

Prüfbericht-Nr.: <i>Test Report No.:</i>	60392562 001	Auftrags-Nr.: <i>Order No.:</i>	158212804	Seite 1 von 15 <i>Page 1 of 15</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	08.06.2020	
Auftraggeber: <i>Client:</i>	Bulk Unlimited Corp 199 Lee Ave., Suite 464, Brooklyn, USA			
Prüfgegenstand: <i>Test item:</i>	Short Range Device - ARMOGEAR BOXING GEAR (2.4GHz)			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	AG-2909			
Auftrags-Inhalt: <i>Order content:</i>	FCC and ISED Certification			
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15 Subpart C, ANSI C63.10-2013 RSS-210 Issue 10, RSS-Gen Issue 5			
Wareneingangsdatum: <i>Date of receipt:</i>	08.06.2020			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A002881646-003			
Prüfzeitraum: <i>Testing period:</i>	03.08.2020 – 12.08.2020			
Ort der Prüfung: <i>Place of testing:</i>	Hong Kong			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland Hong Kong Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
				
09.02.2022	Felicia Chan/ Senior Engineer	09.02.2022	Sharon Li / Unit Senior Manager	
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>
Sonstiges / Other:				
FCC ID:2AE67-AG2909 IC: 24386-AG2909				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* 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				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

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Product information

Manufacturers declarations

	Transmitter
Operating frequency range	2420 - 2462MHz
Type of modulation	GFSK
Number of channels	12
Type of antenna	Wire Antenna
Power level	fix
Connection to public utility power line	No
Nominal voltage	4.5 VDC

Product function and intended use

The equipment under test (EUT) is a RF transceiver operating at 2.4GHz band. It is powered by battery only.

FCC ID:2AE67-AG2909/ IC: 24386-AG2909

Models	Product description
AG-2909	Short Range Device - ARMOGEAR BOXING GEAR (2.4GHz)

Submitted documents

Circuit Diagram
 Block Diagram
 Technical Description
 User manual
 Label

Independent Operation Modes

The basic operation modes are:

- 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.

- Test mode samples with maximum RF output power and duty cycle and capable to transmit continuously at the lowest, middle and highest frequency channels is provided by the applicant for the testing.

Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

- None

Countermeasures to achieve EMC Compliance

- None

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 3 m 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.

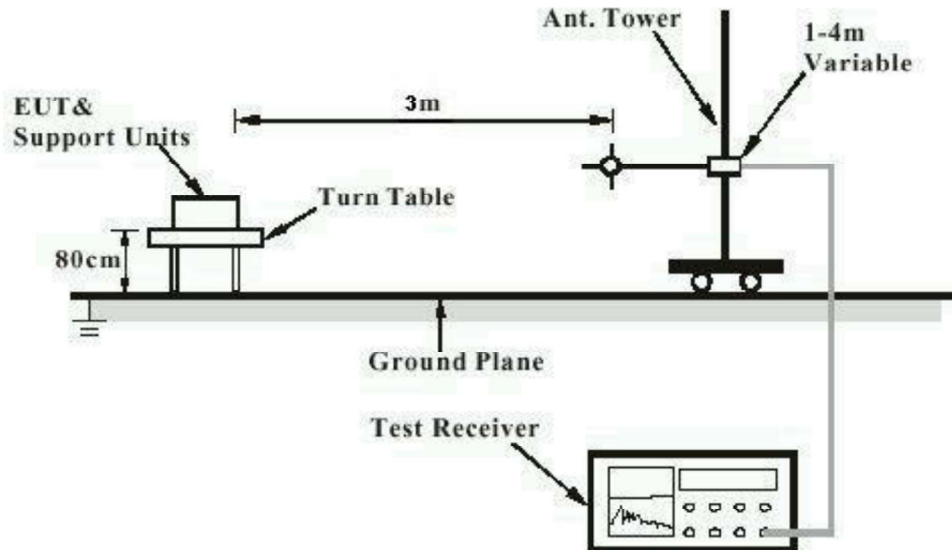
FA = Filter Attenuation Factor in dB.

PA = Preamplifier Factor in dB.

