

TEST REPORT

of

FCC Part 15 Subpart C

☒ New Application; ☐ Class I PC; ☐ Class II PC

Product : Card Reader
Brand: TOP
Model: CMS100
Model Difference: N/A
FCC ID: 2AUZVCMS100
FCC Rule Part: §15.231 (a)
Applicant: Top Vending Machine Electronics Co.,Ltd.
Address: No.11, Anzhong St., Luzhu Dist., Taoyuan City 33868, Taiwan (R.O.C.)

Test Performed by:
International Standards Laboratory Corp.

<LT Lab.>

*Site Registration No.

BSMI: SL2-IN-E-0013; MRA TW1036; TAF: 0997

*Address:

No. 120, Lane 180, Hsin Ho Rd.

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Report No.: ISL-19LR329FC433

Issue Date : 2019/12/10

Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.

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VERIFICATION OF COMPLIANCE

Applicant: Top Vending Machine Electronics Co.,Ltd.
Product Description: Card Reader
Brand Name: TOP
FCC ID: 2AUZVCMS100
FCC Rule Part: §15.231 (a)
Model No.: CMS100
Model Difference: N/A
Date of test: 2019/11/01 ~ 2019/12/09
Date of EUT Received: 2019/11/01

We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory Corp.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

Test By:		Date:	2019/12/10
	<i>Bill Huang / Engineer</i>		
Prepared By:		Date:	2019/12/10
	<i>Gigi Yeh / Sr. Engineer</i>		
Approved By:		Date:	2019/12/10
	<i>Jerry Liu / Technical Manger</i>		

Version

Version No.	Date	Description
00	2019/12/10	Initial creation of document

Uncertainty of Measurement

Description Of Test	Uncertainty
Conducted Emission (AC power line)	2.586 dB
Field Strength of Spurious Radiation	<=30MHz: 2.96dB 30-1GHz: 4.22 dB 1-40 GHz: 4.08 dB
Conducted Power	2.412 GHz: 1.30 dB 5.805 GHz: 1.55 dB
Power Density	2.412 GHz: 1.30 dB 5.805 GHz: 1.67 dB
Frequency	0.0032%
Time	0.01%
DC Voltage	1%

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1. General Information

1.1 Product Description

Product Name	Card Reader
Brand Name	TOP
Model Name	CMS100
Model Difference	N/A
Power Supply	3Vdc from coin battery

TX:

Operating Frequency	411MHz~441MHz
Transmit Power	85.81dBuV/m at 3m
Modulation Technique	FSK
Number of Channels	31
Channel Spacing	1MHz
Antenna Type	PCB Antenna
Antenna Gain	3 dBi

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: **2AUZVCMS100** filing to comply with Section 15.231 (a1) of the FCC Part 15, Subpart C., Subpart C Rules filing to comply.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in C63.10: 2013. Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of **International Standards Laboratory Corp.** <LT Lab.> No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.10: 2013. FCC Registration Number is: 487532; Designation Number is: TW0997.

1.5 Special Accessories

Not available for this EUT intended for grant.

1.6 Equipment Modifications

Not available for this EUT intended for grant.

2. System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT (Transmitter) was tested with a test program to fix the Tx frequency that was for the purpose of the measurements. For more information please see test data and APPENDIX 1 for set-up photographs.

2.3 Test Procedure

2.3.1 Conducted Emissions (Not apply in the report)

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10: 2013. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR 16-1-1 Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m/1.5m(Frequency above 1GHz) above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 6 and 11 of ANSI C63.10: 2013.

2.4 Limitation

(1) Conducted Emission

Frequency range MHz	Limits dB (uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

(2) Radiated Emission

According to 15.231(a) the field strength of emissions from Intentional Radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	50
130-174	¹ 1,250 to 3,750	¹ 125 to 375
174-260	3,750	375
260-470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1250

¹Linear interpolations.

