

Prüfbericht-Nr.: Test Report No.:	CN23JWM9 001	Auftrags-Nr.: Order No.:	158256816	Seite 1 von 15 Page 1 of 15
Kunden-Referenz-Nr.: Client Reference No.:	N/A	Auftragsdatum: Order date:	27.06.2023	
Auftraggeber: Client:	Carrera Toys GmbH Rennbahn Allee 1, 5412 Puch, Salzburg, Austria			
Prüfgegenstand: Test item:	Short Range Device - Remote Control Toy Transmitter (2.4GHz)			
Bezeichnung / Typ-Nr.: Identification / Type No.:	370410537			
Auftrags-Inhalt: Order content:	FCC and ISCED Certification			
Prüfgrundlage: Test specification:	FCC Part 15 Subpart C, ANSI C63.10-2013 RSS-210 Issue 10, RSS-Gen Issue 5			
Wareneingangsdatum: Date of receipt:	27.06.2023			
Prüfmuster-Nr.: Test sample No.:	A003521691-001; 002			
Prüfzeitraum: Testing period:	21.07.2023 - 28.07.2023			
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:		
				
31.07.2023	Eddy Tsang / Engineer	31.07.2023	Sharon Li / Unit Senior Manager	
Datum Date	Name / Stellung Name / Position	Unterschrift Signature	Datum Date	Name / Stellung Name / Position
Sonstiges / Other: FCC ID: YFA370410537 IC ID: 12260A-370410537				
"Decision Rule" document announced in our website (https://www.tuv.com/landingpage/en/qm-gcn/) describes the statement of conformity and its rule of enforcement for test results are applicable throughout this test report.				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/T = nicht getestet
Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient 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. 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.				

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Product information

Manufacturers declarations

	Transmitter
Operating frequency range	2405 - 2475MHz
Type of modulation	GFSK
Number of channels	71
Type of antenna	Fixed Integral wire antenna
Power level	fix
Connection to public utility power line	No
Nominal voltage	3.0 VDC

Product function and intended use

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

FCC ID: YFA370410537 / IC ID: 12260A-370410537

Models	Product description
370410537	Short Range Device - Remote Control Toy Transmitter (2.4GHz)

Submitted documents

Nil

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

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:

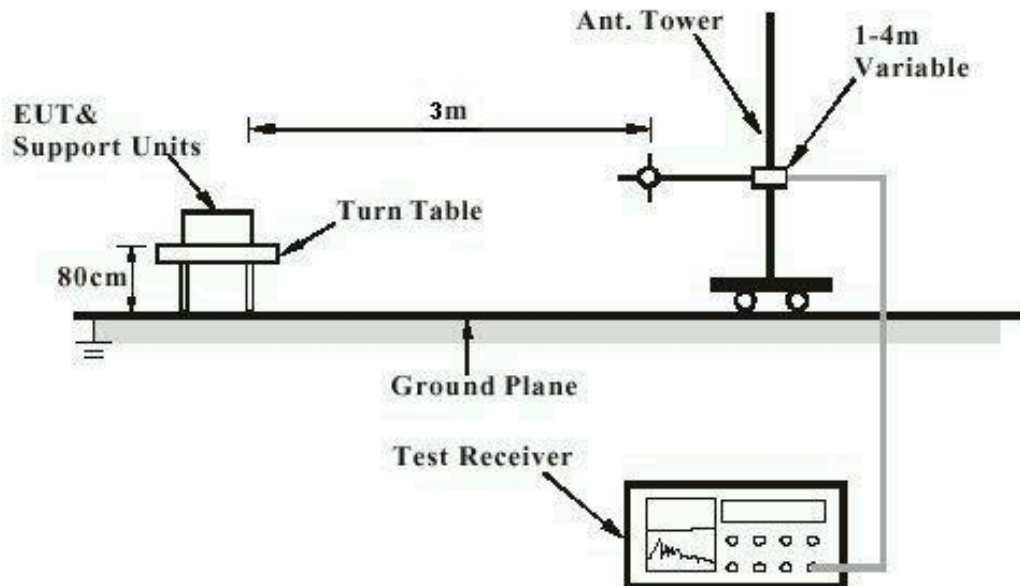
$$FS = R + AF + CF + FA - PA$$

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.

