

FCC Test Report

Product Name	RFID Reader
Model No.	BF-IDM01
FCC ID	2AGZY-BFIDM01

Applicant	Balluff GmbH
Address	Schurwaldstrasse 9, 73765 Neuhausen a.d.F., Germany

Date of Receipt	May 19, 2016
Issued Date	Jun. 13, 2016
Report No.	1650440R-RFUSP17V00
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

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Applicant	Balluff GmbH
Address	Schurwaldstrasse 9, 73765 Neuhausen a.d.F., Germany
Manufacturer	Balluff GmbH
Model No.	BF-IDM01
FCC ID.	2AGZY-BFIDM01
EUT Rated Voltage	DC 24V
EUT Test Voltage	DC 24V
Trade Name	BALLUFF
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2015 ANSI C63.4: 2014, ANSI C63.10: 2013
Test Result	Complied

Documented By :

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Tested By :

Paul Jiang

(Engineer / Paul Jiang)

Approved By :

Vincent Lin

(Director / Vincent Lin)

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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	RFID Reader
Trade Name	BALLUFF
Model No.	BF-IDM01
FCC ID	2AGZY-BFIDM01
Frequency Range	13.56MHz
Modulation	ASK
Antenna Type	Loop Antenna

Frequency of Each Channel:

Channel	Frequency
Channel 1:	13.56 MHz

Note:

1. This device is an RFID Reader with a built-in 13.56MHz transceiver.
2. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.225
3. 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 Mode
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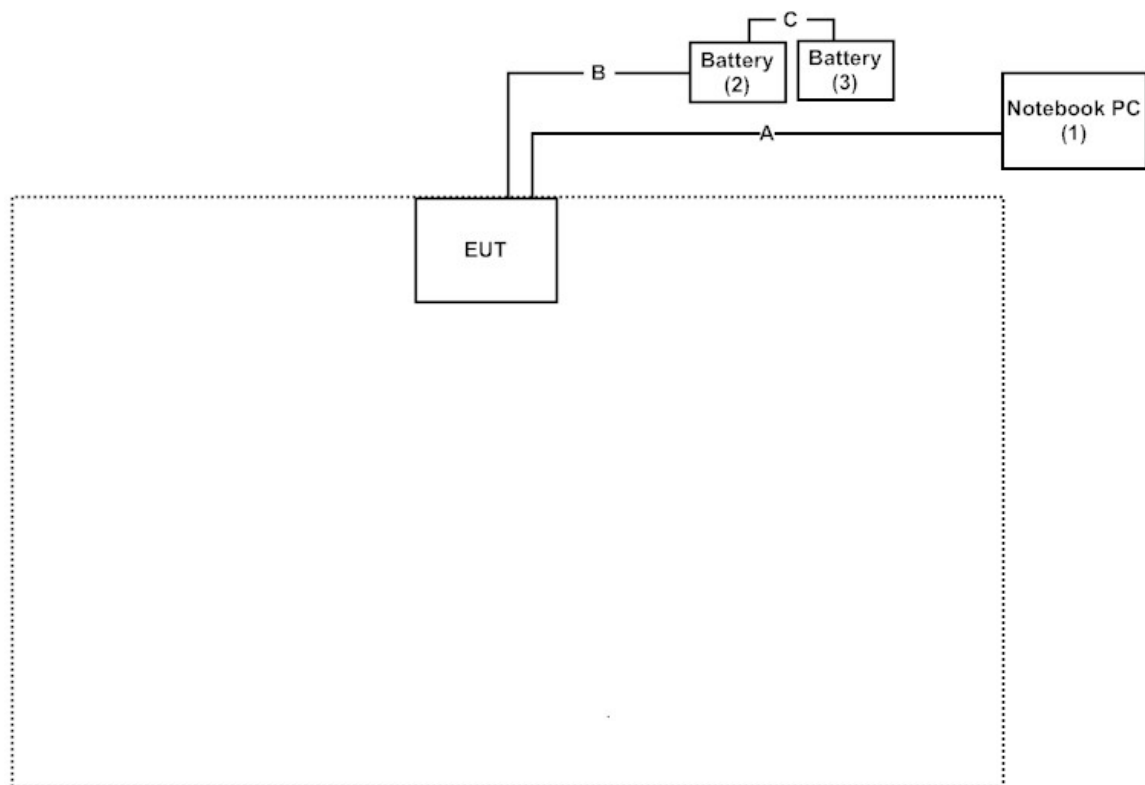
1.3. Tested System Details

