TEST REPORT

Date: 2014-12-22
Report No.: 60.870.14.025.01F

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.: MBP867 BU FCCID: VLJ-MBP867BU
Date Samples Received:	2014-12-12
Date Tested:	2014-12-13 to 2014-12-19
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

Attestation of Global Compliance SZ Co Ltd.
2/F, Building 2,No.1-No.4,Chaxi Sanwei, Technical Industrial Park, Gushu, Xixiang, Shenzhen, China.
Registration Number: 259865

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

Dongguan TaoSen Electronic Technology Co. Ltd.
No.7 Huanguoshan Road, Xinan Community, Changan Town, Dongguan City, Guangdong, China

1.3 Equipment Under Test [EUT]

Description of EUT

Product Description:	Digital Video Baby Monitor (Baby Unit)
Model No.:	MBP867 BU
Brand Name:	Motorola
FCCID:	VLJ-MBP867BU
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.

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:	2014-12-18
Mode of Operation:	Transmitting mode.
Detector Function:	Max Hold

Result: PASS

Measured Result :

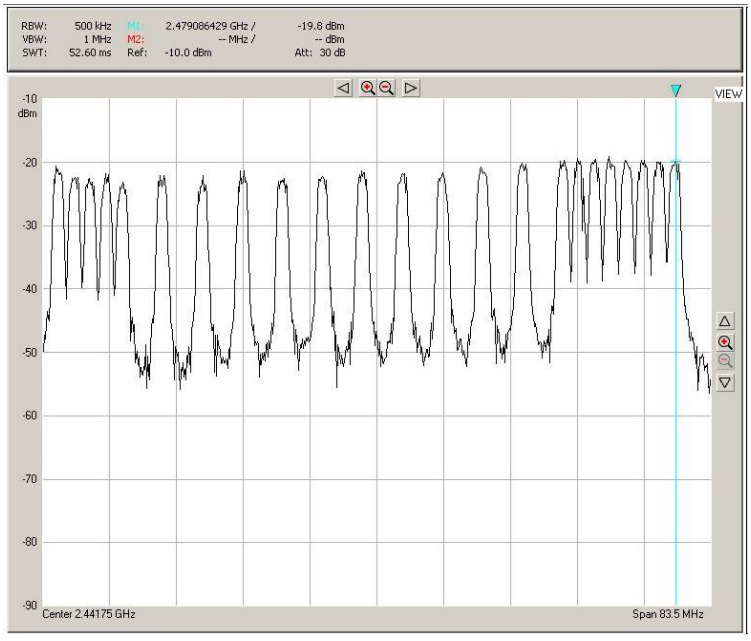
Operating Channel Frequency in sequence (MHz):

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:	2014-12-17
Mode of Operation:	Transmitting mode.
Detector Function:	Max Hold

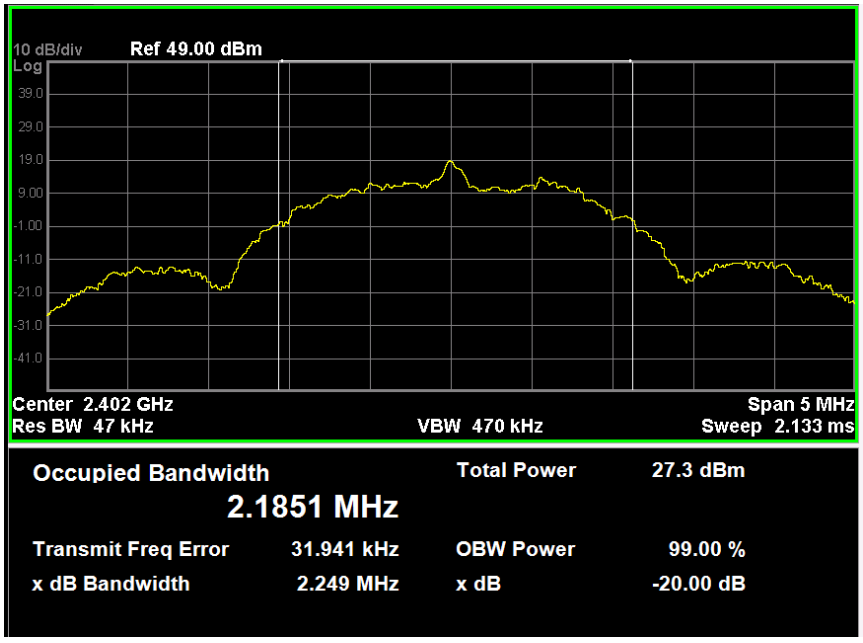
Test Setup:

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.

