

# **TEST REPORT**

# Date: 2009-12-09 Report No.: 60.870.9.020.01F

Applicant:	Summer Infant Inc. 1275 Park East Drive, Woonsocket, USA, RI, 02895		
Description of Samples:	Model name: Sleek & Secure Handheld Color Monitor 02290 Brand name: Model no.: 0229R FCCID: PZK-0229R		
Date Samples Received:	2009-11-05		
Date Tested:	2009-11-10 to 2009-12-08		
Investigation Requested:	FCC Part 15 S	Subpart C, Section 15.247	
Conclusions:	The submitted product <u>COMPLIED</u> with the requirements of Federal 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:			

Remarks: Checked by:

Approved by:-

Victor Kwan Manager Telecom department

Prudence Poon Project Manager Telecom department

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Internal EUT Photos

# 1.0 General Details

# 1.1 Test Laboratory

EMC Laboratory registered by FCC with FCC Registration Number: 607756

### 1.2 Applicant Details Applicant

#### Summer Infant Inc.

1275 Park East Drive, Woonsocket, USA, RI, 02895

### Manufacturer

### Allied Hill Ent. Ind.

Suite 507, Tower 1 Silvercord, 30 Canton Road, T.S.T Kowloon. HK

# 1.3 Equipment Under Test [EUT]

### **Description of EUT**

Product Description: Model No.: Brand Name: FCCID: Rating:	Sleek & Secure Handheld Color Video Monitor 02290 0229R Nil PZK-0029R - DC 5.0V,1A powered by AC/DC power adaptor. - DC 3.7V by Li-ion rechargeable battery.
Operated Frequency:	2407 -2476 MHz
No. of Channel:	16
Accessories and Auxiliary Equipments:	-AC/DC power adaptor.
Antenna Type:	Integral
Manufacture of Antenna:	Allied Hill Ent. Ind.
Antenna Gain:	3dBi
Antenna Model:	N/A

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

The Equipment Under Test (EUT) is a receiver (parent unit) of baby monitor operated at 2.4GHz, it has a monitor to show the movie sent from the baby unit. This EUT is designed for fix used, as it is powered by AC/DC adaptor only.

FHSS Operation Principle:

This module is controlled by microchip to generate Pseudorandom Frequency Hopping Sequence, this module support 16 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: 2008 and ANSI C63.4: 2003 for FCC Verification

# 2.2 Test Standards and Results Summary Tables

Test Condition	Test Requirement	Test Result		
		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.

\*On a standard emission test site with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 607756.

# 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: Test Date: Mode of Operation: Detector Function: FCC part 15 section 15.247 (a1)(iii) 2009-11-24 Transmitting mode. Max Hold

### **Result: PASS**

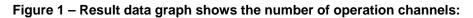
### Measured Result :

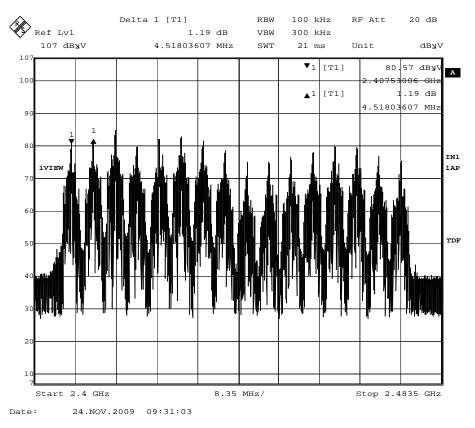
Number of Channels = 16

2407.5MHz,	2412.0MHz,	2416.5MHz,	2421.0MHz,	2405.5MHz,	2430.0MHz
2434.5MHz,	2439.0MHz,	2443.5MHz,	2448.0MHz,	2452.5MHz,	2457.0MHz,
2461.5MHz,	2466.0MHz,	2470.5MHz,	2475.0MHz		

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

At least 16 non-overlapping channels for 2400-2483.5MHz.





