

## **TEST REPORT**

Date: 2013-03-25

Report No.: 60.870.13.008.02F

Binatone Electronics International Ltd. Applicant: Floor 23A, 9 Des Voeux Road West, Sheung Wan, Hong Kong Baby Monitor (Parent Unit) **Description of Samples:** Model name: Brand name: **MOTOROLA** MBP43PU Model no.: FCCID: VLJ-MBP43PU **Date Samples Received:** 2013-02-04 **Date Tested:** 2013-02-05 to 2013-02-27 **Investigation Requested:** FCC Part 15 Subpart C, Section 15.247 Conclusions: The submitted product **COMPLIED** with the Federal requirements of Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report. Remarks: Checked by: Approved by:-

Ray Cheung Project Engineer Wireless & Telecom Department Jeff Pong Operation Manager Wireless & Telecom Department



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External EUT Photos

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Internal EUT Photos



## 1.0 General Details

## 1.1 Test Laboratory

SEM. Test Compliance Service Co., Ltd 3/F, Jinbao Commerce Building, Xin'an Fanshen Road, Bao'an District, Shenzhen Registration Number: 994117

Test By:

1.2 Applicant Details Applicant

**Binatone Electronics International Ltd.**Floor 23A, 9 Des Voeux Road West, Sheung Wan Hong Kong

#### Manufacturer

Alford Industries Ltd. Unit 02, 6<sup>th</sup> Floor, Yen Sheng Centre, 64 Hoi Yuen Road, Kwun Tong, Kowloon, HK



#### 1.3 Equipment Under Test [EUT]

#### **Description of EUT**

Product Description: Baby Monitor (Parent Unit)

Model No.: MBP43PU
Brand Name: MOTOROLA
FCCID: VLJ-MBP43PU

Rating: - DC 6V, 500mA powered by AC/DC power adaptor

or

- DC 3.6V, 900mAh Ni-MH Rechargeable Battery

Operated Frequency: 2410.875 – 2471.625 MHz

No. of Operated Channel:

Accessories and Auxiliary Equipments: - AC/DC power adaptor.

Antenna Type: Integral

Manufacture of Antenna: Alford Industries Ltd.

Antenna Gain: 0 dBi Antenna Model: N/A

#### **General Operation of EUT**

The Equipment Under Test (EUT) is a monitor of wireless baby monitor system which operated at 2.4GHz.

#### FHSS Operation Principle:

This module is controlled by microchip to generate Pseudorandom Frequency Hopping Sequence, this module support 19 hopping channels. Refer to section 4.5 of this report to have more detail of Pseudorandom Hopping Algorithm.

#### 1.4 Related Submittal(s) Grants

This is a signal application subjected to Certificate Authorization.



## 2.0 Technical Details

## 2.1 Investigations Requested

Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15 and ANSI C63.4: 2003

## 2.2 Test Standards and Results Summary Tables

Test Condition	Test Requirement	Test Re	sult
		Pass	N/A
Number of Frequency Hopping	Section 15.247 ( a1 )		
20dB Bandwidth Measurement	Section 15.247 (a1)		
Hopping Channel Carrier Frequency Separation	Section 15.247 ( a1 )		
Average Time of Occupancy	Section 15.247 ( a1 )		
Pseudorandom Hopping Algorithm	Section 15.247 ( a1 )		
Band Edge Measurement	Section 15.247		
Maximum Output Power	Section 15.247 ( b1 )		
Out of Band Emission	Section 15.247 ( d )		
Radiated Emission in Restricted Band	Section 15.247 ( d )		
Conducted Emission on AC Mains	Section 15.207		
RF Exposure	Section 15.247 ( i )		
Antenna Requirement	Section 15.203	See note 1	

Note 1: The EUT uses a permanently attached antenna, which in accordance to Section 15.203, is considered sufficient to comply with the provisions of this section.