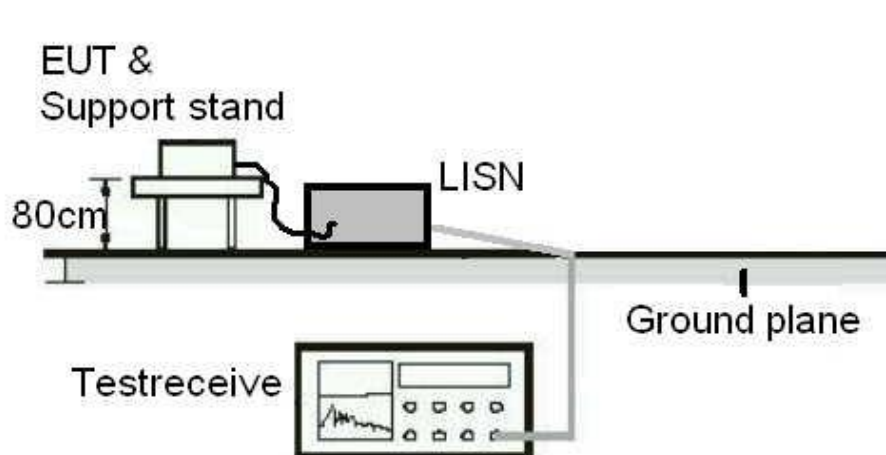
Test Setup Diagram

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

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
Semi-anechoic Chamber	Frankonia	Nil	3-Mar-23	3-Mar-24
Multi-functional Anechoic Chamber	Albatross	Nil	4-Jan-23	4-Jan-24
Test Receiver	R & S	ESU40	9-Mar-23	9-Mar-24
Active Loop Antenna	EMCO	6502	3-Nov-22	3-Nov-24
Bi-conical Antenna	R & S	HK116	24-Oct-22	24-Oct-24
Log Periodic Antenna	R & S	HL223	25-Oct-22	25-Oct-24
Standard Gain Horn	ETS-Lindgren	3160-07	25-Nov-22	25-Nov-24
Standard Gain Horn	ETS-Lindgren	3160-08	25-Nov-22	25-Nov-24
Standard Gain Horn	ETS-Lindgren	3160-10	30-Nov-22	30-Nov-24
Double-Ridged Waveguide Horn	EMCO	3116	30-Nov-22	30-Nov-24
Double-Ridged Waveguide Horn	EMCO	3117	21-Nov-22	21-Nov-24
Coaxial cable	Harbour	SF118/11n/11n/1 2000.0	3-Aug-22	3-Aug-24
High Frequency Cable	Pasternack	PE3VNA4001-3M	29-Jan-23	29-Jan-25
Microwave amplifier 0.5-26.5GHz, 25dB gain	COM-POWER Corporation	PAM-118A	3-Mar-23	3-Mar-24
Preamplifier 18GHz to 40GHz with cable (EMC656)	A.H. Systems, Inc.	PAM-1840VH	27-Jan-23	27-Jan-24
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	30-Oct-21	30-Oct-23

Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Signal and Spectrum Analyzer	R & S	FSV30	31-Jan-23	31-Jan-24

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:	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 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.		

FCC 15.215 (c) – 20 dB Bandwidth				Pass
Test Specification : ANSI C63.10 – 2013 Test date : 28.07.2023 Mode of operation : Tx mode Port of testing : Antenna port Supply voltage : 3.0 VDC 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)
2405	2404.510	> 2400	2405.510	< 2483.5
2440	2439.520	> 2400	2440.510	< 2483.5
2475	2474.510	> 2400	2475.510	< 2483.5

RSS-Gen 6.6 – Occupied Bandwidth				Pass
FCC/ IC Requirement : N/A				
Test Specification : RSS-Gen Test date : 28.07.2023 Mode of operation : Tx mode Port of testing : Antenna port Supply voltage : 3.0 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)	
2405	2404.340	2405.560	1.220	
2440	2439.340	2440.540	1.200	
2475	2474.300	2475.550	1.250	

FCC 15.249(a) / RSS-210 B.10(a) – Field Strength of Fundamental and Harmonics			Pass *
Test Specification : ANSI C63.10 – 2013 Test date : 21.07.2023 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 3.0 VDC Temperature : 23°C Humidity : 56%			
Requirement: The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following limit.			
Results: PASS. Marginal pass result is marked with an Asterisk *			
Fundamental Frequency 2405MHz		Vertical Polarization	
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	
2404.838	90.5	114.0 / PK	
2404.838	86.6	94.0 / AV	
Fundamental Frequency 2405MHz		Horizontal Polarization	
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	
2404.839	90.6	114.0 / PK	
2404.839	86.1	94.0 / AV	
Harmonics 2405MHz		Vertical Polarization	
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	
4809.671	58.2	74.0 / PK	
4809.671	51.9 *	54.0 / AV	
Harmonics 2405MHz		Horizontal Polarization	
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	
4809.671	55.4	74.0 / PK	
4809.671	48.8	54.0 / AV	

