FCC RF Test Report

APPLICANT	:	**Tesla Motors, Inc.**
EQUIPMENT	:	**Charging handles**
BRAND NAME	:	**Tesla**
MODEL NAME	:	**1023049-02**
FCC ID	:	**2AEIM-1023049**
STANDARD	:	**FCC Part 15 Subpart C §15.231**
CLASSIFICATION	:	**(DSC) Security/Remote Control Transmitter**

The testing was completed on Aug. 11, 2017. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

SPORTON INTERNATIONAL INC.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR781208	Rev. 01	Initial issue of report	Aug. 15, 2017
FR781208	Rev. 02	Add the test description of KDB 414788 in section 1.7 and section 3.4.5.	Aug. 23, 2017

SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart C				
	FCC Rule Part 15C	**Description of Test**	**Result**	**Remark**
3.1	15.207	AC Power Line Conducted Emissions	-	Not Applicable
3.2	15.231(a)	Types of Momentary Signals	Complies	-
3.3	15.231(c)	20dB and 99% Occupied Bandwidth	Complies	-
3.4	15.231(b) 15.231(e)	Field Strength of Fundamental and Spurious Emissions	Complies	Under limit 2.07 dB at 3937.000 MHz

1. GENERAL INFORMATION

1.1 Applicant

Tesla Motors, Inc.

3500 Deer Creek Road Palo Alto, CA 94304

1.2 Manufacturer

Tesla Motors, Inc.

3500 Deer Creek Road Palo Alto, CA 94304

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Charging handles
Brand Name	Tesla
Model Name	1023049-02
FCC ID	2AEIM-1023049
EUT supports Radios application	315MHz Remote Control
EUT Stage	Pre-Production

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Frequency Range	315MHz
Channel Number	1
20dBW	14.45 KHz
99%OBW	17.555 KHz
Antenna Type	dipole/PCB
Type of Modulation	OOK

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978
Test Site No.	**Sporton Site No.**
	DFS02-HY
Test Engineer	PH Yang
Temperature	24~25℃
Relative Humidity	55~56%

Note: The test site complies with ANSI C63.4 2014 requirement.

Test Site	SPORTON INTERNATIONAL INC.	
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd. Guishan Dist, Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855	
Test Site No.	**Sporton Site No.**	
	03CH11-HY	03CH15-HY
Test Engineer	Jacky Hung	Watt Tseng
Temperature	25~26℃	21~25℃
Relative Humidity	53~55%	56~60%

Note: The test site complies with ANSI C63.4 2014 requirement.

1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.231
- FCC KDB 414788 D01 Radiated Test Site v01
- ANSI C63.10-2013

2. TEST CONFIGURATION OF EQUIPMENT UNDER TEST

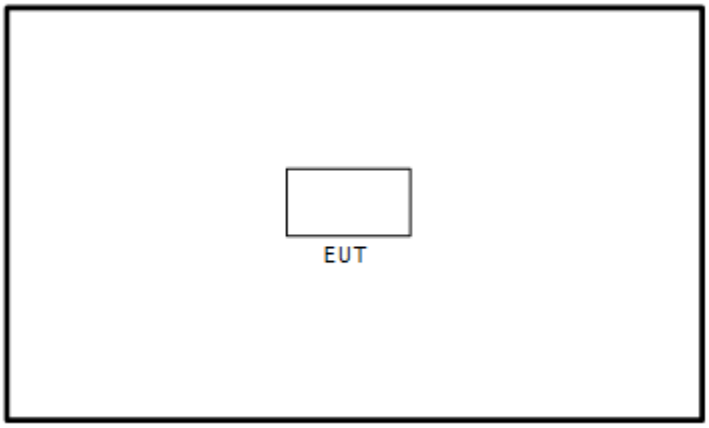
2.1 Descriptions of Test Mode

Investigation has been done on all the possible configurations for searching the worst cases.

The following table is a list of the test modes shown in this test report.

Test Items	
AC Power Line Conducted Emissions	20dB and 99% occupied bandwidth
Test Result of transmission time	Field Strength of Fundamental and Spurious Emissions

2.2 Connection Diagram of Test System



2.3 EUT Operation Test Setup

The EUT was programmed to be in continuously transmitting mode while connected to the control box.

3. TEST RESULTS

3.1 AC Power Line Conducted Emissions Measurement

3.1.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

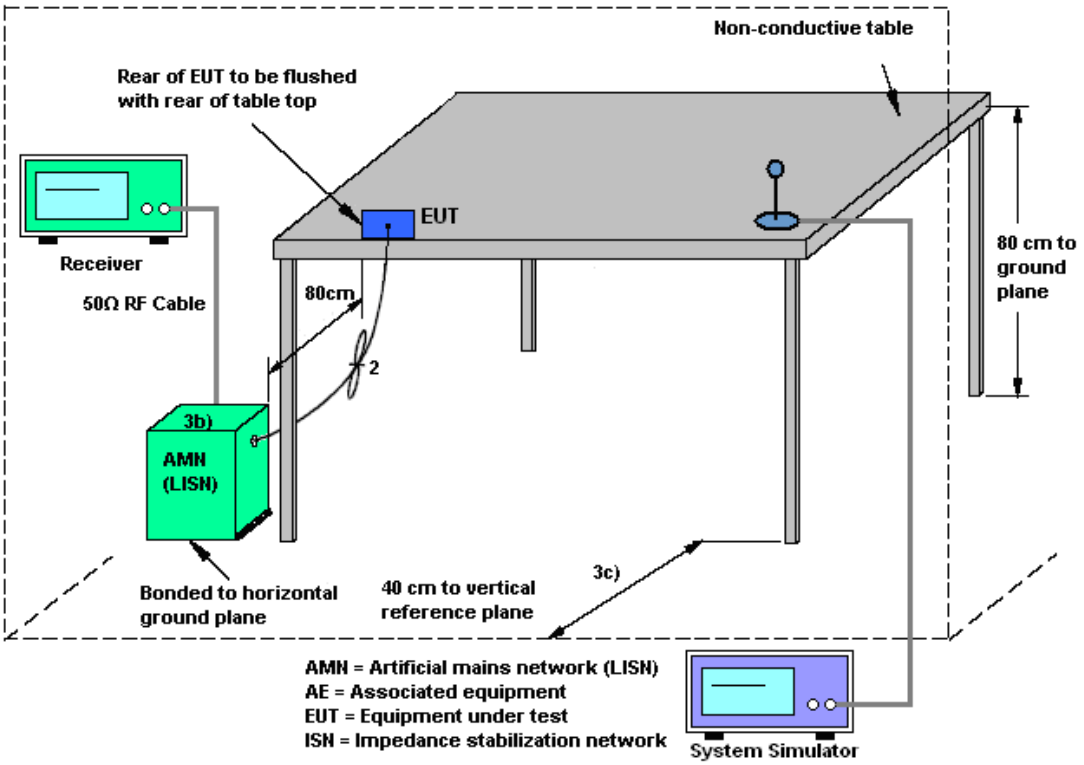
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.1.4 Test setup



3.1.5 Test Result of AC Conducted Emission

Please refer to Appendix A.

