TEST REPORT

Test report

On Behalf of

Balluff GmbH

For

RFID Reader

Model No: BF-IDU05

FCC ID: 2AGZY-BFIDU05

IC: 20739-BFIDU05

Prepared for : **Balluff GmbH**
Schurwaldstrasse 9, 73765 Neuhausen a.d.F., Germany

Prepared By : **Shenzhen HUAK Testing Technology Co., Ltd.**
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Date of Test: **August 08, 2019 - August 16, 2019**
Date of Report: **August 20, 2019**
Report Number: **HK1908162032-E**

TEST RESULT CERTIFICATION

Applicant's name ....:	**Balluff GmbH**
Address ....:	Schurwaldstrasse 9, 73765 Neuhausen a.d.F., Germany
Manufacture's Name ....:	**Balluff GmbH**
Address ....:	Schurwaldstrasse 9, 73765 Neuhausen a.d.F., Germany

Product description

Trade Mark ....:	BALLUFF
Product name ....:	RFID Reader
Model and/or type reference ..:	BF-IDU05
Standards ....:	FCC Rules and Regulations Part 15 Subpart C Section 15.247 ANSI C63.10: 2013

Date of Test.......................... ....:	
Date (s) of performance of tests..........:	August 08, 2019 - August 16, 2019
Date of Issue ....:	August 20, 2019
Test Result ....:	**Pass**

Testing Engineer : Gary Qian

(Gary Qian)

Technical Manager : Eden Hu

(Eden Hu)

Authorized Signatory : Jason Zhou

(Jason Zhou)

Revision History

Revision	Issue Date	Revisions	Revised By
00	August 20, 2019	Initial Issue	Jason Zhou

TABLE OF CONTENTS

Description Page

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

Product Name	:	RFID Reader
Model Number	:	BF-IDU05
Model Difference Declaration	:	N/A
Test Model	:	BF-IDU05
Power Supply	:	DC 24V
Hardware version	:	1.1
Software version	:	1.0
RFID		
Frequency Range	:	902.25 – 927.75 MHz
Channel Number	:	52 Channels
Modulation Technology	:	PR-ASK
Antenna information	:	Antenna 1: Model: BIS U-303-C1-TNCB Type: Detachable Antenna Gain: 5.5 dBi (8.5 dBic) Antenna 2: Model: BIS U-301-C1-TNCB Type: Detachable Antenna Gain: 2.5 dBi (5.5 dBic)
Cable information	:	Cable 1: Model: BIS U-500-EF-05 Type: TNC type Cable Loss: 1.8 dB Cable 2: Model: BIS U-500-EF-02 Type: TNC type Cable Loss: 0.7 dB

Note1: Antenna postion refer to EUT Photos.
Note2: Antenna 1 used with Cable 1, and Antena 2 used with Cable 2.

1.2 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

1.3 External I/O Cable

I/O Port Description	Quantity	Cable
DC/COM Port	1	Power cable:1.0 m, unshielded Serial cable:0.5m,unshielded USB cable: 0.8m,unshield

Note: detail refer to EUT photos

1.4 Description of Test Facility

Designation Number: CN1229
Test Firm Registration Number: 616276

The 3m-Semi anechoic test site fulfills CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010

1.5 Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the HUAK quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6 Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.08dB	(1)
		30MHz~1000MHz	±4.42dB	(1)
		1GHz~40GHz	±4.06dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±2.23dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7 Description of Test Modes

RFID operates in the unlicensed Band at 902 – 928 MHz. All test modes were tested, only the result of the worst case was recorded in the report.

Mode of Operations	Test Frequency (MHz)
PR-ASK	902.25(LCH)
	915.25(MCH)
	927.75(HCH)
For Radiated Emission	
Test Mode	TX Mode

Note: LCH means Low Channel;MCH means Middle Channel; HCH means High Channel

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be TX(HCH).

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR PART 15C 15.207, 15.209, 15.247 and DA 00-705.

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 that intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT was operated in the normal operating mode for Hopping Numbers and Dwell Time test and a continuous transmits mode for other tests.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209, 15.247 under the FCC Rules Part 15 Subpart C.

2.3 General Test Procedures

2.3.1 Radiated Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane.The turntable 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 maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

2.4. Test Sample

The application provides 2 samples to meet requirement;

Sample Number	Description
Sample 1	Engineer sample – continuous transmit
Sample 2	Normal sample – Intermittent transmit

3. SYSTEM TEST CONFIGURATION

3.1 Justification

The system was configured for testing in a continuous transmits condition.

3.2 EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by software (ReaderStart v2)provided by application.

3.3 Special Accessories

No.	Equipment	Manufacturer	Model No.	Serial No.	Length	shielded/ unshielded	Notes
1	PC	ASUS	X454L	15105-0038A1 00	/	/	/

3.4 Block Diagram/Schematics

Please refer to the related document.