Remark: N/A - Not Applicable



#### 3.0 Test Methodology

#### 3.1 Radiated Emission

The sample was placed 0.8m above the ground plane on a standard emission test site \*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

## 3.2 Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

FS = R + System Factor System Factor = AF + CF + FA - PA

Where FS = Net Field Strength in dBuV/m at 3 meters.

R = Reading of Spectrum Analyzer / Test Receiver in dBuV.

AF = Antenna Factor in dB.

CF = Cable Attenuation Factor in dB.

FA = Filter Attenuation Factor in dB.

PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

#### 3.3 Conducted Emissions

The test was performed in accordance with ANSI C63.4: 2003, with the following: initial measurements were performed in peak and average detection modes on the live line of personal computer, any emissions recorded within 30dB of the relevant limit lines were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.



#### 4.0 Test Results

#### 4.1 Number of Hopping Frequency

Test Requirement: FCC part 15 section 15.247 (a1)(iii)

Test Date: 2013-02-05

Mode of Operation: Transmitting mode.

Detector Function: Max Hold

**Result: PASS** 

#### Measured Result:

Operating Channel Frequency in sequence (MHz):

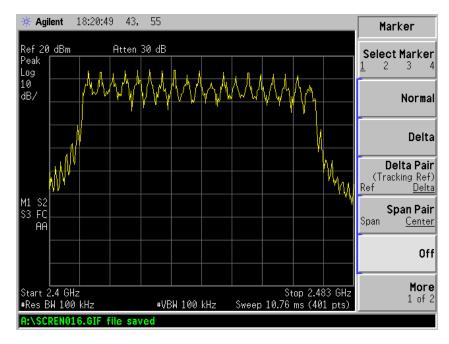
2410.875; 2414.25; 2417.625; 2421; 2424.375; 2427.75; 2431.125; 2434.5; 2437.875; 2441.25; 2444.625; 2448; 2451.375; 2454.75; 2458.125; 2461.5; 2464.875; 2468.25;

2471.625

## Limit for Number of Hopping Channel [ Section 15.247 (a1)(iii) ]

At least 15 non-overlapping channels for 2400-2483.5MHz.

## Result data graph shows the number of operation channels:





#### 4.2 20dB Bandwidth Measurement

Test Requirement: FCC part 15 section 15.247 (a1)

Test Date: 2013-02-05

Mode of Operation: Transmitting mode.

Detector Function: Max Hold

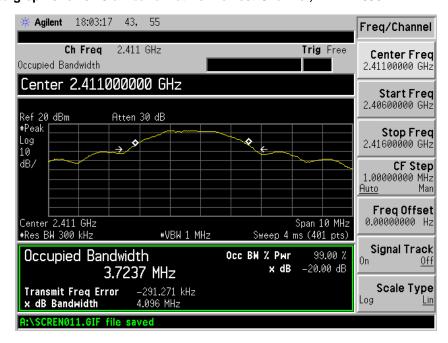
#### Test Setup:

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

Channel	Measured frequency (MHz)	20dB Bandwidth (MHz)
Lowest	2410.875	4.096
Middle	2444.625	4.100
Highest	2471.625	4.096

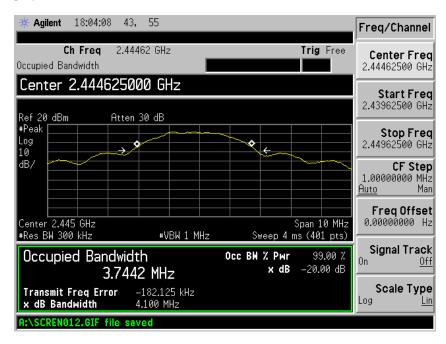
This result is used for checking the hopping channel carrier frequencies separation.