3.2 Types of Momentarily Operated Devices

3.2.1 Limit

☒	§15.231 (a)(1); RSS-210 A1.1 (a) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
☒	§15.231 (a)(2); RSS-210 A1.1 (b) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
☐	§15.231 (a)(3); RSS-210 A1.1 (c) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.
☐	§15.231 (a)(4) ; RSS-210 A1.1 (d) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.
☐	§15.231 (a)(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

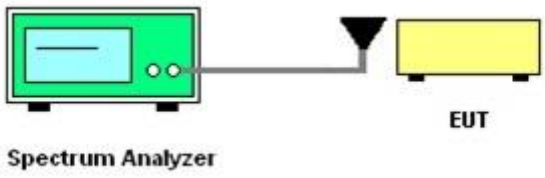
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

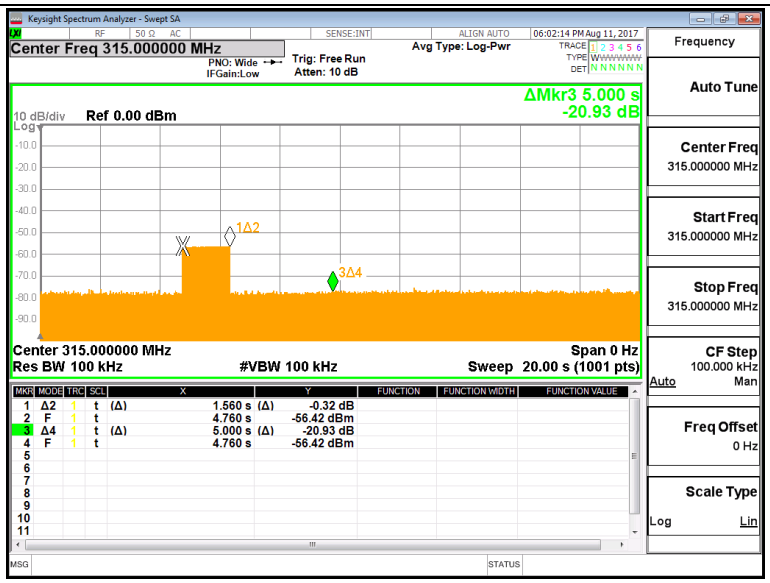
3.2.3 Test Procedures

1. The spectrum analyzer connected via a receive antenna placed near the EUT in peak Max hold mode.
2. The resolution bandwidth of 1 kHz and the video bandwidth of 3 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.
4. Measured the transmission period of EUT under specified condition.

3.2.4 Test Setup



3.2.5 Test Result of transmission time

☒	§15.231 (a)(1); RSS-210 A1.1 (a) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
	 1. Button Pushed @ mark 2 2. Button Released @ marker 4
☒	§15.231 (a)(2); RSS-210 A1.1 (b) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
	 1. Button Pushed and released @ marker 2

3.3 20dB and 99% Occupied Bandwidth Measurement

3.3.1 Limit

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

The 99% bandwidth of momentarily operated devices shall be less or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the 99% bandwidth shall be less or equal to 0.5% of the centre frequency.

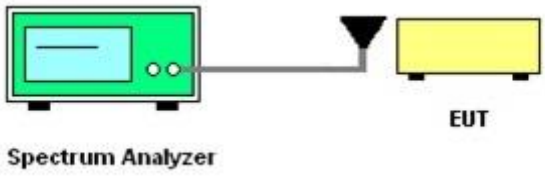
3.3.2 Measuring Instruments

See list of measuring instruments of this test report.

3.3.3 Test Procedures

1. The spectrum analyzer connected via a receive antenna placed near the EUT in peak Max hold mode.
2. The resolution bandwidth of 1 kHz and the video bandwidth of 3 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.
4. Measured the 99% OBW.

3.3.4 Test Setup



3.3.5 Test Result of Conducted Test Items

Please refer to Appendix B.

3.4 Field Strength of Fundamental and Spurious Emissions

3.4.1 Limit

☒ 15.231(b)

In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following

Rules and specifications	FCC CFR 47 Part 15 section 15.231 IC RSS-210 A1.1.2(1)	
Fundamental frequency (MHz)	Field strength of fundamental (μV/m) at 3m	Field strength of spurious emissions (dBμV/m) at 3m
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750*	125 to 375*
174-260	3750	375
260-470	3750 to 12500*	375 to 1250*
Above 470	12500	1250

* Linear interpolation with frequency, f, in MHz.

☐	15.231(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Rules and specifications	**FCC CFR 47 Part 15 section 15.231 IC RSS-210 A1.4**	
Fundamental frequency (MHz)	Field strength of fundamental (μV/m) at 3m	Field strength of spurious emissions (dBμV/m) at 3m
40.66-40.70	1000	100
70-130	500	50
130-174	500 to 1500	50 to 150
174-260	1500	150
260-470	1500 to 5000	150 to 500
Above 470	5000	500

* Linear interpolation with frequency, f, in MHz.

3.4.2 Measuring Instruments

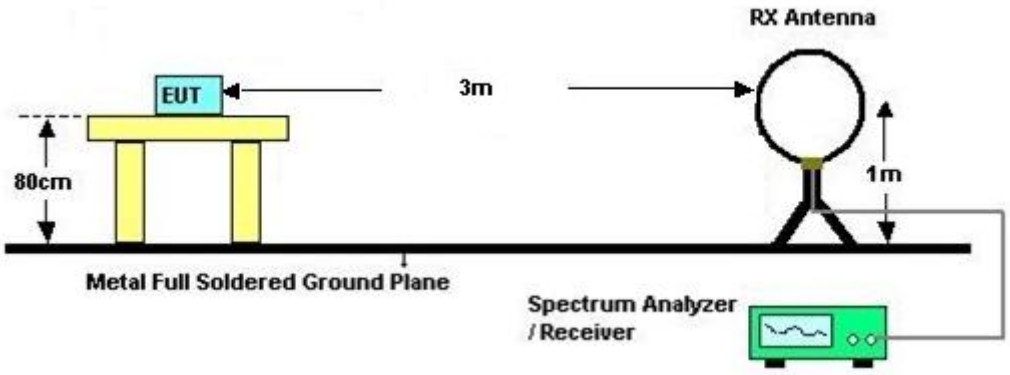
See list of measuring instruments of this test report.