- Remark:
1. Emission level in dBuV/m = $20 \log (\mu\text{V/m})$
 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
 3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of ξ 15.205
 4. Emission spurious frequency which appearing within the Restricted Bands specified in provision of ξ 15.205, then the general radiated emission limits in ξ 15.209 apply.
 5. For the band 130-174MHz, $\mu\text{V/m}$ at 3meters = $56.81818 * F(\text{MHz}) - 6136.3636$;
For the band 260-470MHz $\mu\text{V/m}$ at 3meters = $41.6667 * F(\text{MHz}) - 7083.3333$;
Where F is the frequency in MHz.
 6. 411MHz AV limit = $41.6667 * 411(\text{MHz}) - 7083.3333 = 10041.68 \mu\text{V/m}$
= 80.04dBuV/m
 7. 411MHz Peak limit = AV Limit + 20dB = 100.03MHz
 8. 426MHz AV limit = $41.6667 * 426(\text{MHz}) - 7083.3333 = 10666.68 \mu\text{V/m}$
= 80.56dBuV/m
 9. 426MHz Peak limit = AV Limit + 20dB = 100.56MHz
 10. 441MHz AV limit = $41.6667 * 441(\text{MHz}) - 7083.3333 = 11291.68 \mu\text{V/m}$
= 81.06dBuV/m
 11. 441MHz Peak limit = AV Limit + 20dB = 101.05MHz

2.5 Configuration of Tested System

Fig. 1 Configuration of Tested System

Tx

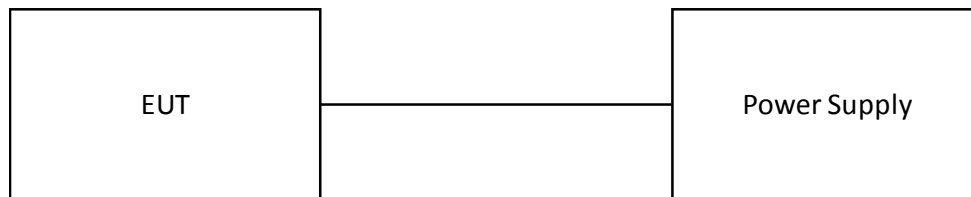


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1.	Power Supply	ABM	8185D	N/A	N/A	N/A

3. Summary of Test Results

FCC /IC Rules	Description Of Test	Result
§15.207	Conducted Emission	N/A
§15.231(a)(3) §15.231(b)	Radiated Emission	Compliant
§15.231(c)	20dB Bandwidth	Compliant
	Duty Cycle Test (Pulse Modulation)	N/A
§15.231(a1) RSS-210 A1.1.1(c)	Release Time	Compliant
§15.203	Antenna Requirement	Compliant

4. Description of Test Modes

The EUT has been tested under engineering test mode condition and the EUT staying in continuous transmitting mode.

Channel low (411MHz) 、 mid (426MHz) and high (441MHz) with each modulation were chosen for full testing.

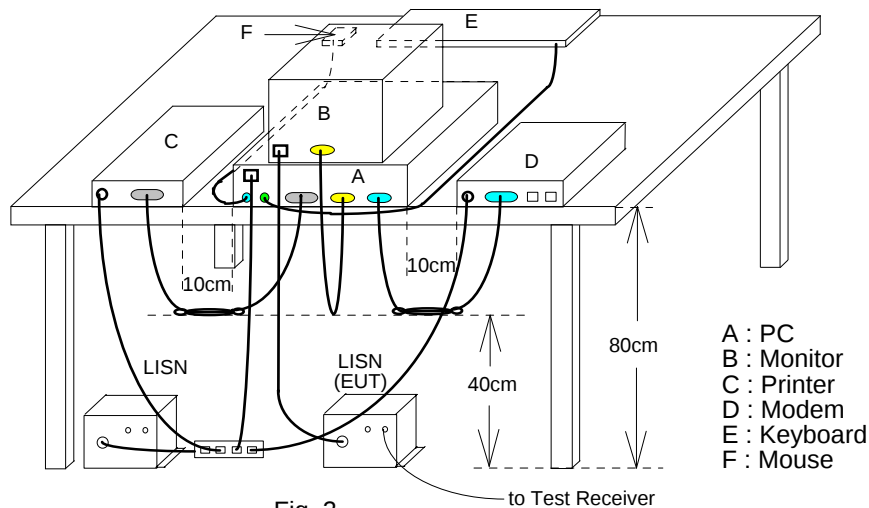
The X, Y and Z-axis of EUT were pre-test; Y mode were the worse case and report.

