Produkte
Products

Prüfbericht-Nr.: *Test Report No.*:	**50229366 001**	**Auftrags-Nr.:** *Order No.*:	**158103259**	**Seite 1 von 16** *Page 1 of 16*
Kunden-Referenz-Nr.: *Client Reference No.*:	**N/A**	**Auftragsdatum:** *Order date*:	**04.03.2019**	
Auftraggeber: *Client*:	**Equisense SAS** **165 avenue de Bretagne, 59000 Lille, France**			
Prüfgegenstand: *Test item*:	**Bluetooth Low Energy device for equestrian sports**			
Bezeichnung / Typ-Nr.: *Identification / Type No.*:	**EQSMS01**			
Auftrags-Inhalt: *Order content*:	**FCC Certification**			
Prüfgrundlage: *Test specification*:	**FCC Part 15 Subpart C; ANSI C63.10-2013**			

Wareneingangsdatum: *Date of receipt*:	**27.05.2019**
Prüfmuster-Nr.: *Test sample No.*:	**A000930150 (004-006)**
Prüfzeitraum: *Testing period*:	**28.05.2019 – 26.06.2019**
Ort der Prüfung: *Place of testing*:	**Hong Kong**
Prüflaboratorium: *Testing laboratory*:	**TÜV Rheinland Hong Kong Ltd.**
Prüfergebnis*: *Test result**:	**Pass**

geprüft von / *tested by*:			**kontrolliert von** / *reviewed by*:		
11.07.2019	Joey Leung Project Manager		11.07.2019	Mika Chan Project Manager	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges: **FCC ID: 2AIQJ-EQSMS01**
Others:

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Table of Content

Page

Cover Page 1

Table of Content 2

Product information 3
- Manufacturers declarations 3
- Product function and intended use 3
- Submitted documents 3
- Independent Operation Modes 3
- Related Submittal(s) Grants 3
- Remark 3

Test Set-up and Operation Mode 4
- Principle of Configuration Selection 4
- Test Operation and Test Software 4
- Special Accessories and Auxiliary Equipment 4
- Countermeasures to achieve EMC Compliance 4

Test Methodology 5
- Radiated Emission 5
- Field Strength Calculation 5

Test Setup Diagram 6

Test Facility 8
- Test Laboratory Information 8

List of Test and Measurement Instruments 9

Measurement Uncertainty 10

Results FCC Part 15 – Subpart C 11
- FCC 15.203 – Antenna Requirement 1 ..... Pass 11
- FCC 15.204 – Antenna Requirement 2 ..... Pass 11
- FCC 15.207 – Conducted Emission on AC Mains ..... Pass 12
- FCC 15.247 (a)(2) – 6dB Bandwidth Measurement ..... Pass 13
- FCC 15.247 (b)(3) – Maximum Peak Conducted Output Power ..... Pass 13
- FCC 15.247 (e) 5.2 – Power Spectral Density ..... Pass 14
- FCC 15.247 (d) – Spurious Conducted Emissions ..... Pass 14
- FCC 15.205 – Radiated Emissions in Restricted Frequency Bands ..... Pass 15

Appendix 1 – Test protocols ..... 17 pages

Appendix 2 – Test setup ..... 3 pages

Appendix 3 – EUT External Photos ..... 4 pages

Appendix 4 – EUT Internal Photos ..... 5 pages

Appendix 5 – RF exposure information ..... 2 pages

Product information

Manufacturers declarations

	BLE Transceiver
Operating frequency range	2402 - 2480 MHz
Type of modulation	GFSK
Number of channels	40
Channel separation	2 MHz
Type of antenna	Integral PCB Antenna
Antenna gain (dBi)	2 dBi
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Operating voltage	V_{oper}: 3.7 VDC
Independent Operation Modes	Transmitting

Product function and intended use

The equipment under test (EUT) is an Bluetooth Low Energy device for equestrian sports. It is powered by 3.7 VDC rechargeable Lithium battery.