#### Result data graph shows 20 dB bandwidth of Lowest Channel, BW = 4.096MHz

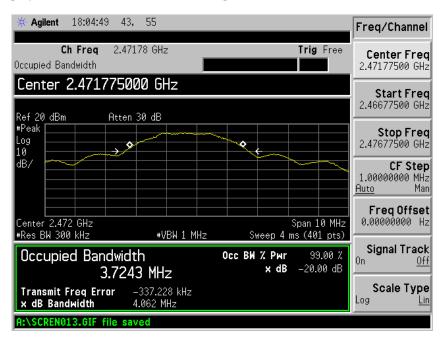




## Result data graph shows 20 dB bandwidth of Middle Channel, BW = 4.100MHz



## Result data graph shows 20 dB bandwidth of Highest Channel, BW = 4.062MHz





#### 4.3 Hopping Channel Carrier Frequency Separation

Test Requirement: FCC part 15 section 15.247 (a1)

Test Date: 2013-02-05

Mode of Operation: Transmitting mode.

Detector Function: Max Hold

**Result: PASS** 

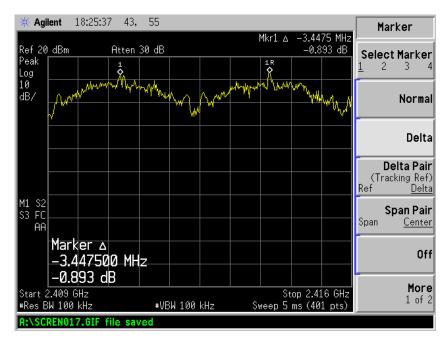
#### Measured Result:

Refer to the delta marker, the frequency separation between two adjacent channels is 3.448MHz, therefore, the requirement of channel separated by a minimum of 25kHz of the hopping channel is applied.

#### Limits for Hopping Channel Separation [ Section 15.247 (a1) ]:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25KHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

## Result data graph shows the channel separation:





#### 4.4 Average Time of Channel Occupancy

Test Requirement: FCC part 15 section 15.247 (a1)(iii)

Test Date: 2013-02-05

Mode of Operation: Transmitting mode.

Detector Function: Zero span, Sweep time 1s

**Result: PASS** 

#### Measured Result:

Each transmission only 19 channels will be used.

Observe time = 19 channels  $\times$  0.4s =7.6s

There are 18 pulses within 1s

And one set of pulses = 360us

Therefore, the average channel occupancy times (ms)

 $= 360us \times 18 \times 10$ 

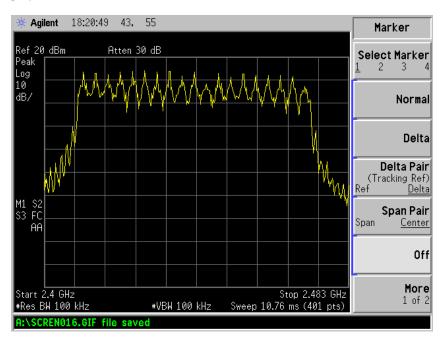
So, total transmitting time is 0.065s. (<0.4s).

#### Limits for Average Time of Occupancy [ Section 15.247 (a1)(iii) ]:

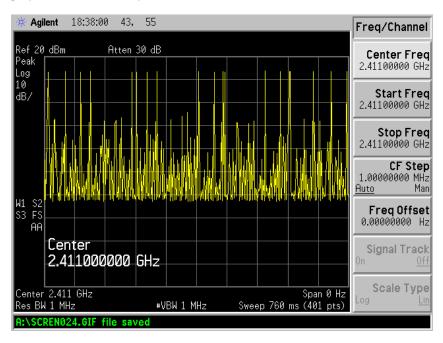
The average time of occupancy on any channel shall not be greater than 0.4 second within a period of 0.4 seconds multiplied by the number of hopping channels employed.



