

Prüfbericht-Nr.: <i>Test Report No.:</i>	CN20CYJ7 001	Auftrags-Nr.: <i>Order No.:</i>	158220637	Seite 1 von 19 <i>Page 1 of 19</i>	
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	04.12.2020		
Auftraggeber: <i>Client:</i>	DATAMARS SA via Industria 16, 6814 Lamone, Switzerland				
Prüfgegenstand: <i>Test item:</i>	Short Range Device - Radio Control Collar Tag (2.4GHz)				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	986 0000-370				
Auftrags-Inhalt: <i>Order content:</i>	FCC and ISCED 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>	04.12.2020				
Prüfmuster-Nr.: <i>Test sample No.:</i>	A002968758-001				
Prüfzeitraum: <i>Testing period:</i>	17.12.2020 - 23.02.2021				
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:			
					
30.07.2021	Felicia Chan / Assistant Engineer	30.07.2021	Sharon Li / 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>	Unterschrift <i>Signature</i>
Sonstiges / Other: FCC ID: NDX-COLLARTAG IC: 8521A-9860000370					
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>					

Table of Content

	Page
Cover Page	1
Table of Content	2
Product information	4
Manufacturers declarations	4
Product function and intended use	4
Submitted documents	4
Independent Operation Modes	4
Related Submittal(s) Grants	4
Remark	5
Test Set-up and Operation Mode	6
Principle of Configuration Selection	6
Test Operation and Test Software	6
Special Accessories and Auxiliary Equipment	6
Countermeasures to achieve EMC Compliance	6
Test Methodology	7
Radiated Emission	7
Field Strength Calculation	7
Test Setup Diagram	8
Test Facility	10
Test Laboratory Information	10
List of Test and Measurement Instruments	11
Measurement Uncertainty	12
Results FCC Part 15 – Subpart C / RSS-210 Issue 9	13
FCC 15.203 – Antenna Requirement 1	Pass 13
FCC 15.204 – Antenna Requirement 2	Pass 13
RSS-Gen 6.3 – External Control	Pass 13
RSS-Gen 8.3 – Antenna Requirement	Pass 13
Subclause 15.215 (c) – 20 dB Bandwidth	Pass 14

RSS-Gen 6.6 – Occupied Bandwidth	Pass	14
Subclause 15.249 (a) / RSS-210 B.10 (a) – Field Strength of Fundamental and Harmonics Pass		15
Subclause 15.249 (d), 15.205 / RSS-210 B.10 (b) – Out Of Band Radiated EmissionPass.....		18
Appendix 1 – Test protocols		5 pages
Appendix 2 – Test setup		2 pages
Appendix 3 – EUT External Photos		3 pages
Appendix 4 – EUT Internal Photos		4 pages
Appendix 5 – RF exposure information.....		2 pages

Product information

Manufacturers declarations

	Transceiver
Operating frequency range	2402 - 2476 MHz
Type of modulation	GFSK
Number of channels	3
Type of antenna	Integral Antenna
Power level	fix
Connection to public utility power line	No
Nominal voltage	V_{nor} : 3.6 V

Product function and intended use

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

FCC ID: NDX-COLLARTAG/ IC: 8521A-9860000370

Models	Product description
986 0000-370	Short Range Device - Radio Control Collar Tag (2.4GHz)

Submitted documents

Circuit Diagram
 Block Diagram
 Technical Description
 User manual
 Label

Independent Operation Modes

The basic operation modes are:

- Transmitting mode.
- Receiving mode
- Normal operation mode

For further information refer to User Manual

Related Submittal(s) Grants

This is a single application for certification of the transceiver.

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

- None

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.

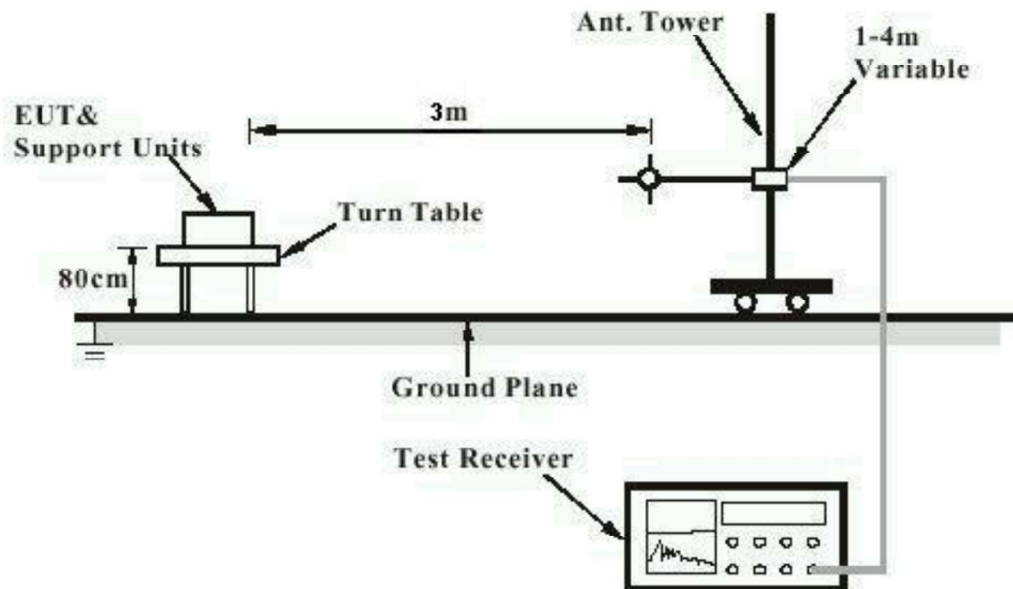
FA = Filter Attenuation Factor in dB.

