FCC Test Report

Report No.:	RFBDYS-WTW-P21117025-2
FCC ID:	2AWUU6048001
Test Model:	AD32-HW
Received Date:	Dec. 16, 2021
Test Date:	Jan. 05, 2022 ~ Jan. 10, 2022
Issued Date:	Jan. 27, 2022
Applicant:	Verkada Inc.
Address:	405 E. 4th Ave., San Mateo, CA 94401, USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location (1):	No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
Test Location (2):	No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan
FCC Registration / Designation Number:	788550 / TW0003 281270 / TW0032

Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
RFBDYS-WTW-P21117025-2	Original Release	Jan. 27, 2022

1 Certificate of Conformity

Product:	Reader
Brand:	Verkada
Test Model:	AD32-HW
Sample Status:	Engineering Sample
Applicant:	Verkada Inc.
Test Date:	Jan. 05, 2022 ~ Jan. 10, 2022
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.209) ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Vera Huang , **Date:** Jan. 27, 2022

Vera Huang / Specialist

Approved by : Jeremy Lin , **Date:** Jan. 27, 2022

Jeremy Lin / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.209)			
FCC Clause	**Test Item**	**Result**	**Remarks**
15.207	Conducted emission test	Pass	Meet the requirement of limit. Minimum passing margin is -14.78 dB at 0.15000 MHz.
15.209	Radiated emission test	Pass	Meet the requirement of limit. Minimum passing margin is -6.27 dB at 34.22 MHz.
15.215 (c)	20 dB Bandwidth	Pass	Meet the requirement of limit.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	**Frequency**	**Expanded Uncertainty (k=2) (±)**
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.79 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.00 dB
	30MHz ~ 200MHz	2.91 dB
	200MHz ~1000MHz	2.93 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Reader
Brand	Verkada
Test Model	AD32-HW
Status of EUT	Engineering Sample
Power Supply Rating	12 Vdc (adapter)
Modulation Type	FSK
Data Rate	2 kbit/s
Operating Frequency	128 kHz
Field Strength (Maximum)	-11.30 dBuV/m (300m)
Antenna Type	Coil and capacitor antenna
Accessory Device	N/A
Data Cable Supplied	0.4m DC cable non-shielded without core

Note:

1. The EUT consumes power from the following adapter. (For support unit only)

Brand	DVE
Model	DSA-12PFT-12 FUS 120100
Input Power	100-240Vac, 50/60Hz, 0.5A
Output Power	12Vdc, 1A
Power Line	1.47m power cable without core

2. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.
3. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or User's Manual.
4. BT, NFC, and RFID can transmit simultaneously.

3.2 Description of Test Modes

1 channel is provided to this EUT:

Channel	Frequency (kHz)
1	128

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To			Description
	RE<1G	PLC	EB	
-	√	√	√	-

Where **RE<1G:** Radiated Emission below 1 GHz **PLC:** Power Line Conducted Emission
EB: 20 dB Bandwidth measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.

Radiated Emission Test (Below 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel
-	1	1

Power Line Conducted Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel
-	1	1

20 dB Bandwidth:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel
-	1	1

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE	23 deg. C, 68 % RH	120 Vac, 60 Hz	Edison Lee
PLC	23 deg. C, 67 % RH	120 Vac, 60 Hz	Adair Peng
EB	23 deg. C, 67 % RH	12 Vdc	Adair Peng

3.3 Description of Support Units

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

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Adapter	DVE	DSA-12PFT-12 FUS 120100	NA	NA	Provided by manufacturer
B	RFID Card	NA	NA	NA	NA	Provided by manufacturer

Note: All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC cable	1	0.4	N	0	Attached on EUT
2.	Adapter cable	1	1.47	Y	0	Provided by manufacturer

3.3.1 Configuration of System under Test

3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.209)
ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1.705	24000/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver Rohde & Schwarz	N9038A	MY55420137	Apr. 09, 2021	Apr. 08, 2022
Spectrum Analyzer KEYSIGHT	N9020B	MY60110440	Dec. 09, 2021	Dec. 08, 2022
BILOG Antenna SCHWARZBECK	VULB9168	1213	Oct. 27, 2021	Oct. 26, 2022
HORN Antenna RF SPIN	DRH18-E	210103A18E	Nov. 14, 2021	Nov. 13, 2022
HORN Antenna SCHWARZBECK	BBHA 9170	9170	Dec. 10, 2021	Dec. 09, 2022
Loop Antenna EMCI	EM-6879	269	Sep. 16, 2021	Sep. 15, 2022
Loop Antenna TESEQ	HLA 6121	45745	Jul. 21, 2021	Jul. 20, 2022
Preamplifier EMCI	EMC330N	980782	Jan. 12, 2021	Jan. 11, 2022
Preamplifier EMCI	EMC118A45SE	980808	Jan. 12, 2021	Jan. 11, 2022
Preamplifier EMCI	EMC184045SE	980788	Jan. 12, 2021	Jan. 11, 2022
RF signal cable EMCI	EMC104-SM-SM-(9000+2000+1000)	201243+ 201231+ 210102	Jan. 12, 2021	Jan. 11, 2022
RF signal cable EMCI	EMCCFD400-NM-NM-(9000+300+500)	201236+ 201235+ 201233	Jan. 12, 2021	Jan. 11, 2022
RF signal cable EMCI	EMC101G-KM-KM-(5000+3000+2000)	201260+201257+201254	Jan. 12, 2021	Jan. 11, 2022
Software BV ADT	ADT_Radiated_V7.6.15.9.5	NA	NA	NA
Antenna Tower Max-Full	MFT-151SS-0.5T	NA	NA	NA
Turn Table Max-Full	MF-7802BS	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208674	NA	NA
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/ MY55190007/MY55210005	Jul. 12, 2021	Jul. 11, 2022

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in WM Chamber 8.

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

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

For Radiated Emission above 30 MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

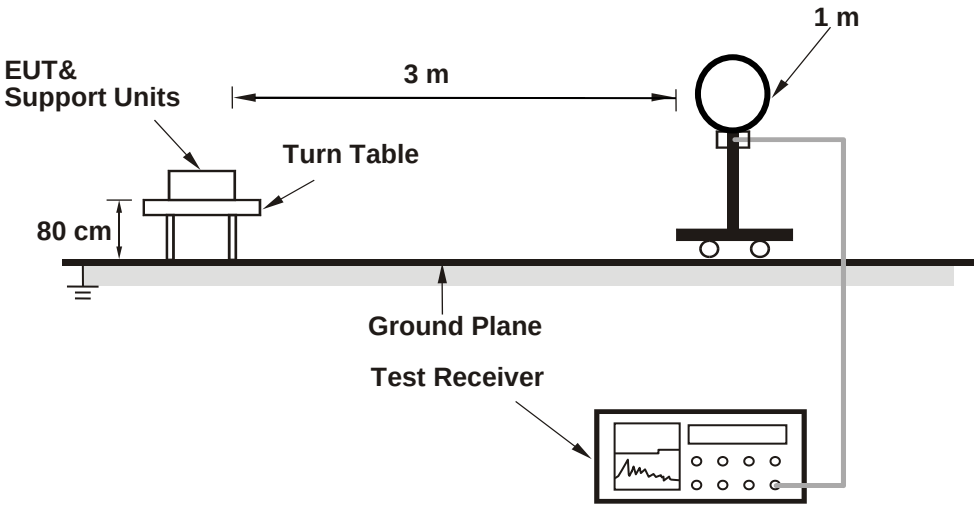
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.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

4.1.4 Deviation from Test Standard

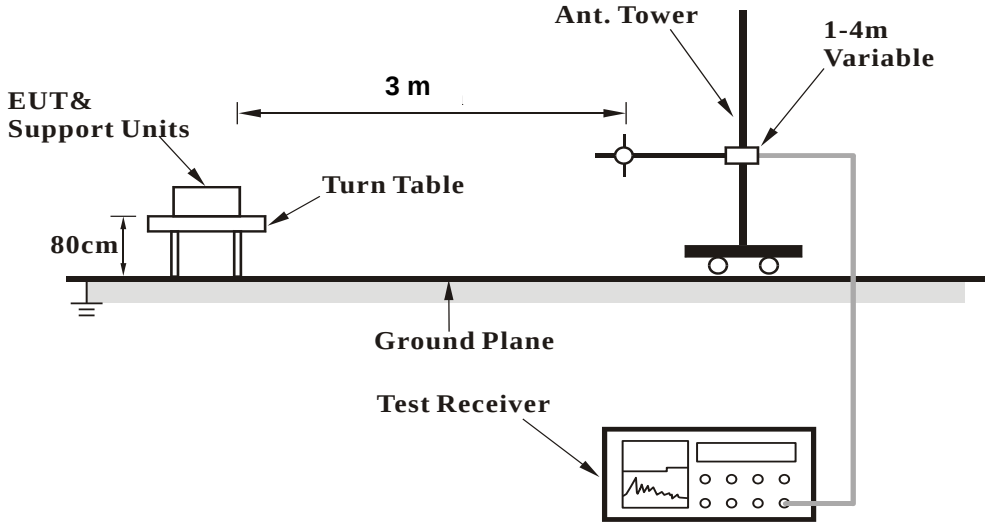
No deviation.

4.1.5 Test Setup

<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

Set the EUT under transmission condition continuously at specific channel frequency.

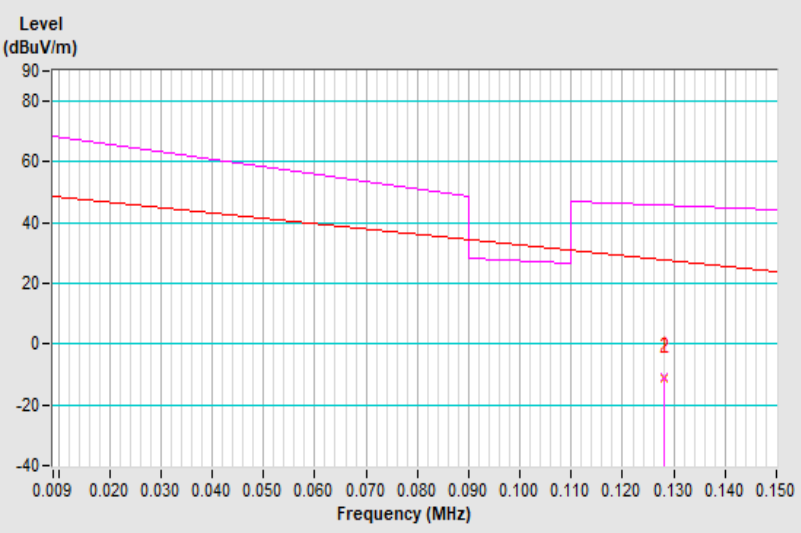
4.1.7 Test Results

Test Mode	Tx		
RF Mode	RFID	Channel	CH 1：128 kHz
Frequency Range	9kHz ~ 150kHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 200Hz

Antenna Polarity : Parallel								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*0.1280	-11.00 PK	45.46	-56.46	1.00	5	49.20	-60.20
2	***0.1280**	**-11.30 AV**	**25.46**	**-36.76**	**1.00**	**5**	**48.90**	**-60.20**

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) + Distance conversion factor
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. For 0.009 ~ 0.49MHz, the measured field strength was extrapolated to distance 300 meters
Distance factor@3m = 40*log(3/300) = -80dB

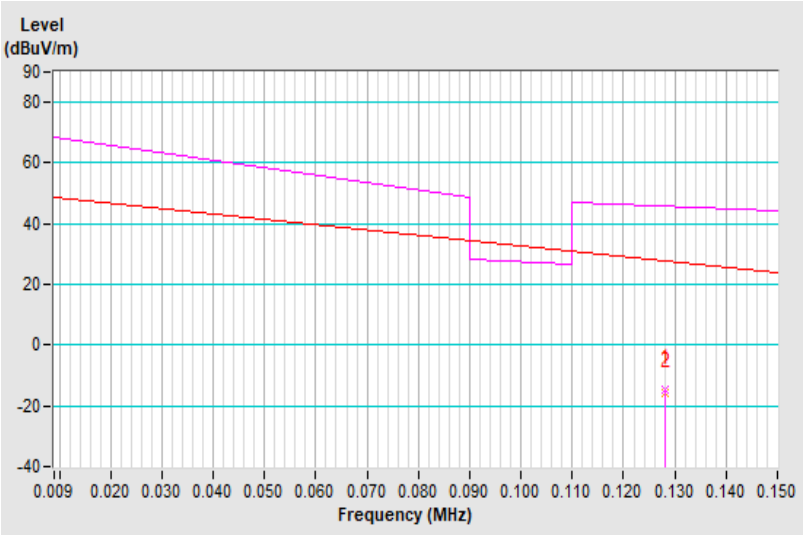


Test Mode	Tx		
RF Mode	RFID	Channel	CH 1：128 kHz
Frequency Range	9kHz ~ 150kHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 200Hz

Antenna Polarity : Perpendicular								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*0.1280	-14.60 PK	45.46	-60.06	1.00	91	45.60	-60.20
2	*0.1280	-15.70 AV	25.46	-41.16	1.00	91	44.50	-60.20

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
   + Distance conversion factor
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. “ * “: Fundamental frequency.
6. For 0.009 ~ 0.49MHz, the measured field strength was extrapolated to distance 300 meters
   Distance factor@3m = 40*log(3/300) = -80dB