## Result data graph shows total 19 channels are used

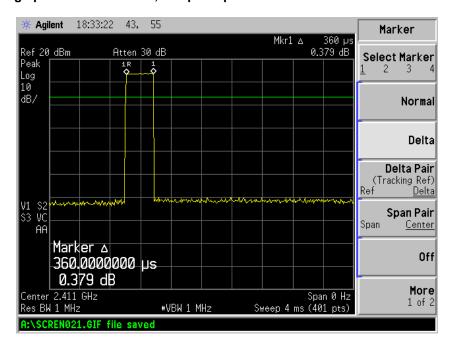


## Result data graph shows total 18 pulses with 760ms





## Result data graph zooms into detail, one pulse period is 360us





#### 4.5 Pseudorandom Hopping Algorithm

## **Pseudorandom Frequency Hopping**

MBP43PU uses FHSS technology with 19 hopping frequencies. Each channel frequency is selected from a pseudorandom ordered list of hopping frequencies, from 2410.875MHz to 2471.625MHz. A single data frame is transmitted on each frequency location before skipping to the next hopping frequency in the list.

Pseudorandom Frequency Hopping Sequence

```
2410.875; 2414.25; 2417.625; 2421; 2424.375; 2427.75; 2431.125; 2434.5; 2437.875; 2441.25; 2444.625; 2448; 2451.375; 2454.75; 2458.125; 2461.5; 2464.875; 2468.25; 2471.625
```

#### Requirement for Pseudorandom Hopping Algorithm [Section 15.247 (a1)]:

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on average by the transmitter.



#### 4.6 Band Edge Measurement

Test Requirement: FCC part 15 section 15.247

Test Date: 2013-02-13

Mode of Operation: Transmitting mode.

Detector Function: Max Hold

**Result: PASS** 

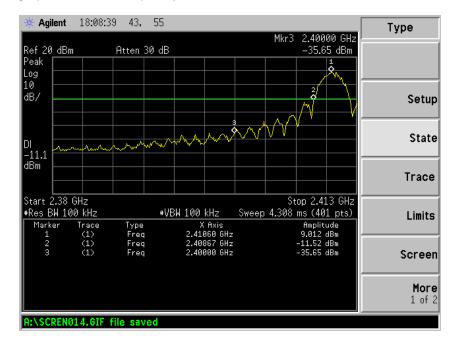
#### Measured Result:

Refer to the figure, it shows the frequency of lower band edge and upper band edge separately.

#### Limits of Band Edge for Carrier Frequencies Operated within the Bands [ Section 15.247 ]:

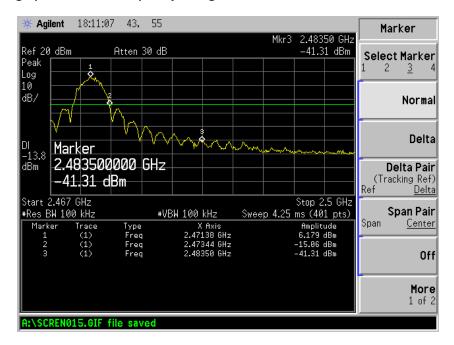
The carrier frequencies should operate within 2400-2483.5MHz.

#### Result data graph shows the frequency of lowest channel.





## Result data graph shows the frequency of highest channel.





## 4.7 Maximum Output Power

Test Requirement: FCC part 15 section 15.247 (a1)

Test Method: ANSI C63.4:2003
Test Date: 2013-02-27
Mode of Operation: Transmitting mode.

Detector Function: Peak

Measurement BW: RBW 1MHz ; VBW 1MHz

#### Test Setup:



**Result: PASS** 

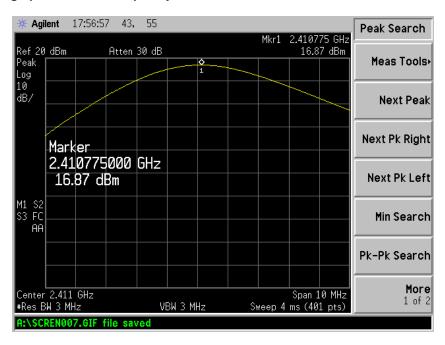
Frequency	Peak Output Power		Limit	
(MHz)	(dBm)	(W)	(dBm)	(W)
Lowest Channel: 2410.875	16.87	0.049	21	0.125
Middle Channel : 2444.625	15.79	0.038	21	0.125
Highest Channel : 2471.625	13.65	0.023	21	0.125