5. AC Conducted Emissions Test

5.1 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

5.2 Test SET-UP (Block Diagram of Configuration)



5.3 Measurement Equipment Used:

Conducted Emission Test Site					
Equipment Type	MFR	Model Number	Searial Number	Last Cal.	Cal Due.
Chamber05 -1 Cable	WOKEN	CFD 300-NL	Chamber05 -1 Cable	08/29/2019	08/29/2020
EMI Receiver 13	ROHDE & SCHWARZ	ESCI	101015	07/25/2019	07/25/2020
LISN 15	ROHDE & SCHWARZ	ENV216	101335	11/22/2019	11/22/2020
LISN 22	ROHDE & SCHWARZ	ENV216	101478	08/13/2019	08/13/2020
Test Software	Farad	EZEMC Ver:ISL-03A2	N/A	N/A	N/A

5.4 Measurement Result:

N/A

6. Radiated Emission Test

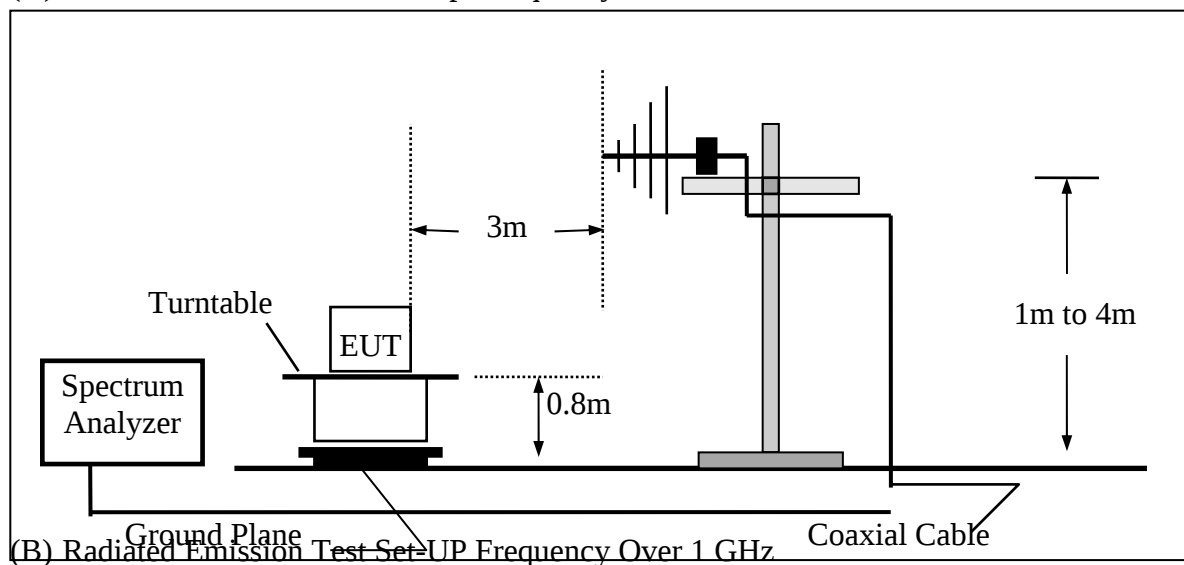
15.231 (e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs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

6.1 Measurement Procedure

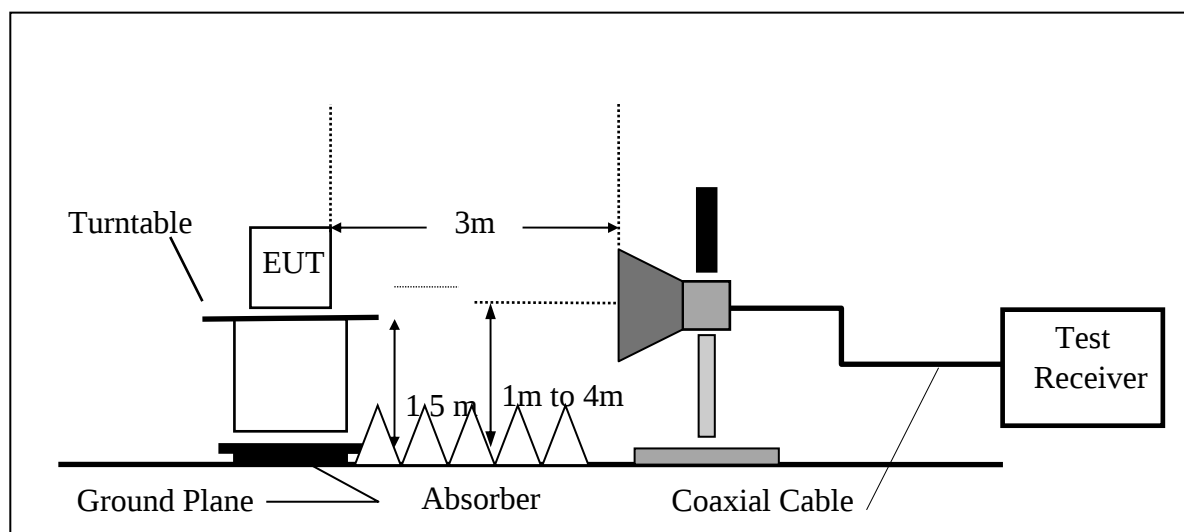
1. The EUT was placed on a turn table which is 0.8/1.5m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured were complete.

