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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart C (15.247) DTS Specifications and Industry Canada RSS 210 Issue 5 for an Intentional Radiator on the Motion Research Model: SportVue MSU

FCC ID:	SG3-MCMSUV1
UPN:	5316A-MCMSUV1
GRANTEE:	Motion Research 1818 Westlake Ave Seattle, WA 98109
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
AND	Elliott Laboratories, Inc. 41039 Boyce Road Fremont, CA 94538
REPORT DATE:	September 10, 2004
FINAL TEST DATE:	August 25 and September 4, 2004
AUTHORIZED SIGNATORY:	Juan Martinez Senior EMC Engineer

ACCREDITED

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SCOPE

An electromagnetic emissions test has been performed on the Motion Research model SportVue MSU pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators and RSS-210 Issue 5 for licence-exempt low power devices. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Motion Research model SportVue MSU and therefore apply only to the tested sample. The sample was selected and prepared by Dominic Dobson of Motion Research

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules and RSS-210 Issue 5 for license-exempt low power devices for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units that are subsequently manufactured.

SUMMARY OF RESULTS

FCC Part 15 Section	RSS 210 Section	Description	Measured Value	Comments	Result
15.247(a)			Systems uses Direct Sequence Spread Spectrum techniques	System must utilize a digital transmission technology	Complies
15.247 (a) (2)		6dB Bandwidth	931 kHz	Minimum allowed is 500kHz	Complies
	RSP 100	99% Bandwidth	1.3 MHz	Minimum allowed is 500kHz	Complies
15.247 (b) (3)	6.2.2(o)(b)	Output Power, 2400 - 2483.5 MHz	1.1 dBm EIRP (0.0013Watts)	Multi-point applications: Maximum permitted is 1Watt, with EIRP limited to 4 Watts.	Complies
15.247(d)	6.2.2(o)(b)	Power Spectral Density	-4.89 dBm / MHz	Maximum permitted is 8dBm/3kHz	Complies
15.247(c)	6.2.2(o)(e1)	Spurious Emissions – Antenna Conducted 30MHz – 25GHz	All spurious emissions < -20dBc	All spurious emissions < -20dBc.	Complies
	6.2.2(o)(e1)	Radiated Spurious Emissions 30MHz – 25GHz	All spurious emissions < -20dBc	Emissions in restricted bands must meet the radiated emissions limits detailed in 15.207	Complies
15.247(c) / 15.209		Radiated Spurious Emissions 30MHz – 25GHz	51.4 dBuV/m @ 4910 MHz (-2.6 dB)	Emissions in restricted bands must meet the radiated emissions limits detailed in 15.207. All others must be < -20dBc	Complies
15.207		AC Conducted Emissions	N/A	EUT is battery operated	N/A
15.247 (b) (5)		RF Exposure Requirements	MPE calculation	-	-
15.203		RF Connector	Unique antenna connection required for user-installed applications. Integral antenna (Permanently attached)	Integral antenna	Complies
	6.2.2(o)(b)	Processing Gain		Requirement has been removed	

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	30 to 1000	± 3.6

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Motion Research model SportVue MSU is a SportVue Motorcycle Sending Unit Which is designed to send a signal to the SportVue HMD (Helmet Mounted Display). Normally, the EUT would be mounted on a motorcycle during operation. The EUT was, therefore, treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 3Vdc.

The sample was received on August 25, 2004 and tested on August 25 and September 4, 2004. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Motion Research	MSU	Base Unit	N/A	SG3-MCMSUV1

ENCLOSURE

The EUT enclosure is primarily constructed of Plastic. It measures approximately 5.5 cm wide by 8 cm deep by 3.5 cm high.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with the emission specifications.

SUPPORT EQUIPMENT

No equipment was used as local and remote support equipment for emissions testing:

EUT INTERFACE PORTS

The I/O cabling configuration during emissions testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length (m)
I/O and Power	Motorcycle Speed Sensor	Multiwire	Unshielded	0.2

EUT OPERATION DURING TESTING

Continuously transmitting at maximum power on low, middle, and high channels.