FCC ID: 2AIQJ-EQSMS01

Models	Product description
EQSMS01	Bluetooth Low Energy Device for equestrian sports

Submitted documents

Circuit Diagram
Block Diagram
Technical Description
User manual
Label

Independent Operation Modes

The basic operation mode is transmitting mode.

For further information refer to User Manual

Related Submittal(s) Grants

This is a single application for certification of the transmitter.

Remark

The test results in this test report are only relevant to the tested sample and does not involve any assessment in the production.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

Test Operation and Test Software

Test operation should refer to test methodology.

- During test, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power was selected according to the instruction given by the manufacturer. The setting of the RF output power expected by the customer shall be fixed on the firmware of the final end product.

Special Accessories and Auxiliary Equipment

- A DC regulated power supply provided by TÜV Rheinland Hong Kong Ltd. Was used to supply 5.0VDC during testing.

Countermeasures to achieve EMC Compliance

- Nil.

Test Methodology

Radiated Emission

The radiated emission measurements of the transmitter part were performed according to the procedures in ANSI C63.10-2013.

For measurement below 1GHz - the equipment under test (EUT) was placed at the middle of the 80 cm height turntable. For measurement above 1GHz - the EUT was placed at the middle of the 1.5 m height turntable and RF absorbing material was placed on ground plane between turntable and measuring antenna. During the testing, the EUT was operated standalone and arranged for maximum emissions. The EUT was tested in three orthogonal planes.

The investigation is performed with the EUT rotated 360 ° , the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.

All radiated tests were performed at an antenna to EUT with 3 meters distance, unless stated otherwise in particular parts of this test report.

Field Strength Calculation

The field strength at 3m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

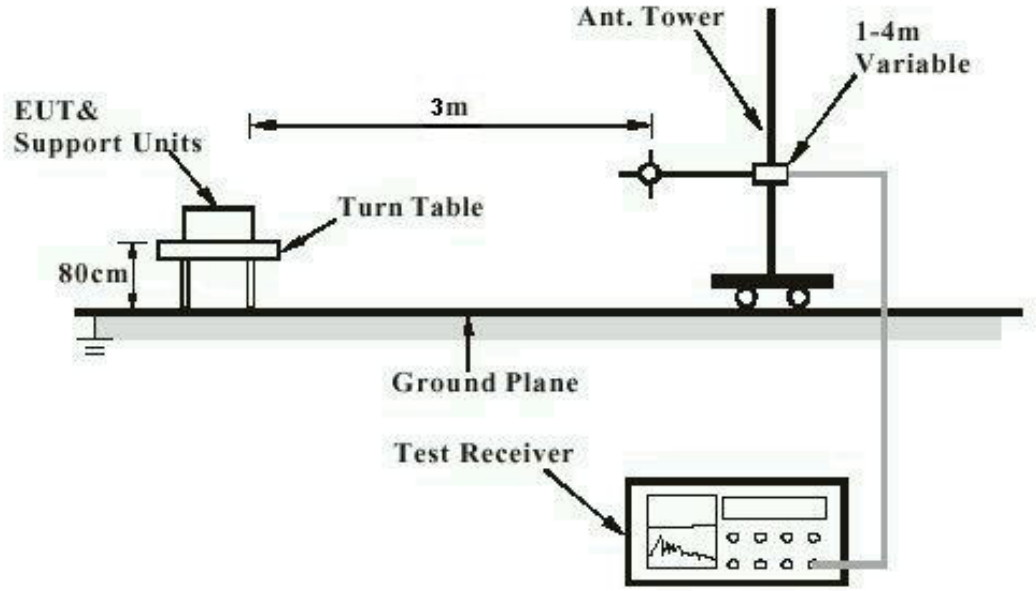
FS = R + AF + CF + FA – PA

Where FS = Field Strength in dBuV/m at 3 meters.
R = Reading of Spectrum Analyzer in dBuV.
AF = Antenna Factor in dB.
CF = Cable Attenuation Factor in dB.
FA = Filter Attenuation Factor in dB.
PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)

