RADIO TEST REPORT

Product	:	REMOTE CONTROL
Model Name	:	HBC1
FCC ID	:	VVP-HBC1
Test Regulation	:	FCC 47 CFR Part 15 Subpart C (Section 15.231)
Received Date	:	2021/10/5
Test Date	:	2021/10/15 ~ 2021/12/2
Issued Date	:	2022/1/4
Applicant	:	Leyant Industry Co., Ltd No. 20, Lane 929, San Feng Rd., FengYuan City 420, Taichung Hsien Taiwan
Issued By	:	Underwriters Laboratories Taiwan Co., Ltd. Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Testing Laboratory
3398

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REVISION HISTORY

Original Test Report No.: 4790071801-US-R0-V0

Rev.	Test report No.	Date	Page revised	Contents
Original	4790071801-US-R0-V0	2022/1/4	-	Initial issue

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1. Attestation of Test Results

APPLICANT:	Leyant Industry Co., Ltd No. 20, Lane 929, San Feng Rd., FengYuan City 420, Taichung Hsien Taiwan
MANUFACTURER:	Leyant Industry Co., Ltd No. 20, Lane 929, San Feng Rd., FengYuan City 420, Taichung Hsien Taiwan
EUT DESCRIPTION:	REMOTE CONTROL
BRAND:	BEST
MODEL:	HBC1
SAMPLE STAGE:	Identical Prototype
DATE of TESTED:	2021/10/15 ~ 2021/12/2

APPLICABLE STANDARDS	
STANDARD	**Test Results**
FCC 47 CFR PART 15 Subpart C (Section 15.231)	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Sally Lu Date : 2022/1/4
Project Handler

Approved and Authorized By:

Mike Cai Date : 2022/1/4
Engineer Project Associate

2. Summary of Test Results

Summary of Test Results		
FCC Clause	**Test Items**	**Result**
15.209 / 15.231(b)	Radiated Emissions	PASS
15.231(c)	Emission Bandwidth Test	PASS
15.231(a)	De-activation	PASS

Note:
1. For the Radiated Emissions test plots were recorded in Appendix I.

3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013.

4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.

5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor k=2.

Measurement	Frequency	Uncertainty
Conducted disturbance at mains terminals ports	150kHz ~ 30MHz	±3.1 dB
RF Conducted	9 kHz - 40GHz	±1.9 dB
Radiated disturbance below 30MHz	9 kHz - 30 MHz	±1.9 dB
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	±5.4 dB
Radiated disturbance above 1 GHz	1GHz ~ 40GHz	±4.7 dB

6. Equipment under Test

6.1. Description of EUT

Product	REMOTE CONTROL
Brand Name	BEST
Model Name	HBC1
Operating Frequency	315 MHz
Modulation	ASK
Number of Channel	1
Maximum Output Power	69.5 dBuV/m
Normal Voltage	12Vdc from Battery
Sample ID	4453377

Note:

1. The EUT could be supplied with rechargeable battery as the following table:

Brand Name	Model	Description
GP	23A	12 Vdc

2. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

6.2. Channel List

Channel	Frequency (MHz)
1	315

6.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Radiated Spurious Emission	966-2	22~26℃/ 62~68%RH	12Vdc	2021/10/15~ 2021/12/02	WaterNil Guan
Emission Bandwidth	966-2	22~26℃/ 62~68%RH	12Vdc	2021/10/15~ 2021/12/02	WaterNil Guan
Deactivation Time	966-2	22~26℃/ 62~68%RH	12Vdc	2021/10/15~ 2021/12/02	WaterNil Guan

FCC Test Firm Registration Number: 498077

6.4. Description of Available Antennas

Ant. No.	Brand Name	Model Name	Ant. Type	Maximum Gain (dBi)
1	TLC	AK9200AS-RF	Copper Wire	-

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual.

6.5. Test Mode Applicability and Tested Channel Detail

- The fundamental of the EUT was investigated in three orthogonal axes X-Y/Y-Z/X-Z, it was determined that Y-Z plane was worst-case. Therefore, all final radiated testing was performed with the EUT in Y-Z plane.
- The power only source 12Vdc from battery.
- For Antenna Port Conducted Measurement, this item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Test Item	Modulation Type	Available Channel	Test Frequency (MHz)
Radiated Emissions	ASK	1	315MHz
Emission Bandwidth Test	ASK	1	315MHz
De-activation	ASK	1	315MHz

6.6. Duty Cycle of Test Signal

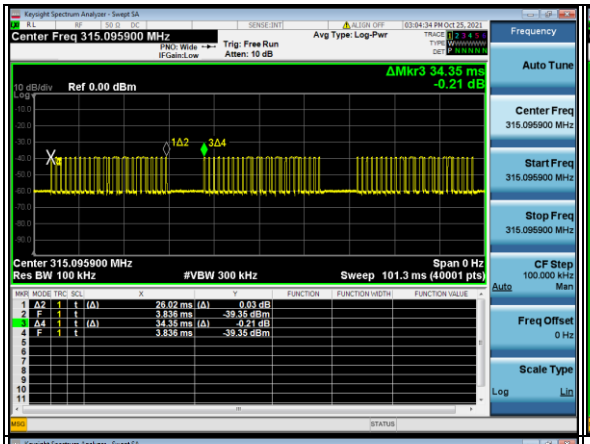
Long burst packet = 0.792 ms, number of long burst packet is 6.

