

# FCC Test Report

Product Name	UHF RFID Reader Module
Model No.	RSK-UHF01
FCC ID	2ABTU-RSKUHF01

Applicant	RuggON Corporation
Address	4F, No. 298, Yang Guang St., Neihu Dist., Taipei City, Taiwan

Date of Receipt	Dec 24, 2018
Issued Date	Feb. 23, 2019
Report No.	18C0314R-RFUSP66V00
Report Version	V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

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# Test Report

Issued Date: Feb. 23, 2019

Report No.: 18C0314R-RFUSP66V00



Product Name	UHF RFID Reader Module
Applicant	RuggON Corporation
Address	4F, No. 298, Yang Guang St., Neihu Dist., Taipei City, Taiwan
Manufacturer	RuggON Corporation
Model No.	RSK-UHF01
EUT Rated Voltage	DC 3.3V
EUT Test Voltage	DC 3.3V
Trade Name	RuggON
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2017 ANSI C63.4: 2014, ANSI C63.10: 2013
Test Result	Complied

Documented By

:



( Adm. Assistant / Elephant Chen )

Tested By

:



( Engineer / Yunche Chen )

Approved By

:



( Director / Vincent Lin )

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Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs

**1. GENERAL INFORMATION**

**1.1. EUT Description**

Product Name	UHF RFID Reader Module
Trade Name	RuggON
Model No.	RSK-UHF01
FCC ID	2ABTU-RSKUHF01
Frequency Range	902.75MHz-927.25MHz
Channel Control	Auto
Type of Modulation	FSK
Antenna Type	Patch Antenna

Center Frequency of Each Channel

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 1:	902.75 MHz	Channel 2:	903.25 MHz	Channel 3:	903.75 MHz	Channel 4:	904.25 MHz
Channel 5:	904.75 MHz	Channel 6:	905.25 MHz	Channel 7:	905.75 MHz	Channel 8:	906.25 MHz
Channel 9:	906.75 MHz	Channel 10:	907.25 MHz	Channel 11:	907.75 MHz	Channel 12:	908.25 MHz
Channel 13:	908.75 MHz	Channel 14:	909.25 MHz	Channel 15:	909.75 MHz	Channel 16:	910.25 MHz
Channel 17:	910.75 MHz	Channel 18:	911.25 MHz	Channel 19:	911.75 MHz	Channel 20:	912.25 MHz
Channel 21:	912.75 MHz	Channel 22:	913.25 MHz	Channel 23:	913.75 MHz	Channel 24:	914.25 MHz
Channel 25:	914.75 MHz	Channel 26:	915.25 MHz	Channel 27:	915.75 MHz	Channel 28:	916.25 MHz
Channel 29:	916.75 MHz	Channel 30:	917.25 MHz	Channel 31:	917.75 MHz	Channel 32:	918.25 MHz
Channel 33:	918.75 MHz	Channel 34:	919.25 MHz	Channel 35:	919.75 MHz	Channel 36:	920.25 MHz
Channel 37:	920.75 MHz	Channel 38:	921.25 MHz	Channel 39:	921.75 MHz	Channel 40:	922.25 MHz
Channel 41:	922.75 MHz	Channel 42:	923.25 MHz	Channel 43:	923.75 MHz	Channel 44:	924.25 MHz
Channel 45:	924.75 MHz	Channel 46:	925.25 MHz	Channel 47:	925.75 MHz	Channel 48:	926.25 MHz
Channel 49:	926.75 MHz	Channel 50:	927.25 MHz				

Note:

1. The EUT is a UHF RFID Reader Module with a built-in RFID transceiver.
2. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

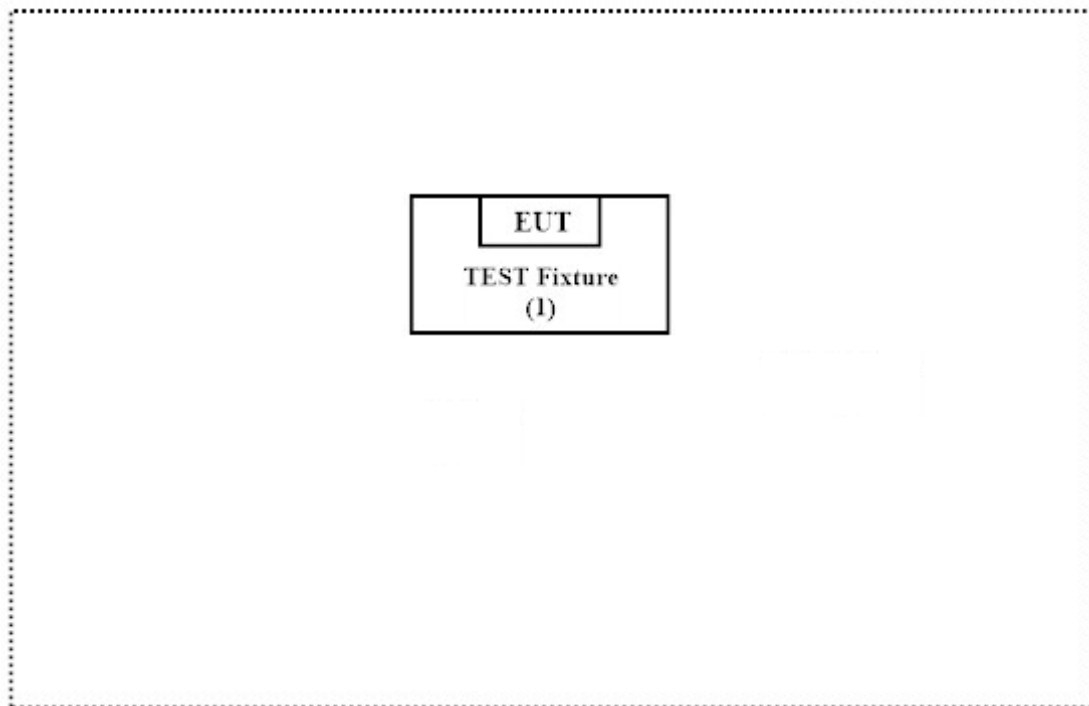
Test Mode	Mode 1: Transmit
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### 1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 TEST Fixture	ubiqconn	N/A	N/A	N/A