## Limits for Maximum Output Power [ Section 15.247 (a1)(iii) ]:

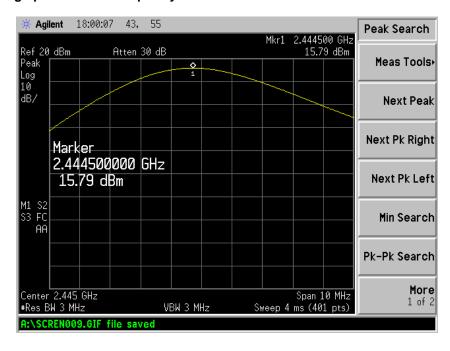
For frequency hopping systems employing at least 75 hopping channels: 1 Watt For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts



#### Result data graph shows the frequency of lowest channel

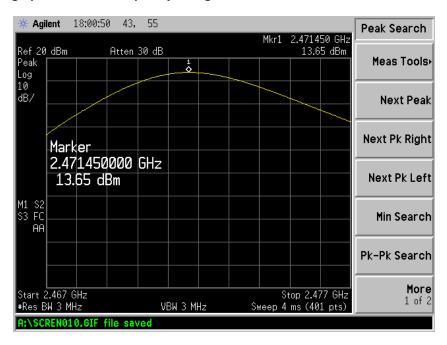


## Result data graph shows the frequency of middle channel





## Result data graph shows the frequency of highest channel





## 4.8 Out of Band Emissions and Emissions in Restricted Bands

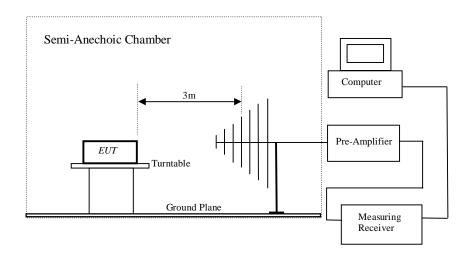
Test Requirement: FCC part 15 section 15.247 (d )

Test Method: ANSI C63.4:2003
Test Date: 2013-02-27
Mode of Operation: Transmitting mode.

Detector Function: Peak

Measurement BW: RBW 100KHz ; VBW 300KHz

## **Test Setup:**





**Result: PASS** 

#### **Out of Frequency Band Emissions:**

For out of band emissions that are close to or exceed 20dB attenuation requirement, and emission falls into restricted band, radiated emission was performed in order to show compliance with the general radiated emission requirement.

#### **Result Summary:**

Refer to the emission data graph, result shows that the significant emissions detected are with more than 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

#### Limits for Out of Frequency Band Emission [ Section 15.247 (d) ]:

In any 100kHz 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 100kHz bandwidth within the band that contains the highest level of the desired power. Attenuation below the general limits specified in Section 15.209(a) is not required.

#### Limit for Radiated Emission Falling in Restricted Bands [ Section 15.209 ]:

Frequency (MHz)	Field Strength [μV/m]	Field Strength [dBμV/m]
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

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.

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.



