FCC TEST REPORT

for

DRAGINO TECHNOLOGY CO., LIMITED

Wireless Sensor Node

Model Number: MS14, FLM03B, MS14-P, MS14-S, MS14-MLC

FCC ID: ZHZMS14

Prepared for : DRAGINO TECHNOLOGY CO., LIMITED.

Address : Room 2073, Zi'An Commercial Building, Qian Jin 1 Road,

Xin'An 6th District, Bao'an District; Shenzhen 518101, China

Prepared by: Keyway Testing Technology Co., Ltd.

Address : Baishun Industrial Zone, Zhangmutou Town,

Dongguan, Guangdong, China

Tel: 86-769-8718 2258 Fax: 86-769-8718 1058

Report No. : 13KWE11103808R Date of Test : Nov. 11~22, 2013 Date of Report : Nov. 24, 2013

TABLE OF CONTENTS

Test Report Declara	ation	Page
1. TEST SUMMARY		4
2. GENERAL PROD	UCT INFORMATION	5
2.1. Product Functi	on	5
2.2. Description of	Device (EUT)	5
	peration Modes	
3. TEST SITES		6
3.2. List of Test and	d Measurement Instruments	7
4. TEST SET-UP AN	ID OPERATION MODES	8
4.1. Principle of Co	nfiguration Selection	8
	of Test Set-up	
	Mode and Test Software	
	sories and Auxiliary Equipment	
	res to Achieve EMC Compliance	
	RESULTS	
	ission at the Mains Terminals Test	
	sion Test	
6. 20DB OCCUPY B	ANDWIDTH	16
6.1. Limits		16
7. BAND EDGE COM	MPLIANCE TEST	18
7.1. Limits		18
7.2. Test setup		18
8. ANTENNA REQU	IREMENT:	20
9. PHOTOGRAPHS	OF TEST SET-UP	21
9.1. Set-up for Con	ducted Emission Test	21
•	iated Emission Test	
10. PHOTOGRAPH	IS OF THE EUT	22

FCC ID: ZHZMS14

Keyway Testing Technology Co., Ltd.

Applicant: DRAGINO TECHNOLOGY CO., LIMITED.

Address: Room 2073, Zi'An Commercial Building, Qian Jin 1 Road,

Xin'An 6th District, Bao'an District; Shenzhen 518101, China

Manufacturer: DRAGINO TECHNOLOGY CO., LIMITED.

Address: Room 2073, Zi'An Commercial Building, Qian Jin 1 Road,

Xin'An 6th District, Bao'an District; Shenzhen 518101, China

E.U.T: Wireless Sensor Node

Model Number: MS14, FLM03B, MS14-P, MS14-S, MS14-MLC

Trade Name: DRAGINO FLUKS •

Date of Receipt: Nov. 10, 2013 **Date of Test:** Nov. 10~22, 2013

Test Specification: FCC Part 15, Subpart C: Oct. 1, 2013

ANSI C63.4:2003

Test Result: The equipment under test was found to be compliance with the

requirements of the standards applied.

Issue Date: Nov. 24, 2013

Tested by:

Reviewed by:

Approved by:

Andy Gao / Engineer

Jade Yang/ Supervisor

Chris Du / Manager

Other Aspects:

None.

Abbreviations: OK/P=passed

fail/F=failed

n.a/N=not applicable

E.U.T=equipment under tested

This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd.

1.TEST SUMMARY

Test Items	Test Requirement	Uncertainty	Result
Conducted Emissions	15.207 ANSI C63.4	\pm 2.7dB	PASS
Radiated Emissions	15.209 15.249 ANSI C63.4	±3.6dB	PASS
20dB Bandwidth	15.249 ANSI C63.4	±1kHz	PASS
Band Edge Compliance Test	15.249 ANSI C63.4	\pm 3.6dB	PASS
Antenna Requirement	15.203 ANSI C63.4	/	PASS

Note: N/A means not applicable.

