



TEST REPORT

Date: 2013-10-31

Report No.: 60.870.13.032.01F

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

Description of Samples: Model name: Baby Monitor (Baby Unit)
Brand name: MOTOROLA
Model no.: MBP27TBU
FCCID: VLJ-MBP27TBU

Date Samples Received: 2013-09-25

Date Tested: 2013-09-25 to 2013-10-28

Investigation Requested: FCC Part 15 Subpart C, Section 15.247

Conclusions: The submitted product COMPLIED 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: ----

Checked by:

Approved by:-

Ray Cheung
Project Engineer
Wireless & Telecom Department

Jeff Pong
Operation Manager
Wireless & Telecom Department



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Photos of Test Setup

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External EUT Photos

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Internal EUT Photos



1.0 General Details

1.1 Test Laboratory

Global United Technology Services Co. Ltd.
2nd Floor, Block No.2, Laodong Industrial Zone, Xixiang
Road Baoan District
Registration Number: 600491

Tested by:

A handwritten signature in blue ink, appearing to read 'John Zhi', written over a horizontal line.

John Zhi

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, 6th Floor, Yen Sheng Centre, 64 Hoi Yuen
Road, Kwun Tong, Hong Kong



1.3 Equipment Under Test [EUT]

Description of EUT

Product Description:	Baby Monitor (Baby Unit)
Model No.:	MBP27TBU
Brand Name:	MOTOROLA
FCCID:	VLJ-MBP27TBU
Rating:	- DC6.0V, 500mA powered by AC/DC power adaptor
Operated Frequency:	2410.875 -2471.625 MHz
No. of Operated Channel:	19
Accessories and Auxiliary Equipments:	Nil
Antenna Type:	Integral
Manufacture of Antenna:	Alford.
Antenna Gain:	0dBi
Antenna Model:	N/A

General Operation of EUT

The Equipment Under Test (EUT) is a Camera of Wireless Monitoring System.

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 Result	
		Pass	N/A
Number of Frequency Hopping	Section 15.247 (a1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
20dB Bandwidth Measurement	Section 15.247 (a1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Hopping Channel Carrier Frequency Separation	Section 15.247 (a1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Average Time of Occupancy	Section 15.247 (a1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pseudorandom Hopping Algorithm	Section 15.247 (a1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Band Edge Measurement	Section 15.247	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Maximum Output Power	Section 15.247 (b1)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Out of Band Emission	Section 15.247 (d)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Radiated Emission in Restricted Band	Section 15.247 (d)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Conducted Emission on AC Mains	Section 15.207	<input checked="" type="checkbox"/>	<input type="checkbox"/>
RF Exposure	Section 15.247 (i)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Antenna Requirement	Section 15.203	<input checked="" type="checkbox"/> See note 1	<input type="checkbox"/>

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:

$$\text{FS} = \text{R} + \text{System Factor}$$
$$\text{System Factor} = \text{AF} + \text{CF} + \text{FA} - \text{PA}$$

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:	2013-09-30
Mode of Operation:	Transmitting mode.
Detector Function:	Max Hold

Result: PASS

Measured Result :

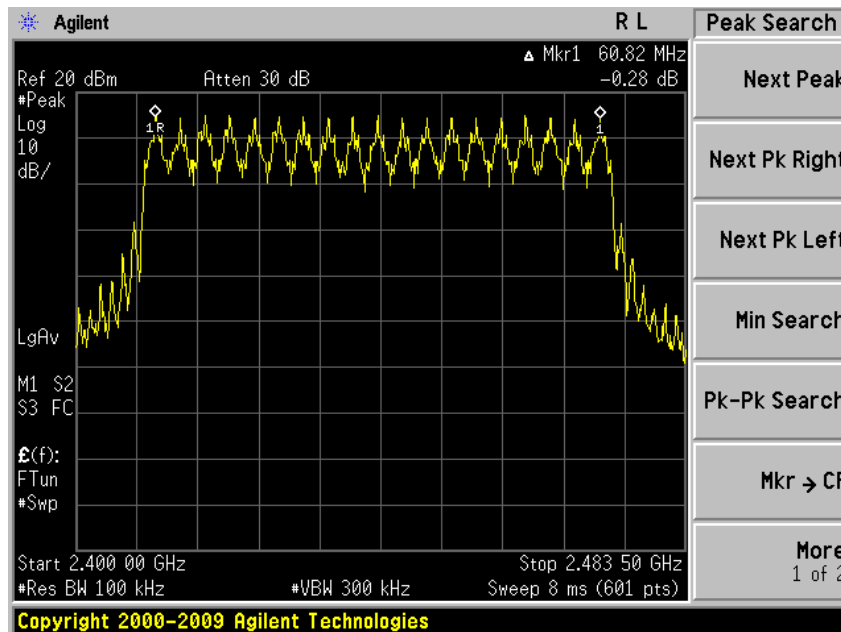
Operating Channel Frequency in sequence (MHz):

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 of each sequence 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: 2013-09-30
 Mode of Operation: Transmitting mode.
 Detector Function: Max Hold

