STC Test Report

Applicant (GTC001):	AQUATIC AV 1476 Camden Ave, Campbell, CA 95008, United states
Manufacturer:	Eastern Partner Limited. Room 1413, ICC Tower, Fuhau San Road, Futian CBD, ShenZhen 518048 China.
Description of Sample(s):	Product: Water/Dust Proof MP3/iPod Digital Media Locker with Floating RF LCD 2-way Remote Control Brand Name: AQUATIC AV Model Number: AQ-DM-4 FCC ID: WBQAQRFDM4D
Date Sample(s) Received:	2012-12-11
Date Tested:	2012-12-11
Investigation Requested:	Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2011 and ANSI C63.4:2009 for FCC Certification.
Conclusion(s):	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.
Remark(s):	---

Dr. LEE Kam Chuen
Authorized Signatory
ElectroMagnetic Compatibility Department
For and on behalf of
The Hong Kong Standards and Testing Centre Ltd.

CONTENT:

1.0 General Details

1.1 Test Laboratory

The Hong Kong Standards and Testing Centre Ltd.
EMC Laboratory
10 Dai Wang Street, Taipo Industrial Estate
New Territories, Hong Kong

1.2 Equipment Under Test [EUT]
Description of Sample(s)

Product:	Water/Dust Proof MP3/iPod Digital Media Locker with Floating RF LCD 2-way Remote Control
Manufacturer:	Eastern Partner Limited. Room 1413, ICC Tower, Fuhau San Road, Futian CBD, ShenZhen 518048 China.
Brand Name:	AQUATIC AV
Additional Brand Name(s):	JACUZZI, SUNDANCE
Model Number:	AQ-DM-4
Additional Model Number(s):	AQ-DM-3B, AQ-DM-3BG, AQ-DM-4G, AQ-DM-4B, AQ-DM-4BG, AQ-DM-4U, AQ-DM-4UG, AQ-DM4UBT, AQ-DM-4UBTG, 6500-819, 6500-400, 6500-880, 6560-300, 6560-302, AQ-RFDM-4, AQ-RFDM-4U
Rating:	12Vd.c. (Lead-acid battery)

1.2.1 Description of EUT Operation

The Equipment Under Test (EUT) is an AQUATIC AV., Water/Dust Proof MP3/iPod Digital Media Locker. The audio input is able to be provided digital device through Bluetooth, USB (the EUT act as a host) and Aux-in cable (3.5mm jack), the EUT is able to be controlled by a 2.4GHz remote controller, and also report status to the controller.

1.3 Date of Order

2012-12-11

1.4 Submitted Sample(s):

2 Samples

1.5 Test Duration

2012-12-11

1.6 Country of Origin

China

1.7 RF Module Details

Module Model Number:	BC05
Module FCC ID:	N/A
Module Transmission Type:	Bluetooth V2.1+EDR
Modulation:	FHSS (GFSK / π/4-DQPSK / 8DPSK)
Data Rates:	1MBps: GFSK 2 MBps: π/4-DQPSK 3 MBps: 8DPSK
Frequency Range:	2400-2483.5MHz
Carrier Frequencies:	2402MHz – 2480MHz

Module Specification (specification provided by manufacturer)

1.8 Antenna Details

Antenna Type:	Dipole
Antenna Gain:	0dBi
Antenna Length:	120mm

2.0 Technical Details

2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2011 Regulations and ANSI C63.4:2009 for FCC Certification.

2.2 Test Standards and Results Summary Tables

EMISSION
Results Summary

Test Condition	Test Requirement	Test Method	Class / Severity	Test Result		
				Pass	Fail	N/A
Output Power of Fundamental Emissions	FCC 47CFR 15.247(b)(1)	ANSI C63.4:2009	N/A	☒	☐	☐
RF Conducted Spurious Emission	FCC 47CFR 15.247(c)	N/A	N/A	☒	☐	☐
Radiated Spurious Emissions	FCC 47CFR 15.209	ANSI C63.4:2009	N/A	☒	☐	☐
Number of Operating Channel	FCC 47CFR 15.247(a)(2)(b)(1)	N/A	N/A	☒	☐	☐
Band-edge compliance of Conducted Emission	FCC 47CFR 15.247(c)	N/A	N/A	☒	☐	☐
Pseudorandom Hopping Algorithm	FCC 47CFR 15.247(a)(1)	N/A	N/A	☒	☐	☐
Time of Occupancy	FCC 47CFR 15.247(a)(1)(iii)	N/A	N/A	☒	☐	☐
20dB Bandwidth	FCC 47CFR 15.247(a)(2)	N/A	N/A	☒	☐	☐
Hopping Channel Separation	FCC 47CFR 15.247(a)(1)	N/A	N/A	☒	☐	☐
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	☒	☐	☐