Short burst packet = 0.26 ms, number of short burst packet is 19.

Total on within 100 ms = {(0.792 ms x 6) + (0.26 ms x 19)} x 3 = 29.076 ms

Duty Cycle = 29.076 ms / 100 ms = 29.076%

Duty factor = 20 * log (Duty Cycle) = 20 * log (0.29076) = -10.73 dB



7. Test Equipment

Test Equipment List					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Expired date**
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	2020/11/11	2021/11/10
				2021/11/9	2022/11/8
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	2020/12/11	2021/12/10
Loop Antenna	ETS lindgren	6502	00213440	2020/12/25	2021/12/24
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	2021/1/13	2022/1/12
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	2020/12/30	2021/12/29
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	2021/6/8	2022/6/7
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	2021/2/3	2022/2/2
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	2021/1/22	2022/1/21

UL Software		
Description	**Name**	**Version**
Radiated measurement	e3	6.191211 (V6)
Conducted measurement	RF Conducted Test Tools	ver 2.4.0.620b

8. Description of Test Setup

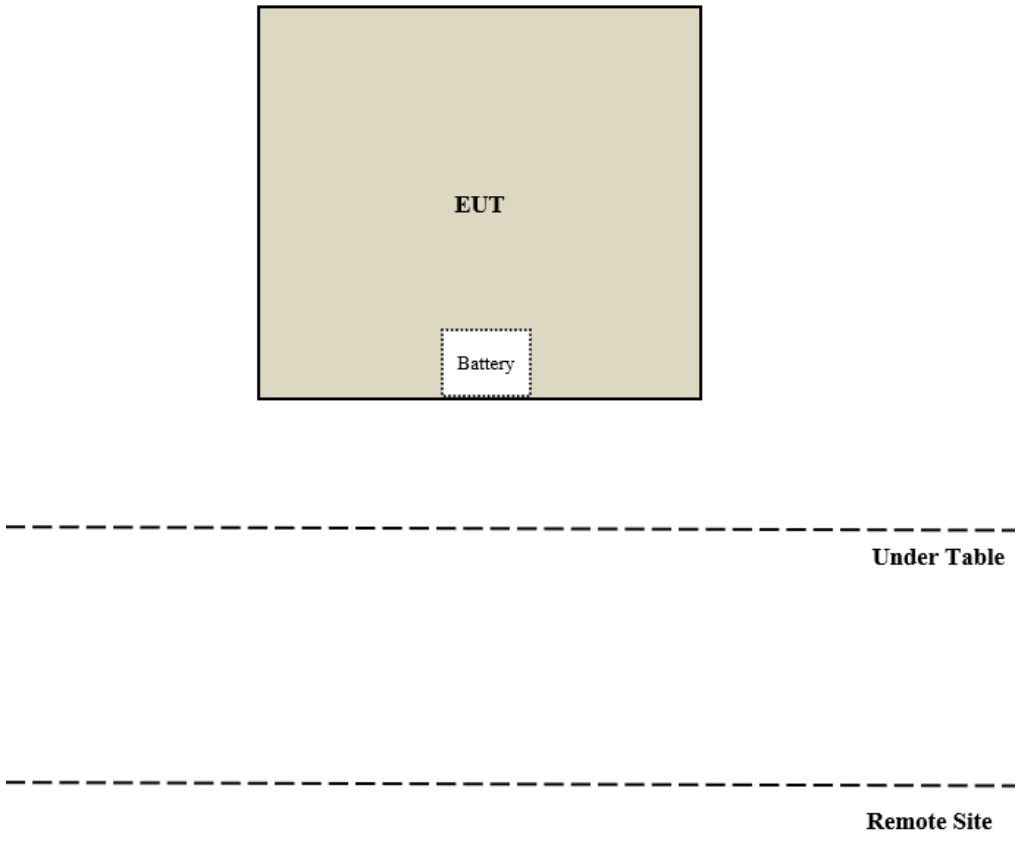
Support Equipment

ID	Equipment	Brand Name	Model Name	S/N	Remark
A	Battery	GP	23A	-	12 Vdc

Test Setup

After EUT power on, it works in engineering mode to transmit signals.