2.GENERAL PRODUCT INFORMATION

2.1. Product Function

Refer to Technical Construction Form and User Manual.

2.2. Description of Device (EUT)

Product Name:	Wireless Sensor Node
Model No.:	MS14, FLM03B, MS14-P, MS14-S, MS14-MLC
	2412MHz~2462MHz (802.11b/802.11g/802.11n(H20))
Operation Frequency:	2422MHz~2452MHz (802.11n(H40))
	915MHz
Channel numbers:	11 for 802.11b/802.11g/802.11n(H20) ,7 for 802.11n(H40)
Channel separation:	5MHz for 802.11
Modulation technology: (IEEE 802.11b)	Direct Sequence Spread Spectrum (DSSS)
Modulation technology: (IEEE 802.11g/802.11n)	Orthogonal Frequency Division Multiplexing(OFDM)
Data speed (IEEE 802.11b):	1Mbps, 2Mbps, 5.5Mbps, 11Mbps
Data and (IEEE 202 44 a).	6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps,
Data speed (IEEE 802.11g):	36Mbps, 48Mbps,54Mbps
Data speed (IEEE 802.11n):	Up to 150Mbps
Antenna Type:	External for wifi
Antenna Type.	Internal for 915MHz
Antenna gain:	2.0dBi for wifi(declare by Applicant)
Antenna gam.	0dBi for 915MHz(declare by Applicant)
Power supply:	DC 5V from adapter

2.3. Independent Operation Modes

The basic operation modes are:

2.3.1. WIFI turn off and 915MHz keep transmitter mode

3. TEST SITES

3.1. Test Facilities

Lab Qualifications: 944 Shielded Room built by ETS-Lindgren, USA

Date of completion: March 28, 2011

966 Chamber built by ETS-Lindgren, USA

Date of completion: March 28, 2011

Certificated by TUV Rheinland, Germany.

Registration No.: UA 50207153 Date of registration: July 13, 2011

Certificated by UL, USA Registration No.: 100567-237

Date of registration: September 1, 2011

Certificated by Intertek

Registration No.: 2011-RTL-L1-31 Date of registration: October 11, 2011

Certificated by Industry Canada

Registration No.: 9868A

Date of registration: December 8, 2011

Certificated by FCC, USA Registration No.: 370994

Date of registration: February 21, 2012

Certificated by CNAS China Registration No.: CNAS L5783 Date of registration: August 8, 2012

Name of Firm : Keyway Testing Technology Co., Ltd.

Site Location : Baishun Industrial Zone, Zhangmutou Town,

Dongguan, Guangdong, China

3.2. List of Test and Measurement Instruments

3.2.1. For conducted emission at the mains terminals test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	May 9,13	May 9,14
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	May 9,13	May 9,14
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	May 9,13	May 9,14
RF Cable	FUJIKURA	3D-2W	944 Cable	May 9,13	May 9,14

3.2.2. For radiated emission test (Below 1GHz)

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	May 9,13	May 9,14
Bilog Antenna	ETS-LINDGREEN	3142D	135452	May 20,13	May 20,14
Spectrum Analyzer	Agilent	E4411B	MY4511304	May 9,13	May 9,14
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	May 9,13	May 9,14
Signal Amplifier	SONOMA	310	187016	May 9,13	May 9,14
Signal Amplifier	Agilent	8449B	3008A00251	May 9,13	May 9,14
RF Cable	IMRO	IMRO-400	966 Cable 1#	N/A	N/A
MULTI-DEVICE Controller	ETS-LINDGREEN	2090	126913	N/A	N/A