3.4.3 Test Procedures

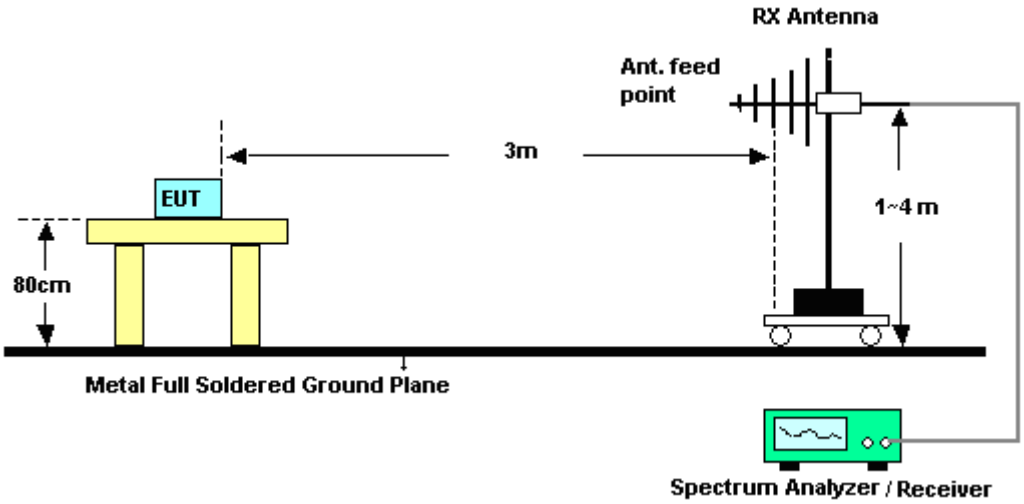
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the loop receiving antenna mounted antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the receiving antenna was fixed at one meter above ground to find the maximum emissions field strength.
4. For Fundamental emissions, use the receiver to measure Average reading.
5. For average measurement: use duty cycle correction factor method per 15.35(c).
   Duty cycle = On time/100 milliseconds
   On time = N1*L1+N2*L2+...+Nn-1*LNn-1+Nn*Ln
   Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.
   Average Emission Level = Peak Emission Level + 20*log(Duty cycle)
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

3.4.4 Test Setup

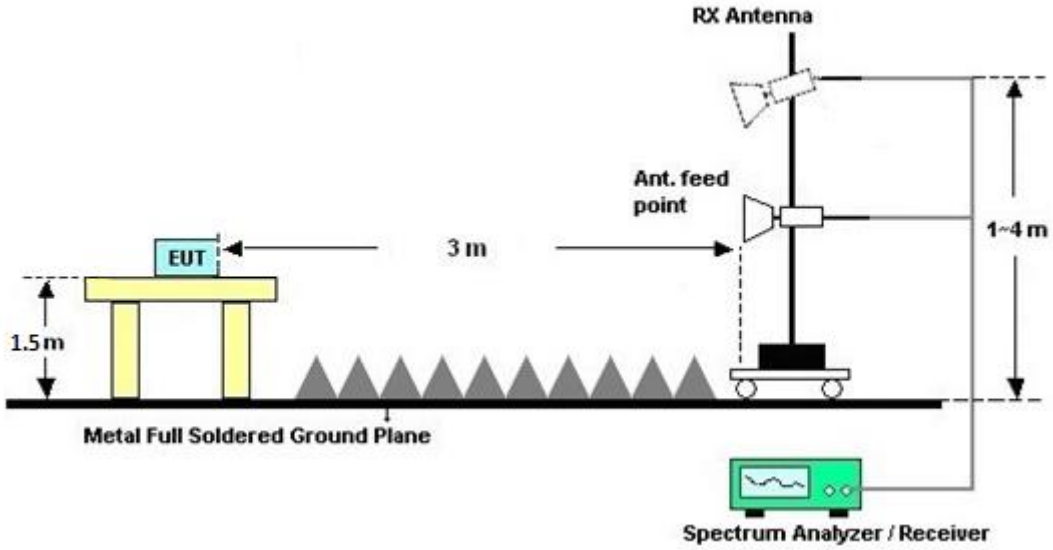
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



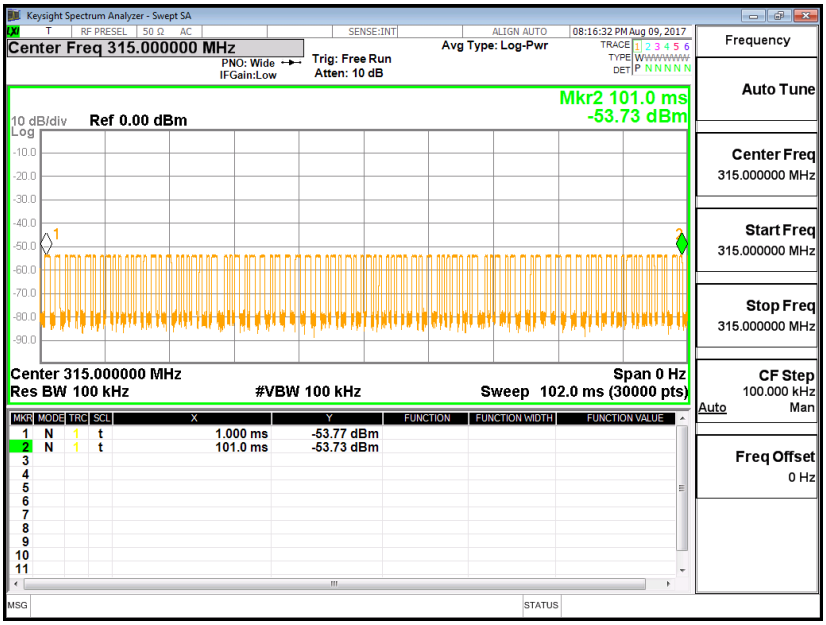
3.4.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.4.6 Duty cycle correction factor for average measurement

315MHz on time Plot



Note:

1. Worst case Duty cycle = on time/100 milliseconds = 50.59 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -5.92 dB

3.4.7 Test Result of Fundamental and Spurious Emissions

Please refer to Appendix C and D.