ANTENNA REQUIREMENTS

The antenna is permanently attached and is integral to the device, which meets the requirements of 15.203.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on August 25 and September 4, 2004 at the Elliott Laboratories Chamber 2 located at 684 West Maude Avenue, Sunnyvale, California and Chamber 4 located at 41039 Boyce Road, Fremont, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Federal Communications Commission. In accordance with Industry Canada rules detailed in RSS 210 Issue 5 and RSS-212, construction, calibration, and equipment data for the test sites have been filed with the Federal Communications Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

POWER METER

A power meter and peak power sensor are used for all direct output power measurements from transmitters as they provide a broadband indication of the power output.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

Measurement bandwidths (video and resolution) are set in accordance with FCC procedures for the type of radio being tested.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions from the AC power port are given in units of microvolts, the limits for radiated electric field emissions are given in units of microvolts per meter at a specified test distance and the output power limits are given in temrs of Watts, milliwatts or dBm. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp) the following formula is used to determine the field strength limit in terms of microvolts per meter at a distance of 3m from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{3} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For reference, converting the voltage and electric field strength specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. Conversion of power specification limits from linear units (in milliwatts) to decibel form (in dBm) is accomplished by taking the base ten logarithm, then multiplying by 10.

FCC 15.407 (a)and RSS 210 (o) OUTPUT POWER LIMITS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Number Of Channels	Output Power
902 – 928	>=50	1 W (30 dBm)
902 – 928	< 50	0.25 W (24 dBm)
2400 – 2483.5	>= 75	1 W (30 dBm)
2400 – 2483.5	>= 75	0.125 W (21 dBm)
5725 – 5850	>=75	1 W (30 dBm)

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

RSS 210 (o) AND FCC 15.247 SPURIOUS RADIATED EMISSIONS LIMITS

T limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands detailed in Part 15.205 and for all spurious emissions from the receiver are:

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level.

FCC AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in FCC Part 15.207.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

RSS-210 SECTION 6.6 AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in Industry Canada RSS-210 section 6.6.

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level - Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radiated Emissions, 30 - 26,500 MHz, 07-Sep-04
Engineer: Juan Martinez

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	EMC Spectrum Analyzer 9KHz-26.5GHz, non programmable	8563E	284	15-Mar-05
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	868	20-Apr-06
Hewlett Packard	EMC Spectrum Analyzer 30Hz - 40 GHz, Sunnyvale	8564E (84125C)	1148	09-Jun-05
Miteq	Preamplifier, 1-18GHz	AFS44	1346	08-Jan-05
Sunol Sciences	Biconilog, 30-3000MHz	JB3	1548	29-Mar-05
Com-Power	Pre Amplifier , 30-1000MHz	PA-103	1633	27-Jan-05

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T56907 7 Pages

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EMC Test Data

Client:	Motion Research	Job Number:	J56894
Model:	SportVue HMD& MSU	T-Log Number:	T56907
		Account Manager:	James
Contact:	Dominic Dobson		
Emissions Spec:	FCC 15.247 & RSS-210, FCC	Class:	Radio / B
Immunity Spec:		Environment:	

EMC Test Data

For The

Motion Research

Model

SportVue HMD& MSU

Date of Last Test: 9/4/2004

Client:	Motion Research	Job Number:	J56894
Model:	SportVue HMD& MSU	T-Log Number:	T56907
		Account Manager:	James
Contact:	Dominic Dobson		
Emissions Spec:	FCC 15.247 & RSS-210, FCC	Class:	Radio / B
Immunity Spec:	Enter immunity spec on cover	Environment:	

EUT INFORMATION

General Description

The EUT is a SportVue Helmet Mounted Display which is designed to displayed via a 2.4 GHz spread spectrum wireless link from a Motorcycle Sending Unit (MSU) mounted to the motorcycle. Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 3Vdc.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Motion Research	HMD	Display	N/A	SG3-SVHMDV1
Motion Research	MSU	Base Unit	N/A	SG3-MCMSUV1

Other EUT Details

Display EUT Enclosure

The EUT enclosure is primarily constructed of Plastic. It measures approximately 3.5 cm wide by 2.5 cm deep by 13 cm high.