Setup Diagram for Test



9. Test Results

9.1. Radiated Spurious Emission

Requirements

Limits of Radiated Emission Measurement

Fundamental Frequency (MHz)	Field Strength of Fundamental		Field Strength of Spurious	
	uV/meter	dBuV/meter	uV/meter	dBuV/meter
40.66 ~ 40.70	2250	67.04	225	48.04
70 ~ 130	1250	61.94	125	41.94
130 ~ 174	1250 ~ 3750	61.94 ~ 71.48	125 ~ 375	41.94 ~ 51.48
174 ~ 260	3750	71.48	375	51.48
260 ~ 470	3750 ~ 12500	71.48 ~ 81.94	375 ~ 1250	51.48 ~ 61.94
Above 470	12500	81.94	1250	61.94

Note:
1. Where F is the frequency in MHz, the formula for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F)-6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F)-7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.
2. The above field strength limits are specified at a distance of 3meters. The tighter limits apply at the band edges.

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequency(MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Test Procedures

[For 9 kHz ~ 30 MHz]

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

NOTE:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]

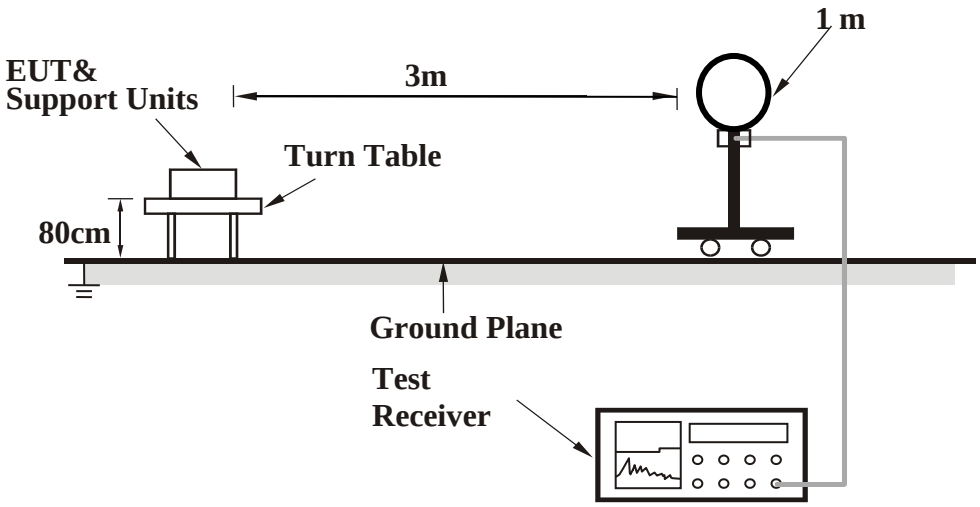
a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. 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.
d. 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.
e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

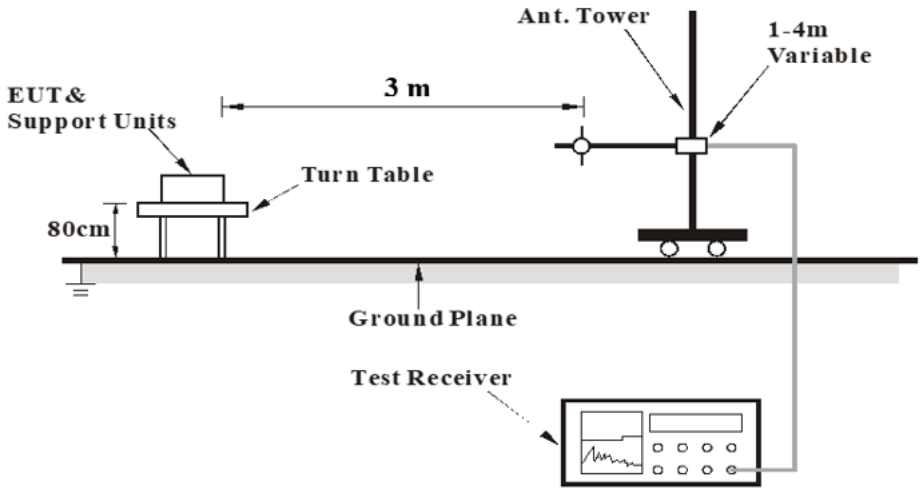
a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
b. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
d. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported.