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)	Notebook PC	DELL	Latitude E5440	B6TYTZ1	Non-Shielded, 0.8m
(2)	DC 12V Battery	TRANE	12B50PE	N/A	N/A
(3)	DC 12V Battery	Chen Guang	66N50	N/A	N/A

Signal Cable Type	Signal cable Description
A MR to LAN Cable	Shielded, 10m
B DC Cable	Non-Shielded, 1.8m, with two ferrite cores bonded.
C DC Cable	Non-Shielded, 0.1m

1.4. Configuration of tested System



1.5. EUT Exercise Software

- (1) Setup the EUT as shown in Section 1.4
- (2) Provide the DC Power Source.
- (3) Configure the test mode, the test channel.
- (4) 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 QuieTek Corporation's Web Site: <http://www.quietek.com/chinese/about/certificates.aspx?bval=5>
The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site: <http://www.quietek.com/>

Site Description: File on
Federal Communications Commission
FCC Engineering Laboratory
7435 Oakland Mills Road
Columbia, MD 21046
Registration Number: 92195

Site Name: Quietek Corporation
Site Address: No.5-22, Ruishukeng,
Linkou Dist. New Taipei City 24451,
Taiwan, R.O.C.
TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : service@quietek.com

FCC Accreditation Number: TW1014

2. Conducted Emission

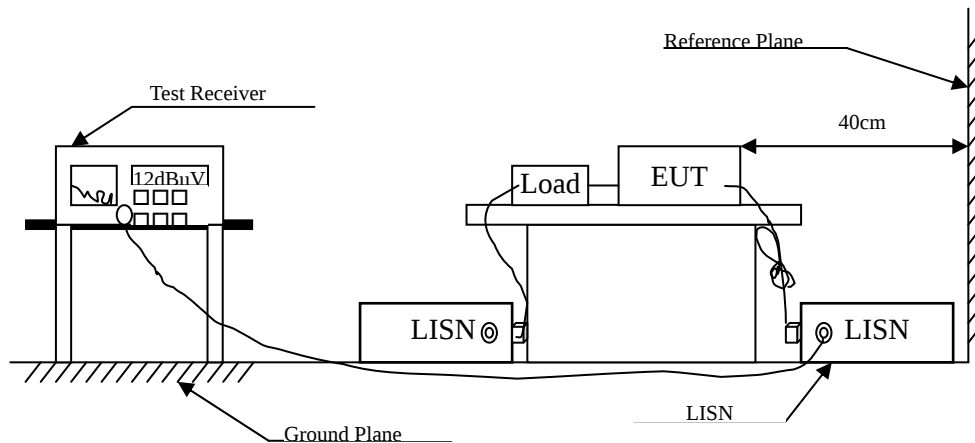
2.1. Test Equipment

	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
X	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2015	
X	Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2016	Peripherals
X	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2016	EUT
	DC LISN	Schwarzbeck	8226 / 176	Mar, 2016	EUT
X	Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2016	
	No.1 Shielded Room				

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked by "X" are used to measure the final test results.

2.2. Test Setup



2.3. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56 _(註)	56-46 _(註)
0.50-5.0	56	46
5.0 - 30	60	50

2.4. 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 invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

2.5. Uncertainty

± 2.26 dB

2.6. Test Result of Conducted Emission

Owing to the DC operation of EUT, this test item is not performed.

