	1.3	130	27.11	46.02	-18.91
1260	-97.64	29.96	H	1.6	190	39.32	53.98	-14.66
1575	-121.78	32.45	H	1.3	100	17.67	53.98	-36.31
1890	-119.30	34.34	H	1.6	50	22.04	53.98	-31.94
2205	-118.22	36.19	V	2.1	100	24.96	53.98	-29.02
2520	-118.81	37.90	V	1.4	130	26.09	53.98	-27.89
2835	-116.47	39.33	V	1.2	290	29.87	53.98	-24.11
3150	-115.03	40.81	V	1.5	210	32.79	53.98	-21.19

Table 9-4. Radiated Fundamental and Harmonics Measurements



NOTES:

1. All measurements were recorded using a spectrum analyzer employing a quasi-peak detector.
2. Both Vertical and Horizontal polarities of the receive antenna were evaluated with the worst case emissions being reported. Below 30MHz the Loop antenna was positioned in 3 separate radials.
3. The EUT is supplied with fully charged battery.
4. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.

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10.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Olympus Capsule Endoscope System FCC ID: S8QEC-S10** has been tested to show compliance with the requirements specified in §15.209 of the FCC Rules and RSS-210 of the Industry Canada rules.

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Test Report S/N: 0Y1105100855-R4.S8Q	Test Date(s): May 10, 2011	EUT Type: Olympus Capsule Endoscope System	Page 16 of 16	