Test Setup

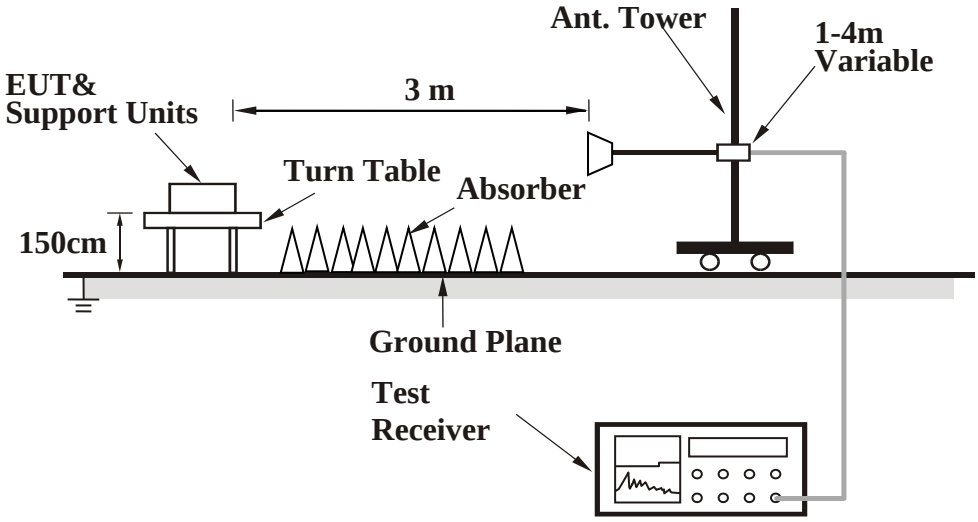
<Frequency Range 9 kHz ~ 30 MHz>



<Frequency Range 30 MHz ~ 1 GHz >



<Frequency Range above 1 GHz>



For the actual test configuration, please refer to the Setup Configurations.

Test Data

Above 1GHz Data

EUT Test Condition		Measurement Detail	
Channel	1	**Frequency Range**	1 GHz ~ 6 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	**Frequency**	**Reading**	**Correct**	**Result**	**Limit**	**Margin**	**Remark**
	(MHz)	**(dBuV/m)**	**dB/m**	**(dBuV/m)**	**(dBuV/m)**	**(dB)**	
*	1575	59.3	-8.15	51.15	74	-22.85	Peak
*	2205	54.65	-4.04	50.61	74	-23.39	Peak
-	2520	45.61	-3.91	41.7	54	-12.3	Average
-	2520	56.34	-3.91	52.43	74	-21.57	Peak
-	3150	45.79	-1.31	44.48	54	-9.52	Average
-	3150	56.52	-1.31	55.21	74	-18.79	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	**Frequency**	**Reading**	**Correct**	**Result**	**Limit**	**Margin**	**Remark**
	(MHz)	**(dBuV/m)**	**dB/m**	**(dBuV/m)**	**(dBuV/m)**	**(dB)**	
*	1260	53.62	-8.49	45.13	74	-28.87	Peak
-	1575	51.07	-8.15	42.92	54	-11.08	Average
-	1575	62.74	-8.15	54.59	74	-19.41	Peak
-	2205	44	-4.04	39.96	54	-14.04	Average
-	2205	54.73	-4.04	50.69	74	-23.31	Peak
*	3150	50.7	-1.31	49.39	74	-24.61	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. " * ": The peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.
5. The other emission levels were very low against the limit.
6. The AVG harmonic field strength = PK harmonic field strength + Duty Factor

   = PK harmonic field strength – 10.73 dB

   The duty factor could refer to section 6.6.

9 kHz ~ 30 MHz Data:

For 9 kHz to 30 MHz radiated emission have performed all modes of operation were investigated. The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

No non-compliance noted:

KDB 414788 D01 OATS and Chamber Correlation Justification

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

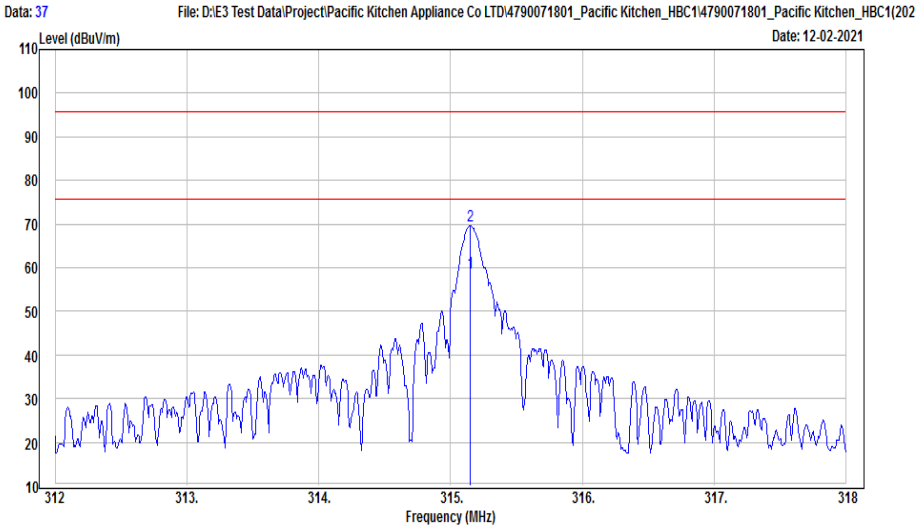
- OATs and chamber correlation testing had been performed and chamber measured test results is the worst case test result.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