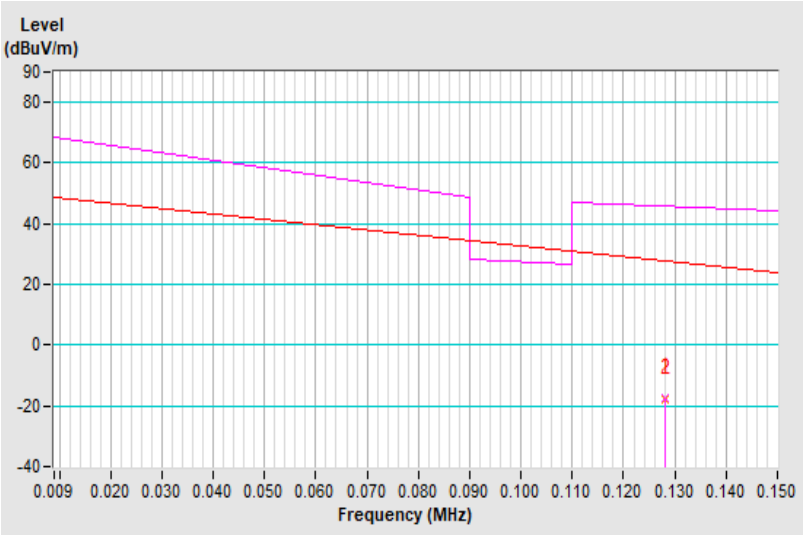


Test Mode	Tx		
RF Mode	RFID	Channel	CH 1：128 kHz
Frequency Range	9kHz ~ 150kHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 200Hz

Antenna Polarity : Ground-parallel								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*0.1280	-17.30 PK	45.46	-62.76	1.00	183	42.90	-60.20
2	*0.1280	-17.70 AV	25.46	-43.16	1.00	183	42.50	-60.20

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
   + Distance conversion factor
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. “ * “: Fundamental frequency.
6. For 0.009 ~ 0.49MHz, the measured field strength was extrapolated to distance 300 meters
   Distance factor@3m = 40*log(3/300) = -80dB



Test Mode	Tx		
RF Mode	RFID	Channel	CH 1：128 kHz
Frequency Range	9kHz ~ 30MHz	Detector Function & Bandwidth	Peak (PK), 9kHz

Antenna Polarity : Parallel								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	3.2300	-2.09 PK	29.54	-31.63	1.00	100	17.89	-19.98
2	4.3100	0.29 PK	29.54	-29.25	1.00	190	20.16	-19.87
3	5.1400	-2.59 PK	29.54	-32.13	1.00	307	17.16	-19.75
4	15.5700	1.97 PK	29.54	-27.57	1.00	66	19.90	-17.93
5	18.3900	2.02 PK	29.54	-27.52	1.00	76	19.87	-17.85
6	23.7000	-1.40 PK	29.54	-30.94	1.00	77	16.47	-17.87

Remarks:

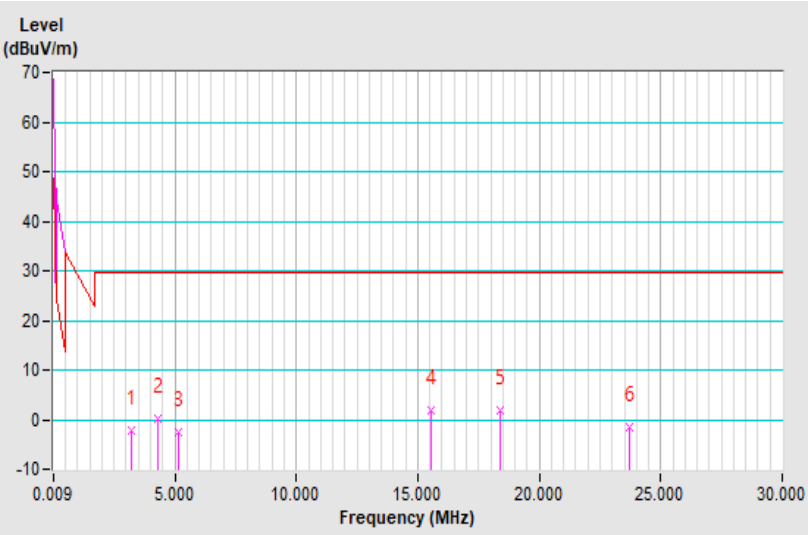
1. Emission level (dBuV/m) = Raw Value (dBuV) + Factor (dB/m)

2 The other emission levels were very low against the limit.

3. Margin value = Emission level – Limit value.

4. The factor value already contains the test distance interpolation coefficient.

The measured field strength above 490kHz was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



Test Mode	Tx		
RF Mode	RFID	Channel	CH 1：128 kHz
Frequency Range	9kHz ~ 30MHz	Detector Function & Bandwidth	Peak (PK), 9kHz

Antenna Polarity : Perpendicular								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4.0900	-4.61 PK	29.54	-34.15	1.00	127	15.28	-19.89
2	8.1400	-5.02 PK	29.54	-34.56	1.00	333	13.71	-18.73
3	16.2200	-3.02 PK	29.54	-32.56	1.00	261	14.89	-17.91
4	19.3100	-0.97 PK	29.54	-30.51	1.00	8	16.85	-17.82
5	21.5700	-1.87 PK	29.54	-31.41	1.00	68	15.96	-17.83
6	24.3100	-3.52 PK	29.54	-33.06	1.00	360	14.37	-17.89

Remarks:

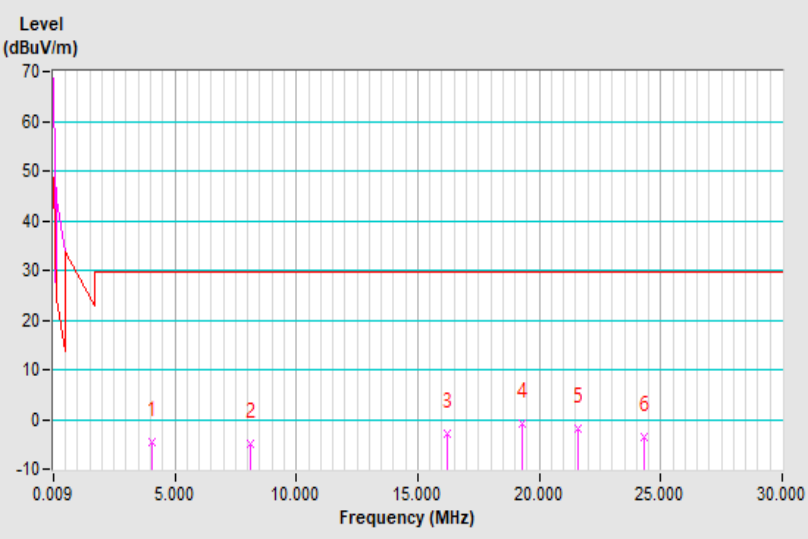
1. Emission level (dBuV/m) = Raw Value (dBuV) + Factor (dB/m)

2 The other emission levels were very low against the limit.

3. Margin value = Emission level – Limit value.

4. The factor value already contains the test distance interpolation coefficient.

The measured field strength above 490kHz was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

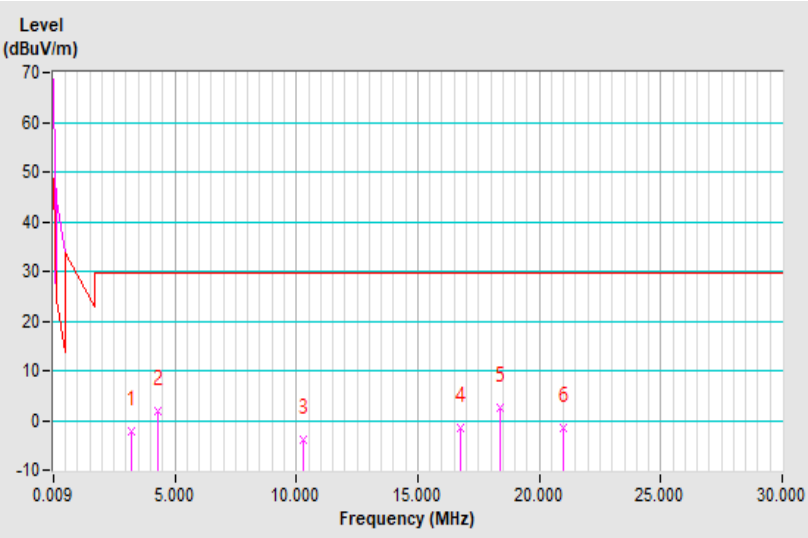


Test Mode	Tx		
RF Mode	RFID	Channel	CH 1：128 kHz
Frequency Range	9kHz ~ 30MHz	Detector Function & Bandwidth	Peak (PK), 9kHz

Antenna Polarity : Ground-parallel								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	3.2300	-2.19 PK	29.54	-31.73	1.00	23	17.79	-19.98
2	4.3100	1.77 PK	29.54	-27.77	1.00	314	21.64	-19.87
3	10.2700	-3.83 PK	29.54	-33.37	1.00	169	14.26	-18.09
4	16.7400	-1.44 PK	29.54	-30.98	1.00	50	16.46	-17.90
5	18.3900	2.54 PK	29.54	-27.00	1.00	172	20.39	-17.85
6	21.0000	-1.38 PK	29.54	-30.92	1.00	223	16.44	-17.82