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

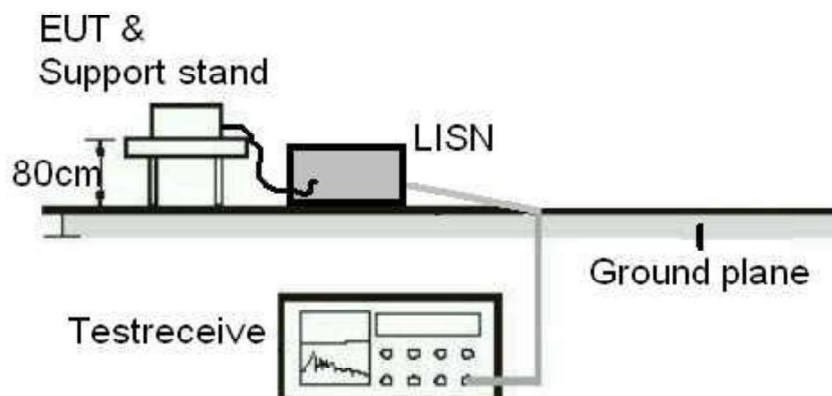
Test Setup Diagram

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)



Test Facility

Test Laboratory Information

TÜV Rheinland Hong Kong Ltd.

Address: 3-4 /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

Industry Canada

Type	: Accredited Test Firm
CAB identifier	: HK0013
ISED number	: 26152
Scope	: RSS-Gen, RSS-210, RSS-247

List of Test and Measurement Instruments

Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber (SiteVSWR)	Frankonia	Nil	16-May-20	16-May-21
Standard Gain Horn	ETS-Lindgren	3160-07	4-Sep-18	4-Sep-20
Standard Gain Horn	ETS-Lindgren	3160-08	26-Sep-18	26-Sep-20
Standard Gain Horn	ETS-Lindgren	3160-10	3-Oct-18	3-Oct-20
Double-Ridged Waveguide Horn	EMCO	3116	5-Oct-18	5-Oct-20
Double-Ridged Waveguide Horn	EMCO	3117	30-Aug-18	30-Aug-20
Test Receiver	R & S	ESU40	10-Oct-19	10-Oct-20
Coaxial cable	Huber+Suhner	CNM-NMCMILX800-473	4-Oct-18	4-Oct-20
Microwave Preamplifier	COM-POWER Corporation	PAM-118A	6-Mar-20	6-Mar-21
Preamplifier 18GHz to 40GHz with cable	A.H. Systems, Inc.	PAM-1840VH	30-Jan-20	30-Jan-21
High Pass Filter (cutoff freq. = 1000MHz)	Trilithic	23042	30-Oct-19	30-Oct-21
High Frequency Cable	Pasternack	PE3VNA4001-3M	29-Jan-19	29-Jan-21

Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP40	17-Jan-20	17-Jan-21

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is $\pm 2.42\text{dB}$.

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

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 / RSS-210 Issue 10

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:	Fixed Integral wire antenna
	b) Manufacturer and model no:	N/A
	c) Peak Gain:	0 dBi
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:	N/A	

RSS-Gen 6.3 – External Control		Pass
IC Requirement: The device shall not have any external controls accessible to the user that enable it to be adjusted, selected or programmed to operate in violation of the limits prescribed in the applicable RSS.		
Results:	The device does not have any transmitter external controls accessible to the user that can be adjusted and operated in violation of the limits of this standard.	
Verdict:	Pass	

RSS-Gen 8.3 – Antenna Requirement		Pass
IC Requirement: When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer.		
Results:	a) Antenna type:	Fixed Integral wire antenna
	b) Manufacturer	N/A
	c) model no	N/A
	d) Gain with reference to an isotropic radiator:	0 dBi
Verdict:	Pass	

FCC 15.207/ RSS-Gen 8.8 – Conducted Emission on AC Mains		N/A
There is no AC power input or output ports on the EUT.		

