FCC - TEST REPORT

Report Number	:	**68.910.21.0031.01**	Date of Issue:	May 13, 2021
Model	:	TRCDH1235		
Serial Model		PT2026, PT2026VAR		
Product Type	:	1:10 CRAWLER		
Applicant	:	Shantou Dihua trading Co., Ltd		
Address	:	No.1 Leshan road, Shantou, Guangdong, China		
Manufacturer	:	Shantou Dihua trading Co., Ltd		
Address	:	No.1 Leshan road, Shantou, Guangdong, China		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	22		

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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, Nantou Checkpoint Road 2, Nanshan District, Shenzhen City, 518052, P. R. China
FCC Registration Number:	514049
FCC Designation Number:	CN5009
Telephone:	86 755 8828 6998
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3 Description of the Equipment Under Test

Description of the Equipment Under Test

Product name:	1:10 CRAWLER
Model no.:	TRCDH1235, PT2026, PT2026VAR
FCC ID:	2AK3Z-202103
Options and accessories:	NIL
Ratings:	3.0VDC (Supplied by 2*1.5V AA Batteries)
RF Transmission Frequency:	2407MHz-2475MHz
Channel No.:	69
Modulation:	GFSK
Antenna Type:	Internal Antenna
Antenna Gain:	0dBi
Description of the EUT:	The product is a 1:10 CRAWLER that operated at 2.4GHz, The TX range is 2407MHz-2475MHz

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	RATINGS	MODEL NO.
--	--	--	--

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2019 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

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

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5 Summary of Test Results

Technical Requirements					
FCC Part 15 Subpart C 15.249					
Test Condition	Pages	Test Site	Test Result		
			Pass	Fail	N/A
§15.207 Conducted emission AC power port	See note 1		☐	☐	☒
§15.205(a), §15.209(a), §15.249(a), §15.249(c) Field strength of emissions and Restricted bands	10	Site 1	☒	☐	☐
§15.249(d) Out of band emissions	14	Site 1	☒	☐	☐
FCC §15.215(c) 20dB bandwidth 99% Occupied Bandwidth	17	Site 1	☒	☐	☐
§15.203 Antenna requirement	See note 2		☒	☐	☐

Remark 1: N/A- Not Applicable;
Note 1: The EUT is not intended to operate from the AC power lines;
Note 2: The EUT used an Internal Antenna, which gain is 0dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

Remarks
This submittal(s) (test report) is intended for FCC ID: 2AK3Z-202103 complies with Section 15.205, 15.209, 15.249 of the FCC Part 15, Subpart C Rules.

SUMMARY:

All tests according to the regulations cited on page 6 were

■ - Performed

☐ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements.

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

Sample Received Date:	April 01, 2021
Testing Start Date:	April 01, 2021
Testing End Date:	April 14, 2021

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

Reviewed by:	Prepared by:	Tested by:
Dawi Xu	Richard He	Hardy Huang
EMC Project Manager	EMC Project Engineer	EMC Test Engineer

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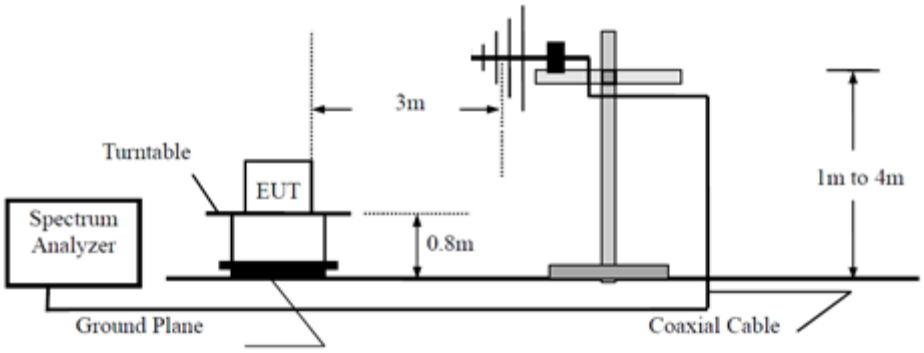
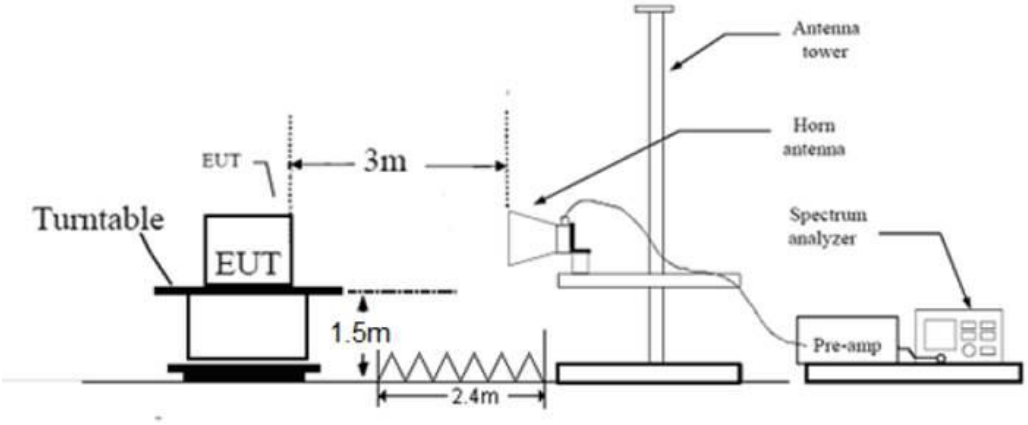
7 Test setups