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

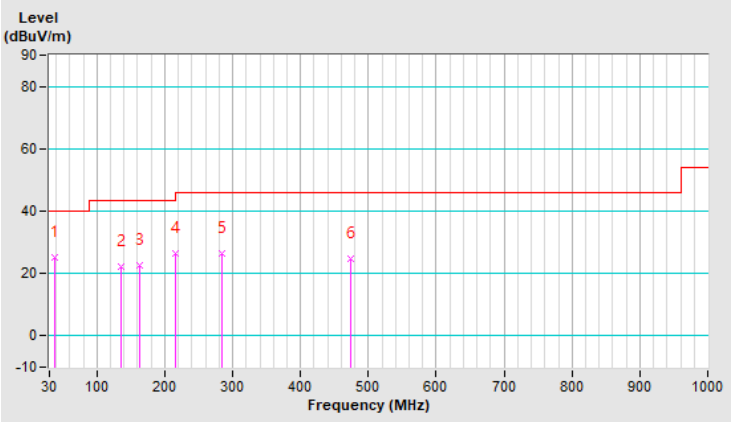


RF Mode	TX RFID	Channel	CH 1：128 kHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	38.43	25.08 QP	40.00	-14.92	2.00 H	5	43.78	-18.70
2	135.43	22.14 QP	43.50	-21.36	2.00 H	282	41.08	-18.94
3	162.14	22.66 QP	43.50	-20.84	2.00 H	2	40.75	-18.09
4	215.57	26.60 QP	43.50	-16.90	1.51 H	281	48.25	-21.65
5	284.45	26.56 QP	46.00	-19.44	1.01 H	199	44.46	-17.90
6	474.23	24.78 QP	46.00	-21.22	2.00 H	203	37.92	-13.14

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

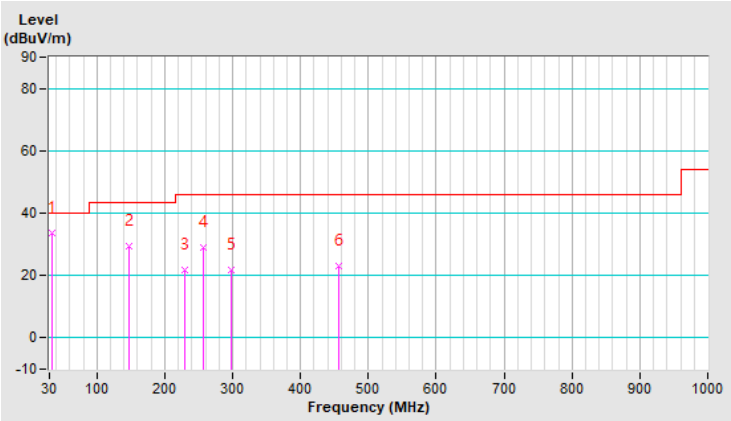


RF Mode	TX RFID	Channel	CH 1：128 kHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	**34.22**	**33.73 QP**	**40.00**	**-6.27**	**1.50 V**	**351**	**52.92**	**-19.19**
2	148.09	29.28 QP	43.50	-14.22	1.99 V	324	47.42	-18.14
3	229.62	21.82 QP	46.00	-24.18	1.00 V	147	42.53	-20.71
4	256.33	29.13 QP	46.00	-16.87	1.00 V	177	48.33	-19.20
5	297.10	21.97 QP	46.00	-24.03	1.00 V	166	39.65	-17.68
6	455.96	22.98 QP	46.00	-23.02	1.00 V	208	36.33	-13.35

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	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 lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 03, 2021	Dec. 02, 2022
RF signal cable Woken	5D-FB	Cable-cond1-01	Jan. 16, 2021	Jan. 15, 2022
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 25, 2021	Feb. 24, 2022
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Sep. 07, 2021	Sep. 06, 2022
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Shielded Room 1 (Conduction 1).
3. The VCCI Site Registration No. is C-12040.