### 4.2 20dB Bandwidth Measurement

Test Requirement: Test Date: Mode of Operation: Detector Function: FCC part 15 section 15.247 (a1) 2009-11-24 Transmitting mode. Max Hold

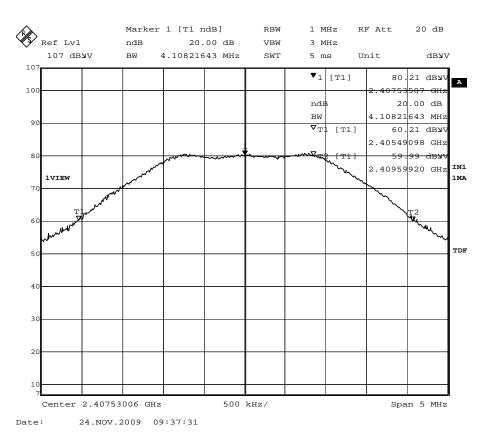
### **Test Setup:**

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: 1	2407.5	4.11
Middle: 9	2443.5	4.17
Highest : 16	2475.0	4.14

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

### Figure 2 – Result data graph shows 20 dB bandwidth, CF = 2.4075GHz, BW = 4.11MHz



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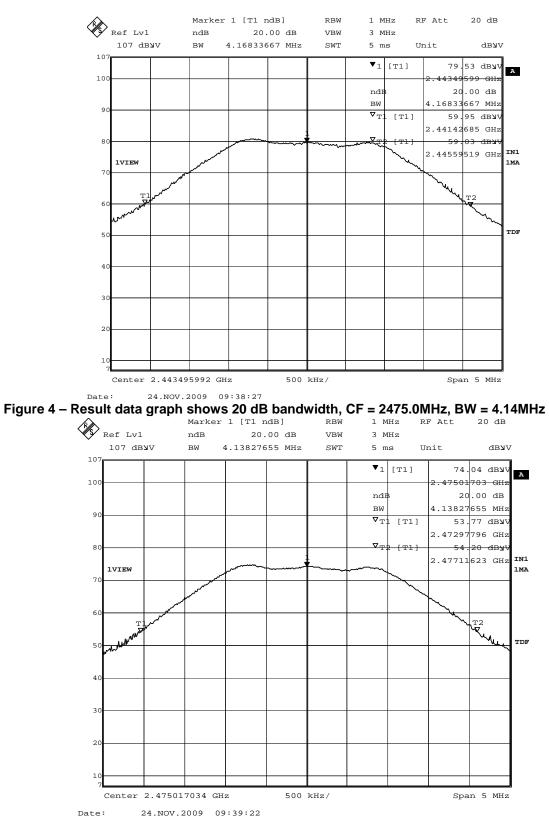


Figure 3 – Result data graph shows 20 dB bandwidth, CF = 2.443.5GHz, BW = 4.17MHz

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#### 4.3 Hopping Channel Carrier Frequency Separation

Test Requirement: Test Date: Mode of Operation: Detector Function: FCC part 15 section 15.247 (a1) 2009-11-24 Transmitting mode. Max Hold

#### **Result: PASS**

#### **Measured Result :**

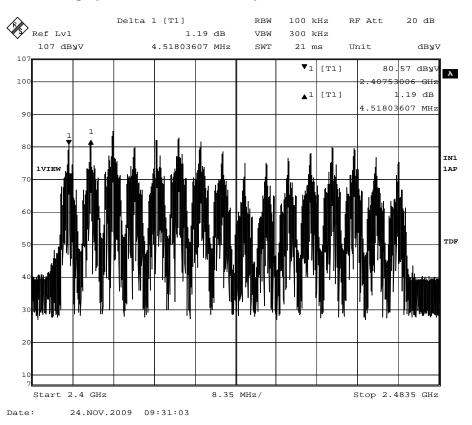
Refer to the delta marker, the frequency separation between two adjacent channels is 4.518MHz, therefore requirement of channel separated by a minimum of the 20dB bandwidth of the hopping channel is applied.

According to the test result shown in section 4.2, the maximum 20dB bandwidth is 4.17MHz, so the hopping channel separation of this EUT is found to comply with the requirement.

### 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.

#### Figure 5 – Result data graph shows the channel separation:



### 4.4 Average Time of Channel Occupancy

Test Requirement: Test Date: Mode of Operation: Detector Function: FCC part 15 section 15.247 (a1)(iii) 2009-11-24 Transmitting mode. Zero span, Sweep time 1s

### **Result : PASS**

### **Measured Result :**

Observing time for total 16 hopping channels is  $16 \times 0.4s = 6.4s$ 

Figure 6 shows total 16 transmission periods is detected within 1s

Figure 7 shows each big pulse contains of 4 mini pulse, and one mini pulse occupies 80us.