Note: N/A – Not Applicable

2.3 Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate in the table below is the worst case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate
Max. Conducted Output Power	GFSK / π/4-DQPSK / 8DPSK	1MBps / 2MBps / 3MBps
Hopping Channel Separation	8DPSK	3MBps
Number of Hopping Frequency	8DPSK	3MBps
Dwell Time	DH1 / DH3 / DH5	3MBps
Radiated Emissions Below 1GHz	GFSK	1MBps
Radiated Emission Above 1GHz	GFSK	1MBps
Band Edge Emissions	GFSK / π/4-DQPSK / 8DPSK	1MBps / 2MBps / 3MBps

3.0 Test Results

3.1 Emission

3.1.1 Maximum Peak Output Power

Test Requirement:	FCC 47CFR 15.247(b)(1)
Test Method:	N/A
Test Date:	2012-12-11
Mode of Operation:	Bluetooth Communication mode (Fundamental Power)

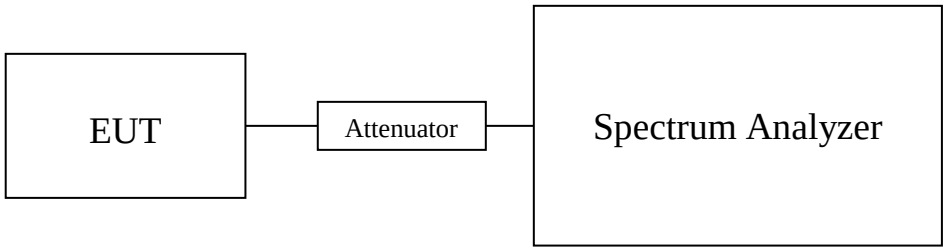
Test Method:

The RF output of the EUT was connected to the spectrum analyzer. All the attenuation or cable loss will be added to the measured maximum output power. The results are recorded in dBm.

Spectrum Analyzer Setting:

RBW = 3 MHz, VBW= 3MHz, Sweep = Auto, Span = 10MHz
Detector = Peak, Trace = Max. hold

Test Setup:



Limits for Peak Output Power of Fundamental & Harmonics Emissions [FCC 47CFR 15.247]:

The maximum peak output power shall not exceeded the following limits: 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 For Digital Transmission systems in 2400-2483.5 MHz Band: 1 Watt

Results of Bluetooth Communication mode (GFSK) (Fundamental Power): Pass
Maximum conducted output power

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000037

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.000034

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000031

Results of Bluetooth Communication mode (π/4-DQPSK) (Fundamental Power): Pass
Maximum conducted output power

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000022

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.000021

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000019

Results of Bluetooth Communication mode (8 DPSK) (Fundamental Power): Pass
Maximum conducted output power

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000026

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.000027

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000022

Limit: 0.125W (125mW)

Calculated measurement uncertainty : 30MHz to 1GHz 1.7dB
1GHz to 18GHz 1.7dB

3.1.2 Radiated Spurious Emissions

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.4:2009
Test Date:	2012-12-11
Mode of Operation:	Bluetooth Communication mode / Aux in connected to iPod / USB mode (connected to USB storage) / FM mode

Test Method:

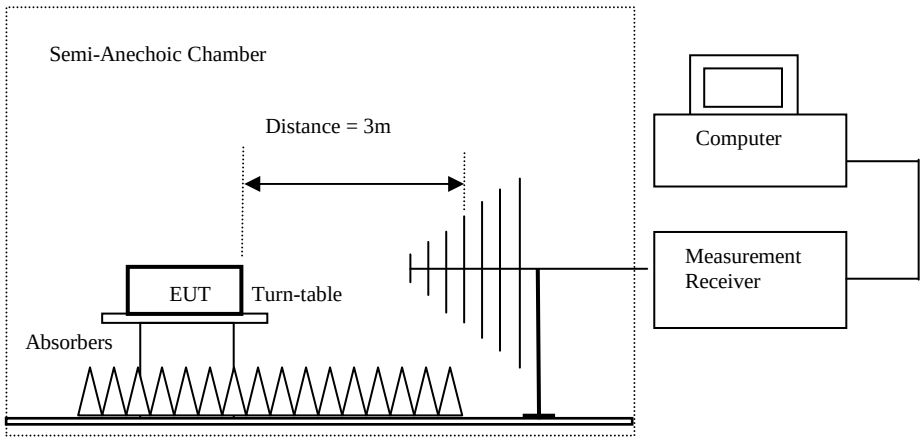
The sample was placed 0.8m above the ground plane of semi-anechoic Chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, considered typical configuration 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.

* Semi-anechoic chamber located on the G/F of "The Hong Kong Standards and Testing Centre Ltd." with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 607756.

Spectrum Analyzer Setting:

9KHz – 30MHz (Pk & Av)	RBW:	10kHz
	VBW:	30kHz
	Sweep:	Auto
	Span:	Fully capture the emissions being measured
	Trace:	Max. hold
30MHz – 1GHz (QP)	RBW:	120kHz
	VBW:	120kHz
	Sweep:	Auto
	Span:	Fully capture the emissions being measured
	Trace:	Max. hold
Above 1GHz (Pk & Av)	RBW:	3MHz
	VBW:	3MHz
	Sweep:	Auto
	Span:	Fully capture the emissions being measured
	Trace:	Max. hold

Test Setup:



Ground Plane

Absorbers placed on top of the ground plane are for measurements above 1000MHz only.

Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range	Quasi-Peak Limits
[MHz]	[µV/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

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 of Bluetooth Communication mode (GFSK) (9kHz – 30MHz): PASS

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Results of Bluetooth Communication mode (GFSK) (30MHz – 1000MHz): PASS

Field Strength of Spurious Emissions						
Quasi-Peak						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
48.0	28.0	10.1	38.1	40.0	1.9	Vertical
96.0	25.2	9.0	34.2	43.5	9.3	Vertical
120.0	18.6	8.1	26.7	43.5	16.8	Vertical
128.0	27.7	9.0	36.7	43.5	6.8	Horizontal
144.0	26.3	9.8	36.1	43.5	7.4	Horizontal
287.9	15.7	15.2	30.9	46.0	15.1	Horizontal

Result of Bluetooth Communication mode (GFSK) (1GHz – 26GHz): Pass

Channel 0

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2402.0	50.4	28.0	78.4	--	--	Horizontal

Channel 40

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2441.0	50.3	28.0	78.3	--	--	Horizontal

Channel 79

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2480.0	48.8	28.0	76.8	--	--	Horizontal

Result of Bluetooth Communication mode (GFSK) (1GHz – 26GHz): Pass

Channel 0

Field Strength of Spurious Emissions Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2402.0	30.4	28.0	58.4	--	--	Horizontal

Channel 40

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2441.0	30.3	28.0	58.3	--	--	Horizontal

Channel 79

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2480.0	28.8	28.0	56.8	--	--	Horizontal

Result of Bluetooth Communication mode (π/4-DQPSK) (9kHz – 30MHz): PASS

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Results of Bluetooth Communication mode (π/4-DQPSK) (30MHz – 1000MHz): PASS

Field Strength of Spurious Emissions						
Quasi-Peak						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
48.0	28.0	10.1	38.1	40.0	1.9	Vertical
96.0	25.2	9.0	34.2	43.5	9.3	Vertical
120.0	18.6	8.1	26.7	43.5	16.8	Vertical
128.0	27.7	9.0	36.7	43.5	6.8	Horizontal
144.0	26.3	9.8	36.1	43.5	7.4	Horizontal
287.9	15.7	15.2	30.9	46.0	15.1	Horizontal

Result of Bluetooth Communication mode (π/4-DQPSK) (1GHz – 26GHz): Pass

Channel 0

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2402.0	49.7	28.0	77.7	--	--	Horizontal

Channel 40

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2441.0	49.1	28.0	77.1	--	--	Horizontal

Channel 79

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2480.0	49.3	28.0	77.3	--	--	Horizontal