3.5 Equipment Modifications

Shenzhen HUAK Testing Technology Co., Ltd. has not done any modification on the EUT.

3.6 Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

IC Rules	FCC Rules	Description of Test	Test Sample	Result
RSS-247 5.4(b)	§15.247(b)(1)	Maximum Conducted Output Power	Sample 1	Compliant
RSS-247 5.1(b)	§15.247(c)	Frequency Separation And 20 dB Bandwidth	Sample 1	Compliant
RSS-Gen 6.7	N/A	99% Bandwidth	Sample 1	Compliant
RSS-247 5.1(d)	§15.247(a)(1)(ii)	Number Of Hopping Frequency	Sample 2	Compliant
RSS-247 5.1(d)	§15.247(a)(1)(iii)	Time Of Occupancy (Dwell Time)	Sample 1	Compliant
RSS-247 5.4(d); RSS-Gen 8.9	§15.209, §15.247(d)	Conducted Spurious Emissions and Band Edges Test	Sample 1	Compliant
RSS-247 5.5; RSS-Gen 8.9	§15.209, §15.247(d)	Radiated Emissions	Sample 1	Compliant
RSS-Gen 8.10	§15.205	Emissions at Restricted Band	Sample 1	Compliant
RSS-Gen 8.8	§15.207(a)	Conducted Emissions	N/A	Compliant
RSS-Gen 6.8	§15.203	Antenna Requirements	N/A	Compliant

Note 1: there are four antenna ports, every port has been tested, and list the worst result(Antenna 4) in this report

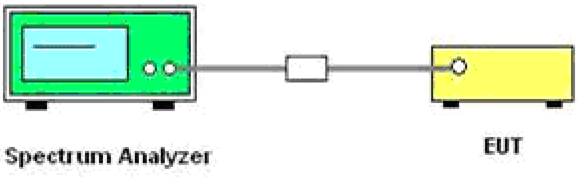
5. SUMMARY OF TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 27, 2018	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 27, 2018	1 Year
4.	Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 27, 2018	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 27, 2018	1 Year
6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 27, 2018	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 27, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 27, 2018	1 Year
10.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 27, 2018	1 Year
11.	Broadband Horn Antenna	Schewarzbeck	BBHA 9170	HKE-017	Dec. 27, 2018	1 Year
12.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 27, 2018	1 Year
13.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 27, 2018	1 Year
14.	EMI Test Software EZ-EMC	Tonscend	JS1120-B	HKE-083	Dec. 27, 2018	N/A
15.	Power Sensor	Agilent	E9300A	HKE-086	Dec. 27, 2018	1 Year
16.	Signal generator	Agilent	N5182A	HKE-029	Dec. 27, 2018	1 Year
17.	Signal Generator	Agilent	83630A	HKE-028	Dec. 27, 2018	1 Year
18.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 27, 2018	3 Year
19.	Horn Antenna	ETS	3117	HKE-040	Dec. 27, 2018	1 Year
20.	RF Cable(below 1GHz)	HUBER+SUHNER	RG214	HKE-055	Dec. 27, 2018	1 Year
21.	RF Cable(above 1GHz)	HUBER+SUHNER	RG214	HKE-056	Dec. 27, 2018	1 Year

6. MEASUREMENT RESULTS

6.1 Peak Power

6.1.1 Block Diagram of Test Setup



6.1.2 Limit

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

6.1.3 Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

6.1.4 Test Results

Temperature	28.1℃	Humidity	58%
Test Engineer	Gary Qian	Configurations	BT

Remark:

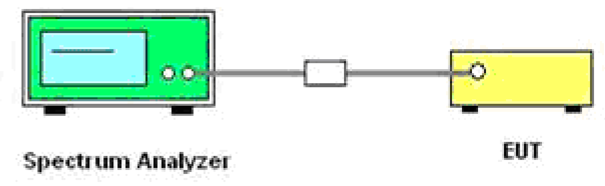
1. *Test results including cable loss;*
2. *please refer to following plots;*
3. *Measured output power at difference Packet Type for each mode and recorded worst case for each mode.*
4. ***Plesase See appendix for Peak Output Power test data***

6.2 Frequency Separation, 20 dB Bandwidth and 99% Bandwidth

6.2.1 Limit

According to §15.247(a) (1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

6.2.2 Block Diagram of Test Setup



6.2.3 Test Procedure

Frequency separation test procedure：

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set center frequency of Spectrum Analyzer = middle of hopping channel.

4). Set the Spectrum Analyzer as RBW = 100 kHz, VBW = 300 kHz, Span = wide enough to capture the peaks of two adjacent channels, Sweep = auto.

5). Max hold, mark 2 peaks of hopping channel and record the 2 peaks frequency.