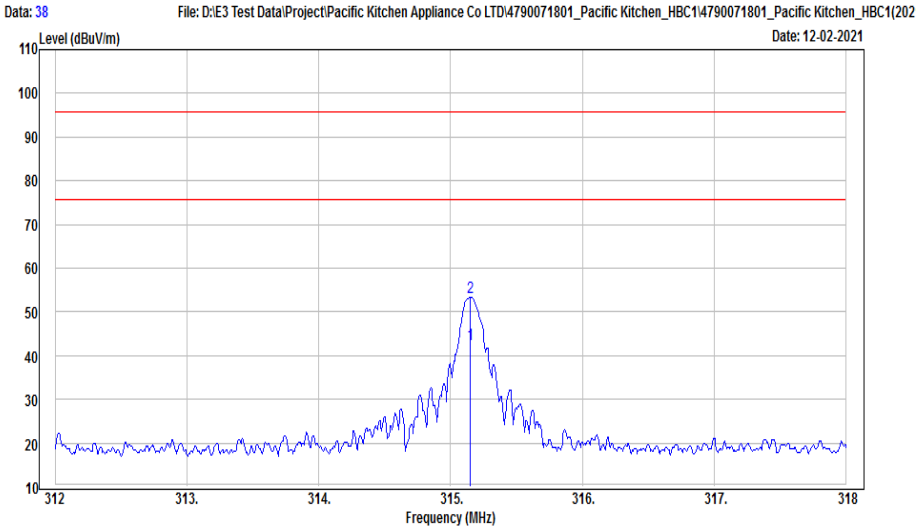
30 MHz ~ 1 GHz Data

EUT Test Condition		Measurement Detail	
Channel	1	**Frequency Range**	312 MHz ~ 318 MHz

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	**Frequency**	**Reading**	**Correct**	**Result**	**Limit**	**Margin**	**Remark**
	(MHz)	**(dBuV/m)**	**dB/m**	**(dBuV/m)**	**(dBuV/m)**	**(dB)**	
@	315.15	68.29	-9.52	58.77	75.62	-16.85	Average
@	315.15	79.02	-9.52	69.5	95.62	-26.12	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	**Frequency**	**Reading**	**Correct**	**Result**	**Limit**	**Margin**	**Remark**
	(MHz)	**(dBuV/m)**	**dB/m**	**(dBuV/m)**	**(dBuV/m)**	**(dB)**	
@	315.15	52.12	-9.52	42.6	75.62	-33.02	Average
@	315.15	62.85	-9.52	53.33	95.62	-42.29	Peak

Remarks:

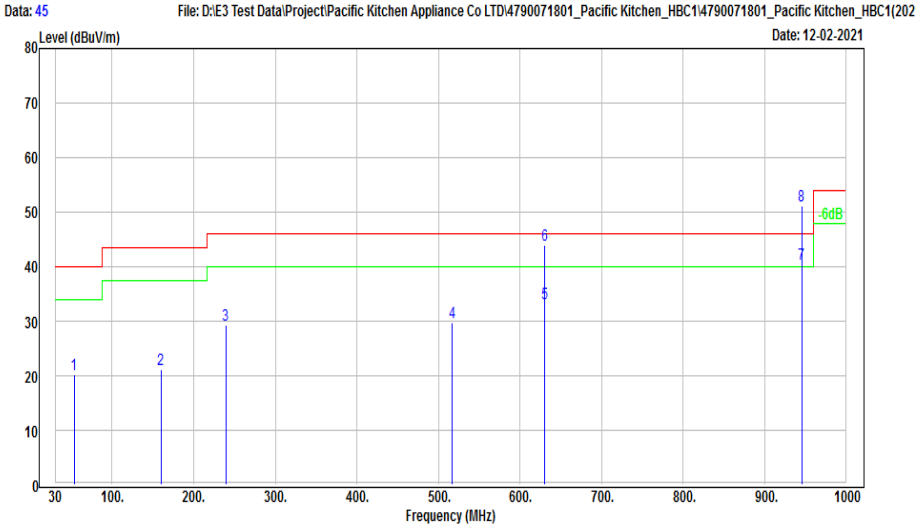
1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. The peak result complies with QP limit, QP result is deemed to comply with QP limit.
6. The other emission levels were very low against the limit.
7. The AVG harmonic field strength = PK harmonic field strength + Duty Factor

   = PK harmonic field strength – 10.73dB

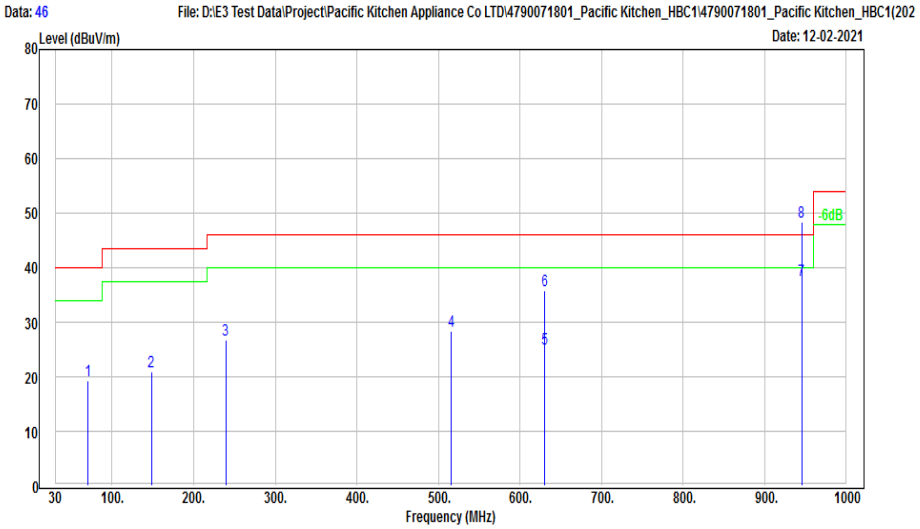
   The duty factor could refer to section 6.6.