7.1 Radiated test setups

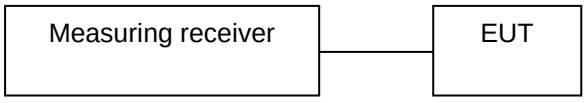
Below 1GHz



Above 1GHz



7.2 Conducted RF test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
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9 Technical Requirement

9.1 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≥RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, 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 = 100 KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:

1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
3: Modify the unit for continuous operation: use the settings shown above, then correct the reading by subcontracting the peak to average duty cycle correction factor 20log (duty cycle), derived from the appropriate duty cycle calculation.

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Field strength of emissions and Restricted bands

Limits

According to §15.249 (a) & RSS-210 A2.9(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 dBµV/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

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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.

Test result as below:

Low channel 2407MHz Test Result

Radiated Emission								
Value	Emissions Frequency **MHz**	E-Field Polarity	Reading Level **dBµV/m**	Limit **dBµV/m**	Margin **dBm**	Correct factor **(dB/m)**	**Result**	Emission Type
PK	2407	H	76.58	114.00	37.42	-5.93	Pass	Fundamental
AV	2407	H	70.62	94.00	23.38	-5.93	Pass	Fundamental
PK	4814.00	H	60.77	74.00	13.23	2.37	Pass	Spurious
AV	4814.00	H	51.36	54.00	2.64	2.37	Pass	Spurious
PK	2407	V	75.26	114.00	38.74	-5.93	Pass	Fundamental
AV	2407	V	73.21	94.00	20.79	-5.93	Pass	Fundamental
PK	4814.00	V	52.87	74.00	21.13	2.37	Pass	Spurious
AV	4814.00	V	52.28	54.00	1.72	2.37	Pass	Spurious
QP	569.9	V	35.74	46	10.26	28.94	Pass	Spurious

Middle channel 2445MHz Test Result

Radiated Emission								
Value	Emissions Frequency **MHz**	E-Field Polarity	Reading Level **dBµV/m**	Limit **dBµV/m**	Margin **dBm**	Correct factor **(dB/m)**	**Result**	Emission Type
PK	2445.24	H	74.79	114.00	39.21	-5.81	Pass	Fundamental
AV	2445.24	H	71.36	94.00	22.64	-5.81	Pass	Fundamental
PK	4890.00	H	60.72	74.00	13.28	2.66	Pass	Spurious
AV	4890.00	H	51.81	54.00	2.19	2.66	Pass	Spurious
PK	2445.24	V	76.01	114.00	37.99	-5.81	Pass	Fundamental
AV	2445.24	V	70.91	94.00	23.09	-5.81	Pass	Fundamental
PK	4890.00	V	52.77	74.00	21.23	2.66	Pass	Spurious
AV	4890.00	V	51.32	54.00	2.68	2.66	Pass	Spurious