3. Radiated Emission

3.1. Test Equipment

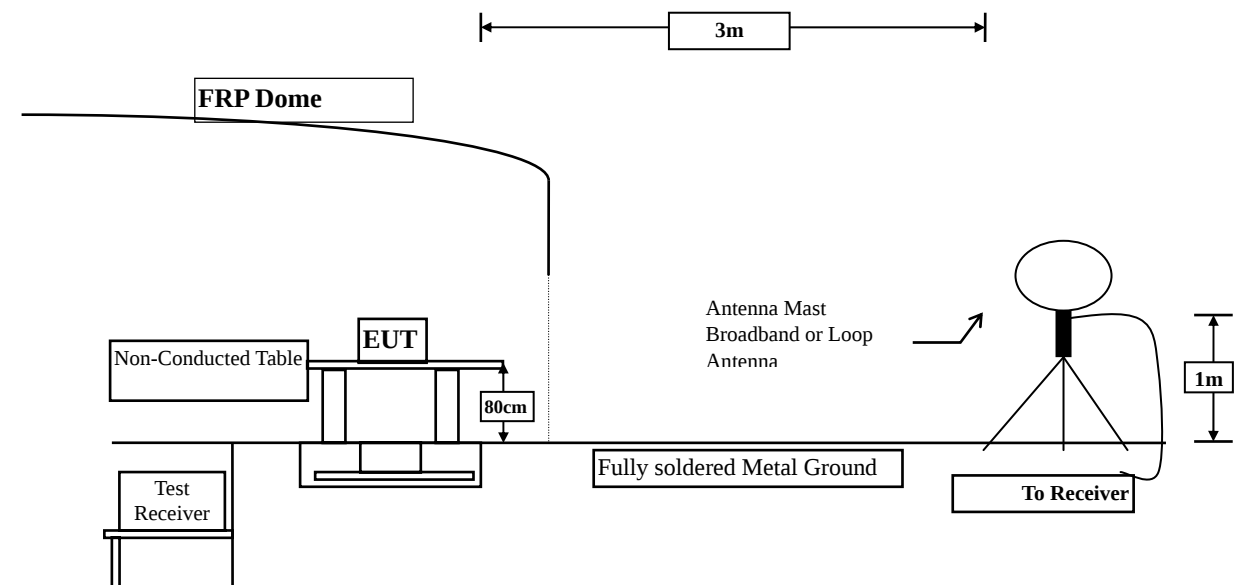
The following test equipments are used during the radiated emission test:

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☑ Site # 3	X	Magnetic Loop Antenna	Teseq	HLA6121/ 37133	Sep, 2015
	X	Bilog Antenna	Schaffner Chase	CBL6112B/ 2707	Jun, 2016
	X	EMI Test Receiver	R&S	ESCS 30/838251/ 001	Jun, 2016
	X	Coaxial Cable	QTK(Armist)	RG 214/ LC003-RG	Jun, 2016
	X	Coaxial signal switch	Armist	MP59B/ 6200798682	Jun, 2016

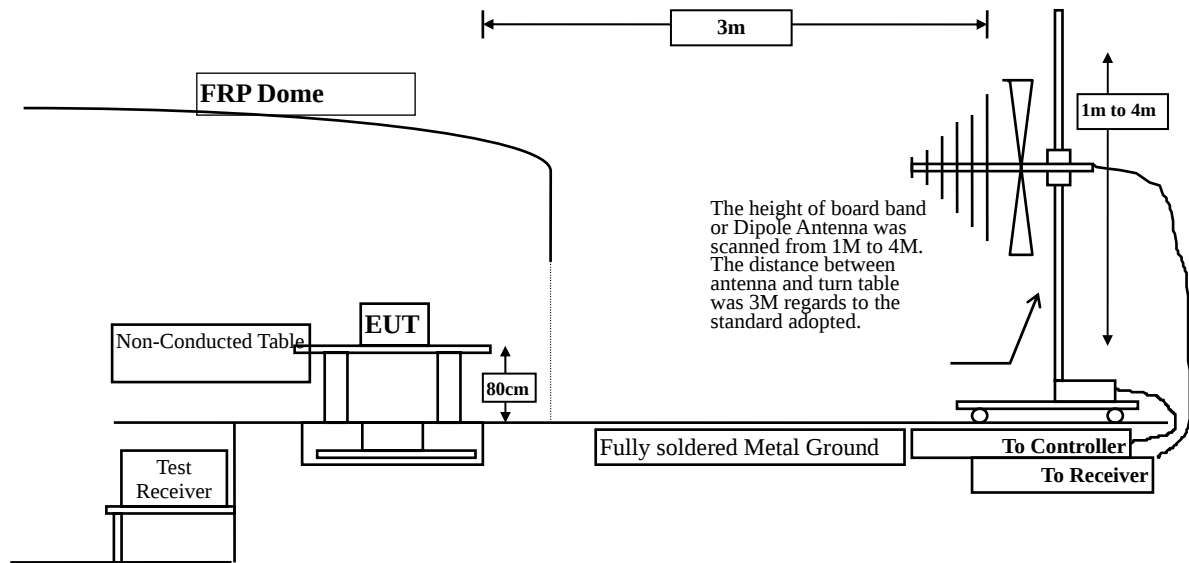
- Note:
1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
 2. The test instruments marked with “X” are used to measure the final test results.