Therefore, the average channel occupancy times (ms)

= 6.4s x 16 x 4 x 80us

So, total transmitting time is 32.77ms. (<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.

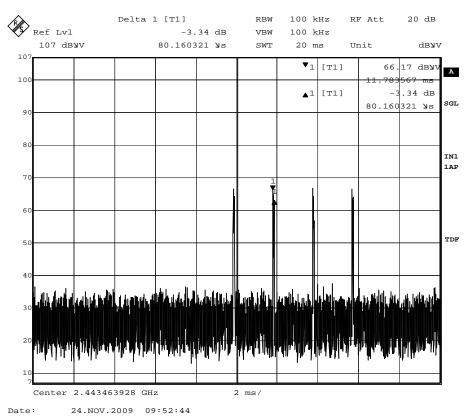
#### Delta 1 [T1] 100 kHz 20 dB RBW RF Att Ŵ Ref Lvl 0.65 dB VBW 100 kHz 107 dbyv 6.012024 ms SWT 1 s dbyv Unit 10' **v**1 [T1] 67.75 dBNV А 605210 ms 100 202 [T1] .65 dB **1** 6.012024 ms 91 80 IN1 1VIEW 1AP 70 61 TDF 51 30 20 Center 2.443463928 GHz 100 ms/

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### 4.5 Pseudorandom Hopping Algorithm

### **Pseudorandom Frequency Hopping**

The embedded FHSS engine uses 16 hopping frequencies. Each channel frequency is selected from a pseudorandom ordered list of hopping frequencies, from 2407MHz to 2475MHz with separating in 4.5MHz apart from each of the channels. A single data frame is transmitted on each frequency location before skipping to the next hopping frequency in the list.

The system will generate a pseudorandom ordered list base on:

- 1/A 16 bit Random ID (16 bit)
- 2/ A Sequence No. (8 bit)
- 3/ A 16 bit polynomial Randomization

Frequency use is equally used on average.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2407.5	9	2443.5
2	2412.0	10	2448.0
3	2416.5	11	2452.5
4	2421.0	12	2457.0
5	2425.5	13	2461.5
6	2430.0	14	2466.0
7	2434.5	15	2470.5
8	2439.1	16	2475.0

#### System Receiver Input Bandwidth

The receiver bandwidth is equal to the receiver bandwidth in the 16 hopping channel mode, which is 4.5MHz. The receiver bandwidth was verified during RF hopping to the relative channel.

#### **Receiver Hopping Capability**

The associated receiver has the ability to shift frequencies in synchronization with the transmitted signals, with they start connect with a same channel and then hop to next channel with a same formula among each other.

#### 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: Test Date: Mode of Operation: Detector Function: FCC part 15 section 15.247 2009-12-08 Transmitting mode. Max Hold

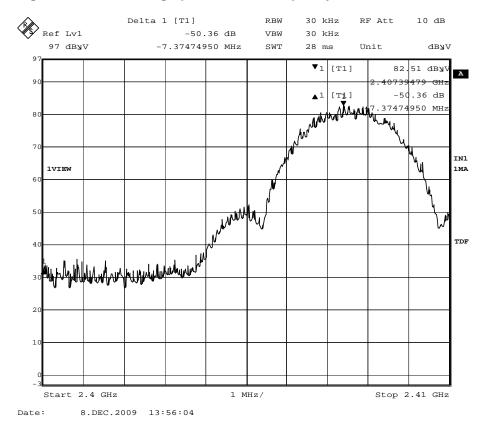
#### **Result: PASS**

#### **Measured Result :**

Refer to the figure 8 and 9, it shows the frequency of lower band edge and upper band edge is 2.407GHz and 2.475GHz separately.

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

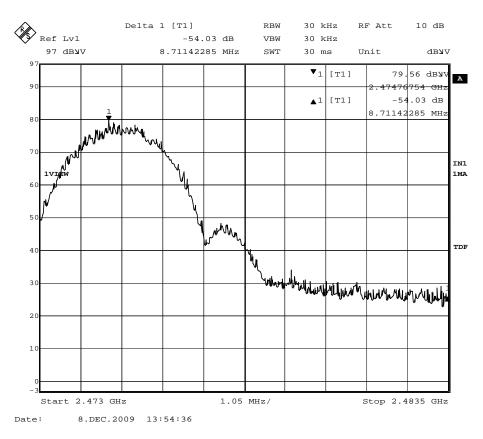
The carrier frequencies should operate within 2400-2483.5MHz.



