



FCC - TEST REPORT

Report Number	: 68.940.22.0057.01	Date of Issue: <u>June 6, 2022</u>
Model	: E598-003, E331-003, E332-003, E333-003, E334-003, E101-003, E102-003, E103-003, E104-003, E105-003, E106-003, E107-003, E108-003, E111-003, E112-003, E116-003, E580-003, E588-003, E384-003, E371-003	
Product Type	: Remote controller	
Applicant	: DOUBLEEAGLE INDUSTRY (CHINA) LIMITED	
Address	: XINGDA INDUSTRIAL PARK, CHENGHAI, SHANTOU CITY, GUANGDONG PROVINCE, CHINA	
Manufacturer	: DOUBLEEAGLE INDUSTRY (CHINA) LIMITED	
Address	: XINGDA INDUSTRIAL PARK, CHENGHAI, SHANTOU CITY, GUANGDONG PROVINCE, CHINA	
Test Result	: <input checked="" type="checkbox"/> Positive <input type="checkbox"/> Negative	
Total pages including Appendices	: <u>25</u>	

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13, Zhiheng Wisdomland Business Park,
Guankou Erlu, Nantou, Nanshan District,
Shenzhen, 518052 China

FCC Registration Number: 514049

FCC Designation Number: CN5009

Telephone: 86 755 8828 6998
Fax: 86 755 8828 5299

3 Description of the Equipment Under Test

Description of the Equipment Under Test

Product:	Remote controller
Model no.:	E598-003, E331-003, E332-003, E333-003, E334-003, E101-003, E102-003, E103-003, E104-003, E105-003, E106-003, E107-003, E108-003, E111-003, E112-003, E116-003, E580-003, E588-003, E384-003, E371-003
FCC ID:	2AAFASY-E598-003-05
Options and accessories:	NIL
Ratings:	3 x 1.5VDC AA size batteries (for remote controller)
RF Transmission Frequency:	2402MHz-2475MHz
Modulation:	GFSK
Antenna Type:	Monopole Antenna
Antenna Gain:	0dBi
Description of the EUT:	The product is remote controller operated with 2.4GHz wireless function, the transmitting frequency range is 2402MHz - 2475MHz.

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2020 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to ANSI C63.10-2013.

5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C 15.249		Pages	Test Site	Test Result		
Test Condition				Pass	Fail	N/A
15.207 Conducted emission AC power port	see note 1	---		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.205(a), §15.209(a), §15.249(a), §15.249(c) Field strength of emissions and Restricted bands	10	Site 1		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.249(d) Out of band emissions	15	Site 1		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FCC §15.215(c) 20dB bandwidth	20	Site 1		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.203 Antenna requirement	See note 2			<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note 1: The device is battery powered and can not be directly or indirectly connected to the AC mains, therefore the conducted emission measurement is not applicable.

Note 2: The EUT used an integral antenna, which gain is 0dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.



6 General Remarks

Remarks

All the models have same circuit, PCB layout and electric components, only the appearance, color and model named are different. Therefore, the EMC full tests were applied on model E598-003, other models are deemed to fulfill relevant EMC requirement without further testing.

This submittal(s) (test report) is intended for FCC ID: 2AAFASY-E598-003-05 complies with Section 15.207, 15.205, 15.209, 15.249 of the FCC Part 15, Subpart C Rules.

SUMMARY:

All tests according to the regulations cited on page 5 were

- Performed

- Not Performed

The Equipment Under Test

- **Fulfils** the general approval requirements.

- **Does not** fulfill the general approval requirements.

Sample Received Date: April 18, 2022

Testing Start Date: May 07, 2022

Testing End Date: May 08, 2022

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:

Jessie He
EMC Project Manager



Prepared by:

Myron Yu
EMC Project Engineer

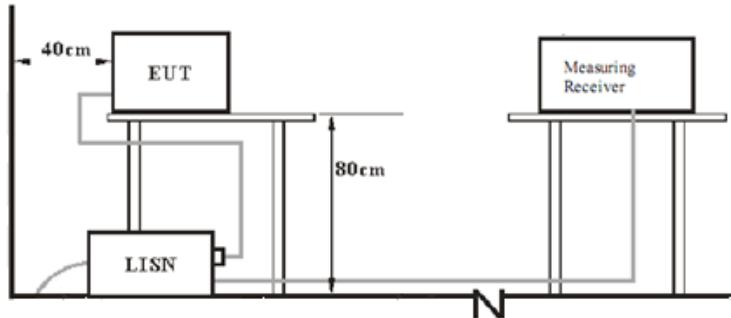
Tested by:

