

FCC Test Report

Product Name	Mini-Magnetic sensor
Model No.	HSM02-0
FCC ID.	FU5HSM02

Applicant	EVERSPRING INDUSTRY CO., LTD
Address	3F, No.50, Sec.1, Zhonghua Rd., Tucheng Dist., New Taipei City 23666,Taiwan

Date of Receipt	Jun. 25, 2013
Issued Date	Aug. 05, 2013
Report No.	136400R-RFUSP30V01
Report Version	V1.0



The Test Results relate only to the samples tested.

The test report shall not be reproduced except in full without the written approval of Quietek Corporation.

This report must not be used to claim product endorsement by TAF or any agency of the U.S. Government

Test Report Certification

Issued Date: Aug. 05, 2013

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Product Name	Mini-Magnetic sensor
Applicant	EVERSPRING INDUSTRY CO., LTD
Address	3F, No.50, Sec.1, Zhonghua Rd., Tucheng Dist., New Taipei City 23666,Taiwan
Manufacturer	Dong-Guan Li Yuan Electronics Co., Ltd
Model No.	HSM02-0
FCC ID.	FU5HSM02
EUT Rated Voltage	DC 6V (Power by CR2450 Battery x2)
EUT Test Voltage	DC 6V (Power by CR2450 Battery x2)
Trade Name	EVERSPRING
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2012 ANSI C63.4: 2003, ANSI C63.10: 2009
Test Result	Complied

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(Engineer / Andy Lin)

Approved By : Vincent Lin
(Manager / Vincent Lin)

TABLE OF CONTENTS

Description	Page
1. GENERAL INFORMATION.....	4
1.1. EUT Description	4
1.2. Tested System Details	5
1.3. Configuration of Test System.....	5
1.4. EUT Exercise Software.....	5
1.5. Test Facility.....	6
2. Conducted Emission	7
2.1. Test Equipment	7
2.2. Test Setup.....	7
2.3. Limits	8
2.4. Test Procedure.....	8
2.5. Uncertainty.....	8
2.6. Test Result of Conducted Emission	9
3. Radiated Emission	10
3.1. Test Equipment	10
3.2. Test Setup.....	11
3.3. Limits	12
3.4. Test Procedure.....	13
3.5. Uncertainty.....	13
3.6. Test Result of Radiated Emission	14
4. Band Edge.....	20
4.1. Test Equipment	20
4.2. Test Setup.....	21
4.3. Limit.....	21
4.4. Test Procedure.....	22
4.5. Uncertainty.....	22
4.6. Test Result of Band Edge.....	23
5. Occupied Bandwidth.....	25
5.1. Test Equipment	25
5.2. Test Setup.....	25
5.3. Limits	25
5.4. Test Procedure.....	25
5.5. Uncertainty.....	25
5.6. Test Result of Occupied Bandwidth.....	26
6. EMI Reduction Method During Compliance Testing.....	27

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Mini-Magnetic sensor
Trade Name	EVERSPRING
FCC ID.	FU5HSM02
Model No.	HSM02-0
Frequency Range	908.42MHz
Type of Modulation	FSK
Number of Channels	1
Antenna Type	Coil Antenna

Center Frequency of Each Channel:

Channel	Frequency
Channel 1:	908.42MHz

Note:

1. The EUT is a Mini-Magnetic sensor with a built-in 908.42MHz Z-Wave transceiver.
2. The new batteries are used during the measurement.
3. These tests are conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.249.
4. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
5. 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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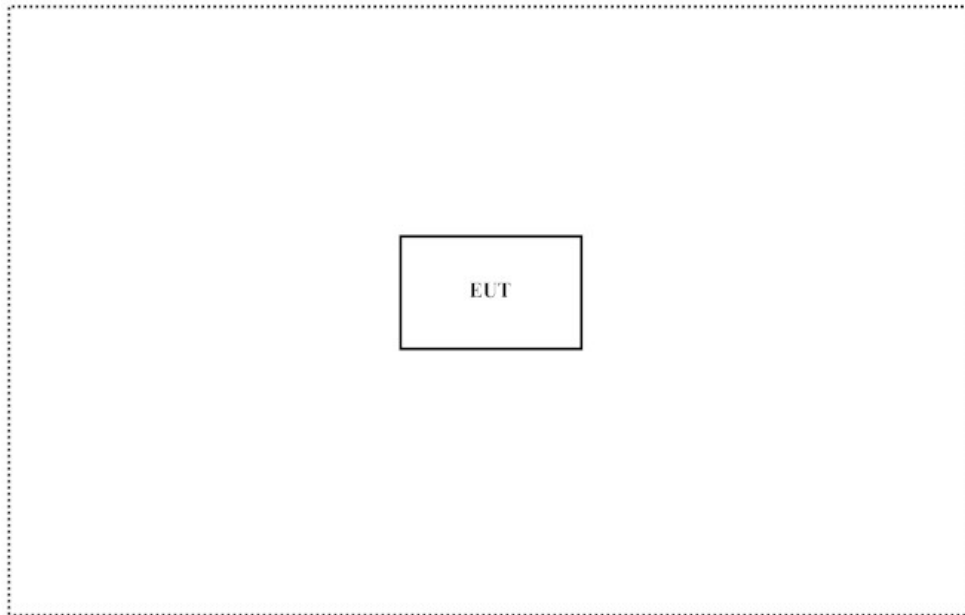
1.2. Tested System Details

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
N/A				

Signal Cable Type	Signal cable Description
N/A	

1.3. Configuration of Test System



1.4. EUT Exercise Software

- (1) Setup the EUT as shown in section 1.4.
- (2) Inserts the battery, start continuous transmit
- (3) Verify that the EUT works correctly.

1.5. 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://tw.quietek.com/modules/myalbum/>
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

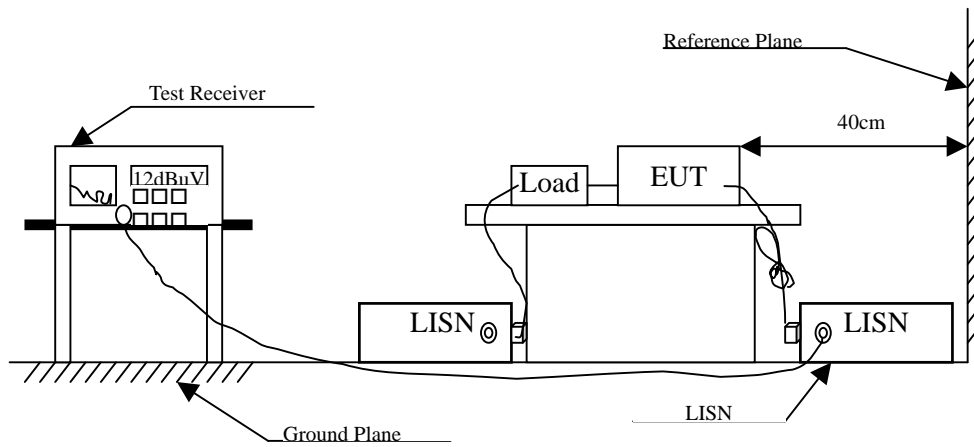
2.1. Test Equipment

	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
X	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2012	
X	Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2013	Peripherals
X	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2013	EUT
	DC LISN	Schwarzbeck	8226 / 176	Mar, 2013	EUT
X	Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2013	
	No.8 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	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.

2.4. 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 C63.10: 2009 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 EUT use battery supply voltage, this test item is not performed.