3.2. Test Setup

9kHz~30MHz



30MHz~1GHz



3.3. Limits

➤ Fundamental electric field strength Limit

FCC Part 15 Subpart C Paragraph 15.225 Limits				
Fundamental Frequency MHz	Field strength of fundamental			
	uV/m	Distance (meter)	dBuV/m	Distance (meter)
13.553 – 13.567	15848	30	124	3
13.410 – 13.553 and 13.567 – 13.710	334	30	90.47	3
13.110 – 13.410 and 13.710 – 14.010	106	30	80.50	3
Outside of the 13.110 – 14.010	See 15.209 Limits			

Remarks : 1. RF Voltage (dBuV) = 20 log RF Voltage (uV)

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.

3. The emission limit in this paragraph is based on measurement instrumentation employing an average detector.

➤ Spurious electric field strength Limit

FCC Part 15 Subpart C Paragraph 15.209 Limits			
Frequency MHz	uV/m	dBuV/m	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	See Remark ¹	300
0.490-1.705	24000/F(kHz)	See Remark ¹	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Remarks :

1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

3.4. Test Procedure

Fundamental electric field strength:

The EUT and its simulators are placed on a turn table which is 1 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum electric field strength. The EUT was positioned such that the distance from antenna to the EUT was 3 meters. The antenna which is 1 meter above ground. All X-axis, Y-axis and Z-axis polarization of the antenna are set on measurement.

Spurious electric field strength:

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

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 C6310: 2013 on radiated measurement.

On any frequency the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurement are included emission measurement below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

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

The frequency range from 9kHz to 10th harmonics is checked.

3.5. Uncertainty

± 2.6 dB below 30MHz

± 3.8 dB above 30MHz

3.6. Test Result of Radiated Emission

Product : RFID Reader
Test Item : Fundamental Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit Mode

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
X-axis					
Quasi-Peak					
Horizontal					
13.560	20.410	43.890	64.300	-59.700	124.000
Vertical					
13.560	20.410	38.910	59.320	-64.680	124.000
Y-axis					
Quasi-Peak					
Horizontal					
13.560	20.410	47.290	67.700	-56.300	124.000
Vertical					
13.560	20.410	42.390	62.800	-61.200	124.000
Z-axis					
Quasi-Peak					
Horizontal					
13.560	20.410	39.420	59.830	-64.170	124.000
Vertical					
13.560	20.410	46.660	67.070	-56.930	124.000

Note:

1. Limit=84dBuV/m + 40*Log (30(m)/3(m))=124dBuV/m
2. All Readings below 1GHz are Quasi-Peak, above are average value.
3. Measurement Level = Reading Level + Correct Factor.
4. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : RFID Reader
Test Item : General Radiated Emission Data (below 30MHz)
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit Mode

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
27.120	19.950	20.730	40.680	-28.860	69.540
Vertical					
27.120	19.950	20.120	40.070	-29.470	69.540

Note:

1. Limit=29.54dBuV/m + 40*Log (30(m)/3(m))=69.54dBuV/m
2. All Readings below 1GHz are Quasi-Peak, above are average value.
3. " " means the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.

