FCC Radio Test Report

FCC ID: 2ARP8-SG200

Report No.	:	BTL-FCCP-1-2005T134
Equipment	:	ZigBee Lighting Control Box
Model Name	:	SG200
Brand Name	:	Lumani
Applicant	:	Lumani Pte Ltd
Address	:	71 Ayer Rajah Crescent #02-10/11 Singapore 139951
Manufacturer	:	Billion Electric Co., Ltd.
Address	:	8F., No.192, Sec. 2, Zhongxing Rd., Xindian Dist., New Taipei City 231, Taiwan (R.O.C.)
Radio Function	:	ZigBee
FCC Rule Part(s)	:	FCC Part15, Subpart C (15.247)
Measurement Procedure(s)	:	ANSI C63.10-2013
Date of Receipt	:	2020/5/28
Date of Test	:	2020/5/28~ 2020/6/22
Issued Date	:	2020/6/24

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

Prepared by : Peter Chen, Engineer

Approved by : Scott Hsu , Manager

BTL Inc.

No.18, Ln. 171, Sec. 2, Jiuzong Rd., Neihu Dist., Taipei City 114, Taiwan

Tel: +886-2-2657-3299 Fax: +886-2-2657-3331 Web: www.newbtl.com

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.

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BTL's laboratory quality assurance procedures are in compliance with the **ISO/IEC 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 which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and 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.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

CONTENTS

REPORT ISSUED HISTORY		5
1	SUMMARY OF TEST RESULTS	6
1.1	TEST FACILITY	7
1.2	MEASUREMENT UNCERTAINTY	7
1.3	TEST ENVIRONMENT CONDITIONS	8
1.4	TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING	8
1.5	DUTY CYCLE	8
2	GENERAL INFORMATION	9
2.1	DESCRIPTION OF EUT	9
2.2	TEST MODES	10
2.3	BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	11
2.4	SUPPORT UNITS	12
3	AC POWER LINE CONDUCTED EMISSIONS TEST	13
3.1	LIMIT	13
3.2	TEST PROCEDURE	13
3.3	DEVIATION FROM TEST STANDARD	13
3.4	TEST SETUP	14
3.5	TEST RESULT	14
4	RADIATED EMISSIONS TEST	15
4.1	LIMIT	15
4.2	TEST PROCEDURE	16
4.3	DEVIATION FROM TEST STANDARD	16
4.4	TEST SETUP	17
4.5	EUT OPERATING CONDITIONS	18
4.6	TEST RESULT – 30 MHZ TO 1 GHZ	18
4.7	TEST RESULT – ABOVE 1 GHZ	18
5	BANDWIDTH TEST	19
5.1	APPLIED PROCEDURES / LIMIT	19
5.2	TEST PROCEDURE	19
5.3	DEVIATION FROM STANDARD	19
5.4	TEST SETUP	19
5.5	EUT OPERATION CONDITIONS	19
5.6	TEST RESULTS	19
6	OUTPUT POWER TEST	20
6.1	APPLIED PROCEDURES / LIMIT	20
6.2	TEST PROCEDURE	20
6.3	DEVIATION FROM STANDARD	20
6.4	TEST SETUP	20
6.5	EUT OPERATION CONDITIONS	20
6.6	TEST RESULTS	20
7	POWER SPECTRAL DENSITY TEST	21
7.1	APPLIED PROCEDURES / LIMIT	21
7.2	TEST PROCEDURE	21
7.3	DEVIATION FROM STANDARD	21
7.4	TEST SETUP	21
7.5	EUT OPERATION CONDITIONS	21
7.6	TEST RESULTS	21

8	ANTENNA CONDUCTED SPURIOUS EMISSION	22
8.1	APPLIED PROCEDURES / LIMIT	22
8.2	TEST PROCEDURE	22
8.3	DEVIATION FROM STANDARD	22
8.4	TEST SETUP	22
8.5	EUT OPERATION CONDITIONS	22
8.6	TEST RESULTS	22
9	LIST OF MEASURING EQUIPMENTS	23
10	EUT TEST PHOTO	25
11	EUT PHOTOS	25

APPENDIX A	AC POWER LINE CONDUCTED EMISSIONS	26
APPENDIX B	RADIATED EMISSIONS - 30 MHZ TO 1 GHZ	31
APPENDIX C	RADIATED EMISSIONS - ABOVE 1 GHZ	34
APPENDIX D	BANDWIDTH	43
APPENDIX E	OUTPUT POWER	45
APPENDIX F	POWER SPECTRAL DENSITY TEST	47
APPENDIX G	ANTENNA CONDUCTED SPURIOUS EMISSION	49

REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	2020/6/24

1 SUMMARY OF TEST RESULTS

Test procedures according to the technical standards.

FCC Part 15, Subpart C (15.247)				
Standard(s) Section	**Description**	**Test Result**	**Judgement**	**Remark**
15.207	AC Power Line Conducted Emissions	APPENDIX A	Pass	------
15.205 15.209 15.247(d)	Radiated Emissions	APPENDIX B APPENDIX C	Pass	------
15.247(a)(2)	Bandwidth	APPENDIX D	Pass	------
15.247(b)(3)	Output Power	APPENDIX E	Pass	------
15.247(e)	Power Spectral Density	APPENDIX F	Pass	------
15.247(d)	Antenna conducted Spurious Emission	APPENDIX G	Pass	------
15.203	Antenna Requirement	------	Pass	------

NOTE:
(1) ”N/A” denotes test is not applicable in this Test Report.
(2) The report format version is TP.1.1.1.

1.1 TEST FACILITY

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

No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan
The test sites and facilities are covered under FCC RN:674415; FCC DN:TW0659.

☒ C05 ☐ CB08 ☐ CB11 ☒ CB15 ☐ CB16
☒ SR06

1.2 MEASUREMENT UNCERTAINTY

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 %**. The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{cispr} requirement.

A. AC power line conducted emissions test:

Test Site	Method	Measurement Frequency Range	U,(dB)
C05	CISPR	150 kHz ~ 30MHz	3.44

B. Radiated emissions test :

Test Site	Measurement Frequency Range	U,(dB)
CB15	0.03 GHz ~ 0.2 GHz	4.17
	0.2 GHz ~ 1 GHz	4.72
	1 GHz ~ 6 GHz	5.21
	6 GHz ~ 18 GHz	5.51
	18 GHz ~ 26 GHz	3.69
	26 GHz ~ 40 GHz	4.23

C. Conducted test :

Test Item	U,(dB)
Bandwidth	1.13
Output power	1.06
Power Spectral Density	1.20
Conducted Spurious emissions	1.14
Conducted Band edges	1.13

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

1.3 TEST ENVIRONMENT CONDITIONS

Test Item	Environment Condition	Tested by
AC Power Line Conducted Emissions	24 °C, 57 %	William Wei
Radiated emissions below 1 GHz	23 °C, 70 %	John Chuang
Radiated emissions above 1 GHz	23 °C, 70 %	John Chuang
Bandwidth	24.3 °C, 49 %	Jay Kao
Output Power	24.3 °C, 49 %	Jay Kao
Power Spectral Density	24.3 °C, 49 %	Jay Kao
Antenna conducted Spurious Emission	24.3 °C, 49 %	Jay Kao

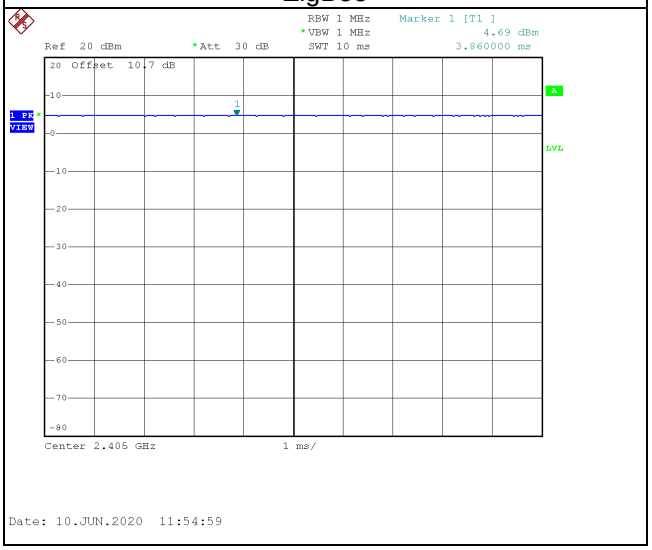
1.4 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

Test Software	Teraterm			
Modulation Mode	2405 MHz	2445 MHz	2480 MHz	Data Rate
ZigBee	8	7	-6	250 kbps

1.5 DUTY CYCLE

If duty cycle is ≥ 98 %, duty factor is not required.
If duty cycle is < 98 %, duty factor shall be considered.

ZigBee



Remark	Delta 1			Delta 2	On Time/Period	10 log(1/Duty Cycle)
Mode	ON (ms)	Numbers (ON)	On Time (B) (ms)	Period (ON+OFF) (ms)	Duty Cycle (%)	Duty Factor (dB)
ZigBee	100.000	1	100.000	100.000	100.00%	0.00

2 GENERAL INFORMATION

2.1 DESCRIPTION OF EUT

Equipment	ZigBee Lighting Control Box
Model Name	SG200
Brand Name	Lumani
Model Difference	N/A
Power Source	AC Mains.
Power Rating	I/P: AC 100~277V, 0.2A, 50/60Hz, O/P: Max.load 800VA
Products Covered	N/A
Frequency Range	2400 MHz ~ 2483.5 MHz
Operation Frequency	2405 MHz~ 2480 MHz
Modulation Technology	O-QPSK
Transfer Rate	250 kbit/s
Output Power Max.	7.67 dBm (0.0058 W)
Test Model	SG200
Sample Status	Engineering Sample
EUT Modification(s)	N/A

NOTE:

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

(2) Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

(3) Table for Filed Antenna:

Ant.	Brand	Model No.	Antenna Type	Connector	Gain (dBi)
1	M.gear	C942-510009-A	Dipole	SMA Plug Reverse	1.8