#### Figure 8 – Result data graph shows the frequency of lowest channel.

- 50.36dB reduction at band edge 2400MHz (location: delta Mk1)

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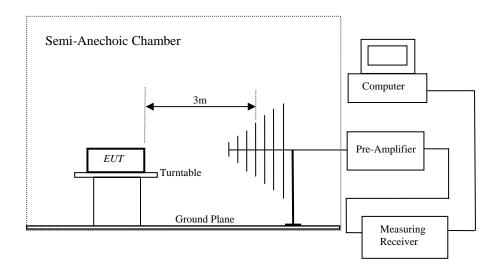


- 54.03dB reduction at band edge 2483.5MHz (location: delta Mk1)

### 4.7 Maximum Output Power

Test Requirement: Test Method: Test Date: Mode of Operation: Detector Function: Measurement BW: FCC part 15 section 15.247 (a1) ANSI C63.4:2003 2009-11-23 Transmitting mode. Peak RBW 5MHz ; VBW 10MHz

# **Test Setup:**



### **Result : PASS**

Frequency	Output	Power	Max. Output Power
(MHz)	(dBuV/m) (V/m)		(mW)
Lowest Channel : 2407	106.5	0.211	6.68
Middle Channel : 2444	109.5	0.298	13.32
Highest Channel : 2476	107.6	0.239	8.57
Limit	119.2	0.913	125.0

Calculate the transmitter's peak power using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

Where:E is the measured maximum fundamental field strength in V/m, utilizing a RBW  $\geq$  the 20 dB bandwidth of the emission, VBW > RBW, peak detector function. Follow the procedures in C63.4-2003 with respect to maximizing the emission.

G is the numeric gain of the transmitting antenna with reference to an isotropic radiator. Than antenna is generally less than 3dBi PCB integrated in the actual use. 3dB logarithmic terms convert to numeric result is nearly 2. So, we apply G = 2.0.

d is the distance in meters from which the field strength was measured.

P is the power in watts for which you are solving:

$$\mathsf{P} = \frac{(\mathsf{E}*\mathsf{d})2}{30\mathsf{G}}$$

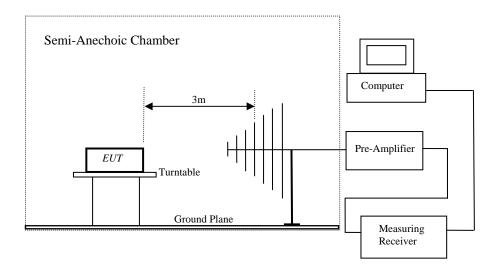
# Limits for Maximum Output Power [ Section 15.247 (a1)(iii) ]:

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

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

Test Requirement: Test Method: Test Date: Mode of Operation: Detector Function: Measurement BW: FCC part 15 section 15.247 (d ) ANSI C63.4:2003 2009-11-23 Transmit mode. Peak 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 Figure 10 to 11 for 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.

# **Result : PASS**

	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	Ch.					
PK	4815.00	V	22.60	33.60	56.20	74.00	17.80
AV		V	2.20	33.60	35.80	54.00	18.20
PK	7222.00	V	25.50	36.80	62.30	86.50	24.20
AV		V	3.90	36.80	40.70	66.50	25.80
	Middle	Ch.					
PK	4889.00	V	19.20	33.90	53.10	74.00	20.90
		V	0.60	33.90	34.50	54.00	19.50
PK	7329.00	V	26.1	37.00	63.10	74.00	10.90
		V	5.3	37.00	42.30	54.00	11.70
	Highest	Ch.					
PK	4953.00	V	24.60	34.10	58.70	74.00	15.30
AV		V	2.40	34.10	36.50	54.00	17.50
PK	7425.00	V	24.60	37.10	61.70	74.00	12.30
AV		V	2.80	37.10	39.90	54.00	14.10

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

# Refer to Figure 10 to 11 shows the worst case channel's emission data graph from 30MHz-26.5GHz.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.