Fundamental Frequency 2440MHz			Vertical Polarization		
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m
2439.839	85.5	114.0 / PK	2439.839	80.2	94.0 / AV
2439.839	80.2	94.0 / AV			
Fundamental Frequency 2440MHz			Horizontal Polarization		
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m
2439.839	89.5	114.0 / PK	2439.839	85.2	94.0 / AV
2439.839	85.2	94.0 / AV			
Harmonics 2440MHz			Vertical Polarization		
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m
4879.679	56.9	74.0 / PK	4879.679	50.5	54.0 / AV
4879.679	50.5	54.0 / AV			
Harmonics 2440MHz			Horizontal Polarization		
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m
4879.679	53.0	74.0 / PK	4879.679	46.1	54.0 / AV
4879.679	46.1	54.0 / AV			
Fundamental Frequency 2475MHz			Vertical Polarization		
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m
2474.839	88.3	114.0 / PK	2474.839	83.9	94.0 / AV
2474.839	83.9	94.0 / AV			
Fundamental Frequency 2475MHz			Horizontal Polarization		
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m
2474.839	89.6	114.0 / PK	2474.839	85.2	94.0 / AV
2474.839	85.2	94.0 / AV			
Harmonics 2475MHz			Vertical Polarization		
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m
4949.680	53.4	74.0 / PK	4949.680	46.4	54.0 / AV
4949.680	46.4	54.0 / AV			
Harmonics 2475MHz			Horizontal Polarization		
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m
4949.673	53.7	74.0 / PK	4949.673	47.0	54.0 / AV
4949.673	47.0	54.0 / AV			

FCC 15.249(d), 15.205 / RSS-210 B.10(b) – Out Of Band Radiated Emission			Pass *
Test Specification : ANSI C63.10 – 2013 Test date : 21.07.2023 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 3.0 VDC Temperature : 24°C Humidity : 55%			
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. Marginal pass result is marked with an Asterisk *			
Tx frequency 2405MHz			Vertical Polarization
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	
2400.000	58.6	74.0 / PK	
2400.000	27.1	54.0 / AV	
3206.666	55.8	74.0 / PK	
3206.666	52.3 *	54.0 / AV	
4008.490	47.2	74.0 / PK	
4008.490	40.1	54.0 / AV	
Tx frequency 2405MHz			Horizontal Polarization
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	
2400.000	57.8	74.0 / PK	
2400.000	27.0	54.0 / AV	
3206.672	54.6	74.0 / PK	
3206.672	51.0 *	54.0 / AV	
4008.490	49.6	74.0 / PK	
4008.490	42.8	54.0 / AV	
Tx frequency 2440MHz			Vertical Polarization
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	
3253.330	55.2	74.0 / PK	
3253.330	51.6 *	54.0 / AV	
4066.830	47.3	74.0 / PK	
4066.830	40.0	54.0 / AV	
Tx frequency 2440MHz			Horizontal Polarization
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m	
3253.330	56.0	74.0 / PK	
3253.330	52.6 *	54.0 / AV	
4066.830	50.5	74.0 / PK	
4066.830	44.2	54.0 / AV	

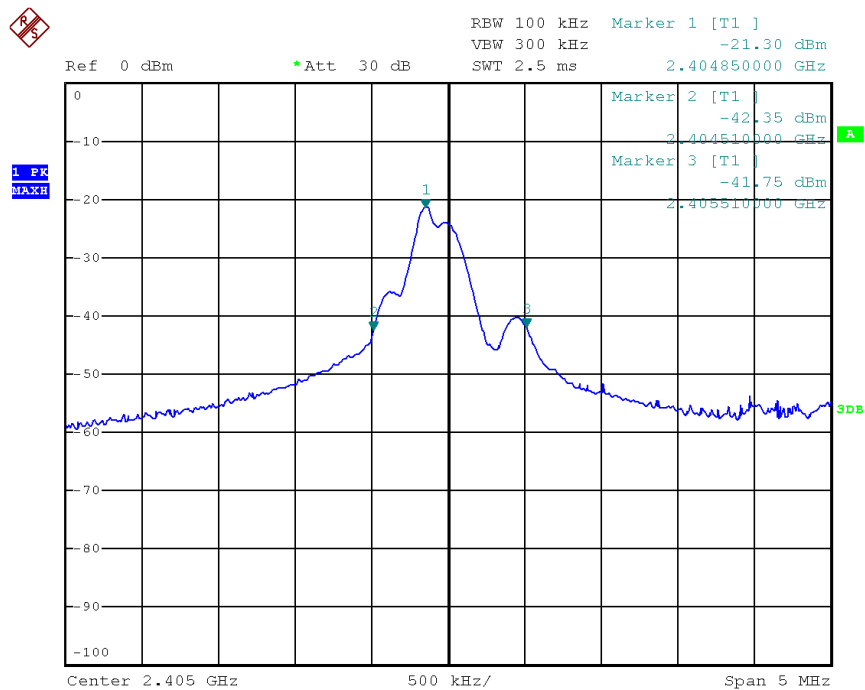
Tx frequency 2475MHz Vertical Polarization		
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m
2483.500	48.9	74.0 / PK
2483.500	26.3	54.0 / AV
3299.998	55.0	74.0 / PK
3299.998	51.4 *	54.0 / AV
Tx frequency 2475MHz Horizontal Polarization		
Frequency MHz	Level dBuV/m	Limit / Detector dBuV/m
2483.500	50.0	74.0 / PK
2483.500	26.6	54.0 / AV
3299.998	55.4	74.0 / PK
3299.998	51.8 *	54.0 / AV
4125.160	49.4	74.0 / PK
4125.160	42.6	54.0 / AV