2.2 TEST MODES

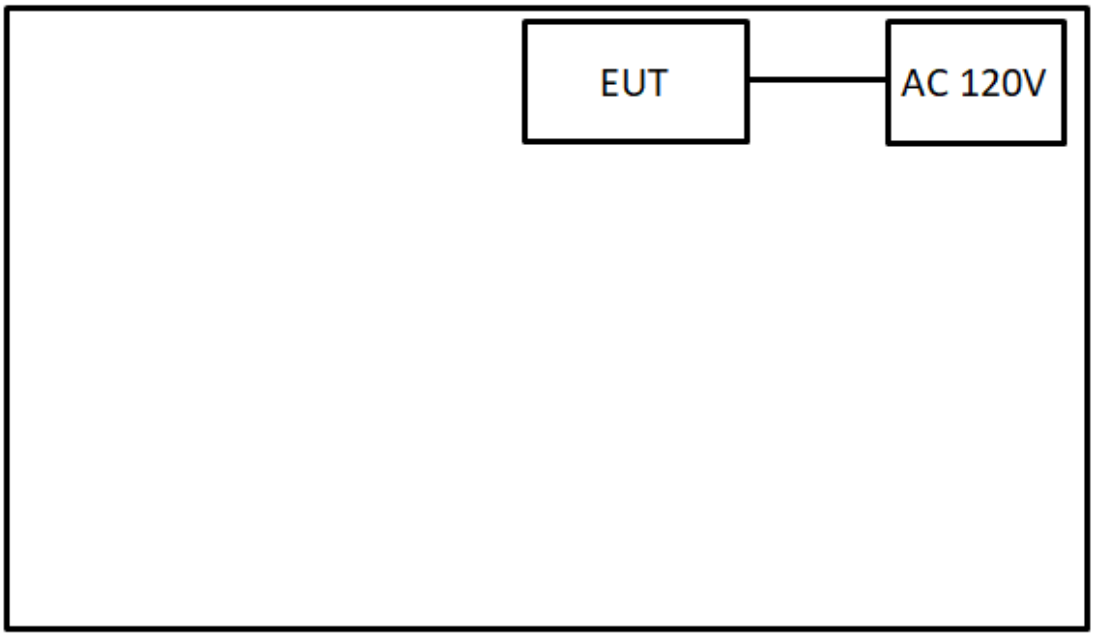
Test Items	Test mode	Channel	Note
AC power line conducted emissions	Normal/Idle	-	-
Transmitter Radiated Emissions (below 1GHz)	ZigBee	26	-
Transmitter Radiated Emissions (above 1GHz)	ZigBee	11/26	Bandedge
	ZigBee	11/19/26	Harmonic
Bandwidth	ZigBee	11/19/26	-
Output Power	ZigBee	11/19/26	-
Power Spectral Density	ZigBee	11/19/26	-
Antenna conducted Spurious Emission	ZigBee	11/19/26	-

NOTE:
(1) For radiated emission band edge test, both Vertical and Horizontal are evaluated, but only the worst case (Horizontal) is recorded.
(2) All X, Y and Z axes are evaluated, but only the worst case (X axis) is recorded.
(3) There were no emissions found below 30 MHz within 20 dB of the limit.

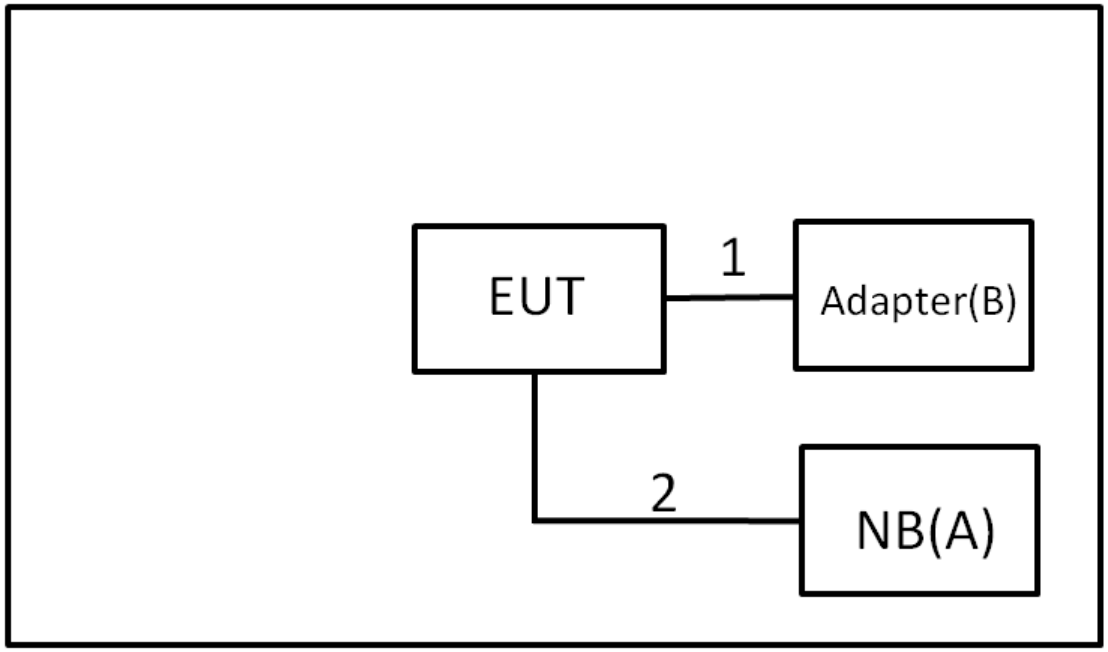
2.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Equipment letters and Cable numbers refer to item numbers described in the tables of clause 2.4.

AC Power Line Conducted Emissions



Radiated Emissions



2.4 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.	Remarks
A	NB	HP	TPN-I119	5CG7032BNS	Furnished by test lab.
B	Adapter	EGB	PAW018A12UL	N/A	Supplied by test requester.

Item	Shielded	Ferrite Core	Length	Cable Type	Remarks
1	N/A	N/A	1m	Power cable	Furnished by test lab.
2	N/A	N/A	1m	RS232 to USB Cable	Furnished by test lab.

3 AC POWER LINE CONDUCTED EMISSIONS TEST

3.1 LIMIT

Frequency (MHz)	Limit (dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56 *	56 - 46 *
0.50 - 5.0	56	46
5.0 - 30.0	60	50

NOTE:
(1) The tighter limit applies at the band edges.
(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
(3) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor
Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor (if use)
Margin Level = Measurement Value – Limit Value
Calculation example:

Reading Level		Correct Factor		Measurement Value
38.22	+	3.45	=	41.67

Measurement Value		Limit Value		Margin Level
41.67	-	60	=	-18.33

The following table is the setting of the receiver.

Receiver Parameter	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 KHz

3.2 TEST PROCEDURE

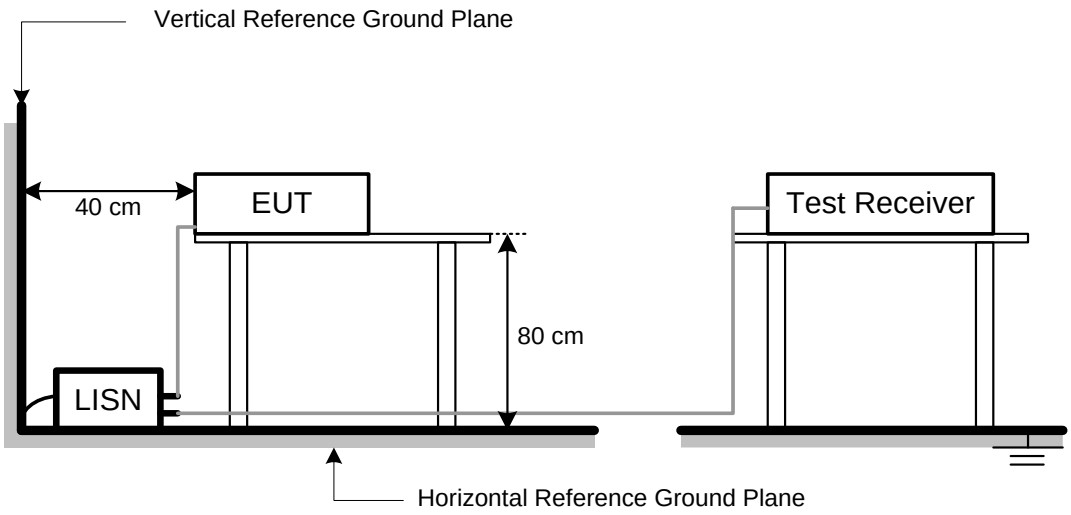
a. The EUT was placed 0.8 m above the horizontal ground plane with the EUT being connected to the power mains through a line impedance stabilization network (LISN).
All other support equipment were powered from an additional LISN(s).
The LISN provides 50 Ohm/50uH of impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle to keep the cable above 40 cm.
c. Excess I/O cables that are not connected to a peripheral shall be bundled in the center.
The end of the cable will be terminated, using the correct terminating impedance.
The overall length shall not exceed 1 m.
d. The LISN is spaced at least 80 cm from the nearest part of the EUT chassis.
e. For the actual test configuration, please refer to the related Item - 錯誤! 找不到參照來源。.

NOTE:
(1) In the results, each reading is marked as Peak, QP or AVG per the detector used.
BW=9 kHz (6 dB Bandwidth)
(2) All readings are Peak unless otherwise stated QP or AVG in column of Note. Both the QP and the AVG readings must be less than the limit for compliance.

3.3 DEVIATION FROM TEST STANDARD

No deviation.

3.4 TEST SETUP



3.5 TEST RESULT

Please refer to the APPENDIX A.

4 RADIATED EMISSIONS TEST

4.1 LIMIT

In case the emission fall within the restricted band specified on 15.205, then the 15.209 limit in the table below has to be followed.