Subclause 15.215 (c) – 20 dB Bandwidth				Pass
Test Specification : ANSI C63.10 – 2013 Test date : 12.08.2020 Mode of operation : Tx mode Port of testing : Antenna port Supply voltage : 4.5 VDC Temperature : 25°C Humidity : 55%				
Requirement: The intentional radiators must be designed to ensure that the 20dB bandwidth of the emission, is contained within the frequency band designated in the rule section under which the equipment is operated.				
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. For test protocols refer to Appendix 1.				
Frequency (MHz)	20 dB left (MHz)	Limit (MHz)	20 dB right (MHz)	Limit (MHz)
2420	2415.369	> 2400	2424.081	< 2483.5
2442	2437.919	> 2400	2445.357	< 2483.5
2462	2458.498	> 2400	2464.431	< 2483.5

RSS-Gen 6.6 – Occupied Bandwidth				Pass
FCC/ IC Requirement : N/A				
Test Specification : RSS-Gen Test date : 12.08.2020 Mode of operation : Tx mode Port of testing : Antenna port Supply voltage : 4.5 VDC Temperature : 25°C Humidity : 55%				
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. For test protocols refer to Appendix 1.				
Frequency (MHz)	Left (MHz)	Right (MHz)	99% bandwidth (MHz)	
2420	2414.906	2425.123	10.217	
2442	2437.601	2445.965	8.364	
2462	2459.048	2464.576	5.528	

Subclause 15.249(a)/RSS-210 B.10(a) – Field Strength of Fundamental and Harmonics Pass		
Test Specification : ANSI C63.10 – 2013 Test date : 03.08.2020 – 12.08.2020 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 4.5 VDC Temperature : 23°C Humidity : 50%		
Requirement: The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following limit.		
Results: PASS.		
Fundamental Frequency 2420MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2419.983	94.5	114.0 / PK
2419.983	67.3	94.0 / AV
Fundamental Frequency 2420MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2419.967	95.8	114.0 / PK
2419.967	68.2	94.0 / AV
Harmonics 2420MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4839.955	53.8	74.0 / PK
4839.955	31.9	54.0 / AV
7259.868	46.5	74.0 / PK
7259.868	30.1	54.0 / AV
Harmonics 2420MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4839.923	51.9	74.0 / PK
4839.923	30.9	54.0 / AV
7259.884	44.2	74.0 / PK
7259.884	29.7	54.0 / AV
Fundamental Frequency 2442MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2441.875	95.9	114.0 / PK
2441.875	68.5	94.0 / AV
Fundamental Frequency 2442MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2442.019	95.5	114.0 / PK
2442.019	68.4	94.0 / AV

Harmonics 2442MHz			Vertical Polarization		
	Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m
	4883.902		55.1		74.0 / PK
	4883.902		32.5		54.0 / AV
Harmonics 2442MHz			Horizontal Polarization		
	Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m
	4883.914		55.9		74.0 / PK
	4883.914		33.4		54.0 / AV
Fundamental Frequency 2462MHz			Vertical Polarization		
	Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m
	2461.964		95.9		114.0 / PK
	2461.964		68.7		94.0 / AV
Fundamental Frequency 2462MHz			Horizontal Polarization		
	Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m
	2461.987		99.2		114.0 / PK
	2461.987		72.1		94.0 / AV
Harmonics 2462MHz			Vertical Polarization		
	Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m
	4923.951		56.6		74.0 / PK
	4923.951		33.3		54.0 / AV
	7385.935		51.0		74.0 / PK
	7385.935		31.3		54.0 / AV
Harmonics 2462MHz			Horizontal Polarization		
	Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m
	4923.951		58.0		74.0 / PK
	4923.951		34.1		54.0 / AV
	7385.935		53.7		74.0 / PK
	7385.935		23.2		54.0 / AV

Subclause 15.249(d), 15.205/RSS-210 B.10(b) – Out Of Band Radiated Emission		Pass
Test Specification : ANSI C63.10 – 2013 Test date : 03.08.2020 – 12.08.2020 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 4.5 VDC Temperature : 23°C Humidity : 50%		
Requirement: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.		
Results: All three transmit frequency modes comply with the field strength limit of section 15.209. There is no spurious found below 30MHz.		
Tx frequency 2420MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2400.000	52.5	74.0 / PK
2400.000	26.6	54.0 / AV
Tx frequency 2420MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2400.000	55.5	74.0 / PK
2400.000	27.0	54.0 / AV
Tx frequency 2442MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
No peak found	---	74.0 / PK
No peak found	---	54.0 / AV
Tx frequency 2442MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
No peak found	---	74.0 / PK
No peak found	---	54.0 / AV
Tx frequency 2462MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2483.500	51.8	74.0 / PK
2483.500	26.9	54.0 / AV
Tx frequency 2462MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2483.500	50.7	74.0 / PK
2483.500	26.8	54.0 / AV