Appendix 1

Test Results

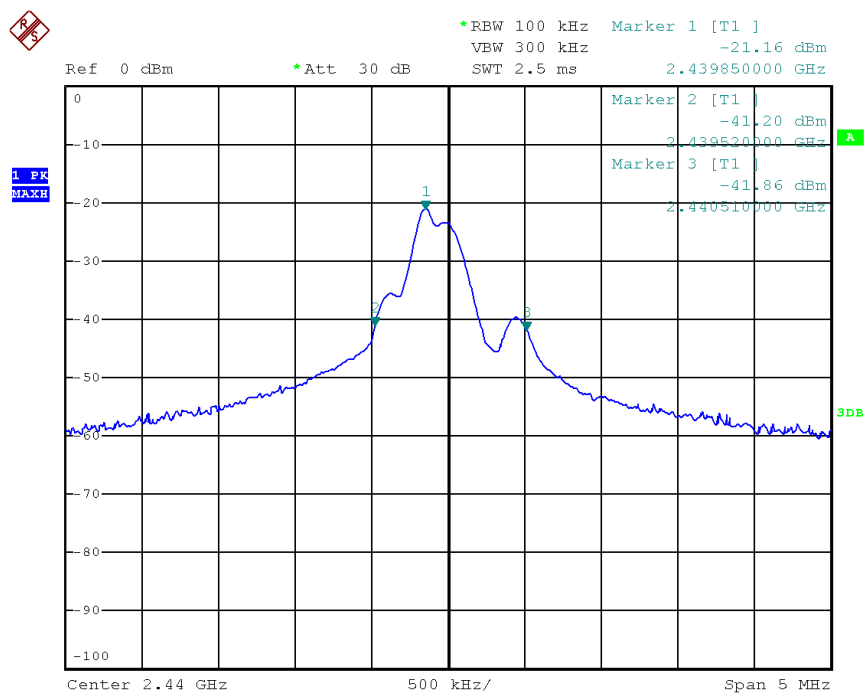
20dB Bandwidth

Tx frequency: 2405 MHz



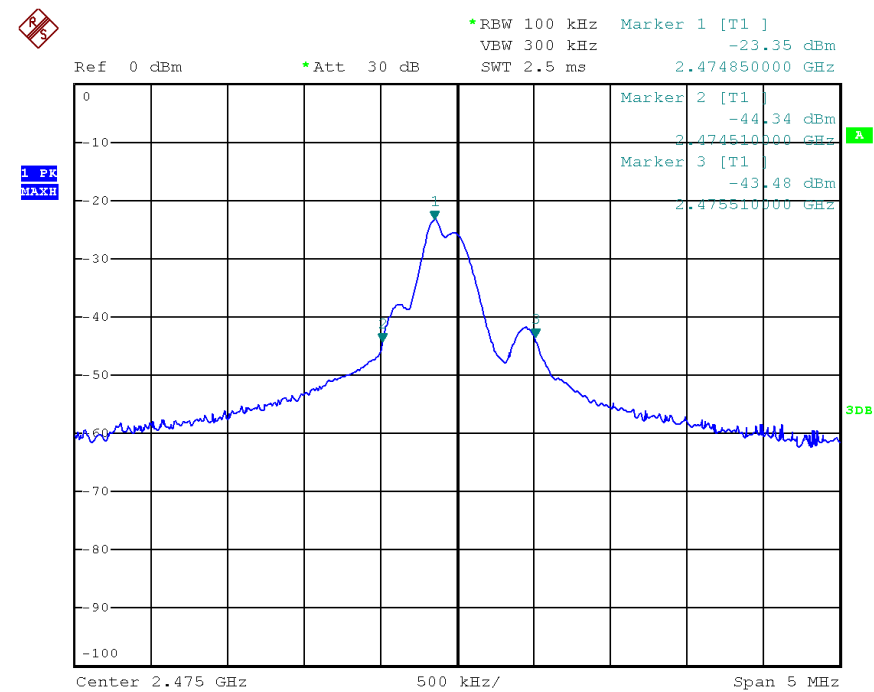
Date: 28.JUL.2023 11:18:52

Tx frequency: 2440 MHz



Date: 28.JUL.2023 11:28:49

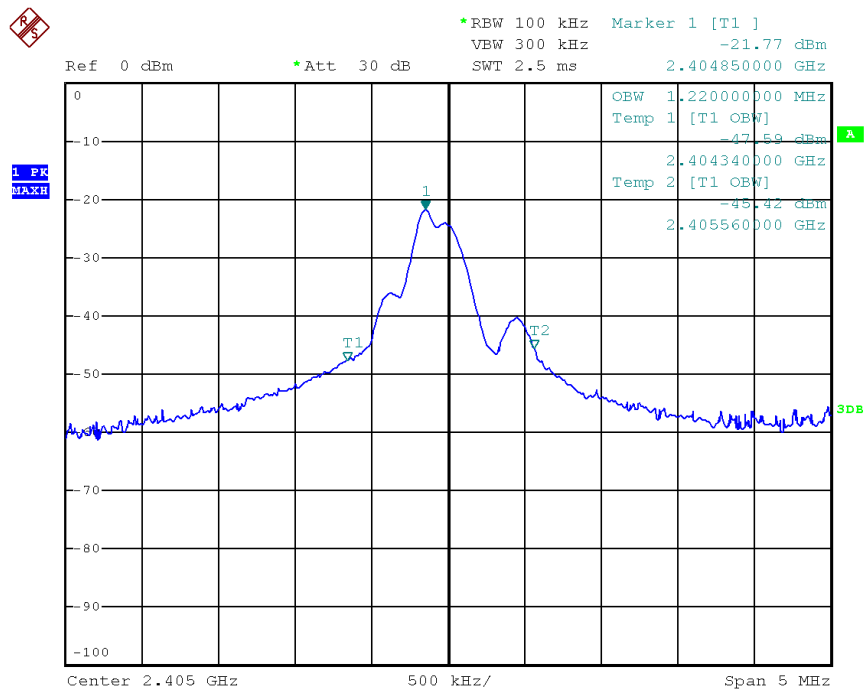
Tx frequency: 2475 MHz



Date: 28.JUL.2023 11:30:10

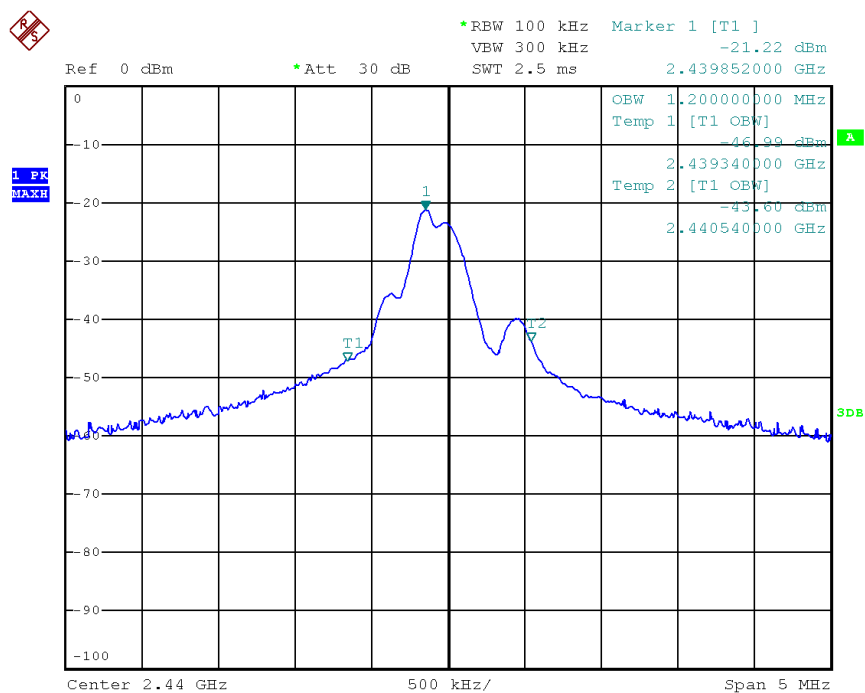
99% Bandwidth

Tx frequency: 2405 MHz