20dB and 99% bandwidth test procedure：

1). Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel.

2). RBW ≥1% of the 20 dB bandwidth, VBW ≥RBW.

3). Detector function = peak.

4). Trace = max hold.

6.2.4 Test Results

Temperature	28.1℃	Humidity	58%
Test Engineer	Gary Qian	Configurations	BT

Remark:

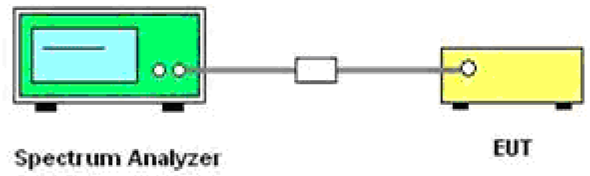
1. *Test results including cable loss;*
2. *please refer to following plots;*
3. *Measured at difference Packet Type for each mode and recorded worst case for each mode.*
4. ***Plesase See appendix for 20dB Bandwidth test data***
5. ***Plesase See appendix for Carrier Frequency Separation test data***

6.3 Number of Hopping Frequency

6.3.1 Limit

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies

6.3.2 Block Diagram of Test Setup



6.3.3 Test Procedure

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set Spectrum Analyzer Start=902MHz, Stop = 908MHz, Sweep = auto.

4). Set the Spectrum Analyzer as RBW=100KHz, VBW=300KHz.

5). Max hold, view and count how many channel in the band.

6.3.4 Test Results

Temperature	28.1℃	Humidity	58%
Test Engineer	Gary Qian	Configurations	BT

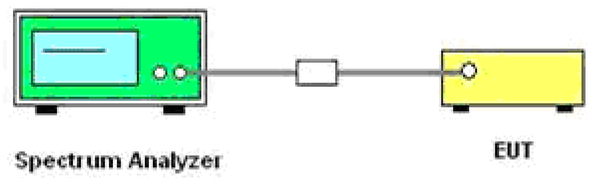
Plesase See appendix for Hopping Channel Number test data

6.4 Time of Occupancy (Dwell Time)

6.4.1 Limit

The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

6.4.2 Block Diagram of Test Setup



6.4.3 Test Procedure

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set center frequency of Spectrum Analyzer = operating frequency.

4). Set the Spectrum Analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.

5). Use software to collect the data form spectrum analyzer, and calculate the total on points

Dwell time = (TX_{ON} Points)/Total sweep points * sweep time

6). Repeat above procedures until all frequency measured was complete.

6.4.4 Test Results

Temperature	28.1℃	Humidity	58%
Test Engineer	Gary Qian	Configurations	BT

Remark:

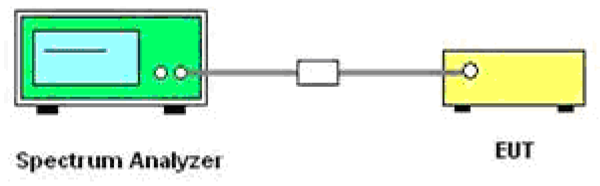
1. *Test results including cable loss;*
2. **Plesase See appendix for Dwell Time test data**

6.5 Conducted Spurious Emissions and Band Edges Test

6.5.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

6.5.2 Block Diagram of Test Setup



6.5.3 Test Procedure

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 300 KHz.

Measurements are made over the 9 kHz to 10GHz range with the transmitter set to the lowest, middle, and highest channels

6.5.4 Test Results of Conducted Spurious Emissions

No non-compliance noted. Only record the worst test result in this report. The test data refer to the following page.

Temperature	28.1℃	Humidity	52%
Test Engineer	Gary Qian	Configurations	BT

Test Mode	Channel	Frequency (MHz)	Measured Frequency Range	Spurious RF Conducted Emission (dBc)	Limits (dBc)	Verdict
GFSK	LCH	902.25	9 KHz – 26.5 GHz	<-20	-20	PASS
	MCH	915.25	9 KHz – 26.5 GHz	<-20		
	HCH	927.75	9 KHz – 26.5 GHz	<-20		

Remark:

1. *Test results including cable loss;*
2. *please refer to following plots;*
3. *Measured at difference Packet Type for each mode and recorded worst case for each mode.*
4. **Plesase See appendix for Band-edge Emissions test data**
5. **Plesase See appendix for Conducted Spurious Emissions test data**

6.6 Radiated Emission and Restricted Band Emission

6.6.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

\2\ Above 38.6

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

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

6.6.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10^{th} carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

6.6.3. Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 10 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