Carry Cai
EMC Test Engineer

7 Test setups

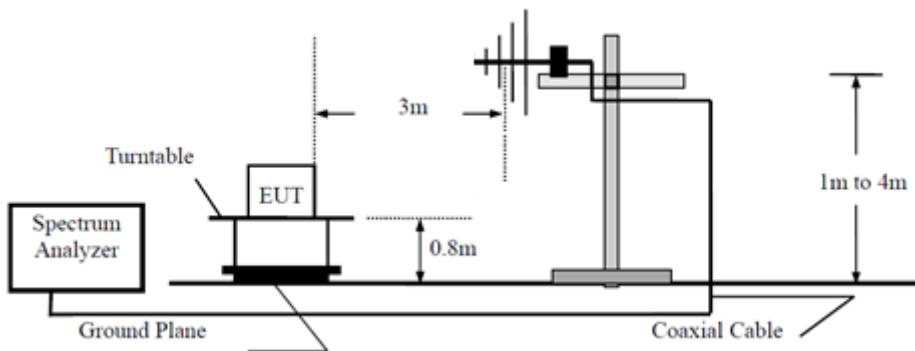
7.1 AC Power Line Conducted Emission test setups

AC Power Line Conducted Emission test setups

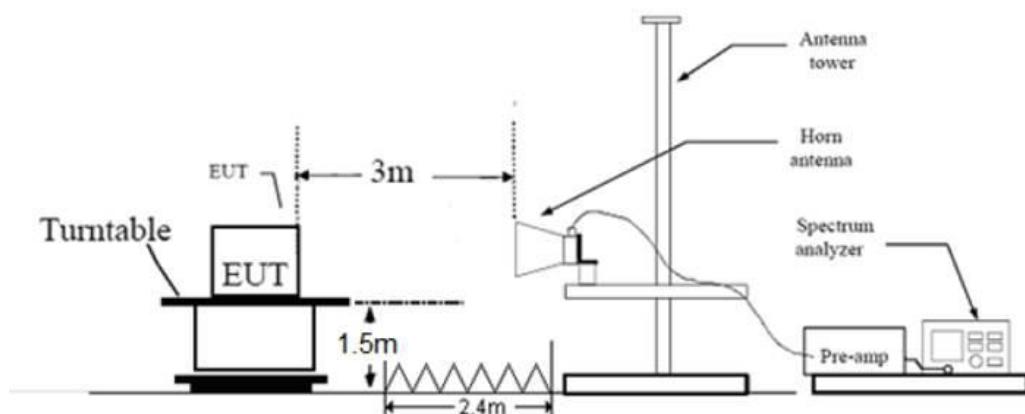


7.2 Radiated test setups

Below 1GHz



Above 1GHz



8 Technical Requirement

8.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through an Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. An EMI test receiver is used to test the emissions from both sides of AC line

Limit

Frequency MHz	QP Limit dB μ V	AV Limit dB μ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

*Decreasing linearly with logarithm of the frequency.

Test results

Not applicable

8.2 Field strength of emissions and Restricted bands

Test Method

- 1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3-meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
- 3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5: Use the following spectrum analyzer settings According to C63.10:

For Above 1GHz

Span = wide enough to capture the peak level of the in-band emission and all spurious
 RBW = 1MHz, VBW \geq 3RBW, Sweep = auto, Detector function = peak and average,
 Trace = max hold.

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious
 RBW = 120KHz, VBW \geq 3RBW, Sweep = auto, Detector function = QP,
 Trace = max hold.

Field strength of emissions and Restricted bands

Limits

According to §15.249 (a), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

According to §15.249 (c), Field strength limits are specified at a distance of 3 meters.

According to §15.249 (d), Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

According to §15.205 Unwanted emissions falling into restricted bands in §15.205 (a) shall comply with the limits specified in §15.209.