4. LIST OF MEASURING EQUIPMENT

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	Keysight	N9010A	MY56070412	10Hz~7GHz	Aug. 08, 2017	Aug. 10, 2017 ~ Aug. 11, 2017	Aug. 07, 2018	DFS (DFS02-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Nov. 10, 2016	Aug. 10, 2017	Nov. 09, 2017	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0602	30MHz~1GHz	Oct. 15, 2016	Aug. 10, 2017	Oct. 14, 2017	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Oct. 20, 2016	Aug. 10, 2017	Oct. 19, 2018	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 12, 2016	Aug. 10, 2017	Oct. 11, 2017	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Aug. 10, 2017	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Aug. 10, 2017	N/A	Radiation (03CH11-HY)
EMI Test Receiver	Agilent	N9038A (MXE)	MY53290053	20Hz to 26.5GHz	Jan. 12, 2017	Aug. 10, 2017	Jan. 11, 2018	Radiation (03CH11-HY)
Preamplifier	MITEQ	AMF-7D-00101800	2025787	1GHZ~18GHZ	Feb. 13, 2017	Aug. 09, 2017 ~ Aug. 11, 2017	Feb. 12, 2018	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	18GHz ~ 40GHz	Apr. 27, 2017	Aug. 09, 2017 ~ Aug. 11, 2017	Apr. 26, 2018	Radiation (03CH15-HY)
Preamplifier	MITEQ	TTA 1840-35-HG	1871923	18GHz ~ 40GHz	Jul. 18, 2017	Aug. 09, 2017 ~ Aug. 11, 2017	Jul. 17, 2018	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	9kHz~1GHz	Nov. 09, 2016	Aug. 09, 2017 ~ Aug. 11, 2017	Nov. 08, 2017	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL6111D&00800N1D01N-06	41912&05	30MHz to 1GHz	Jan. 07, 2017	Aug. 09, 2017 ~ Aug. 11, 2017	Jan. 06, 2018	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1620	1G~18GHz	Sep. 30, 2016	Aug. 09, 2017 ~ Aug. 11, 2017	Sep. 29, 2017	Radiation (03CH15-HY)
Preamplifier	Keysight	83017A	MY53270195	1GHz~26.5GHz	Aug. 24, 2016	Aug. 09, 2017 ~ Aug. 11, 2017	Aug. 23, 2017	Radiation (03CH15-HY)
Spectrum Analyzer	Agilent	N9030A	MY52350276	3Hz~44GHz	Mar. 23, 2017	Aug. 09, 2017 ~ Aug. 11, 2017	Mar. 22, 2018	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Aug. 09, 2017 ~ Aug. 11, 2017	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Aug. 09, 2017 ~ Aug. 11, 2017	N/A	Radiation (03CH15-HY)

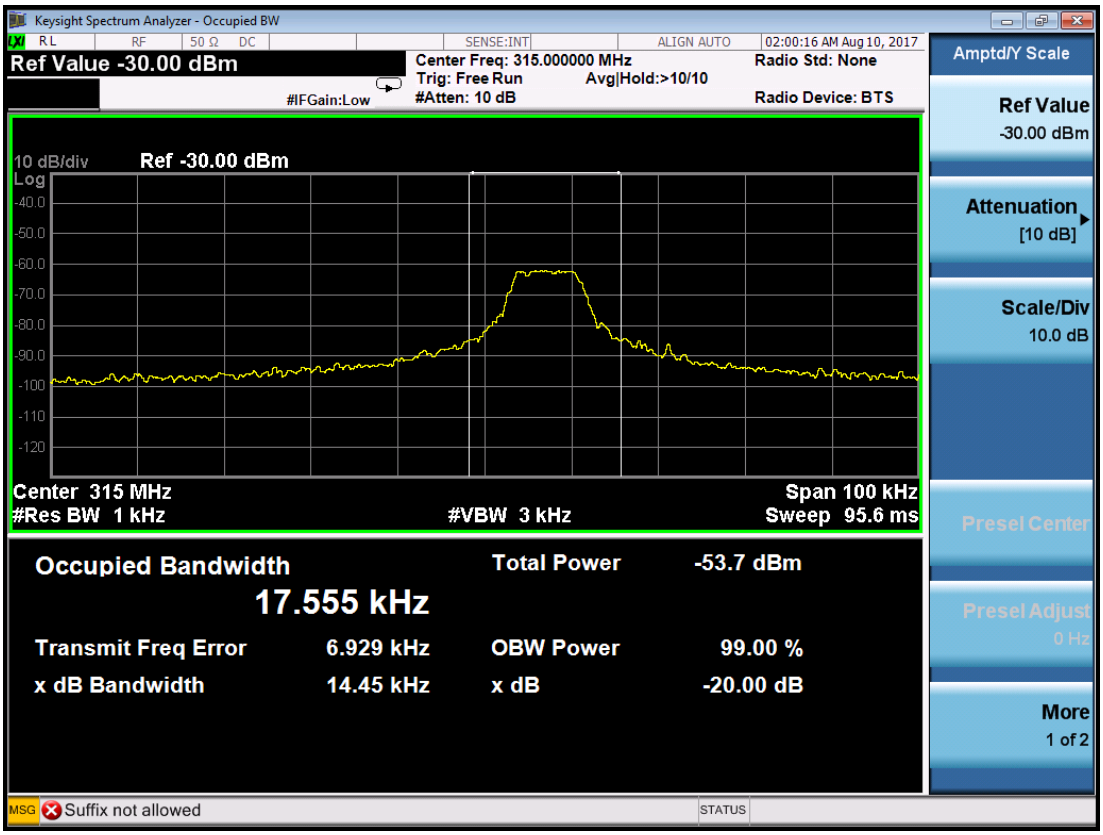
Appendix A. Test Results of Conducted Emission Test

Not Applicable, since it is powered up by DC batteries (3V DC).

Appendix B. Test Results of Conducted Test Items

B1. Test Result of 20dB and Occupied Bandwidth

Test mode	315MHz Tx	Test Frequency (MHz)	315



20dB Bandwidth (kHz)	14.45	99% OccupiedBW(kHz)	17.555
Bandwidth Limit	**Shall be less than 0.25% of 315MHz**	**Shall be less than 0.25% of 315MHz**	**Test Result**
	< 787.5kHz	**< 787.5kHz**	**Complies**

Appendix C. Radiated Spurious Emission

Test Engineer :	Watt Tseng and Jacky Hung	**Temperature :**	21~26°C
		Relative Humidity :	53~60%

