



FCC&ISED Radio Test Report

FCC ID: 2AEUPBHARG042

IC: 20271-BHARG042

This report concerns (check one): ☐ Original Grant ☐ Class I Change ☐ Class II Change

Project No. : 1803T001E

Equipment: Ring

Test Model: Video-Doorbell 2

Series Model : N/A Applicant : Ring, Inc.

Address: 1523 26th St, Santa Monica, CA 90404,USA

Date of Receipt : Oct. 23, 2018

Date of Test : Oct. 23, 2018 ~ Nov. 08, 2018

Issued Date : Mar. 20, 2019 Tested by : BTL Inc.

Testing Engineer

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Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. BTL shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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BTL's laboratory quality assurance procedures are in compliance with the ISO Guide 17025 requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

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REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue. This is a supplementary report to the original test report (BTL-FICP-1-1803001). The difference compared with original report is change bandpass filter for Dipole Antenna. Only Peak Output Power and Radiated Emissions (TX B MODE Low Channel) test need to be verified and the other original test data are kept in this report.	Nov. 12, 2018
R01	Revised report to address TCB's comments.	Mar. 20, 2019

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1. CERTIFICATION

Equipment : Ring Brand Name: ring

Test Model : Video-Doorbell 2

Series Model: N/A Applicant : Ring, Inc.

Manufacturer: Goldtek Technology CO.,LTD.

Address : 16F., No166, Jian 1st Rd., Zhonghe Dist., New Taipei City 235, Taiwan (R.O.C.)

Goldtek Technology CO.,LTD. Factory

16F., No166, Jian 1st Rd., Zhonghe Dist., New Taipei City 235, Taiwan (R.O.C.) Address

Date of Test : Oct. 23, 2018 ~ Nov. 08, 2018

Test Sample: Engineering Sample

Standard(s) : FCC Part15, Subpart C:(15.247) / ANSI C63.10-2013

RSS-247 Issue 2, Feb. 2017 RSS-GEN Issue 5, Apr. 2018

The above equipment has been tested and found in compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FICP-1-1803T001E) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

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2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

Applied Standard(s): FCC Part15 (15.247), Subpart C Canada RSS-247 Issue 2, Feb. 2017, RSS-GEN Issue 5, Apr. 2018							
Standard FCC	d(s) Section IC	Test Item	Judgment	Remark			
15.247(b)(3)	RSS-247 5.4 (d)	Peak Output Power	PASS				
15.247(d)/ 15.205/ 15.209	RSS-247 5.5	Transmitter Radiated Emissions	PASS				

NOTE:

- (1)" N/A" denotes test is not applicable in this test report.
- (2) Input power is supplied by battery.

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2.1 TEST FACILITY

The test facilities used to collect the test data in this report:

Radiated emission Test (Below 1 GHz):

CB15: (FCC RN:674415; FCC DN:TW0659; ISED Assigned Code:20088-5)

No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

Radiated emission Test (Above 1 GHz):

CB15: (FCC RN:674415; FCC DN:TW0659; ISED Assigned Code:20088-5)

No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

2.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{cispr} requirement.

The reported uncertainty of measurement y ± U, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

A. Radiated emission test:

Test Site	Method	Measurement Frequency Range	U,(dB)
CB15	CISPR	9kHz ~ 150kHz	2.82
(3m)	CIOPK	150kHz ~ 30MHz	2.58

Test Site	Method	Measurement Frequency Range	Ant.	U,(dB)
		30MHz ~ 200MHz	V	4.20
CB15	CISPR	30MHz ~ 200MHz	Н	3.64
(3m)	CISPR	200MHz ~ 1,000MHz	V	4.56
		200MHz ~ 1,000MHz	Н	3.90

Test Site	Method	Measurement Frequency Range	Ant.	U,(dB)
		1GHz ~ 6GHz	V	4.46
CB15	CISPR	1GHz ~ 6GHz	Н	4.40
(3m)	CISPR	6GHz ~ 18GHz	V	3.88
		6GHz ~ 18GHz	Н	4.00

Test Site	Method	Measurement Frequency Range	U,(dB)
CB15	CISPR	18 ~ 26.5 GHz	4.62
(1m)	CISPR	26.5 ~ 40 GHz	5.12

Our calculated Measurement Instrumentation Uncertainty is shown in the tables above. These are our U_{lab} values in CISPR 16-4-2 terminology.