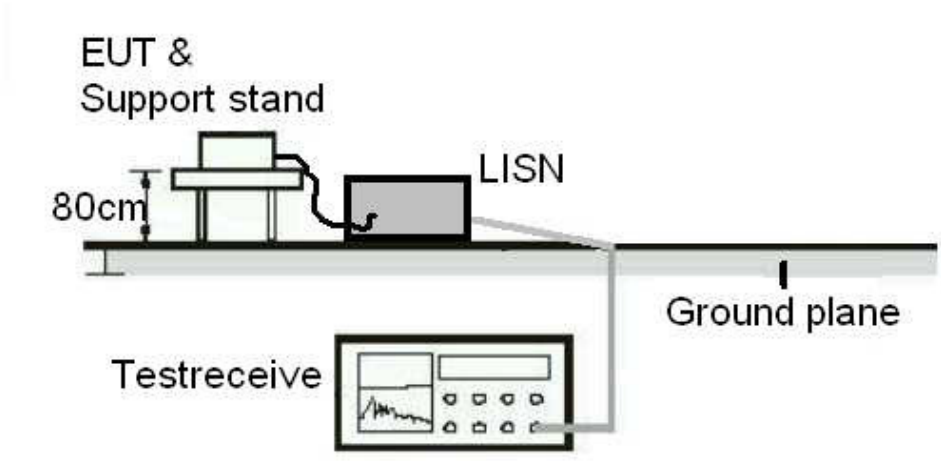
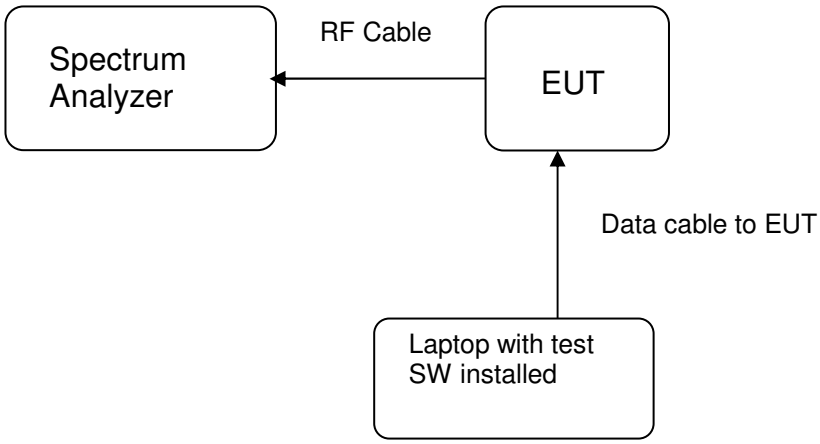


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)



Test Facility

Test Laboratory Information

TÜV Rheinland Hong Kong Ltd.
Address: 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, N.T., Hong Kong
Tel.: +852 2192 1000
Fax: +852 2192 1001
Email service-gc@tuv.com
Web: www.tuv.com

The test facility is recognized or accredited by the following organizations:

FCC

Type	:	Accredited Test Firm
Designation Number	:	HK0013
Test Firm Registration Number	:	371735
Scope	:	Intentional Radiators