Product : RFID Reader
Test Item : General Radiated Emission Data (above 30MHz)
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit Mode

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
QP Detector					
33.880	-7.772	44.189	36.417	-3.583	40.000
317.120	-17.184	61.051	43.867	-2.133	46.000
406.360	-11.647	50.257	38.610	-7.390	46.000
600.360	-6.830	40.621	33.791	-12.209	46.000
800.180	-6.808	43.177	36.369	-9.631	46.000
963.140	-6.502	45.242	38.740	-15.260	54.000
Vertical					
QP Detector					
39.700	-18.150	55.666	37.516	-2.484	40.000
210.420	-12.549	50.889	38.340	-5.160	43.500
319.060	-18.242	61.188	42.946	-3.054	46.000
499.480	-12.482	49.660	37.178	-8.822	46.000
701.240	-10.255	43.672	33.417	-12.583	46.000
935.980	-5.925	47.611	41.686	-4.314	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

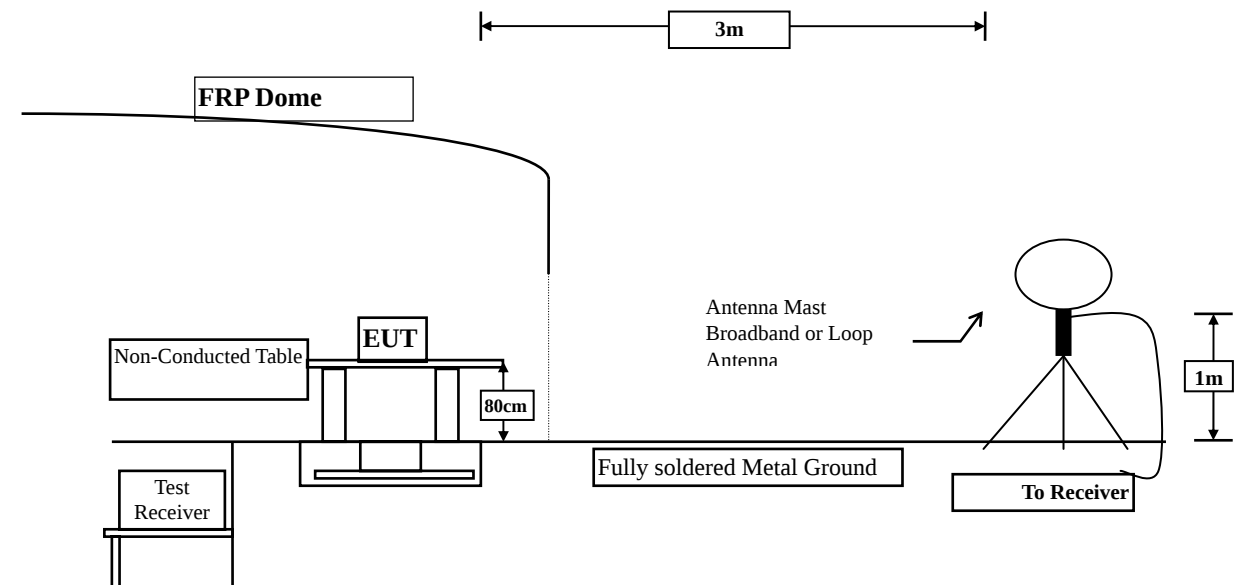
4. Band Edge

4.1. Test Equipment

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒ Site # 3	X	Magnetic Loop Antenna	Teseq	HLA6121/ 37133	Sep, 2015
	X	Bilog Antenna	Schaffner Chase	CBL6112B/ 2707	Jun, 2016
	X	EMI Test Receiver	R&S	ESCS 30/838251/ 001	Jun, 2016
	X	Coaxial Cable	QTK(Arnist)	RG 214/ LC003-RG	Jun, 2016
	X	Coaxial signal switch	Arnist	MP59B/ 6200798682	Jun, 2016

Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with “X” are used to measure the final test results.

4.2. Test Setup



4.3. Limits

In any 9 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 50 dB below that in the 9 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. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

4.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 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 below 30MHz setting on the field strength meter is 9kHz and above 30MHz is 120kHz.