3. Radiated Emission

3.1. Test Equipment

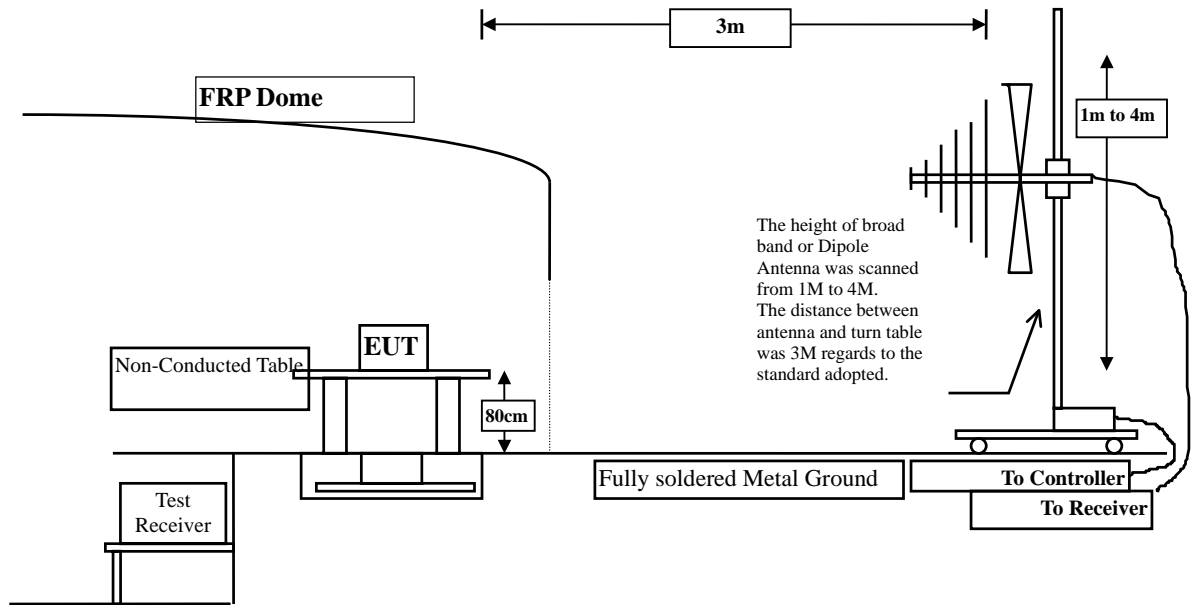
The following test equipment are used during the radiated emission test:

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒ Site # 3	X Loop Antenna	Teseq	HLA6120 / 26739	Jul., 2013
	X Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2012
	X Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2012
	X Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2013
	X Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2013
	X Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2012
	X Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/ 925975	Mar, 2013
	X Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2013
	X Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2012
	X Coaxial Cable	Quietek	QTK-CABLE/ CAB5	Feb., 2013
	X Controller	Quietek	QTK-CONTROLLER/ CTRL3	N/A
	X Coaxial Switch	Anritsu	MP59B/6200265729	N/A

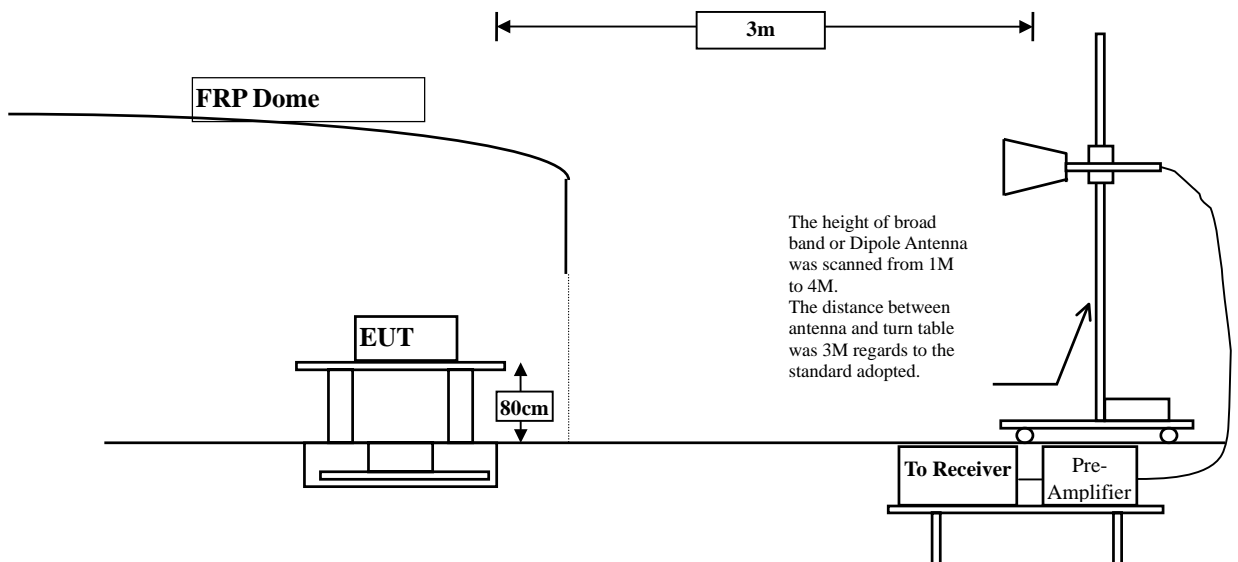
- Note:
1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
 2. The test instruments marked with "X" are used to measure the final test results.

3.2. Test Setup

Below 1GHz



Above 1GHz



3.3. 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)	(dBuV/m @3m)	(uV/m @3m)	(dBuV/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 (dBuV/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 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 :
1. RF Voltage (dBuV/m) = 20 log RF Voltage (uV/m)
 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

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: 2009 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 on the Final Measurement.

The measurement frequency range form 9KHz - 10th Harmonic of fundamental was investigated.

3.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

3.6. Test Result of Radiated Emission

Product : Mini-Magnetic sensor
 Test Item : Fundamental Radiated Emission
 Test Site : No.3OATS
 Test Mode : Mode 1: Transmit (X-axis)

Peak Detector					
Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
908.420	5.992	83.210	89.202	-4.798	94.000
--					
Vertical					
908.420	2.503	86.199	88.702	-5.298	94.000
--					

Note:

1. All Readings below 1GHz are 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 – PreAMP.

Product : Mini-Magnetic sensor
 Test Item : Fundamental Radiated Emission
 Test Site : No.3OATS
 Test Mode : Mode 1: Transmit (Y-axis)

Peak Detector

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
908.420	5.992	87.110	93.102	-0.898	94.000
--					
Vertical					
908.420	2.503	87.199	89.702	-4.298	94.000
--					

Note:

1. All Readings below 1GHz are 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 – PreAMP.

Product : Mini-Magnetic sensor
 Test Item : Fundamental Radiated Emission
 Test Site : No.3OATS
 Test Mode : Mode 1: Transmit (Z-asix)

Peak Detector

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
908.420	5.992	86.910	92.902	-1.098	94.000
--					
Vertical					
908.420	2.503	88.299	90.802	-3.198	94.000
--					

Note:

1. All Readings below 1GHz are 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 – PreAMP.

Product : Mini-Magnetic sensor
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector:					
1816.840	-4.390	37.094	32.704	-41.296	74.000
2725.260	-1.075	36.737	35.661	-38.339	74.000
3633.680	-0.395	38.253	37.858	-36.142	74.000
4542.100	1.901	36.251	38.153	-35.847	74.000
5450.520	4.228	36.097	40.325	-33.675	74.000
6358.940	6.502	35.497	41.999	-32.001	74.000
7267.360	11.106	34.434	45.540	-28.460	74.000
8175.780	14.925	34.264	49.189	-24.811	74.000
9084.200	13.021	33.774	46.795	-27.205	74.000

Average Detector:

--

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 : Mini-Magnetic sensor
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Vertical					
Peak Detector:					
1816.840	-2.613	38.567	35.954	-38.046	74.000
2725.260	-1.228	37.185	35.957	-38.043	74.000
3633.680	0.379	39.006	39.385	-34.615	74.000
4542.100	5.407	36.512	41.919	-32.081	74.000
5450.520	5.976	35.906	41.881	-32.119	74.000
6358.940	7.975	36.241	44.217	-29.783	74.000
7267.360	11.925	35.336	47.261	-26.739	74.000
8175.780	15.635	34.109	49.744	-24.256	74.000
9084.200	13.142	34.285	47.427	-26.573	74.000

Average Detector:

--

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 : Mini-Magnetic sensor
 Test Item : General Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit

Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
371.440	-1.097	25.070	23.973	-22.027	46.000
472.320	0.637	25.425	26.062	-19.938	46.000
544.100	3.512	24.675	28.187	-17.813	46.000
644.980	1.552	26.096	27.648	-18.352	46.000
745.860	3.308	26.193	29.501	-16.499	46.000
837.040	5.103	24.083	29.185	-16.815	46.000
Vertical					
107.600	-0.318	23.818	23.500	-20.000	43.500
381.140	-1.558	23.809	22.251	-23.749	46.000
544.100	-0.688	23.635	22.947	-23.053	46.000
689.600	2.538	23.715	26.253	-19.747	46.000
807.940	3.586	23.264	26.849	-19.151	46.000
988.360	3.370	22.645	26.015	-27.985	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.
8. No emission found between lowest internal used/generated frequency to 30MHz.

4. Band Edge

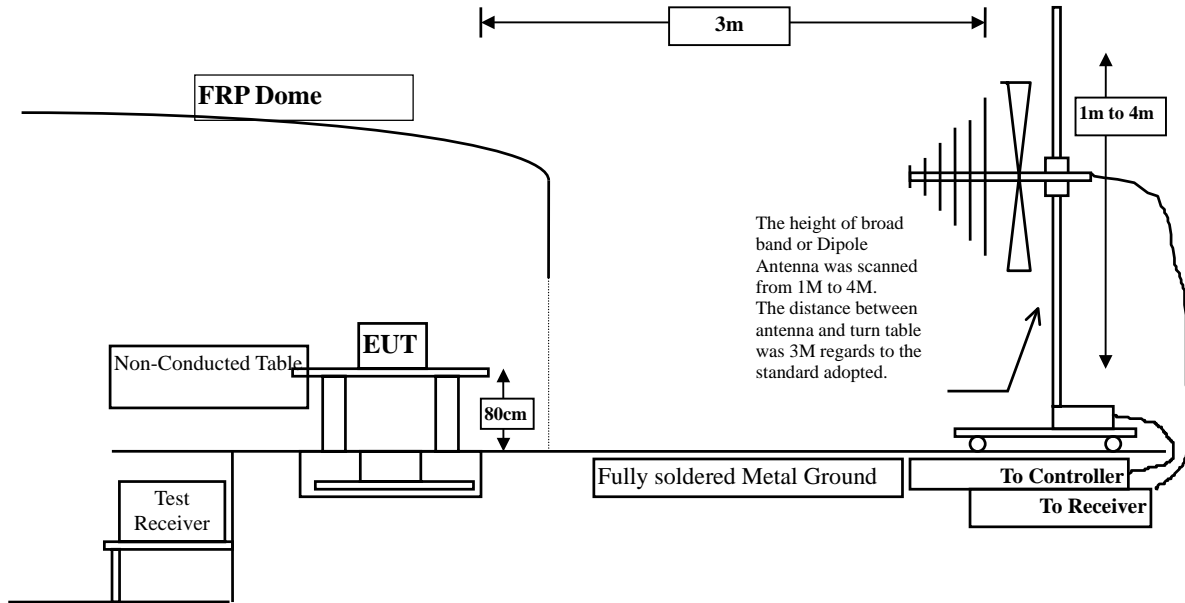
4.1. Test Equipment

The following test equipments are used during the band edge tests:

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒ Site # 3	X Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2012
	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2012
	Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2013
	X Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2013
	Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2012
	Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/ 925975	Mar, 2013
	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2013
	X Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2012
	X Coaxial Cable	Quietek	QTK-CABLE/ CAB5	Feb., 2013
	X Controller	Quietek	QTK-CONTROLLER/ CTRL3	N/A
	X Coaxial Switch	Anritsu	MP59B/6200265729	N/A

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

4.2. Test Setup



4.3. Limit

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 C63.10:2009 on radiated measurement.

The bandwidth below 1GHz setting on the field strength meter (R&S Test Receiver ESCS 30)is 120 kHz, above 1GHz are 1 MHz.

4.5. Uncertainty

Radiated is ± 3.9 dB.