Since Table 1 of CISPR 16-4-2 has values of measurement instrumentation uncertainty, called U_{CISPR}, as follows:

Conducted Disturbance (mains port) – 150 kHz – 30 MHz: 3.6 dB

Radiated Disturbance (electric field strength on an open area test site or alternative test site) - 30 MHz - 1000 MHz: 5.2 dB

It can be seen that our U_{lab} values are smaller than U_{CISPR} .

Note: unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

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3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	Ring
Brand Name	ring
Test Model	Video-Doorbell 2
Series Model	N/A
Model Difference	N/A
Power Source	Battery supplied. (Battery is charged independently by USB power supply)
Power Rating	Battery charge input: DC 5V Battery output: (1) FUJI/V4: DC 3.65V 6040mAh 22.046Wh (2) WTELG/V4: DC 3.65V 6040mAh 22.046Wh (3) WTEPanasonic/V4: DC 3.65V 6040mAh 22.046Wh
Products Covered	3 * Battery: (1) FUJI/V4 (2) WTELG/V4 (3) WTEPanasonic /V4
Operation Frequency	2412~2462 MHz
Modulation Technology	802.11b:DSSS 802.11g:OFDM 802.11n:OFDM
Bit Rate of Transmitter	802.11b: 11/5.5/2/1 Mbps 802.11g: 54/48/36/24/18/12/9/6 Mbps 802.11n up to 72.2 Mbps
Output Power (Max.)	802.11b: 14.52dBm 802.11g: 17.13dBm 802.11n(20MHz): 17.04dBm

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

2. Channel List:

	CH01 – CH11 for 802.11b, 802.11g, 802.11n(20MHz)						
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2412	04	2427	07	2442	10	2457
02	2417	05	2432	08	2447	11	2462
03	2422	06	2437	09	2452		

3. Table for Filed Antenna:

Ant.	Manufacturer	Model Name	Antenna Type	Connector	Gain (dBi)
1	WIESON	GY196HT0264L-010	Dipole Antenna	SMA	1.38

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3.2 DESCRIPTION OF TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation mode.

Following mode(s) as (were) found to be the worst case(s) and selected for the final test.

Test Items	Test mode	Channel	Note
Transmitter Radiated Emissions (BELOW 1GHz)	TX B MODE	11	
Transmitter Radiated Emissions (ABOVE 1GHz)	TX B MODE	11	
	TX B MODE	01/06/11	
Peak Output Power	TX G MODE	01/06/11	
	TX N-20M MODE	01/06/11	

Note:

(1) The measurements are performed at the high, middle, low available channels.

(2) 802.11b mode: DBPSK (1Mbps) 802.11g mode: OFDM (6Mbps)

802.11n HT20 mode: BPSK (MCS 0)

For radiated emission tests, the highest output powers were set for final test.

3.3 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

During testing, channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of WLAN

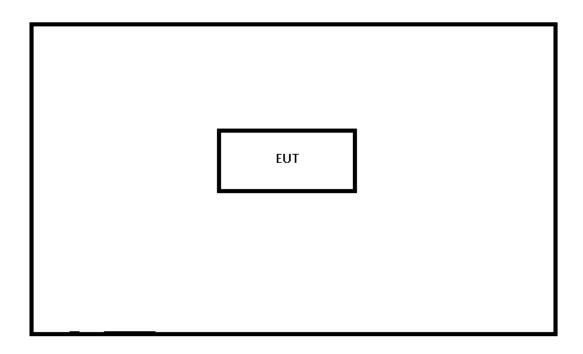
Test software version	RadioToolGUI Version 0.8.5973.20907			
Frequency (MHz)	2412	2437	2462	
802.11b	0	0	0	
802.11g	0	0	0	
802.11n (20MHz)	0	0	0	

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3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