**Result: PASS** All Emission and Emissions Fall into Restricted Band were recorded as below:

	Radiated Emissions							
	Emissions Frequency	E-Field Polarity	Reading	System Factor	Field strength at 3m	Limit	Delta to Limit	
	MHz		dBuV/m	dB	dBuV/m	dBuV/m	dBuV/m	
	Lowest Chann							
PK	1357.25	V	57.21	-14.90	42.31	74.00	-31.69	
PK	2281.32	V	61.78	-11.72	50.06	74.00	-23.94	
PK	1357.25	Н	56.56	-14.90	41.66	74.00	-32.34	
PK	2281.32	Н	63.75	-11.72	52.03	74.00	-21.97	
	Middle Chann							
PK	1364.18	V	59.07	-14.88	44.19	74.00	-29.81	
PK	2316.43	V	60.34	-11.72	48.62	74.00	-25.38	
PK	6713.01	V	52.90	-0.65	52.25	74.00	-21.75	
PK	1364.18	Н	58.81	-14.88	43.93	74.00	-30.07	
PK	2316.43	Η	63.29	-11.72	51.57	74.00	-22.43	
	Highest Chan	nel						
PK	1371.15	V	70.17	-14.87	55.30	74.00	-18.70	
PK	2352.08	V	60.13	-11.73	48.40	74.00	-25.60	
PK	1371.15	Н	67.17	-14.87	52.30	74.00	-21.70	
PK	2352.08	Η	60.54	-11.73	48.81	74.00	-25.19	
	Spurious Emis	ssions						
QP	31.95	V	29.39	8.37	37.76	40.00	-2.24	
QP	35.25	V	24.50	8.92	33.42	40.00	-6.58	
QP	84.11	V	25.53	2.84	28.37	40.00	-11.63	
QP	96.10	V	26.18	5.87	32.05	43.50	-11.45	
QP	351.71	V	20.63	10.48	31.11	46.00	-14.89	
QP	517.25	V	24.46	12.82	37.28	46.00	-8.72	
QP	30.42	Н	20.16	8.11	28.27	40.00	-11.73	
QP	96.10	Н	21.49	5.87	27.36	43.50	-16.14	
QP	346.81	Н	27.72	10.33	38.05	46.00	-7.95	
QP	396.24	Н	25.76	11.37	37.13	46.00	-8.87	
QP	517.25	Н	23.79	12.82	36.61	46.00	-9.39	

Refer to Figures shows the worst case channel's emission data graph from 30MHz-26GHz.



#### **Result Summary:**

- 1) Communication mode: All other emissions are more than 20dB below FCC part 15.209 limit.
- 2) No further spurious emissions found between 30 MHz and lowest internal used/generated frequency and from 30MHz to 1GHz.

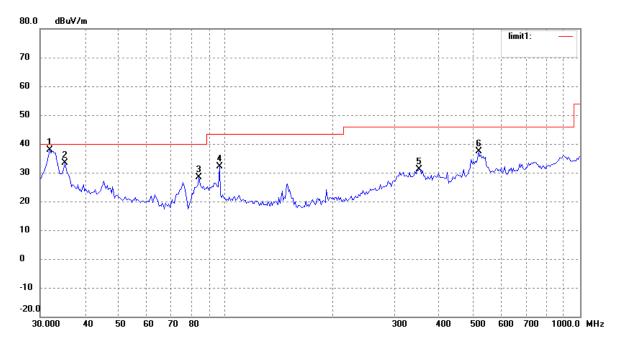
#### Remarks:

- 1. "\*" Radiated emissions which fall in the restricted bands as defined in Section 15.205(a).
- 2. Emission level with more than 20dB below the FCC required limit is not mentioned in table.
- 3. Delta to Limit = Field strength  $(dB\mu V/m)$  Limit  $(dB\mu V/m)$ .
- 4. Calculated measurement uncertainty: 9kHz -30MHz: 1.8dB.

30MHz -1GHz: 5.2dB. 1GHz -18GHz: 5.1dB.

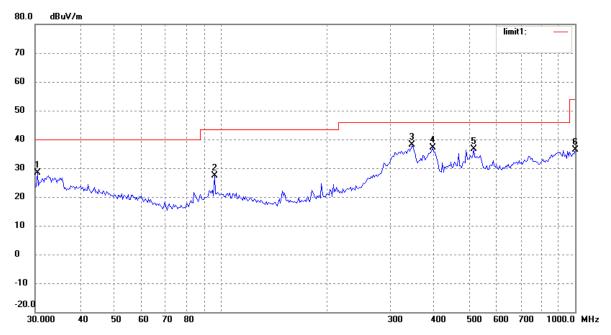


#### Radiated emission data graph (Vertical polarization, 30MHz-1GHz)



Remark: Only background noise was measured from 1GHz-26GHz excluding the operation frequency relational.