4.5. Uncertainty

Radiated is ± 2.6 dB

4.6. Test Result of Band Edge

Product : RFID Reader
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit Mode

RF Radiated Measurement

(Horizontal)

Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	QP Limit (dBuV/m)	Result
13.110	20.410	7.800	28.210	69.540	Pass
13.290	20.410	13.600	34.010	69.540	Pass
13.360	20.410	7.800	28.210	69.540	Pass
13.400	20.410	19.800	40.210	69.540	Pass
13.410	20.410	15.700	36.110	69.540	Pass
14.010	20.410	6.600	27.010	69.540	Pass
14.060	20.410	8.700	29.110	69.540	Pass

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

(Vertical)

Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	QP Limit (dBuV/m)	Result
13.060	20.410	9.000	29.410	69.540	Pass
13.110	20.410	8.500	28.910	69.540	Pass
13.260	20.410	9.500	29.910	69.540	Pass
13.360	20.410	9.200	29.610	69.540	Pass
13.410	20.410	11.900	32.310	69.540	Pass
14.010	20.410	11.800	32.210	69.540	Pass

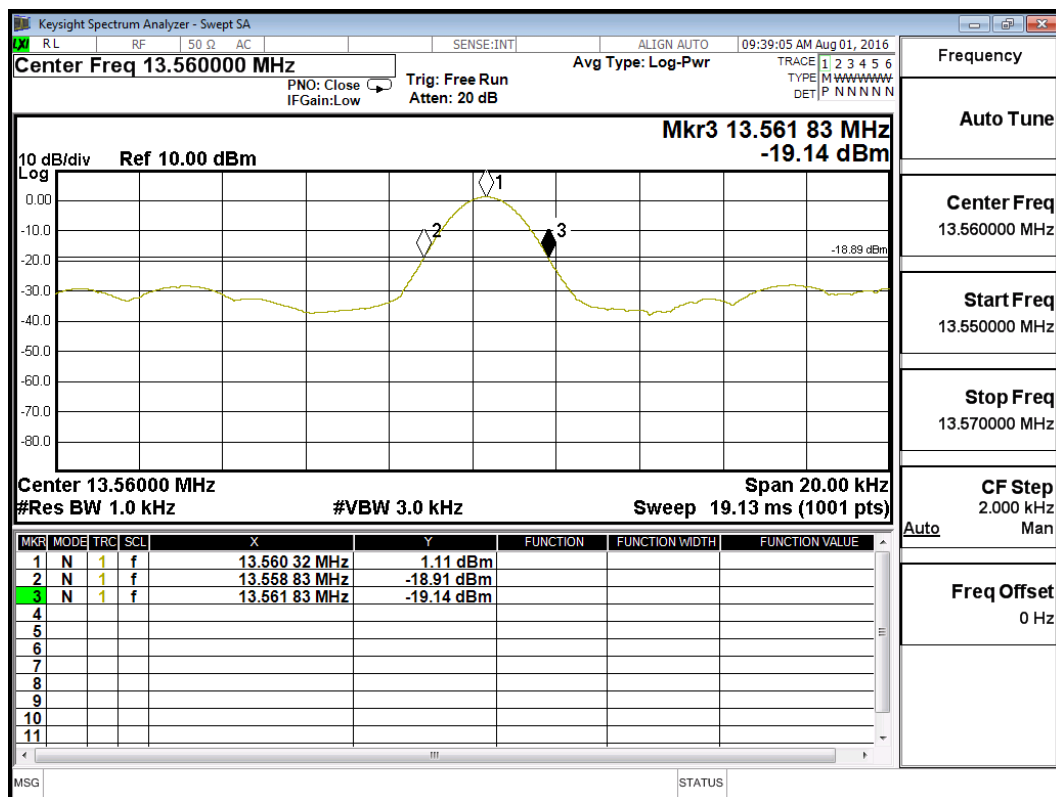
Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : RFID Reader
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit Mode

Test Frequency (MHz)	Measurement Level (20dB BW) (MHz)	Limit (MHz)	Result
13.56	13.558	>13.110	PASS
13.56	13.561	<14.010	PASS

NOTE: Accordance with 15.215 requirement.