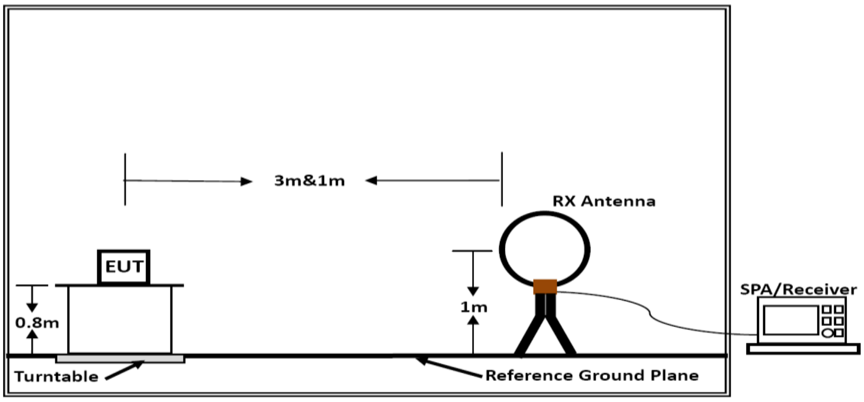
--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

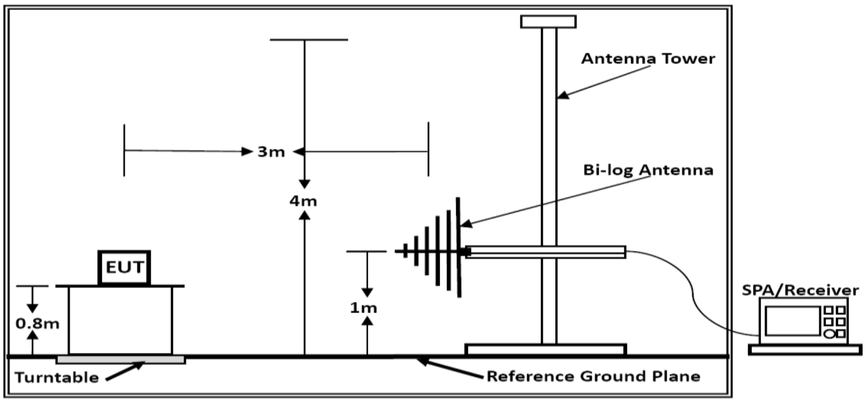
--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

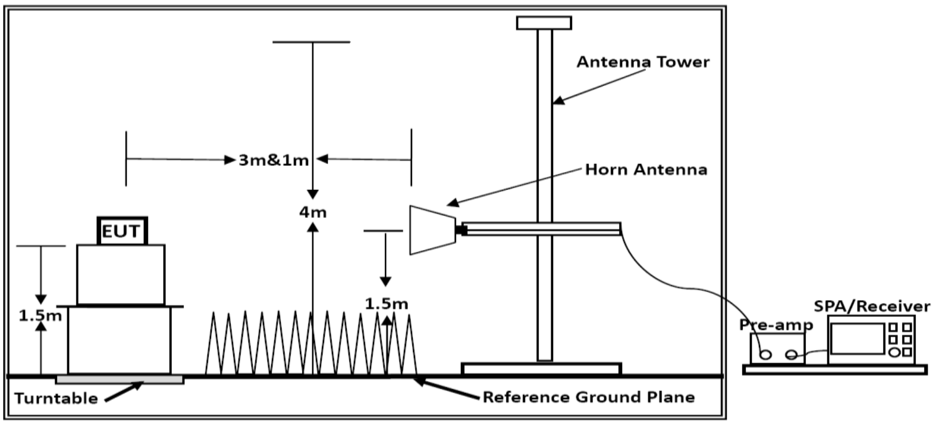
6.6.4. Test Setup Layout



Below 30MHz



Below 1GHz



Above 1GHz

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1.5m]) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

6.6.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.6.6. Results of Radiated Emissions

PASS.

Only record the worst test result in this report.

The test data please refer to following page.

Results of Radiated Emissions (9 kHz~30MHz)