LIMITS OF RADIATED EMISSIONS MEASUREMENT (9 kHz to 1000 MHz)

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
960~1000	500	3

LIMITS OF RADIATED EMISSIONS MEASUREMENT (Above 1000 MHz)

Frequency (MHz)	Radiated Emissions (dBuV/m)		Measurement Distance (meters)
	Peak	Average	
Above 1000	74	54	3

NOTE:
(1) The limit for radiated test was performed according to FCC Part 15, Subpart C.
(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
Calculation example:

Reading Level		Correct Factor		Measurement Value
41.91	+	-8.36	=	33.55

Measurement Value		Limit Value		Margin Level
33.55	-	43.50	=	-9.95

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

Spectrum 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

4.2 TEST PROCEDURE

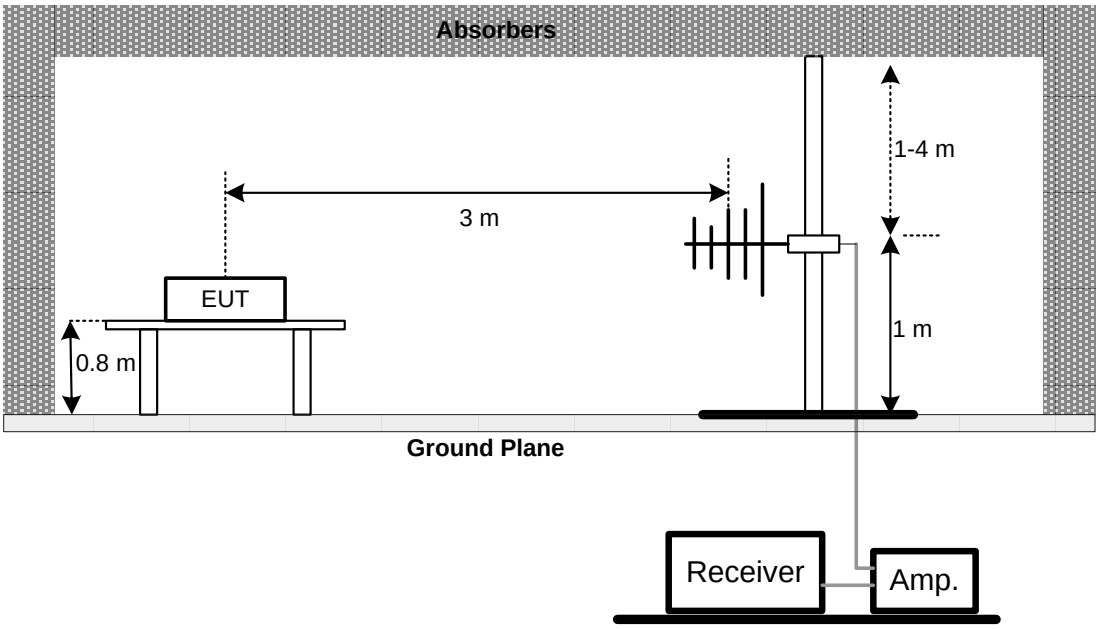
a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
b. The measuring distance 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 0.8 m or 1.5 m, 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 PHOTO.

4.3 DEVIATION FROM TEST STANDARD

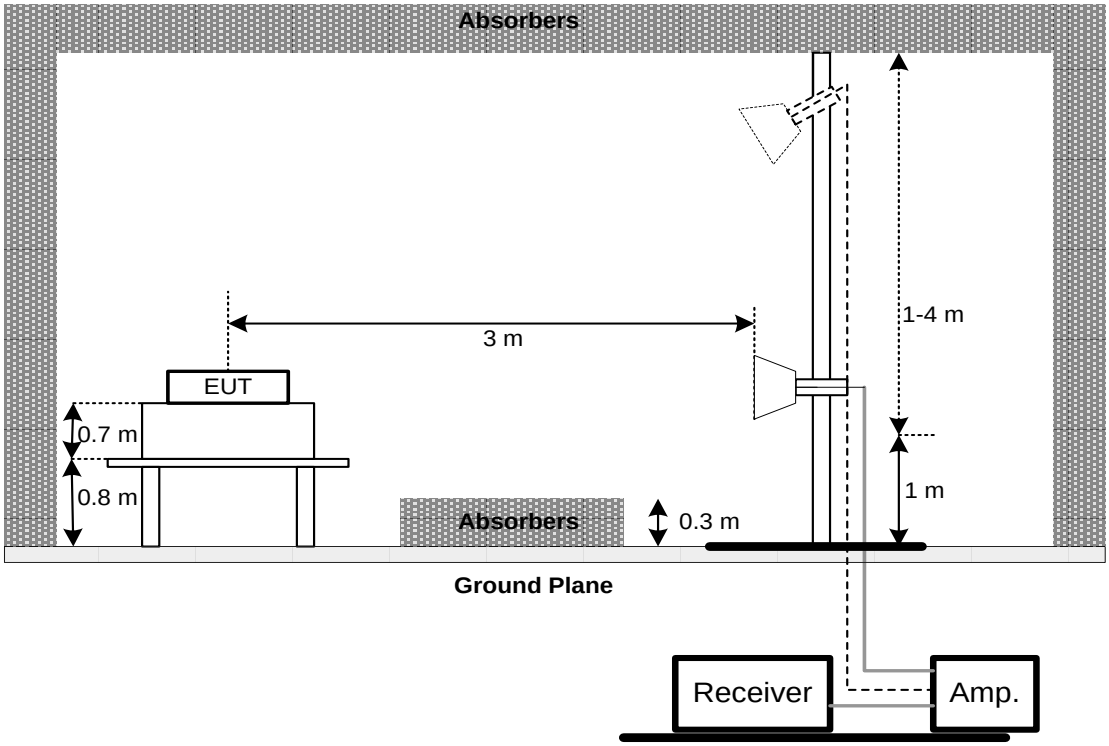
No deviation.

4.4 TEST SETUP

30 MHz to 1 GHz



Above 1 GHz



4.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

4.6 TEST RESULT – 30 MHZ TO 1 GHZ

Please refer to the APPENDIX B.

4.7 TEST RESULT – ABOVE 1 GHZ

Please refer to the APPENDIX C.

NOTE:

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

5 BANDWIDTH TEST

5.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

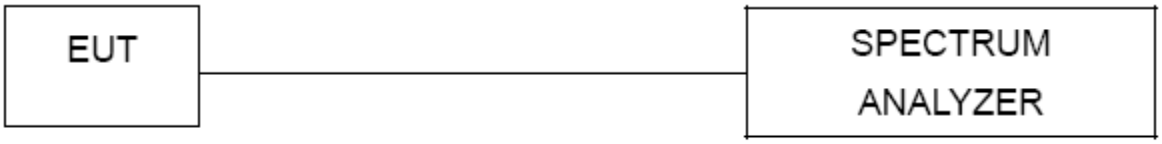
5.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 100KHz, VBW=300KHz, Sweep time = 2.5 ms.

5.3 DEVIATION FROM STANDARD

No deviation.

5.4 TEST SETUP



5.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

5.6 TEST RESULTS

Please refer to the APPENDIX D.

6 OUTPUT POWER TEST

6.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Maximum Output Power	1 watt or 30dBm	2400-2483.5	PASS

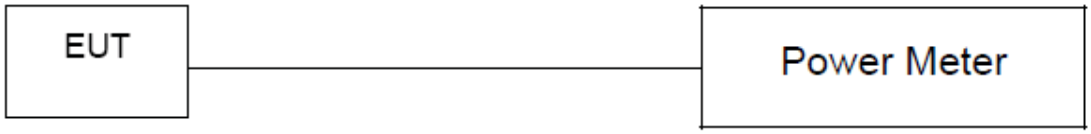
6.2 TEST PROCEDURE

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.

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

6.6 TEST RESULTS

Please refer to the APPENDIX E.

7 POWER SPECTRAL DENSITY TEST

7.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(e)	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

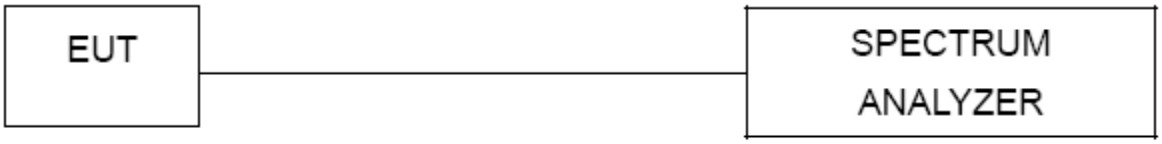
7.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting: RBW=3KHz, VBW=10 KHz, Sweep time = auto.

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

7.6 TEST RESULTS

Please refer to the APPENDIX F.

8 ANTENNA CONDUCTED SPURIOUS EMISSION

8.1 APPLIED PROCEDURES / LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.

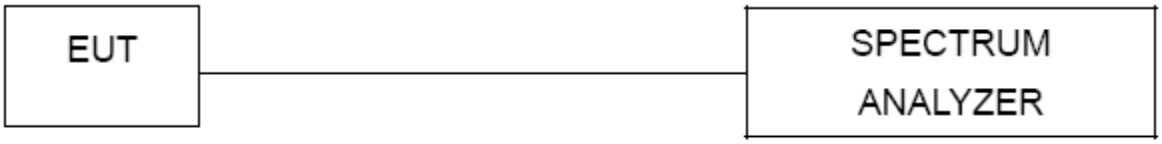
8.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 100KHz, VBW=300KHz, Sweep time = 10 ms.

8.3 DEVIATION FROM STANDARD

No deviation.

8.4 TEST SETUP



8.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

8.6 TEST RESULTS

Please refer to the APPENDIX G.

9 LIST OF MEASURING EQUIPMENTS

AC Power Line Conducted Emissions						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	TWO-LINE V-NETWORK	R&S	ENV216	101050	2020/6/11	2021/6/10
2	Test Cable	EMCI	EMC400-BM-BM-5000	170501	2019/8/15	2020/8/14
3	EMI Test Receiver	R&S	ESR7	101433	2019/12/13	2020/12/12
4	Measurement Software	EZ	EZ_EMC (Version NB-03A1-01)	N/A	N/A	N/A

Radiated Emissions						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Preamplifier	EMCI	EMC02325B	980217	2020/4/10	2021/4/9
2	Preamplifier	EMCI	EMC012645B	980267	2020/4/10	2021/4/9
3	Test Cable	EMCI	EMC104-SM-SM-800	150207	2020/4/10	2021/4/9
4	Test Cable	EMCI	EMC104-SM-SM-3000	151205	2020/4/10	2021/4/9
5	Test Cable	EMCI	EMC-SM-SM-7000	180408	2020/4/10	2021/4/9
6	MXE EMI Receiver	Agilent	N9038A	MY55420127	2020/3/24	2021/3/23
7	Signal Analyzer	Agilent	N9010A	MY56480554	2020/6/4	2021/6/3
8	Horm Ant	SCHWARZBECK	BBHA 9120D	9120D-01783	2019/8/14	2020/8/13
9	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	000352	2019/7/31	2020/7/30
10	5dB Attenuator	EMCI	EMCI-N-6-05	AT-N0625	2019/7/31	2020/7/30

Bandwidth						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP30	100854	2019/6/21	2020/6/20

Output Power						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Power Meter	Keysight	8990B	MY51000517	2020/4/6	2021/4/5
2	Power Sensor	Keysight	N1923A	MY58310005	2020/4/6	2021/4/5

Power Spectral Density						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP30	100854	2019/6/21	2020/6/20

Antenna conducted Spurious Emission						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated Date	Calibrated Until
1	Spectrum Analyzer	R&S	FSP30	100854	2019/6/21	2020/6/20

Remark: "N/A" denotes no model name, no serial no. or no calibration specified.
All calibration period of equipment list is one year.

10 EUT TEST PHOTO

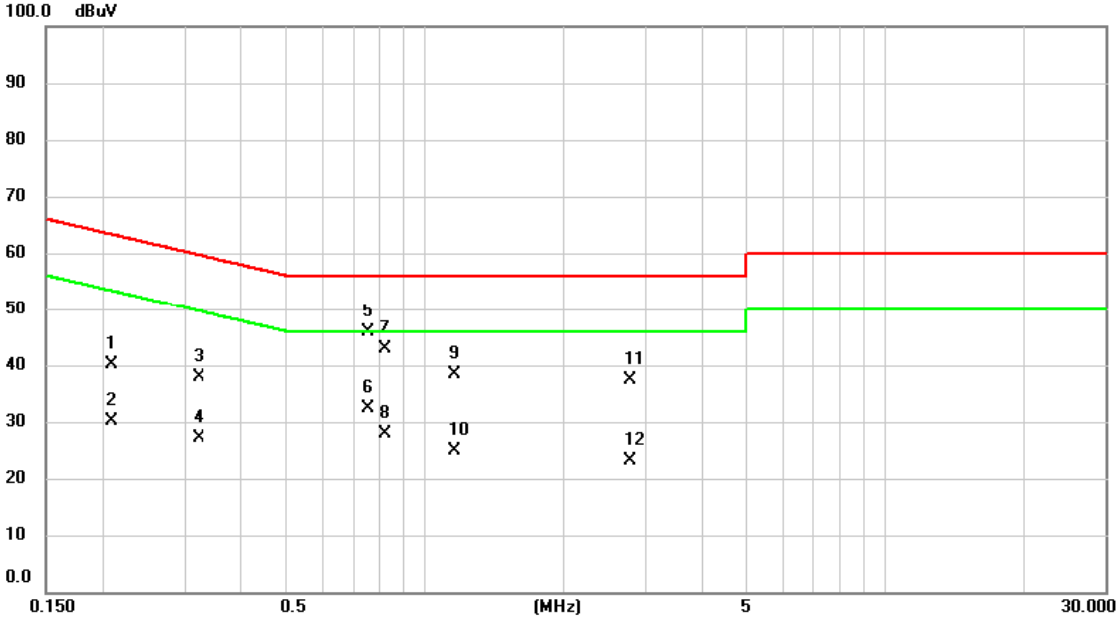
Please refer to document Appendix No.: TP-2005T134-FCCP-1 (APPENDIX-TEST PHOTOS).

11 EUT PHOTOS

Please refer to document Appendix No.: EP-2005T134-1 (APPENDIX-EUT PHOTOS).

APPENDIX A AC POWER LINE CONDUCTED EMISSIONS

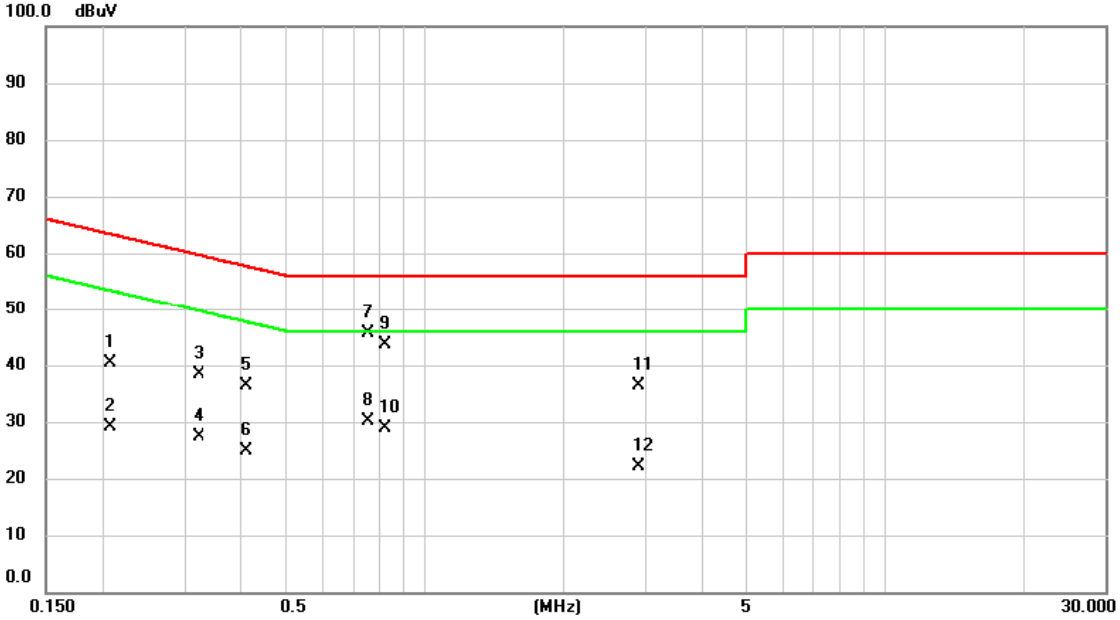
Test Mode	Normal	Tested Date	2020/6/22
Test Voltage	AC 120V/60Hz	Phase	Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2085	30.40	9.63	40.03	63.26	-23.23	QP	
2		0.2085	20.39	9.63	30.02	53.26	-23.24	AVG	
3		0.3232	28.16	9.68	37.84	59.62	-21.78	QP	
4		0.3232	17.54	9.68	27.22	49.62	-22.40	AVG	
5	*	0.7530	36.18	9.70	45.88	56.00	-10.12	QP	
6		0.7530	22.68	9.70	32.38	46.00	-13.62	AVG	
7		0.8227	33.23	9.70	42.93	56.00	-13.07	QP	
8		0.8227	18.11	9.70	27.81	46.00	-18.19	AVG	
9		1.1557	28.77	9.70	38.47	56.00	-17.53	QP	
10		1.1557	15.09	9.70	24.79	46.00	-21.21	AVG	
11		2.7938	27.70	9.75	37.45	56.00	-18.55	QP	
12		2.7938	13.43	9.75	23.18	46.00	-22.82	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

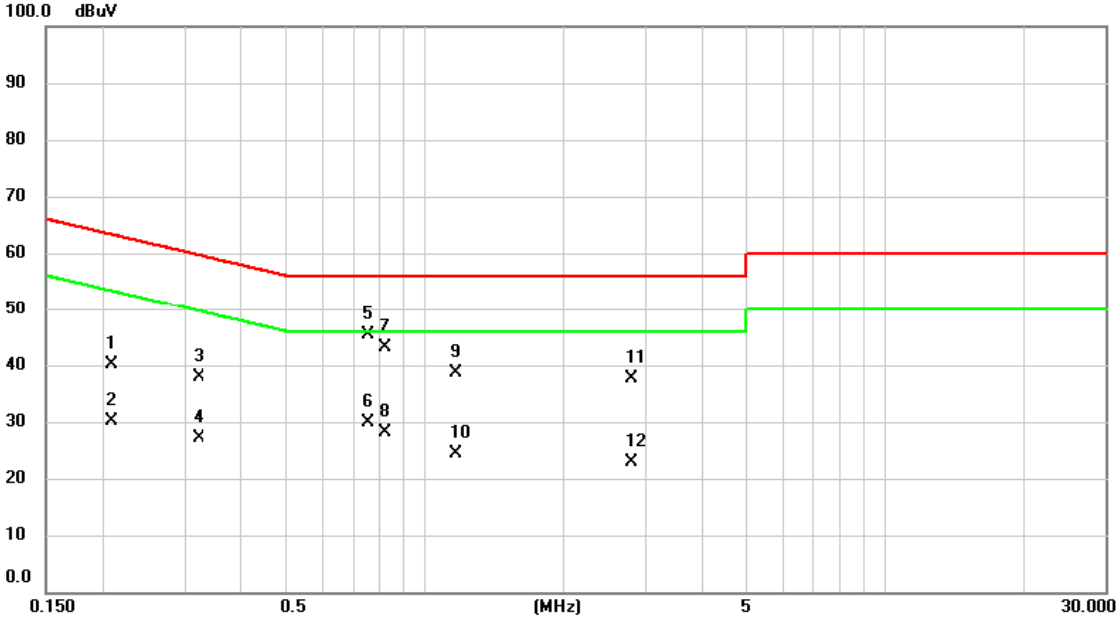
Test Mode	Normal	Tested Date	2020/6/22
Test Voltage	AC 120V/60Hz	Phase	Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2063	30.65	9.63	40.28	63.35	-23.07	QP	
2		0.2063	19.38	9.63	29.01	53.35	-24.34	AVG	
3		0.3232	28.59	9.68	38.27	59.62	-21.35	QP	
4		0.3232	17.80	9.68	27.48	49.62	-22.14	AVG	
5		0.4110	26.82	9.68	36.50	57.63	-21.13	QP	
6		0.4110	15.24	9.68	24.92	47.63	-22.71	AVG	
7	*	0.7552	35.89	9.70	45.59	56.00	-10.41	QP	
8		0.7552	20.49	9.70	30.19	46.00	-15.81	AVG	
9		0.8227	33.86	9.70	43.56	56.00	-12.44	QP	
10		0.8227	19.14	9.70	28.84	46.00	-17.16	AVG	
11		2.9085	26.64	9.75	36.39	56.00	-19.61	QP	
12		2.9085	12.36	9.75	22.11	46.00	-23.89	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