3.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	
-	-	-	-	•	-	

Item	Shielded Type	Ferrite Core	Length	Note
-	-	-	-	-

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4. EMC EMISSION TEST

4.1 RADIATED EMISSION MEASUREMENT

4.1.1 RADIATED EMISSION LIMITS

In case the emission fall within the restricted band specified on 15.205(a) & RSS-247 5.5, then the 15.209(a) & RSS-Gen limit in the table below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (9KHz-1000MHz)

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(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
960~1000	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

Frequency (MHz)	(dBuV/m) (at 3 meters)			
Frequency (Miriz)	PEAK	AVERAGE		
Above 1000	74	54		

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C/RSS-247.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).
- (4) The test result calculated as following: Measurement Value = Reading Level + Correct Factor Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use) Margin Level = Measurement Value - Limit Value

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Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW	1MHz / 3MHz for Peak,
(Emission in restricted band)	1MHz / 1/T for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9KHz~90KHz for PK/AVG detector
Start ~ Stop Frequency	90KHz~110KHz for QP detector
Start ~ Stop Frequency	110KHz~490KHz for PK/AVG detector
Start ~ Stop Frequency	490KHz~30MHz for QP detector
Start ~ Stop Frequency	30MHz~1000MHz for QP detector

4.1.2 TEST PROCEDURE

- a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. (below 1GHz)
- b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
- c. The height of the equipment or of the substitution antenna shall be 0.8m or 1.5m; the height of the test antenna shall vary between 1 m to 4 m. 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 find the maximum reading (used Bore sight function).
- e. The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.
- f. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- g. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1GHz)
- h. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1GHz)
- i. For the actual test configuration, please refer to the related Item -EUT Test Photos.

4.1.3 DEVIATION FROM TEST STANDARD

No deviation

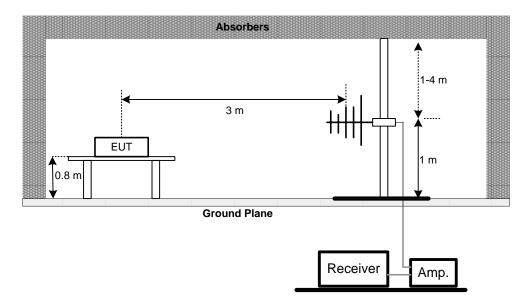
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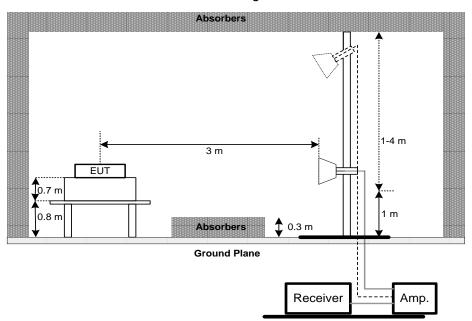


4.1.4 TEST SETUP

(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



(B) Radiated Emission Test Set-Up Frequency Above 1 GHz
Band edge



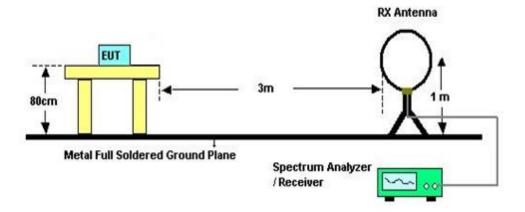
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(C) For Radiated Emissions Below 30MHz



4.1.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

4.1.6 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 55% Test Voltage: DC 3.6V

4.1.7 TEST RESULTS (9KHZ TO 30MHZ)

Please refer to the Appendix A.

Remark:

- (1) The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.
- (2) Distance extrapolation factor = 40 log (specific distance / test distance) (dB).
- (3) Limit line = specific limits (dBuV) + distance extrapolation factor.

4.1.8 TEST RESULTS (30MHZ TO 1000 MHZ)

Please refer to the Appendix B.

4.1.9 TEST RESULTS (ABOVE 1000 MHZ)

Please refer to the Appendix C.

Remark:

(1) No limit: This is fundamental signal, the judgment is not applicable. For fundamental signal judgment was referred to Peak output test.