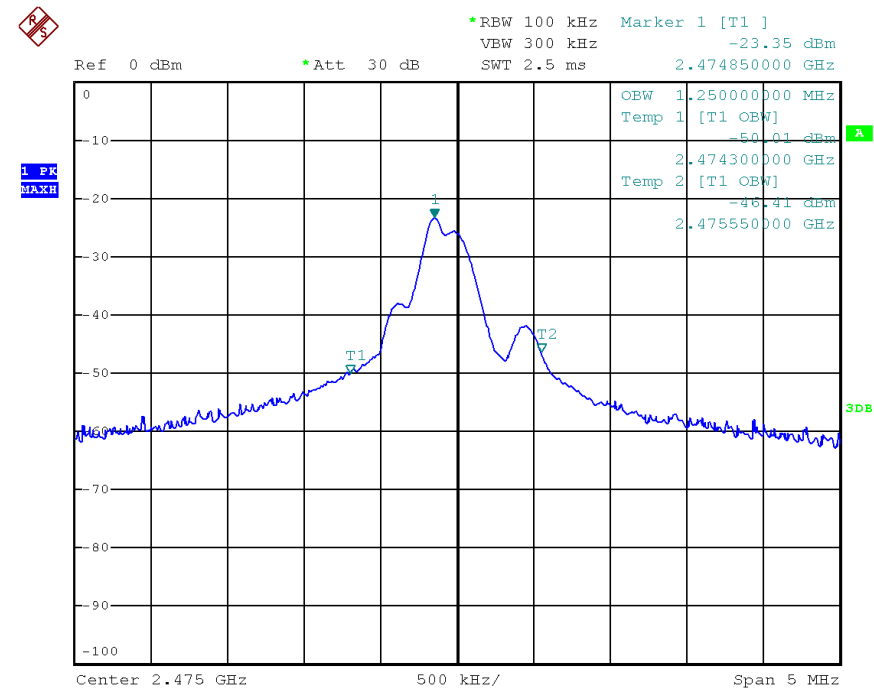
Date: 28.JUL.2023 11:21:20

Tx frequency: 2440 MHz



Date: 28.JUL.2023 11:27:25

Tx frequency: 2475 MHz



Date: 28.JUL.2023 11:31:06

Appendix 2

Test Setup Photos



Set-up for Radiated Emission (9k-30MHz)



Set-up for Radiated Emission (30M-200MHz)



Set-up for Radiated Emission (200M-1GHz)



Set-up for Radiated Emission (1GHz above)