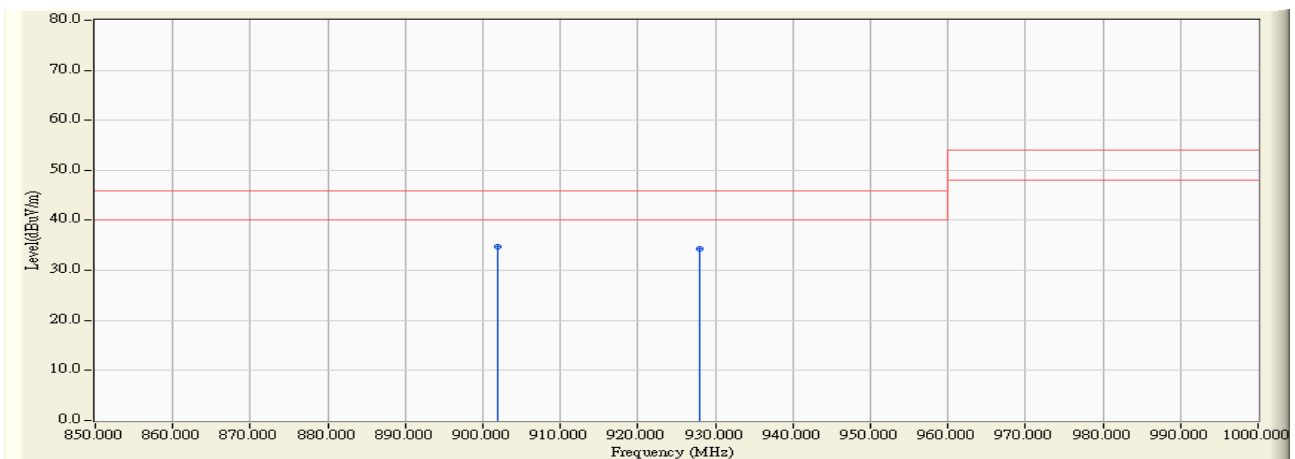
4.6. Test Result of Band Edge

Product : Mini-Magnetic sensor
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit

RF Radiated Measurement (Horizontal):

No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Quasi-Peak Limit (dBuV/m)	Result
01(Quasi-Peak)	902.000	5.628	29.201	34.829	46.000	Pass
02(Quasi-Peak)	928.000	6.848	27.391	34.238	46.000	Pass

Figure Channel 01: Horizontal (Quasi-Peak)



Note:

1. Quasi-Peak measurements: RBW=100kHz,VBW=1MHz,Sweep: Auto.
2. “ * ”, means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

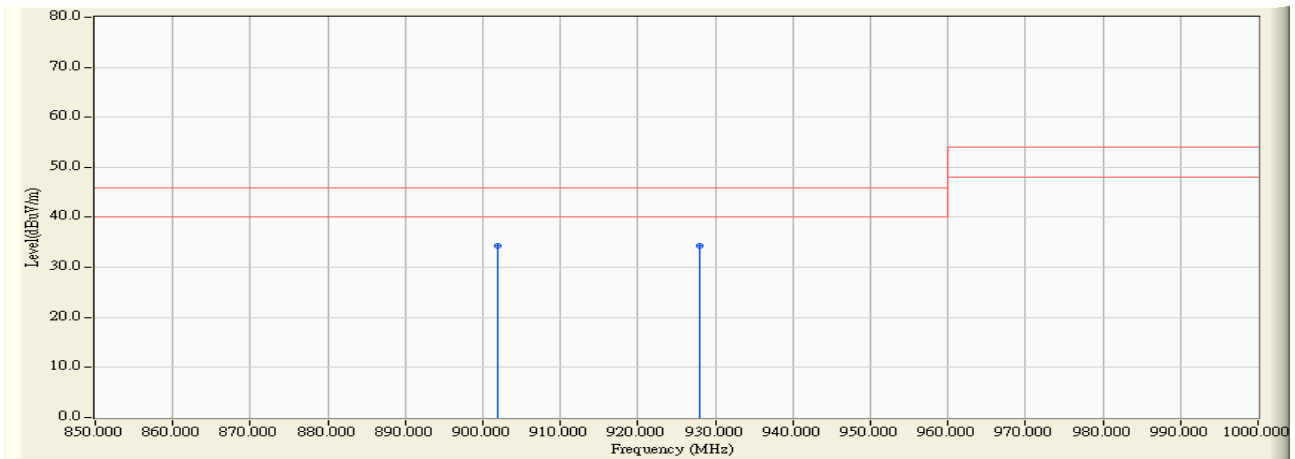
Product : Mini-Magnetic sensor
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit

RF Radiated Measurement (Vertical):

No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Quasi-Peak Limit (dBuV/m)	Result
01(Quasi-Peak)	902.000	3.155	31.075	34.229	46.000	Pass
02(Quasi-Peak)	928.000	6.160	28.078	34.238	46.000	Pass