List of Test and Measurement Instruments

Radiated Emission

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Semi-anechoic Chamber	Frankonia	Nil	Nil	23 Apr 2019	23 Apr 2020
Test Receiver	R & S	ESU26	100050	11 Jun 2019	11 Jun 2020
Bi-conical Antenna	R & S	HK116	100241	21 Mar 2018	21 Mar 2020
Log Periodic Antenna	R & S	HL223	841516/017	22 Mar 2018	22 Mar 2020
Cable with I-Joint Conector	Huber+Suhner	CNM-NMCMILX800-473	A2803 #0001	04 Oct 2018	04 Oct 2020
Active Loop Antenna	EMCO	6502	9107-2651	25 Oct 2018	25 Oct 2019
Semi-anechoic Chamber (SiteVSWR)	Frankonia	Nil	Nil	16 May 2019	16 May 2020
Double-Ridged Waveguide Horn	EMCO	3116	00109210	05 Oct 2018	05 Oct 2019
Double-Ridged Waveguide Horn	EMCO	3117	00094998	30 Aug 2018	30 Aug 2020
Cable with I-Joint Conector	Huber+Suhner	CNM-NMCMILX800-473	A2803 #0001	04 Oct 2018	04 Oct 2020
Microwave Preamplifier	COM-POWER Corporation	PAM-118A	551091	25 Jun 2019	25 Jun 2020
Preamplifier 18GHz to 40GHz with cable (EMC656)	A.H. Systems, Inc.	PAM-1840VH	168	30 Jan 2019	30 Jan 2020
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	9829213	30 Oct 2017	30 Oct 2019
High Frequency Cable	Pasternack	PE3VNA4001-3M	20160707C02493	29 Jan 2019	29 Jan 2020
Horn Antenna	EMCO	3115	9002-3347	28 Mar 2018	28 Mar 2020

AC Mains Conducted Emission

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Test Receiver	R & S	ESU26	100050	11 Jun 2019	11 Jun 2020
RF Voltage Probe	Schwarzbeck	TK9416	None	11 Feb 2018	11 Feb 2020
LISN	R&S	ENV216	102170	31 Jul 2018	31 Jul 2019
Double Shield Cable	Huber+ Suhner	RG223/U-01	None	18 May 2019	18 May 2021

Radio Test

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Spectrum Analyzer	R & S	FSV40	101542	16 Jan 2019	15 Jan 2020

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is ±2.42dB.

The estimated combined standard uncertainty for radiated emissions measurements is ±4.81dB (9kHz to 30MHz) and ±4.62dB (30MHz to 200MHz) and ±5.67dB (200MHz to 1000MHz) and is ±5.07dB (1GHz to 8.2GHz) and ±4.58dB (8.2GHz to 12.4GHz) and ±4.78dB (12.4GHz to 18GHz)

The estimated combined standard uncertainty for antenna conducted emission is ±2.1dB

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of k=2, which for the level of confidence is approximately 95%.

Results FCC Part 15 – Subpart C

FCC 15.203 – Antenna Requirement 1		Pass
FCC Requirement:	No antenna other than that furnished by the responsible party shall be used with the device	
Results:		
	a) Antenna type:	SMT Chip antenna
	b) Manufacturer and model no:	Microgate / MGMA3216H2450-A02
	c) Peak Gain:	2dBi
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2		Pass
FCC Requirement:	An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.	
Results:	Only one integral antenna can be used.	
Verdict:	Pass	

FCC 15.207 – Conducted Emission on AC Mains **Pass**

Test Specification : ANSI C63.10-2013
Test date : 18.06.2019
Mode of operation : TX mode
Port of testing : AC Mains input port of power supply
Supply voltage : 120Vac 60Hz
Temperature : 23ºC
Humidity : 50%

Requirement: 15.207(a)

Results: Pass

Live measurement

Frequency range (MHz)	Frequency (MHz)	Quasi-peak (dBµV)	Average (dBµV)	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0.15 – 0.5	No peak found	---	---	66 - 56	56 - 46	Pass
> 0.5 – 5	No peak found	---	---	56	46	Pass
> 5 – 30	No peak found	---	---	60	50	Pass

Neutral measurement

Frequency range (MHz)	Frequency (MHz)	Quasi-peak (dBµV)	Average (dBµV)	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0.15 – 0.5	0.418	43.4	36.7	66 - 56	56 - 46	Pass
> 0.5 – 5	0.629	43.0	38.2	56	46	Pass
> 5 – 30	17.068	44.1	34.2	60	50	Pass

Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test Results plots refer to Appendix 1.