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5. MAXIMUM PEAK CONDUCTED OUTPUT POWER TEST

5.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C/ RSS-247								
Section Test Item Limit Frequency Range (MHz)								
15.247(b)(3) RSS-247 5.4 (d)	Maximum Output Power	1 Watt or 30dBm	2400-2483.5	PASS				

5.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the power meter and antenna output port as show in the block diagram below,
- b. The maximum peak conducted output power was performed in accordance with method 9.1.2 of FCC KDB 558074 D01 DTS Meas Guidance.

5.1.2 DEVIATION FROM STANDARD

No deviation.

5.1.3 TEST SETUP

EUT	Power Meter
	1 Girol Motol

5.1.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

5.1.5 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 55% Test Voltage: DC 3.6V

5.1.6 TEST RESULTS

Please refer to the Appendix D.

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6. MEASUREMENT INSTRUMENTS LIST

	Radiated Emission Measurement									
Item	Kind of Equipment Manufacturer		Type No.	Serial No.	Calibrated until					
1	Preamplifier	EMCI	012645B	980267	Apr. 14, 2019					
2	Preamplifier	EMCI	EMC02325	980217	Apr. 14, 2019					
3	Preamplifier	EMCI	EMC2654045	980030	Apr. 14, 2019					
4	Test Cable	EMCI	EMC104-SM-S M-8000	8m	Apr. 14, 2019					
5	Test Cable EMCI		EMC104-SM-S M-800	150207	Apr. 14, 2019					
6	Test Cable	EMCI	EEMC104-SM-S M-3000 151205		Apr. 14, 2019					
7	MXE EMI Receiver	Agilent	N9038A	MY5542012 7	Jan. 27, 2019					
8	Signal Analyzer	Agilent	N9010A	MY5222099 0	May 22, 2019					
9	Loop Ant	EMCI	LPA600	274	May 03, 2019					
10	Horn Ant	SCHWARZBECK	BBHA 9120D	9120D-1342	May 02, 2019					
11	Horn Ant	Schwarzbeck	BBHA 9170	187	Aug. 16, 2019					
12	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	9168-548	Mar. 22, 2019					
13	5dB Attenuator	EMCI	EMCI-N-6-05	AT-N0623	Mar. 22, 2019					

	Peak Output Power Measurement										
Item	m Kind of Equipment Manufacturer Type No. Serial No. Calibrated until										
1	Power Meter	Anritsu	ML2495A	1128008	Aug. 15, 2019						
2	Power Sensor	Anritsu	MA2411B	1126001	Aug. 15, 2019						

Remark: "N/A" denotes no model name, serial no. or calibration specified.

All calibration period of equipment list is one year.

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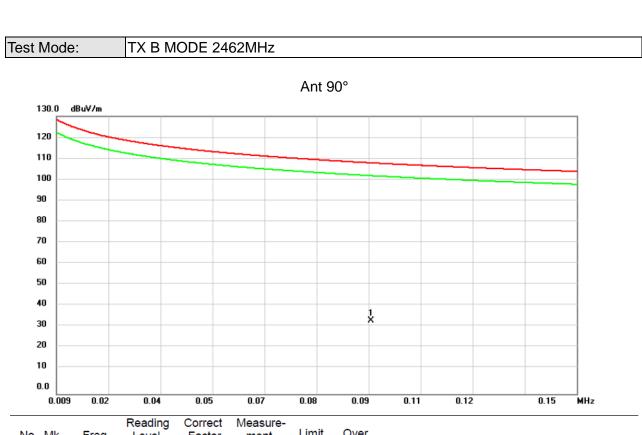


APPENDIX A - RADIATED EMISSION (9KHZ TO 30MHZ)

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No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over				
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment		
1	*	0.0942	17.38	16.77	34.15	108.12	-73.97	peak			

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No.	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over				
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment		
1	*	0.0630	24.36	20.41	44.77	111.62	-66.85	peak			