Temperature	28.1℃	Humidity	52%
Test Engineer	Gary Qian	Configurations	BT

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

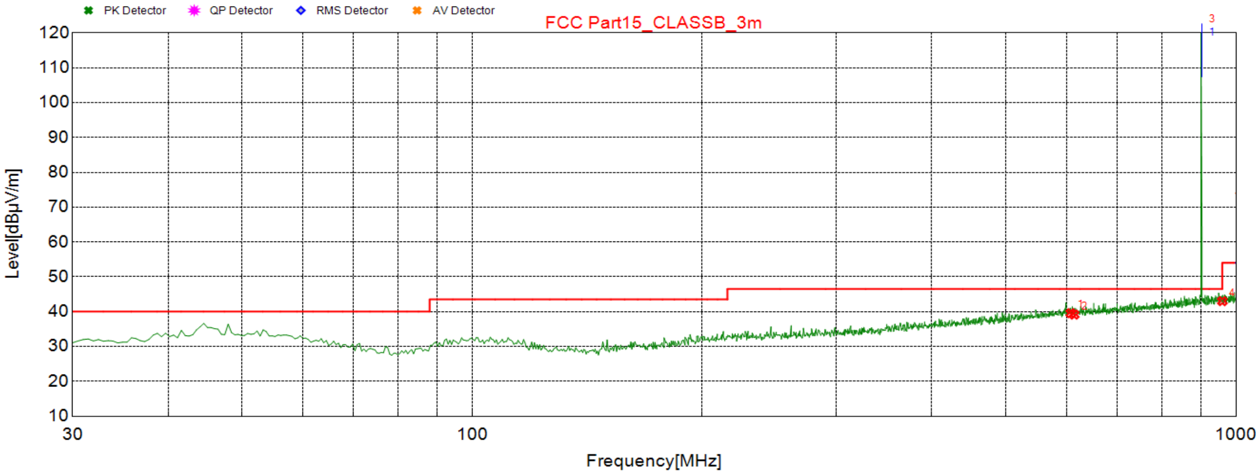
The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

Results of Radiated Emissions (30MHz)~1GHz)

Low Channel

Vertical



NO.	Freq. [MHz]	Result Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	608.120	39.57	19.26	46.50	6.93	200	86	Vertical
2	614.425	39.15	19.32	46.50	7.35	200	177	Vertical
3*	902.515	121.47	22.32	46.50	-74.97	100	157	Vertical
4	960.230	43.01	22.66	54.00	10.99	100	28	Vertical

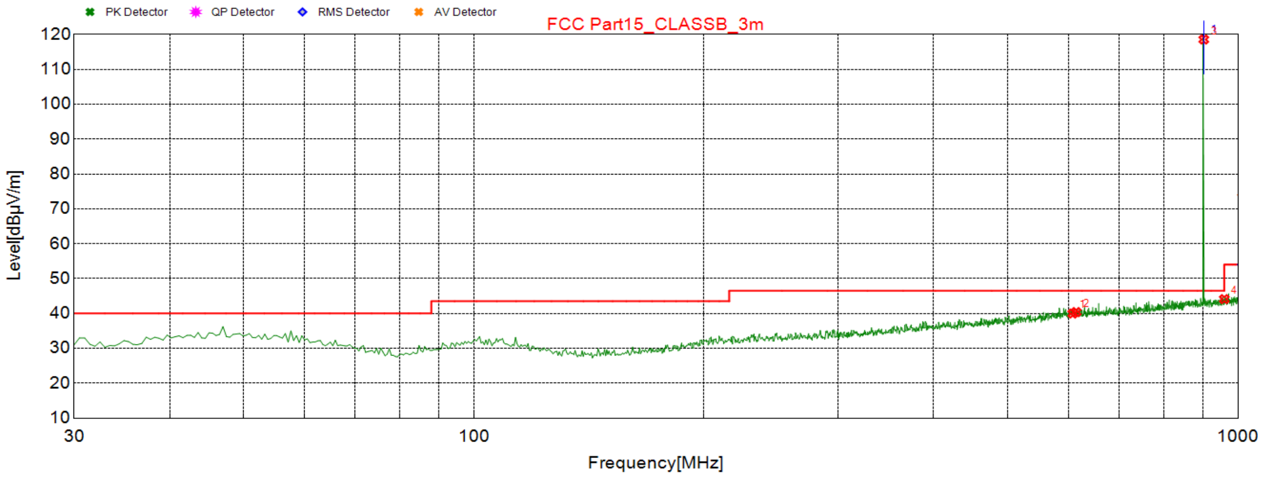
****Note:*

**：Fundamental*

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Margin [dB] = Limit [dBµV/m] - Result Level[dBµV/m]

Horizontal



NO.	Freq. [MHz]	Result Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	608.120	39.98	19.26	46.50	6.52	100	177	Horizontal
2	614.425	40.41	19.32	46.50	6.09	300	261	Horizontal
3*	902.515	118.54	22.32	46.50	-72.04	100	172	Horizontal
4	960.230	44.12	22.66	54.00	9.88	300	312	Horizontal