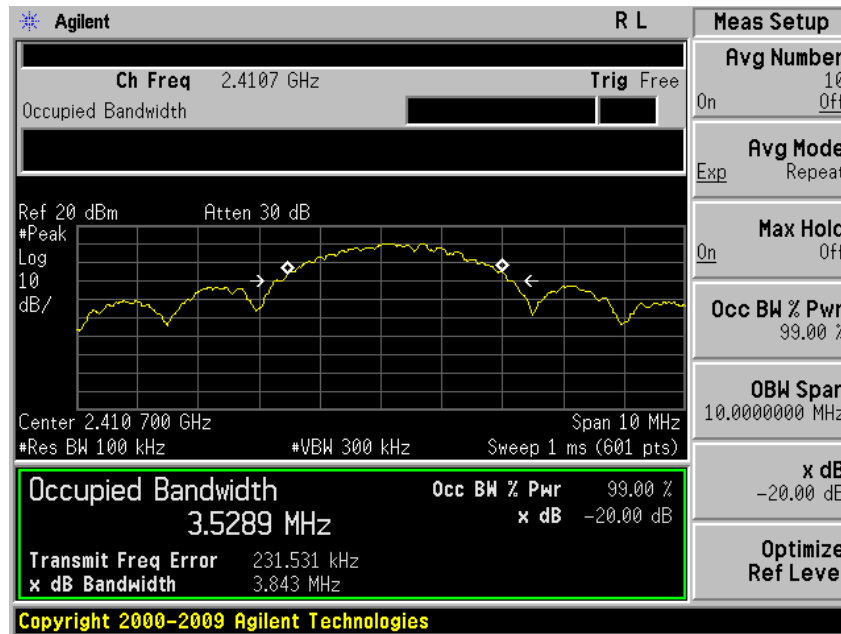
Test Setup:

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	2.410.875	3.843
Middle	2.444.625	3.777
Highest	2.471.625	3.904

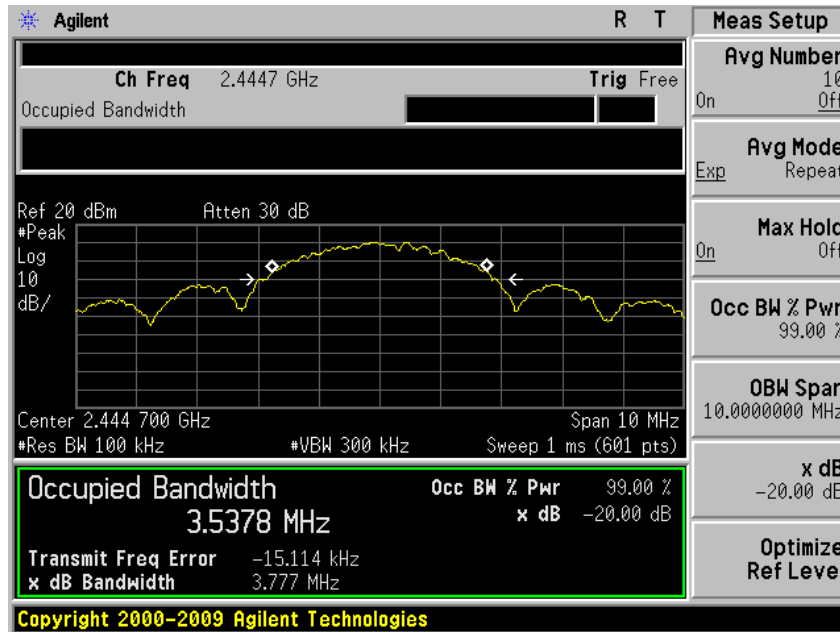
This result is used for checking the hopping channel carrier frequencies separation.

Result data graph shows 20 dB bandwidth, CF = 2410.875MHz, BW = 3.843MHz

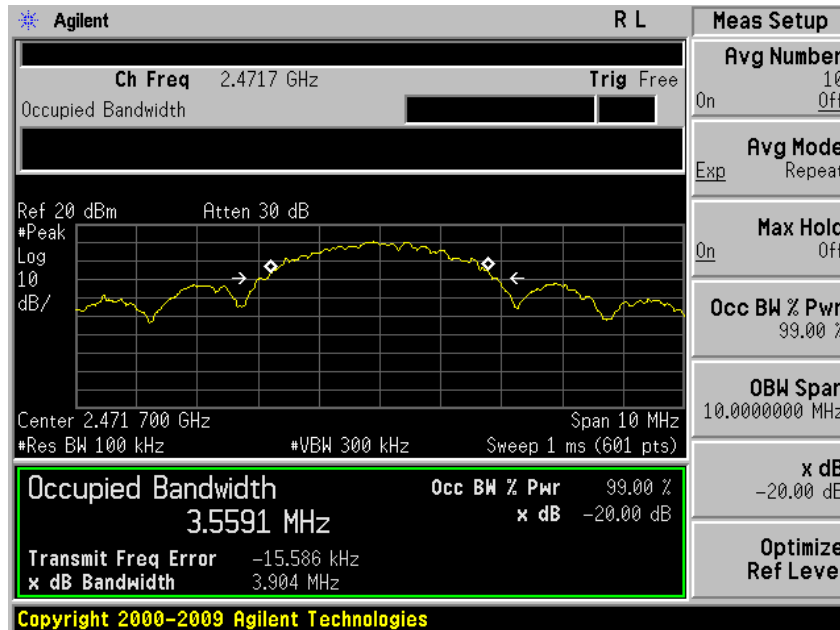




Result data graph shows 20 dB bandwidth, CF = 2444.625MHz, BW = 3.777MHz



Result data graph shows 20 dB bandwidth, CF = 2471.625MHz, BW = 3.904MHz





4.3 Hopping Channel Carrier Frequency Separation

Test Requirement:	FCC part 15 section 15.247 (a1)
Test Date:	2013-09-30
Mode of Operation:	Transmitting mode.
Detector Function:	Max Hold