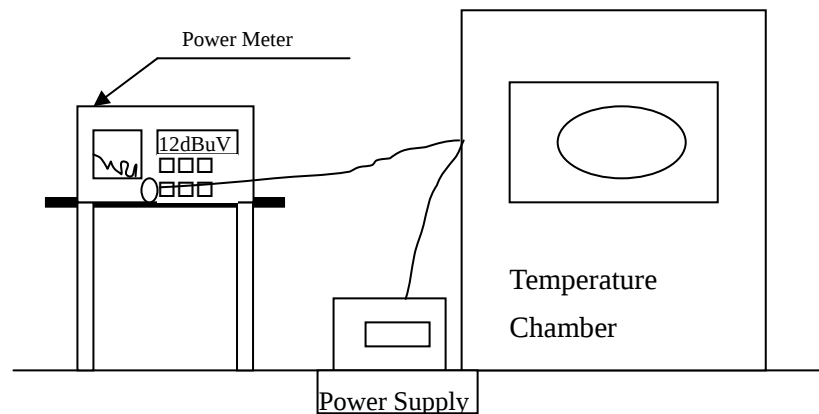
5. Frequency Tolerance

5.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2016
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2016
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2016
X	Temperature Chamber	TDE	CHM 150CT	March, 2016

Note: All equipments are calibrated every one year.

5.2. Test Setup



5.3. Limits

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency.

5.4. Test Procedure

The over operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.5. Uncertainty

± 150 Hz

5.6. Test Result of Frequency Stability

Product : RFID Reader
Test Item : Frequency Tolerance
Test Site : Temperature Chamber
Test Mode : Mode 1: Transmit Mode

Temperature (°C)	Voltage (V)	Observe Time	Declared Frequency (MHz)	Read Frequency (MHz)	Tolerance (%)	Limit (%)
20	24	start	13.56	13.56032	0.002360	± 0.01 %
		2mins	13.56	13.56032	0.002360	
		5mins	13.56	13.56032	0.002360	
		10mins	13.56	13.56032	0.002360	
20	20.4	start	13.56	13.56032	0.002360	± 0.01 %
		2mins	13.56	13.56032	0.002360	
		5mins	13.56	13.56032	0.002360	
		10mins	13.56	13.56032	0.002360	
20	27.6	start	13.56	13.56032	0.002360	± 0.01 %
		2mins	13.56	13.56032	0.002360	
		5mins	13.56	13.56032	0.002360	
		10mins	13.56	13.56032	0.002360	
50	24	start	13.56	13.56029	0.002139	± 0.01 %
		2mins	13.56	13.56029	0.002139	
		5mins	13.56	13.56029	0.002139	
		10mins	13.56	13.56029	0.002139	
40	24	start	13.56	13.56031	0.002286	± 0.01 %
		2mins	13.56	13.56031	0.002286	
		5mins	13.56	13.56031	0.002286	
		10mins	13.56	13.56031	0.002286	
30	24	start	13.56	13.56035	0.002581	± 0.01 %
		2mins	13.56	13.56035	0.002581	
		5mins	13.56	13.56035	0.002581	
		10mins	13.56	13.56035	0.002581	
10	24	start	13.56	13.56041	0.003024	± 0.01 %
		2mins	13.56	13.56041	0.003024	
		5mins	13.56	13.56041	0.003024	
		10mins	13.56	13.56041	0.003024	

0	24	start	13.56	13.56043	0.003171	± 0.01 %
		2mins	13.56	13.56043	0.003171	
		5mins	13.56	13.56043	0.003171	
		10mins	13.56	13.56043	0.003171	
-10	24	start	13.56	13.56044	0.003245	± 0.01 %
		2mins	13.56	13.56044	0.003245	
		5mins	13.56	13.56044	0.003245	
		10mins	13.56	13.56044	0.003245	
-20	24	start	13.56	13.56042	0.003097	± 0.01 %
		2mins	13.56	13.56042	0.003097	
		5mins	13.56	13.56042	0.003097	
		10mins	13.56	13.56042	0.003097	

Note: Limit= Ref. Freq. * (±) 0.01% = 13.55952~13.56223MHz

6. EMI Reduction Method During Compliance Testing

No modification was made during testing.

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs