

TEST REPORT

Product Name : RFID Read/Write Module
Brand Mark : Iotelligent
Model No. : ZK8201
FCC ID : 2BCD8-ZK8201
Report Number : BLA-EMC-202308-A0501
Date of Sample Receipt : 2023/8/2
Date of Test : 2023/8/2 to 2023/8/15
Date of Issue : 2023/8/15
Test Standard : 47 CFR Part 15, Subpart C 15.249
Test Result : Pass

Prepared for:

Iotelligent Co., Ltd.

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Prepared by:

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Sueels

Date:

2023/8/15



REPORT REVISE RECORD

Version No.	Date	Description
00	2023/8/15	Original

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1 TEST SUMMARY

Test item	Test Requirement	Test Method	Class/Severity	Result
Radiated Emissions	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.4&6.5&6.6	47 CFR Part 15, Subpart C 15.209 & 15.249 (a),(d)	Pass
Restricted Band Around Fundamental Frequency	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.4&6.5&6.6	47 CFR Part 15, Subpart C 15.205 & 15.249(d) & 15.209	Pass
Field Strength of the Fundamental Signal (15.249(a))	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.5&6.6	47 CFR Part 15, Subpart C 15.249(a)	Pass
20dB Bandwidth	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.9	47 CFR Part 15, Subpart C 15.215	Pass
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.249	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Antenna Requirement	47 CFR Part 15, Subpart C 15.249	N/A	47 CFR Part 15, Subpart C 15.203	Pass

2 GENERAL INFORMATION

Applicant	lotelligent Co., Ltd.
Address	Room 2006, NO.1199 Defu Road, Jiading, Shanghai, China
Manufacturer	lotelligent Co., Ltd.
Address	Room 2006, NO.1199 Defu Road, Jiading, Shanghai, China
Factory	lotelligent Co., Ltd.
Address	Room 2006, NO.1199 Defu Road, Jiading, Shanghai, China
Product Name	RFID Read/Write Module
Test Model No.	ZK8201

3 GENERAL DESCRIPTION OF E.U.T.

Hardware Version	V1.1
Software Version	V1.4.4
Operation Frequency:	902MHz-928MHz
Channel numbers:	50
Modulation type:	ASK
Antenna Type:	External antenna
Antenna gain:	-24.67dBi(Provided by customer)
Power supply:	DC 5.0V

Operation Frequency:

Channel number	Frequency (KHz)	Channel number	Frequency (KHz)
1	902750	2	903250
3	903750	4	904250
5	904750	6	905250
7	905750	8	906250
9	906750	10	907250
11	907750	12	908250
13	908750	14	909250
15	909750	16	910250
17	910750	18	911250
19	911750	20	912250
21	912750	22	913250
23	913750	24	914250
25	914750	26	915250
27	915750	28	916250
29	916750	30	917250
31	917750	32	918250
33	918750	34	919250
35	919750	36	920250
37	920750	38	921250
39	921750	40	922250
41	922750	42	923250
43	923750	44	924250
45	924750	46	925250
47	925750	48	926250
49	926750	50	927250

the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	902.75MHz
The middle channel	914.75MHz
The Highest channel	927.25MHz

4 TEST ENVIRONMENT

Environment	Temperature	Voltage
Normal	25°C	DC5V

5 TEST MODE

TEST MODE	TEST MODE DESCRIPTION
TX	Keep the EUT in transmitting mode

6 MEASUREMENT UNCERTAINTY

Parameter	Expanded Uncertainty (Confidence of 95%)
Radiated Emission(9kHz-30MHz)	±4.34dB
Radiated Emission(30Mz-1000MHz)	±4.24dB
Radiated Emission(1GHz-18GHz)	±4.68dB
AC Power Line Conducted Emission(150kHz-30MHz)	±3.45dB

Parameter	Expanded Uncertainty (Confidence of 95%)
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1.5 dB
Power Spectral Density, conducted	±3.0 dB
Unwanted Emissions, conducted	±3.0 dB
Temperature	±3 °C
Supply voltages	±3 %
Time	±5 %
Radiated Emission (30MHz ~ 1000MHz)	±4.35 dB
Radiated Emission (1GHz ~ 18GHz)	±4.44 dB

7 DESCRIPTION OF SUPPORT UNIT

Device Type	Manufacturer	Model Name	Serial No.	Remark
N/A	N/A	N/A	N/A	N/A

8 LABORATORY LOCATION

All tests were performed at:
BlueAsia of Technical Services(Shenzhen) Co., Ltd.
Building C, No. 107, Shihuan Road, Shiyan Sub-District, Baoan District, Shenzhen, Guangdong Province, China
Telephone: TEL: +86-755-28682673 FAX: +86-755-28682673
No tests were sub-contracted.

9 TEST INSTRUMENTS LIST

Test Equipment Of Radiated Spurious Emissions					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Chamber 1	SKET	966	N/A	2020/11/10	2023/11/9
Chamber 2	SKET	966	N/A	2021/07/20	2024/07/19
Spectrum	R&S	FSP40	100817	2022/09/15	2023/09/14
Receiver	R&S	ESR7	101199	2022/09/15	2023/09/14
Receiver	R&S	ESPI7	101477	2022/07/16 2023/07/14	2023/07/15 2024/07/13
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	2022/09/15	2023/09/14
Horn Antenna	Schwarzbeck	BBHA9120D	01892 P:00331	2022/09/13	2025/09/12
Amplifier	SKET	LNPA_30M01G-30	SK2021060801	2022/07/16 2023/07/14	2023/07/15 2024/07/13
Amplifier	SKET	PA-000318G-45	N/A	2022/09/13	2023/09/12
Amplifier	SKET	LNPA_18G40G-50	SK2022071301	2022/07/14 2023/07/14	2023/07/13 2024/07/13
Filter group	SKET	2.4G/5G Filter group r	N/A	2022/07/16 2023/07/14	2023/07/15 2024/07/13
EMI software	EZ	EZ-EMC	EEMC-3A1	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2022/9/14	2025/9/13
Controller	SKET	N/A	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-02	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-03	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-01	N/A	N/A	N/A

Test Equipment Of RF Conducted Test

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2022/09/15	2023/09/14
Spectrum	Agilent	N9020A	MY49100060	2022/09/07	2023/09/06
Spectrum	KEYSIGHT	N9030A	MY52350152	2022/07/01	2023/06/30
Spectrum	KEYSIGHT	N9010A	MY54330814	2022/07/01	2023/06/30
Signal Generator	Agilent	N5182A	MY47420955	2022/09/07	2023/09/06
Signal Generator	Agilent	E8257D	MY44320250	2022/07/01	2023/06/30
Signal Generator	Agilent	N5181A	MY46240904	2022/08/02	2023/08/01
Signal Generator	R&S	CMW500	132429	2022/09/07	2023/09/06
BluetoothTester	Anritsu	MT8852B	06262047872	2022/09/07	2023/09/06
Power probe	DARE	RPR3006W	14I00889SN042	2022/09/07	2023/09/06
DCPowersupply	zhaoxin	KXN-305D	20K305D1221363	2022/09/14	2023/09/13
DCPowersupply	zhaoxin	RXN-1505D	19R1505D050168	2022/09/14	2023/09/13
2.4GHz/5GHz RF Test software	MTS	MTS 8310	Version 2.0.0.0	N/A	N/A
Audio Analyzer	Audioprecision	N/A	ATSI-41094	2022/7/1	2023/6/30