Result: PASS

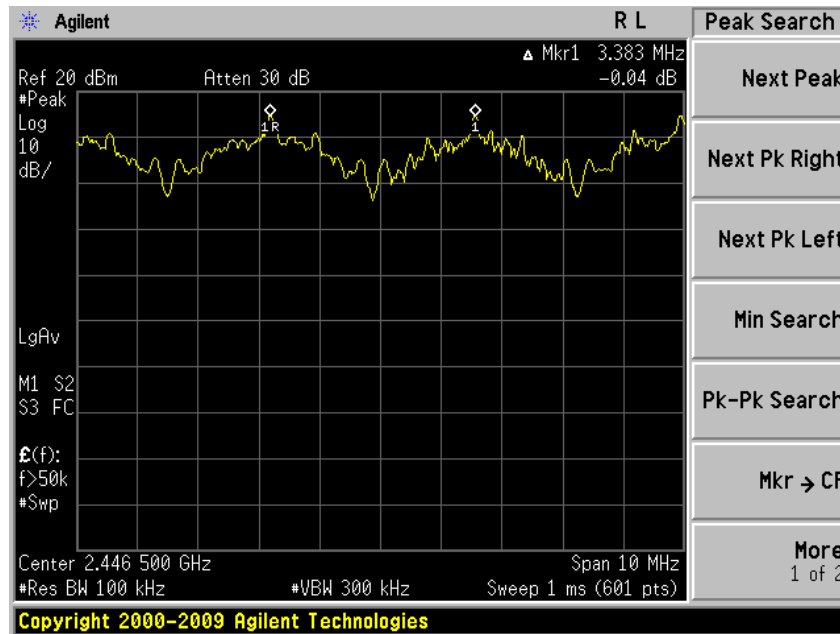
Measured Result :

Refer to the delta marker, the frequency separation between two adjacent channels is 3.38 MHz, 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:	2013-09-30
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 15 pulses within 1s

And one set of pulses = 2.51ms

Therefore, the average channel occupancy times (ms)

= 2.51ms \times 15 \times 7.6

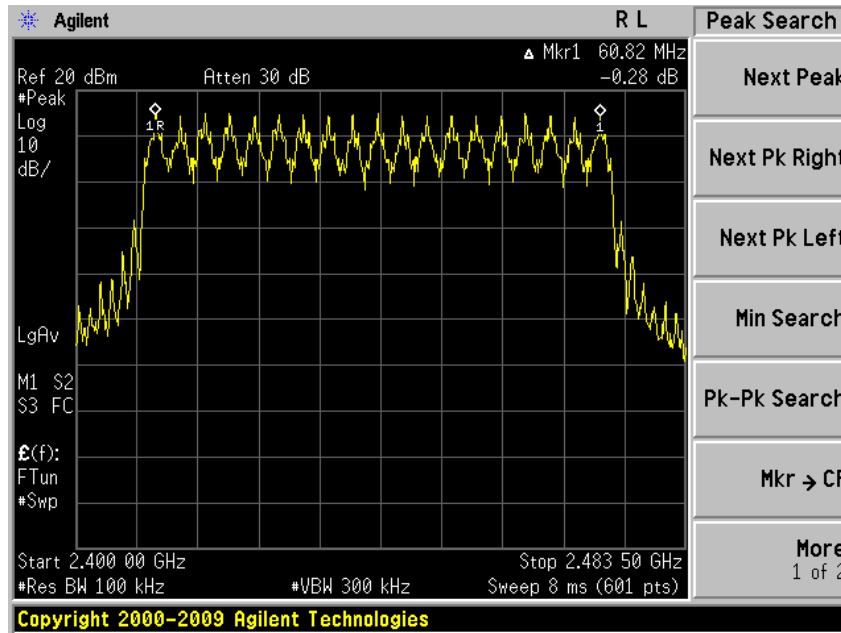
So, total transmitting time is 0.286s. (<0.4s).

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

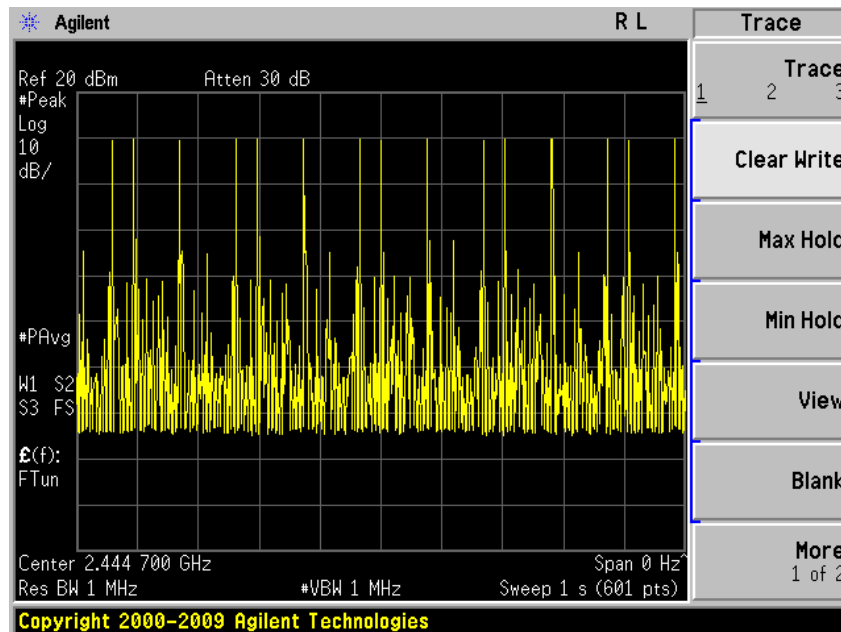
The average time of occupancy on any channel shall not be greater than 0.4 second within a period of 0.4 seconds multiplied by the number of hopping channels employed.



Result data graph shows total 19 channels are used.

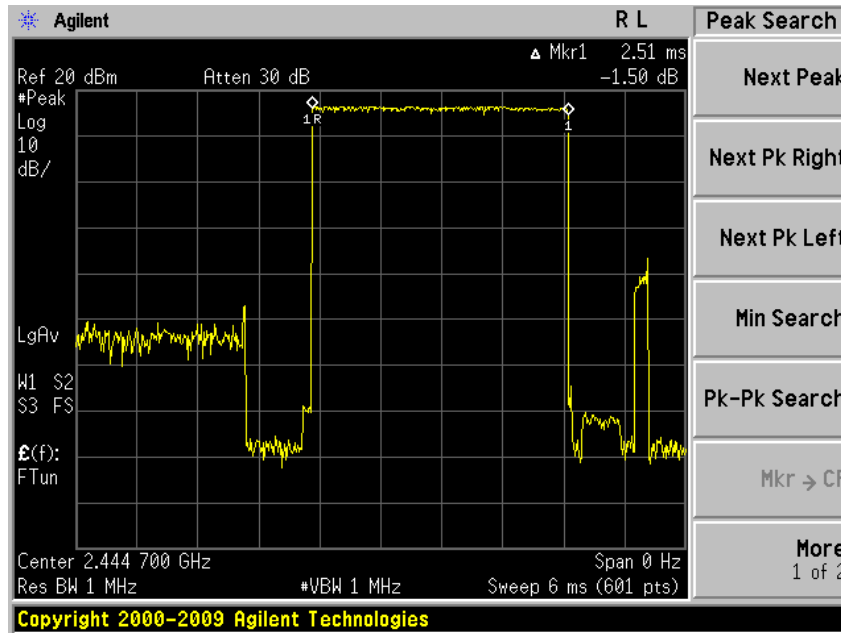


Result data graph shows total 15 pulses with 1s.





Result data graph zooms into detail, one pulse period is 2.51ms.





4.5 Pseudorandom Hopping Algorithm

Pseudorandom Frequency Hopping

MBP27TBU uses FHSS technology with 19 hopping frequencies. Each channel frequency is selected from a pseudorandom ordered list of hopping frequencies, from 2410.875 MHz 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: 2013-09-30
 Mode of Operation: Transmitting mode.
 Detector Function: Max Hold

Result: PASS

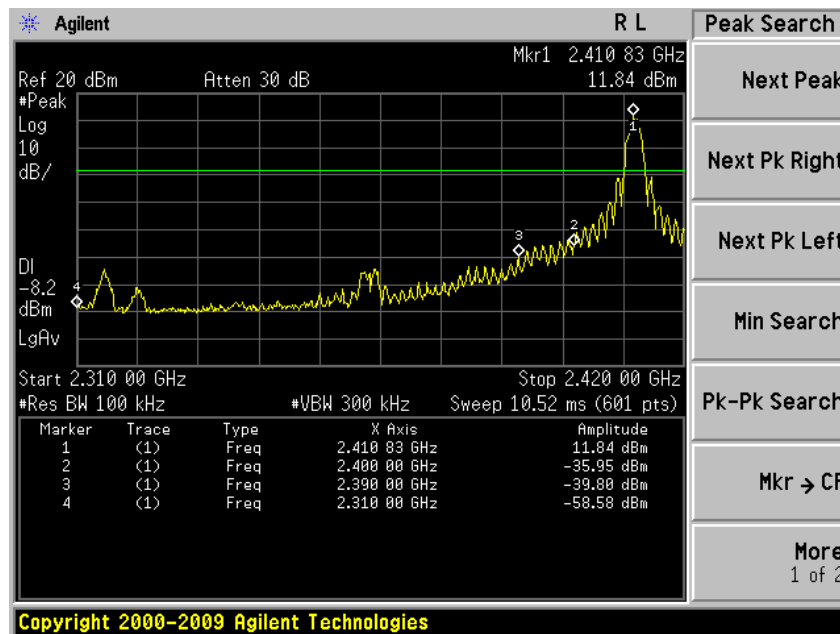
Measured Result :

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]:

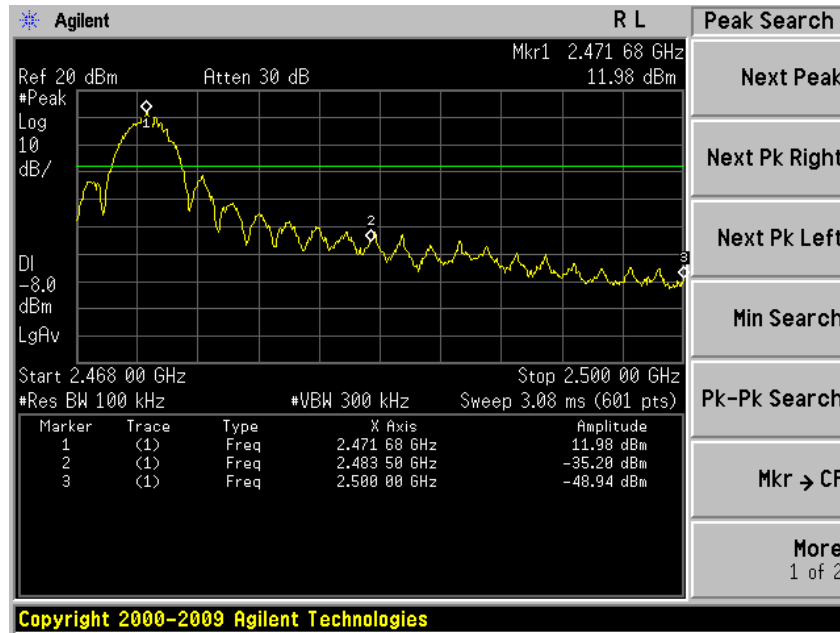
The carrier frequencies should operate within 2400-2483.5MHz.

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:	2013-09-30
Mode of Operation:	Transmitting mode.
Detector Function:	Peak
Measurement BW:	RBW 1MHz ; VBW 1MHz

Test Setup:



Result : PASS

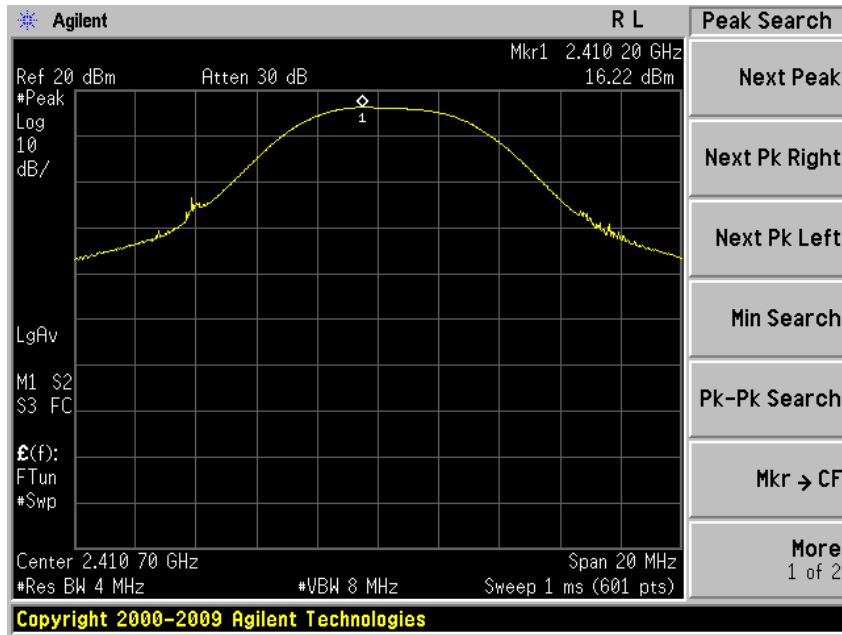
Frequency (MHz)	Peak Output Power		Limit	
	(dBm)	(W)	(dBm)	(W)
Lowest Channel : 2410.875	16.22	0.042	21	0.125
Middle Channel : 2444.625	15.93	0.039	21	0.125
Highest Channel : 2471.625	15.96	0.039	21	0.125

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

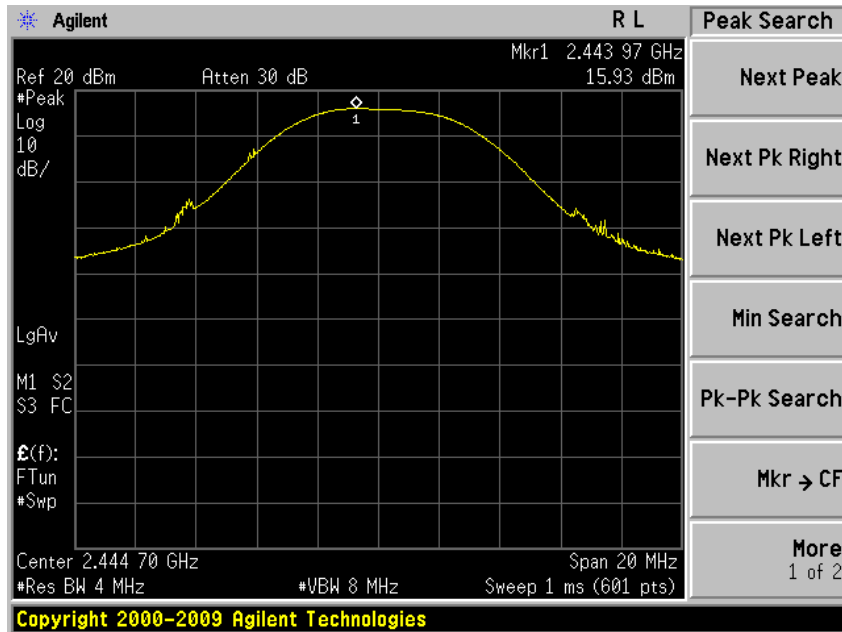
For frequency hopping systems employing at least 75 hopping channels: 1 Watt
 For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts



Result data graph shows the frequency of lowest channel

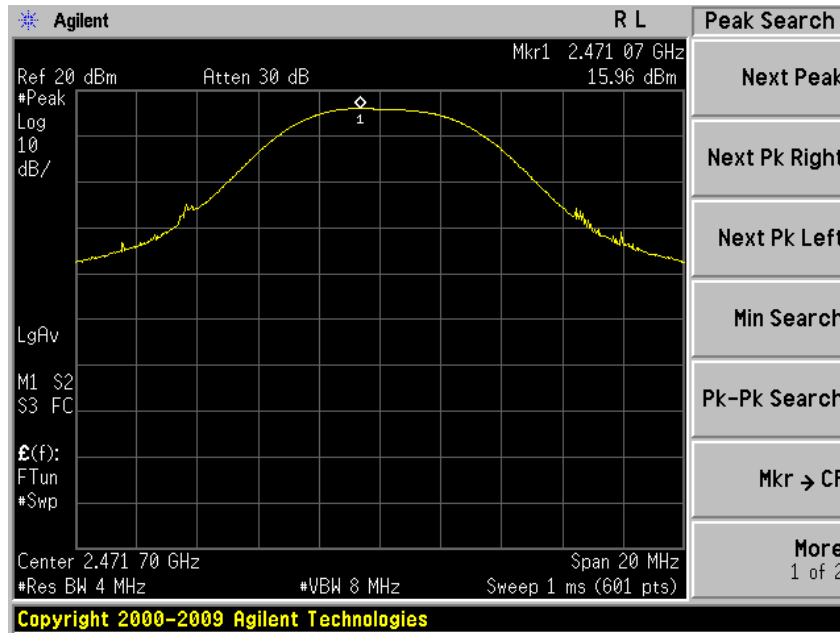


Result data graph shows the frequency of middle channel





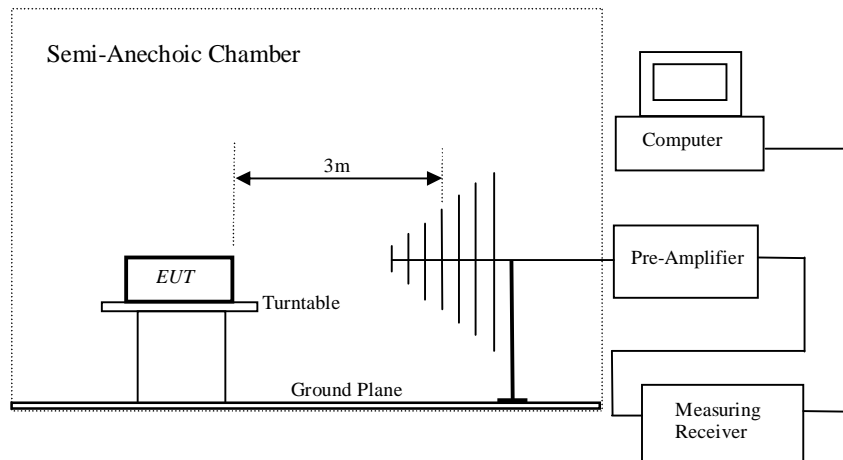
Result data graph shows the frequency of highest channel



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:	2013-10-26
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 [$\mu\text{V/m}$]	Field Strength [dB $\mu\text{V/m}$]
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 Channel							
PK	4820.36	H	59.25	8.30	67.55	74.00	-6.45
AV	4820.35	H	42.28	8.30	50.58	54.00	-3.42
PK	4825.00	V	57.14	8.31	65.45	74.00	-8.55
AV	4825.00	V	42.29	8.31	50.60	54.00	-3.40
Middle Channel							
PK	4888.00	H	59.22	8.40	67.62	74.00	-6.38
AV	4888.00	H	42.55	8.40	50.95	54.00	-3.05
PK	4888.00	V	59.82	8.40	68.22	74.00	-5.78
AV	4888.00	V	42.18	8.40	50.58	54.00	-3.42
Highest Channel							
PK	4942.00	H	58.98	8.46	67.44	74.00	-6.56
AV	4942.00	H	41.71	8.46	50.17	54.00	-3.83
PK	7417.00	H	42.31	16.52	58.83	74.00	-15.17
AV	7417.00	H	32.12	16.52	48.64	54.00	-5.36
PK	4951.00	V	59.30	8.46	67.76	74.00	-6.24
AV	4951.00	V	42.23	8.46	50.69	54.00	-3.31
Spurious Emissions							
QP	36.00	V	51.82	-16.86	34.96	40.00	-5.04
QP	107.89	V	51.25	-16.20	35.05	43.50	-8.45
QP	155.91	V	59.28	-19.89	39.39	43.50	-4.11
QP	180.02	V	55.69	-18.66	37.03	43.50	-6.47
QP	191.75	V	57.43	-17.76	39.67	43.50	-3.83
QP	336.04	V	52.84	-13.53	39.31	46.00	-6.69
QP	167.82	H	58.78	-19.47	39.31	43.50	-4.19
QP	191.75	H	58.02	-17.76	40.26	43.50	-3.24
QP	252.06	H	57.54	-15.95	41.59	46.00	-4.41
QP	287.99	H	56.90	-15.03	41.87	46.00	-4.13
QP	312.18	H	56.24	-14.50	41.74	46.00	-4.26
QP	336.04	H	55.61	-13.53	42.08	46.00	-3.92

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



Result Summary:

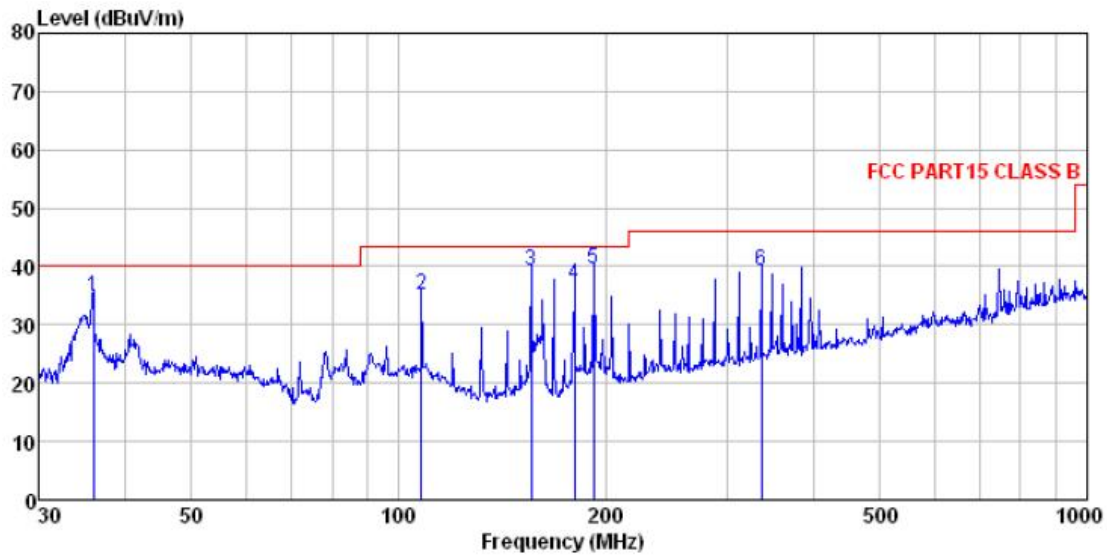
- 1) Communication mode: All other emissions are more than 20dB below FCC part 15.209 limit.
- 2) No further spurious emissions found between 30 MHz and lowest internal used/generated frequency and from 30MHz to 1GHz.

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 μ V/m) – Limit (dB μ V/m).
4. Calculated measurement uncertainty: 9kHz -30MHz: 1.8dB.
30MHz -1GHz: 5.2dB.
1GHz -18GHz: 5.1dB.

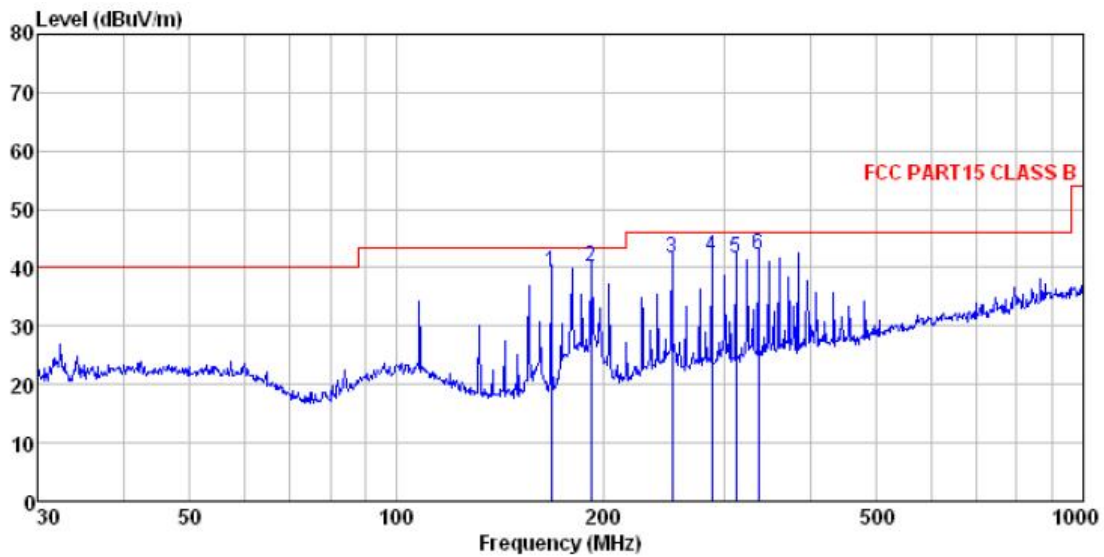


Radiated emission data graph (Vertical polarization, 30MHz-1GHz)



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

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

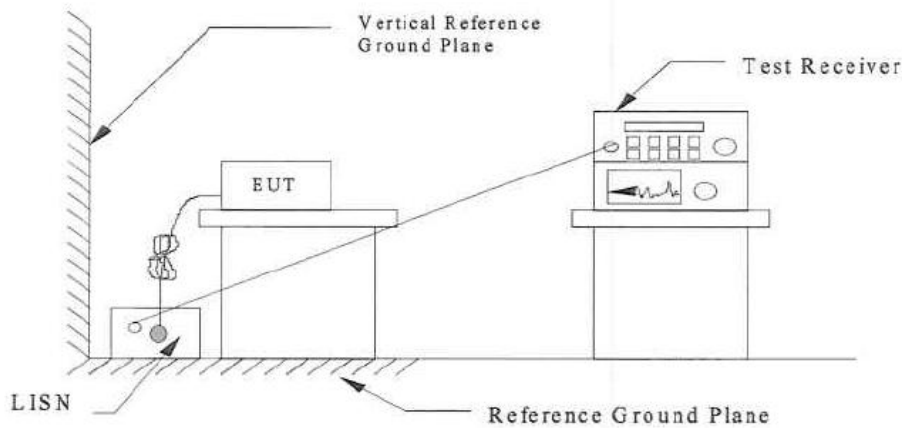


Remark: Only background noise was measured from 1GHz-26GHz excluding the operation frequency relational.

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:	2013-10-10
Mode of Operation:	-Transmitting mode
Detector Function:	CISPR Quasi Peak
Measurement BW:	100 kHz
Worst Case Channel:	1

Test Setup:



Results: PASS

- Refer Figures and tables for the result.

Limits for Conducted Emission [Section 15.207]:

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

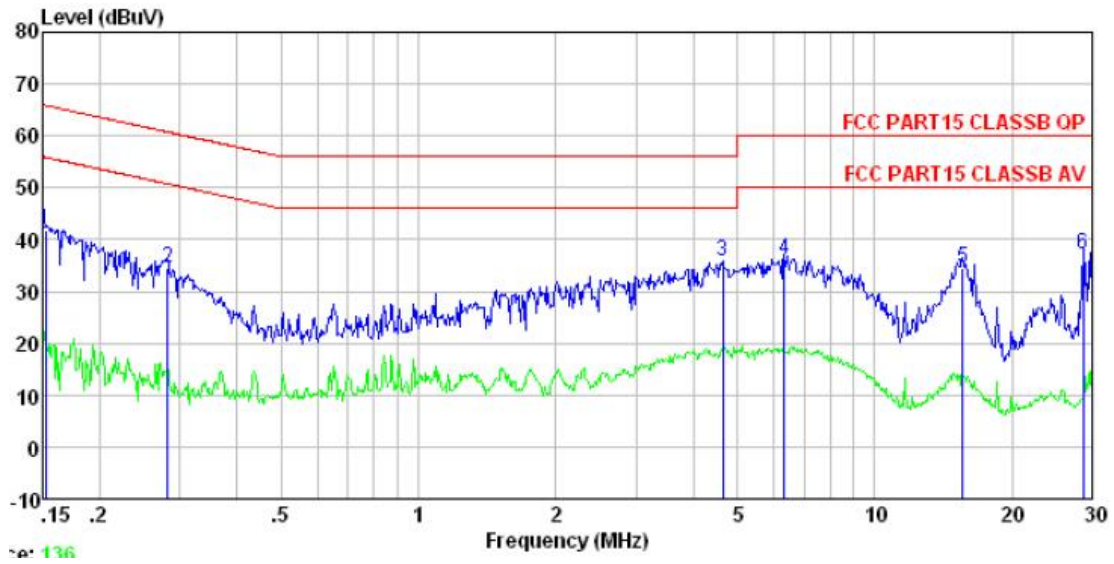
* Decreases with the logarithm of the frequency.