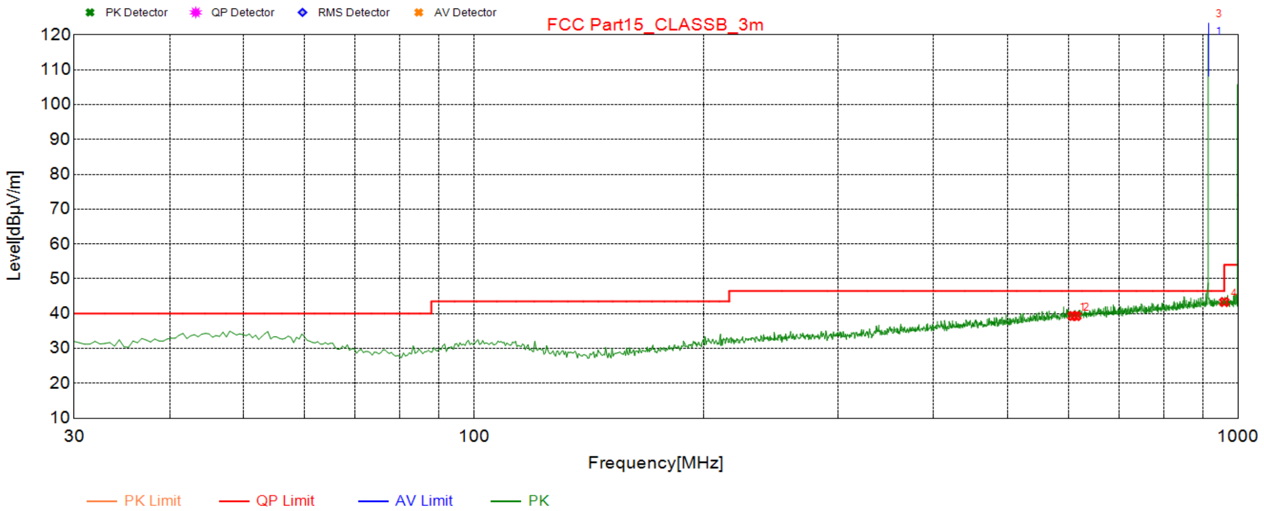
****Note:*

**：Fundamental*

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Margin [dB] = Limit [dBµV/m] - Result Level[dBµV/m]

Middle Channel



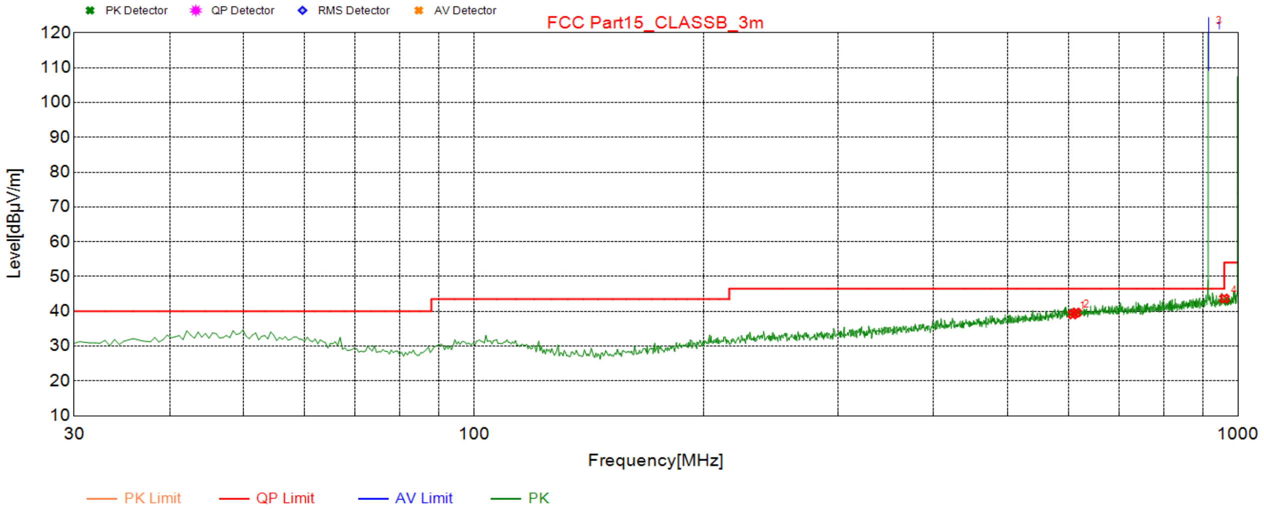
NO.	Freq. [MHz]	Result Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	608.120	39.35	19.26	46.50	7.15	100	180	Vertical
2	614.425	39.3	19.32	46.50	7.20	200	115	Vertical
3*	915.610	123.65	22.39	46.50	-77.15	100	169	Vertical
4	960.230	43.33	22.66	54.00	10.67	200	222	Vertical

****Note:*

**： Fundamental*

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Margin [dB] = Limit [dBµV/m] - Result Level[dBµV/m]



NO.	Freq. [MHz]	Result Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	608.120	39.12	19.26	46.50	7.38	300	227	Horizontal
2	614.425	39.66	19.32	46.50	6.84	100	196	Horizontal
3*	915.610	120.87	22.39	46.50	-74.37	100	176	Horizontal
4	960.230	43.67	22.66	54.00	10.33	300	58	Horizontal