#### Radiated emission data graph (Horizontal polarization, 30MHz-1GHz)



Remark: Only background noise was measured from 1GHz-26GHz excluding the operation frequency relational.



## 4.9 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement: FCC part 15 Section 15.207 Class B

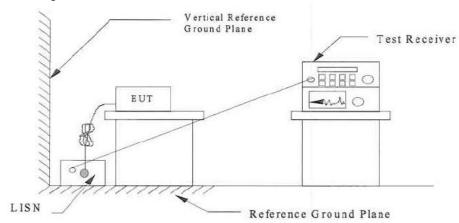
Test Method: ANSI C63.4:2003 Test Date: 2013-02-05

Mode of Operation: -Transmitting mode
Detector Function: CISPR Quasi Peak

Measurement BW: 100 kHz

Worst Case Channel:

## **Test Setup:**



**Results: PASS** 

- Refer Figure and tables the result.

## Limits for Conducted Emission [ Section 15.207]:

Frequency Range [MHz]	Quasi-Peak Limit [dBμV]	Average Limit [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

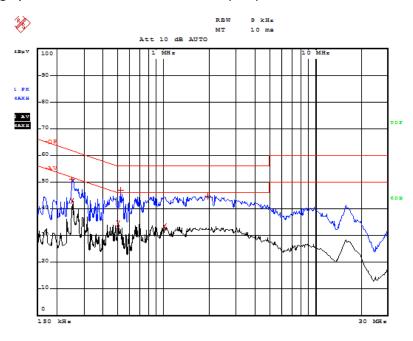
<sup>\*</sup> Decreases with the logarithm of the frequency.

Remarks:

Calculated measurement uncertainty: ±2.8dB



## Result data graph shows the conducted emission (Live).

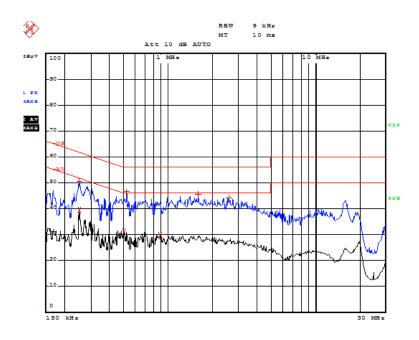


Refer to the following table for the result details:

Conducted Emission							
Frequency Detector Phase Result Limit Margin							
(MHz)	(QP/AV)		(dBµV)	(dBµV)			
0.254	QP	L	51.04	61.62	-10.58		
0.254	AV	L	42.84	51.61	-8.77		
0.506	AV	L	34.42	46.00	-11.58		
0.522	QP	L	47.11	56.00	-8.89		
1.030	AV	Ĺ	33.34	46.00	-12.66		
1.097	QP	Ĺ	44.77	56.00	-11.23		



## Result data graph shows the conducted emission (Neutral).



Refer to the following table for the result details:

Conducted Emission							
Frequency (MHz)	Detector (QP/AV)	Phase	Result (dBµV)	Limit (dBµV)	Margin		
0.250	QP	N	50.60	61.74	-11.14		
0.250	AV	N	39.45	51.74	-12.29		
0.506	AV	N	31.09	46.00	-14.91		
0.522	QP	N	46.69	56.00	-9.31		
0.886	AV	N	29.81	46.00	-16.19		
1.602	QP	N	45.40	56.00	-10.60		



## 5.0 RF Exposure Compliance Requirement

Test Requirement: FCC part 15 section 15.247 (i)
Test Method: FCC part 15 section 1.1307 (b1)
OET Bulletin 65, Edition 01-01

**Results: PASS** 

Systems operation under the provision of this section shall be operated in a manner that ensures the public is not exposed to radio frequency energy levels in excess of the Commission's guideline,

The EUT is considered as a mobile device according to OET Bulletin 65, Edition 01-01, therefore distance to human body of min. 20cm is determined.