### 1.4. Configuration of Test System



### 1.5. EUT Exercise Software

- (1) Setup the EUT as shown in Section 1.4.
- (2) Execute "MIT RFID Explorer v2.0.1" program on the EUT.
- (3) Configure the test mode and the test channel
- (4) Start the continuous Transmit.
- (5) Verify that the EUT works properly.

## 1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:

<http://www.dekra.com.tw/english/about/certificates.aspx?bval=5>

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: [http://www.dekra.com.tw/index\\_en.aspx](http://www.dekra.com.tw/index_en.aspx)

Site Description: Accredited by TAF  
Accredited Number: 3023

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FCC Accreditation Number: TW3023

## 1.7. List of Test Equipment

### For Conducted measurements /SR8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Date	Due. Date
	Temperature Chamber	WIT GROUP	TH-1S-B	EQ-201-00146	2019/2/12	2020/2/11
	Spectrum Analyzer	Agilent	N9010A	MY48030495	2018/10/13	2019/10/12
	Peak Power Analyzer	Keysight	8990B	MY51000410	2018/7/19	2019/7/18
	Wideband Power Sensor	Keysight	N1923A	MY56080003	2018/7/6	2019/7/5
	Wideband Power Sensor	Keysight	N1923A	MY56080004	2018/7/6	2019/7/5
X	EMI Test Receiver	R&S	ESCS 30	100369	2018/11/7	2019/11/6
X	LISN	R&S	ESH3-Z5	836679/017	2019/2/9	2020/2/8
X	LISN	R&S	ENV216	100097	2019/2/9	2020/2/8
X	Coaxial Cable	DEKRA	RG 400	LC018-RG	2018/6/22	2019/6/21

### For Radiated measurements /Site3/CB8

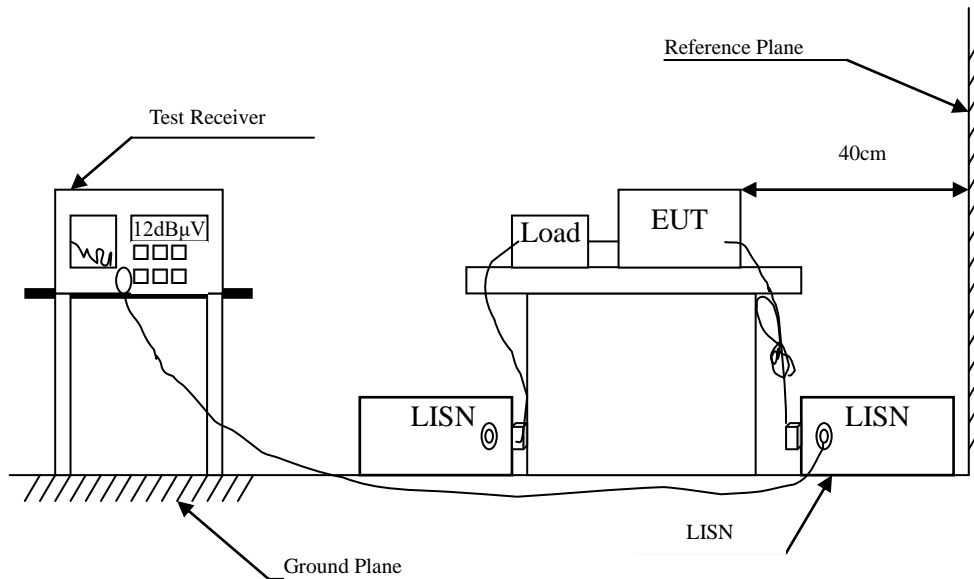
	Equipment	Manufacturer	Model No.	Serial No.	Cali. Date	Due. Date
X	Spectrum Analyzer	R&S	FSP40	100170	2018/3/12	2019/3/11
	Loop Antenna	Teseq	HLA6121	37133	2018/10/13	2019/10/12
X	Bilog Antenna	Schaffner Chase	CBL6112B	2707	2018/6/25	2019/6/24
X	Coaxial Cable	DEKRA	RG 214	LC003-RG	2018/6/15	2019/6/14
X	Pre-Amplifier	Jet-Power	JPA-10M1G33	170101000330 010	2018/7/19	2019/7/18
X	Horn Antenna	ETS-Lindgren	3117	00135205	2018/5/3	2019/5/2
X	Pre-Amplifier	EMCI	EMC012630SE	980210	2018/4/10	2019/4/9
X	Coaxial Cable	QuieTek	SF-106	LC035/37/41- SF	2018/6/21	2019/6/20
X	Amplifier + Cable	EMCI	EMC184045SE	980370	2018/3/21	2019/3/20
X	Horn Antenna	Com-Power	AH-840	101043	2019/1/9	2020/1/8
	Filter	MicroTRON	BRM50701	019	2018/11/21	2019/11/20
	Filter	Microwave Circuits	N0257881	36681	2019/1/22	2020/1/21

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version :QuieTek EMI 2.0 V2.1.113.