High channel 2475MHz Test Result

Radiated Emission								
Value	Emissions Frequency **MHz**	E-Field Polarity	Reading Level **dBµV/m**	Limit **dBµV/m**	Margin **dBm**	Correct factor **(dB/m)**	**Result**	Emission Type
PK	2475.24	H	73.76	114.00	40.24	-5.60	Pass	Fundamental
AV	2475.24	H	71.73	94.00	22.27	-5.60	Pass	Fundamental
PK	4950.00	H	61.38	74.00	12.62	2.90	Pass	Spurious
AV	4950.00	H	51.81	54.00	2.19	2.90	Pass	Spurious
PK	2475.24	V	75.62	114.00	38.24	-5.60	Pass	Fundamental
AV	2475.24	V	70.81	94.00	23.19	-5.60	Pass	Fundamental
PK	4950	V	54.44	74.00	19.56	2.90	Pass	Spurious
AV	4950	V	50.62	54.00	3.38	2.90	Pass	Spurious

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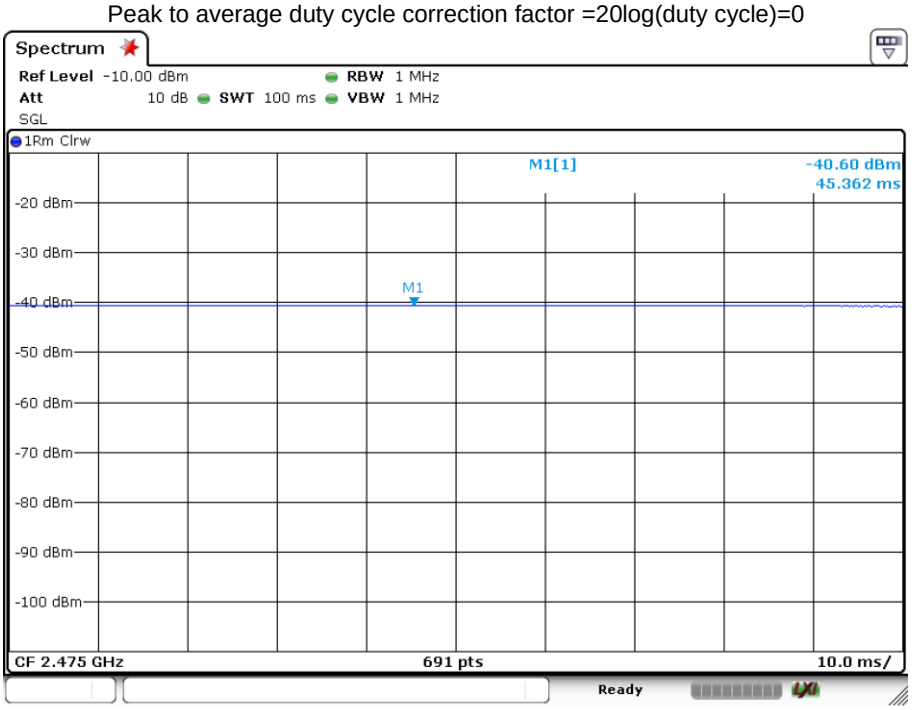
Duty cycle=100%
Peak to average duty cycle correction factor =20log(duty cycle)=0



Remark:

(1) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 10dB below the permissible limits or the field strength is too small to be measured.

(2) Corrected Amplitude= Read level + Corrector factor
Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Pre-amplifier
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
(The Reading Level is recorded by software which is not shown in the sheet)

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9.2 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≥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.