3.2.3. For above 1GHz radiated emission, output power, band edge, 6dB bandwidth test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Horn Antenna	DAZE	ZN30701	11003	May. 11,13	May. 11,14
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	May. 11,13	May. 11,14
Spectrum Analyzer	Agilent	8593E	3911A04271	May. 9,13	May. 9,14
Spectrum Analyzer	Agilent	E4408B	MY44211125	May. 9,13	May. 9,14
3m Semi-anechoic Chamber	ETS-LINDGREN	966	KW01	May. 9,13	May. 9,14
Signal Amplifier	DAZE	ZN3380C	11001	May. 9,13	May. 9,14
Signal Amplifier	Agilent	8449B	3008A00251	May. 9,13	May. 9,14
High Pass filter	Micro	HPM50111	324216	May. 9,13	May. 9,14
Power Meter	R&S	NRVS	101824	May. 9,13	May. 9,14
Peak and Avg Power Sensor	Rohde&Schwarz	URV5-Z2	100655	May. 9,13	May. 9,14
RF Cable	IMRO	IMRO-400	966 Cable 1#	May. 9,13	May. 9,14
MULTI-DEVICE Controller	ETS-LINDGREN	2090	126913	N/A	N/A
Antenna Holder	ETS-LINDGREN	2070B	00109601	N/A	N/A

4. TEST SET-UP AND OPERATION MODES

4.1. Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

4.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



(EUT: Wireless Sensor Node)

4.3. Test Operation Mode and Test Software None.

4.4. Special Accessories and Auxiliary Equipment

Adapter:

Model Number:GQ07-120050-AU

I/P: AC 100~240V 50/60Hz

O/P: DC 12V 0.5A

4.5. Countermeasures to Achieve EMC Compliance None.

5. EMISSION TEST RESULTS

5.1. Conducted Emission at the Mains Terminals Test

5.1.1. Limit 15.209 limits

FREQUENCY OF EMISSION (MHz)	CONDUCTED	LIMIT (dBµV)
	Quasi-peak	Average
0.15-0.5 0.5-5 5-30	66 to 56 56 60	56 to 46 46 50

5.1.2. Test Setup

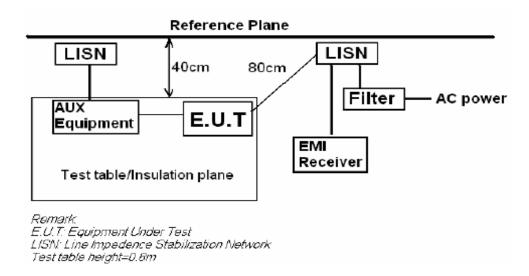
The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the centre so as to form a bundle no longer than 0.4 m.

The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.

The frequency range from 150 kHz to 30 MHz was investigated.

The bandwidth of the test receiver was set at 9 kHz.

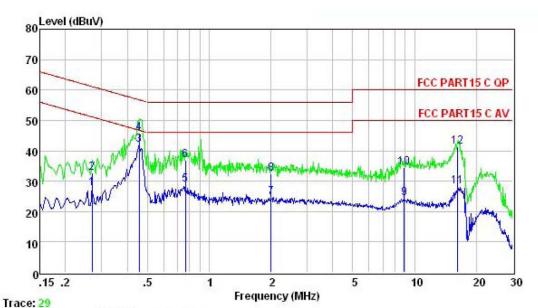
Pretest for all mode, The test data of the worst case condition(s) was reported on the following page.



5.1.3. Test Mode

WIFI turn off and 915MHz keep transmitter mode.

Test Data



Site : 944 Shielded Room
Condition : FCC PART15 C QP LINE
EUT : Wireless Sensor Node

POWER : DC 12V from adapter input AC 120V/60Hz

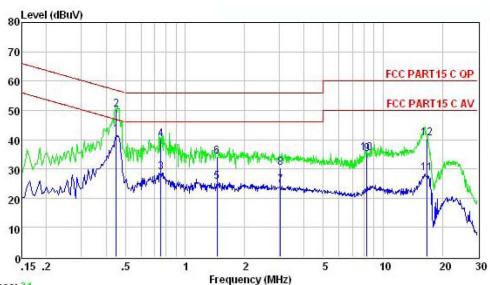
Limit Over

M/N : MS14 Test Engineer: Andy

Comment : Temp:24.9'; Humi:55%; Press; 101.48kPa

Test Mode : TX Mode 915Mhz

	Freq	Level	Line	Limit	Remark
	MHz	dBuV	dBuV	dB	
1	0.270	27.78	51.12	-23.34	Average
2	0.270	32.60	61.12	-28.52	QP
3	0.456	41.86	46.76	-4.90	Average
4	0.456	45.90	56.76	-10.86	QP
5	0.767	28.93	46.00	-17.07	Average
6	0.767	36.90	56.00	-19.10	QP
7	2.001	24.63	46.00	-21.37	Average
8	2.001	32.30	56.00	-23.70	QP
9	8.916	24.53	50.00	-25.47	Average
10	8.916	34.60	60.00	-25.40	QP
11	16.226	28.26	50.00	-21.74	Average
12	16.226	41.30	60.00	-18.70	OP



Trace: 31

Site : 944 Shielded Room
Condition : FCC PART15 C QP NEUTRAL
EUT : Wireless Sensor Node

POWER : DC 12V from adapter input AC 120V/60Hz

Limit Over

M/N : MS14 Test Engineer: Andy

Comment: Temp:24.9'; Humi:55%; Press; 101.48kPa

Test Mode : TX Mode 915Mhz

	Freq	Level	Line	Limit	Remark
-	MHz	dBuV	dBuV	dB	-
1	0.449	41.51	46.89	-5.38	Average
2	0.449	50.20	56.89	-6.69	QP
3	0.755	28.73	46.00	-17.27	Average
4	0.755	40.03	56.00	-15.97	QP
5	1.456	25.69	46.00	-20.31	Average
6	1.456	34.30	56.00	-21.70	QP
7	3.041	24.38	46.00	-21.62	Average
8	3.041	30.20	56.00	-25.80	QP
9	8.279	35.00	50.00	-15.00	Average
10	8.279	35.30	60.00	-24.70	QP
11	16.661	28.57	50.00	-21.43	Average
12	16.661	40.30	60.00	-19.70	QP

5.2. Radiated Emission Test

5.2.1. Limit 15.209 limits

FREQUENCY	DISTANCE	FIELD STREN	NGTHS LIMIT
MHz	Meters	$\mu V/m$	dB(μV)/m
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV	7)/m (Peak)
		54.0 dB(μV	V)/m (Average)

5.2.2. Fundamental and harmonics emission limits

Fundamental	Field Strength of Fundamental		Field Strength of Harmonics	
Frequency	mV/m	dBuV/m	uV/m	dBuV/m
902~928 MHz	50	94	500	54
2400~2483.5 MHz	50	94	500	54
5725~5875MHz	50	94	500	54
24.0~24.25GHz	250	108	2500	68

5.2.3. Restricted bands of operation

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)

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

5.2.4. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

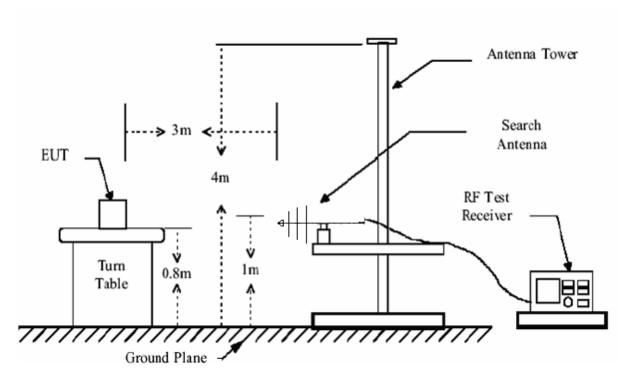
The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz, Both PK and AV measure, PK detector is used.

The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

The test data of the worst case condition(s) was reported on the following pages.

Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.

2. Measurement Uncertainty: ±3.6 dB at a level of confidence of 95%.



Test Data
Below 1GHz
915MHz Vertical polarizations

		Freq	Factor	Level	Loss	Factor	Level	Line	Limit	Remark
	13	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	()
1		31.87	31.40	44.59	0.56	17.70	31.45	40.00	-8.55	QP
2		61.21	31.34	53.89	0.75	7.32	30.62	40.00	-9.38	QP
3		146.54	31.23	53.27	1.22	8.79	32.05	43.50	-11.45	QP
4		215.87	31.02	50.97	1.53	11.76	33.24	43.50	-10.26	QP
5		339.87	30.72	43.10	2.10	15.09	29.57	46.00	-16.43	QP
6		795.28	30.58	30.99	4.29	22.94	27.64	46.00	-18.36	QP
7	*	915.00	29.94	88.13	4.87	24.42	87.48	94.00	-6.52	Average
8	*	915.00	29.94	93.86	4.87	24.42	93.21	114.00	-20.79	Peak

915MHz Horizontal polarizations

			Preamp	Read	Cablei	Antenna		Limit	Over	
		Freq	Factor	Level	Loss	Factor	Level	Line	Limit	Remark
	14	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	s is
1		61.02	31.34	51.22	0.75	7.32	27.95	40.00	-12.05	QP
2		146.35	31.23	52.82	1.22	8.78	31.59	43.50	-11.91	QP
3		272.61	30.95	49.20	1.78	12.99	33.02	46.00	-12.98	QP
4		350.18	30.66	45.65	2.10	15.52	32.61	46.00	-13.39	QP
5		548.67	30.86	37.66	3.03	19.48	29.31	46.00	-16.69	QP
6		708.95	30.66	38.24	3.88	22.15	33.61	46.00	-12.39	QP
7	*	915.00	29.94	87.94	4.87	24.42	87.29	94.00	-6.71	Average
8	*	915.00	29.94	92.29	4.87	24.42	91.64	114.00	-22.36	Peak

Above 1GHz

915MHz Vertical polarizations

		Preamp	Read	Cablei	Antenna		Limit	Over	
	Freq	Factor	Level	Loss	Factor	Level	Line	Limit	Remark
,	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	; ;
1	1830.00	26.17	44.03	6.08	27.37	51.31	74.00	-22.69	Peak
2	2745.00	26.42	37.89	8.75	29.40	49.62	74.00	-24.38	Peak
3	3660.00	26.83	33.52	10.06	30.81	47.56	74.00	-26.44	Peak
4	4575.00	27.35	30.64	11.45	32.37	47.11	74.00	-26.89	Peak
5	5490.00	27.65	25.69	13.93	34.08	46.05	74.00	-27.95	Peak
6	6287.00	27.76	19.33	16.60	35.60	43.77	74.00	-30.23	Peak

915MHz Horizontal polarizations

		Preamp	Read	CableAntenna			Limit	Over	
	Freq	Factor	Level	Loss	Factor	Level	Line	Limit	Remark
,	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	3 3 1 3
1	1830.00	26.17	44.11	6.08	27.37	51.39	74.00	-22.61	Peak
2	2745.00	26.42	38.80	8.75	29.40	50.53	74.00	-23.47	Peak
3	3660.00	26.83	34.33	10.06	30.81	48.37	74.00	-25.63	Peak
4	4575.00	27.35	31.35	11.45	32.37	47.82	74.00	-26.18	Peak
5	5490.00	27.65	27.27	13.93	34.08	47.63	74.00	-26.37	Peak
6	8786.00	28.33	16.50	16.83	37.14	42.14	74.00	-31.86	Peak