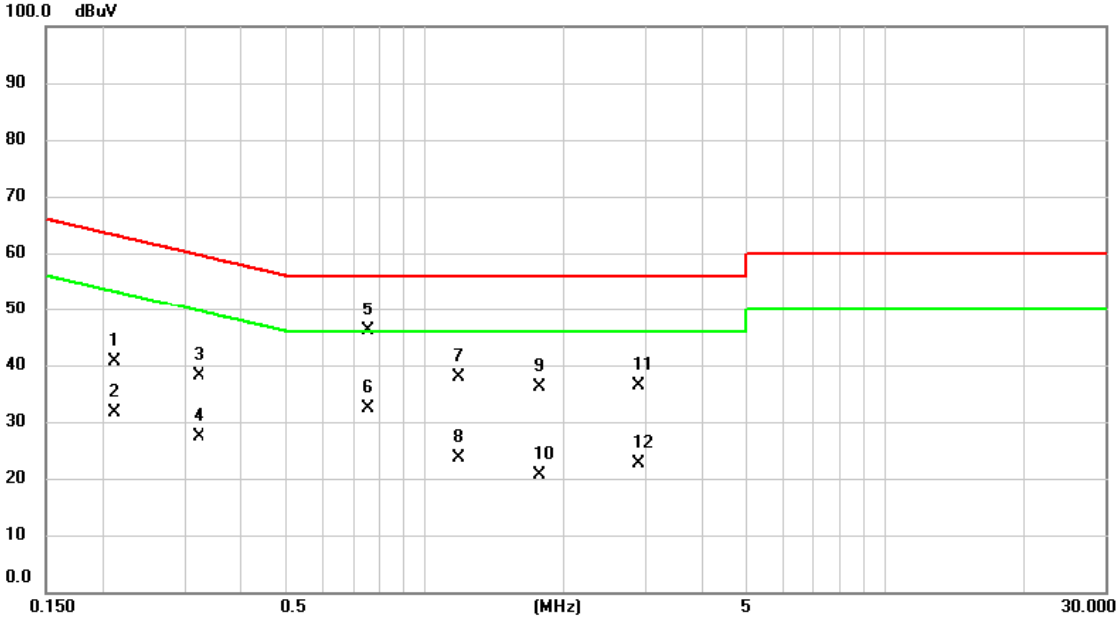
Test Mode	Idle	Tested Date	2020/6/22
Test Voltage	AC 120V/60Hz	Phase	Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2085	30.53	9.63	40.16	63.26	-23.10	QP	
2		0.2085	20.47	9.63	30.10	53.26	-23.16	AVG	
3		0.3232	28.14	9.68	37.82	59.62	-21.80	QP	
4		0.3232	17.48	9.68	27.16	49.62	-22.46	AVG	
5	*	0.7552	35.59	9.70	45.29	56.00	-10.71	QP	
6		0.7552	20.24	9.70	29.94	46.00	-16.06	AVG	
7		0.8227	33.36	9.70	43.06	56.00	-12.94	QP	
8		0.8227	18.31	9.70	28.01	46.00	-17.99	AVG	
9		1.1715	28.85	9.70	38.55	56.00	-17.45	QP	
10		1.1715	14.70	9.70	24.40	46.00	-21.60	AVG	
11		2.7983	27.77	9.75	37.52	56.00	-18.48	QP	
12		2.7983	13.11	9.75	22.86	46.00	-23.14	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	Idle	Tested Date	2020/6/22
Test Voltage	AC 120V/60Hz	Phase	Neutral

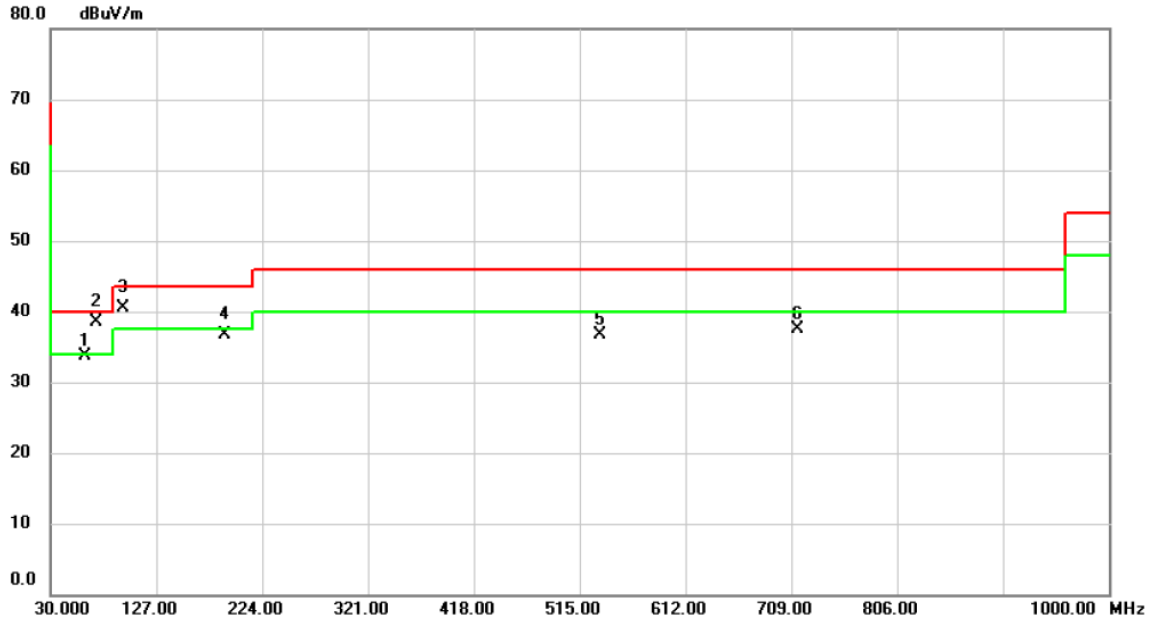


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2108	30.96	9.63	40.59	63.17	-22.58	QP	
2		0.2108	22.08	9.63	31.71	53.17	-21.46	AVG	
3		0.3232	28.50	9.68	38.18	59.62	-21.44	QP	
4		0.3232	17.58	9.68	27.26	49.62	-22.36	AVG	
5	*	0.7530	36.51	9.70	46.21	56.00	-9.79	QP	
6		0.7530	22.56	9.70	32.26	46.00	-13.74	AVG	
7		1.1805	28.08	9.70	37.78	56.00	-18.22	QP	
8		1.1805	13.90	9.70	23.60	46.00	-22.40	AVG	
9		1.7678	26.48	9.73	36.21	56.00	-19.79	QP	
10		1.7678	10.89	9.73	20.62	46.00	-25.38	AVG	
11		2.9018	26.62	9.75	36.37	56.00	-19.63	QP	
12		2.9018	12.92	9.75	22.67	46.00	-23.33	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX B RADIATED EMISSIONS - 30 MHZ TO 1 GHZ

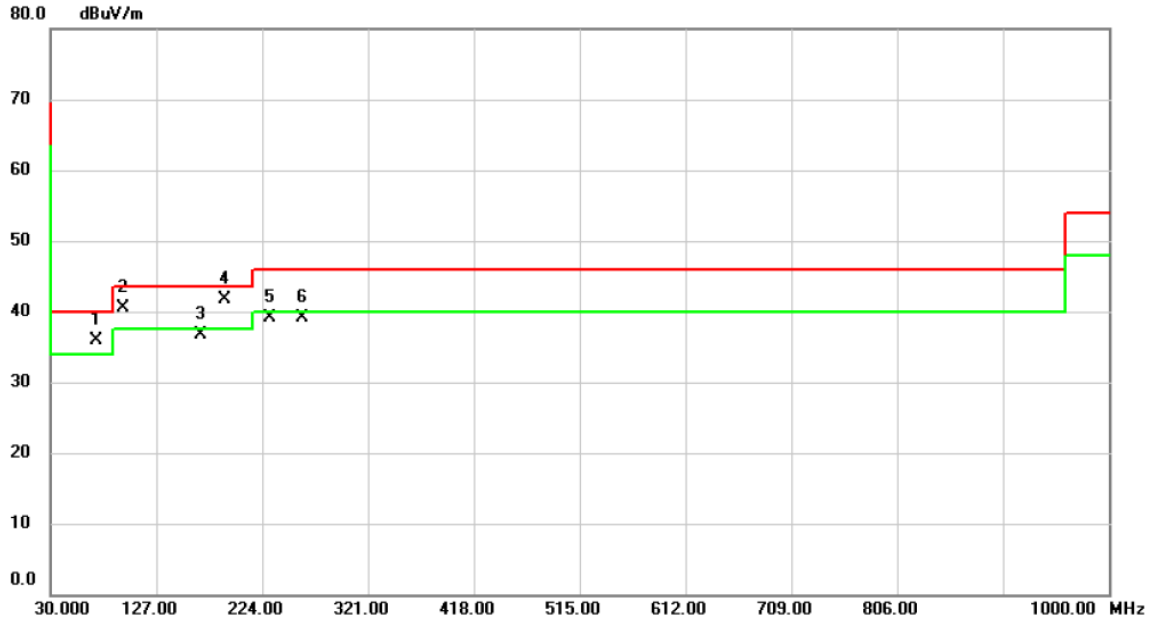
Test Mode	TX Mode 2480MHz_CH26	Tested Date	2020/6/10
Test Voltage	AC 120V/60Hz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		62.0100	42.69	-8.93	33.76	40.00	-6.24	peak	
2	*	71.7100	49.64	-11.06	38.58	40.00	-1.42	QP	
3	!	95.9600	54.12	-13.52	40.60	43.50	-2.90	QP	
4		190.0500	46.69	-10.00	36.69	43.50	-6.81	QP	
5		533.4300	38.80	-2.00	36.80	46.00	-9.20	peak	
6		714.8200	36.00	1.42	37.42	46.00	-8.58	peak	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	TX Mode 2480MHz_CH26	Tested Date	2020/6/10
Test Voltage	AC 120V/60Hz	Polarization	Horizontal

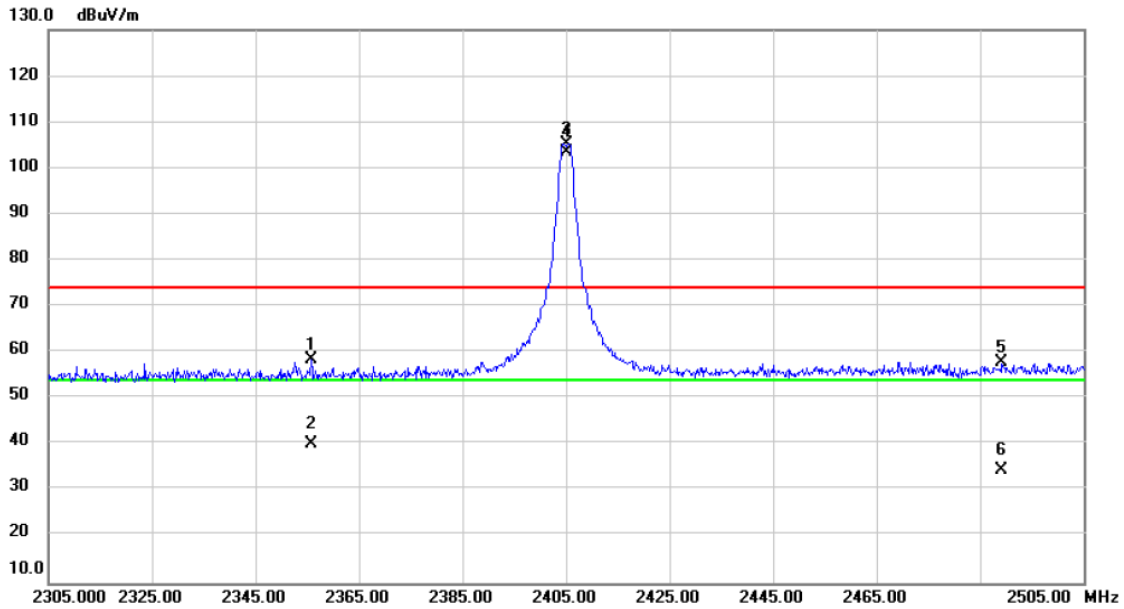


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	!	71.7100	46.89	-11.06	35.83	40.00	-4.17	QP	
2	!	95.9600	54.09	-13.52	40.57	43.50	-2.93	QP	
3		167.7400	45.09	-8.32	36.77	43.50	-6.73	QP	
4	*	189.0800	51.68	-9.94	41.74	43.50	-1.76	QP	
5		230.7900	48.87	-9.81	39.06	46.00	-6.94	QP	
6		260.8600	47.90	-8.77	39.13	46.00	-6.87	QP	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX C RADIATED EMISSIONS - ABOVE 1 GHZ

