TEST REPORT

Date: 2015-01-29
Report No.: 60.870.14.027.01F

Applicant:	Binatone Electronics International Ltd. Floor 23A, 9 Des Voeux Road West, Sheung Wan, Hong Kong
Description of Samples:	Model name: Digital Video Baby Monitor (Baby Unit) Brand name: motorola Model no.: MBP41SBU, MBP43SBU FCCID: VLJ-MBP41SBU
Date Samples Received:	2014-12-29
Date Tested:	2014-12-30 to 2015-01-27
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:

Ray Cheung
Project Engineer
Wireless & Telecom Department

Approved by:

Jeff Pong
Manager
Wireless & Telecom Department

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5.0 List of Measurement Equipments

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Photos of Test Setup

Appendix B

External EUT Photos

Appendix C

Internal EUT Photos

1.0 General Details

1.1 Test Laboratory

TUV SUD Certification and Testing (China) Co., Ltd.
Building 12 & 13, Zhiheng Wisdomland Business Park,
Nantou Checkpoint Road 2, Shenzhen, 518052, China.
Registration Number: 502708

Tested by:

John Zhi

1.2 Applicant Details

Applicant

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

Manufacturer

VTech(Dongguan) Telecommunications Limted
VTech Science Park, Xia Ling Bei Management Zone, Liaobu, Dongguan, Guandong, China

1.3 Equipment Under Test [EUT]

Description of EUT

Product Description:	Digital Video Baby Monitor (Baby Unit)
Model No.:	MBP41SBU
Multi-listing Model(s)	MBP43SBU
Brand Name:	motorola
FCCID:	VLJ-MBP41SBU
Rating:	DC5.0V, 1000mA powered by AC/DC power adaptor
Operated Frequency:	2402 – 2479 MHz
No. of Operated Channel:	23
Accessories and Auxiliary Equipments:	AC/DC Switching Adaptor
Antenna Type:	Integral
Manufacture of Antenna:	CVISION HK LTD
Antenna Gain:	0 dBi
Antenna Model:	N/A

General Operation of EUT

The Equipment Under Test (EUT) is a Camera of Wireless Monitoring System, which include of a FHSS Module.

As per Client Declaration, MBP41SBU & all multi-list models (multi-list model listed on above) have the same technical construction including Software design, RF module, PCB layout, Circuit design, all electrical construction and basic mechanical construction. Only the system grouping is different between the models, so we use MBP41SBU as a representative model to perform all testing.

FHSS Operation Principle:

This module is controlled by microchip to generate Pseudorandom Frequency Hopping Sequence, this module support 23 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 15:2012 and ANSI C63.4: 2009

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	☒	☐
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: 2009, 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:	2015-01-19
Mode of Operation:	Transmitting mode.
Detector Function:	Max Hold

Result: PASS

Measured Result :

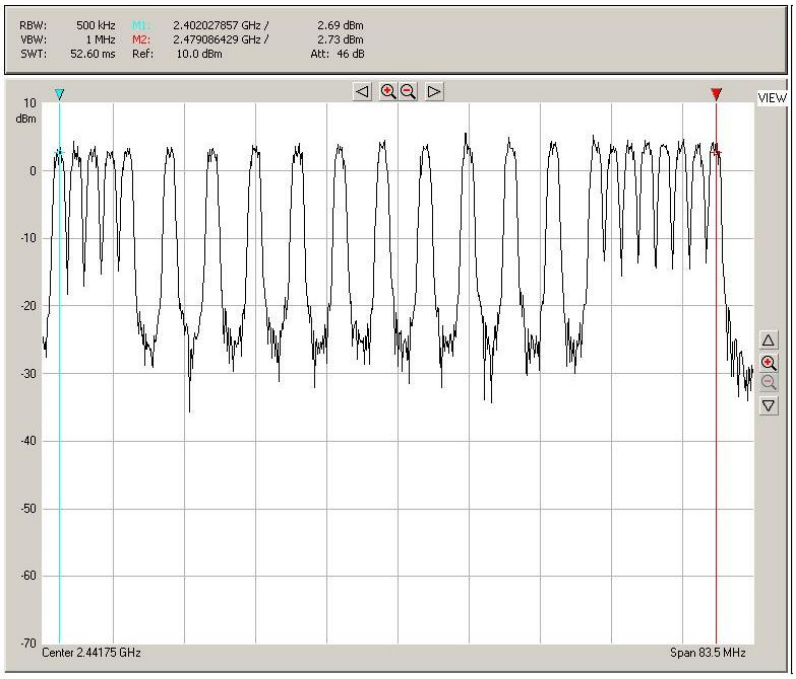
Operating Channel Frequency in sequence (MHz):

Channels list		
CH1=2402MHz	CH2=2404MHz	CH3=2406MHz
CH4=2408MHz	CH5=2410MHz	CH6=2415MHz
CH7=2420MHz	CH8=2425MHz	CH9=2430MHz
CH10=2435MHz	CH11=2440MHz	CH12=2445MHz
CH13=2450MHz	CH14=2455MHz	CH15=2460MHz
CH16=2465MHz	CH17=2467MHz	CH18=2469MHz
CH19=2471MHz	CH20=2473MHz	CH21=2475MHz
CH22=2477MHz	CH23=2479MHz	

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:	2015-01-19
Mode of Operation:	Transmitting mode.
Detector Function:	Max Hold

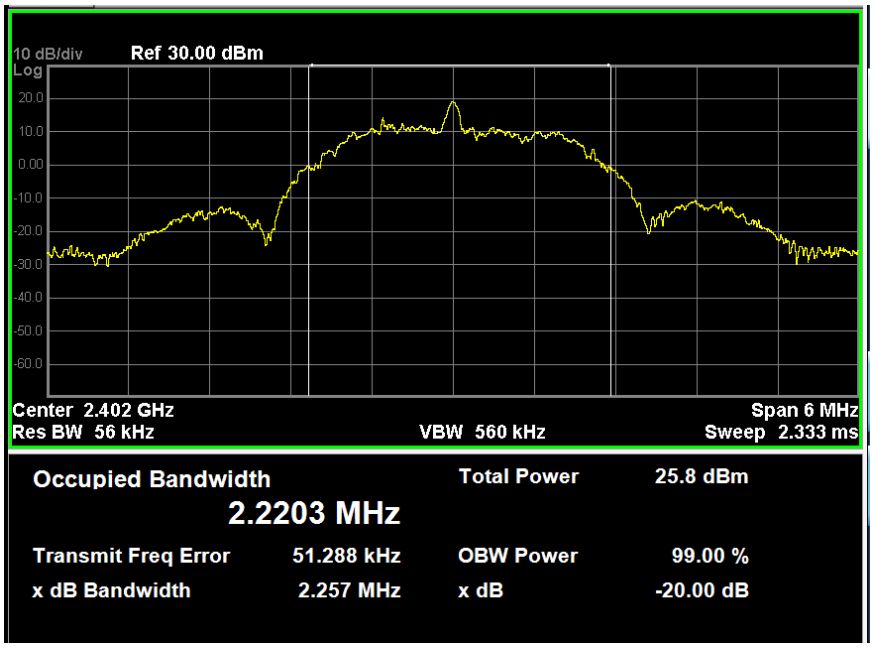
Test Setup:

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.

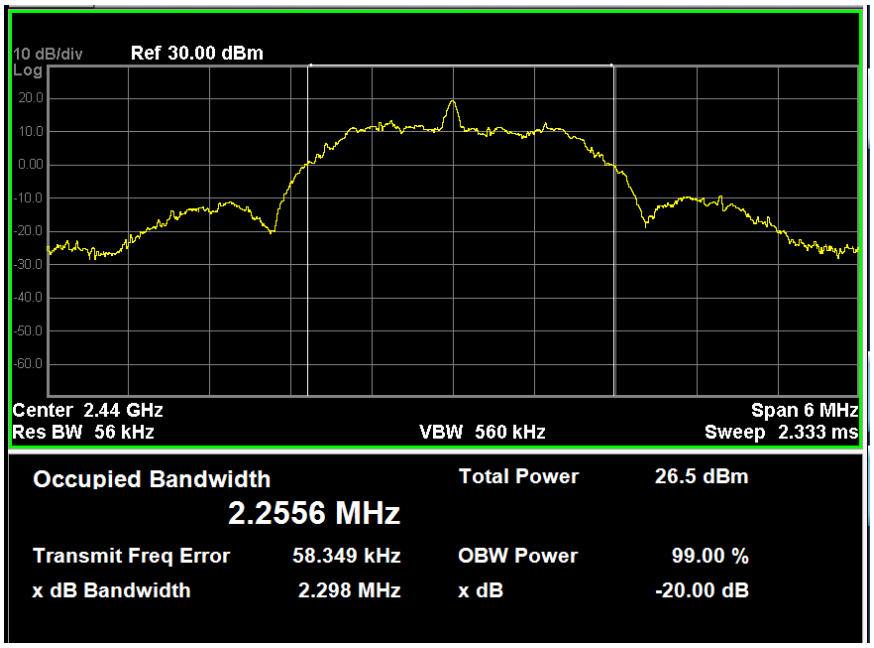
Channel	Measured frequency (MHz)	20dB Bandwidth (MHz)
Lowest	2402	2.257
Middle	2440	2.298
Highest	2479	2.291

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

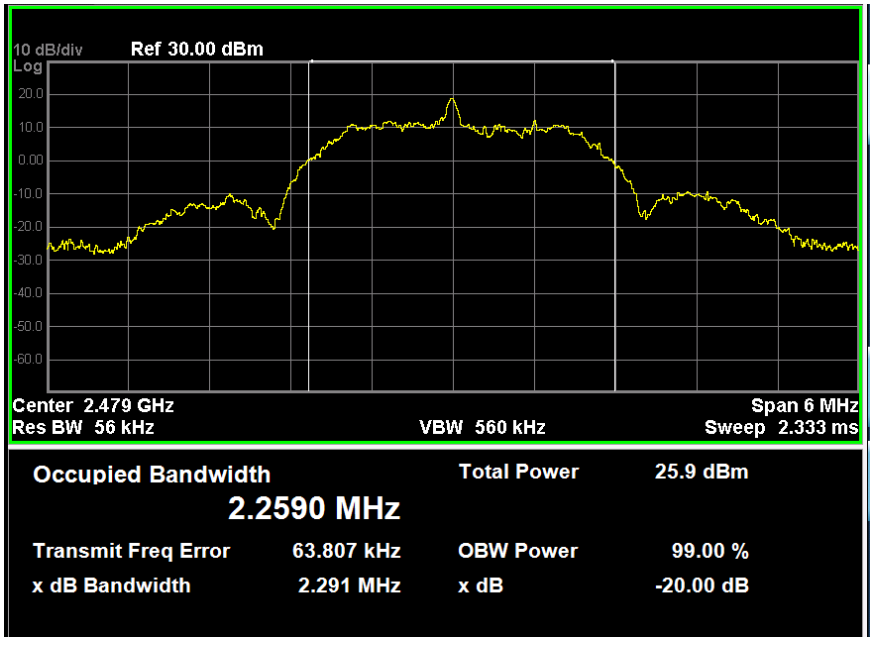
Result data graph shows 20 dB bandwidth, CF = 2402MHz, BW = 2.257MHz



Result data graph shows 20 dB bandwidth, CF = 2440MHz, BW = 2.298MHz



Result data graph shows 20 dB bandwidth, CF = 2479MHz, BW = 2.291MHz



4.3 Hopping Channel Carrier Frequency Separation

Test Requirement:	FCC part 15 section 15.247 (a1)
Test Date:	2015-01-19
Mode of Operation:	Transmitting mode.
Detector Function:	Max Hold

Result: PASS

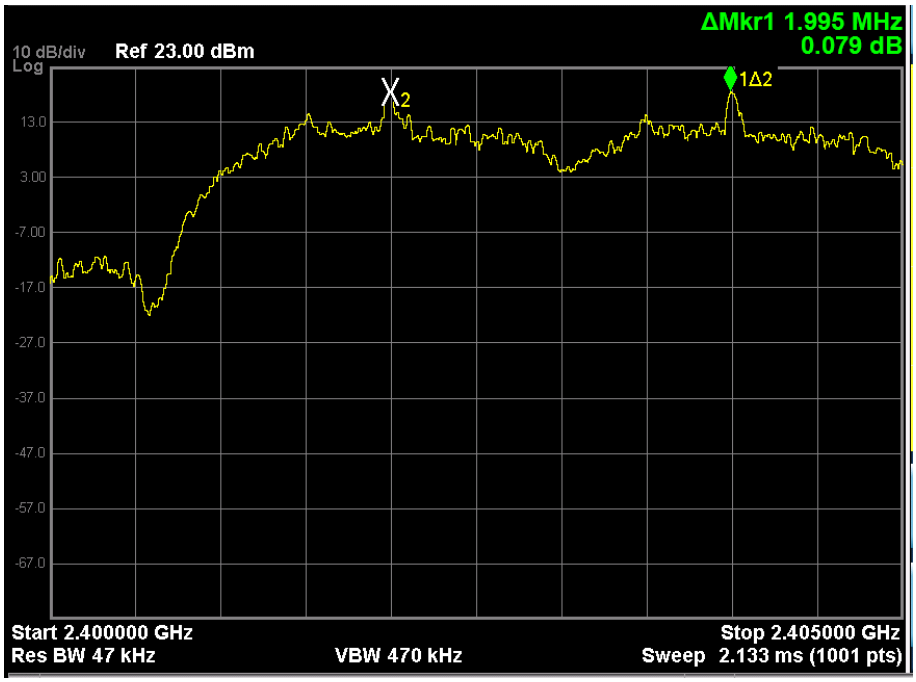
Measured Result :

Refer to the delta marker, the worst frequency separation between two adjacent channels is 2 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:



TÜV SÜD Hong Kong Ltd.
3/F, West Wing, Phase 2, 10 Science Park West Avenue, Hong Kong Science Park, Shatin, Hong Kong

4.4 Average Time of Channel Occupancy

Test Requirement:	FCC part 15 section 15.247 (a1)(iii)
Test Date:	2015-01-19
Mode of Operation:	Transmitting mode.
Detector Function:	Zero span, Sweep time 1s

Result : PASS

Measured Result :

Each transmission only 23 channels will be used.

Observe time = 23 channels × 0.4s = 9.2s

There are 14 pulses within 920ms

And one set of pulses = 857us

Therefore, the average channel occupancy times (ms)

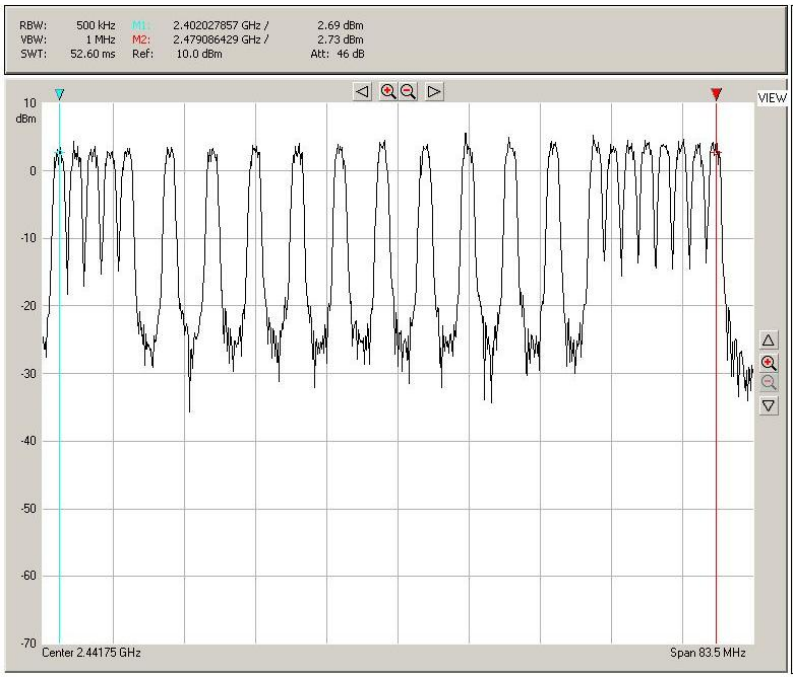
= 857us x 14 x (9.2s/920ms)

So, total transmitting time is 0.120s. (<0.4s).

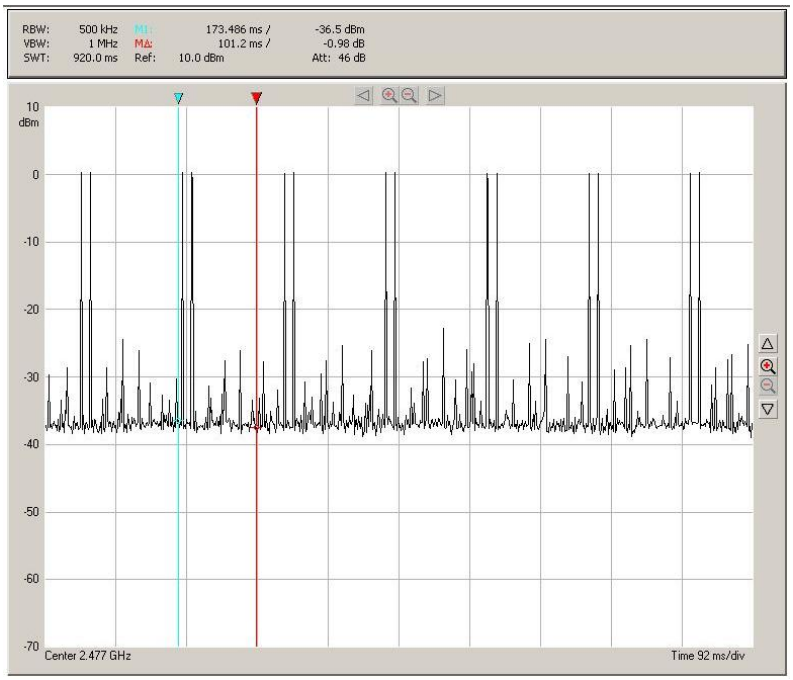
Limits for Average Time of Occupancy [Section 15.247 (a1)(iii)]:

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.

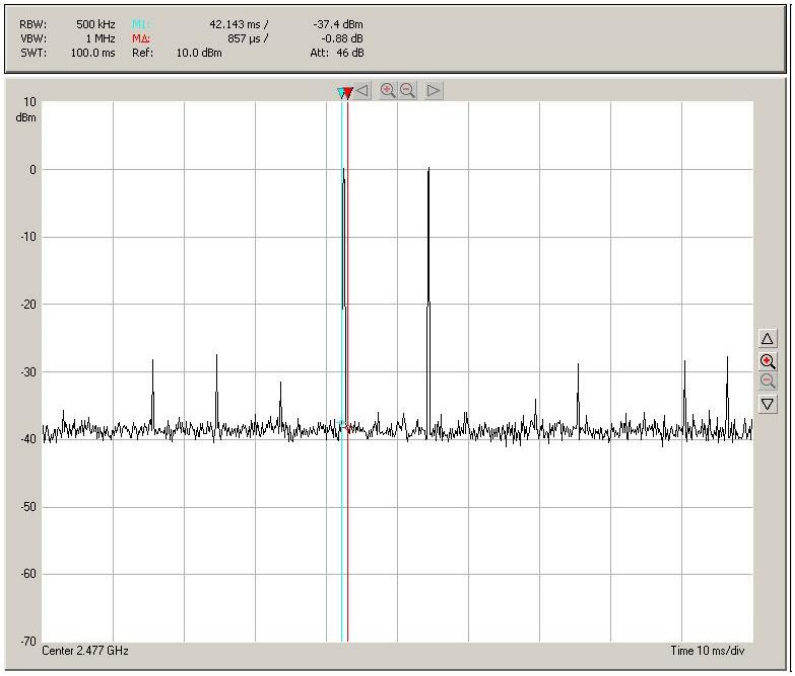
Result data graph shows total 23 channels are used.



Result data graph shows total 14 pulses with 920ms.



Result data graph zooms into detail, one pulse period is 857us.



4.5 Pseudorandom Hopping Algorithm

Pseudorandom Frequency Hopping

MBP41SBU uses FHSS technology the frequency range of the system is operating from 2402MHz to 2479MHz. There are totally 23 channels with 2MHz (the worst) channel separation. A single data frame is transmitted on each frequency location before skipping to the next hopping frequency in the list.

Channels list		
CH1=2402MHz	CH2=2404MHz	CH3=2406MHz
CH4=2408MHz	CH5=2410MHz	CH6=2415MHz
CH7=2420MHz	CH8=2425MHz	CH9=2430MHz
CH10=2435MHz	CH11=2440MHz	CH12=2445MHz
CH13=2450MHz	CH14=2455MHz	CH15=2460MHz
CH16=2465MHz	CH17=2467MHz	CH18=2469MHz
CH19=2471MHz	CH20=2473MHz	CH21=2475MHz
CH22=2477MHz	CH23=2479MHz	

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:	2015-01-19
Mode of Operation:	Transmitting mode.
Detector Function:	Max Hold

Result: PASS

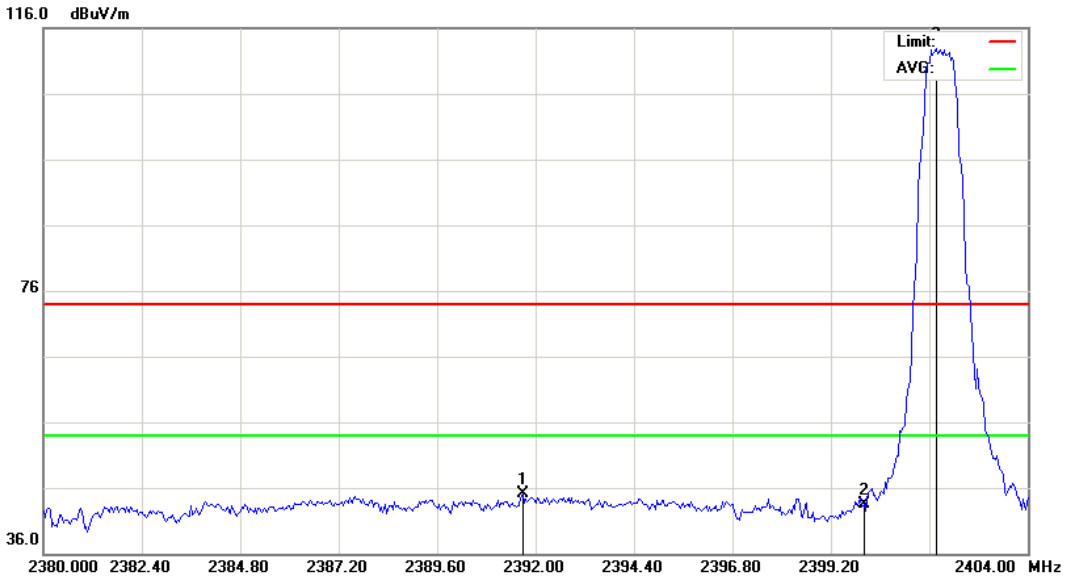
Measured Result :

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

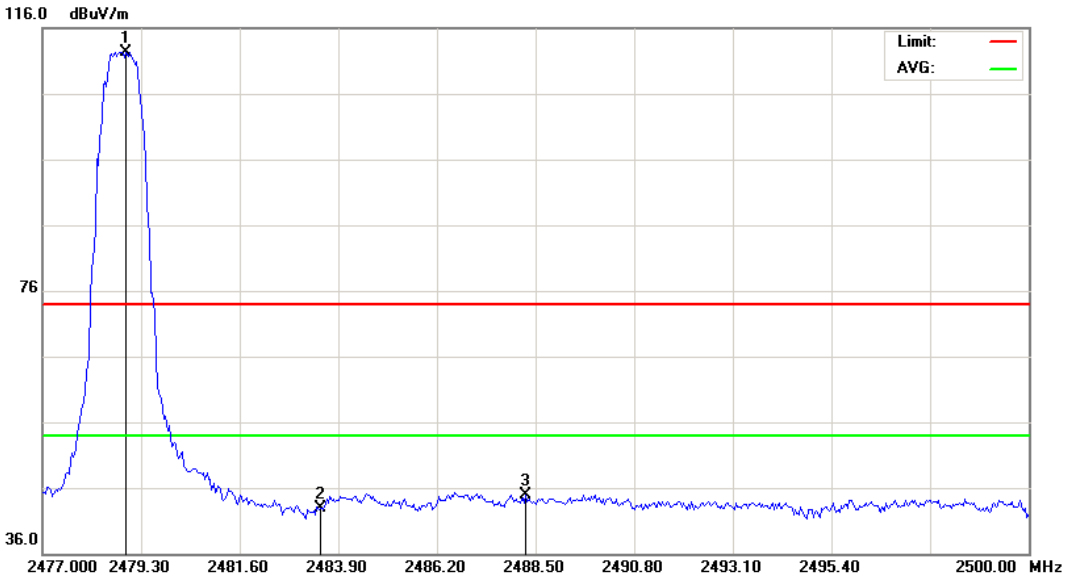
Limits of Band Edge for Carrier Frequencies Operated within the Bands [Section 15.247]:

The carrier frequencies should operate within 2400-2483.5MHz.

Result data graph shows the frequency of lowest channel.



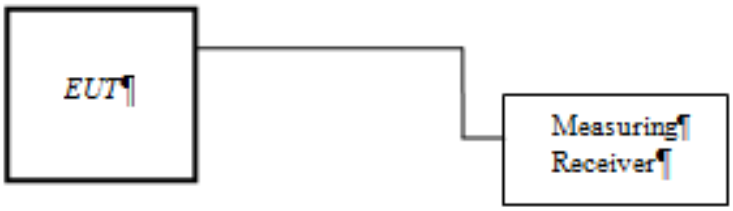
Result data graph shows the frequency of highest channel.



4.7 Maximum Output Power

Test Requirement:	FCC part 15 section 15.247 (a1)
Test Method:	ANSI C63.4:2009
Test Date:	2015-01-19
Mode of Operation:	Transmitting mode.
Detector Function:	Peak
Measurement BW:	RBW 1MHz ; VBW 1MHz

Test Setup:



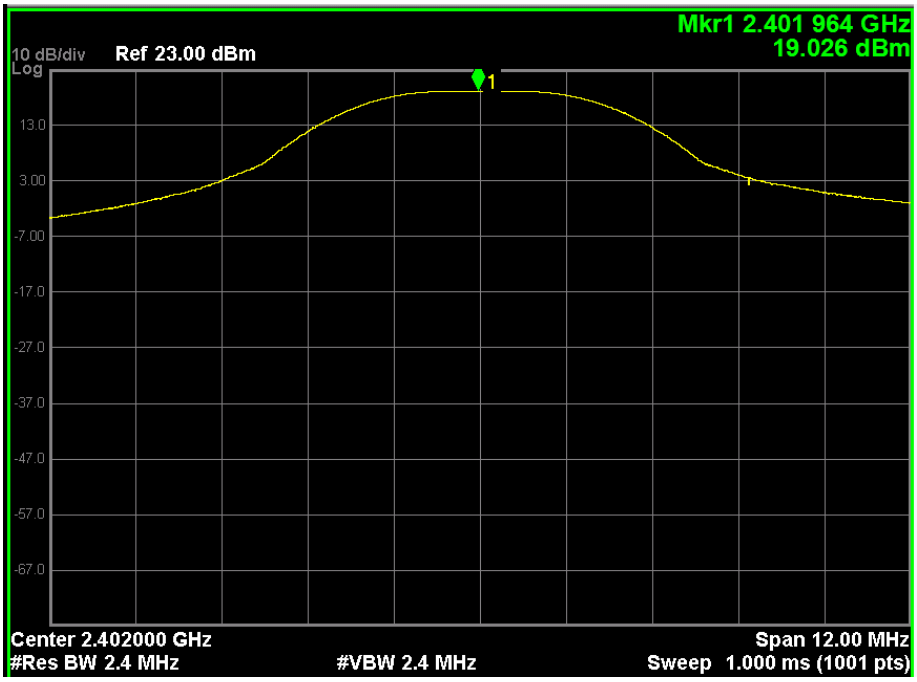
Result : PASS

Frequency (MHz)	Peak Output Power		Limit	
	(dBm)	(W)	(dBm)	(W)
Lowest Channel : 2402	19.029	0.080	21	0.125
Middle Channel : 2440	19.448	0.088	21	0.125
Highest Channel : 2479	18.826	0.076	21	0.125

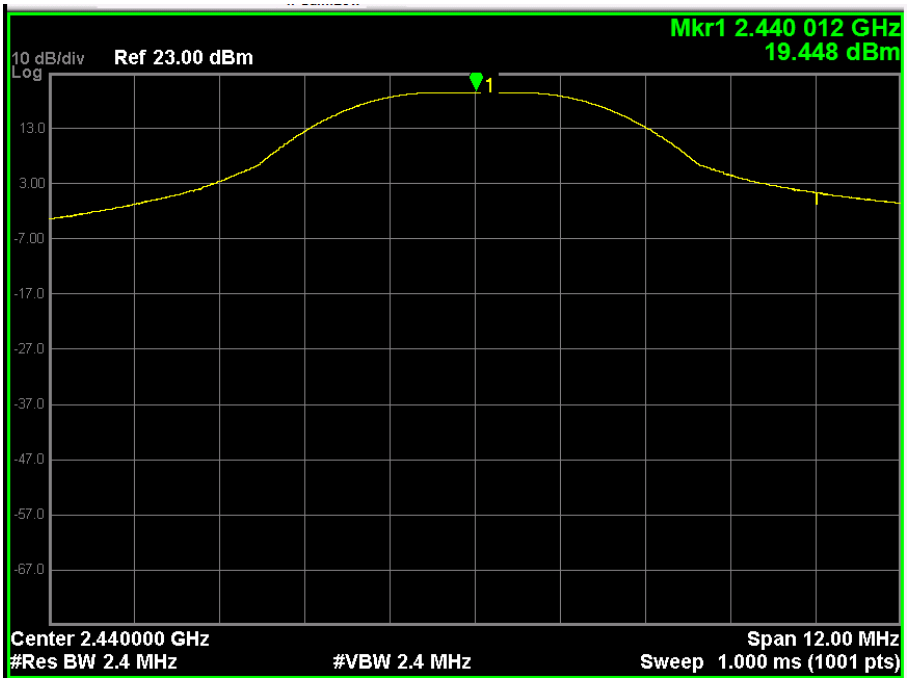
Limits for Maximum Output Power [Section 15.247 (a1)(iii)]:

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

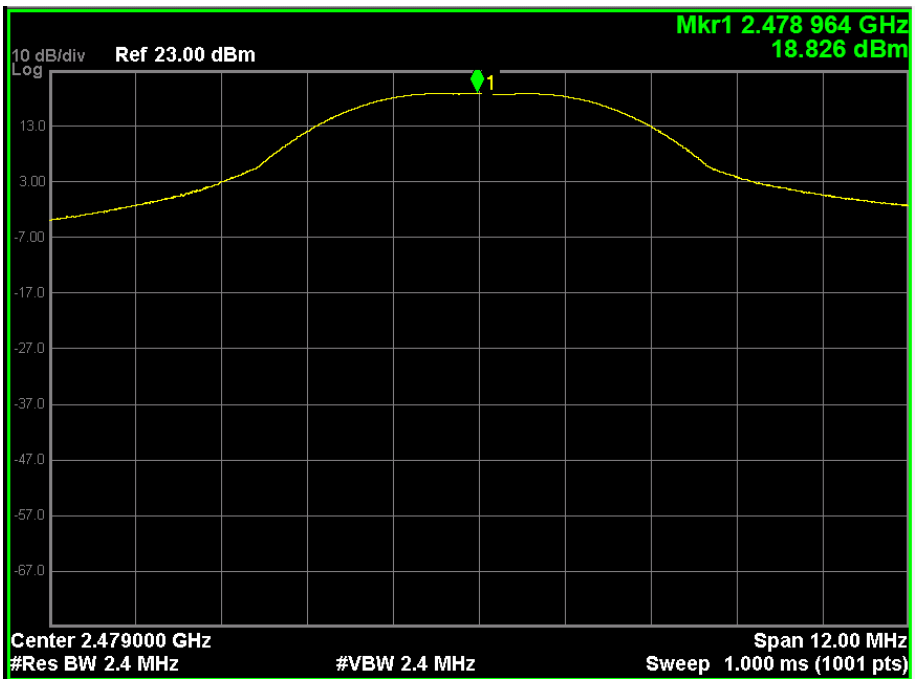
Result data graph shows the frequency of lowest channel



Result data graph shows the frequency of middle channel



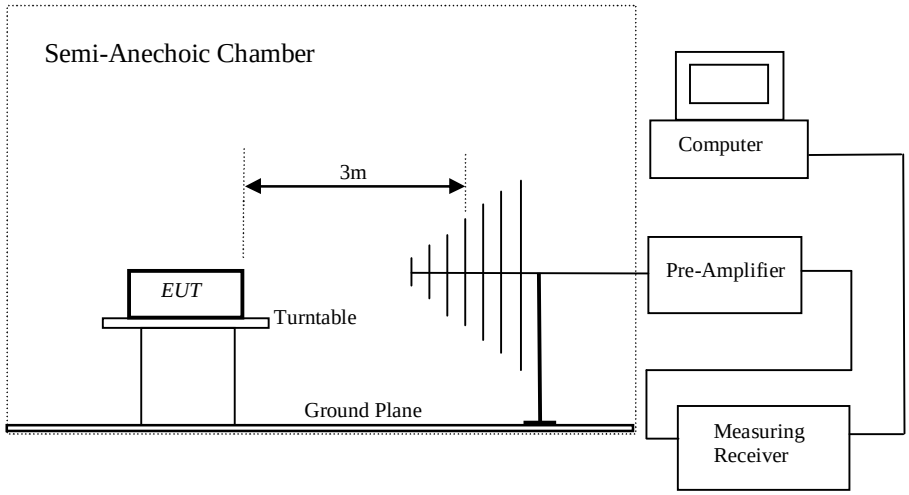
Result data graph shows the frequency of highest channel



4.8 Out of Band Emissions and Emissions in Restricted Bands

Test Requirement:	FCC part 15 section 15.247 (d)
Test Method:	ANSI C63.4:2009
Test Date:	2015-01-19
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 MHz	E-Field Polarity	Reading dBuV/m	System Factor dB	Field strength at 3m dBuV/m	Limit dBuV/m	Delta to Limit dBuV/m
	Lowest Channel						
PK	4804.00	V	42.60	8.50	51.10	74.00	-22.90
PK	4804.00	H	42.45	8.50	50.95	74.00	-23.05
	Middle Channel						
PK	4880.00	V	41.57	8.80	50.37	74.00	-23.63
PK	4880.00	H	42.18	8.80	50.98	74.00	-23.02
	Highest Channel						
PK	4958.00	V	39.77	9.10	48.87	74.00	-25.13
PK	4958.00	H	39.01	9.10	48.11	74.00	-25.89

Frequency MHz	Polarization	Reading dB(uV)	Factor dB	Level dB(uV/m)	Limit dB(uV/m)	Margin dB	Detector
37.760	V	13.4	21.2	34.6	40.0	-5.4	QP
131.850	V	13.0	14.3	27.3	43.5	-16.2	QP
326.820	V	14.9	17.1	32.0	46.0	-14.0	QP
384.050	V	14.8	18.4	33.2	46.0	-12.8	QP
408.300	V	16.4	18.7	35.1	46.0	-10.9	QP
480.080	V	17.7	20.2	37.9	46.0	-8.1	QP
119.725	H	23.6	12.6	36.2	43.5	-7.3	QP
122.635	H	17.3	13.2	30.5	43.5	-13.0	QP
156.100	H	17.6	15.2	32.8	43.5	-10.7	QP
167.740	H	24.1	14.9	39.0	43.5	-4.5	QP
191.990	H	18.2	12.7	30.9	43.5	-12.6	QP
215.755	H	20.1	11.8	31.9	43.5	-11.6	QP

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

Calculated measurement uncertainty: ±3.8dB

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:

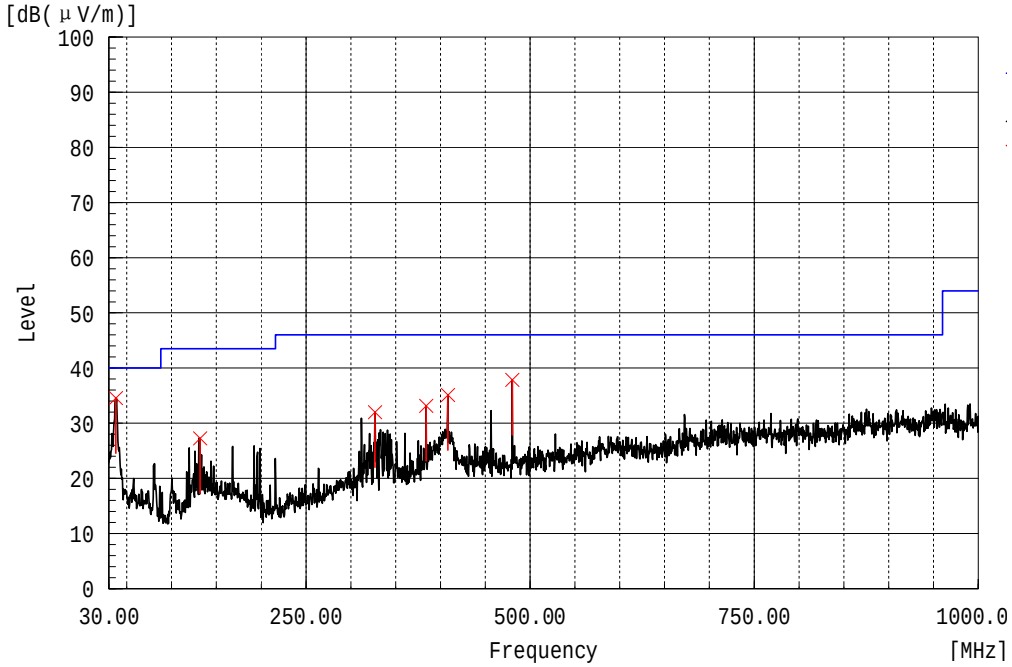
1. " * " Radiated emissions which fall in the restricted bands as defined in Section 15.205(a).

2. Emission level with more than 20dB below the FCC required limit is not mentioned in table.

3. Delta to Limit = Field strength (dBµV/m) – Limit (dBµV/m).

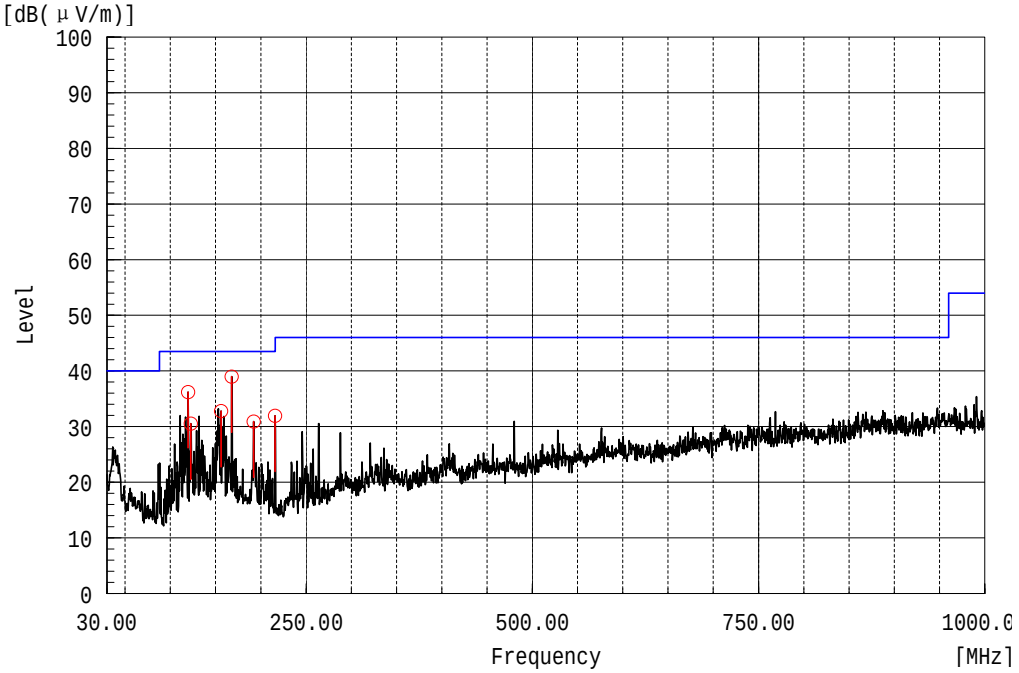
4. Calculated measurement uncertainty: 1GHz -18GHz: 5.1dB

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)

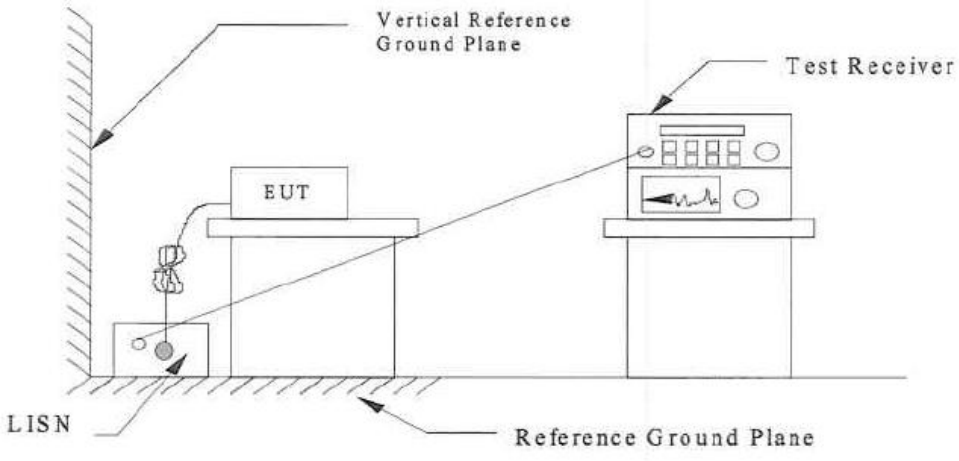


Remark: Only background noise was measured from 1GHz-26GHz excluding the operation frequency relational.

4.9 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC part 15 Section 15.207 Class B
Test Method:	ANSI C63.4:2009
Test Date:	2015-01-22
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.