Y-Axis

Ant. 1	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
315MHz		60.78	21.1	-54.5	75.6	41	11.95	0.67	32.58	100	0	P	H
		60.78	15.18	-40.42	55.6	-	-	-	-	-	-	A	H
		179.58	20.83	-54.77	75.6	36.89	15.2	1.06	32.52	100	0	P	H
		179.58	14.91	-40.69	55.6	-	-	-	-	-	-	A	H
	*	315	59.59	-36.01	95.6	71.09	19.56	1.4	32.56	100	235	P	H
	*	315	53.67	-21.93	75.6	-	-	-	-	-	-	A	H
		630	27.15	-48.45	75.6	31.27	26.37	1.97	32.62	100	0	P	H
		630	21.23	-34.37	55.6	-	-	-	-	-	-	A	H
		945	44.18	-31.42	75.6	42.26	30.6	2.44	31.36	100	0	P	H
		945	38.26	-17.34	55.6	-	-	-	-	-	-	A	H
		1260	30.14	-45.46	75.6	67.76	24.16	3.2	64.98	100	0	P	H
		1260	24.22	-31.38	55.6	-	-	-	-	-	-	A	H
		1575	33.11	-40.89	74	69.44	24.63	3.62	64.58	100	0	P	H
		1575	27.19	-26.81	54	-	-	-	-	-	-	A	H
		1890	35.24	-40.36	75.6	70.68	25.47	3.97	64.88	100	0	P	H
		1890	29.32	-26.28	55.6	-	-	-	-	-	-	A	H
		2205	34.2	-39.8	74	68.35	26.46	4.31	64.92	100	0	P	H
		2205	28.28	-25.72	54	-	-	-	-	-	-	A	H
		2520	35.18	-40.42	75.6	67.91	27.44	4.63	64.8	100	0	P	H
		2520	29.26	-26.34	55.6	-	-	-	-	-	-	A	H
		2835	35.09	-38.91	74	66.82	28.27	4.87	64.87	100	0	P	H
		2835	29.17	-24.83	54	-	-	-	-	-	-	A	H
		3150	35.51	-40.09	75.6	66.5	28.64	5.19	64.82	100	0	P	H
		3150	29.59	-26.01	55.6	-	-	-	-	-	-	A	H
		3937	55.12	-18.88	74	84.24	29.67	5.81	64.6	120	175	P	H
		3937	49.2	-4.8	54	-	-	-	-	-	-	A	H
		7874	42.51	-33.09	75.6	62.53	36.71	8.39	65.12	100	0	P	H
		7874	36.59	-19.01	55.6	-	-	-	-	-	-	A	H
		11811	46.67	-27.33	74	61.92	39.5	10.53	65.28	100	0	P	H
		11811	40.75	-13.25	54	-	-	-	-	-	-	A	H

		15748	43.86	-30.14	74	58.65	37.29	12.39	64.47	100	0	P	H
		15748	37.94	-16.06	54	-	-	-	-	-	-	A	H
		19685	46.7	-27.3	74	45.01	38.2	13.99	50.5	100	0	P	H
		19685	40.78	-13.22	54	-	-	-	-	-	-	A	H

Ant. 1	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
315MHz		59.43	30.42	-45.18	75.6	50.21	12.07	0.67	32.58	100	0	P	V
		59.43	24.5	-31.1	55.6	-	-	-	-	-	-	A	V
		91.56	23.33	-52.27	75.6	40.44	14.64	0.74	32.59	100	0	P	V
		91.56	17.41	-38.19	55.6	-	-	-	-	-	-	A	V
	*	315	59.02	-36.58	95.6	70.52	19.56	1.4	32.56	112	216	P	V
	*	315	53.1	-22.5	75.6	-	-	-	-	-	-	A	V
		630	28.61	-46.99	75.6	32.73	26.37	1.97	32.62	100	0	P	V
		630	22.69	-32.91	55.6	-	-	-	-	-	-	A	V
		945	48.07	-27.53	75.6	46.15	30.6	2.44	31.36	100	0	P	V
		945	42.15	-13.45	55.6	-	-	-	-	-	-	A	V
		1260	30.46	-45.14	75.6	68.08	24.16	3.2	64.98	100	0	P	V
		1260	24.54	-31.06	55.6	-	-	-	-	-	-	A	V
		1575	31.73	-42.27	74	68.06	24.63	3.62	64.58	100	0	P	V
		1575	25.81	-28.19	54	-	-	-	-	-	-	A	V
		1890	35.15	-40.45	75.6	70.59	25.47	3.97	64.88	100	0	P	V
		1890	29.23	-26.37	55.6	-	-	-	-	-	-	A	V
		2205	34.44	-39.56	74	68.59	26.46	4.31	64.92	100	0	P	V
		2205	28.52	-25.48	54	-	-	-	-	-	-	A	V
		2520	34.59	-41.01	75.6	67.32	27.44	4.63	64.8	100	0	P	V
		2520	28.67	-26.93	55.6	-	-	-	-	-	-	A	V
		2835	35.63	-38.37	74	67.36	28.27	4.87	64.87	100	0	P	V
		2835	29.71	-24.29	54	-	-	-	-	-	-	A	V
		3150	35.48	-40.12	75.6	66.47	28.64	5.19	64.82	100	0	P	V
		3150	29.56	-26.04	55.6	-	-	-	-	-	-	A	V
		3937	57.85	-16.15	74	86.97	29.67	5.81	64.6	129	177	P	V
		3937	51.93	-2.07	54	-	-	-	-	-	-	A	V
		7874	43.15	-32.45	75.6	63.17	36.71	8.39	65.12	100	0	P	V
		7874	37.23	-18.37	55.6	-	-	-	-	-	-	A	V
		11811	45.74	-28.26	74	60.99	39.5	10.53	65.28	100	0	P	V
		11811	39.82	-14.18	54	-	-	-	-	-	-	A	V

		15748	44.18	-29.82	74	58.97	37.29	12.39	64.47	100	0	P	V
		15748	38.26	-15.74	54	-	-	-	-	-	-	A	V
		19685	48.03	-25.97	74	46.34	38.2	13.99	50.5	100	0	P	V
		19685	42.11	-11.89	54	-	-	-	-	-	-	A	V

	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
LF		0.01925	54.57	-67.35	121.92	34.51	20.05	0.01	-	-	A	H
		0.07809	49.59	-60.16	109.75	29.57	20.01	0.01	-	-	A	H
		0.1094	44.68	-62.14	106.82	24.66	20.01	0.01	-	-	QP	H
		0.14064	44.46	-60.18	104.64	24.45	20	0.01	-	-	A	H
		0.1551	52.28	-51.51	103.79	32.28	19.99	0.01	-	-	A	H
		1.369	42.62	-22.26	64.88	22.5	20.01	0.11	100	0	QP	H
		8.44	37.4	-32.1	69.5	17.13	20.11	0.16	-	-	QP	H
		16.063	36.8	-32.7	69.5	16.33	20.18	0.29	-	-	QP	H
		25.71	36.53	-32.97	69.5	15.77	20.5	0.26	-	-	QP	H
												H
												H
												H
		0.01925	57.09	-64.83	121.92	37.03	20.05	0.01	-	-	A	V
		0.07806	56.3	-53.46	109.76	36.28	20.01	0.01	-	-	A	V
		0.10942	52.69	-54.13	106.82	32.67	20.01	0.01	-	-	QP	V
		0.14068	52.19	-52.45	104.64	32.18	20	0.01	-	-	A	V
		0.15646	55.88	-47.84	103.72	35.88	19.99	0.01	-	-	A	V
		1.279	51.17	-14.3	65.47	31.07	20	0.1	100	0	QP	V
		9.048	40.61	-28.89	69.5	20.33	20.12	0.16	-	-	QP	V
		16.441	35.91	-33.59	69.5	15.43	20.2	0.28	-	-	QP	V
		27.055	35.33	-34.17	69.5	14.7	20.38	0.25	-	-	QP	V
												V
												V
												V