Figure Channel 01:

Vertical (Quasi-Peak)



Note:

1. Quasi-Peak measurements: RBW=100kHz,VBW=1MHz,Sweep: Auto.
2. “ * ”, means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

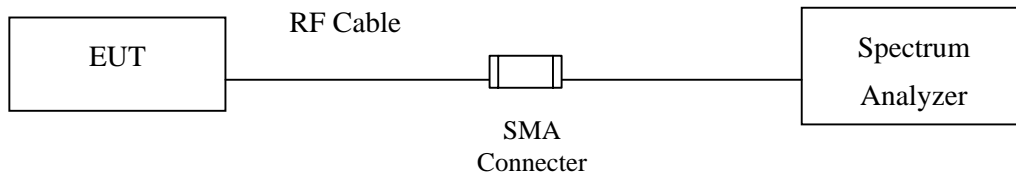
5. Occupied Bandwidth

5.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2013
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2013
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2013

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

5.2. Test Setup



5.3. Limits

Accordance with 15.215 requirement.

5.4. Test Procedure

The EUT was setup to ANSI C63.4, 2003

5.5. Uncertainty

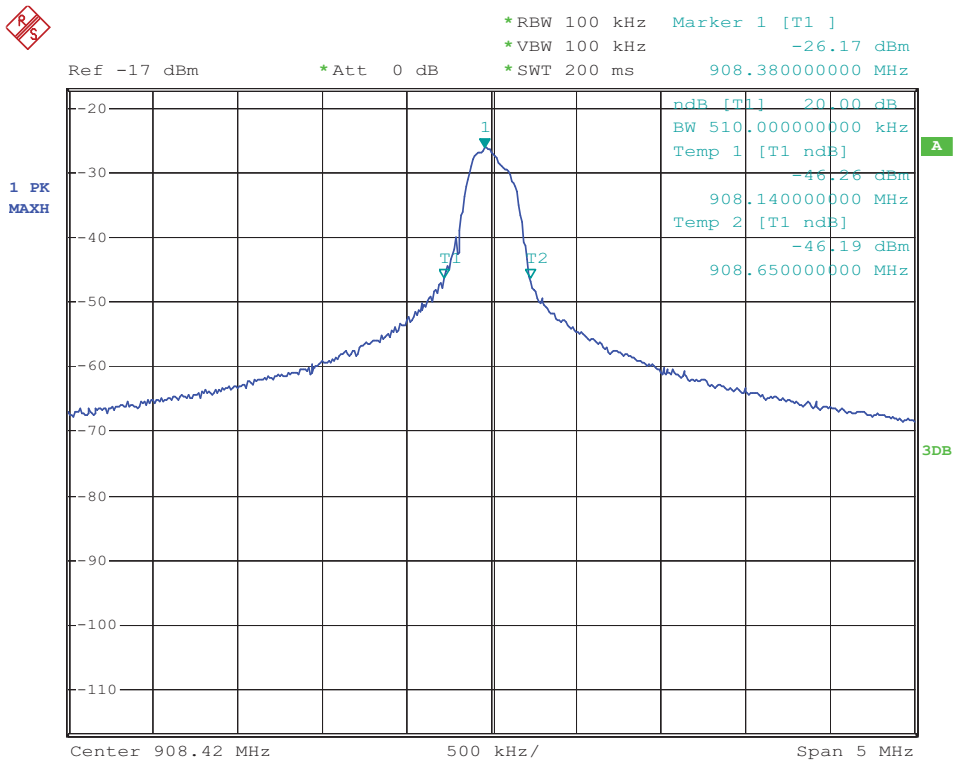
± 150Hz

5.6. Test Result of Occupied Bandwidth

Product : **Mini-Magnetic sensor**
 Test Item : Occupied Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : **Mode 1: Transmit(2402MHz)**

Frequency (MHz)	20dB Bandwidth (MHz)		Required Limit (MHz)	Result
2402	Frequency (Low)	908.14	>902	PASS
	Frequency (High)	908.65	<928	PASS

NOTE: Accordance with 15.215 requirements.



6. EMI Reduction Method During Compliance Testing

No modification was made during testing.