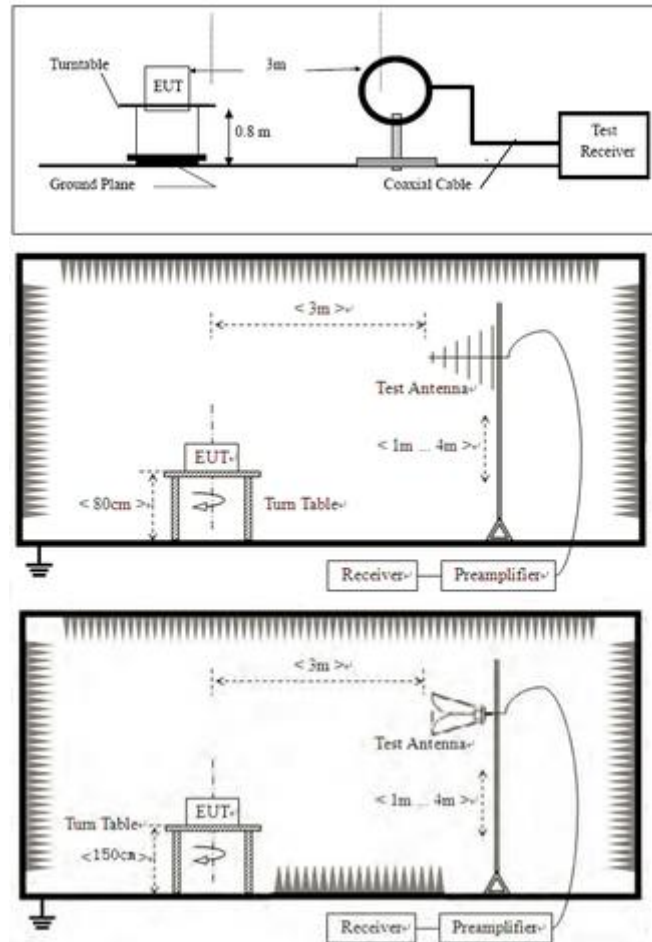
10 RADIATED EMISSIONS

Test Standard	47 CFR Part 15, Subpart C 15.249
Test Method	ANSI C63.10 (2013) Section 6.4&6.5&6.6
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Jozu
Temperature	25℃
Humidity	60%

10.1 LIMITS

Frequency(MHz)	Field strength (microvolts/meter)	Limit (dBuV/m)	Detector	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	-	300
0.490-1.705	24000/F(kHz)	-	-	30
1.705-30	30	-	-	30
30-88	100	40.0	QP	3
88-216	150	43.5	QP	3
216-960	200	46.0	QP	3
960-1000	500	54.0	QP	3
Above 1000	500	54.0	AV	3

10.2 BLOCK DIAGRAM OF TEST SETUP



10.3 PROCEDURE

For testing performed with the loop antenna, the center of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specified distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane. Only the worst position of vertical was shown in the report.

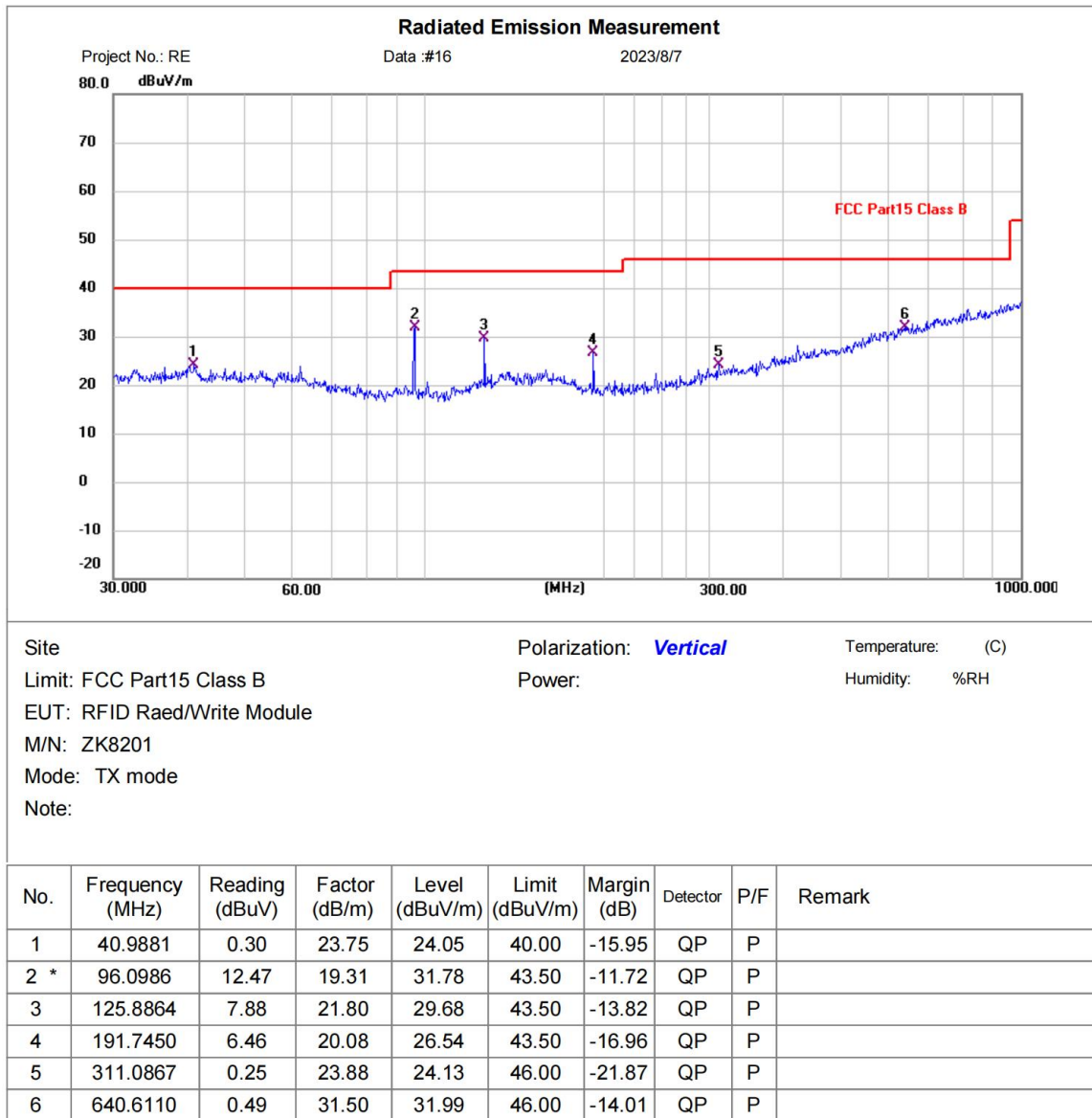
Remark:

- 1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

$$\text{Final Test Level} = \text{Receiver Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Preamplifier Factor}$$
- 3) Scan from 9kHz to 25GHz, the disturbance above 12.75GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported. fundamental frequency is blocked by filter, and only spurious emission is shown.
- 4) For frequencies above 1GHz, the field strength limits are based on average limits. 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. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