Remark

1. No other spurious found.
2. All results are PASS against limit line.

Z-Axis

Ant. 1	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
315MHz		60.78	19.88	-55.72	75.6	39.78	11.95	0.67	32.58	100	0	P	H
		60.78	13.96	-41.64	55.6	-	-	-	-	-	-	A	H
		87.78	20.64	-54.96	75.6	38.05	14.34	0.74	32.59	100	0	P	H
		87.78	14.72	-40.88	55.6	-	-	-	-	-	-	A	H
	*	315	56.98	-38.62	95.6	68.48	19.56	1.4	32.56	100	230	P	H
	*	315	51.06	-24.54	75.6	-	-	-	-	-	-	A	H
		630	28.54	-47.06	75.6	32.66	26.37	1.97	32.62	100	0	P	H
		630	22.62	-32.98	55.6	-	-	-	-	-	-	A	H
		945	42.99	-32.61	75.6	41.07	30.6	2.44	31.36	100	0	P	H
		945	37.07	-18.53	55.6	-	-	-	-	-	-	A	H
		1260	31.18	-44.42	75.6	68.8	24.16	3.2	64.98	100	0	P	H
		1260	25.26	-30.34	55.6	-	-	-	-	-	-	A	H
		1575	31.31	-42.69	74	67.64	24.63	3.62	64.58	100	0	P	H
		1575	25.39	-28.61	54	-	-	-	-	-	-	A	H
		1890	34.32	-41.28	75.6	69.76	25.47	3.97	64.88	100	0	P	H
		1890	28.4	-27.2	55.6	-	-	-	-	-	-	A	H
		2205	33.85	-40.15	74	68	26.46	4.31	64.92	100	0	P	H
		2205	27.93	-26.07	54	-	-	-	-	-	-	A	H
		2520	34.49	-41.11	75.6	67.22	27.44	4.63	64.8	100	0	P	H
		2520	28.57	-27.03	55.6	-	-	-	-	-	-	A	H
		2835	35.53	-38.47	74	67.26	28.27	4.87	64.87	100	0	P	H
		2835	29.61	-24.39	54	-	-	-	-	-	-	A	H
		3150	36.25	-39.35	75.6	67.24	28.64	5.19	64.82	100	0	P	H
		3150	30.33	-25.27	55.6	-	-	-	-	-	-	A	H
		3937	51.54	-22.46	74	80.66	29.67	5.81	64.6	148	186	P	H
		3937	45.62	-8.38	54	-	-	-	-	-	-	A	H
		7874	42.59	-33.01	75.6	62.61	36.71	8.39	65.12	100	0	P	H
		7874	36.67	-18.93	55.6	-	-	-	-	-	-	A	H
		11811	45.57	-28.43	74	60.82	39.5	10.53	65.28	100	0	P	H
		11811	39.65	-14.35	54	-	-	-	-	-	-	A	H

		15748	43.8	-30.2	74	58.59	37.29	12.39	64.47	100	0	P	H
		15748	37.88	-16.12	54	-	-	-	-	-	-	A	H
		19685	46.87	-27.13	74	45.18	38.2	13.99	50.5	100	0	P	H
		19685	40.95	-13.05	54	-	-	-	-	-	-	A	H

Ant. 1	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		52.95	29.65	-45.95	75.6	48.37	13.22	0.59	32.57	100	0	P	V
		52.95	23.73	-31.87	55.6	-	-	-	-	-	-	A	V
		94.26	23.2	-52.4	75.6	39.68	15.24	0.79	32.6	100	0	P	V
		94.26	17.28	-38.32	55.6	-	-	-	-	-	-	A	V
	*	315	58.56	-37.04	95.6	70.06	19.56	1.4	32.56	119	26	P	V
	*	315	52.64	-22.96	75.6	-	-	-	-	-	-	A	V
		630	30.06	-45.54	75.6	34.18	26.37	1.97	32.62	100	0	P	V
		630	24.14	-31.46	55.6	-	-	-	-	-	-	A	V
		945	47.66	-27.94	75.6	45.74	30.6	2.44	31.36	100	0	P	V
		945	41.74	-13.86	55.6	-	-	-	-	-	-	A	V
		1260	29.69	-45.91	75.6	67.31	24.16	3.2	64.98	100	0	P	V
		1260	23.77	-31.83	55.6	-	-	-	-	-	-	A	V
		1575	32.39	-41.61	74	68.72	24.63	3.62	64.58	100	0	P	V
		1575	26.47	-27.53	54	-	-	-	-	-	-	A	V
		1890	35.91	-39.69	75.6	71.35	25.47	3.97	64.88	100	0	P	V
315MHz		1890	29.99	-25.61	55.6	-	-	-	-	-	-	A	V
		2205	33.73	-40.27	74	67.88	26.46	4.31	64.92	100	0	P	V
		2205	27.81	-26.19	54	-	-	-	-	-	-	A	V
		2520	34.59	-41.01	75.6	67.32	27.44	4.63	64.8	100	0	P	V
		2520	28.67	-26.93	55.6	-	-	-	-	-	-	A	V
		2835	35.38	-38.62	74	67.11	28.27	4.87	64.87	100	0	P	V
		2835	29.46	-24.54	54	-	-	-	-	-	-	A	V
		3150	35.9	-39.7	75.6	66.89	28.64	5.19	64.82	100	0	P	V
		3150	29.98	-25.62	55.6	-	-	-	-	-	-	A	V
		3937	53.08	-20.92	74	82.2	29.67	5.81	64.6	284	196	P	V
		3937	47.16	-6.84	54	-	-	-	-	-	-	A	V
		7874	42.85	-32.75	75.6	62.87	36.71	8.39	65.12	100	0	P	V
		7874	36.93	-18.67	55.6	-	-	-	-	-	-	A	V
		11811	45.53	-28.47	74	60.78	39.5	10.53	65.28	100	0	P	V
		11811	39.61	-14.39	54	-	-	-	-	-	-	A	V
		15748	45.62	-28.38	74	60.41	37.29	12.39	64.47	100	0	P	V

		15748	39.7	-14.3	54	-	-	-	-	-	-	A	V
		19685	46.06	-27.94	74	44.37	38.2	13.99	50.5	100	0	P	V
		19685	40.14	-13.86	54	-	-	-	-	-	-	A	V