Result of Bluetooth Communication mode (π/4-DQPSK) (1GHz – 26GHz): Pass

Channel 0

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2402.0	29.7	28.0	57.7	--	--	Horizontal

Channel 40

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2441.0	29.1	28.0	57.1	--	--	Horizontal

Channel 79

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2480.0	29.3	28.0	57.3	--	--	Horizontal

Result of Bluetooth Communication mode (8QPSK) (9kHz – 30MHz): PASS

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Results of Bluetooth Communication mode (8QPSK) (30MHz – 1000MHz): PASS

Field Strength of Spurious Emissions						
Quasi-Peak						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
48.0	28.0	10.1	38.1	40.0	1.9	Vertical
96.0	25.2	9.0	34.2	43.5	9.3	Vertical
120.0	18.6	8.1	26.7	43.5	16.8	Vertical
128.0	27.7	9.0	36.7	43.5	6.8	Horizontal
144.0	26.3	9.8	36.1	43.5	7.4	Horizontal
287.9	15.7	15.2	30.9	46.0	15.1	Horizontal

Result of Bluetooth Communication mode (8QPSK) (1GHz – 26GHz): Pass

Channel 0

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2402.0	49.7	28.0	77.7	--	--	Horizontal

Channel 40

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2441.0	48.9	28.0	76.9	--	--	Horizontal

Channel 79

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2480.0	49.1	28.0	77.1	--	--	Horizontal

Result of Bluetooth Communication mode (8QPSK) (1GHz – 26GHz): Pass

Channel 0

Field Strength of Spurious Emissions Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2402.0	29.7	28.0	57.7	--	--	Horizontal

Channel 40

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2441.0	28.9	28.0	56.9	--	--	Horizontal

Channel 79

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
2480.0	29.1	28.0	57.1	--	--	Horizontal

Remarks:

* Denotes restricted band of operation.
Measurements were made using a peak detector. Any emission less than 1000MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty : 30MHz to 1GHz 4.9dB
1GHz to 6GHz 4.02dB
6GHz to 18GHz 4.03dB

Result of Band-edge measurement:

Bluetooth Communication mode (GFSK mode) (out of band measurement):

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
2398.0	2.3	28.0	30.3	32.7	5,000.0	Vertical
2486.0	2.9	28.0	30.9	35.1	5,000.0	Vertical

Field Strength of Spurious Emissions Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
2398.0	0.7	28.0	28.7	27.2	500.0	Vertical
2486.0	1.3	28.0	29.3	29.2	500.0	Vertical

Bluetooth Communication mode (GFSK mode) (over 1GHz out of band measurement):

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
4804.1	3.6	32.7	36.3	65.3	5,000.0	Vertical
4882.1	3.3	32.8	36.1	63.8	5,000.0	Vertical
4960.1	5.1	33.0	38.1	80.4	5,000.0	Vertical

Field Strength of Spurious Emissions Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
4804.1	-0.4	32.7	32.3	41.2	500.0	Vertical
4882.1	-0.7	32.8	32.1	40.3	500.0	Vertical
4960.1	0.1	33.0	33.1	45.2	500.0	Vertical

Bluetooth Communication mode (π/4-DQPSK mode) (out of band measurement):

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
2390.0	2.1	28.0	30.1	32.0	5,000.0	Vertical
2484.0	2.4	28.0	30.4	33.1	5,000.0	Vertical

Field Strength of Spurious Emissions Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
2390.0	0.7	28.0	28.7	27.2	500.0	Vertical
2484.0	1.1	28.0	29.1	28.5	500.0	Vertical

Bluetooth Communication mode (π/4-DQPSK mode) (over 1GHz out of band measurement):

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
4804.1	3.5	32.7	36.2	64.6	5,000.0	Vertical
4882.1	3.1	32.8	35.9	62.4	5,000.0	Vertical
4960.1	4.7	33.0	37.7	76.7	5,000.0	Vertical

Field Strength of Spurious Emissions Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
4804.1	-0.5	32.7	32.2	40.7	500.0	Vertical
4882.1	-0.6	32.8	32.2	40.7	500.0	Vertical
4960.1	-0.1	33.0	32.9	44.2	500.0	Vertical

Bluetooth Communication mode (8DPSK mode) (out of band measurement):