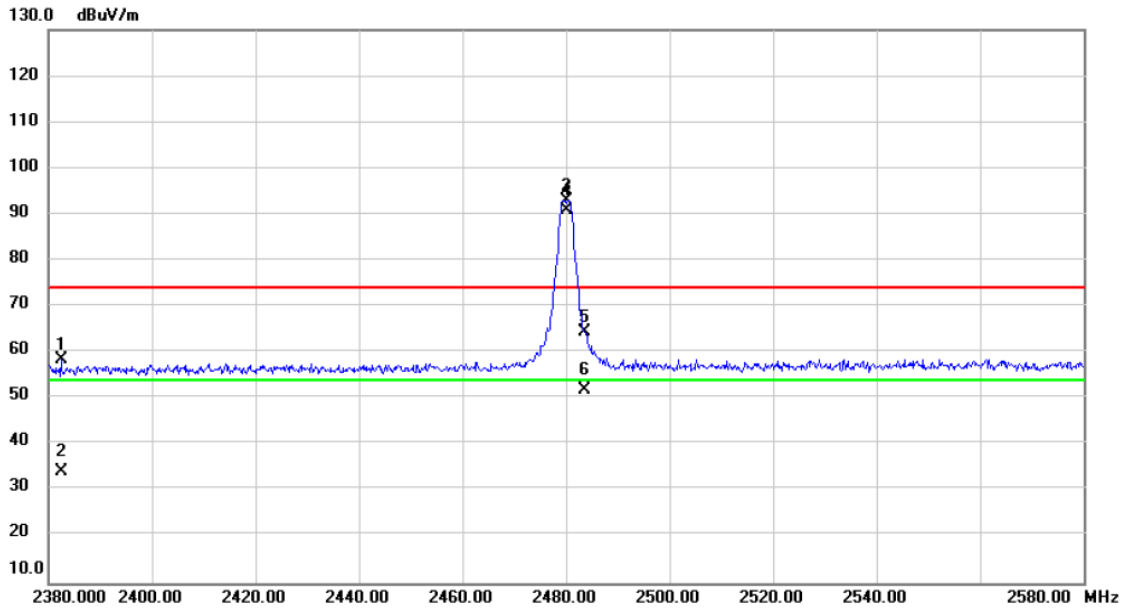
Test Mode	TX Mode 2405MHz_CH11	Tested Date	2020/6/10
Test Voltage	AC 120V/60Hz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2355.800	27.34	30.98	58.32	74.00	-15.68	peak	
2		2355.800	9.14	30.98	40.12	54.00	-13.88	AVG	
3	X	2405.000	74.01	31.17	105.18	74.00	31.18	peak	No Limit
4	*	2405.000	72.17	31.17	103.34	54.00	49.34	AVG	No Limit
5		2489.200	26.21	31.49	57.70	74.00	-16.30	peak	
6		2489.200	2.95	31.49	34.44	54.00	-19.56	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

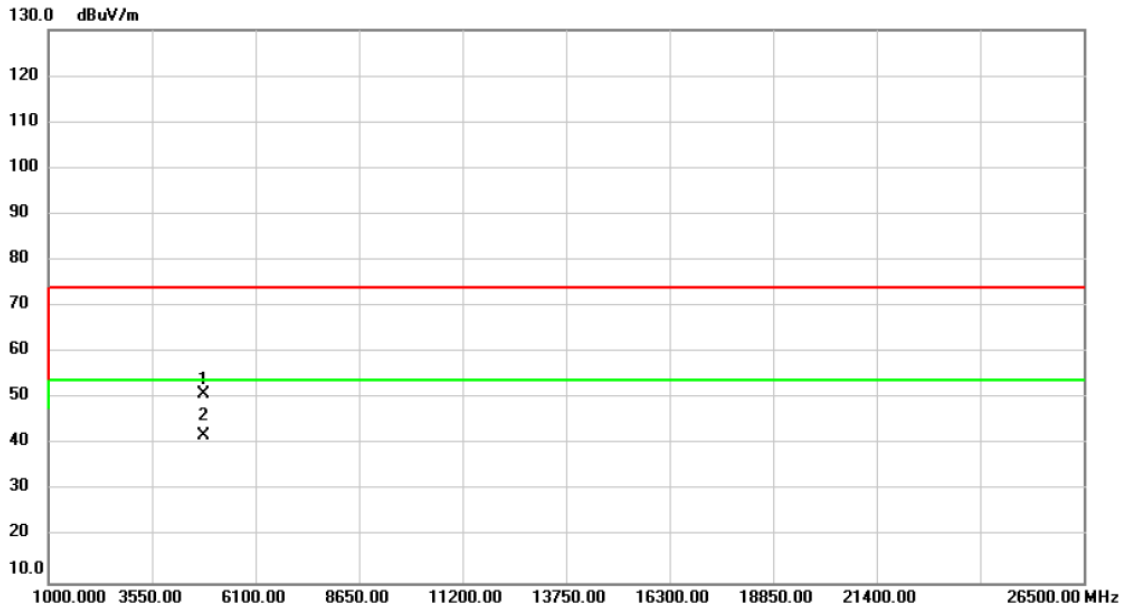
Test Mode	TX Mode 2480MHz_CH26	Tested Date	2020/6/10
Test Voltage	AC 120V/60Hz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2382.400	27.28	31.08	58.36	74.00	-15.64	peak	
2		2382.400	3.11	31.08	34.19	54.00	-19.81	AVG	
3	X	2480.000	61.64	31.46	93.10	74.00	19.10	peak	No Limit
4	*	2480.000	59.42	31.46	90.88	54.00	36.88	AVG	No Limit
5		2483.500	32.86	31.47	64.33	74.00	-9.67	peak	
6		2483.500	20.29	31.47	51.76	54.00	-2.24	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

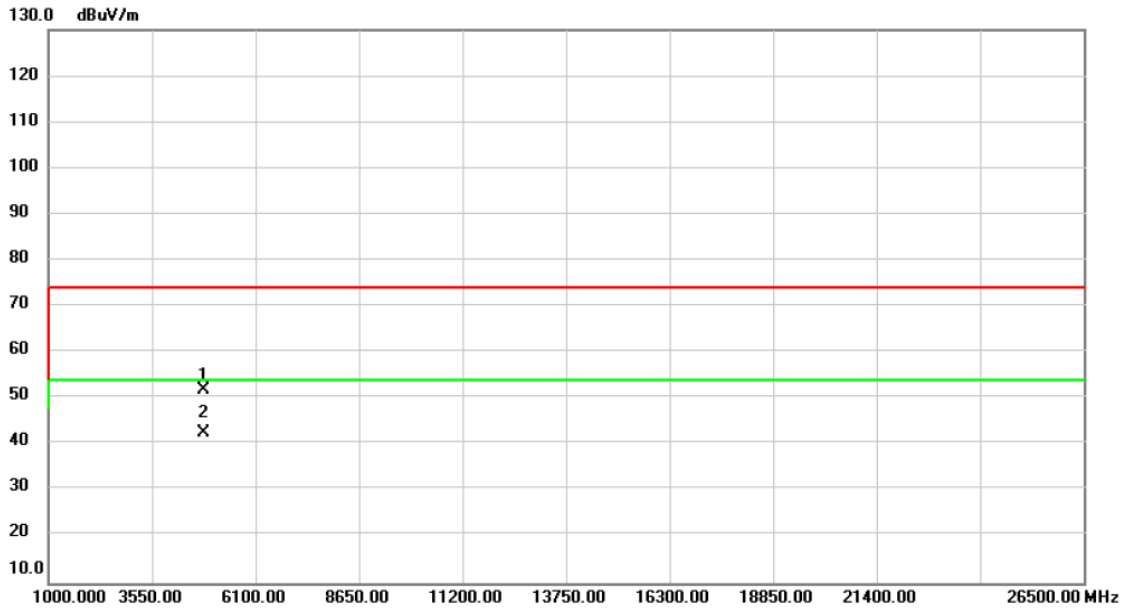
Test Mode	TX Mode 2405MHz_CH11	Tested Date	2020/6/10
Test Voltage	AC 120V/60Hz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4810.000	61.06	-9.98	51.08	74.00	-22.92	peak	
2	*	4810.000	51.94	-9.98	41.96	54.00	-12.04	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