EUT Test Condition		Measurement Detail	
Channel	1	**Frequency Range**	30 MHz ~ 1 GHz

Horizontal



Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	**Frequency**	**Reading**	**Correct**	**Result**	**Limit**	**Margin**	**Remark**
	(MHz)	**(dBuV/m)**	**dB/m**	**(dBuV/m)**	**(dBuV/m)**	**(dB)**	
1	53.28	31.43	-11.11	20.32	40	-19.68	Peak
2	159.98	32.3	-11.08	21.22	43.5	-22.28	Peak
3	239.52	41.34	-12.12	29.22	46	-16.78	Peak
4	516.94	33.96	-4.21	29.75	46	-16.25	Peak
5	630.43	34.87	-1.53	33.34	55.62	-22.28	Average
6	630.43	45.57	-1.53	44.04	75.62	-31.58	Peak
7	945.68	36.78	3.72	40.5	55.62	-15.12	Average
8	945.68	47.51	3.72	51.23	75.62	-24.39	Peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	**Frequency**	**Reading**	**Correct**	**Result**	**Limit**	**Margin**	**Remark**
	(MHz)	**(dBuV/m)**	**dB/m**	**(dBuV/m)**	**(dBuV/m)**	**(dB)**	
1	70.74	33.54	-14.25	19.29	40	-20.71	Peak
2	148.34	32.54	-11.54	21	43.5	-22.5	Peak
3	239.52	38.95	-12.12	26.83	46	-19.17	Peak
4	515.97	32.62	-4.25	28.37	46	-17.63	Peak
5	630.43	26.62	-1.53	25.09	55.62	-30.53	Average
6	630.43	37.35	-1.53	35.82	75.62	-39.8	Peak
7	945.68	33.92	3.72	37.64	55.62	-17.98	Average
8	945.68	44.65	3.72	48.37	75.62	-27.25	Peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. The peak result complies with QP limit, QP result is deemed to comply with QP limit.
5. The other emission levels were very low against the limit.
6. The AVG harmonic field strength = PK harmonic field strength + Duty Factor

   = PK harmonic field strength – 10.73dB

   The duty factor could refer to section 6.6.
7. The Notation No. 5,6,7,8 are Field Strength of Spurious.

9.2. 20dB Bandwidth Measurement

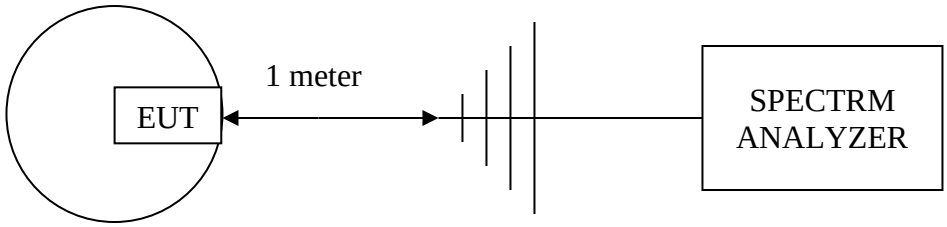
Requirements

Limits of 20dB Bandwidth Measurement

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for device operating above 70 MHz and below 900 MHz.

Fundamental Frequency (MHz)	Limit of Emission Bandwidth (kHz)
315	787.5

Test Setup



Test Instruments

Refer to section 6 to get information of above instrument.

Test Procedure

a. The EUT was placed on the turn table.
b. The signal was coupled to the spectrum analyzer through an antenna.
c. Set the resolution bandwidth to 6.2 kHz and video bandwidth to 18 kHz then select Peak function to scan the channel frequency.
d. The emission bandwidth was measured and recorded.