## 2. Conducted Emission

### 2.1. Test Setup



### 2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dB $\mu$ V) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

### 2.3. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

### 2.4. Uncertainty

$\pm 2.26$  dB



## 2.5. Test Result of Conducted Emission

Product : UHF RFID Reader Module  
 Test Item : Conducted Emission Test  
 Power Line : Line 1  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit (914.75MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V	Margin dB	Limit dB $\mu$ V
<b>LINE 1</b>					
<b>Quasi-Peak</b>					
0.170	9.643	41.620	51.263	-14.166	65.429
0.189	9.637	40.740	50.377	-14.509	64.886
0.240	9.639	30.180	39.819	-23.610	63.429
0.463	9.639	26.140	35.779	-21.278	57.057
2.986	9.741	25.800	35.540	-20.460	56.000
19.916	10.111	25.400	35.511	-24.489	60.000
<b>Average</b>					
0.170	9.643	15.400	25.043	-30.386	55.429
0.189	9.637	23.150	32.787	-22.099	54.886
0.240	9.639	16.220	25.859	-27.570	53.429
0.463	9.639	22.150	31.789	-15.268	47.057
2.986	9.741	19.800	29.540	-16.460	46.000
19.916	10.111	19.740	29.851	-20.149	50.000

### Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : UHF RFID Reader Module  
 Test Item : Conducted Emission Test  
 Power Line : Line 2  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit (914.75MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V	Margin dB	Limit dB $\mu$ V
<b>LINE 2</b>					
<b>Quasi-Peak</b>					
0.173	9.597	41.760	51.357	-13.986	65.343
0.212	9.588	28.460	38.048	-26.181	64.229
0.224	9.589	32.360	41.949	-21.937	63.886
0.463	9.589	27.840	37.429	-19.628	57.057
2.869	9.695	25.500	35.195	-20.805	56.000
18.357	10.140	26.060	36.200	-23.800	60.000
<b>Average</b>					
0.173	9.597	29.470	39.067	-16.276	55.343
0.212	9.588	12.610	22.198	-32.031	54.229
0.224	9.589	13.490	23.079	-30.807	53.886
0.463	9.589	20.620	30.209	-16.848	47.057
2.869	9.695	20.620	30.315	-15.685	46.000
18.357	10.140	20.930	31.070	-18.930	50.000

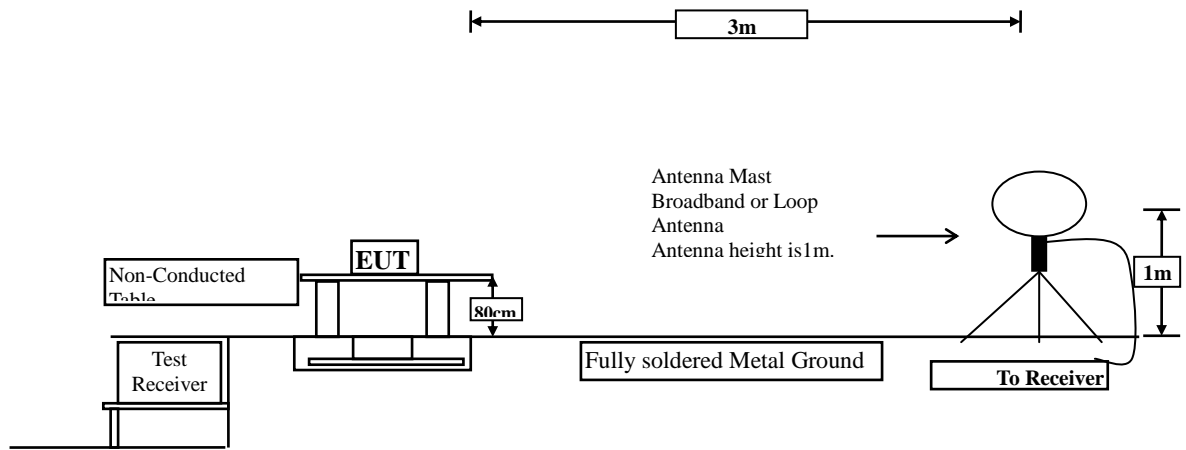
Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "█" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