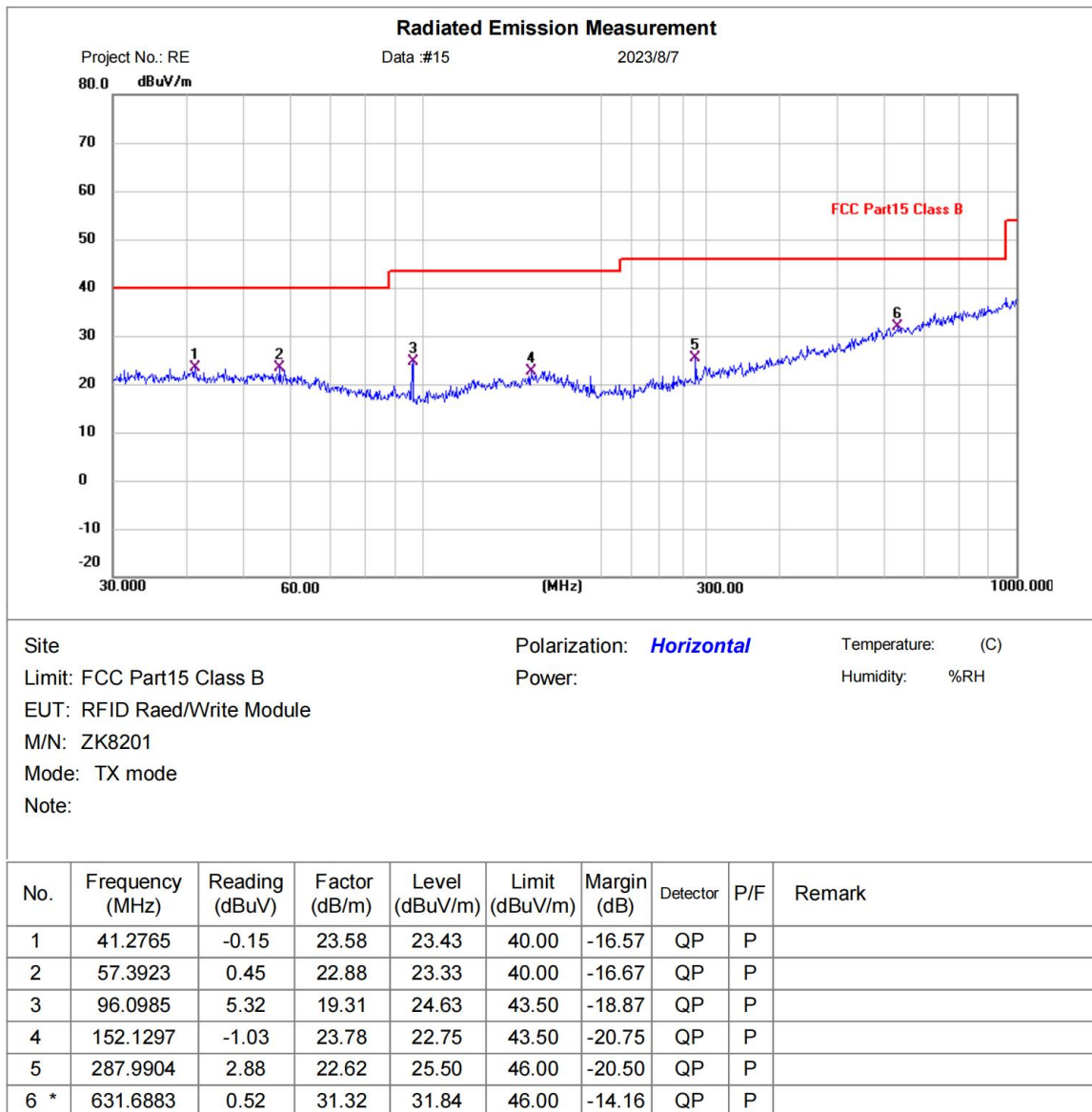
10.4 TEST DATA

[TestMode: TX below 1G]; [Polarity: Vertical]



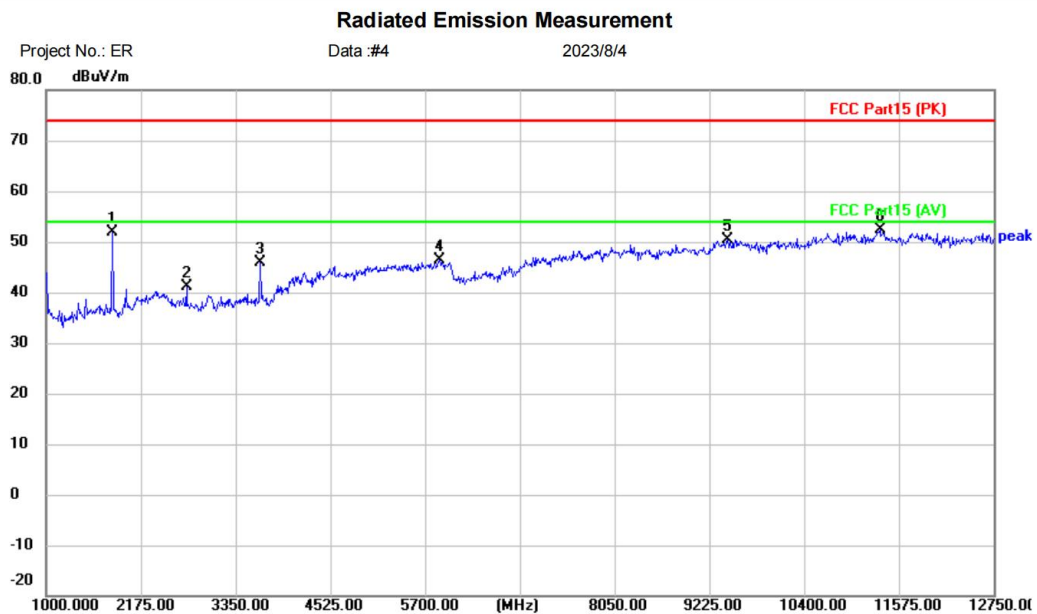
Test Result: Pass

[TestMode: TX below 1G]; [Polarity: Horizontal]



Test Result: Pass

[TestMode: TX mid channel]; [Polarity: Vertical]



Site: Polarization: **Vertical** Temperature: (C)
Limit: FCC Part15 (PK) Power: Humidity: %RH
EUT: RFID Raed/Write Module
M/N: ZK8201
Mode: TX-M
Note:

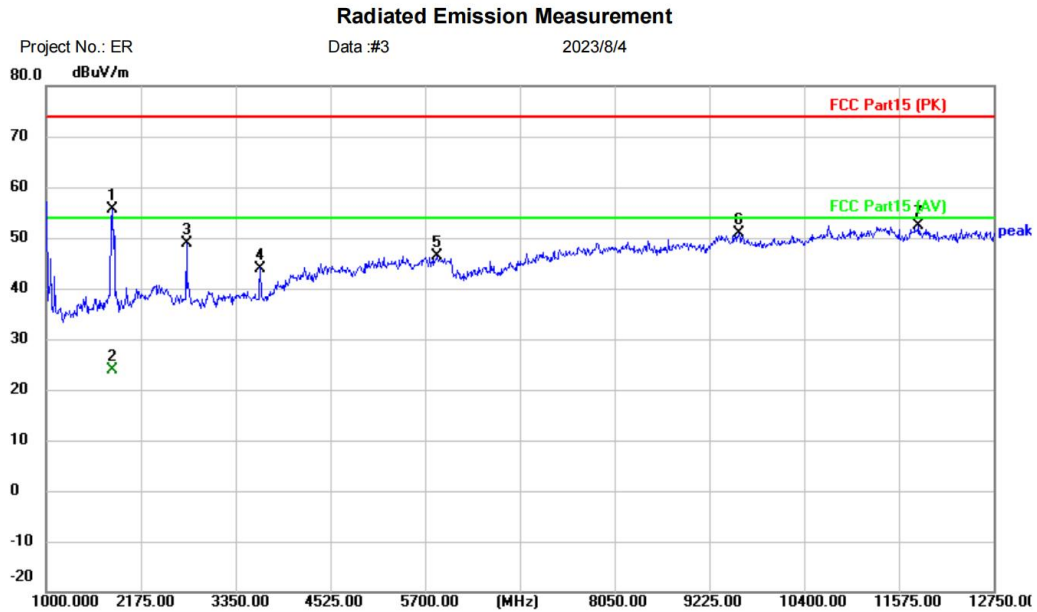
No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	1822.500	58.37	-6.55	51.82	74.00	-22.18	peak	
2	2739.000	44.69	-3.64	41.05	74.00	-32.95	peak	
3	3655.500	47.51	-1.71	45.80	74.00	-28.20	peak	
4	5876.250	39.82	6.66	46.48	74.00	-27.52	peak	
5	9448.250	39.12	11.36	50.48	74.00	-23.52	peak	
6 *	11340.00	38.90	13.40	52.30	74.00	-21.70	peak	

*:Maximum data x:Over limit !:over margin

⟨Reference Only

Test Result: Pass

[TestMode: TX mid channel]; [Polarity: Horizontal]



Site: Polarization: **Horizontal** Temperature: (C)
Limit: FCC Part15 (PK) Power: Humidity: %RH
EUT: RFID Raed/Write Module
M/N: ZK8201
Mode: TX-M
Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	1822.500	62.27	-6.55	55.72	74.00	-18.28	peak	
2		1822.500	30.42	-6.55	23.87	54.00	-30.13	AVG	
3		2739.000	52.53	-3.64	48.89	74.00	-25.11	peak	
4		3655.500	45.71	-1.71	44.00	74.00	-30.00	peak	
5		5841.000	39.77	6.49	46.26	74.00	-27.74	peak	
6		9589.250	39.25	11.54	50.79	74.00	-23.21	peak	
7		11821.75	39.31	13.00	52.31	74.00	-21.69	peak	

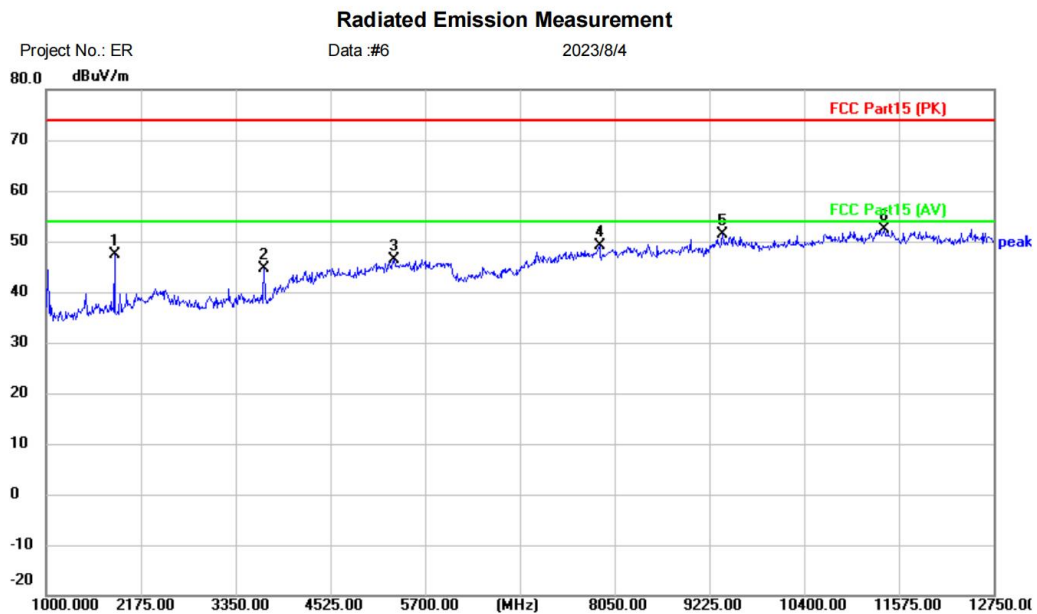
*:Maximum data x:Over limit !:over margin <Reference Only

Receiver: ESR_1 Spectrum Analyzer: FSP40

Antenna: EZ 9120D 1G-18G new Engineer Signature:

Test Result: Pass

[TestMode: TX high channel]; [Polarity: Vertical]



Site: Polarization: **Vertical** Temperature: (C)
Limit: FCC Part15 (PK) Power: Humidity: %RH
EUT: RFID Raed/Write Module
M/N: ZK8201
Mode: TX-H
Note:

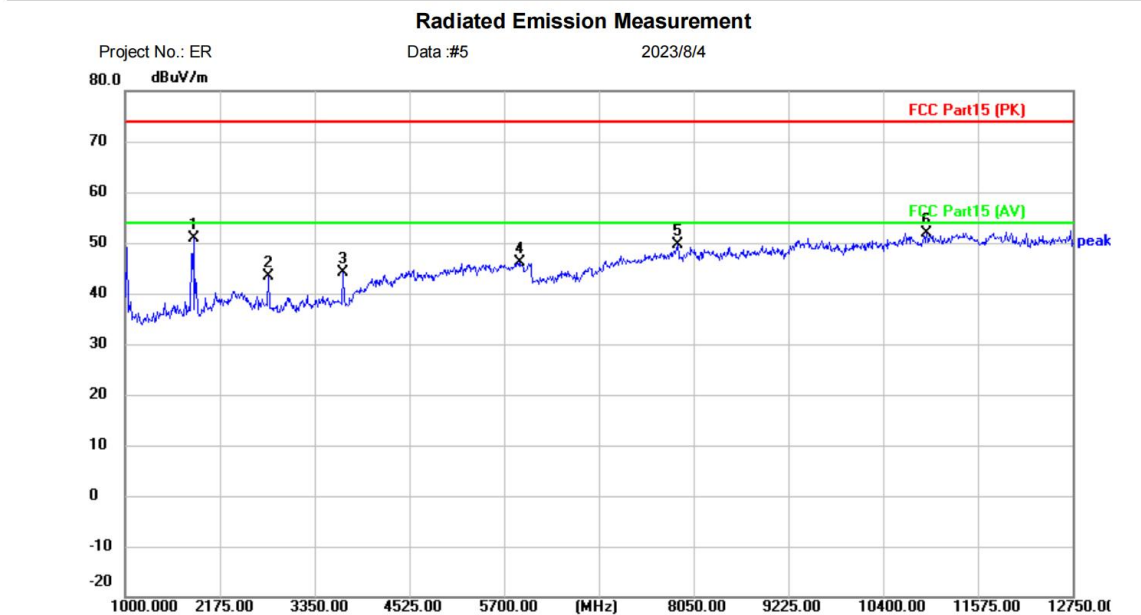
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		1846.000	53.94	-6.57	47.37	74.00	-26.63	peak	
2		3702.500	46.46	-1.76	44.70	74.00	-29.30	peak	
3		5312.250	40.58	5.83	46.41	74.00	-27.59	peak	
4		7862.000	40.31	8.70	49.01	74.00	-24.99	peak	
5		9389.500	39.98	11.48	51.46	74.00	-22.54	peak	
6	*	11398.75	38.98	13.41	52.39	74.00	-21.61	peak	