6.2 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



6.3 Measurement Equipment Used:

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Chamber 19	Spectrum analyzer	R&S	FSP40	100116	01/10/2019	01/10/2020
Chamber 19	EMI Receiver	R&S	ESR3	102461	08/08/2018	08/08/2020
Chamber 19	Loop Antenna	EM	EM-6879	271	05/31/2019	05/31/2020
Chamber 19	Bilog Antenna (30MHz-1GHz)	Schwarzbeck	VULB9168 w 5dB Att.	736	01/29/2019	01/29/2020
Chamber 19	Horn antenna (1GHz-18GHz)	Schwarzbeck	9120D	9120D-1627	06/17/2019	06/17/2020
Chamber 19	Horn antenna (18GHz-26GHz)	Com-power	AH-826	081001	11/25/2019	11/25/2020
Chamber 19	Horn antenna (26GHz-40GHz)	Com-power	AH-640	100A	03/29/2019	03/29/2021
Chamber 19	Preamplifier (9kHz-1GHz)	HP	8447F	3113A06362	01/14/2019	01/14/2020
Chamber 19	Preamplifier (1GHz-26GHz)	Agilent	8449B	3008A02471	10/05/2019	10/05/2020
Chamber 19	Preamplifier (26GHz-40GHz)	MITEQ	JS4-26004000-27-5A	818471	05/06/2019	05/06/2020
Chamber 19	RF Cable (9kHz-18GHz)	HUBER SUHNER	Sucoflex 104A	MY1397/4A	01/17/2019	01/17/2020
Chamber 19	RF Cable (18GHz-40GHz)	HUBER SUHNER	Sucoflex 102	27963/2&374 21/2	11/21/2019	11/21/2020
Chamber 19	Signal Generator	Anritsu	MG3692A	20311	01/09/2019	01/09/2020
Chamber 19	Test Software	Audix	E3 Ver:6.12023	N/A	N/A	N/A
Chamber 19	Magnetic Field Meter	Combinova	MFM-10	645	10/16/2019	10/16/2020
Chamber 19	Magnetic Field Meter	Combinova	MFM-1000	619	12/06/2019	12/06/2020
Chamber 19	Electric Field Meter	Combinova	EFM-200	402	10/16/2019	10/16/2020
Chamber 19	E-field probe	Narda / Wandel & Goltermann	EF-0691 + NBM-520	D-0135 + D-0526	03/02/2019	03/02/2020

6.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Average Value = Peak Value + 20 Log (Ton/Tp)Pulse Modulation Duty Cycle Correction Factor

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

6.5 Measurement Result

Fundamental Measurement Result

Operation Mode:	Transmitting Mode	Test Date:	2019/11/19
Fundamental Frequency:	411MHz	Test By:	Bill
Temp:	25 °C	Hum.:	60%

Low

Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
410.81	80.06	-1.83	78.24	80.04	-1.81	Average	VERTICAL
410.81	85.57	-1.83	83.74	100.04	-16.30	Peak	VERTICAL
410.91	79.80	-1.83	77.97	80.04	-2.07	Average	HORIZONTAL
410.91	85.31	-1.83	83.48	100.04	-16.56	Peak	HORIZONTAL

Remark:

- 1 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 2 The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz, VBW=300kHz.
- 3 Average Value = Peak Value + 20 Log (Ton/Tp)Pulse Modulation Duty Cycle Correction Factor

Note:

Duty cycle = 53ms/100ms = 0.53

Average Factor = 20log (0.53) = -5.51

Operation Mode: Transmitting Mode
Fundamental Frequency: 426MHz
Temp: 25 °C

Test Date: 2019/11/19
Test By: Bill
Hum.: 60%

Mid

Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
426.16	79.17	-1.52	77.65	80.56	-2.91	Average	VERTICAL
426.16	84.68	-1.52	83.16	100.56	-17.40	Peak	VERTICAL
425.95	81.58	-1.53	80.05	100.56	-20.51	Peak	HORIZONTAL