# 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.

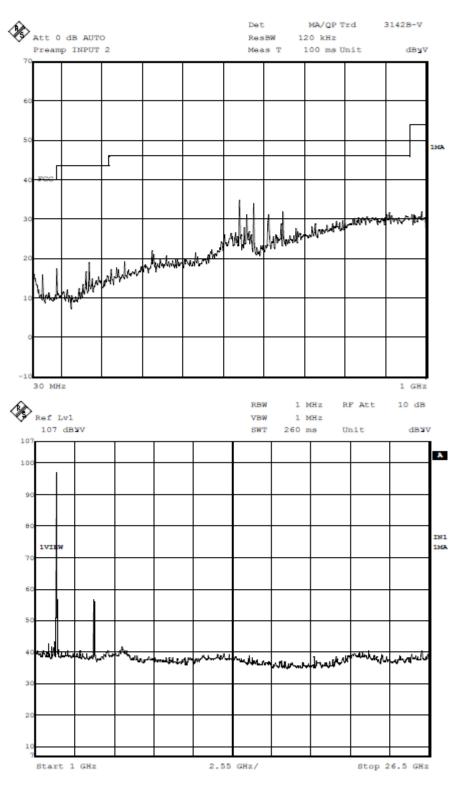


Figure 10 – Radiated emission data graph (Vertical polarization, 30MHz-26.5GHz)

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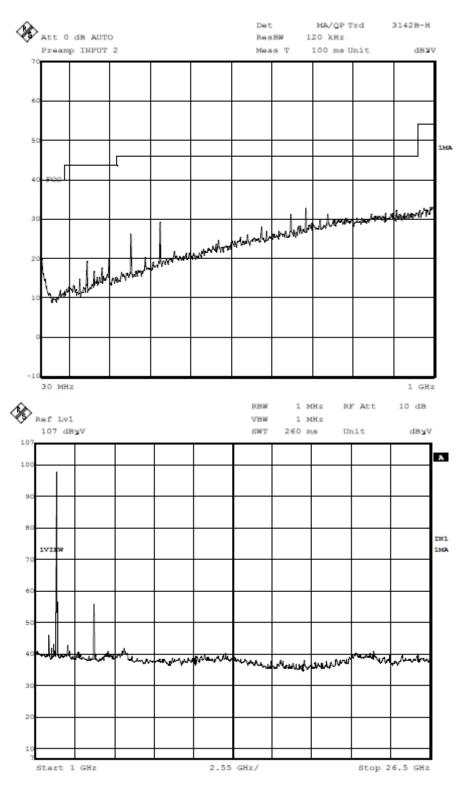


Figure 11 - Radiated emission data graph (Horizontal polarization, 30MHz-26.5GHz)

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

Test Requirement: Test Method: Test Date: Mode of Operation: Detector Function: Measurement BW: Worst Case Channel: FCC part 15 Section 15.207 Class B ANSI C63.4:2003 2009-11-20 -Transmitting mode CISPR Quasi Peak 100 kHz 1

# **Results: PASS**

### - Refer Figure 12 for the result data graph.

### Limits for Conducted Emission [ Section 15.207]:

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

\* Decreases with the logarithm of the frequency.

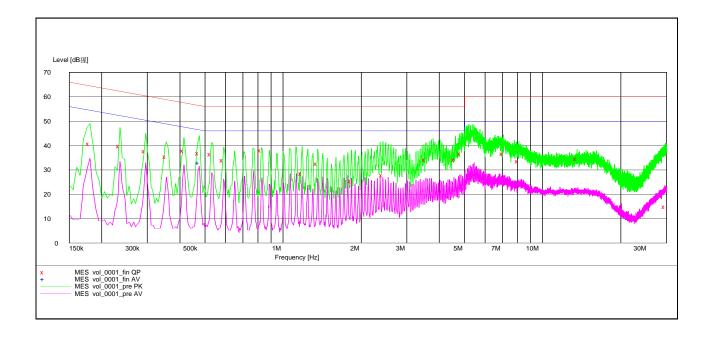
Remarks: Calculated measurement uncertainty: ±2.8dB

### Figure 12 – Result data graph shows the conducted emission.

<b>Test Specification</b>	: FCC Part 15 Class B
Comment :	117Va.c., Live and Neutral
Start of Test:	20/11/2009 / 17:04:43

# SCAN TABLE: "FCC part15 B Voltage"

Short Desc	ription:	Part 15 Class B Voltage			
Start	Stop	Step	Detector	Meas.	IF
Frequency	Frequency	Width		Time	Bandw.
150.0 kHz	30.0 MHz	5.0 kHz	MaxPeak	10.0 ms	9 kHz
			Average		