Base EUT Enclosure

The EUT enclosure is primarily constructed of Plastic. It measures approximately 5.5 cm wide by 8 cm deep by 3.5 cm high.

Modification History

Mod. #	Test	Date	Modification
1			
2			
3			

Modifications applied are assumed to be used on subsequent tests unless otherwise stated as a further modification.

Client:	Motion Research	Job Number:	J56894
Model:	SportVue HMD& MSU	T-Log Number:	T56907
		Account Manager:	James
Contact:	Dominic Dobson		
Emissions Spec:	FCC 15.247 & RSS-210, FCC	Class:	Radio / B
Immunity Spec:	Enter immunity spec on cover	Environment:	

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Display Interface Cabling and Ports

		Cable(s)		
Port	Connected To	Description	Shielded or Unshielded	Length(m)
None				

MSU Interface Cabling and Ports

		Cable(s)		
Port	Connected To	Description	Shielded or Unshielded	Length(m)
I/O and Power	Motorcycle Speed sensor	Multiwire	Unshielded	0.2

EUT Operation During Emissions

Continuously transmitting at maximum power on low, middle, and high channels.

Client:	Motion Research	Job Number:	J56894
Model:	SportVue HMD& MSU	T-Log Number:	T56907
		Account Manager:	James
Contact:	Dominic Dobson		
Spec:	FCC 15.247 & RSS-210, FCC	Class:	N/A

Radiated Emissions (Base-MSU)

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 9/4/2004
Test Engineer: Juan Martinez
Test Location: Fremont Chamber #4
Config. Used: 1
Config Change: None
EUT Voltage: Battery

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

No antenna port was available. 6-dB BW and Power spectral Denisty measurements were performed radiated at 3 meters. Corrected radiated readings were converted to dBm by uring 95.2 dB.

Ambient Conditions:

Temperature: 17 °C
Rel. Humidity: 45 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1a	RE, 30 - 26,000 MHz - Spurious Emissions (Low)	FCC Part 15.209 / 15.247(c)	Pass	-3.2dB @ 2439.0MHz
1b	RE, 30 - 26,000 MHz - Spurious Emissions (Mid)	FCC Part 15.209 / 15.247(c)	Pass	-2.6dB @ 4910MHz
1c	RE, 30 - 26,000 MHz - Spurious Emissions (High)	FCC Part 15.209 / 15.247(c)	Pass	-3.5dB @ 2483.5MHz
2	6dB Bandwidth	15.247(a)	Pass	931kHz
3	Output Power	15.247(b)	Pass	1.1dBm
4	Power Spectral Density (PSD)	15.247(d)	Pass	-4.89dBm

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

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EMC Test Data

Client:	Motion Research	Job Number:	J56894
Model:	SportVue HMD& MSU	T-Log Number:	T56907
		Account Manager:	James
Contact:	Dominic Dobson		
Spec:	FCC 15.247 & RSS-210, FCC	Class:	N/A

Run #1a: Radiated Spurious Emissions, 30 - 26,000 MHz. Low Channel @ 2402 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2439.000	50.8	H	54.0	-3.2	AVG	180	1.5	
2439.000	64.0	H	74.0	-10.0	PK	180	1.5	
4808.000	42.1	H	54.0	-11.9	AVG	139	1.0	
4808.000	48.5	H	74.0	-25.5	PK	139	1.0	
4808.000	42.1	V	54.0	-11.9	AVG	114	1.0	
4808.000	46.2	V	74.0	-27.8	PK	114	1.0	
7206.000	37.1	V	54.0	-16.9	AVG	200	1.0	
7206.000	46.5	V	74.0	-27.5	PK	200	1.0	
7206.000	35.1	H	54.0	-18.9	AVG	0	1.0	
7206.000	47.2	H	74.0	-26.8	PK	0	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20 dB below the level of the fundamental.
Note 2:	No other emission detected after the 3rd harmonic 20-dB of the limit.