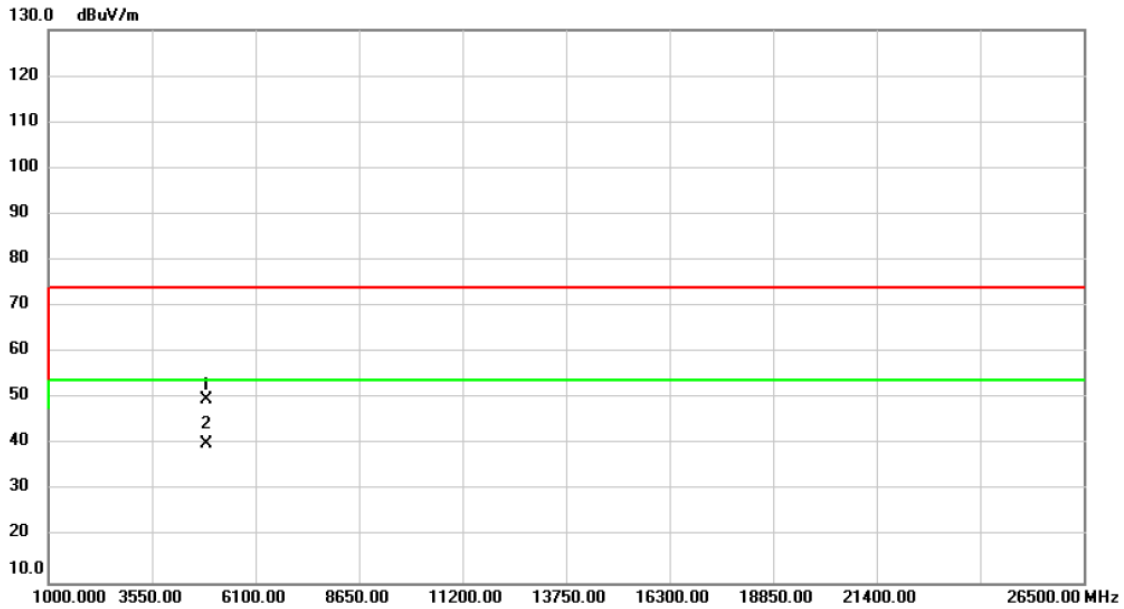
Test Mode	TX Mode 2405MHz_CH11	Tested Date	2020/6/10
Test Voltage	AC 120V/60Hz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4810.000	61.73	-9.98	51.75	74.00	-22.25	peak	
2	*	4810.000	52.43	-9.98	42.45	54.00	-11.55	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

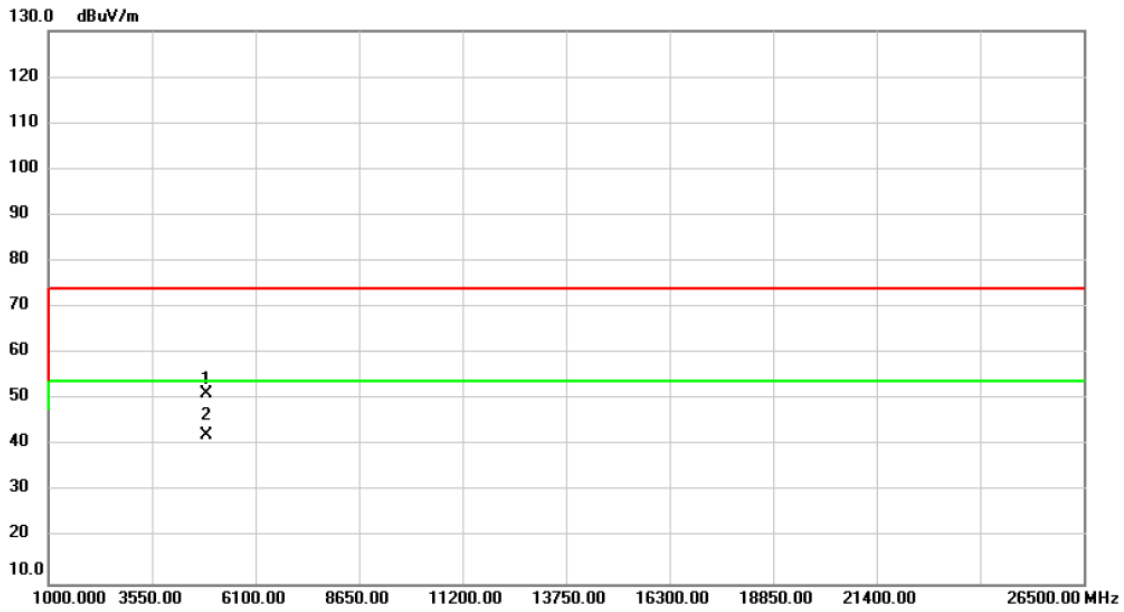
Test Mode	TX Mode 2445MHz_CH19	Tested Date	2020/6/10
Test Voltage	AC 120V/60Hz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4890.000	59.43	-9.68	49.75	74.00	-24.25	peak	
2	*	4890.000	49.82	-9.68	40.14	54.00	-13.86	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

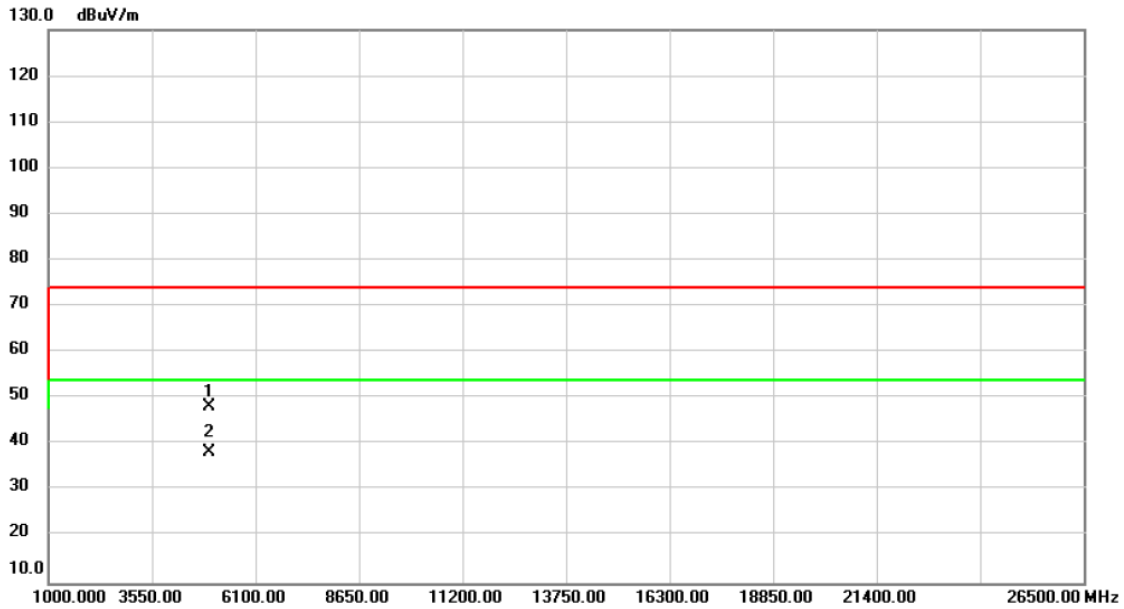
Test Mode	TX Mode 2445MHz_CH19	Tested Date	2020/6/10
Test Voltage	AC 120V/60Hz	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4890.000	60.81	-9.68	51.13	74.00	-22.87	peak	
2	*	4890.000	52.07	-9.68	42.39	54.00	-11.61	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

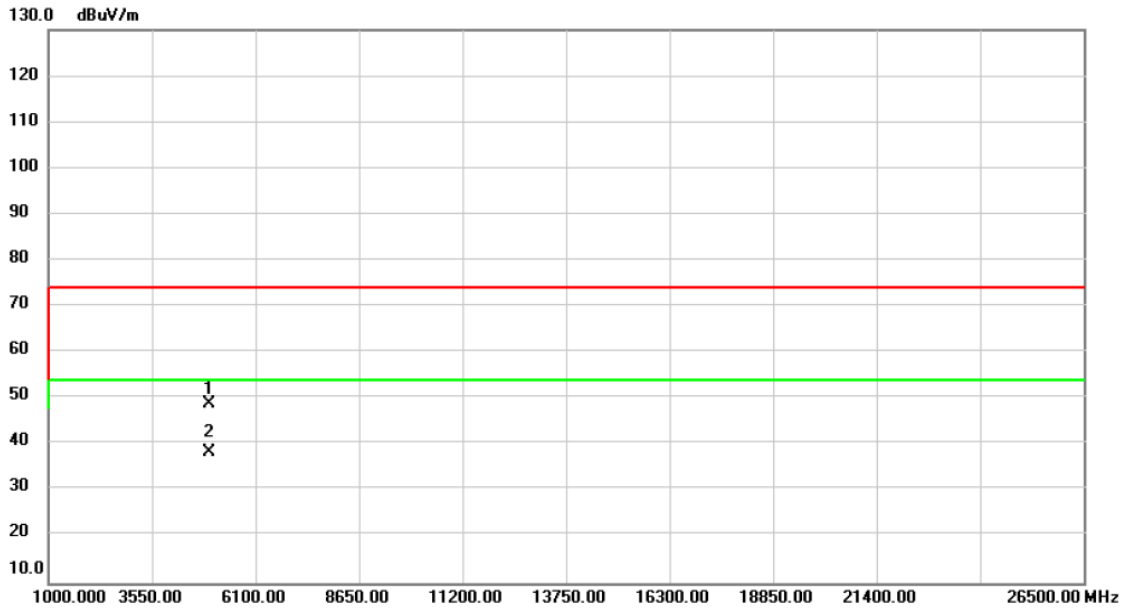
Test Mode	TX Mode 2480MHz_CH26	Tested Date	2020/6/10
Test Voltage	AC 120V/60Hz	Polarization	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	57.62	-9.41	48.21	74.00	-25.79	peak	
2	*	4960.000	47.85	-9.41	38.44	54.00	-15.56	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Test Mode	TX Mode 2480MHz_CH26	Tested Date	2020/6/10
Test Voltage	AC 120V/60Hz	Polarization	Horizontal



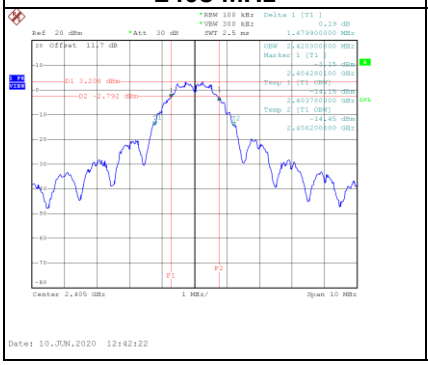
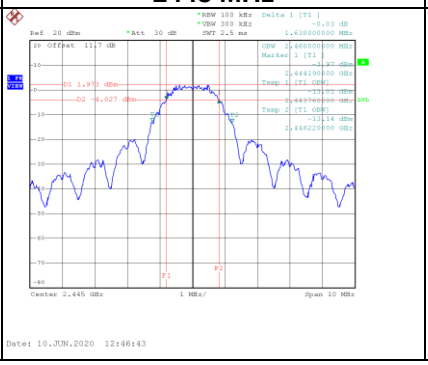
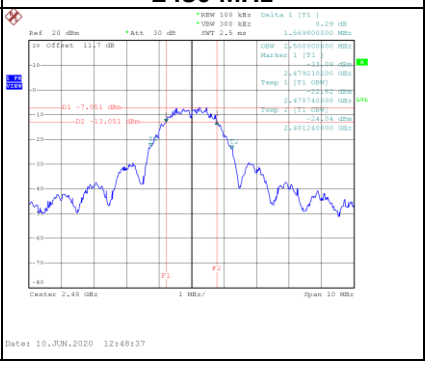
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	58.24	-9.41	48.83	74.00	-25.17	peak	
2	*	4960.000	47.71	-9.41	38.30	54.00	-15.70	AVG	