*:Maximum data x:Over limit !:over margin

(Reference Only)

Test Result: Pass

[TestMode: TX high channel]; [Polarity: Horizontal]



Site: Polarization: **Horizontal** Temperature: (C)
Limit: FCC Part15 (PK) Power: Humidity: %RH
EUT: RFID Raed/Write Module
M/N: ZK8201
Mode: TX-H
Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		1846.000	57.43	-6.57	50.86	74.00	-23.14	peak	
2		2774.250	47.09	-3.73	43.36	74.00	-30.64	peak	
3		3702.500	45.85	-1.76	44.09	74.00	-29.91	peak	
4		5899.750	39.33	6.75	46.08	74.00	-27.92	peak	
5		7850.250	40.81	8.80	49.61	74.00	-24.39	peak	
6	*	10940.50	38.31	13.57	51.88	74.00	-22.12	peak	

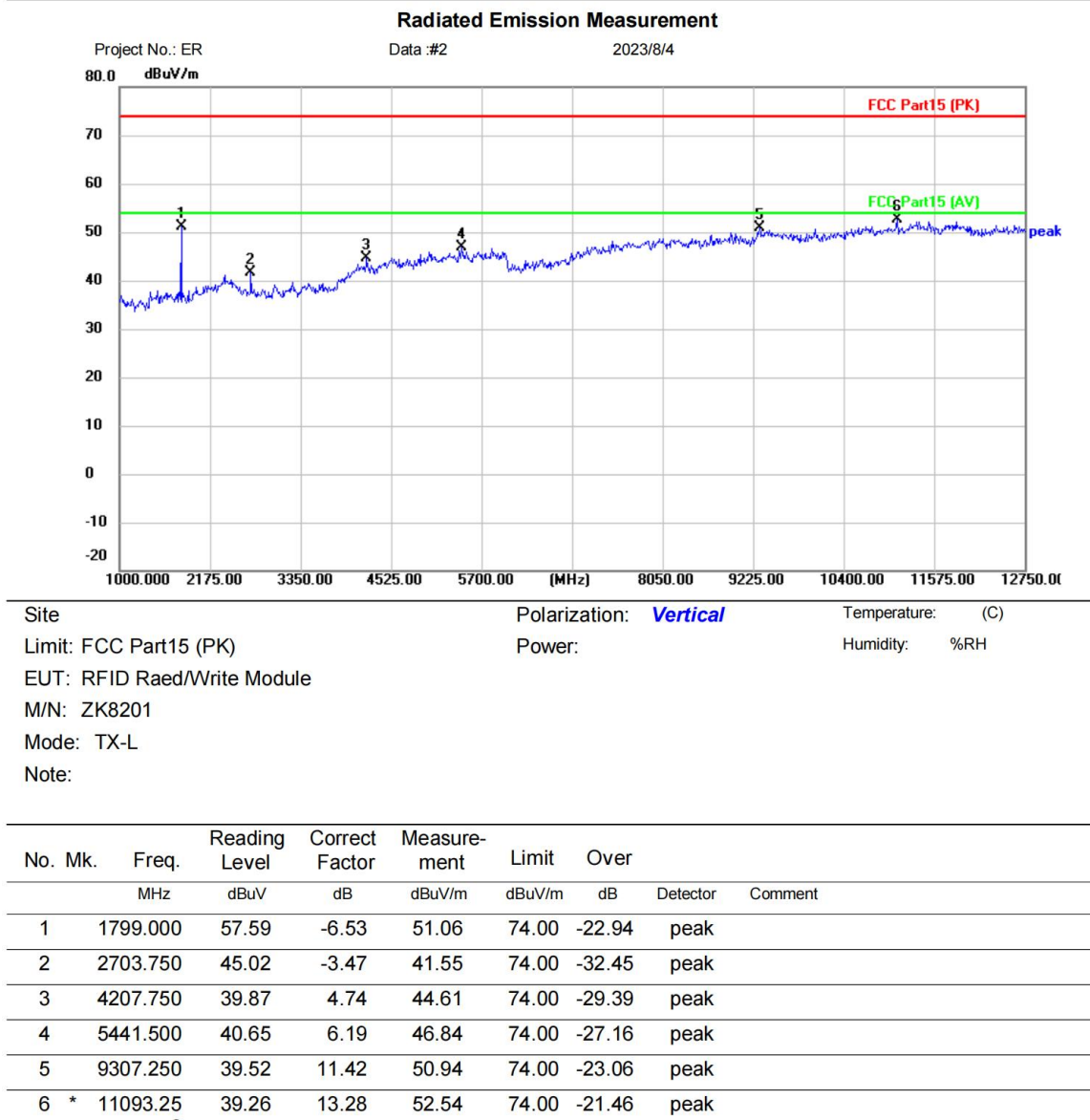
*:Maximum data x:Over limit !:over margin <Reference Only

Receiver: ESR_1 Spectrum Analyzer: FSP40

Antenna: EZ 9120D 1G-18G new Engineer Signature:

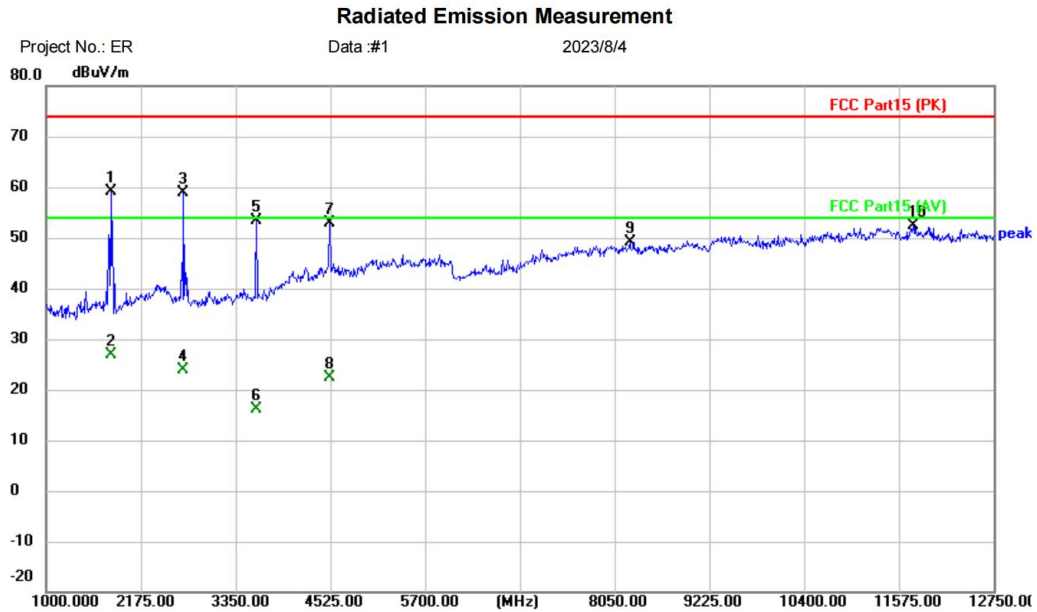
Test Result: Pass

[TestMode: TX low channel]; [Polarity: Vertical]