6. 20DB OCCUPY BANDWIDTH

6.1. Limits

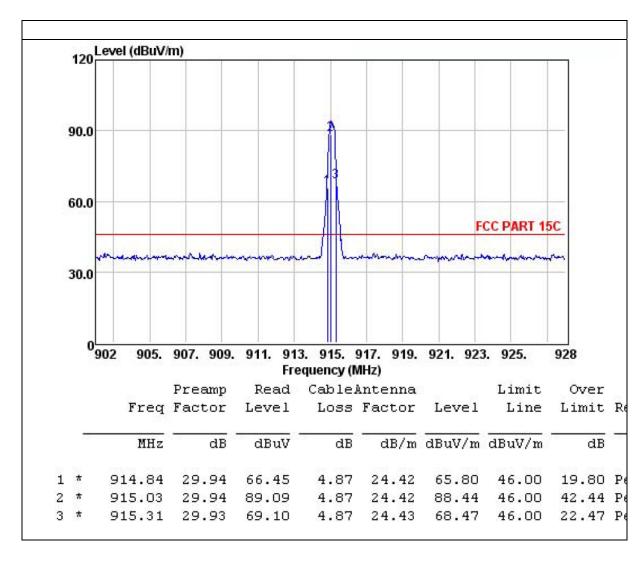
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

The bandwidth of the Spectrum's VBW is set at 100kHz and RBW is set at 300kHz for peak measurement.

Test data:

Channel Frequency	20dB Bandwidth	Limit
(MHz)	(MHz)	(kHz)
915	0.47	N/A

Test plot as follows:



7. BAND EDGE COMPLIANCE TEST

7.1. Limits

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

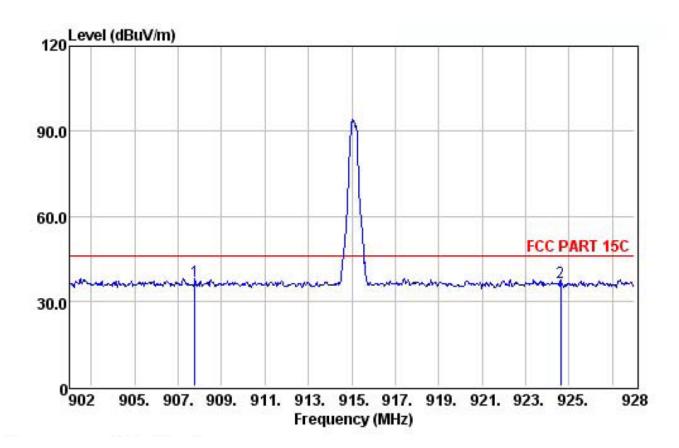
7.2. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The bandwidth of the Spectrum's VBW is set at 100kHz and RBW is set at 300kHz for peak measurement.

Note: we pretest horizontal and vertical polarizations, the worst was vertical polarizations and recorded in test report.

For radiated test as follows:



		Preamp	Read	Cable.	Antenna		Limit	Over	
	Freq	Factor	Level	Loss	Factor	Level	Line	Limit	Remark
ŧ	MHz	dB	dBuV	dB	dB/m	dBuV/m	$\overline{\text{dBuV/m}}$	dB	()
1	907.77	30.00	38.14	4.84	24.22	37.20	46.00	-8.80	Peak
2	924.62	29.85	36.66	4.87	24.69	36.37	46.00	-9.63	Peak

8. ANTENNA REQUIREMENT:

Standard requirement: FCC Part15 C Section 15.203 /249(c)

15.203 requirement:

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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.249 requirement:

Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.

E.U.T Antenna:

The antenna is internal antenna, the best case gain of the antenna is 0dBi

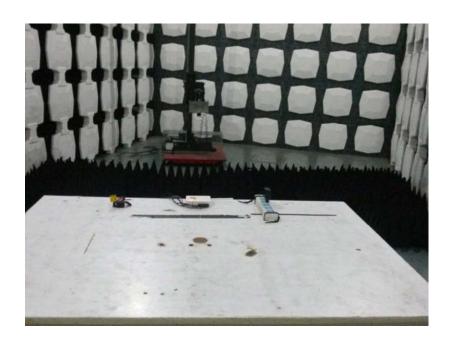
9. PHOTOGRAPHS OF TEST SET-UP

9.1. Set-up for Conducted Emission Test



9.2. Set-up for Radiated Emission Test





10. PHOTOGRAPHS OF THE EUT

Reference to the test report No. 13KWE11103807R

END