Frequency MHz	Field Strength uV/m	Field Strength dB μ V/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Field strength of emissions and Restricted bands

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

EUT: Remote controller

M/N: E598-003

Operating Condition: Tx 2402MHz

For Peak Value

Radiated Emission								
Value	Emissions Frequency MHz	E-Field Polarity	Reading Level dB μ V/m	Correction Factor dB/m	PK Emission dB μ V/m	Limit dB μ V/m	Margin dBm	Emission Type
PK	495.438333	H	2.16	25.48	27.64	46.00	18.36	Spurious
PK	728.130556	V	3.38	29.33	32.71	46.00	13.29	Spurious
PK	2401.850000	H	93.53	-6.31	87.22	114.00	26.78	Fundamental
PK	2402.125000	V	95.95	-6.30	89.65	114.00	24.35	Fundamental
PK	4804.000000*	H	53.81	3.80	57.61	74.00	16.39	Spurious
PK	4804.500000*	V	53.36	3.80	57.16	74.00	16.84	Spurious

For AV Value

Radiated Emission										
Value	Emissions Frequency MHz	E-Field Polarity	Reading Level dB μ V/m	Correction Factor dB	PK Emission dB μ V/m	Average Factor dB	AV Emission dB μ V/m	Limit dB μ V/m	Margin dBm	Emission Type
AV	2401.850000	H	93.53	-6.31	87.22	-11.12	76.10	94.00	17.90	Fundamental
AV	2402.125000	V	95.95	-6.30	89.65	-11.12	78.53	94.00	15.47	Fundamental
AV	4804.000000*	H	53.81	3.80	57.61	-11.12	46.49	54.00	7.51	Spurious
AV	4804.500000*	V	53.36	3.80	57.16	-11.12	46.04	54.00	7.96	Spurious

Peak to average duty cycle correction factor = $20\log$ (duty cycle), duty cycle=27.81%

Remark:

1: Data of measurement within this frequency range shown "/" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

2: "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

3: PK Emission = Reading Level + Correction Factor

4: AV Emission Level= PK Emission + $20\log$ (duty cycle)

Correction Factor=Antenna Factor + Cable Loss (For Below 1GHz)

Correction Factor = Antenna Factor + Cable Loss- Amplifier Gain (For Above 1GHz)

(The Reading Level is recorded by software which is not shown in the sheet)

Field strength of emissions and Restricted bands

EUT: Remote controller

M/N: E598-003

Operating Condition: Tx 2440MHz

For Peak Value

Radiated Emission								
Value	Emissions Frequency MHz	E-Field Polarity	Reading Level dB μ V/m	Correction Factor dB/m	PK Emission dB μ V/m	Limit dB μ V/m	Margin dBm	Emission Type
PK	2440.250000	H	94.42	-6.05	88.37	114.00	25.63	Fundamental
PK	2440.500000	V	97.09	-6.05	91.04	114.00	22.96	Fundamental
PK	4880.500000*	H	54.04	4.50	58.54	74.00	15.46	Spurious
PK	4880.500000*	V	50.88	4.50	55.38	74.00	18.62	Spurious

For AV Value

Radiated Emission										
Value	Emissions Frequency MHz	E-Field Polarity	Reading Level dB μ V/m	Correction Factor dB	PK Emission dB μ V/m	Average Factor dB	AV Emission dB μ V/m	Limit dB μ V/m	Margin dBm	Emission Type
AV	2440.250000	H	94.42	-6.05	88.37	-11.12	77.25	94.00	16.75	Fundamental
AV	2440.500000	V	97.09	-6.05	91.04	-11.12	79.92	94.00	14.08	Fundamental
AV	4880.500000*	H	54.04	4.50	58.54	-11.12	47.42	54.00	6.58	Spurious
AV	4880.500000*	V	50.88	4.50	55.38	-11.12	44.26	54.00	9.74	Spurious

Peak to average duty cycle correction factor = $20\log$ (duty cycle), duty cycle=27.81%

Remark:

1: Data of measurement within this frequency range shown "/" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

2: "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

3: PK Emission = Reading Level + Correction Factor

4: AV Emission Level= PK Emission + $20\log$ (duty cycle)

Correction Factor=Antenna Factor + Cable Loss (For Below 1GHz)

Correction Factor = Antenna Factor + Cable Loss- Amplifier Gain (For Above 1GHz)

(The Reading Level is recorded by software which is not shown in the sheet)

Field strength of emissions and Restricted bands

EUT: Remote controller

M/N: E598-003

Operating Condition: Tx 2475MHz

For Peak Value

Radiated Emission								
Value	Emissions Frequency MHz	E-Field Polarity	Reading Level dB μ V/m	Correction Factor dB/m	PK Emission dB μ V/m	Limit dB μ V/m	Margin dBm	Emission Type
PK	2475.000000	H	92.67	-5.71	86.96	114.00	27.04	Fundamental
PK	2474.850000	V	95.01	-5.72	89.29	114.00	24.71	Fundamental
PK	4950.500000*	H	52.04	4.65	56.69	74.00	17.31	Spurious
PK	4951.000000*	V	51.37	4.65	56.02	74.00	17.98	Spurious