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)

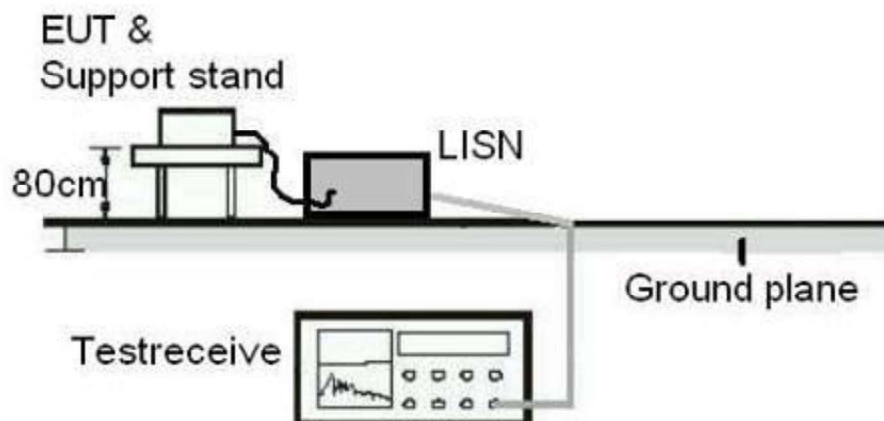
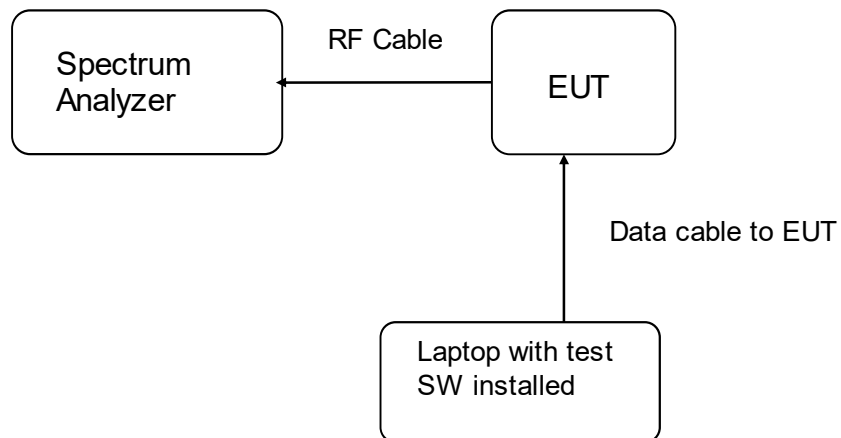


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)

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

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

FCC

Test Firm Registration Number : 371735

ISED/IC

Test Site Registration Number : 26152

List of Test and Measurement Instruments

Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Multi-functional Anechoic Chamber (S _{VSWR})	Albatross	N/A	04 Jan 21	04 Jan 22
Standard Gain Horn	ETS-Lindgren	3160-07	24 Nov 20	24 Nov 22
Standard Gain Horn	ETS-Lindgren	3160-08	24 Nov 20	24 Nov 22
Standard Gain Horn	ETS-Lindgren	3160-10	30 Nov 20	30 Nov 22
Double-Ridged Waveguide Horn	EMCO	3116	30 Nov 20	30 Nov 22
Double-Ridged Waveguide Horn	EMCO	3117	11 Nov 20	11 Nov 22
Test Receiver	R & S	ESU26	07 Oct 20	07 Oct 21
Coaxial cable	Huber+Suhner	SF118/11N/11N/12000MM	07 Jan 21	07 Jan 23
Microwave Preamplifier	COM-POWER Corporation	PAM-118A	06Mar 20	06 Mar 21
Preamplifier 18GHz to 40GHz with cable	A.H. Systems, Inc.	PAM-1840VH	29 Jan 21	29 Jan 22
High Pass Filter (cutoff freq. = 1000MHz)	Trilithic	23042	30 Oct 19	30 Oct 21
High Frequency Cable	Pasternack	PE3VNA4001-3M	29 Jan 21	29 Jan 23
Multi-functional Anechoic Chamber (S _{VSWR})	Albatross	N/A	04 Jan 21	04 Jan 22
Standard Gain Horn	ETS-Lindgren	3160-07	24 Nov 20	24 Nov 22
Multi-functional Anechoic Chamber (NSA)	Albatross	Nil	6-Jan-21	6-Jan-22
Bi-conical Antenna	R & S	HK116	15-Sep-20	15-Sep-22
Log Periodic Antenna	R & S	HL223	15-Sep-20	15-Sep-22
Active Loop Antenna	EMCO	6502	3-Nov-20	3-Nov-22
Bore-Sight Antenna Mast	Maturo	BAM 4.0-P-10kg	N.A.	N.A.

Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSV40	21 Jan 21	21 Jan 22

Measurement Uncertainty

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 estimated combined standard uncertainty for antenna conducted emission is $\pm 2.1\text{dB}$

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 9

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

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 antenna b) Manufacturer: N/A c) model no: N/A d) Gain with reference to an isotropic radiator: 0 dBi	
Verdict:	Pass	

Subclause 15.215 (c) – 20 dB Bandwidth				Pass
Test Specification : ANSI C63.10 – 2013 Test date : 13.01.2021 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.6VDC Temperature : 23°C Humidity : 50%				
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)
2402	2401.68	> 2400	2402.30	< 2483.5
2440	2439.71	> 2400	2440.29	< 2483.5
2476	2475.68	> 2400	2476.31	< 2483.5

RSS-Gen 6.6 – Occupied Bandwidth				Pass
FCC/ IC Requirement : N/A				
Test Specification : RSS-Gen Test date : 21.01.2021 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.6VDC Temperature : 23°C Humidity : 50%				
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)	
2402	2401.71	2402.30	0.588	
2440	2439.72	2440.30	0.580	
2476	2475.72	2476.29	0.572	

Subclause 15.249 (a) / RSS-210 B.10 (a) – Field Strength of Fundamental and Harmonics
Pass

Test Specification : ANSI C63.10 – 2013

Test date : 28.12.2020

Mode of operation : Tx mode

Port of testing : Enclosure

Frequency range : 9kHz – 25GHz

Supply voltage : 3.6VDC

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 2402MHz Vertical Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2402.000	97.7	114.0 / PK
2402.000	52.2	94.0 / AV

Fundamental Frequency 2402MHz Horizontal Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2402.020	105.6	114.0 / PK
2402.020	60.1	94.0 / AV

Harmonics 2402MHz Vertical Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4804.000	51.0	74.0 / PK
4804.000	29.8	54.0 / AV
7206.000	59.5	74.0 / PK
7206.000	31.9	54.0 / AV

Harmonics 2402MHz Horizontal Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4803.999	54.4	74.0 / PK
4803.999	29.9	54.0 / AV
7205.991	58.0	74.0 / PK
7205.991	31.8	54.0 / AV

Fundamental Frequency 2440MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2439.903	99.4	114.0 / PK
2439.903	53.6	94.0 / AV
Fundamental Frequency 2440MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2440.016	107.0	114.0 / PK
2440.016	61.3	94.0 / AV
Harmonics 2440MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4879.807	52.1	74.0 / PK
4879.807	29.2	54.0 / AV
7319.711	59.4	74.0 / PK
7319.711	31.6	54.0 / AV
Harmonics 2440MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4880.032	61.1	74.0 / PK
4880.032	30.2	54.0 / AV
7319.711	55.7	74.0 / PK
7319.711	31.3	54.0 / AV
Fundamental Frequency 2476MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2476.000	98.0	114.0 / PK
2476.000	52.6	94.0 / AV
Fundamental Frequency 2476MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2476.080	106.3	114.0 / PK
2476.080	60.6	94.0 / AV
Harmonics 2476MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4951.727	52.0	74.0 / PK
4951.727	28.9	54.0 / AV
7428.384	52.9	74.0 / PK
7428.384	30.5	54.0 / AV

Harmonics 2476MHz		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
4952.000	56.6	74.0 / PK	
4952.000	29.4	54.0 / AV	
7428.000	60.3	74.0 / PK	
7428.000	31.2	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 : 28.12.2020

Mode of operation : Tx mode

Port of testing : Enclosure

Frequency range : 9kHz – 25GHz

Supply voltage : 3.6VDC

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 2402MHz Vertical Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2400.000	56.9	74.0 / PK
2400.000	26.7	54.0 / AV
2390.000	39.2	74.0 / PK
2390.000	26.3	54.0 / AV

Tx frequency 2402MHz Horizontal Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2400.000	64.4	74.0 / PK
2400.000	27.1	54.0 / AV
2390.000	41.4	74.0 / PK
2390.000	26.3	54.0 / AV

Tx frequency 2440MHz 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 2440MHz 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 2476MHz			Vertical Polarization		
Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m	
2483.500		42.5		74.0 / PK	
2483.500		28.7		54.0 / AV	
Tx frequency 2476MHz			Horizontal Polarization		
Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m	
2483.500		48.1		74.0 / PK	
2483.500		28.7		54.0 / AV	