Appendix 3

EUT External Photos

FCC ID: YFA370410537
IC ID: 12260A-370410537



External View



External View



External View



External View



External View

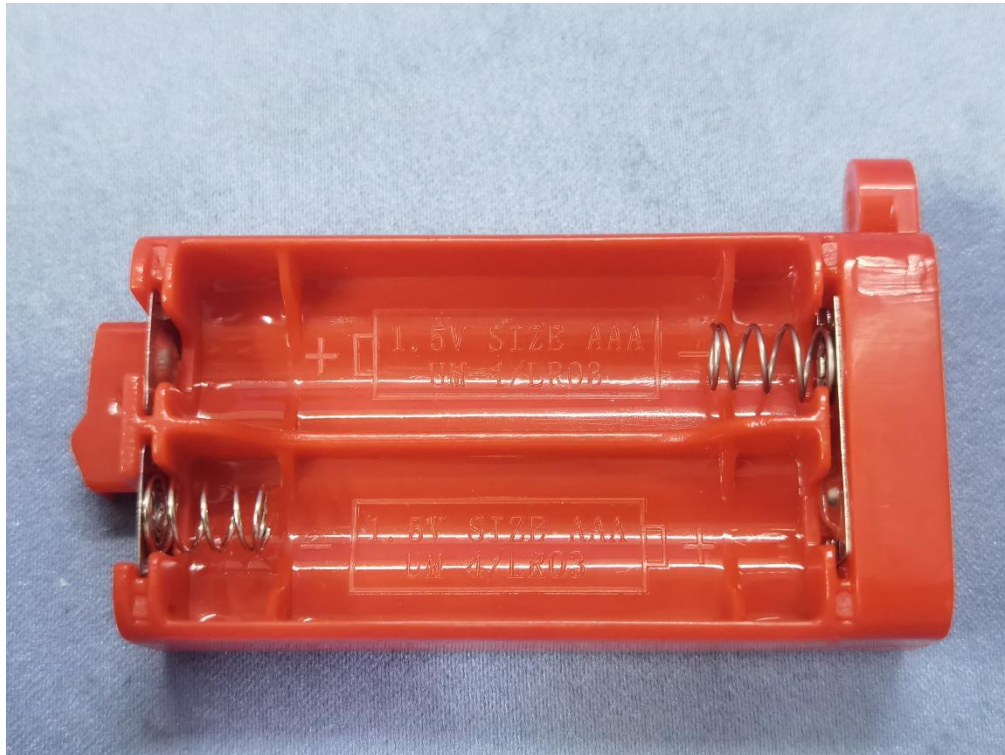


External View

Appendix 4

EUT Internal Photos

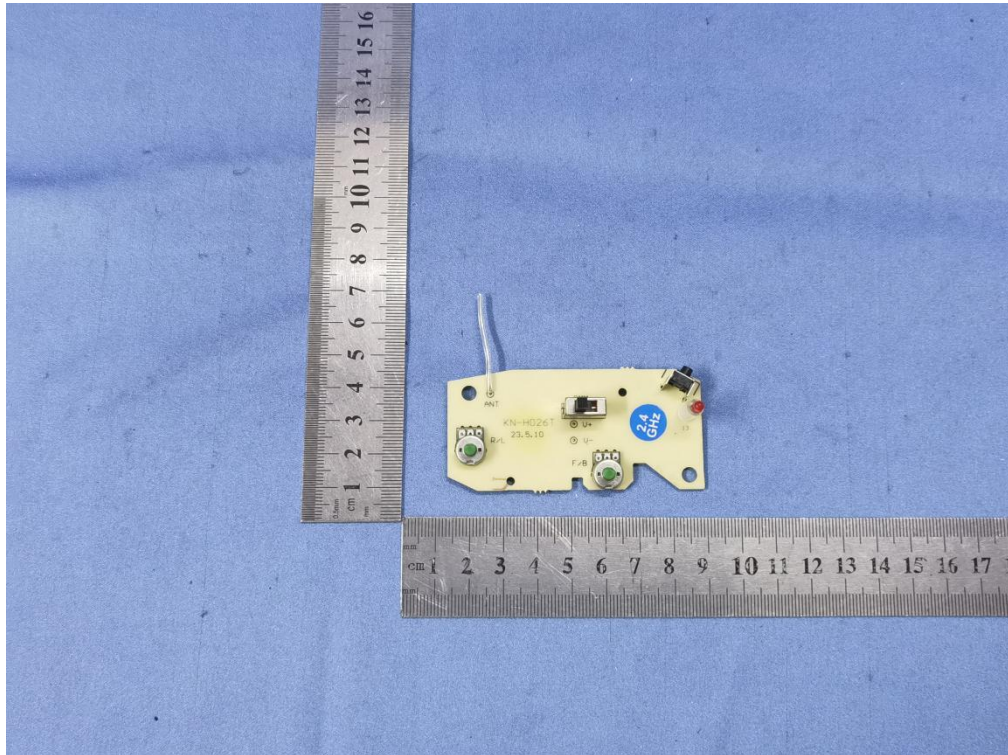
FCC ID: YFA370410537
IC ID: 12260A-370410537