For AV Value

Radiated Emission										
Value	Emissions Frequency MHz	E-Field Polarity	Reading Level dB μ V/m	Correction Factor dB	PK Emission dB μ V/m	Average Factor dB	AV Emission dB μ V/m	Limit dB μ V/m	Margin dBm	Emission Type
AV	2475.000000	H	92.67	-5.71	86.96	-11.12	75.84	94.00	18.16	Fundamental
AV	2474.850000	V	95.01	-5.72	89.29	-11.12	78.17	94.00	15.83	Fundamental
AV	4950.500000*	H	52.04	4.65	56.69	-11.12	45.57	54.00	8.43	Spurious
AV	4951.000000*	V	51.37	4.65	56.02	-11.12	44.90	54.00	9.10	Spurious

Peak to average duty cycle correction factor =20log(duty cycle), duty cycle=27.81%

Remark:

1: Data of measurement within this frequency range shown "/" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

2: "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

3: PK Emission = Reading Level + Correction Factor

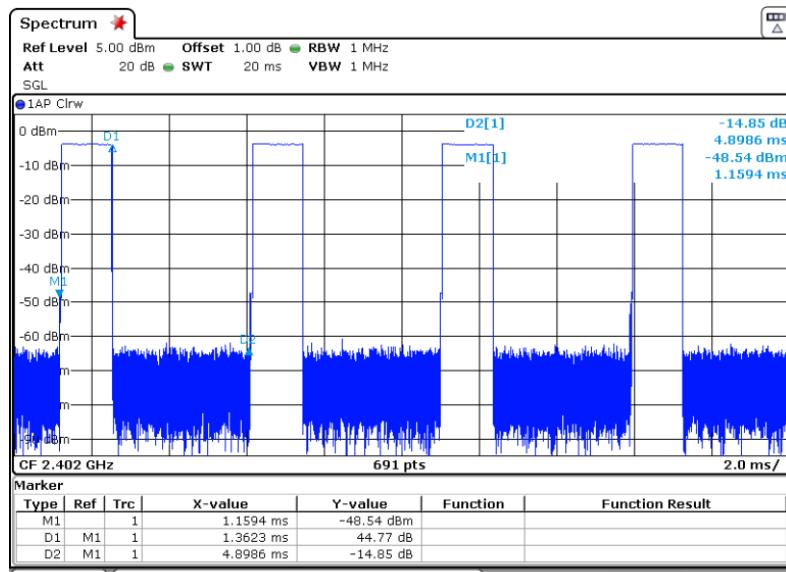
4: AV Emission Level= PK Emission +20log(duty cycle)

Correction Factor=Antenna Factor + Cable Loss (For Below 1GHz)

Correction Factor = Antenna Factor + Cable Loss- Amplifier Gain (For Above 1GHz)

(The Reading Level is recorded by software which is not shown in the sheet)

Duty Cycle=1.36 ms/4.90 ms=27.81 %



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8.3 Out of Band Emissions

Test Method

- 1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max hold.
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section.

Limits

According to §15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

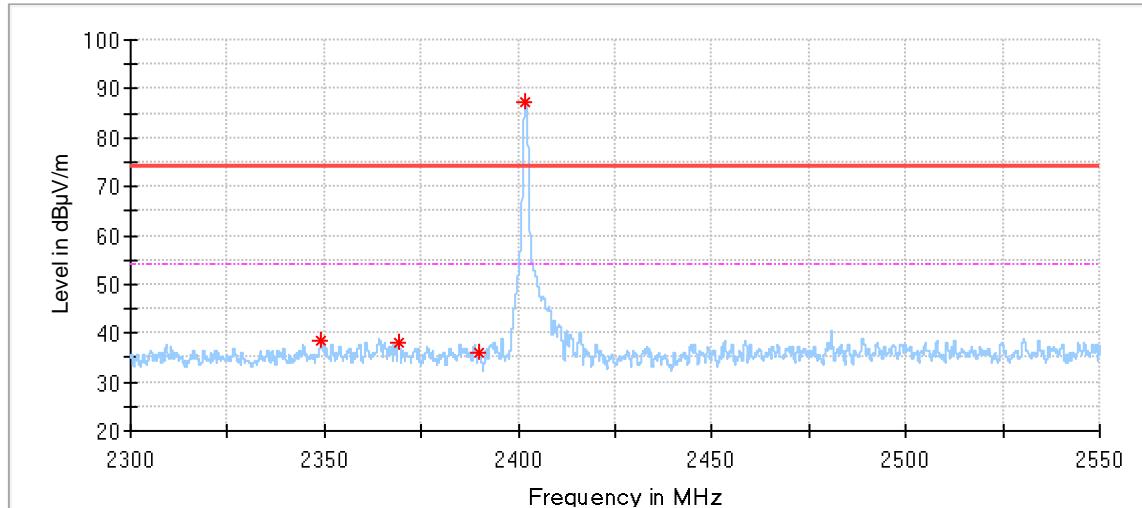
Out of Band Emissions

EUT: Remote controller

M/N: E598-003

Operating Condition: Tx 2402MHz

Polarization: Horizontal



Critical Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2349.200000	38.43	74.00	35.57	150.0	H	170.0	-6.27
2369.125000	37.95	74.00	36.05	150.0	H	208.0	-6.28
2390.000000	35.91	74.00	38.09	150.0	H	352.0	-6.33
2401.850000	87.22	74.00	-13.22	150.0	H	329.0	-6.31

Remark:

Level=Reading Level + Correction Factor

Correction Factor=Antenna Factor + Cable Loss – Pre-amplifier

(The Reading Level is recorded by software which is not shown in the sheet)

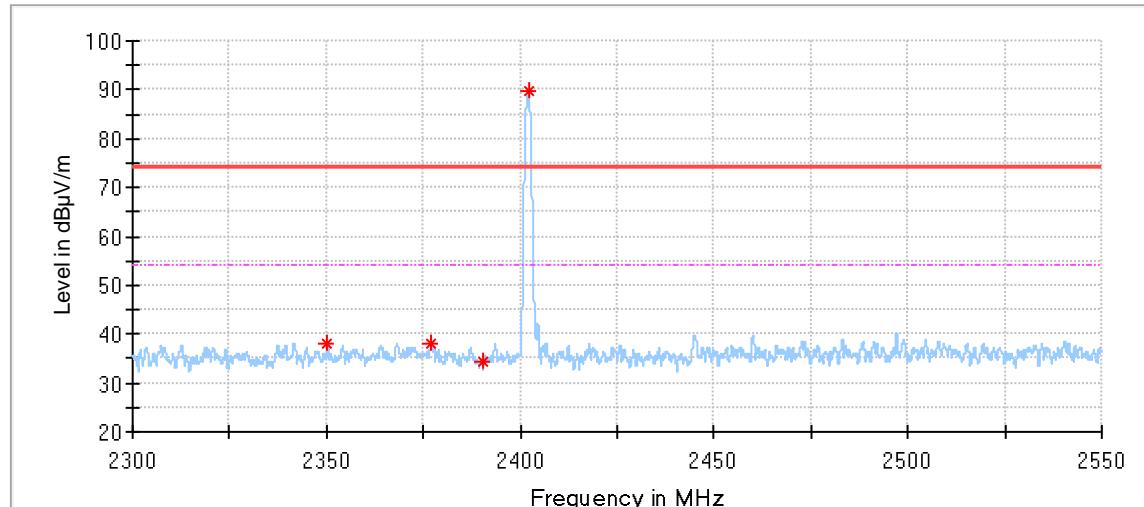
Out of Band Emissions

EUT: Remote controller

M/N: E598-003

Operating Condition: Tx 2402MHz

Polarization: Vertical



Critical Freqs

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2350.250000	37.90	74.00	36.10	150.0	V	334.0	-6.25
2376.950000	37.93	74.00	36.07	150.0	V	90.0	-6.33
2390.175000	34.24	74.00	39.76	150.0	V	4.0	-6.33
2402.125000	89.65	74.00	-15.65	150.0	V	103.0	-6.30

Remark:

Level=Reading Level + Correction Factor

Correction Factor=Antenna Factor + Cable Loss – Pre-amplifier

(The Reading Level is recorded by software which is not shown in the sheet)