Remark:

- 1 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 2 The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz, VBW=300kHz.
- 3 Average Value = Peak Value + 20 Log (Ton/Tp)Pulse Modulation Duty Cycle Correction Factor

Note:

Duty cycle = 53ms/100ms = 0.53

Average Factor = 20log (0.53) = -5.51

Operation Mode: Transmitting Mode
Fundamental Frequency: 441MHz
Temp: 25 °C

Test Date: 2019/11/19
Test By: Bill
Hum.: 60%

High

Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
441.23	81.45	-1.15	80.30	81.06	-0.76	Average	VERTICAL
441.23	86.96	-1.15	85.81	101.06	-15.25	Peak	VERTICAL
440.89	81.72	-1.15	80.57	101.05	-20.48	Peak	HORIZONTAL

Remark:

- 1 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 2 The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz, VBW=300kHz.
- 3 Average Value = Peak Value + 20 Log (Ton/Tp)Pulse Modulation Duty Cycle Correction Factor

Note:

Duty cycle = 53ms/100ms = 0.53

Average Factor = 20log (0.53) = -5.51

Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode: TX CH Low

Test Date: 2019/11/19

Fundamental Frequency: 411MHz

Test By: Bill

Temperature : 25 °C

Humidity : 60 %

No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	170.65	26.18	-5.25	20.93	43.50	-22.57	QP	VERTICAL
2	341.37	27.08	-3.02	24.06	46.00	-21.94	QP	VERTICAL
3	498.51	29.57	-0.65	28.92	46.00	-17.08	QP	VERTICAL
4	604.24	28.31	1.58	29.89	46.00	-16.11	QP	VERTICAL
5	763.32	26.66	4.24	30.90	46.00	-15.10	QP	VERTICAL
6	822.49	53.57	5.02	58.59	60.00	-1.41	QP	VERTICAL
1	157.07	26.27	-5.04	21.23	43.50	-22.27	QP	HORIZONTAL
2	278.32	25.34	-4.38	20.96	46.00	-25.04	QP	HORIZONTAL
3	353.98	28.67	-2.92	25.75	46.00	-20.25	QP	HORIZONTAL
4	497.54	30.64	-0.67	29.97	46.00	-16.03	QP	HORIZONTAL
5	715.79	27.02	3.22	30.24	46.00	-15.76	QP	HORIZONTAL
6	822.49	53.09	5.02	58.11	60.00	-1.89	QP	HORIZONTAL

Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz, VBW=300kHz.

Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode: TX CH Mid

Test Date: 2019/11/19

Fundamental Frequency: 426MHz

Test By: Bill

Temperature : 25 °C

Humidity : 60 %

No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	162.89	26.19	-5.03	21.16	43.50	-22.34	QP	VERTICAL
2	449.04	27.79	-1.10	26.69	46.00	-19.31	QP	VERTICAL
3	611.03	28.93	1.66	30.59	46.00	-15.41	QP	VERTICAL
4	799.21	31.89	4.58	36.47	46.00	-9.53	QP	VERTICAL
5	852.56	52.36	5.37	57.73	60.00	-2.27	QP	VERTICAL
6	959.26	35.64	7.11	42.75	46.00	-3.25	QP	VERTICAL
1	162.89	26.16	-5.03	21.13	43.50	-22.37	QP	HORIZONTAL
2	356.89	28.29	-2.87	25.42	46.00	-20.58	QP	HORIZONTAL
3	607.15	28.65	1.62	30.27	46.00	-15.73	QP	HORIZONTAL
4	784.66	30.28	4.42	34.70	46.00	-11.30	QP	HORIZONTAL
5	852.56	54.56	5.37	59.93	60.00	-0.07	QP	HORIZONTAL
6	951.50	37.19	7.00	44.19	46.00	-1.81	QP	HORIZONTAL

Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz, VBW=300kHz.

Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode: TX CH High

Test Date: 2019/11/19

Fundamental Frequency: 441MHz

Test By: Bill

Temperature : 25 °C

Humidity : 60 %

No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	149.31	26.74	-5.28	21.46	43.50	-22.04	QP	VERTICAL
2	354.95	28.27	-2.91	25.36	46.00	-20.64	QP	VERTICAL
3	582.90	28.45	1.10	29.55	46.00	-16.45	QP	VERTICAL
4	784.66	30.80	4.42	35.22	46.00	-10.78	QP	VERTICAL
5	881.66	47.45	5.80	53.25	60.00	-6.75	QP	VERTICAL
6	952.47	36.74	7.02	43.76	46.00	-2.24	QP	VERTICAL
1	160.95	26.37	-4.99	21.38	43.50	-22.12	QP	HORIZONTAL
2	370.47	26.96	-2.46	24.50	46.00	-21.50	QP	HORIZONTAL
3	559.62	28.74	0.49	29.23	46.00	-16.77	QP	HORIZONTAL
4	769.14	28.76	4.26	33.02	46.00	-12.98	QP	HORIZONTAL
5	882.63	54.17	5.81	59.98	60.00	-0.02	QP	HORIZONTAL
6	959.26	37.87	7.11	44.98	46.00	-1.02	QP	HORIZONTAL

Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz, VBW=300kHz.

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode: TX CH Low Test Date: 2019/11/19
Fundamental Frequency: 411MHz Test By: Bill
Temperature : 25 °C Humidity : 60 %

No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2443.00	58.55	-15.85	42.70	60.04	-17.34	Peak	VERTICAL
2	3544.00	49.52	-13.64	35.88	60.04	-24.16	Peak	VERTICAL
1	2461.00	59.64	-15.84	43.80	60.04	-16.24	Peak	HORIZONTAL
2	3553.00	49.20	-13.61	35.59	60.04	-24.45	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3 MHz.
- 5 Average Value = Peak Value + 20 Log (Ton/Tp).....Pulse Modulation Duty Cycle Corrction Factor.

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode: TX CH Mid

Test Date: 2019/11/19

Fundamental Frequency: 426MHz

Test By: Bill

Temperature : 25 °C

Humidity : 60 %

No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2473.00	57.19	-15.85	41.34	60.56	-19.22	Peak	VERTICAL
2	3643.00	48.79	-13.31	35.48	54.00	-18.52	Peak	VERTICAL
1	1510.00	48.89	-19.16	29.73	54.00	-24.27	Peak	HORIZONTAL
2	2476.00	52.58	-15.84	36.74	60.56	-23.82	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3 MHz.
- 5 Average Value = Peak Value + 20 Log (Ton/Tp).....Pulse Modulation Duty Cycle Corrcion Factor.

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode: TX CH High Test Date: 2019/11/19
Fundamental Frequency: 441MHz Test By: Bill
Temperature : 25 °C Humidity : 60 %

No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2446.00	62.79	-15.85	46.94	61.06	-14.12	Peak	VERTICAL
2	3103.00	49.61	-14.44	35.17	61.06	-25.89	Peak	VERTICAL
1	2467.00	60.48	-15.85	44.63	61.06	-16.43	Peak	HORIZONTAL
2	3541.00	48.19	-13.65	34.54	61.06	-26.52	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3 MHz.
- 5 Average Value = Peak Value + 20 Log (Ton/Tp).....Pulse Modulation Duty Cycle Corrcion Factor.

7. 20dB Occupied Bandwidth

7.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Center Frequency = fundamental frequency, RBW= 10kHz, VBW= 30kHz, Span =3MHz.
4. Set SPA Max hold. Mark peak, -20dB.

7.2 Test SET-UP (Block Diagram of Configuration)

Same as 6.2 Radiated Emission Measurement.

7.3 Measurement Equipment Used:

Same as 6.3 Radiated Emission Measurement.

7.4 Measurement Results

Refer to attached data chart.

The center frequency f_c is **Low: 411MHz, and Mid: 426MHz, and High: 441MHz** according to the Rules, section 15.231(C), the Bandwidth of Center Frequency at-20dB should be calculated as following:

$$411 \times 0.0025 = 1.0275(\text{MHz})$$

$$426 \times 0.0025 = 1.0650(\text{MHz})$$

$$441 \times 0.0025 = 1.1025(\text{MHz})$$

7.5 Measurement Result:

Low

720 kHz < limit 1.0275MHz

Mid

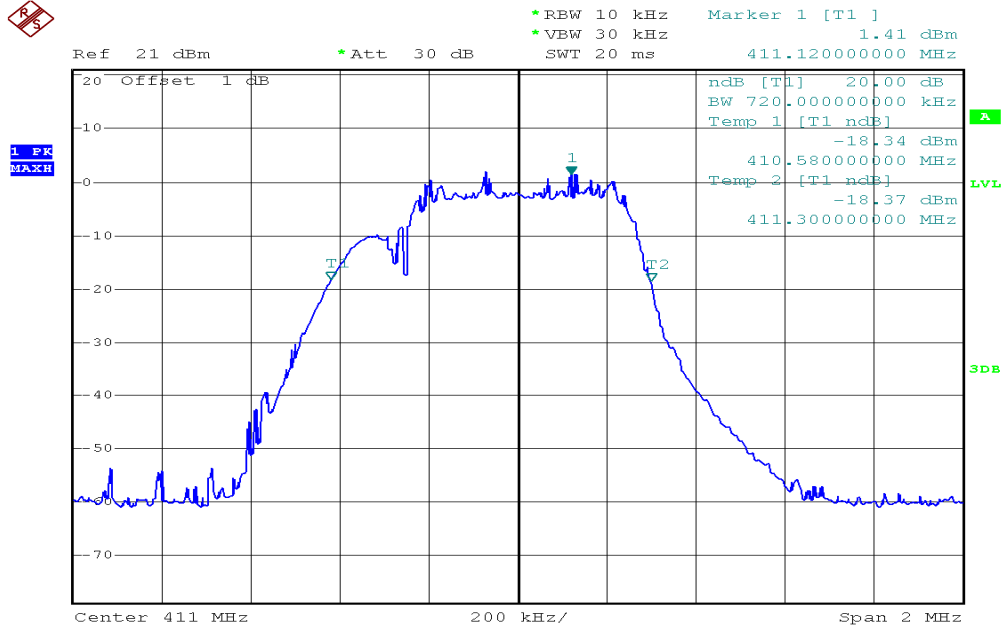
688 kHz < limit 1.0650MH

High

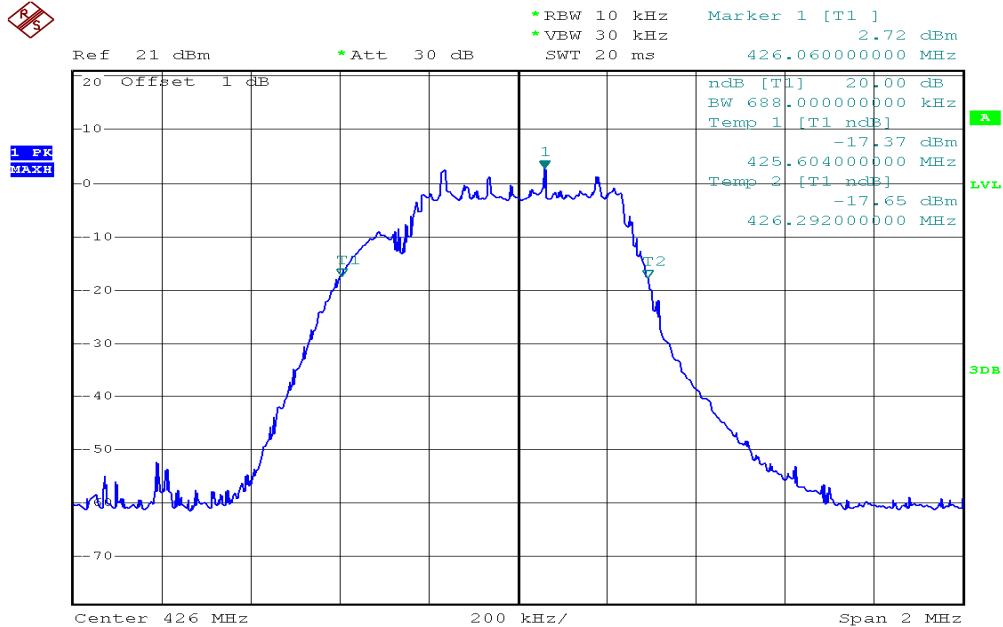
688 kHz < limit 1.1025MHz

20dB Band Width Test Data

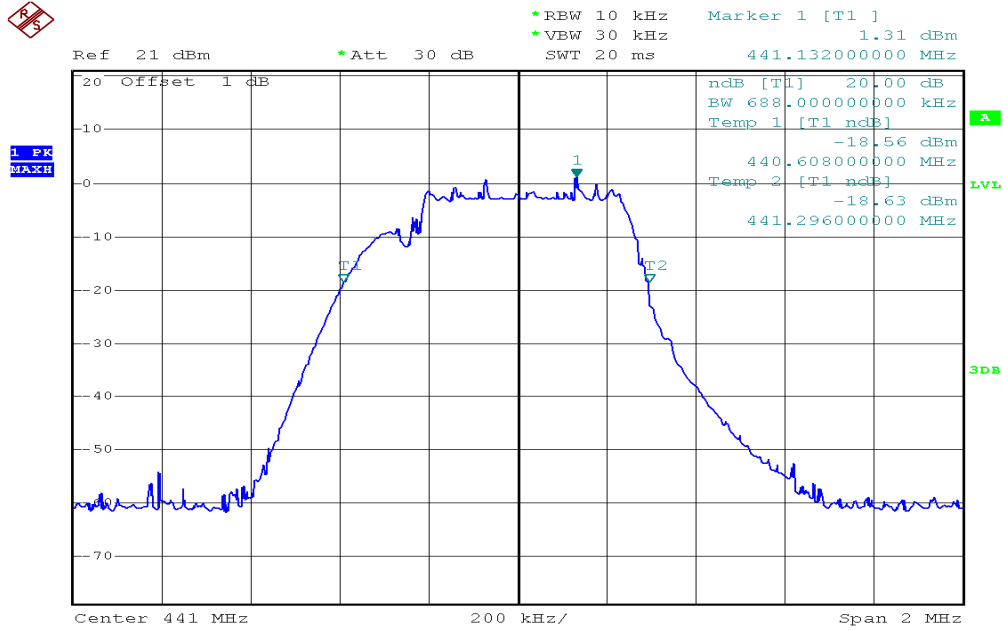
Low



Mid



High



8. RELEASE TIME MEASUREMENT:

15.231 (a) (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