Test Result: Pass

[TestMode: TX low channel]; [Polarity: Horizontal]



Site: Polarization: **Horizontal** Temperature: (C)
Limit: FCC Part15 (PK) Power: Humidity: %RH
EUT: RFID Raed/Write Module
M/N: ZK8201
Mode: TX-L
Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	1799.000	65.56	-6.53	59.03	74.00	-14.97	peak	
2		1799.000	33.45	-6.53	26.92	54.00	-27.08	AVG	
3		2703.750	62.47	-3.47	59.00	74.00	-15.00	peak	
4		2703.750	27.37	-3.47	23.90	54.00	-30.10	AVG	
5		3608.500	55.05	-1.76	53.29	74.00	-20.71	peak	
6		3608.500	17.99	-1.76	16.23	54.00	-37.77	AVG	
7		4513.250	49.11	3.71	52.82	74.00	-21.18	peak	
8		4513.250	18.71	3.71	22.42	54.00	-31.58	AVG	
9		8238.000	40.61	8.54	49.15	74.00	-24.85	peak	
10		11751.25	39.40	12.98	52.38	74.00	-21.62	peak	

*:Maximum data x:Over limit !:over margin

⟨Reference Only

Receiver: ESR_1 Spectrum Analyzer: FSP40
Antenna: EZ 9120D 1G-18G new Engineer Signature:

Test Result: Pass

Remark:

1. Final Level = Receiver Read level + Correct factor
2. Correct factor = Antenna Factor + Cable Loss – Preamplifier Factor
3. The emission levels of other frequencies are very lower than the limit and not show in test report.

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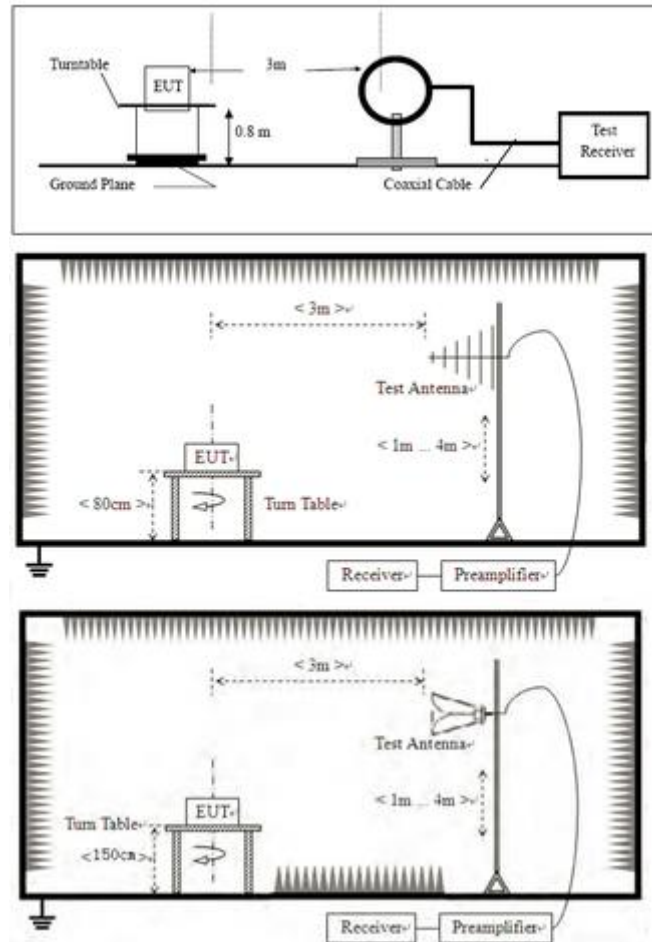
11 RESTRICTED BAND AROUND FUNDAMENTAL FREQUENCY

Test Standard	47 CFR Part 15, Subpart C 15.249
Test Method	ANSI C63.10 (2013) Section 6.4&6.5&6.6
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Jozu
Temperature	25℃
Humidity	60%

11.1 LIMITS

Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
Above 1GHz	74.0	Peak Value
Emission radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.		

11.2 BLOCK DIAGRAM OF TEST SETUP



11.3 PROCEDURE

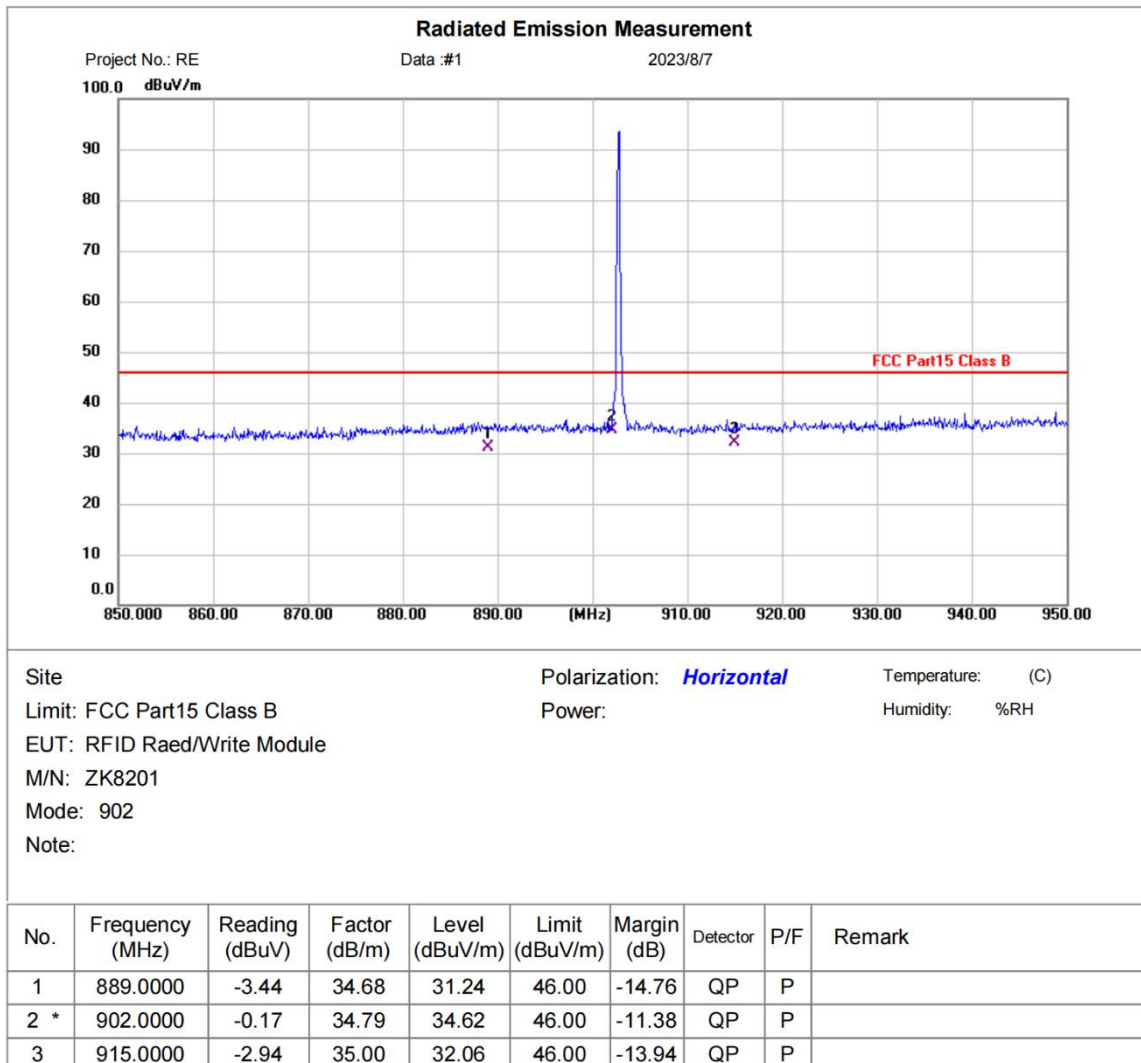
- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height 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.
- 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
 - i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
 - j. Repeat above procedures until all frequencies measured was complete.
- Remark: $\text{Level} = \text{Read Level} + \text{Cable Loss} + \text{Antenna Factor} - \text{Preamp Factor}$

BlueAsia

11.4 TEST DATA

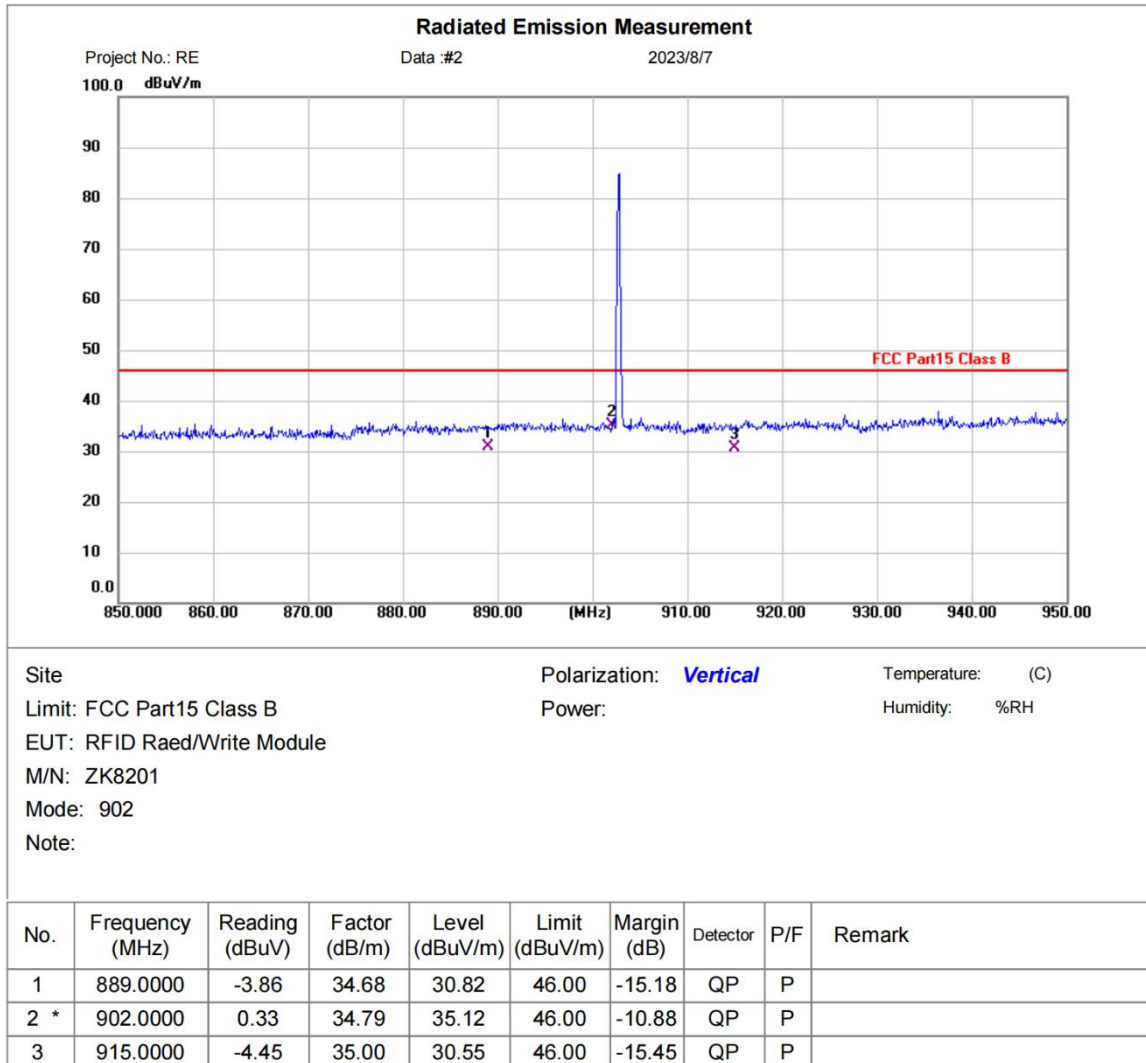
[TestMode: TX low channel]; [Polarity: Horizontal]