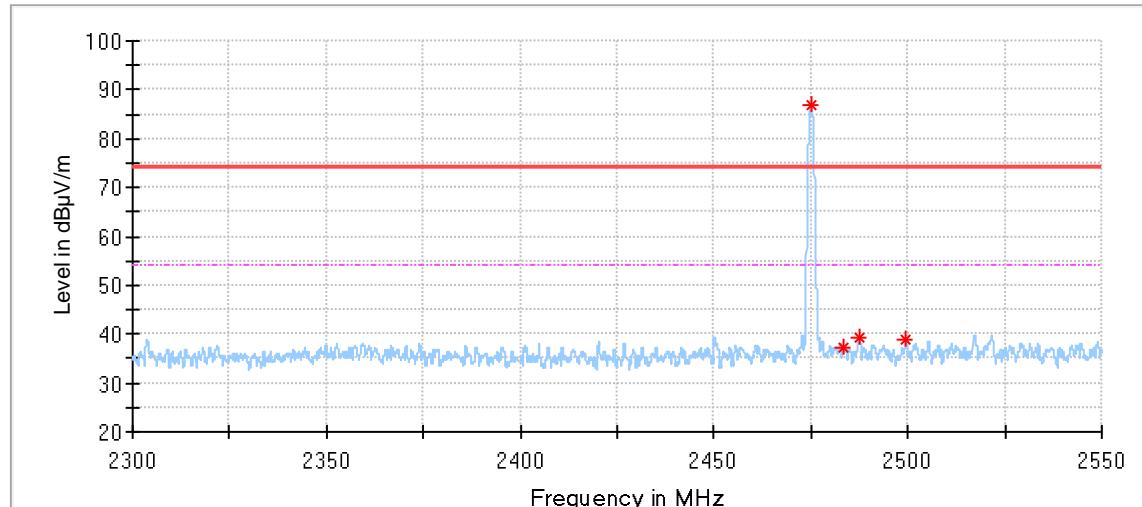
Out of Band Emissions

EUT: Remote controller

M/N: E598-003

Operating Condition: Tx 2475MHz

Polarization: Horizontal



Critical Freqs

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2475.000000	86.96	74.00	-12.96	150.0	H	121.0	-5.71
2483.500000	37.21	74.00	36.79	150.0	H	190.0	-5.67
2487.450000	39.12	74.00	34.88	150.0	H	82.0	-5.65
2499.575000	38.84	74.00	35.16	150.0	H	333.0	-5.59

Remark:

Level=Reading Level + Correction Factor

Correction Factor=Antenna Factor + Cable Loss – Pre-amplifier

(The Reading Level is recorded by software which is not shown in the sheet)

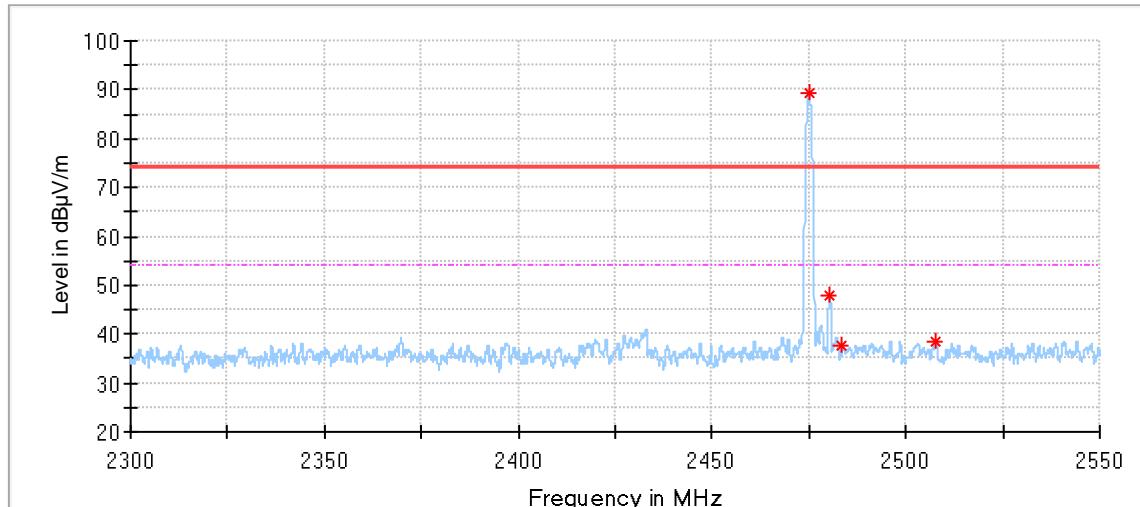
Out of Band Emissions

EUT: Remote controller

M/N: E598-003

Operating Condition: Tx 2475MHz

Polarization: Vertical



Critical Freqs

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2474.850000	89.29	74.00	-15.29	150.0	V	31.0	-5.72
2480.275000	47.88	74.00	26.12	150.0	V	238.0	-5.69
2483.500000	37.56	74.00	36.44	150.0	V	286.0	-5.67
2507.775000	38.62	74.00	35.38	150.0	V	182.0	-5.52