Run #1b: Radiated Spurious Emissions, 30 - 26,000 MHz. Center Channel @ 2450 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4910.000	58.5	v	74.0	-15.5	Pk	184	1.3	
4910.000	51.4	v	54.0	-2.6	Avg	184	1.3	
4910.000	48.5	h	74.0	-25.5	Pk	150	1.0	
4910.000	45.2	h	54.0	-8.8	Avg	150	1.0	
7362.000	52.1	v	74.0	-21.9	Pk	175	1.0	
7362.000	39.4	v	54.0	-14.6	Avg	175	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.
Note 2:	No other emission detected after the 3rd harmonic 20-dB of the limit.

Elliott

EMC Test Data

Client:	Motion Research	Job Number:	J56894
Model:	SportVue HMD& MSU	T-Log Number:	T56907
		Account Manager:	James
Contact:	Dominic Dobson		
Spec:	FCC 15.247 & RSS-210, FCC	Class:	N/A

Run #1c: Radiated Spurious Emissions, 30 - 26,000 MHz. High Channel @ 2479.8 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	50.5	H	54.0	-3.5	AVG	200	1.5	
2483.500	61.2	H	74.0	-12.8	PK	200	1.5	
7439.400	40.7	H	54.0	-13.3	AVG	175	1.0	
7439.400	51.2	H	74.0	-22.8	PK	175	1.0	
4959.600	48.1	V	54.0	-5.9	AVG	95	1.0	
4959.600	52.4	V	74.0	-21.6	PK	95	1.0	
4959.600	39.5	H	54.0	-14.5	AVG	145	1.0	
4959.600	42.5	H	74.0	-31.5	PK	145	1.0	
7439.400	41.2	V	54.0	-12.8	AVG	0	1.0	
7439.400	52.1	V	74.0	-21.9	PK	0	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.
Note 2:	No other emission detected after the 3rd harmonic 20-dB of the limit.

Run #2: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	6dB Signal Bandwidth	99%
Low	2402	100kHz	920kHz	1.2Mhz
Mid	2450	100kHz	912kHz	1.2MHz
High	2479.8	100kHz	931kHz	1.2MHz

Note 1:	Add note here
Note 2:	

Client:	Motion Research	Job Number:	J56894
Model:	SportVue HMD& MSU	T-Log Number:	T56907
		Account Manager:	James
Contact:	Dominic Dobson		
Spec:	FCC 15.247 & RSS-210, FCC	Class:	N/A

Run #2: Output Power

Channel	Frequency (MHz)	Field Strength at 3m	Antenna Pol. (H/V)	Res BW	Output Power (dBm)
Low	2402	96.4	H	1MHz	1.1
Low	2402	85.1	V	1MHz	-10.2
Mid	2450	94.5	V	1MHz	-0.8
Mid	2450	87.3	H	1MHz	-8.0
High	2479.8	95.5	H	1MHz	0.2
High	2479.8	94.5	V	1MHz	-0.8

Note 1:	No antenna port was available all measurements were performed radiated at 3 meters.
Note 2:	

Run #3: Power Spectral Density

Channel	Frequency (MHz)	Res BW	P.S.D. (averaged over 1 second in a 3kHz bandwidth) (dBm)	Comment
Low	2402	3kHz	-6.45	
Mid	2450	3kHz	-4.89	
High	2479.8	3kHz	-10.2	