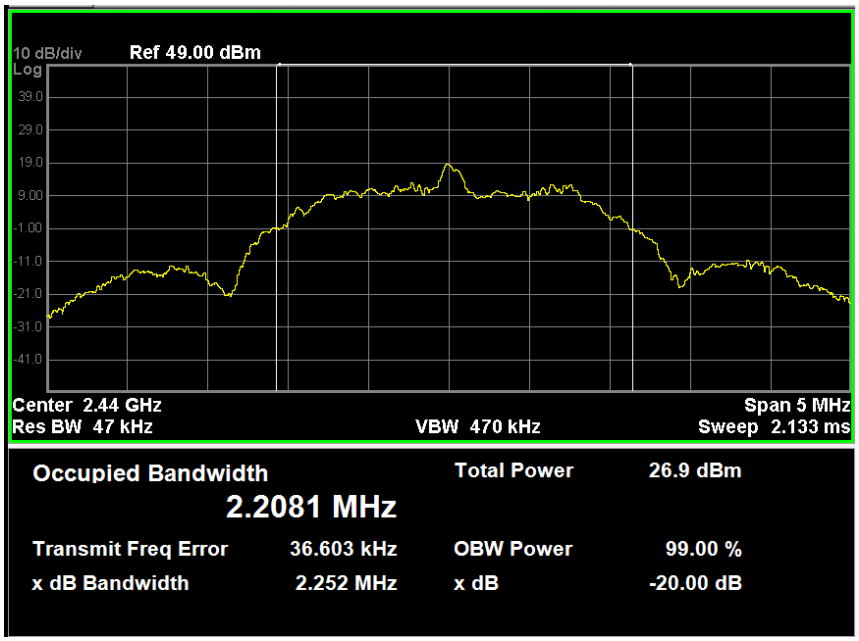
Channel	Measured frequency (MHz)	20dB Bandwidth (MHz)
Lowest	2402	2.249
Middle	2440	2.252
Highest	2479	2.271

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

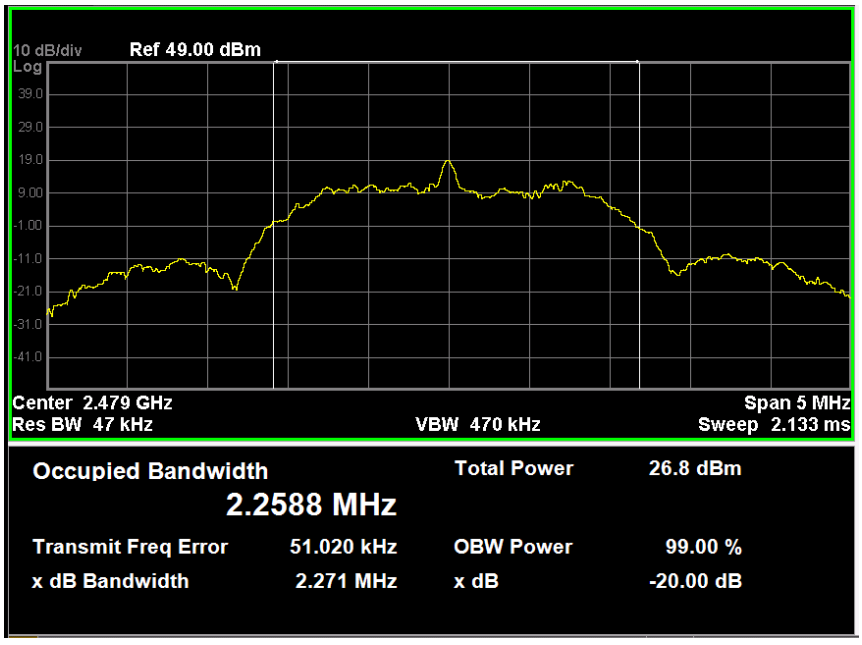
Result data graph shows 20 dB bandwidth, CF = 2402MHz, BW = 2.249MHz



Result data graph shows 20 dB bandwidth, CF = 2440MHz, BW = 2.252MHz



Result data graph shows 20 dB bandwidth, CF = 2479MHz, BW = 2.271MHz



4.3 Hopping Channel Carrier Frequency Separation

Test Requirement:	FCC part 15 section 15.247 (a1)
Test Date:	2014-12-17
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:

MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.401 992 65 GHz	-18.484 dBm			
2	N	1	f	2.403 997 55 GHz	-18.766 dBm			
3								
4								
5								
6								
7								
8								
9								
10								
11								

4.4 Average Time of Channel Occupancy

Test Requirement:	FCC part 15 section 15.247 (a1)(iii)
Test Date:	2014-12-18
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 30 pulses within 920ms

And one set of pulses = 857us

Therefore, the average channel occupancy times (ms)

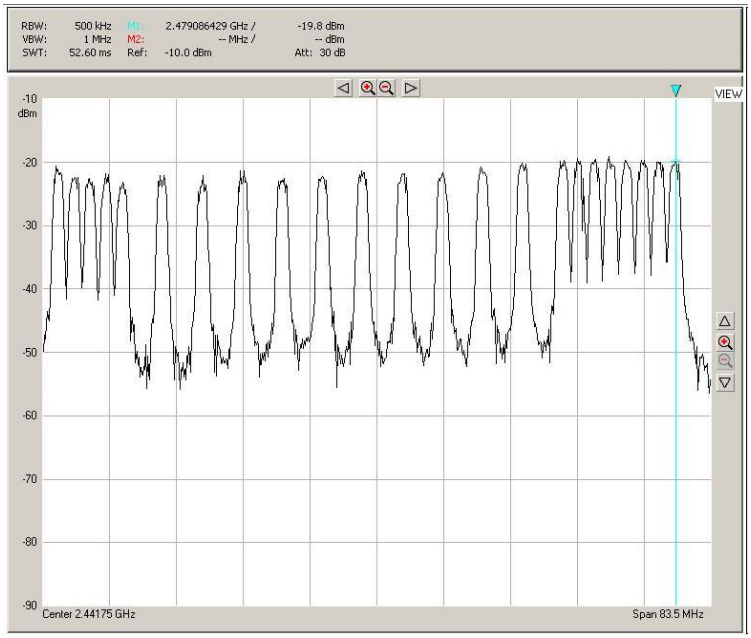
= 857us x 30 x (9.2s/920ms)

So, total transmitting time is 0.257s. (<0.4s).

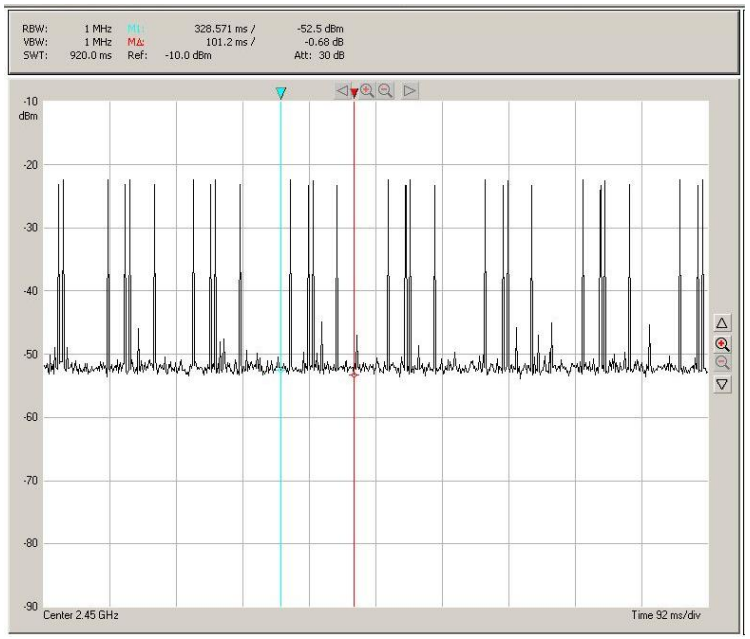
Limits for Average Time of Occupancy [Section 15.247 (a1)(iii)]:

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.

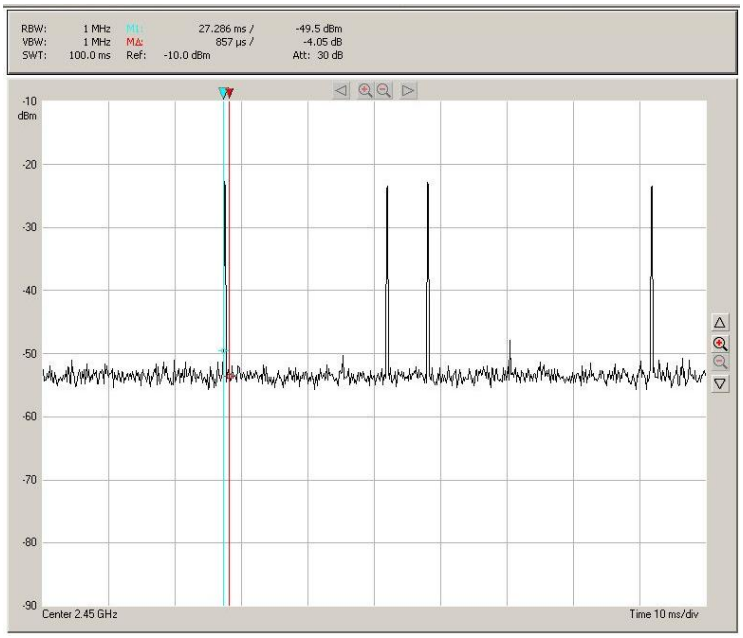
Result data graph shows total 23 channels are used.



Result data graph shows total 30 pulses with 920ms.



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



4.5 Pseudorandom Hopping Algorithm

Pseudorandom Frequency Hopping

MBP867 BU 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:	2014-12-17
Mode of Operation:	Transmitting mode.
Detector Function:	Max Hold

Result: PASS

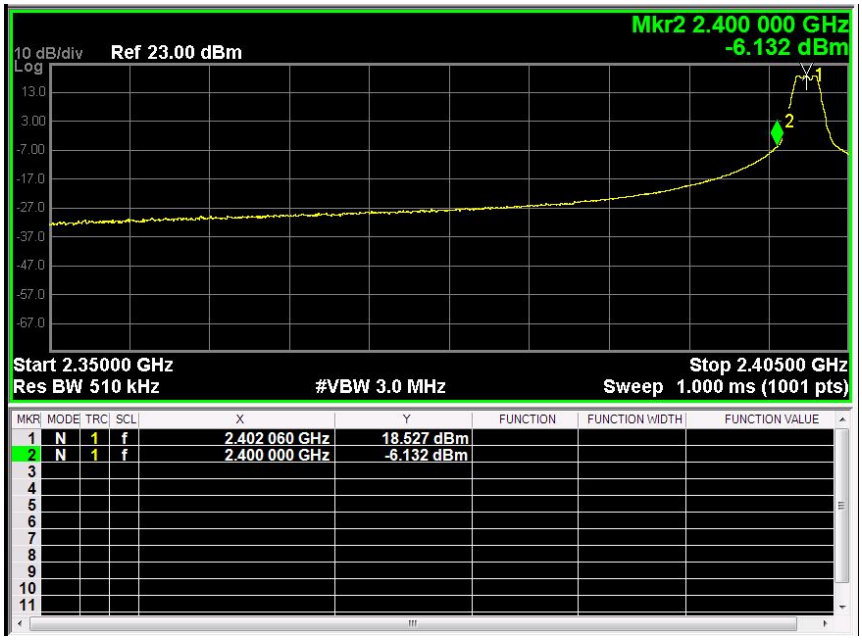
Measured Result :

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.



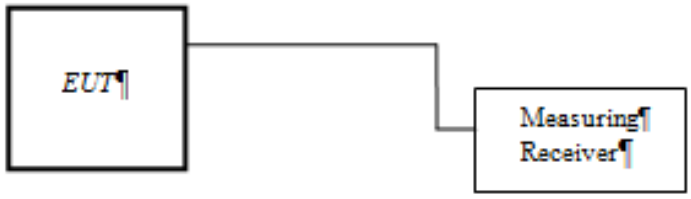
Result data graph shows the frequency of highest channel.

MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.478 990 GHz	18.827 dBm			
2	N	1	f	2.483 500 GHz	-19.415 dBm			
3								
4								
5								
6								
7								
8								
9								
10								
11								

4.7 Maximum Output Power

Test Requirement:	FCC part 15 section 15.247 (a1)
Test Method:	ANSI C63.4:2009
Test Date:	2014-12-18
Mode of Operation:	Transmitting mode.
Detector Function:	Peak
Measurement BW:	RBW 1MHz ; VBW 1MHz

Test Setup:



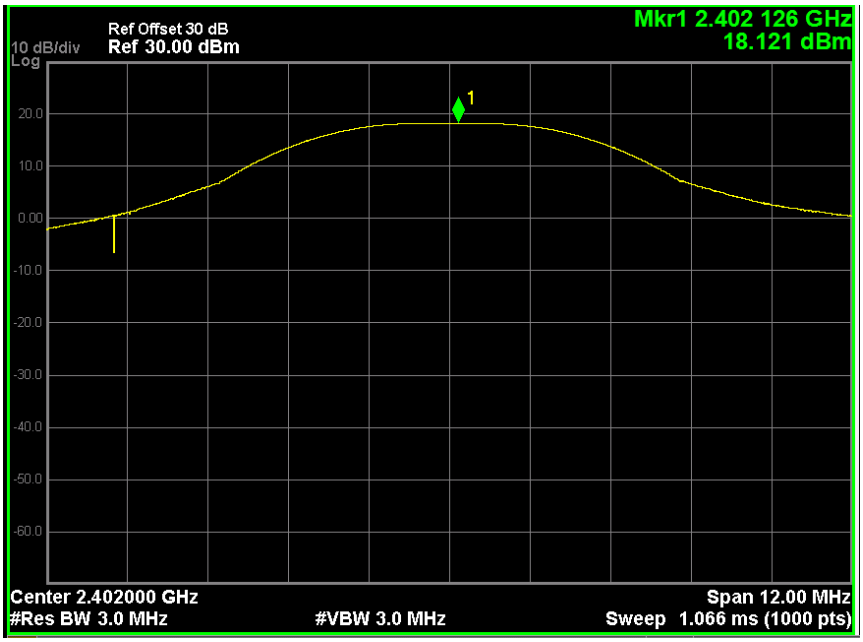
Result : PASS

Frequency (MHz)	Peak Output Power		Limit	
	(dBm)	(W)	(dBm)	(W)
Lowest Channel : 2402	18.121	0.065	21	0.125
Middle Channel : 2440	18.419	0.069	21	0.125
Highest Channel : 2479	18.135	0.065	21	0.125

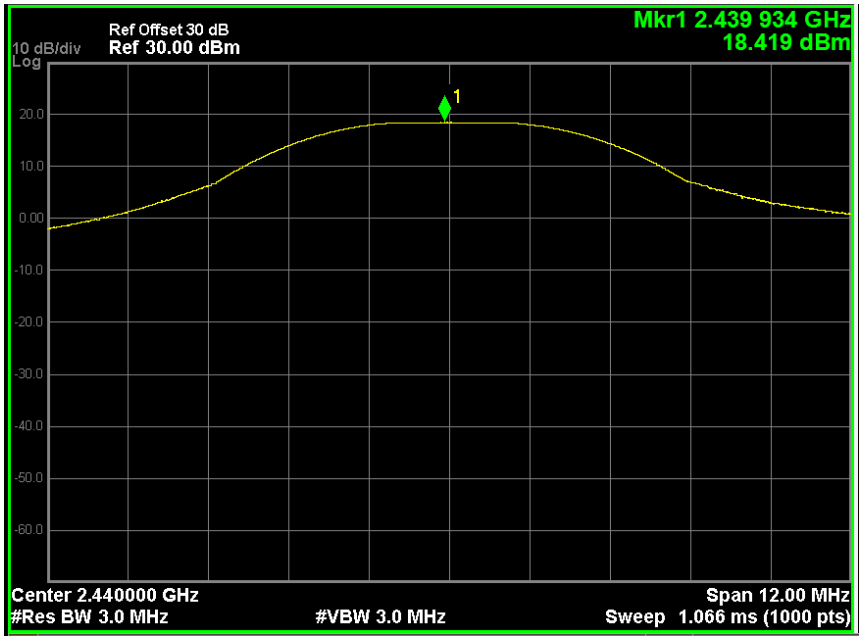
Limits for Maximum Output Power [Section 15.247 (a1)(iii)]:

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

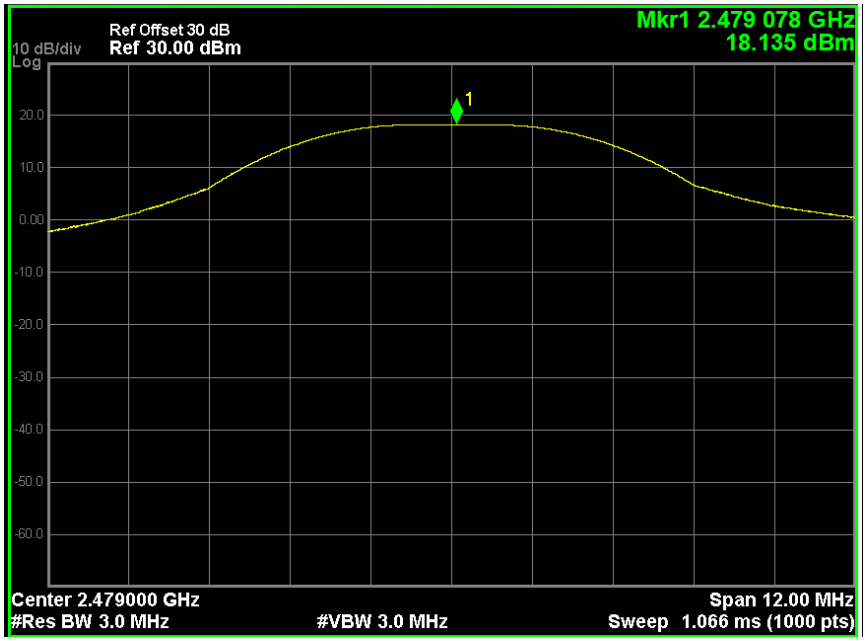
Result data graph shows the frequency of lowest channel



Result data graph shows the frequency of middle channel



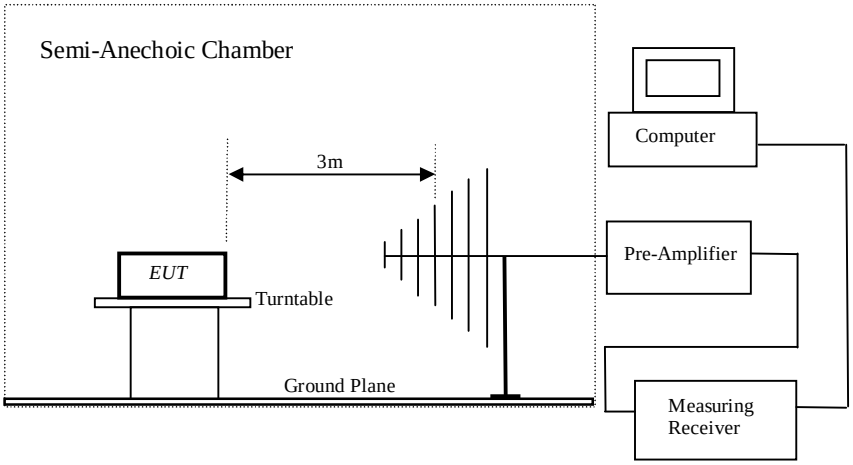
Result data graph shows the frequency of highest channel



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:	2014-12-18
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	43.80	8.50	52.30	74.00	-21.70
PK	4804.00	H	45.50	8.50	54.00	74.00	-20.00
	Middle Channel						
PK	4880.00	V	43.30	8.80	52.10	74.00	-21.90
PK	4880.00	H	45.10	8.80	53.90	74.00	-20.10
	Highest Channel						
PK	4958.00	V	43.40	9.10	52.50	74.00	-21.50
PK	4958.00	H	44.50	9.10	53.60	74.00	-20.40

Frequency MHz	Polarization	Reading dB(uV)	Factor dB	Level dB(uV/m)	Limit dB(uV/m)	Margin dB	Detector
89.655	V	31.0	9.4	40.4	43.5	-3.1	QP
94.505	V	26.0	9.5	35.5	43.5	-8.0	QP
106.630	V	27.6	11.4	39.0	43.5	-4.5	QP
470.865	V	20.1	20.1	40.2	46.0	-5.8	QP
538.280	V	21.1	21.2	42.3	46.0	-3.7	QP
605.695	V	17.0	23.0	40.0	46.0	-6.0	QP
38.245	H	5.7	21.2	26.9	40.0	-13.1	QP
82.380	H	26.4	9.7	36.1	40.0	-3.9	QP
470.865	H	14.5	20.1	34.6	46.0	-11.4	QP
538.280	H	17.7	21.2	38.9	46.0	-7.1	QP
605.695	H	10.7	23.0	33.7	46.0	-12.3	QP
955.865	H	6.3	28.7	35.0	46.0	-11.0	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:

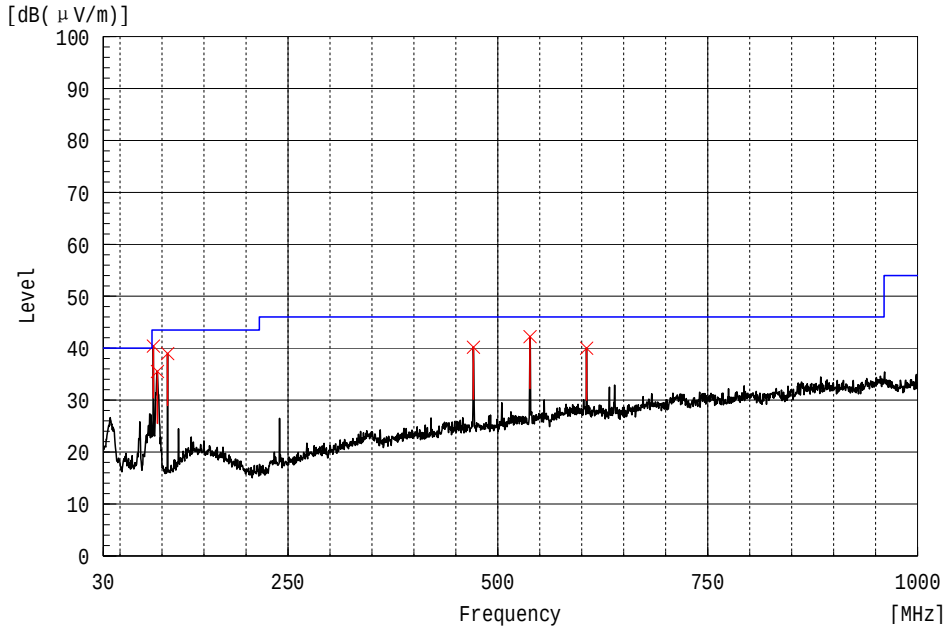
1. " * " Radiated emissions which fall in the restricted bands as defined in Section 15.205(a).

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).

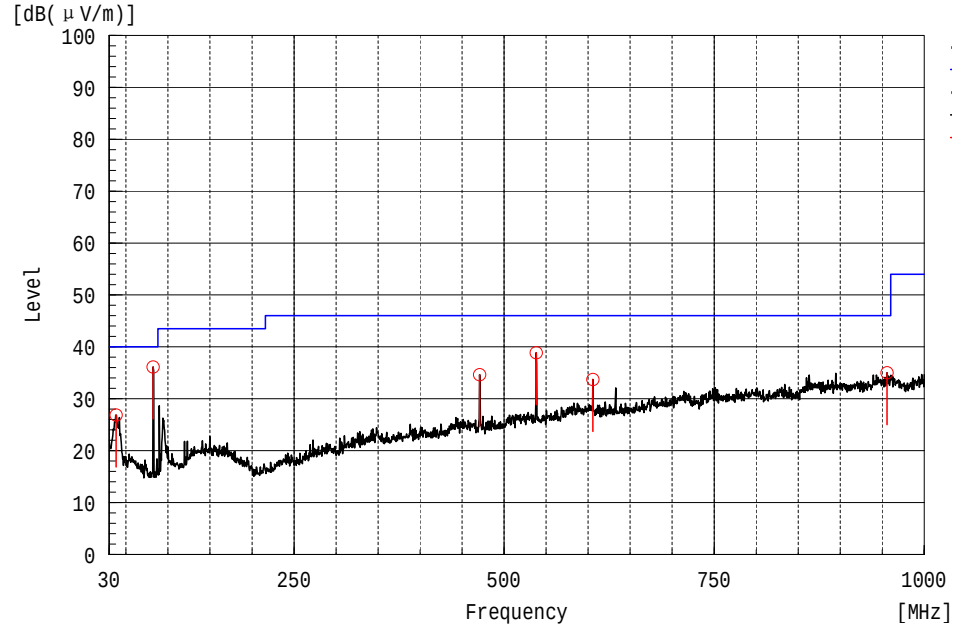
4. Calculated measurement uncertainty: 9kHz -30MHz: 1.8dB.
30MHz -1GHz: 5.2dB.
1GHz -18GHz: 5.1dB.

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)

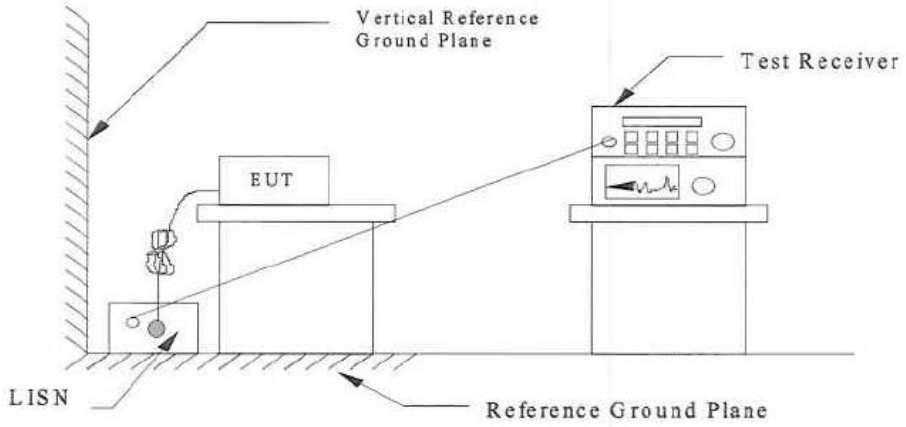


Remark: Only background noise was measured from 1GHz-26GHz excluding the operation frequency relational.

4.9 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC part 15 Section 15.207 Class B
Test Method:	ANSI C63.4:2009
Test Date:	2014-12-18
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.

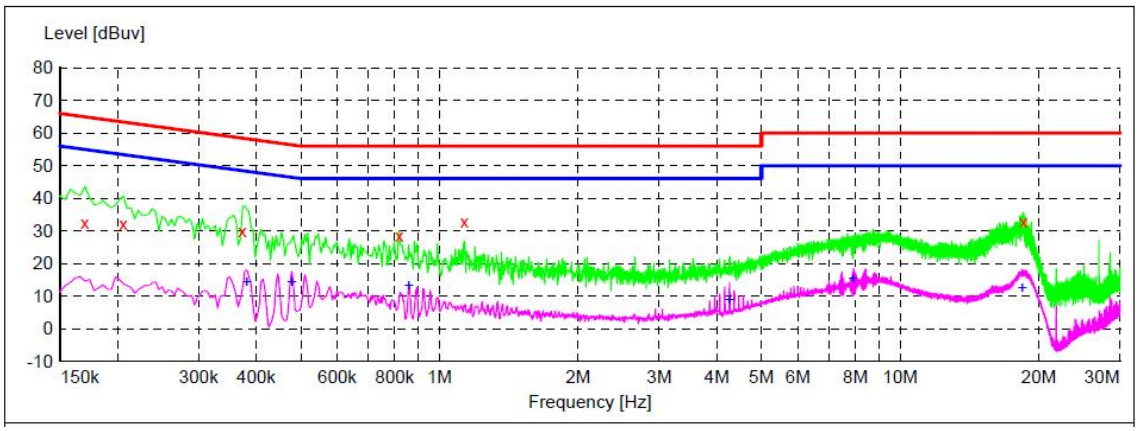
Limits for Conducted Emission [Section 15.207]:

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).



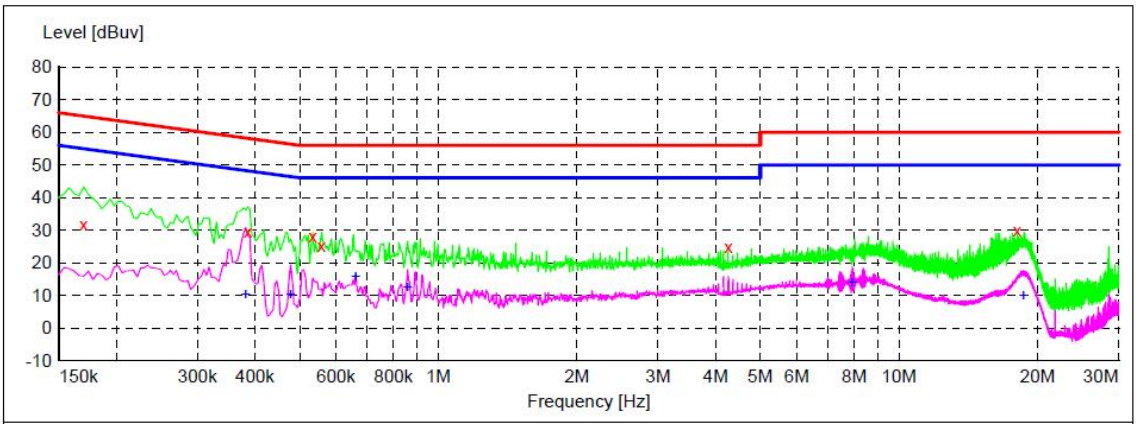
MEASUREMENT RESULT:

Frequency MHz	Level dBuv	Transd dB	Limit dBuv	Margin dB	Detector	Line	PE
0.170000	32.40	0.2	65	32.6	QP	L1	FLO
0.206000	32.10	0.2	63	31.3	QP	L1	FLO
0.374000	29.90	0.2	58	28.5	QP	L1	FLO
0.818000	28.40	0.2	56	27.6	QP	L1	FLO
1.134000	33.00	0.2	56	23.0	QP	L1	FLO
18.526000	32.90	0.7	60	27.1	QP	L1	FLO

MEASUREMENT RESULT:

Frequency MHz	Level dBuv	Transd dB	Limit dBuv	Margin dB	Detector	Line	PE
0.382000	14.40	0.2	48	33.8	AV	L1	FLO
0.478000	14.10	0.2	46	32.3	AV	L1	FLO
0.858000	13.10	0.2	46	32.9	AV	L1	FLO
4.262000	8.70	0.3	46	37.3	AV	L1	FLO
7.922000	15.40	0.4	50	34.6	AV	L1	FLO
18.434000	12.50	0.7	50	37.5	AV	L1	FLO

Result data graph shows the conducted emission (Neutral).



MEASUREMENT RESULT:

Frequency MHz	Level dBuv	Transd dB	Limit dBuv	Margin dB	Detector	Line	PE
0.170000	31.60	0.2	65	33.4	QP	N	FLO
0.386000	29.60	0.2	58	28.5	QP	N	FLO
0.534000	28.20	0.2	56	27.8	QP	N	FLO
0.558000	25.20	0.2	56	30.8	QP	N	FLO
4.266000	24.70	0.3	56	31.3	QP	N	FLO
18.054000	29.80	0.7	60	30.2	QP	N	FLO

MEASUREMENT RESULT:

Frequency MHz	Level dBuv	Transd dB	Limit dBuv	Margin dB	Detector	Line	PE
0.382000	10.30	0.2	48	37.9	AV	N	FLO
0.478000	10.30	0.2	46	36.1	AV	N	FLO
0.662000	15.70	0.2	46	30.3	AV	N	FLO
0.858000	12.60	0.2	46	33.4	AV	N	FLO
7.918000	13.80	0.4	50	36.2	AV	N	FLO
18.666000	9.80	0.7	50	40.2	AV	N	FLO

5.0 List of Measurement Equipment

Radiated Emission and Bandwidth Emissions

Manufacturer	Description	Model no.	Serial no.	CAL due
N/A	3m Semi- Anechoic Chamber	9.0(L)*6.0(W)* 6.0(H)	N/A	Jul. 16 2015
Agilent	Spectrum Analyzer	E4440A	US41421290	Jul. 16 2015
R&S	EMI Test Receiver	ESCI	100694	Jul. 16 2015
A.H.	Wideband Antenna	SAS-521-4	26	Jul. 16 2015
EMCO	Antenna	3142C	60447	Jul. 16 2015
EM	Horn Antenna	EM-AH-10180	67	Jul. 16 2015
EM	Power Amplifier	EM30180	0607030	Jul. 16 2015
MF	Position Controller	MF-7802	MF780208138	N/A

Conducted Emissions

Manufacturer	Description	Model no.	Serial no.	CAL due
N/A	Shielding Room	7.(L)x4(W)x3(H)	N/A	Jul. 16 2015
R&S	EMI Test Receiver	ESCI	100694	Jul. 16 2015
R&S	LISN	ESH3-Z5	8389791009	Jul. 16 2015

N/A Not Applicable or Not Available