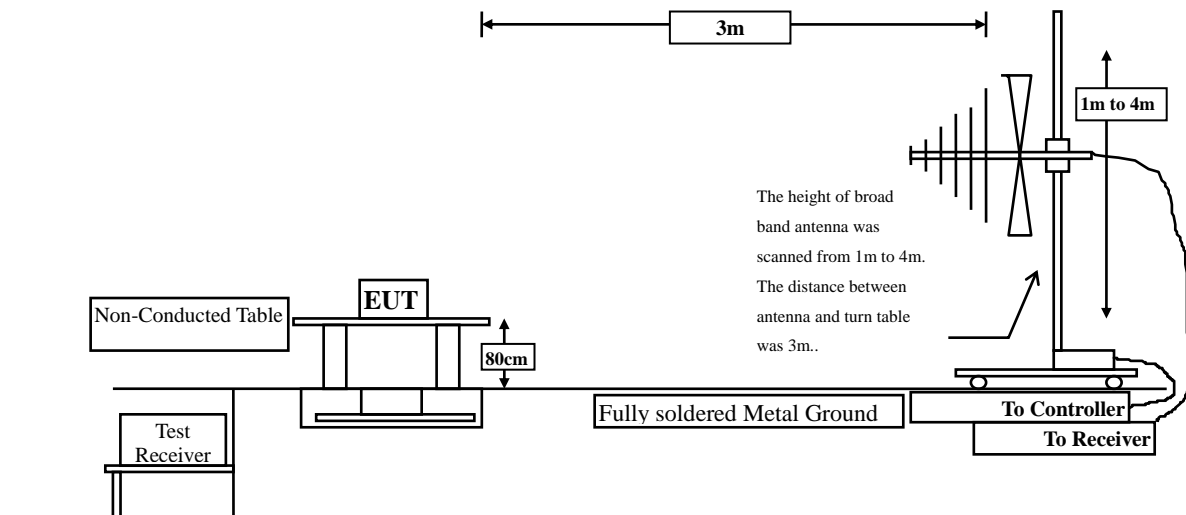
### 3. Radiated Emission

#### 3.1. Test Setup

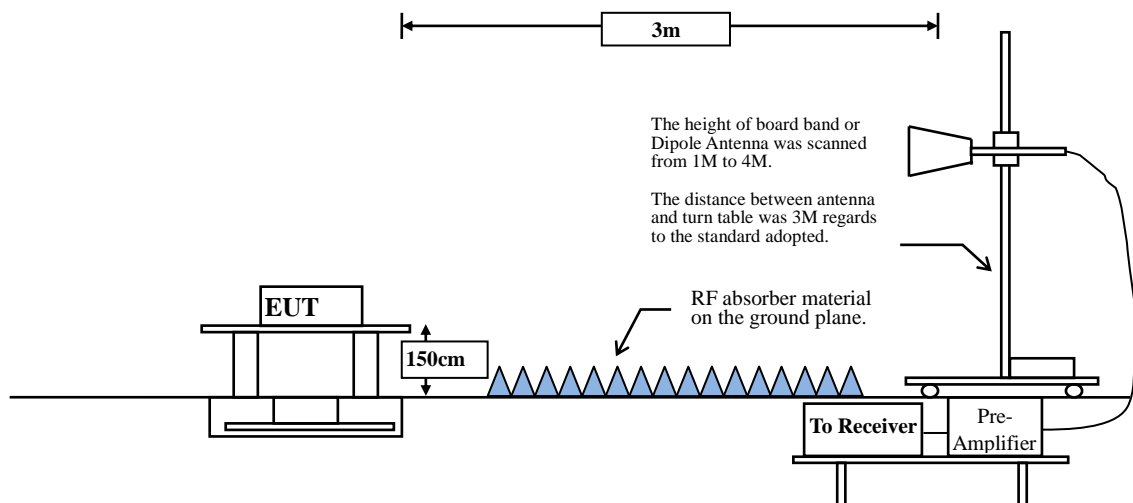
Radiated Emission Under 30MHz



Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



### 3.2. Limits

#### ➤ Fundamental and Harmonics Emission Limits

FCC Part 15 Subpart C Paragraph 15.249 Limits				
Frequency MHz	Field Strength of Fundamental		Field Strength of Harmonics	
	(mV/m @3m)	(dB $\mu$ V /m @3m)	(uV/m @3m)	(dB $\mu$ V /m @3m)
902-928	50	94	500	54
2400-2483.5	50	94	500	54
5725-5875	50	94	500	54

- Remarks :
1. RF Voltage (dB $\mu$ V /m) = 20 log RF Voltage (uV/m)
  2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

#### ➤ General Radiated Emission Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209(a) Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remarks: E field strength (dB $\mu$ V /m) = 20 log E field strength (uV/m)

### 3.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested compliance to FCC 47CFR 15.249 requirements.

Measuring the frequency range below 1GHz, the EUT is placed on a turn table which is 0.8 meter above ground, when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level.

This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2013 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The worst radiated emission is measured in the Open Area Test Site on the Final Measurement.

The measurement frequency range from 9kHz - 10th Harmonic of fundamental was investigated.

### 3.4. Uncertainty

± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

### 3.5. Test Result of Radiated Emission

Product : UHF RFID Reader Module  
 Test Item : Fundamental Radiated Emission  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit

#### X-Axis

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V/m	Margin dB	Limit dB $\mu$ V/m
<b>Horizontal Quasi-Peak</b>					
902.750	12.154	79.410	91.564	-2.436	94.000
914.750	12.350	80.900	93.250	-0.750	94.000
927.250	12.568	77.820	90.388	-3.612	94.000

#### Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.

Product : UHF RFID Reader Module  
 Test Item : Fundamental Radiated Emission  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit

**X-Axis**

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Vertical</b>					
<b>Quasi-Peak</b>					
902.750	12.154	76.350	88.504	-5.496	94.000
914.750	12.350	80.300	92.650	-1.350	94.000
927.250	12.568	79.510	92.078	-1.922	94.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.

Product : UHF RFID Reader Module  
 Test Item : Fundamental Radiated Emission  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit

**Y-Axis**

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Horizontal</b>					
<b>Quasi-Peak</b>					
902.750	12.154	70.600	82.754	-11.246	94.000
914.750	12.350	73.620	85.970	-8.030	94.000
927.250	12.568	73.920	86.488	-7.512	94.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.



Product : UHF RFID Reader Module  
 Test Item : Fundamental Radiated Emission  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit

**Y-Axis**

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Vertical</b>					
<b>Quasi-Peak</b>					
902.750	12.154	71.110	83.264	-10.736	94.000
914.750	12.350	72.790	85.140	-8.860	94.000
927.250	12.568	71.710	84.278	-9.722	94.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.

Product : UHF RFID Reader Module  
 Test Item : Fundamental Radiated Emission  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit

**Z-Axis**

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Horizontal</b>					
<b>Quasi-Peak</b>					
902.750	12.154	71.860	84.014	-9.986	94.000
914.750	12.350	75.920	88.270	-5.730	94.000
927.250	12.568	73.920	86.488	-7.512	94.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.