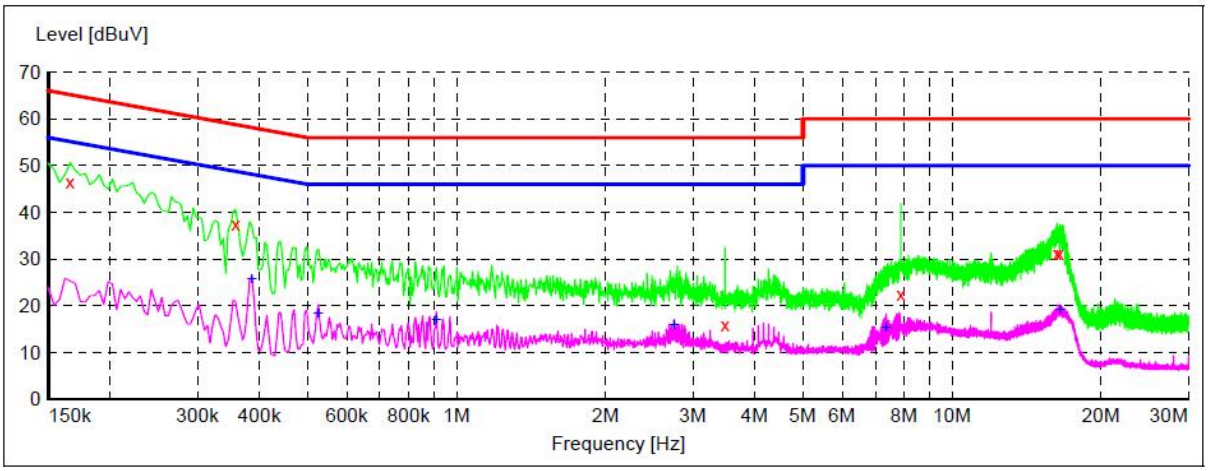
Limits for Conducted Emission [Section 15.207]:

Frequency Range [MHz]	Quasi-Peak Limit [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

* Decreases with the logarithm of the frequency.

Remarks:
Calculated measurement uncertainty: ±2.8dB
The result shown the worst case of the connection.

Result data graph shows the conducted emission (Live).



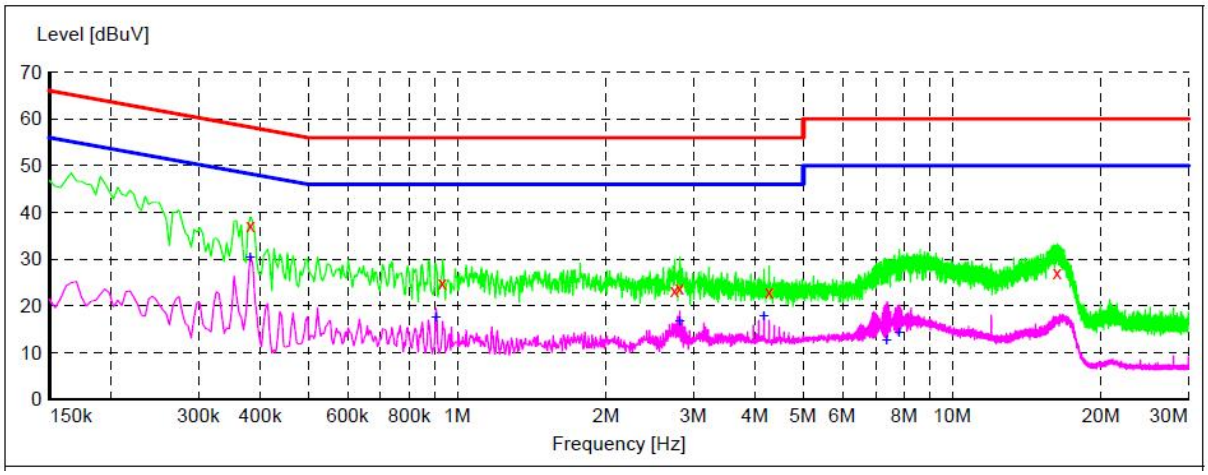
MEASUREMENT RESULT:

Frequency	Level	Transd	Limit	Margin	Detector	Line
MHz	dBuV	dB	dBuV	dB		
0.166000	46.60	0.0	65	18.6	QP	L1
0.358000	37.50	0.0	59	21.3	QP	L1
3.482000	15.80	0.0	56	40.2	QP	L1
7.882000	22.60	0.0	60	37.4	QP	L1
16.294000	31.30	0.0	60	28.7	QP	L1
16.498000	31.20	0.0	60	28.8	QP	L1

MEASUREMENT RESULT:

Frequency	Level	Transd	Limit	Margin	Detector	Line
MHz	dBuV	dB	dBuV	dB		
0.386000	25.80	0.0	48	22.3	AV	L1
0.526000	18.40	0.0	46	27.6	AV	L1
0.910000	17.00	0.0	46	29.0	AV	L1
2.750000	16.00	0.0	46	30.0	AV	L1
7.366000	15.40	0.0	50	34.6	AV	L1
16.522000	19.20	0.0	50	30.8	AV	L1

Result data graph shows the conducted emission (Neutral).



MEASUREMENT RESULT:

Frequency	Level	Transd	Limit	Margin	Detector	Line
MHz	dBuV	dB	dBuV	dB		
0.382000	37.10	0.0	58	21.1	QP	N
0.934000	25.00	0.0	56	31.0	QP	N
2.750000	23.30	0.0	56	32.7	QP	N
2.814000	23.80	0.0	56	32.2	QP	N
4.266000	22.90	0.0	56	33.1	QP	N
16.318000	27.10	0.0	60	32.9	QP	N

MEASUREMENT RESULT:

Frequency	Level	Transd	Limit	Margin	Detector	Line
MHz	dBuV	dB	dBuV	dB		
0.382000	30.40	0.0	48	17.8	AV	N
0.906000	17.50	0.0	46	28.5	AV	N
2.814000	16.60	0.0	46	29.4	AV	N
4.166000	17.90	0.0	46	28.1	AV	N
7.378000	12.60	0.0	50	37.4	AV	N
7.818000	14.20	0.0	50	35.8	AV	N

5.0 List of Measurement Equipment

Radiated Emission and Bandwidth Emissions

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2015-8-17
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2017-8-17
Horn Antenna	Rohde & Schwarz	HF907	102294	2017-8-17
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2015-8-17
Spectrum Analyzer	Agilent	E7405A	MY45111421	2015-8-19
3m Semi-anechoic chamber	TDK	9X6X6	----	2019-5-29

Conducted Emissions

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2015-8-17
LISN	Rohde & Schwarz	ENV4200	100249	2015-8-17
LISN	Rohde & Schwarz	ENV216	100326	2015-8-17

N/A Not Applicable or Not Available