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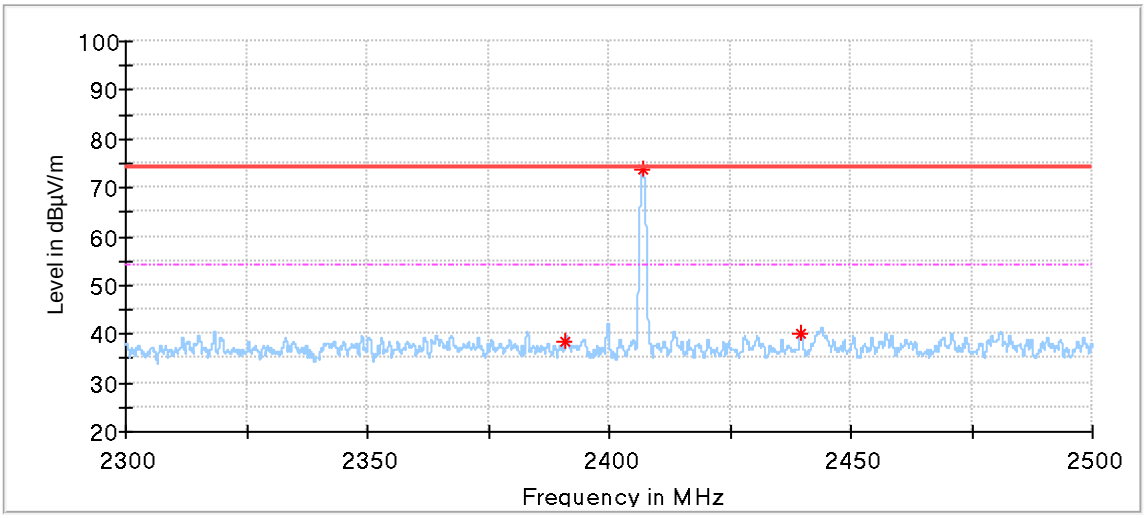
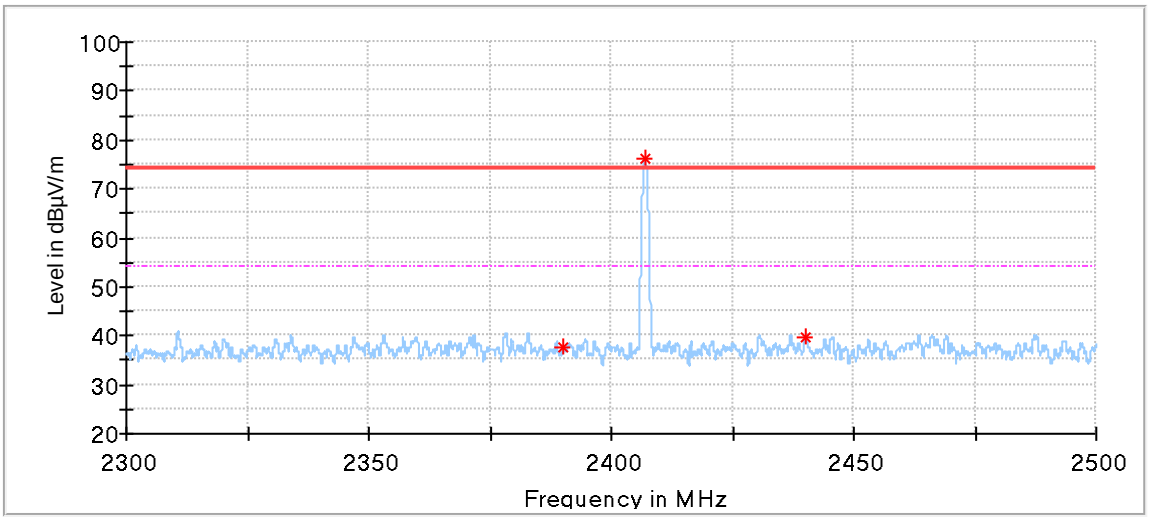
Out of Band Emissions

2407MHz



Critical_Freqs

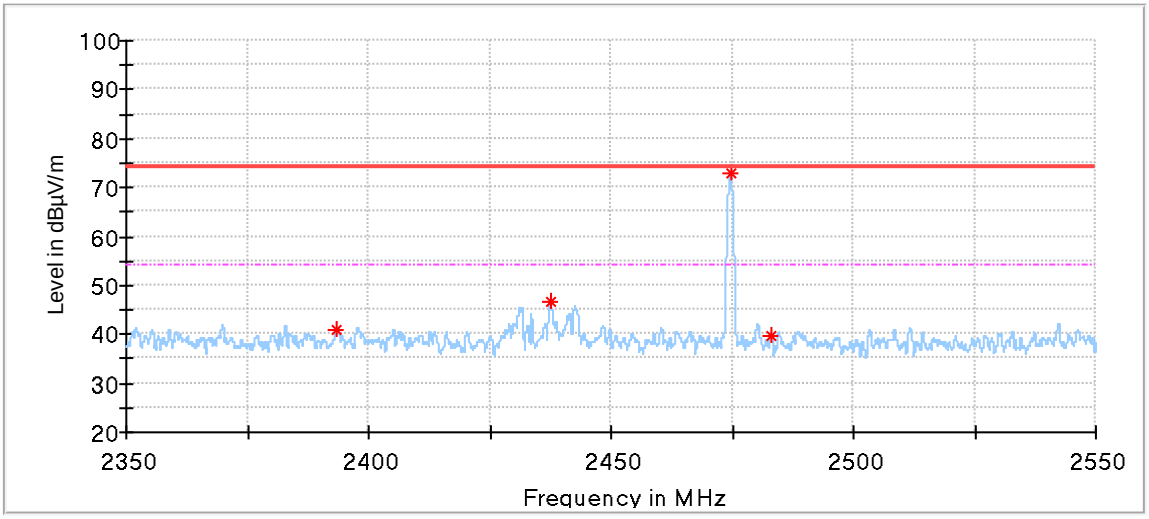
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2390.960000	38.30	74.00	35.70	150.0	H	148.0	-3.91
2406.960000	73.80	74.00	0.20	150.0	H	19.0	-3.93
2439.780000	40.30	74.00	33.70	150.0	H	103.0	-3.84



Critical_Freqs

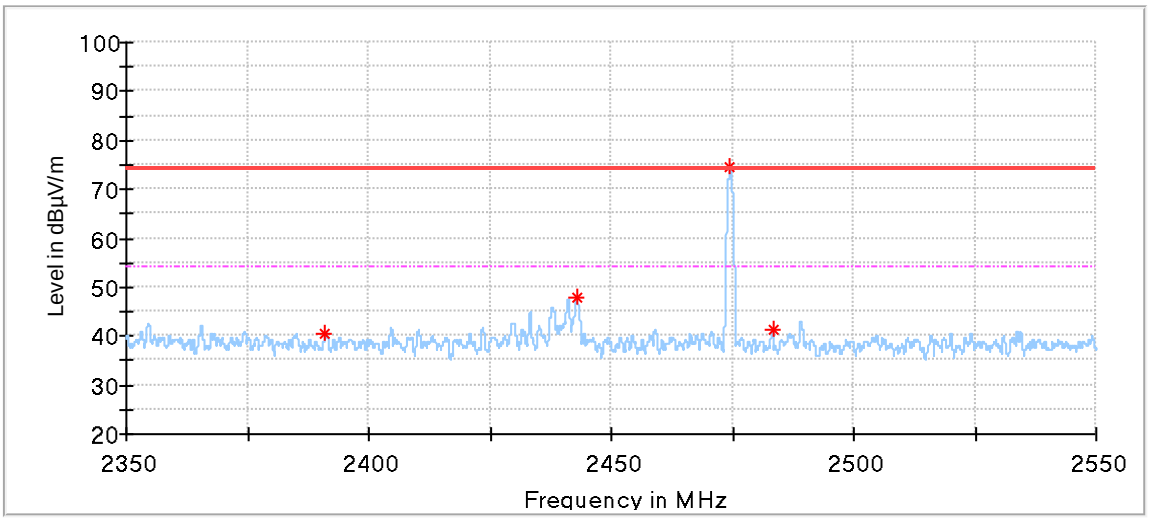
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2390.180000	37.45	74.00	36.55	150.0	V	152.0	-3.91
2406.980000	76.23	74.00	-2.23	150.0	V	319.0	-3.93
2440.100000	39.49	74.00	34.51	150.0	V	356.0	-3.84

2475MHz



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2393.520000	41.10	74.00	32.90	150.0	H	328.0	-2.97
2437.520000	46.68	74.00	27.32	150.0	H	42.0	-2.91
2474.600000	72.84	74.00	1.16	150.0	H	243.0	-2.68
2483.200000	39.82	74.00	34.18	150.0	H	122.0	-2.69



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2391.040000	40.67	74.00	33.33	150.0	V	160.0	-2.96
2442.940000	47.71	74.00	26.29	150.0	V	201.0	-2.89
2474.500000	74.73	74.00	-0.73	150.0	V	309.0	-2.68
2483.300000	41.28	74.00	32.72	150.0	V	4.0	-2.69

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9.3 20dB Bandwidth & 99% Occupied 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/99% 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.

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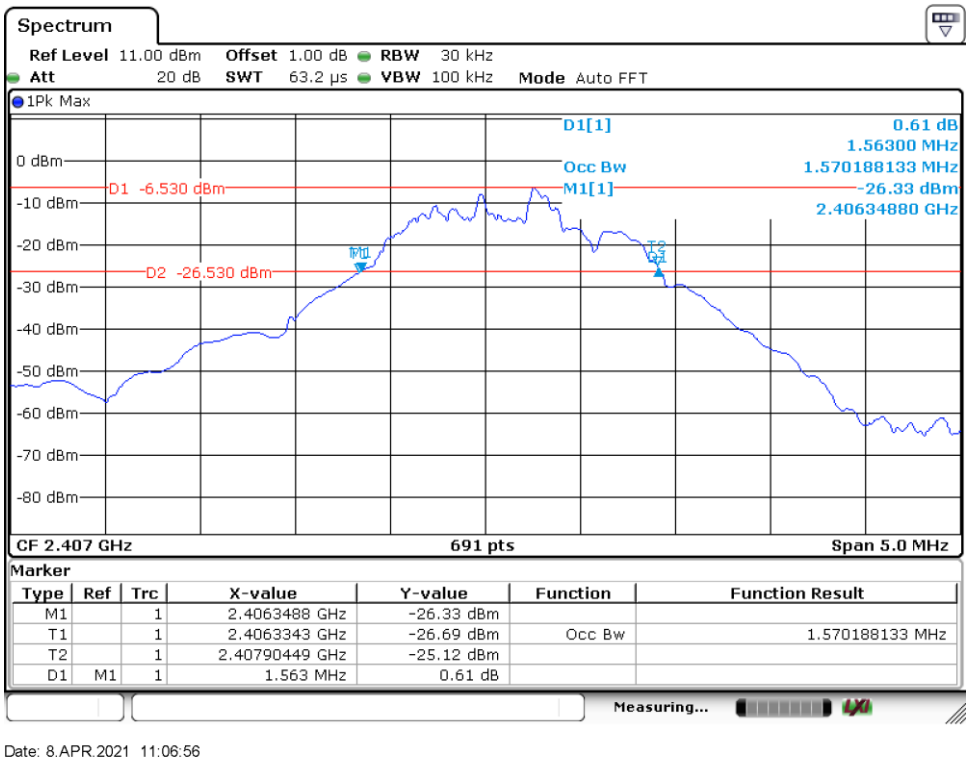
20dB Bandwidth & 99% Occupied Bandwidth

Frequency	20dB Bandwidth	99% Bandwidth	Limit
MHz	MHz	MHz	MHz
2407	1.563	1.570	--



2407MHz

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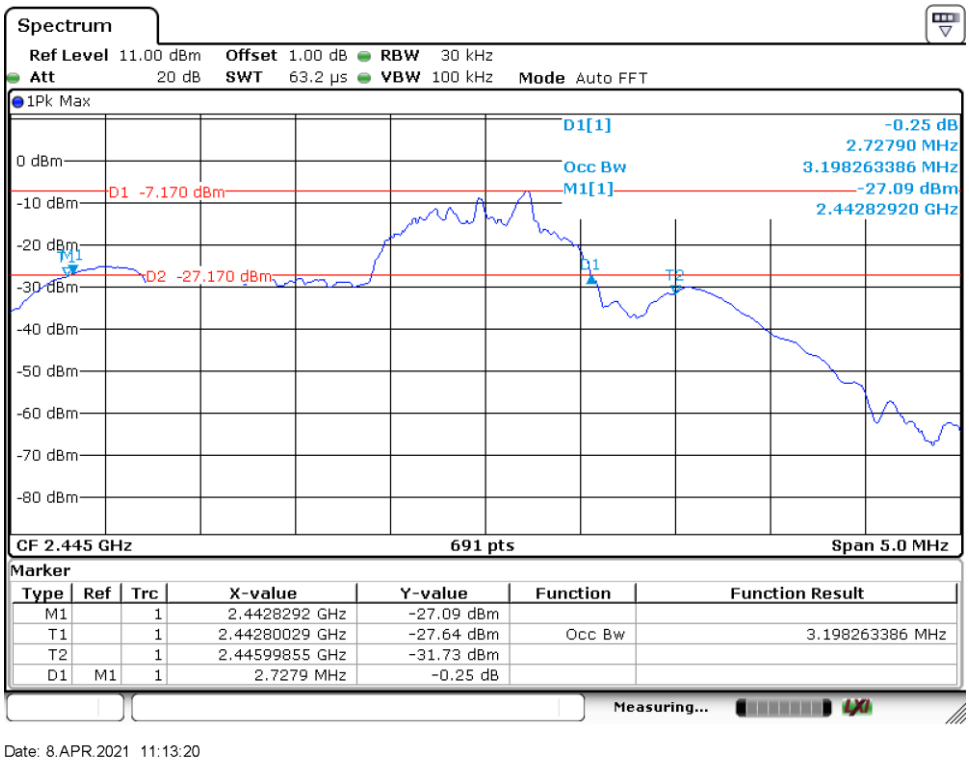
20dB Bandwidth & 99% Occupied Bandwidth

Frequency	20dB Bandwidth	99% Bandwidth	Limit
MHz	MHz	MHz	MHz
2445	2.728	3.198	--



2442MHz

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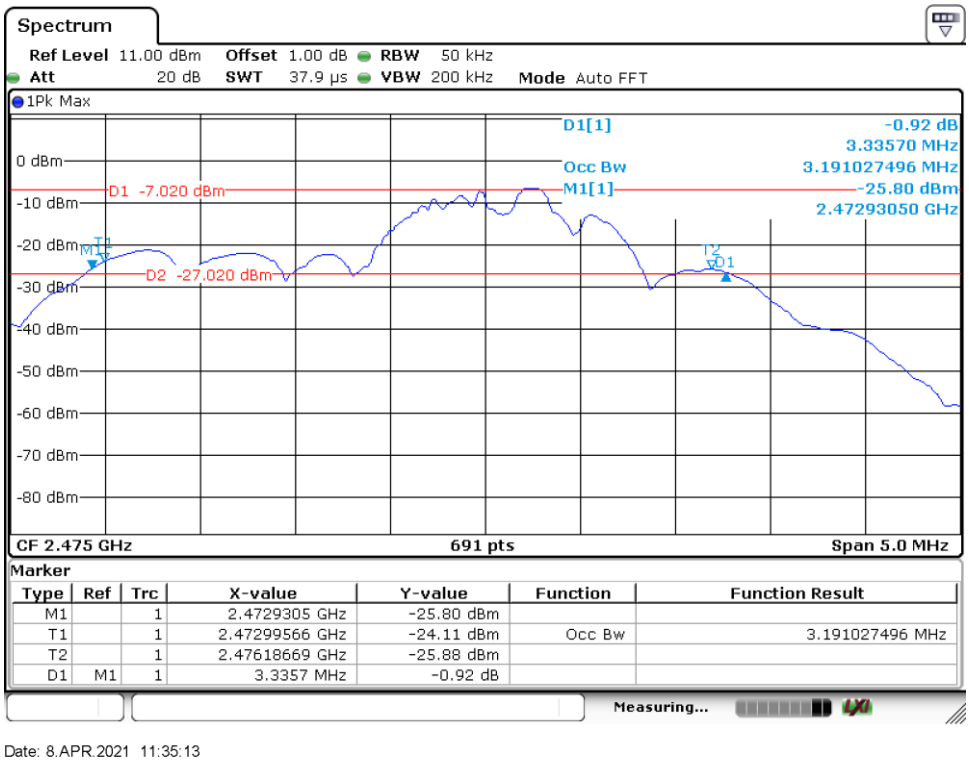
20dB Bandwidth & 99% Occupied Bandwidth

Frequency	20dB Bandwidth	99% Bandwidth	Limit
MHz	MHz	MHz	MHz
2475	3.336	3.191	--



2475MHz

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10 Test equipment lists

List of Test Instruments

Radiated Spurious Emission Test

Description	Manufacturer	Model no.	Equipment ID	Serial no.	cal interval (year)	cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 7	68-4-74-19-001	102176	1	2021-6-29
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	68-4-80-14-002	707	1	2021-8-4
Horn Antenna	Rohde & Schwarz	HF907	68-4-80-14-005	102294	1	2021-7-14
Loop Antenna	Rohde & Schwarz	HFH2-Z2	68-4-80-14-006	100398	1	2021-7-7
Pre-amplifier	Rohde & Schwarz	SCU 18	68-4-29-14-001	102230	1	2021-6-21
Attenuator	Agilent	8491A	68-4-81-16-001	MY39264334	1	2021-6-21
3m Semi-anechoic chamber	TDK	9X6X6	68-4-90-14-001	----	3	2022-10-28
Test software	Rohde & Schwarz	EMC32	68-4-90-14-001-A10	Version10.35.02	N/A	N/A

RF Conducted

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	2021-6-21

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11 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 3m chamber (68-4-90-14-001) 30MHz-1000MHz	Horizontal: 5.12dB; Vertical: 5.10dB;
Uncertainty for Radiated Emission in 3m chamber (68-4-90-14-001) 1000MHz-18000MHz	Horizontal: 5.01dB; Vertical: 5.00dB;
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.16dB Frequency test involved: 0.6×10-7 or 1%

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