Product : UHF RFID Reader Module  
 Test Item : Fundamental Radiated Emission  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit

**Z-Axis**

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Vertical</b>					
<b>Quasi-Peak</b>					
902.750	12.154	74.500	86.654	-7.346	94.000
914.750	12.350	75.900	88.250	-5.750	94.000
927.250	12.568	73.730	86.298	-7.702	94.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.

Product : UHF RFID Reader Module  
 Test Item : Harmonic Radiated Emission Data  
 Test Date : 2019/02/12  
 Test Mode : Mode 1: Transmit (902.75MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
1805.500	-3.122	42.480	39.358	-34.642	74.000
2708.250	-1.700	44.435	42.735	-31.265	74.000
3611.000	-0.441	41.267	40.826	-33.174	74.000
4513.750	0.631	32.717	33.348	-40.652	74.000
5416.500	1.617	32.599	34.216	-39.784	74.000
6319.250	2.574	31.399	33.973	-40.027	74.000
7222.000	3.487	42.439	45.926	-28.074	74.000
8124.750	4.332	38.136	42.468	-31.532	74.000
9027.500	5.473	36.440	41.913	-32.087	74.000
<b>Average Detector:</b>					
--					54.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : UHF RFID Reader Module  
 Test Item : Harmonic Radiated Emission Data  
 Test Date : 2019/02/12  
 Test Mode : Mode 1: Transmit (902.75MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Vertical</b>					
<b>Peak Detector:</b>					
1805.500	-3.122	39.125	36.003	-37.997	74.000
2708.250	-1.700	34.801	33.101	-40.899	74.000
3611.000	-0.441	36.314	35.873	-38.127	74.000
4513.750	0.631	32.827	33.458	-40.542	74.000
5416.500	1.617	32.729	34.346	-39.654	74.000
6319.250	2.574	32.469	35.043	-38.957	74.000
7222.000	3.487	36.869	40.356	-33.644	74.000
8124.750	4.332	39.422	43.754	-30.246	74.000
9027.500	5.473	36.255	41.728	-32.272	74.000
<b>Average Detector:</b>					
--					54.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : UHF RFID Reader Module  
 Test Item : Harmonic Radiated Emission Data  
 Test Date : 2019/02/12  
 Test Mode : Mode 1: Transmit (914.75MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
1829.500	-3.053	31.907	28.854	-45.146	74.000
2744.250	-1.585	37.129	35.544	-38.456	74.000
3659.000	-0.432	39.995	39.563	-34.437	74.000
4573.750	0.634	32.597	33.231	-40.769	74.000
5488.500	1.762	32.900	34.662	-39.338	74.000
6403.250	2.702	31.410	34.112	-39.888	74.000
7318.000	3.575	43.861	47.435	-26.565	74.000
8232.750	4.453	40.456	44.909	-29.091	74.000
9147.500	5.794	32.647	38.441	-35.559	74.000
<b>Average Detector:</b>					
--					54.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : UHF RFID Reader Module  
 Test Item : Harmonic Radiated Emission Data  
 Test Date : 2019/02/12  
 Test Mode : Mode 1: Transmit (914.75MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Vertical</b>					
<b>Peak Detector:</b>					
1829.500	-3.053	31.237	28.184	-45.816	74.000
2744.250	-1.585	37.539	35.954	-38.046	74.000
3659.000	-0.432	32.095	31.663	-42.337	74.000
4573.750	0.634	32.597	33.231	-40.769	74.000
5488.500	1.762	32.930	34.692	-39.308	74.000
6403.250	2.702	35.140	37.842	-36.158	74.000
7318.000	3.575	37.121	40.695	-33.305	74.000
8232.750	4.453	41.286	45.739	-28.261	74.000
9147.500	5.794	32.554	38.348	-35.652	74.000
<b>Average Detector:</b>					
--					54.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : UHF RFID Reader Module  
 Test Item : Harmonic Radiated Emission Data  
 Test Date : 2019/02/12  
 Test Mode : Mode 1: Transmit (927.25MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Horizontal</b>					
<b>Peak Detector:</b>					
1854.500	-2.963	41.010	38.047	-35.953	74.000
2781.750	-1.549	37.046	35.497	-38.503	74.000
3709.000	-0.301	39.213	38.912	-35.088	74.000
4636.250	0.747	32.717	33.464	-40.536	74.000
5563.500	2.053	34.083	36.136	-37.864	74.000
6490.750	2.805	32.513	35.318	-38.682	74.000
7418.000	3.776	42.657	46.433	-27.567	74.000
8345.250	4.628	40.393	45.022	-28.978	74.000
9272.500	5.752	32.634	38.386	-35.614	74.000
<b>Average Detector:</b>					
--					54.000

## Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.



Product : UHF RFID Reader Module  
 Test Item : Harmonic Radiated Emission Data  
 Test Date : 2019/02/12  
 Test Mode : Mode 1: Transmit (927.25MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Vertical</b>					
<b>Peak Detector:</b>					
1854.500	-2.963	44.266	41.304	-32.696	74.000
2781.750	-1.549	36.096	34.547	-39.453	74.000
3709.000	-0.301	34.924	34.623	-39.377	74.000
4636.250	0.747	37.471	38.218	-35.782	74.000
5563.500	2.053	35.794	37.847	-36.153	74.000
6490.750	2.805	33.476	36.281	-37.719	74.000
7418.000	3.776	37.773	41.549	-32.451	74.000
8345.250	4.628	40.376	45.005	-28.995	74.000
9272.500	5.752	33.610	39.362	-34.638	74.000
<b>Average Detector:</b>					
--					54.000