Deviation from Test Standard

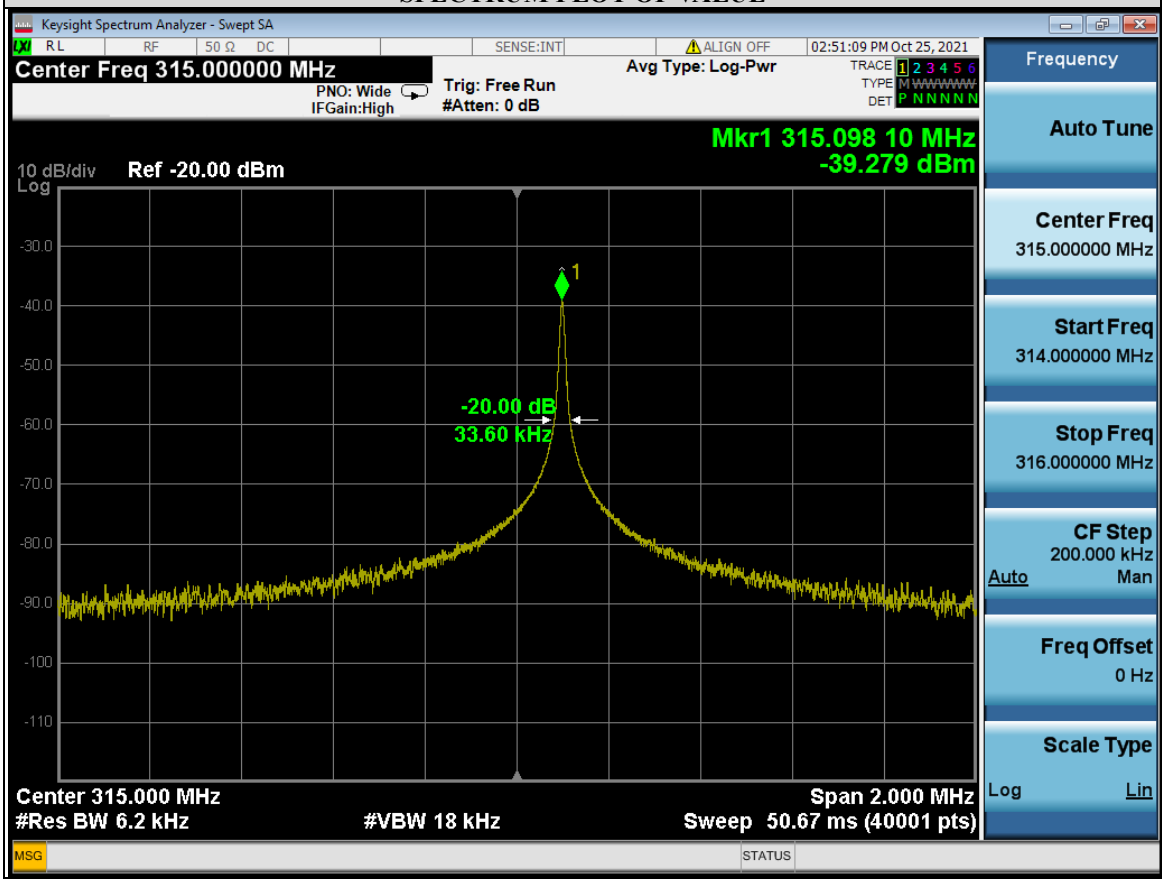
No deviation.

Test Data

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	Maximum Limit (kHz)	Pass / Fail
1	315	33.6	787.5	PASS

Note:
Since fundamental frequency approach to carrier signal, the resolution bandwidth (RBW) can't made 1-5 % of the emission bandwidth.

SPECTRUM PLOT OF VALUE



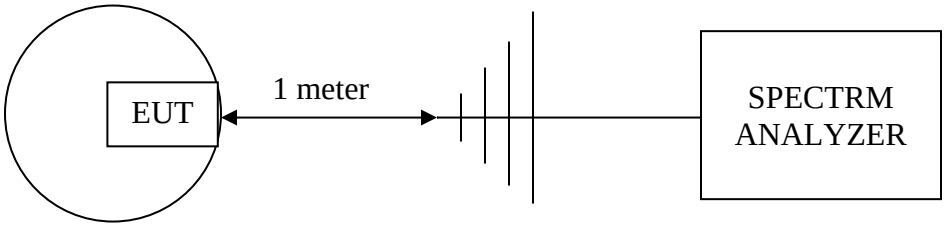
9.3. Deactivation Time Measurement

Requirements

Limits of Deactivation Time Measurement

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Test Setup



Test Instruments

Refer to section 6 to get information of above instrument.

Test Procedure

a. The EUT was placed on the turning table.

b. The signal was coupled to the spectrum analyzer through an antenna.

c. Set the resolution bandwidth to 100kHz and video bandwidth to 300kHz. The spectrum analyser was turned to the centre frequency of the transmitter's and the analyser's marker function was used to determine the duration of transmission.

d. The transmission duration was measured and recorded.

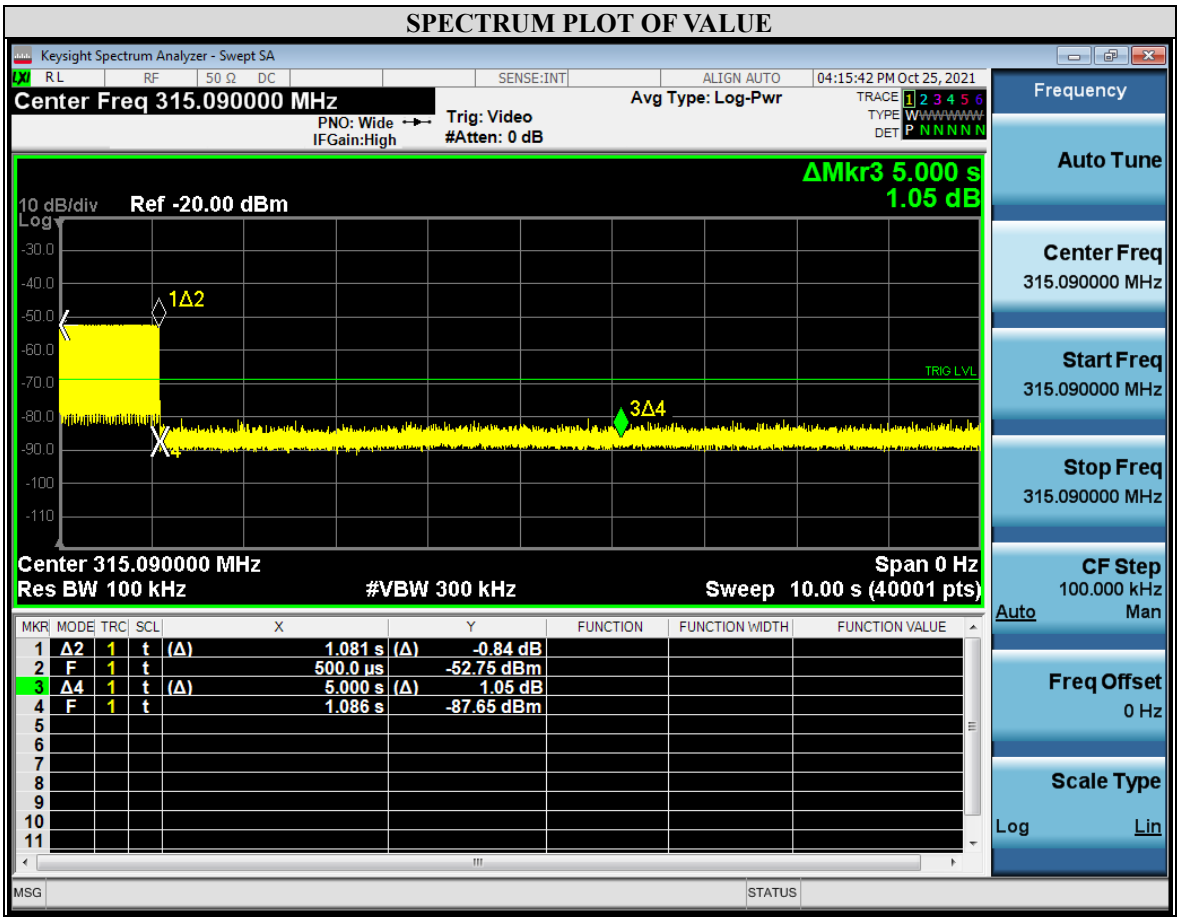
Deviation from Test Standard

No deviation.

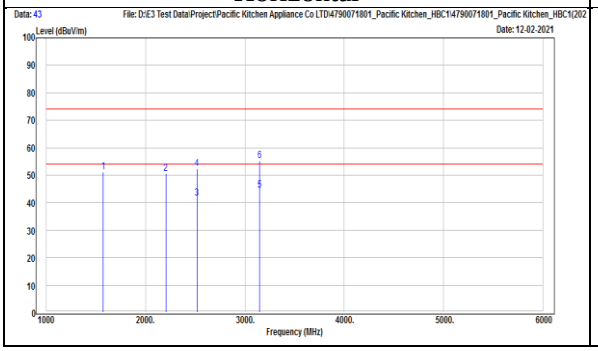
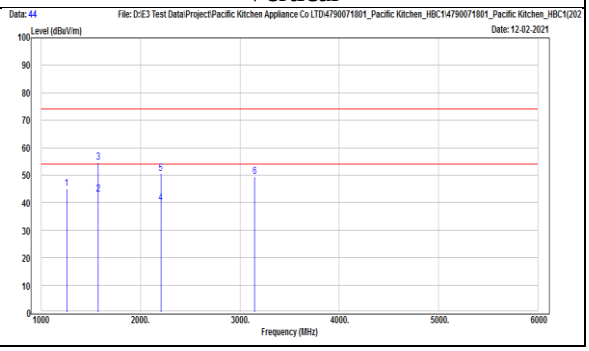
Test Data

Push Button	Frequency (MHz)	Maximum Limit (Sec)	Pass/Fail
1	315	5	PASS

SPECTRUM PLOT OF VALUE



Appendix I Radiated Spurious Emission Measurement

Ch 1	
Horizontal	Vertical
	

END OF REPORT