Remarks:

Calculated measurement uncertainty: ± 2.8 dB



Result data graph shows the conducted emission (Live).

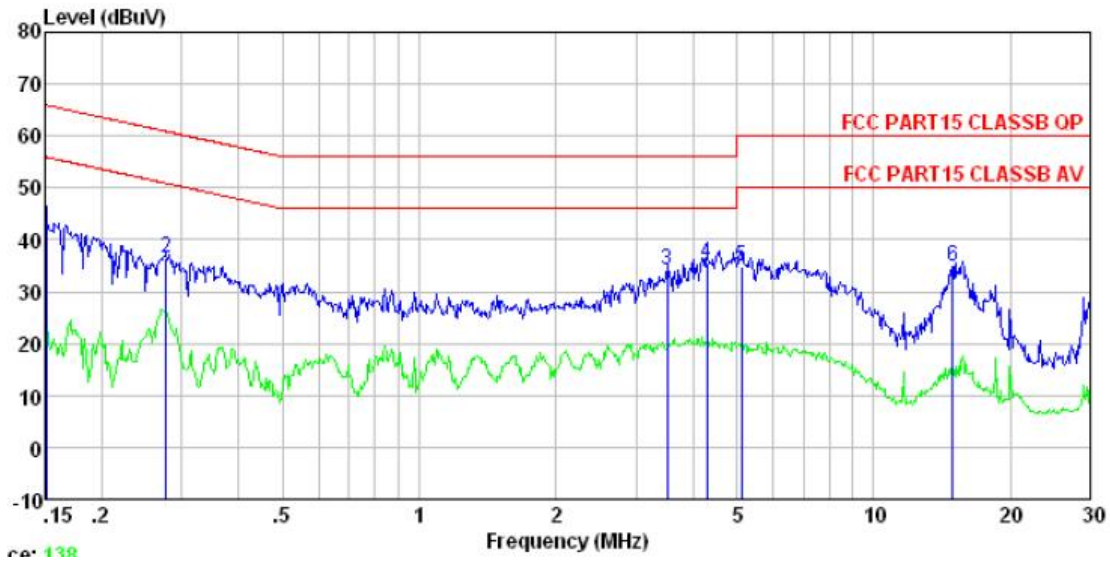


Refer to the following table for the result details:

Conducted Emission					
Frequency (MHz)	Detector (QP/AV)	Phase	Result (dBμV)	Limit (dBμV)	Margin
0.152	QP	L	41.67	65.87	-24.20
0.282	QP	L	34.35	60.76	-26.41
4.647	QP	L	35.70	56.00	-20.30
6.352	QP	L	36.24	60.00	-23.76
15.635	QP	L	34.43	60.00	-25.57
28.603	QP	L	37.06	60.00	-22.94



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
0.152	QP	N	39.00	65.91	-26.91
0.277	QP	N	36.42	60.90	-24.48
3.509	QP	N	34.12	56.00	-21.88
4.292	QP	N	35.33	56.00	-20.67
5.112	QP	N	34.93	60.00	-25.07
14.907	QP	N	34.69	60.00	-25.31

5.0 List of Measurement Equipment

Radiated Emission and Bandwidth Emissions

Description	Manufacturer	Model no.	Serial no.	CAL due
3m Semi-Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	29 May 2014
EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	03 Jul 2014
BiConiLog Antenna	SCHWARZBECK MESS- ELEKTRONIK	VULB9163	GTS214	04 Feb 2014
Double-ridged waveguide horn	SCHWARZBECK MESS- ELEKTRONIK	3160	GTS217	29 Mar 2014
Horn Antenna	ETS-LINDGREN	3160	GTS217	29 Mar 2014
Amplifier (100kHz – 3GHz)	HP	8347A	GTS204	03 Jul 2014
Amplifier (2GHz – 20GHz)	HP	8349B	GTS206	03 Jul 2014
Band filter	Amindeon	82346	GTS219	30 Mar 2014
Constant temperature and humidity box	Oregon Scientific	BA-888	GTS248	09 May 2014
DC Power Supply	Instek	PS-3030	GTS232	09 May 2014
Spectrum Analyzer	R&S	FS300	101335	02 Aug 2014

Conducted Emissions

Description	Manufacturer	Model no.	Serial no.	CAL due
SHIELDING ROOM	ZhongYu Electron	7.0(L)X3.0(W) X 3.0(H)	GTS252	07 Sep 2013
EMI Test Receiver	Rohde & Schwarz	ESCS30	GTS223	02 Jul 2014
10dB Pulse Limiter	Rohde & Schwarz	N/A	GTS224	02 Jul 2014
Coaxial Switch	ANRITSU CORP	MP59B	GTS225	02 Jul 2014
LISN	SCHWARZBECK MESS- ELEKTRONIK	NSLK 8127	GTS226	02 Jul 2014
Coaxial Cable	GTS	N/A	GTS227	02 Jul 2014
Thermo meter	KTJ	TA328	GTS233	05 Jul 2014

N/A Not Applicable or Not Available