4.2.3 Test Procedures

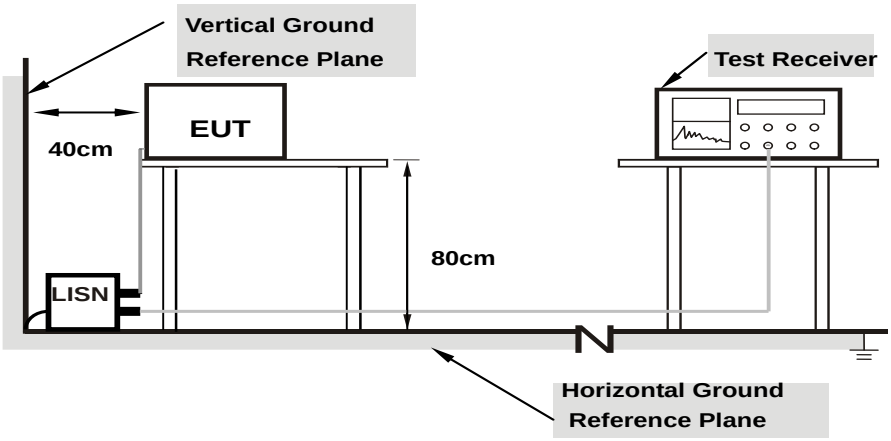
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50 uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz - 30 MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

Same as 4.1.6.

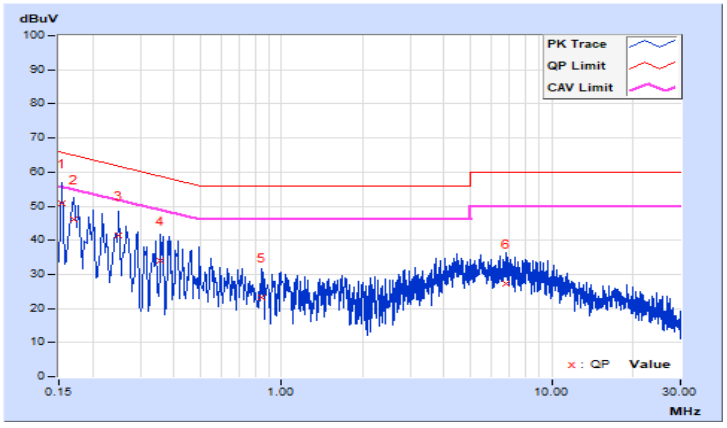
4.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	23 °C, 67% RH
Tested by	Adair Peng	Test Date	2022/1/10

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15400	9.76	41.11	20.45	50.87	30.21	65.78	55.78	-14.91	-25.57
2	0.17000	9.76	36.34	17.40	46.10	27.16	64.96	54.96	-18.86	-27.80
3	0.25000	9.78	31.75	14.68	41.53	24.46	61.76	51.76	-20.23	-27.30
4	0.35800	9.82	24.26	6.13	34.08	15.95	58.77	48.77	-24.69	-32.82
5	0.84600	9.89	13.31	2.30	23.20	12.19	56.00	46.00	-32.80	-33.81
6	6.78200	10.02	17.37	2.99	27.39	13.01	60.00	50.00	-32.61	-36.99

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

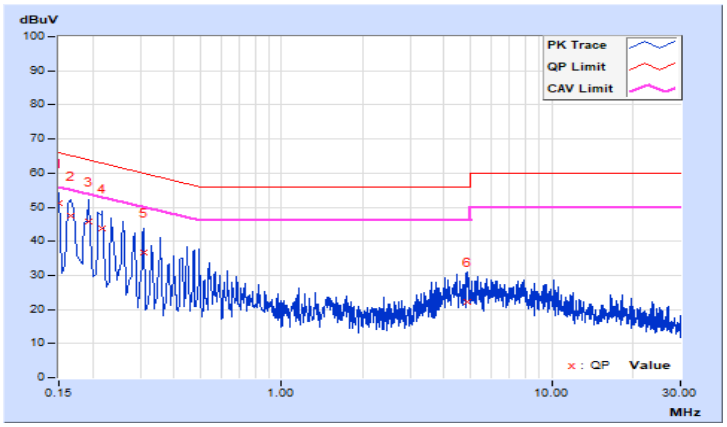


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	23 °C, 67% RH
Tested by	Adair Peng	Test Date	2022/1/10

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.15000**	**9.80**	**41.42**	**17.61**	**51.22**	**27.41**	**66.00**	**56.00**	**-14.78**	**-28.59**
2	0.16535	9.81	37.73	15.18	47.54	24.99	65.19	55.19	-17.65	-30.20
3	0.19400	9.83	36.01	16.36	45.84	26.19	63.86	53.86	-18.02	-27.67
4	0.21800	9.84	33.88	20.50	43.72	30.34	62.89	52.89	-19.17	-22.55
5	0.31000	9.87	26.89	9.28	36.76	19.15	59.97	49.97	-23.21	-30.82
6	4.87800	10.05	12.33	1.36	22.38	11.41	56.00	46.00	-33.62	-34.59

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



4.3 20 dB Bandwidth

4.3.1 Limits of 20 dB Bandwidth Measurement

The 20 dB bandwidth shall be specified in operating frequency band.