8.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 100kHz, Span =0Hz, Sweep Time= 200ms / 20s.
3. Set EUT as normal operation and press Transmitter bottom for 2 s,
4. Set SPA Max hold. Delta Mark.

8.2 Test SET-UP (Block Diagram of Configuration)

Same as 6.2 Radiated Emission Measurement.

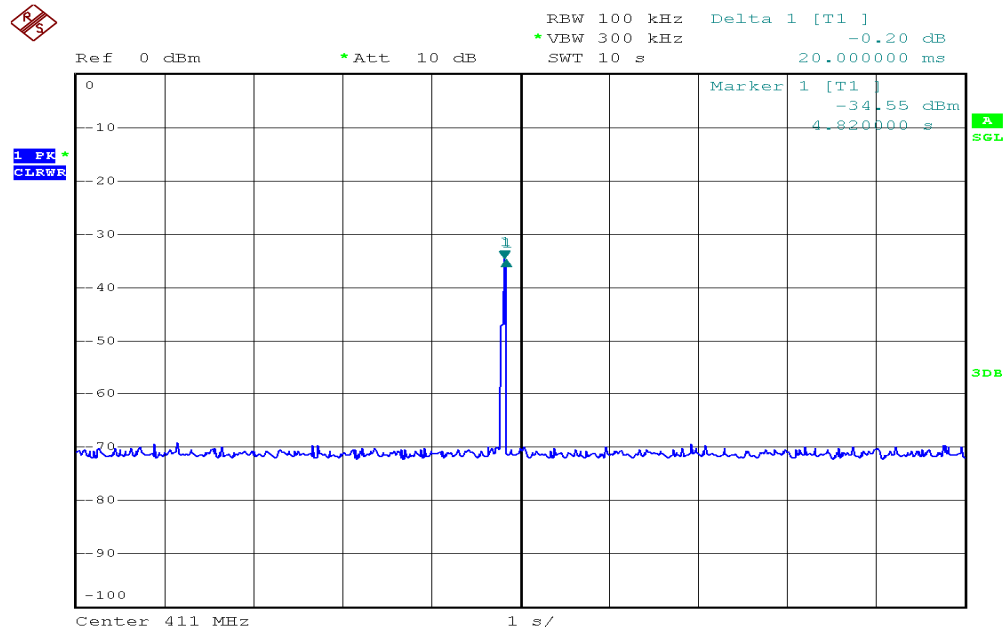
8.3 Measurement Equipment Used:

Same as 6.3 Radiated Emission Measurement.

8.4 Measurement Results

The release time less than 5 s. Refer to attached data chart.

Low



Mid