	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
LF		0.01925	53.23	-68.69	121.92	33.17	20.05	0.01	-	-	A	H
		0.07809	49.07	-60.68	109.75	29.05	20.01	0.01	-	-	A	H
		0.1094	44.35	-62.47	106.82	24.33	20.01	0.01	-	-	QP	H
		0.14064	44.77	-59.87	104.64	24.76	20	0.01	-	-	A	H
		0.15544	52.03	-51.74	103.77	32.03	19.99	0.01	-	-	A	H
		1.286	42.25	-23.17	65.42	22.15	20	0.1	100	0	QP	H
		8.648	36.81	-32.69	69.5	16.54	20.11	0.16	-	-	QP	H
		16.252	37.24	-32.26	69.5	16.77	20.19	0.28	-	-	QP	H
		26.055	36.69	-32.81	69.5	15.94	20.49	0.26	-	-	QP	H
												H
												H
												H
		0.01925	56.9	-65.02	121.92	36.84	20.05	0.01	-	-	A	V
		0.06249	56.26	-55.43	111.69	36.19	20.06	0.01	-	-	A	V
		0.10942	52.64	-54.18	106.82	32.62	20.01	0.01	-	-	QP	V
		0.1406	52.52	-52.12	104.64	32.51	20	0.01	-	-	A	V
		0.15646	55.81	-47.91	103.72	35.81	19.99	0.01	-	-	A	V
		1.203	51.46	-14.54	66	31.36	20	0.1	100	0	QP	V
		8.928	40.72	-28.78	69.5	20.45	20.11	0.16	-	-	QP	V
		16.063	36.23	-33.27	69.5	15.76	20.18	0.29	-	-	QP	V
		27.455	35.06	-34.44	69.5	14.48	20.33	0.25	-	-	QP	V
												V
												V
												V
Remark	1. No other spurious found. 2. All results are PASS against limit line.											

X-Axis

Ant. 1	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		60.51	18.52	-57.08	75.6	38.42	11.96	0.67	32.58	100	0	P	H
		60.51	12.6	-43	55.6	-	-	-	-	-	-	A	H
		87.24	20.54	-55.06	75.6	38.01	14.28	0.74	32.59	100	0	P	H
		87.24	14.62	-40.98	55.6	-	-	-	-	-	-	A	H
	*	315	58.59	-37.01	95.6	70.09	19.56	1.4	32.56	100	225	P	H
	*	315	52.67	-22.93	75.6	-	-	-	-	-	-	A	H
		630	29.59	-46.01	75.6	33.71	26.37	1.97	32.62	100	0	P	H
		630	23.67	-31.93	55.6	-	-	-	-	-	-	A	H
		945	45.14	-30.46	75.6	43.22	30.6	2.44	31.36	100	0	P	H
		945	39.22	-16.38	55.6	-	-	-	-	-	-	A	H
		1260	30.26	-45.34	75.6	67.88	24.16	3.2	64.98	100	0	P	H
		1260	24.34	-31.26	55.6	-	-	-	-	-	-	A	H
		1575	31.77	-42.23	74	68.1	24.63	3.62	64.58	100	0	P	H
		1575	25.85	-28.15	54	-	-	-	-	-	-	A	H
315MHz		1890	36.34	-39.26	75.6	71.78	25.47	3.97	64.88	100	0	P	H
		1890	30.42	-25.18	55.6	-	-	-	-	-	-	A	H
		2205	34.04	-39.96	74	68.19	26.46	4.31	64.92	100	0	P	H
		2205	28.12	-25.88	54	-	-	-	-	-	-	A	H
		2520	34.63	-40.97	75.6	67.36	27.44	4.63	64.8	100	0	P	H
		2520	28.71	-26.89	55.6	-	-	-	-	-	-	A	H
		2835	34.88	-39.12	74	66.61	28.27	4.87	64.87	100	0	P	H
		2835	28.96	-25.04	54	-	-	-	-	-	-	A	H
		3150	36.04	-39.56	75.6	67.03	28.64	5.19	64.82	100	0	P	H
		3150	30.12	-25.48	55.6	-	-	-	-	-	-	A	H
		3937	53.94	-20.06	74	83.06	29.67	5.81	64.6	155	0	P	H
		3937	48.02	-5.98	54	-	-	-	-	-	-	A	H
		7874	42.87	-32.73	75.6	62.89	36.71	8.39	65.12	100	0	P	H
		7874	36.95	-18.65	55.6	-	-	-	-	-	-	A	H
		11811	47.45	-26.55	74	62.7	39.5	10.53	65.28	100	0	P	H

		11811	41.53	-12.47	54	-	-	-	-	-	-	A	H
		15748	44.79	-29.21	74	59.58	37.29	12.39	64.47	100	0	P	H
		15748	38.87	-15.13	54	-	-	-	-	-	-	A	H
		19685	46.1	-27.9	74	44.41	38.2	13.99	50.5	100	0	P	H
		19685	40.18	-13.82	54	-	-	-	-	-	-	A	H

Ant. 1	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
315MHz		32.16	36.36	-39.24	75.6	44.88	23.61	0.46	32.59	100	0	P	V
		32.16	30.44	-25.16	55.6	-	-	-	-	-	-	A	V
		52.95	30.49	-45.11	75.6	49.21	13.22	0.59	32.57	100	0	P	V
		52.95	24.57	-31.03	55.6	-	-	-	-	-	-	A	V
	*	315	57.88	-37.72	95.6	69.38	19.56	1.4	32.56	114	225	P	V
	*	315	51.96	-23.64	75.6	-	-	-	-	-	-	A	V
		630	28.59	-47.01	75.6	32.71	26.37	1.97	32.62	100	0	P	V
		630	22.67	-32.93	55.6	-	-	-	-	-	-	A	V
		945	47.73	-27.87	75.6	45.81	30.6	2.44	31.36	100	0	P	V
		945	41.81	-13.79	55.6	-	-	-	-	-	-	A	V
		1260	29.91	-45.69	75.6	67.53	24.16	3.2	64.98	100	0	P	V
		1260	23.99	-31.61	55.6	-	-	-	-	-	-	A	V
		1575	31.88	-42.12	74	68.21	24.63	3.62	64.58	100	0	P	V
		1575	25.96	-28.04	54	-	-	-	-	-	-	A	V
		1890	34.28	-41.32	75.6	69.72	25.47	3.97	64.88	100	0	P	V
		1890	28.36	-27.24	55.6	-	-	-	-	-	-	A	V
		2205	33.52	-40.48	74	67.67	26.46	4.31	64.92	100	0	P	V
		2205	27.6	-26.4	54	-	-	-	-	-	-	A	V
		2520	35.48	-40.12	75.6	68.21	27.44	4.63	64.8	100	0	P	V
		2520	29.56	-26.04	55.6	-	-	-	-	-	-	A	V
		2835	35.28	-38.72	74	67.01	28.27	4.87	64.87	100	0	P	V
		2835	29.36	-24.64	54	-	-	-	-	-	-	A	V
		3150	35.41	-40.19	75.6	66.4	28.64	5.19	64.82	100	0	P	V
		3150	29.49	-26.11	55.6	-	-	-	-	-	-	A	V
		3937	51.96	-22.04	74	81.08	29.67	5.81	64.6	117	191	P	V
		3937	46.04	-7.96	54	-	-	-	-	-	-	A	V
		7874	42.76	-32.84	75.6	62.78	36.71	8.39	65.12	100	0	P	V
		7874	36.84	-18.76	55.6	-	-	-	-	-	-	A	V
		11811	45.23	-28.77	74	60.48	39.5	10.53	65.28	100	0	P	V
		11811	39.31	-14.69	54	-	-	-	-	-	-	A	V