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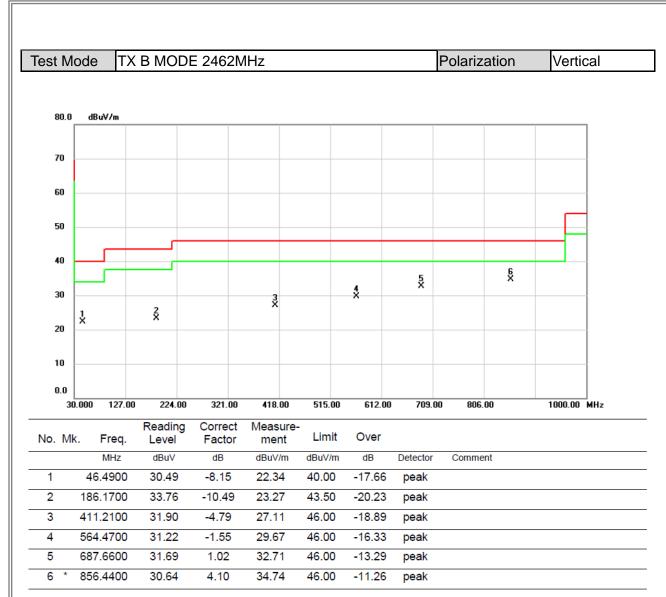


APPENDIX B - RADIATED EMISSION (30MHZ TO 1000MHZ)

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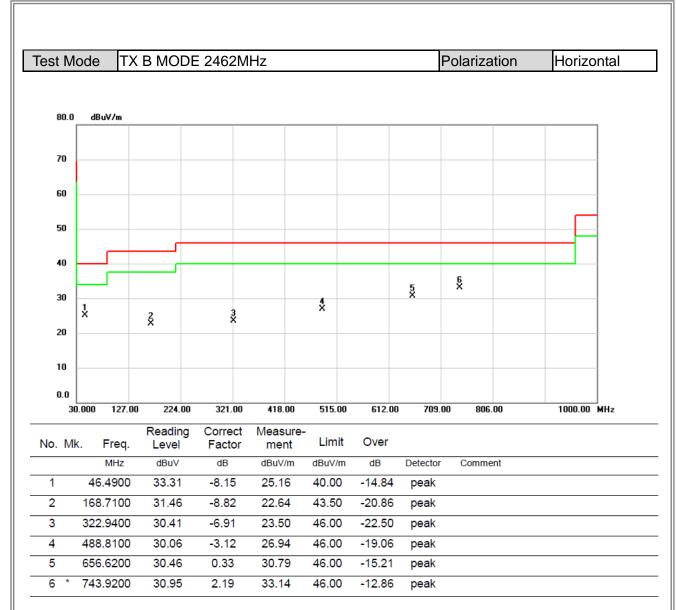


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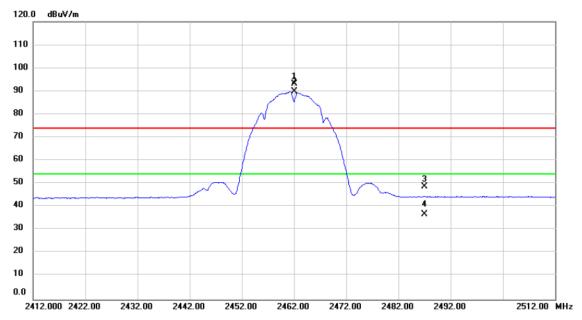
APPENDIX C - RADIATED EMISSION (ABOVE 1000MHZ)

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Test Mode TX B MODE _2462 MHz Polarization Vertical



No	. I	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
			MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		X	2462.000	61.97	31.09	93.06	74.00	19.06	peak	No Limit
2)	*	2462.000	58.72	31.09	89.81	54.00	35.81	AVG	No Limit
3	3		2487.048	17.52	31.18	48.70	74.00	-25.30	peak	
4			2487.048	5.64	31.18	36.82	54.00	-17.18	AVG	

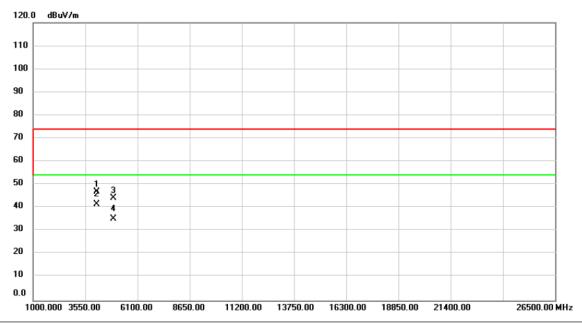
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Test Mode TX B MODE _2462 MHz Polarization Vertical