# MEASUREMENT RESULT: "vol\_0001\_fin QP"

20/11/2009 17:05

Frequency	Level	Transd	Lim	it Margin	Line PE
MHz	dBµV	dB	dBµ∖	/ dB	
0.180000	40.70	10.0	65	23.8 N	GND
0.235000	39.80	10.0	62	22.5 N	GND
0.295000	37.60	10.0	60	22.7 L1	GND
0.355000	35.30	10.0	59	23.6 L1	GND
0.415000	37.90	10.0	58	19.7 L1	GND
0.475000	36.80	10.0	56	19.6 N	GND
0.530000	36.50	10.0	56	19.5 L1	GND
0.590000	33.90	10.0	56	22.1 N	GND
0.825000	38.00	10.0	56	18.0 L1	GND
1.185000	28.40	10.0	56	27.6 N	GND
1.360000	32.50	10.0	56	23.5 N	GND
1.835000	25.30	10.0	56	30.7 N	GND
2.430000	27.80	10.0	56	28.2 N	GND
3.545000	34.20	10.0	56	21.8 N	GND
4.610000	34.10	10.0	56	21.9 N	GND
4.860000	36.60	10.0	56	19.4 N	GND
7.055000	36.60	10.0	60	23.4 L1	GND
8.105000	33.50	10.0	60	26.5 L1	GND
13.585000	34.60	10.0	60	25.4 N	GND
29.730000	14.80	10.0	60	45.2 N	GND

### MEASUREMENT RESULT: "vol\_0001\_fin AV"

20/11/2009	17:05					
Frequency	Level	Transd	Limit	Margin	Line	PE
MHz	dBµV	dB	$dB\mu V$	dB		
0.475000	32.90	10.0	46 1	3.5 N	GND	

# 5.0 RF Exposure Compliance Requirement

Test Requirement: Test Method:

FCC part 15 section 15.247 (i) 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 that the public is not exposed to radio frequency energy levels in excess of the Commission's guideline,

The EUT is considered as a portable device according to OET Bulletin 65, Edition 01-01, therefore SAR evaluation is under taken.

Frequency Band:	2.402GHz ~2.479GHz
Device Category:	<ul> <li>Portable (&lt; 20cm separation )</li> <li>Mobile ( &gt;20cm separation )</li> <li>Others :</li> </ul>
Exposure Classification:	Occupational/ Controlled exposure     General Population / Uncontrolled exposure
Max. Output Power	13.32
Antenna Gain	3dBi ( Numeric gain:2)
Evaluation Applied:	<ul> <li>☐ MPE Evaluation</li> <li>☑ SAR Evaluation</li> </ul>

Limit:

SAR requirement (general population): 60/fGHmW for d<2.5cm = 60/2.4mW= 25mW.

Conclusion:

-No SAR evaluation required since the transmitter power is below FCC threshold.

# 6.0 List of Measurement Equipment

Radiated Emission							
EQP NO.	DESCRIPTION	MANUFACTUR ER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL	
EM020	HORN ANTENNA	EMCO	3115	4032	2009/09/02	2012/09/02	
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A	
EM216	MINI MAST SYSTEM	ЕМСО	2075	00026842	N/A	N/A	
EM217	ELECTRIC POWERED TURNTABLE	EMCO	2088	00029144	N/A	N/A	
EM218	ANECHOIC CHAMBER	ETS-Linggren	FACT-3		2008/12/01	2011/12/01	
EM174	BICONILOG ANTENNA	ЕМСО	3142B	1671	2008/01/24	2010/01/24	
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2009/09/27	2010/09/27	
EM022	LOOP ANTENNA	EMCO	6502	1189-2424	2009/07/26	2011/07/26	

### Line Conducted

-	Line Conducted							
EQP NO.	DESCRIPTION	MANUFACTUR ER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL		
EM197	LISN	EMCO	4825/2	1193	2009/05/15	2010/05/15		
EM181	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB7	100072	2009/06/29	2010/06/29		
EM154	SHIELDING ROOM	SIEMENS MATSUSHITA COMPONENTS	N/A	803-740- 057-99A	2009/01/23	2010/01/23		

CM Corrective Maintenance

N/A Not Applicable or Not Available