		15748	44.02	-29.98	74	58.81	37.29	12.39	64.47	100	0	P	V
		15748	38.1	-15.9	54	-	-	-	-	-	-	A	V
		19685	46.62	-27.38	74	44.93	38.2	13.99	50.5	100	0	P	V
		19685	40.7	-13.3	54	-	-	-	-	-	-	A	V

	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
LF		0.01925	54.64	-67.28	121.92	34.58	20.05	0.01	-	-	A	H
		0.07812	49.72	-60.03	109.75	29.7	20.01	0.01	-	-	A	H
		0.10938	44.76	-62.07	106.83	24.74	20.01	0.01	-	-	QP	H
		0.14064	44.78	-59.86	104.64	24.77	20	0.01	-	-	A	H
		0.15442	52.06	-51.77	103.83	32.06	19.99	0.01	-	-	A	H
		1.249	43.83	-21.85	65.68	23.73	20	0.1	100	0	QP	H
		8.408	37.04	-32.46	69.5	16.77	20.11	0.16	-	-	QP	H
		22.327	37.55	-31.95	69.5	16.77	20.51	0.27	-	-	QP	H
		27.37	37.3	-32.2	69.5	16.71	20.34	0.25	-	-	QP	H
												H
												H
												H
		0.0192	57.61	-64.33	121.94	37.55	20.05	0.01	-	-	A	V
		0.07809	56.66	-53.09	109.75	36.64	20.01	0.01	-	-	A	V
		0.10938	52.75	-54.08	106.83	32.73	20.01	0.01	-	-	QP	V
		0.14068	52.49	-52.15	104.64	32.48	20	0.01	-	-	A	V
		0.15646	57.92	-45.8	103.72	37.92	19.99	0.01	-	-	A	V
		1.264	53.11	-12.46	65.57	33.01	20	0.1	100	0	QP	V
		9.04	39.62	-29.88	69.5	19.34	20.12	0.16	-	-	QP	V
		16.603	36.38	-33.12	69.5	15.9	20.2	0.28	-	-	QP	V
		26.78	34.99	-34.51	69.5	14.33	20.41	0.25	-	-	QP	V
												V
												V
												V
Remark	1. No other spurious found. 2. All results are PASS against limit line.											

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".

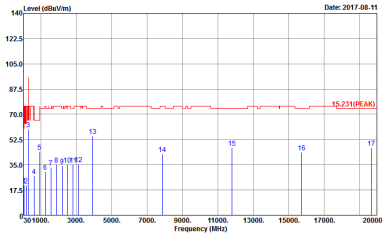
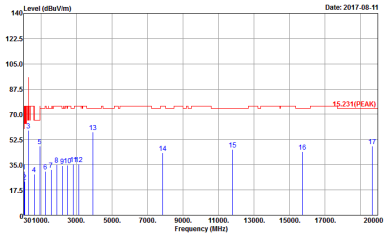
Appendix D. Radiated Spurious Emission Plots

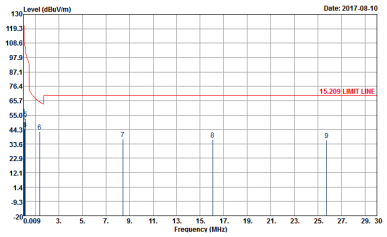
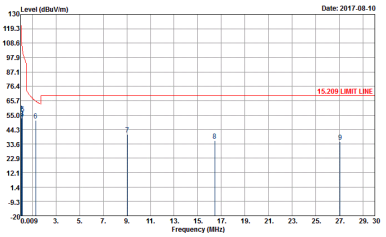
Test Engineer :	Watt Tseng and Jacky Hung	**Temperature :**	21~26°C
		Relative Humidity :	53~60%

Note symbol

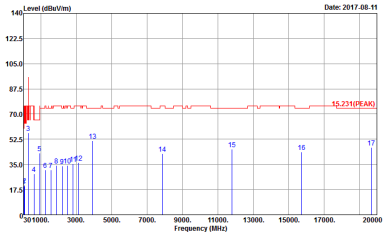
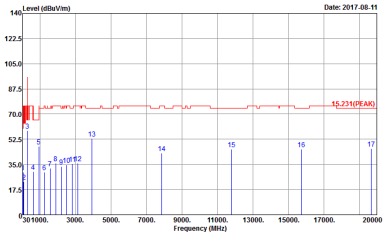
-L	**Low channel location**
-R	**High channel location**

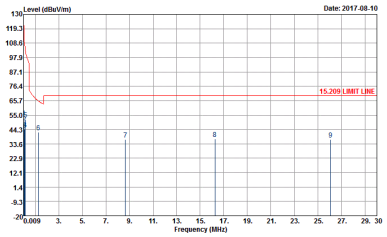
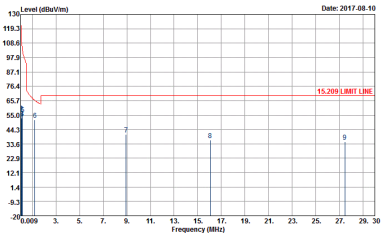
Y-Axis

ANT	**315MHz**	
1	**Horizontal**	**Vertical**
Peak		

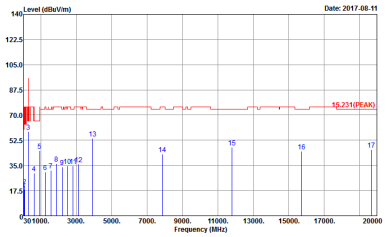
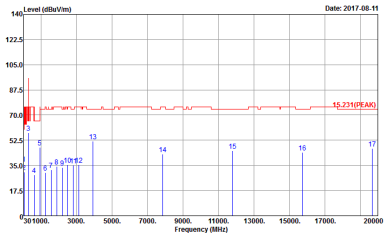
ANT	9K~30MHz	
1	Horizontal	Vertical
QP / Peak		

Z-Axis

ANT	315MHz	
1	Horizontal	Vertical
Peak		

ANT	9K~30MHz	
1	Horizontal	Vertical
QP / Peak		

X-Axis

ANT	315MHz	
1	Horizontal	Vertical
Peak		

ANT	9K~30MHz	
1	Horizontal	Vertical
QP / Peak