## Note:

- All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- Measurement Level = Reading Level + Correct Factor.
- Correct Factor = Antenna factor + Cable loss – Amplifier gain.
- The average measurement was not performed when the peak measured data under the limit of average detection.
- The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : UHF RFID Reader Module  
 Test Item : General Radiated Emission Data  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit (902.75MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Horizontal</b>					
168.349	-2.733	33.191	30.458	-13.042	43.500
311.362	2.051	30.160	32.211	-13.789	46.000
359.551	3.712	28.848	32.561	-13.439	46.000
479.247	6.311	25.591	31.902	-14.098	46.000
769.936	10.417	22.819	33.236	-12.764	46.000
923.830	12.507	24.739	37.246	-8.754	46.000
<b>Vertical</b>					
56.426	-6.367	31.300	24.933	-15.067	40.000
311.362	2.051	28.239	30.290	-15.710	46.000
407.740	5.104	26.269	31.374	-14.626	46.000
455.929	5.884	25.210	31.094	-14.906	46.000
648.686	9.113	23.150	32.264	-13.736	46.000
903.622	12.171	26.219	38.390	-7.610	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

Product : UHF RFID Reader Module  
 Test Item : General Radiated Emission Data  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit (914.75MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Horizontal</b>					
193.221	-2.956	30.466	27.510	-15.990	43.500
266.282	1.245	28.389	29.634	-16.366	46.000
311.362	2.051	28.088	30.139	-15.861	46.000
407.740	5.104	24.950	30.055	-15.945	46.000
614.487	8.578	22.176	30.754	-15.246	46.000
923.830	12.507	23.542	36.049	-9.951	46.000
<b>Vertical</b>					
120.160	-0.580	22.441	21.861	-21.639	43.500
258.510	1.473	23.898	25.370	-20.630	46.000
311.362	2.051	28.319	30.370	-15.630	46.000
407.740	5.104	28.182	33.287	-12.713	46.000
676.667	9.259	22.923	32.182	-13.818	46.000
903.622	12.171	22.096	34.267	-11.733	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
9. The emission levels of other frequencies are very lower than the limit and not show in test report.
10. No emission found between lowest internal used/generated frequency to 30MHz.

Product : UHF RFID Reader Module  
 Test Item : General Radiated Emission Data  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit (927.25MHz)

Frequency MHz	Correct Factor dB	Reading Level dB $\mu$ V	Measurement Level dB $\mu$ V /m	Margin dB	Limit dB $\mu$ V /m
<b>Horizontal</b>					
166.795	-2.657	29.549	26.892	-16.608	43.500
289.599	1.403	28.123	29.526	-16.474	46.000
359.551	3.712	27.528	31.241	-14.759	46.000
479.247	6.311	24.758	31.069	-14.931	46.000
754.391	10.261	20.987	31.248	-14.752	46.000
903.622	12.171	22.586	34.757	-11.243	46.000
<b>Vertical</b>					
71.971	-6.853	30.355	23.502	-16.498	40.000
311.362	2.051	27.036	29.087	-16.913	46.000
407.740	5.104	26.489	31.594	-14.406	46.000
455.929	5.884	25.248	31.132	-14.868	46.000
687.548	9.314	25.230	34.544	-11.456	46.000
903.622	12.171	26.978	39.149	-6.851	46.000

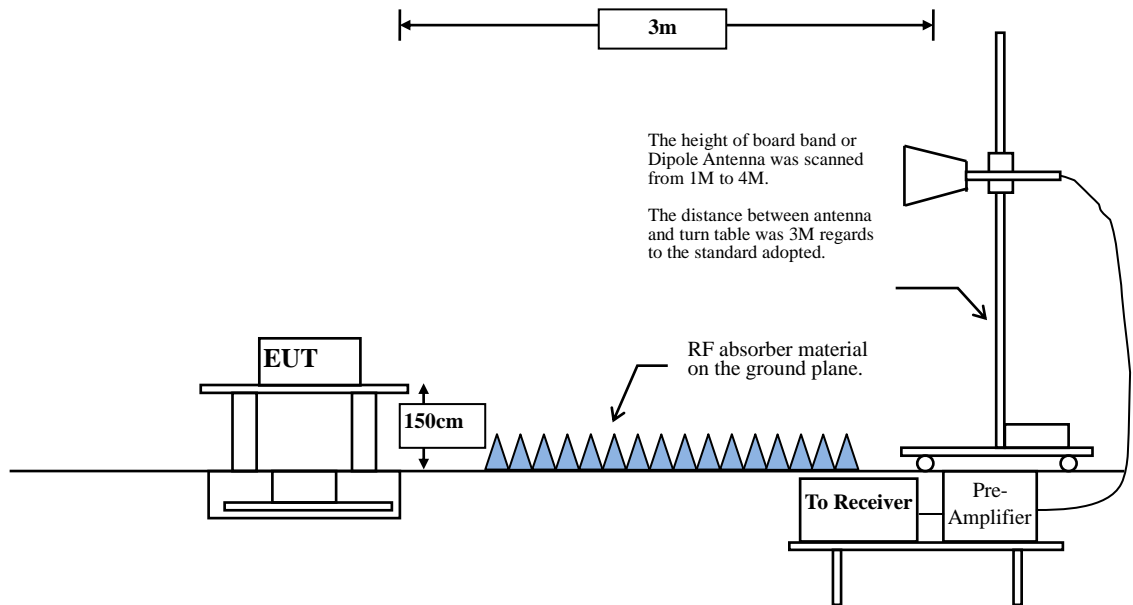
Note:

- All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- Measurement Level = Reading Level + Correct Factor.
- Correct Factor = Antenna factor + Cable loss – Amplifier gain.
- The average measurement was not performed when the peak measured data under the limit of average detection.
- The emission levels of other frequencies are very lower than the limit and not show in test report.
- No emission found between lowest internal used/generated frequency to 30MHz.