	No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
_			MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
_	1		4103.000	59.82	-12.84	46.98	74.00	-27.02	peak	
_	2	*	4103.000	54.28	-12.84	41.44	54.00	-12.56	AVG	
_	3		4924.000	55.60	-11.37	44.23	74.00	-29.77	peak	
_	4		4924.000	46.63	-11.37	35.26	54.00	-18.74	AVG	

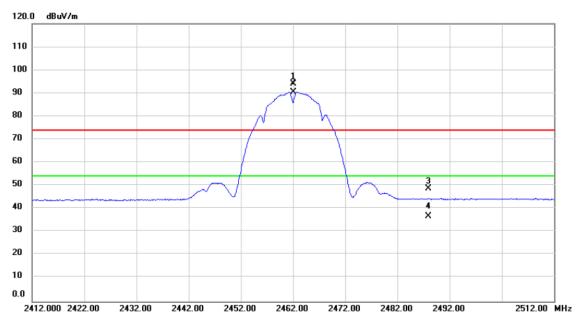
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Test Mode TX B MODE _2462 MHz Polarization Horizontal



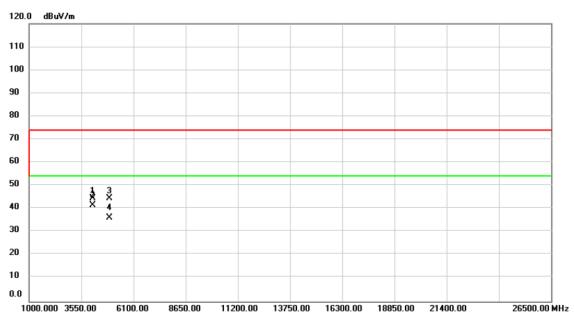
No.	Mk	c. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over			
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment	
1	X	2462.000	62.87	31.09	93.96	74.00	19.96	peak	No Limit	
2	*	2462.000	59.40	31.09	90.49	54.00	36.49	AVG	No Limit	
3		2487.889	17.66	31.19	48.85	74.00	-25.15	peak		
4		2487.889	5.65	31.19	36.84	54.00	-17.16	AVG		

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Test Mode TX B MODE _2462 MHz Polarization Horizontal



No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4103.000	57.25	-12.84	44.41	74.00	-29.59	peak	
2	*	4103.000	54.40	-12.84	41.56	54.00	-12.44	AVG	
3		4924.000	55.88	-11.37	44.51	74.00	-29.49	peak	
4		4924.000	47.56	-11.37	36.19	54.00	-17.81	AVG	

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APPENDIX D - MAXIMUM PEAK CONDUCTED OUTPUT POWER	3

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	Test Mode :TX B Mode_CH01/06/11										
Frequency	Conducted	Conducted	Max. Limit	Max. Limit	Result						
(MHz)	Power (dBm)	Power (W)	(dBm)	(W)							
2412	14.23	0.0265	30.00	1.00	Complies						
2437	14.47	0.0280	30.00	1.00	Complies						
2462	14.52	0.0283	30.00	1.00	Complies						

	Test Mode :TX G Mode_CH01/06/11									
Frequency	Conducted	Conducted	Max. Limit	Max. Limit	Result					
(MHz)	Power (dBm)	Power (W)	(dBm)	(W)	Nesull					
2412	16.57	0.0454	30.00	1.00	Complies					
2437	17.13	0.0516	30.00	1.00	Complies					
2462	17.03	0.0505	30.00	1.00	Complies					

	Test Mode :TX N20 Mode_CH01/06/11										
Frequency	Conducted	Conducted	Max. Limit	Max. Limit	Result						
(MHz)	Power (dBm)	Power (W)	(dBm)	(W)	Nesull						
2412	16.16	0.0413	30.00	1.00	Complies						
2437	17.04	0.0506	30.00	1.00	Complies						
2462	16.70	0.0468	30.00	1.00	Complies						

End of Test Report

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