Remark:

Level=Reading Level + Correction Factor

Correction Factor=Antenna Factor + Cable Loss – Pre-amplifier

(The Reading Level is recorded by software which is not shown in the sheet)

8.4 20dB Bandwidth

Test Method

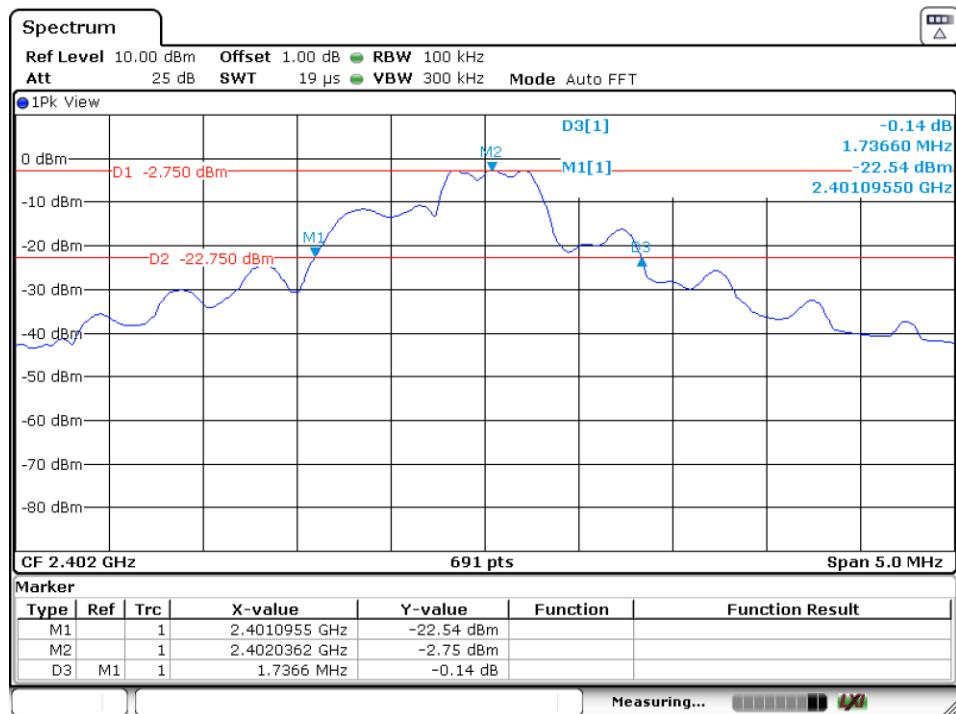
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to spectrum analyser. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.

Limits:

According to 15.215 (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

20dB Bandwidth

Frequency	20dB Bandwidth	Limit
MHz	MHz	MHz
2402	1.737	--

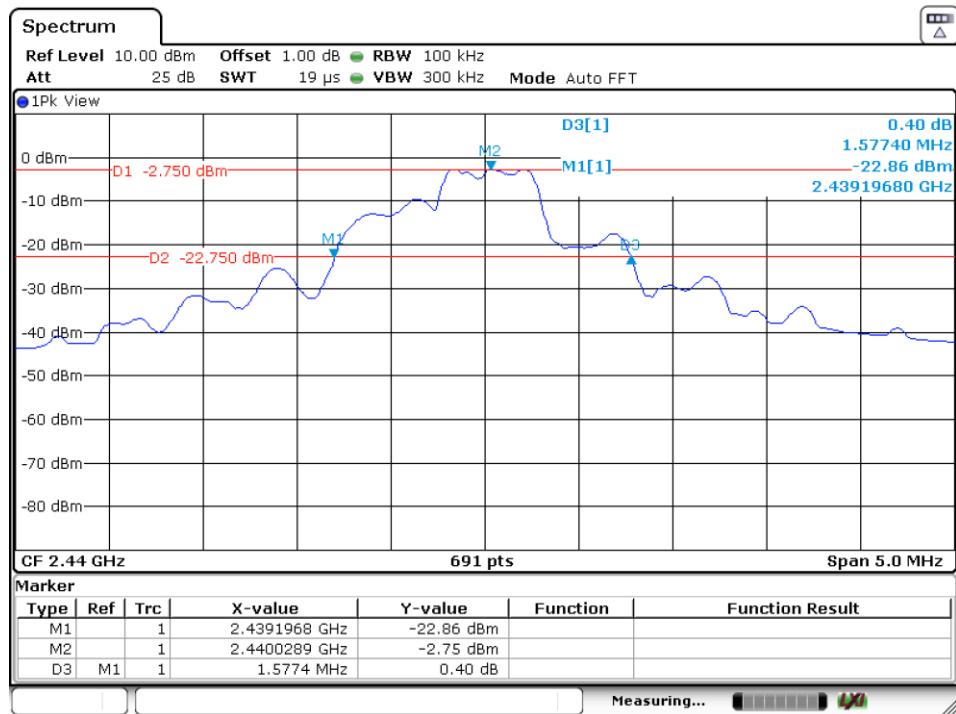


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2402MHz

20dB Bandwidth

Frequency	20dB Bandwidth	Limit
MHz	MHz	MHz
2440	1.578	--

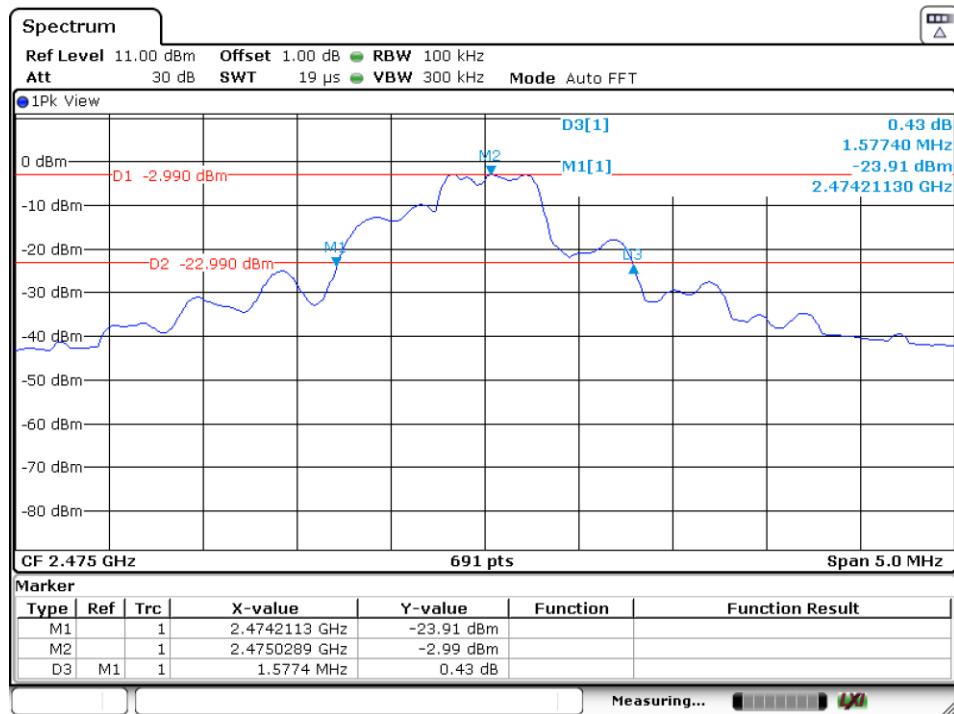


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2440MHz

20dB Bandwidth

Frequency	20dB Bandwidth	Limit
MHz	MHz	MHz
2475	1.578	--



Date: 8.MAY.2022 20:42:59

2475MHz

9 Test equipment lists

Radiated Emission 2# Test Site

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	68-4-74-14-002	101269	1	2022-6-4
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9162	68-4-80-19-003	284	1	2023-1-17
Wave Guide Antenna	ETS	3117	68-4-80-19-001	00218954	1	2022-5-24
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-001	100745	1	2022-10-10
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-002	100746	1	2022-10-10
Sideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	1	2022-7-21
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	1	2022-7-27
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-002	15542	1	2022-8-23
3m Semi-anechoic chamber	TDK	SAC-3 #2	68-4-90-19-006	----	2	2023-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-19-006-A01	Version10.35.02	N/A	N/A

RF Conducted Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-004	101030	1	2022-6-3

10 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 30MHz-1000MHz	Horizontal: 4.67dB; Vertical: 4.65dB
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 1000MHz-18000MHz	Horizontal: 4.76dB; Vertical: 4.75dB
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 18GHz-40GHz	Horizontal: 3.12dB; Vertical: 3.10dB
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.27dB Frequency test involved: 0.6×10^{-7} or 1%

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.