#### 4. Band Edge

##### 4.1. Test Setup

###### RF Radiated Measurement:



##### 4.2. Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209(a) Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remarks: E field strength (dBμV /m) = 20 log E field strength (uV/m)

### 4.3. Test Procedure

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

The bandwidth setting below 1GHz and above 1GHz on the field strength meter is 120 kHz and 1MHz, respectively.

### 4.4. Uncertainty

± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

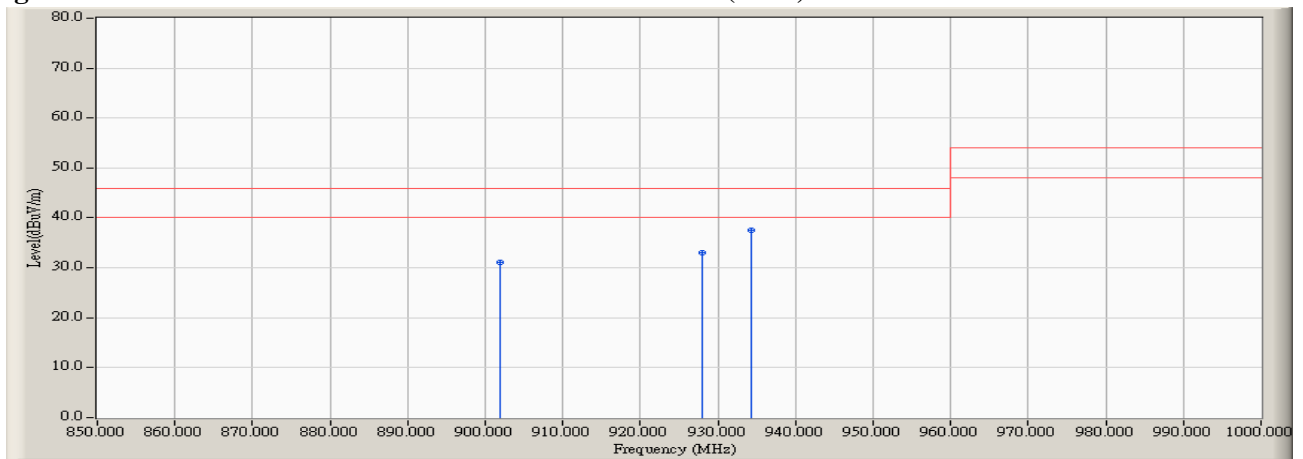
#### 4.5. Test Result of Band Edge

Product : UHF RFID Reader Module  
 Test Item : Band Edge Data  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit (902.75MHz)

##### RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV /m)	Quasi-Peak Limit (dBuV/m)	Result
1 (Quasi-Peak)	902.000	12.145	18.936	31.081	46.000	Pass
1 (Quasi-Peak)	928.000	12.584	20.368	32.953	46.000	Pass
1 (Quasi-Peak)	934.375	12.686	24.763	37.450	46.000	Pass

Figure Channel 1: Horizontal (Peak)



Note:

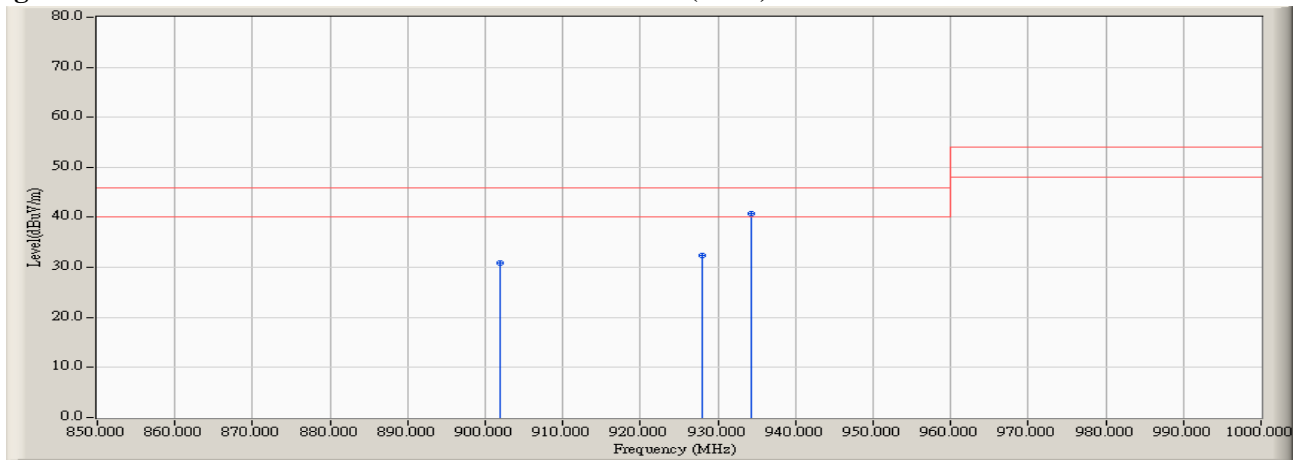
1. Quasi-Peak measurements: RBW=100kHz,VBW=1MHz,Sweep: Auto.
2. Measurement Level = Reading Level + Correct Factor.