REMARKS:
(1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

APPENDIX D BANDWIDTH

Test Mode:	TX Mode
Test Voltage	AC 120V/60Hz

Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied BW (MHz)	Min. Limit (kHz)	Test Result
2405	1.48	2.42	500	Pass
2445	1.63	2.46	500	Pass
2480	1.57	2.50	500	Pass

2405 MHz	2445 MHz	2480 MHz
		

APPENDIX E OUTPUT POWER

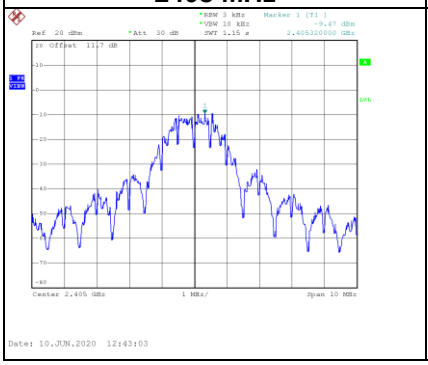
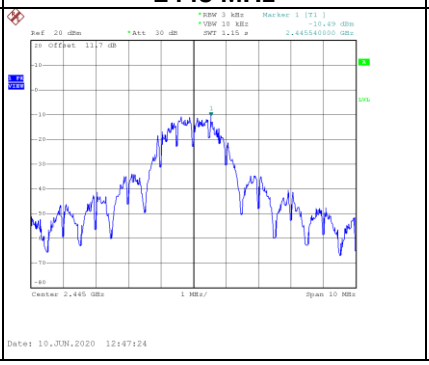
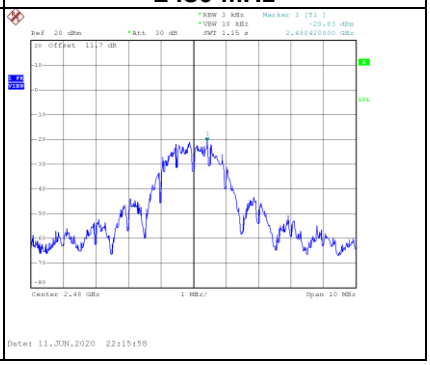
Test Mode :	TX Mode	Tested Date	2020/6/10
Test Voltage	AC 120V/60Hz		

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Max. Limit (dBm)	Max. Limit (W)	Test Result
2405	7.67	0.0058	30.00	1.0000	Pass
2445	7.36	0.0054	30.00	1.0000	Pass
2480	-4.66	0.0003	30.00	1.0000	Pass

APPENDIX F POWER SPECTRAL DENSITY TEST

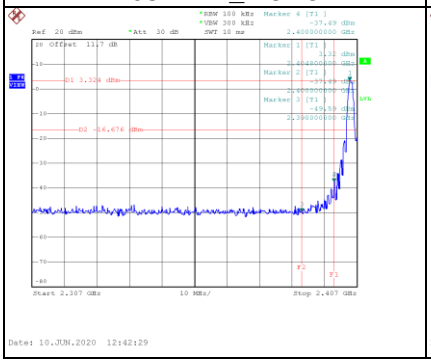
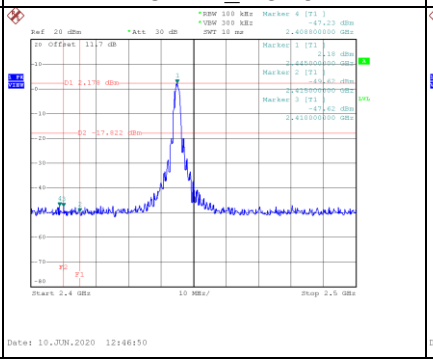
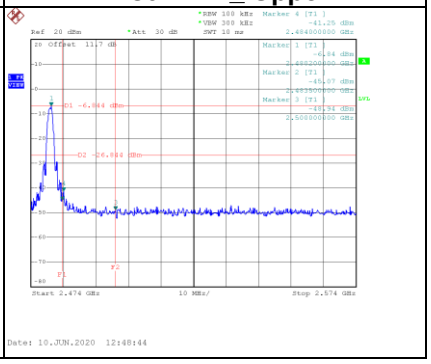
Test Mode:	TX Mode
Test Voltage	AC 120V/60Hz

Frequency (MHz)	Power Density (dBm/3kHz)	Max. Limit (dBm/3kHz)	Test Result
2405	-9.47	8	Pass
2445	-10.49	8	Pass
2480	-20.83	8	Pass

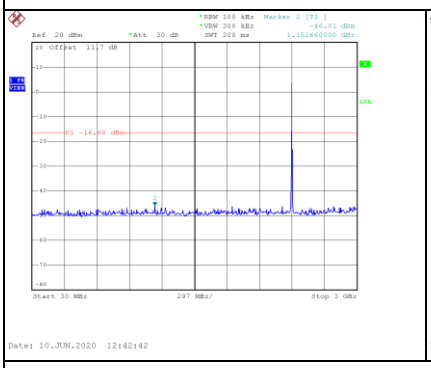
2405 MHz	2445 MHz	2480 MHz
		

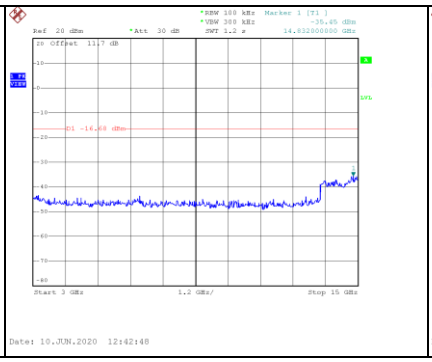
APPENDIX G ANTENNA CONDUCTED SPURIOUS EMISSION

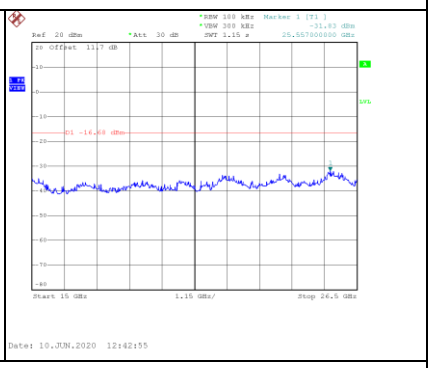
Test Mode :	TX Mode
Test Voltage	AC 120V/60Hz

2405 MHz _ Lower	2445 MHz_ Lower	2480 MHz _ Upper
		

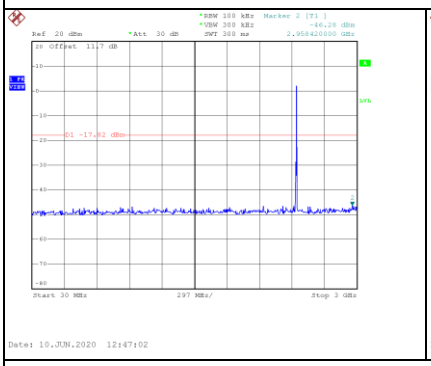
2405 MHz – 10th Harmonics

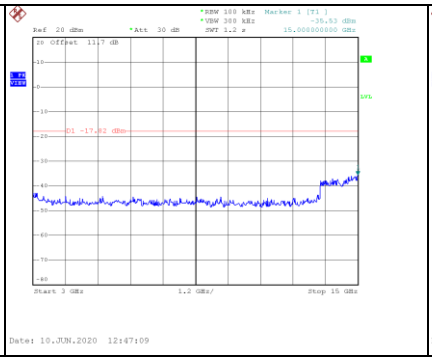


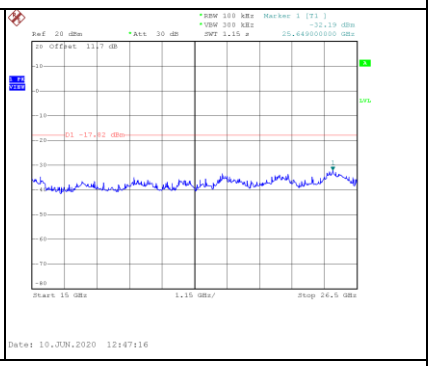




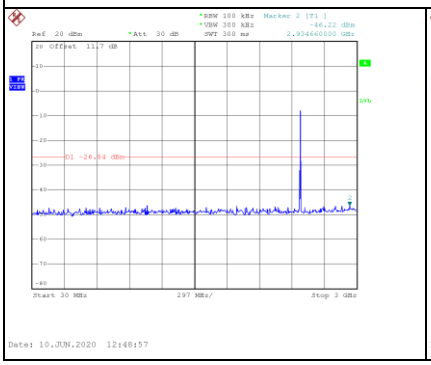
2445 MHz – 10th Harmonics

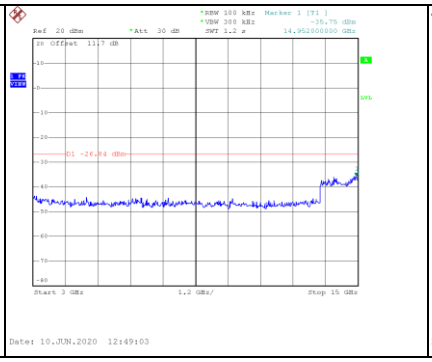


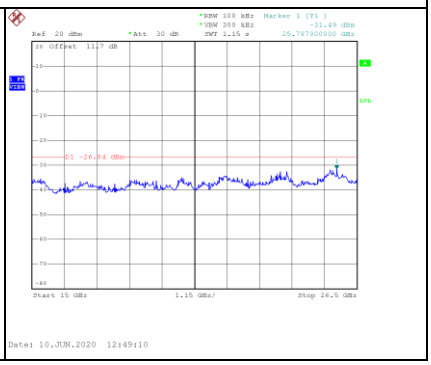




2480 MHz – 10th Harmonics







End of Test Report