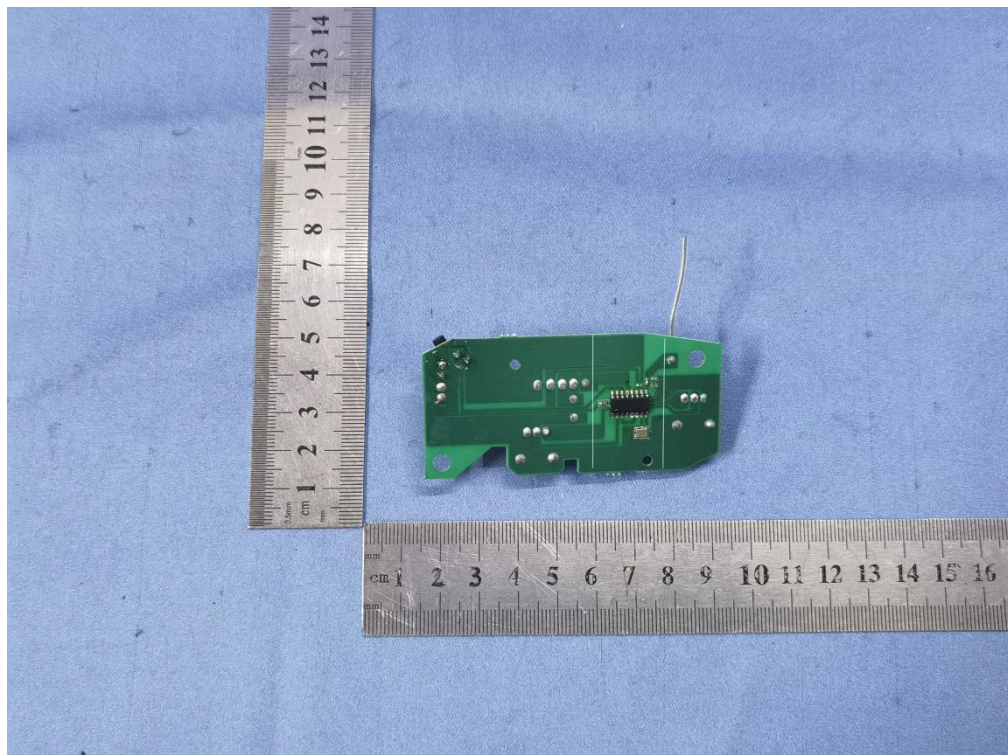
Internal View



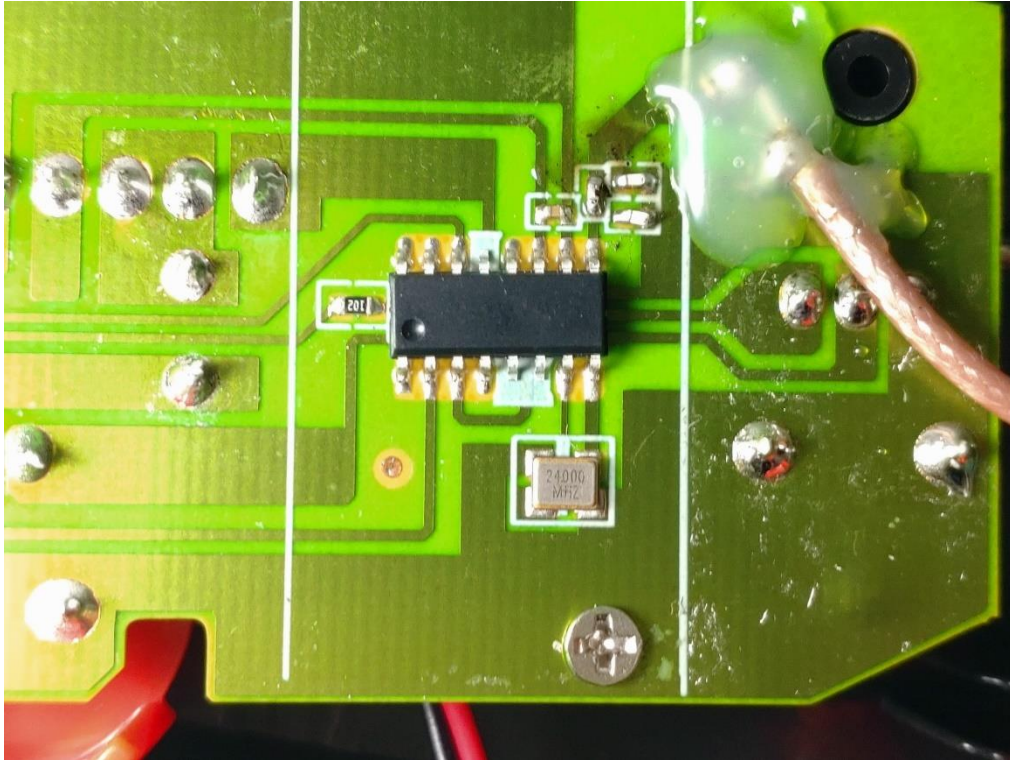
Internal View



Internal View



Internal View



Internal View

Appendix 5

RF Exposure Information

FCC ID: YFA370410537
IC ID: 12260A-370410537

Maximum transmitter power:

Frequency (MHz)	Maximum peak output power (dBm)	Output power (mW)
2405	-4.63	0.344
2440	-5.73	0.267
2475	-5.63	0.274

Note: The maximum peak field strength was taken from table of "Subclause 15.249(a)/RSS-210 B.10(a) – Field Strength of Fundamental and Harmonics".

For FCC

According to KDB 447498 D01:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤5 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

Result:

$$(0.344/5) \cdot \sqrt{2405} = 0.107 < 3.0$$

$$(0.267/5) \cdot \sqrt{2440} = 0.083 < 3.0$$

$$(0.274/5) \cdot \sqrt{2475} = 0.086 < 3.0$$

Conclusion:

No SAR is required.

For ISED

According to table 1 in RSS-102 Issue 5, below exemption limit is applied

Frequency: 2405MHz

At separation distance of ≤ 5mm

Exemption limits: 4mW

Results:

max. power of channel = 0.344mW < 4mW

Conclusion:

The maximum peak output power of the transmitter is less than the SAR evaluation exemption threshold and hence it complies with the RSS-102 RF exposure requirement