Product : UHF RFID Reader Module  
 Test Item : Band Edge Data  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit (902.75MHz)

**RF Radiated Measurement (Vertical):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV )	Emission Level (dBμV /m)	Quasi-Peak Limit (dBuV/m)	Result
1 (Quasi-Peak)	902.000	12.145	18.936	31.081	46.000	Pass
1 (Quasi-Peak)	928.000	12.584	20.368	32.953	46.000	Pass
1 (Quasi-Peak)	934.375	12.686	24.763	37.450	46.000	Pass

**Figure Channel 1: Vertical (Peak)**



Note:

1. Quasi-Peak measurements: RBW=100kHz,VBW=1MHz,Sweep: Auto.
2. Measurement Level = Reading Level + Correct Factor.

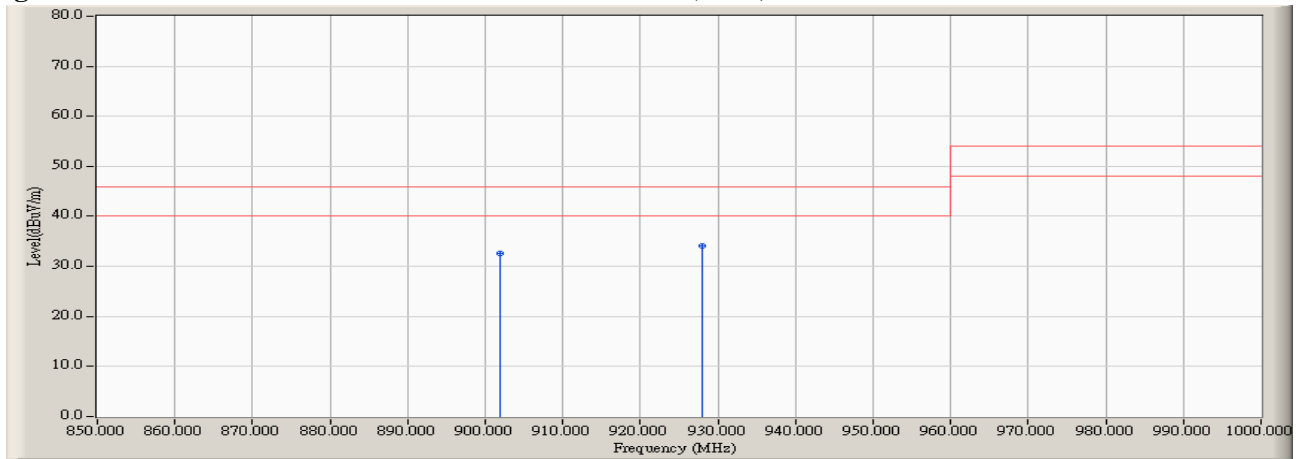


Product : UHF RFID Reader Module  
 Test Item : Band Edge Data  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit (927.25MHz)

**RF Radiated Measurement (Vertical):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV /m)	Quasi-Peak Limit (dBuV/m)	Result
50 (Quasi-Peak)	902.000	12.145	20.487	32.632	46.000	Pass
50 (Quasi-Peak)	928.000	12.584	21.546	34.131	46.000	Pass

**Figure Channel 2: Vertical (Peak)**



Note:

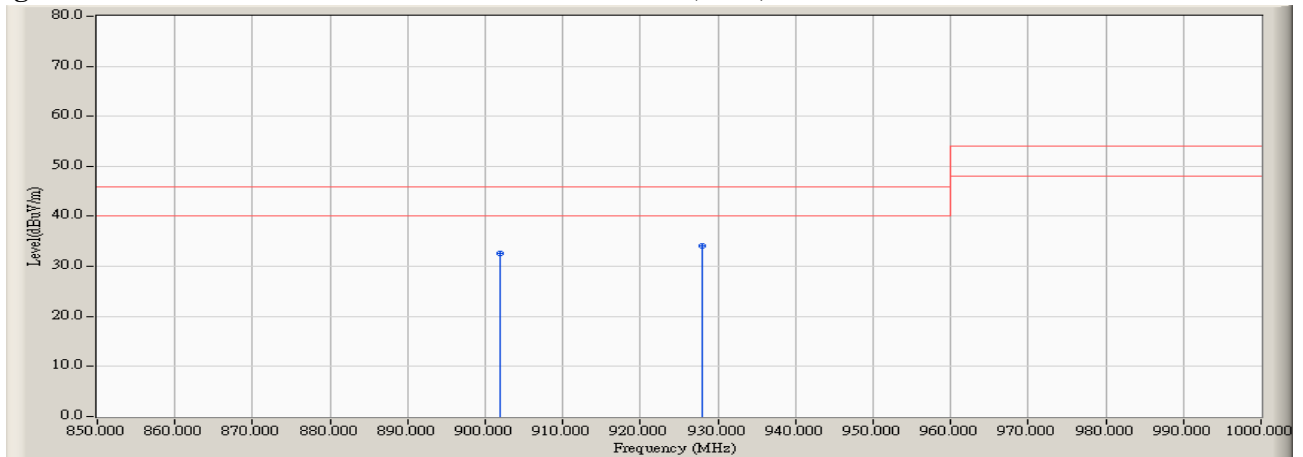
1. Quasi-Peak measurements: RBW=100kHz,VBW=1MHz,Sweep: Auto.
2. Measurement Level = Reading Level + Correct Factor.

Product : UHF RFID Reader Module  
 Test Item : Band Edge Data  
 Test Date : 2019/02/20  
 Test Mode : Mode 1: Transmit (927.25MHz)

**RF Radiated Measurement (Vertical):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV /m)	Quasi-Peak Limit (dBuV/m)	Result
50 (Quasi-Peak)	902.000	12.145	24.508	36.653	46.000	Pass
50 (Quasi-Peak)	928.000	12.584	25.642	38.227	46.000	Pass

**Figure Channel 2: Vertical (Peak)**



Note:

1. Quasi-Peak measurements: RBW=100kHz,VBW=1MHz,Sweep: Auto.
2. Measurement Level = Reading Level + Correct Factor.

## **5. EMI Reduction Method During Compliance Testing**

No modification was made during testing.