4.3.2 Test Setup

Refer to section 4.1.5.

4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedures

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 1 kHz RBW and 3 kHz VBW. The 20 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

4.3.5 Deviation from Test Standard

No deviation.

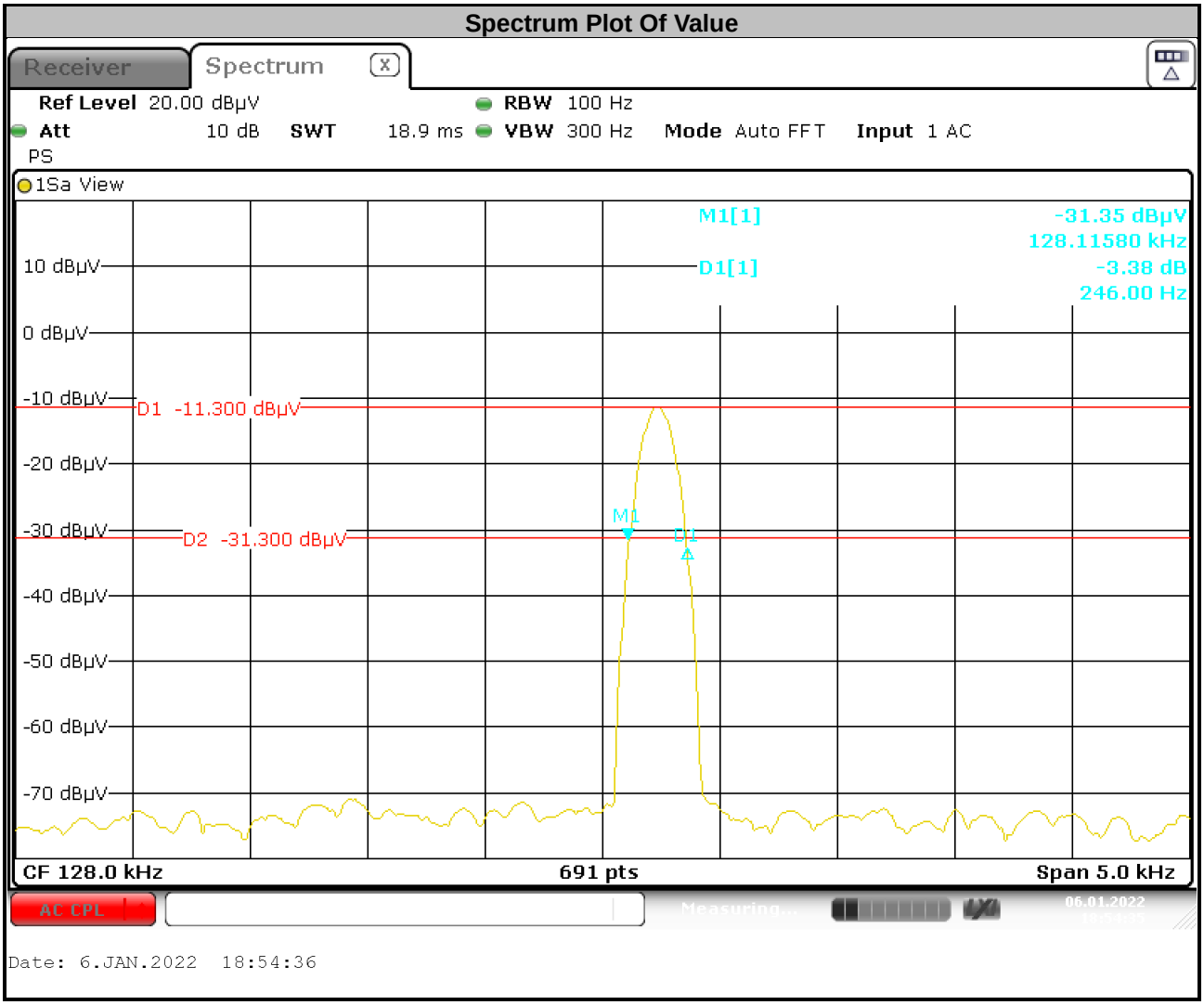
4.3.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Set the EUT under transmission condition continuously at specific channel frequency.

4.3.7 Test Results

20 dBc Point (Low)	20 dBc Point (High)	Frequency (kHz)	20 dBc Bandwidth (kHz)	Pass / Fail
128.11580 kHz	128.3618 kHz	128	0.246	Pass

Spectrum Plot Of Value



5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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