Frequency Band:	2.410.875 GHz ~2.471.625GHz
Device Category:	☐ Portable (< 20cm separation ) ☐ Mobile ( >20cm separation ) ☐ Others :
Exposure Classification:	<ul><li>☐ Occupational/ Controlled exposure</li><li>☒ General Population / Uncontrolled exposure</li></ul>
Max. Output Power	48.64 mW
Antenna Gain	0 dBi ( Numeric gain:1)
Evaluation Applied:	<ul><li>✓ MPE Evaluation</li><li>☐ SAR Evaluation</li></ul>

MPE calculation:

The radiated (EIRP) = 48.64 mW

The power density at 20cm from the antenna : = EIRP /  $4\pi$  R<sup>2</sup> = 0.0097mW / cm<sup>2</sup>

#### Limits for General Population/Uncontrolled Exposure [OET Bulletin 65, Edition 01-01]:

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm²)	Averaging Time $ E ^2$ , $ H ^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	$(180/f^2)*$	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30



#### <u>6.0</u> **List of Measurement Equipment**

## **Radiated Emission and Bandwidth Emissions**

Description	Manufacturer	Model no.	Serial no.	CAL due
Spectrum Analyzer	Agilent	E4402B	US41192821	27 Mar 2013
Test Receiver	R&S	ESI26	838786/013	27 Mar 2013
DC Power Supply	LW	APR-3003	N/A	15 Jul 2013
Spectrum Analyzer	R&S	FSP30	836079/035	27 Mar 2013
Positioning Controller	C&C	CC-C-1F	N/A	19 Dec 2012
RF Switch	EM	EMSW18	SW060023	19 Dec 2013
Pre-amplifier	Agilent	8447F	3113A06717	27 Mar 2013
Pre-amplifier	Compliance Direction	PAP-1G18	24002	27 Mar 2013
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	24 Feb 2014
Horn Antenna	ETS	3117	00086197	24 Feb 2014
Anechoic chamber	Albatross Projects	MCDC	SW060023	19 Mar 2013

## **Conducted Emissions**

Description	Manufacturer	Model no.	Serial no.	CAL due
Test Receiver	Rohde & Schwarz	ESPI	101611	27 Mar 2013
L.I.S.N	Schwarzbeck	NSLK8126	8126-224	27 Mar 2013
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	27 Mar 2013
AMN	EMCO	3825/2	11967C	27 Mar 2013

N/A Not Applicable or Not Available



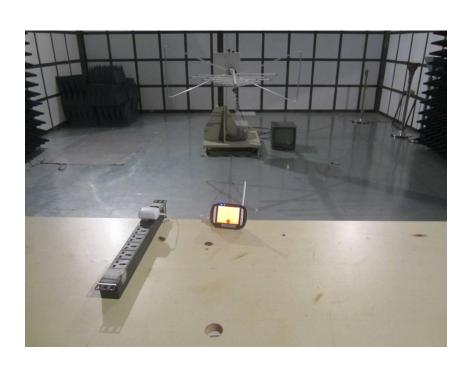
## **Appendix A**

Date: 2013-03-25

Report No.: 60.870.13.008.02F Model No.: MBP43PU

**Photo of Test Setup:** 

## **Radiated Emissions**





## **Appendix A**

Date: 2013-03-25

Report No.: 60.870.13.008.02F Model No.: MBP43PU

**Photo of Test Setup:** 

## **Conducted Emissions**





## **Appendix B**

Date: 2013-03-25

Report No.: 60.870.13.008.02F

Model No.: MBP43PU







## **Appendix B**

Date: 2013-03-25

Report No.: 60.870.13.008.02F

Model No.: MBP43PU







## **Appendix B**

Date: 2013-03-25

Report No.: 60.870.13.008.02F

Model No.: MBP43PU





AC/DC Adaptor



Date: 2013-03-25

Report No.: 60.870.12.008.02F

Model No.: MBP43PU







Date: 2013-03-25

Report No.: 60.870.12.008.02F Model No.: MBP43PU







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