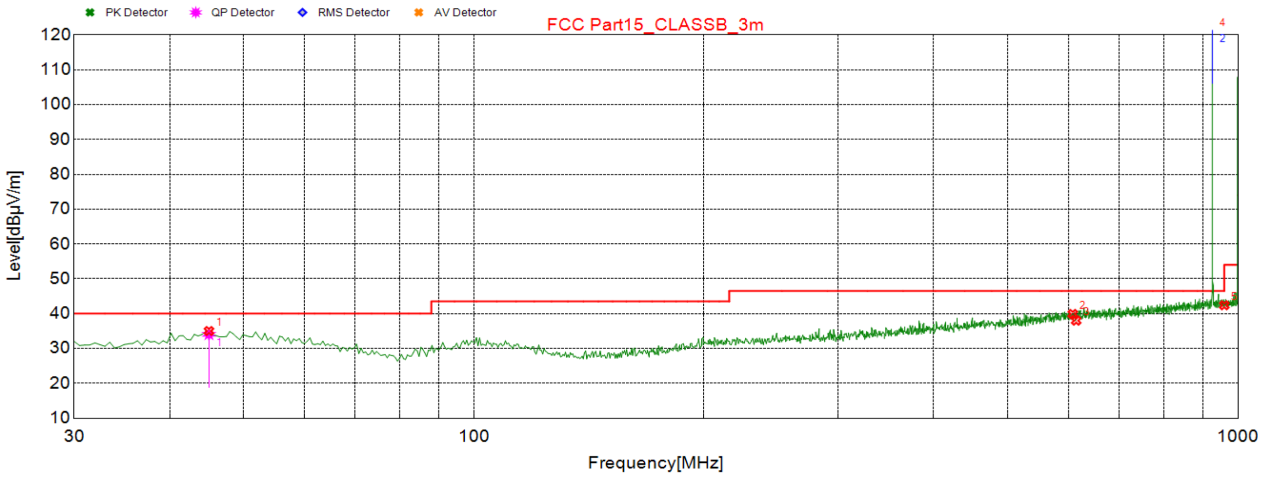
****Note:*

**：Fundamental*

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Margin [dB] = Limit [dBμV/m] - Result Level[dBμV/m]

High Channel



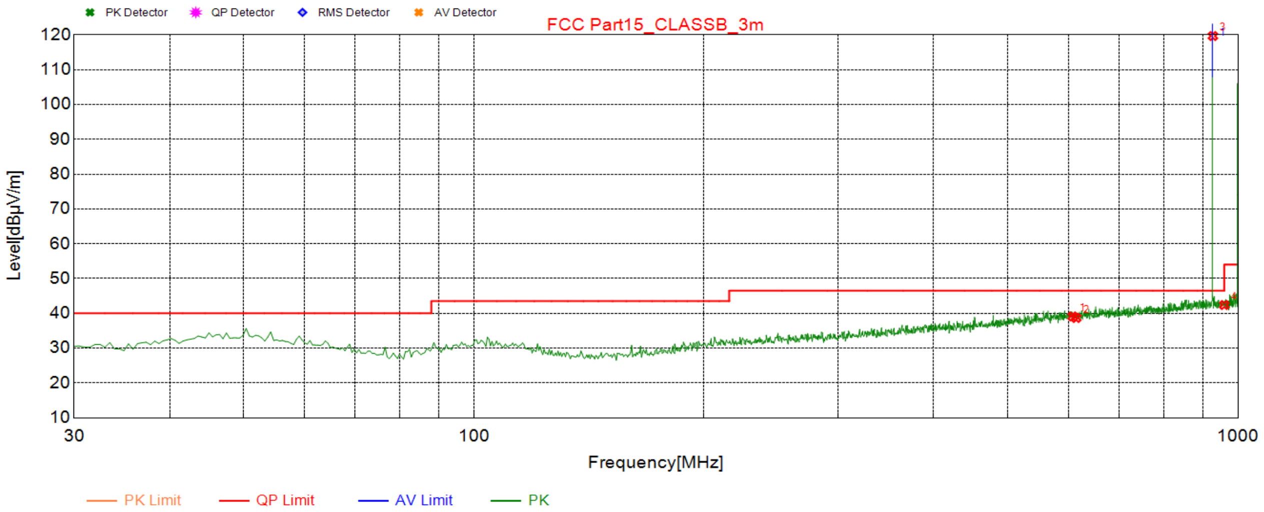
NO.	Freq. [MHz]	Result Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	45.035	35.03	13.40	40.00	4.97	100	167	Vertical
2	608.120	39.93	19.26	46.50	6.57	100	245	Vertical
3	614.425	37.99	19.32	46.50	8.51	100	244	Vertical
3*	927.735	120.97	22.47	46.50	-74.47	100	202	Vertical
5	960.230	42.4	22.66	54.00	11.60	100	329	Vertical

****Note:*

**：Fundamental*

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Margin [dB] = Limit [dBμV/m] - Result Level[dBμV/m]