*:Maximum data x:Over limit !:over margin

Test Result: Pass

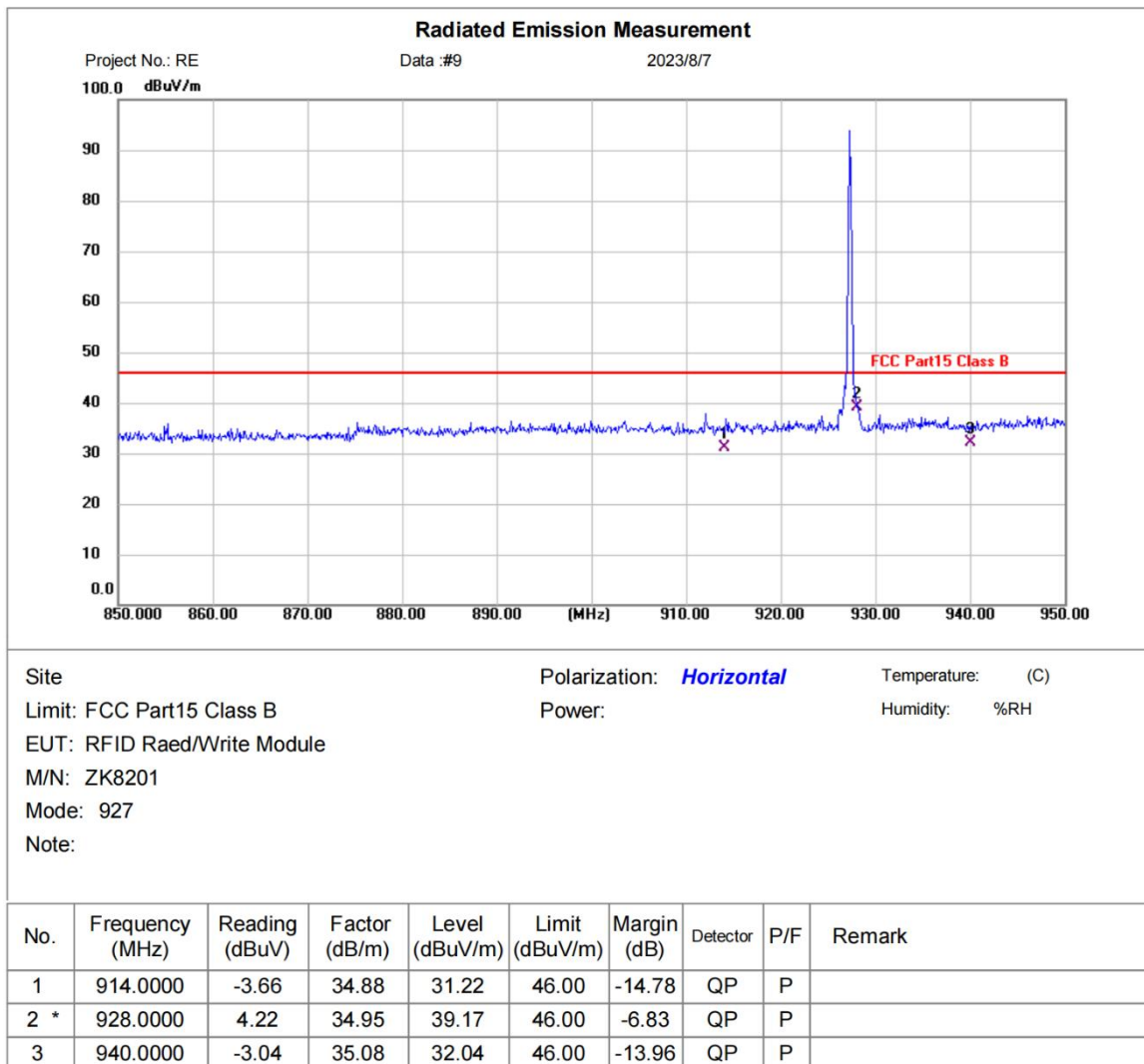
[TestMode: TX low channel]; [Polarity: Vertical]



*:Maximum data x:Over limit !:over margin

Test Result: Pass

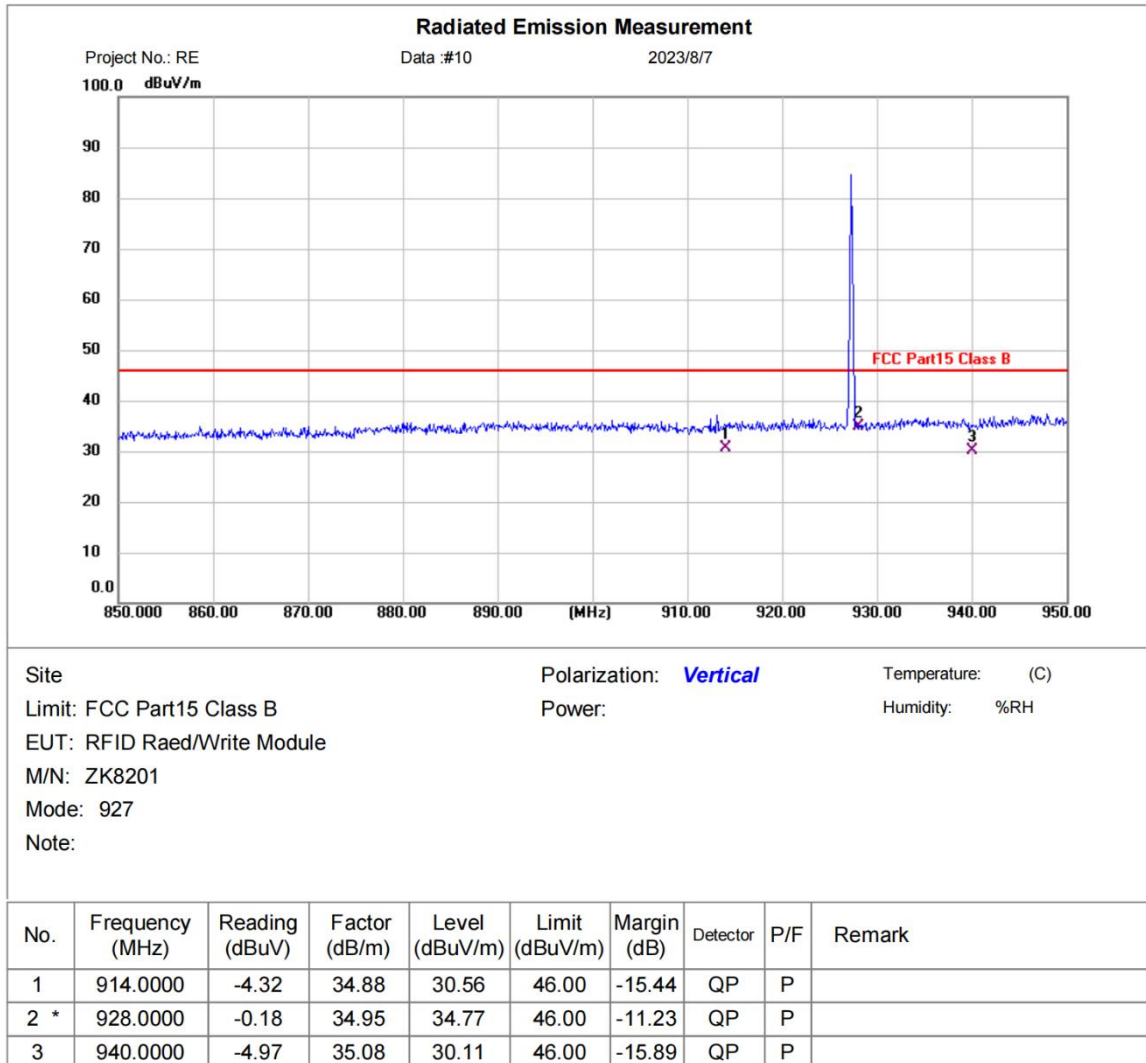
[TestMode: TX high channel]; [Polarity: Horizontal]



*:Maximum data x:Over limit !:over margin

Test Result: Pass

[TestMode: TX high channel]; [Polarity: Vertical]



*:Maximum data x:Over limit !:over margin

Test Result: Pass

Remark:

1. Final Level = Receiver Read level + Correct factor
2. Correct factor = Antenna Factor + Cable Loss – Preamplifier Factor
3. The emission levels of other frequencies are very lower than the limit and not show in test report.

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