FCC 15.247 (a)(2) – 6dB Bandwidth Measurement	**Pass**
FCC Requirement: Systems using digital modulation techniques may operate in the 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500kHz.	
Test Specification : ANSI C63.10 – 2013 Test date : 18.06.2019 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.7 VDC Temperature : 23ºC Humidity : 50%	
Results: For test protocols please refer to Appendix 1	

Channel frequency (MHz)	**6 dB left (MHz)**	**6 dB right (MHz)**	**6dB bandwidth (kHz)**
2402	2401.582	2402.418	836.60
2440	2439.547	2440.355	808.10
2480	2479.588	2480.415	827.60

FCC 15.247 (b)(3) – Maximum Peak Conducted Output Power	**Pass**
FCC Requirement: For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz bands: 1 Watt (30dBm)	
Test Specification : ANSI C63.10 – 2013 Test date : 18.06.2019 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.7 VDC Temperature : 23ºC Humidity : 50%	
Results: For test protocols please refer to Appendix 1	

Frequency (MHz)	**Measured Output Power (dBm)**	**Limit (W/dBm)**	**Verdict**
2402	-0.23	1 / 30.0	Pass
2440	-0.25	1 / 30.0	Pass
2480	-0.36	1 / 30.0	Pass

FCC 15.247 (e) 5.2 – Power Spectral Density	**Pass**

FCC Requirement: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Specification : ANSI C63.10 – 2013
Test date : 18.06.2019
Mode of operation : Tx mode
Port of testing : Temporary antenna port
Supply voltage : 3.7 VDC
Temperature : 23ºC
Humidity : 50%

Results: For test protocols please refer to Appendix 1.

Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2402	-0.26	8.0	Pass
2440	-0.30	8.0	Pass
2480	-0.45	8.0	Pass

FCC 15.247 (d) – Spurious Conducted Emissions	**Pass**

Test Specification : ANSI C63.10 – 2013
Test date : 18.06.2019
Mode of operation : Tx mode
Port of testing : Temporary antenna port
Supply voltage : 3.7 VDC
Temperature : 23ºC
Humidity : 50%

FCC Requirement: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.

Only the worst cases is shown below. For test protocols refer to Appendix 1

Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	2529.700	-41.65	-0.26	41.39	Pass
	7205.400	-48.32	-0.26	48.06	Pass
2440	2311.800	-41.89	-0.30	41.59	Pass
	7320.300	-50.56	-0.30	50.26	Pass
2480	2351.800	-41.38	-0.45	40.93	Pass
	7440.300	-52.40	-0.45	51.95	Pass

FCC 15.205 – Radiated Emissions in Restricted Frequency Bands		**Pass**
Test Specification : ANSI C63.10 – 2013 Test date : 19.06.2019 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 3.7 VDC Temperature : 23ºC Humidity : 50%		
FCC Requirement:	In any 100kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).	
Results:	Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Simultaneous transmission was investigated and no new emissions were found. All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.	
Mode: 2402MHz TX	Vertical Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
2390.000	36.3	74.0 / PK
2390.000	22.6	54.0 / AV
7204.958	56.5	74.0 / PK
7204.958	47.7	54.0 / AV
Mode: 2402 MHz TX	Horizontal Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
2390.000	36.0	74.0 / PK
2390.000	22.4	54.0 / AV
7204.974	53.4	74.0 / PK
7204.974	44.2	54.0 / AV
Mode: 2440 MHz TX	Vertical Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
7320.961	53.8	74.0 / PK
7320.961	44.1	54.0 / AV
Mode: 2440 MHz TX	Horizontal Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
7318.974	55.9	74.0 / PK
7318.974	47.1	54.0 / AV

Mode: 2480MHz TX	Vertical Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
2483.500	39.7	74.0 / PK
2483.500	24.2	54.0 / AV
7438.958	53.6	74.0 / PK
7438.958	44.4	54.0 / AV
Mode: 2480 MHz TX	Horizontal Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
2483.500	38.2	74.0 / PK
2483.500	23.1	54.0 / AV
7438.901	57.1	74.0 / PK
7438.901	48.3	54.0 / AV