NO.	Freq. [MHz]	Result Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle[°]	Polarity
1	608.120	39.12	19.26	46.50	7.38	300	69	Horizontal
2	614.425	38.67	19.32	46.50	7.83	300	259	Horizontal
3*	927.735	119.65	22.47	46.50	-73.15	100	186	Horizontal
4	960.230	42.4	22.66	54.00	11.60	300	109	Horizontal

****Note:*

**： Fundamental*

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Margin [dB] = Limit [dBµV/m] - Result Level[dBµV/m]

Results of Radiated Emissions (1GHz ~10GHz)

Low Channel: 902.25MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
1805.18	45.78	33.06	35.04	3.94	47.74	74.00	26.26	Peak	Horizontal
1804.85	45.38	33.06	35.04	3.94	47.34	74.00	26.66	Peak	Vertical
2706.92	49.21	33.06	35.04	3.94	51.17	74.00	22.83	Peak	Horizontal
2706.82	49.04	33.06	35.04	3.94	51.00	74.00	23.00	Peak	Vertical

Low Channel: 915.25MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
1830.59	48.26	33.16	35.15	3.96	50.23	74.00	23.77	Peak	Horizontal
1831.44	47.45	33.16	35.15	3.96	49.42	74.00	24.58	Peak	Vertical
2746.59	47.14	33.16	35.15	3.96	49.11	74.00	24.89	Peak	Horizontal
2746.49	48.98	33.16	35.15	3.96	50.95	74.00	23.05	Peak	Vertical

Low Channel: 927.75MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
1855.98	48.03	33.26	35.14	3.98	50.13	74.00	23.87	Peak	Horizontal
1855.56	44.61	33.26	35.14	3.98	46.71	74.00	27.29	Peak	Vertical
2783.68	49.48	33.26	35.14	3.98	51.58	74.00	22.42	Peak	Horizontal
2783.72	47.65	33.26	35.14	3.98	49.75	74.00	24.25	Peak	Vertical

Notes:

1). Measuring frequencies from 9k~10th harmonic (ex. 10GHz), No emission found between lowest internal used/generated frequency to 30 MHz.

2). Radiated emissions measured in frequency range from 9k~10th harmonic (ex. 10GHz) were made with an instrument using Peak detector mode.

6.7. AC Power line conducted emissions

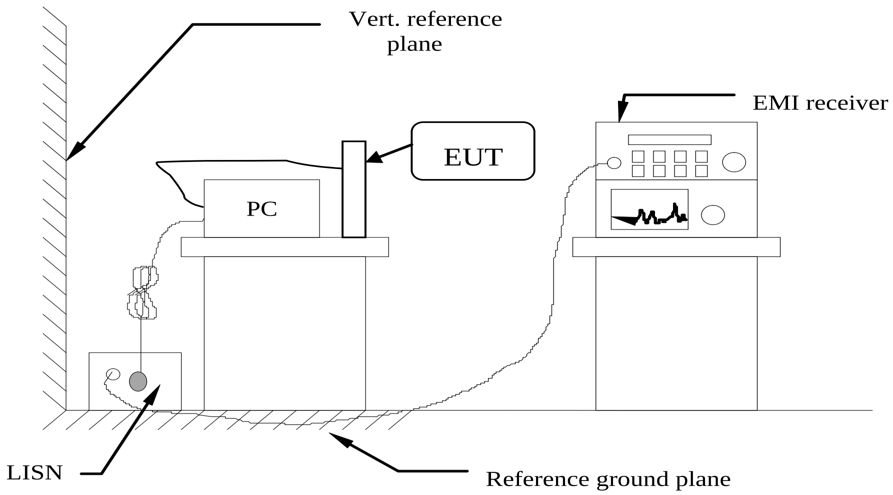
6.7.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	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

* Decreasing linearly with the logarithm of the frequency

6.7.2 Block Diagram of Test Setup



6.7.3 Test Results

Not applicable

This device will not direct or indirect connect to mains power.

6.8. Antenna requirement

6.8.1 Standard Applicable

According to antenna requirement of §15.203.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

6.8.2 Antenna Connected Construction

6.8.2.1. Standard Applicable

According to § 15.203 & RSS-Gen, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

6.8.2.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 5.5dBi(Model: BIS U-303-C1-TNCB) and 2.5dBi(Model: BIS U-303-C1-TNCB) , and the antenna use negative TNC to connect and no consideration ofreplacement. Please see EUT photo for details.

6.8.2.3. Results: Compliance.

7. TEST SETUP PHOTOGRAPHS

Please refer to separated files for Test Setup Photos of the EUT.

8.EXTERNAL PHOTOS OF THE EUT

Please refer to separated files for External Photos of the EUT.

9.INTERIOR PHOTOS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

----------------THE END OF REPORT---------------