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
2390.0	2.3	28.0	30.3	32.7	5,000.0	Vertical
2485.0	2.1	28.0	30.1	32.0	5,000.0	Vertical

Field Strength of Spurious Emissions Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
2390.0	0.7	28.0	28.7	27.2	500.0	Vertical
2485.0	0.9	28.0	28.9	27.9	500.0	Vertical

Bluetooth Communication mode 8DPSK mode) (over 1GHz out of band measurement):

Field Strength of Spurious Emissions Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
4804.1	3.4	32.7	36.1	63.8	5,000.0	Vertical
4882.0	3.2	32.8	36.0	63.1	5,000.0	Vertical
4960.0	4.7	33.0	37.7	76.7	5,000.0	Vertical

Field Strength of Spurious Emissions Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	µV/m	µV/m	
4804.1	-0.3	32.7	32.4	41.7	500.0	Vertical
4882.0	-0.3	32.8	32.5	42.2	500.0	Vertical
4960.0	-0.1	33.0	32.9	44.2	500.0	Vertical

Remarks:

* Denotes restricted band of operation.
Measurements were made using a peak detector. Any emission less than 1000MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty : 30MHz to 1GHz 4.9dB
1GHz to 6GHz 4.02dB
6GHz to 18GHz 4.03dB

Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range	Quasi-Peak Limits
[MHz]	[µV/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

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 of Aux in connected to iPod (9kHz – 30MHz): Pass
Emissions detected are more than 20 dB below the limit line(s)

Result of Aux in connected to iPod (30MHz – 1GHz): Pass

Field Strength of Spurious Emissions Quasi-Peak						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
48.0	27.0	10.1	37.1	40.0	2.9	Vertical
144.0	25.6	9.8	35.4	43.5	8.1	Horizontal
240.0	20.1	13.7	33.8	46.0	12.2	Horizontal
264.0	19.9	14.4	34.3	46.0	11.7	Horizontal
336.0	17.2	17.1	34.3	46.0	11.7	Horizontal
288.0	23.1	15.2	38.3	46.0	7.7	Horizontal

Result of Aux in connected to iPod (1GHz – 26GHz): Pass
Emissions detected are more than 20 dB below the limit line(s)

Result of USB mode (connected to USB storage) (9kHz – 30MHz): Pass
Emissions detected are more than 20 dB below the limit line(s)

Result of USB mode (connected to USB storage) (30MHz – 1GHz): Pass

Field Strength of Spurious Emissions						
Quasi-Peak						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
119.9	34.0	9.1	43.1	43.5	0.4	Horizontal
150.0	24.5	9.6	34.1	43.5	9.4	Vertical
239.8	29.5	13.7	43.2	46.0	2.8	Horizontal
359.8	24.0	17	41.0	46.0	5.0	Vertical
599.6	22	22.1	44.1	46.0	1.9	Vertical
720.0	21.5	23.5	45.0	46.0	1.0	Vertical
839.5	17.7	25.7	43.4	46.0	2.6	Vertical

Result of USB mode (connected to USB storage) (1GHz – 26GHz): Pass
Emissions detected are more than 20 dB below the limit line(s)

Result of FM mode: Pass

Field Strength of Spurious Emissions						
Quasi-Peak						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBµV	dB/m	dBµV/m	dBµV/m	dBµV/m	
48.0	26.1	10.1	36.2	40.0	3.8	Vertical
144.0	23.6	8.8	32.4	43.5	11.1	Vertical
120.0	20.6	8.1	28.7	43.5	14.8	Vertical
264.0	20.7	14.4	35.1	46.0	10.9	Horizontal
288.0	18.9	15.2	34.1	46.0	11.9	Horizontal
336.0	21.0	17.1	38.1	46.0	7.9	Horizontal

Remarks:
* Denotes restricted band of operation.
Measurements were made using a peak detector. Any emission less than 1000MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty : 30MHz to 1GHz 4.9dB
1GHz to 6GHz 4.02dB
6GHz to 18GHz 4.03dB

3.1.4 20dB Bandwidth Measurement

Test Requirement:	FCC 47CFR 15.247(a)(1)
Test Method:	ANSI C63.4:2009
Test Date:	2012-12-11
Mode of Operation:	Communication Mode (8DPSK)

Remark:
The result has been done on all the possible configurations for searching the worst cases.

Test Method:

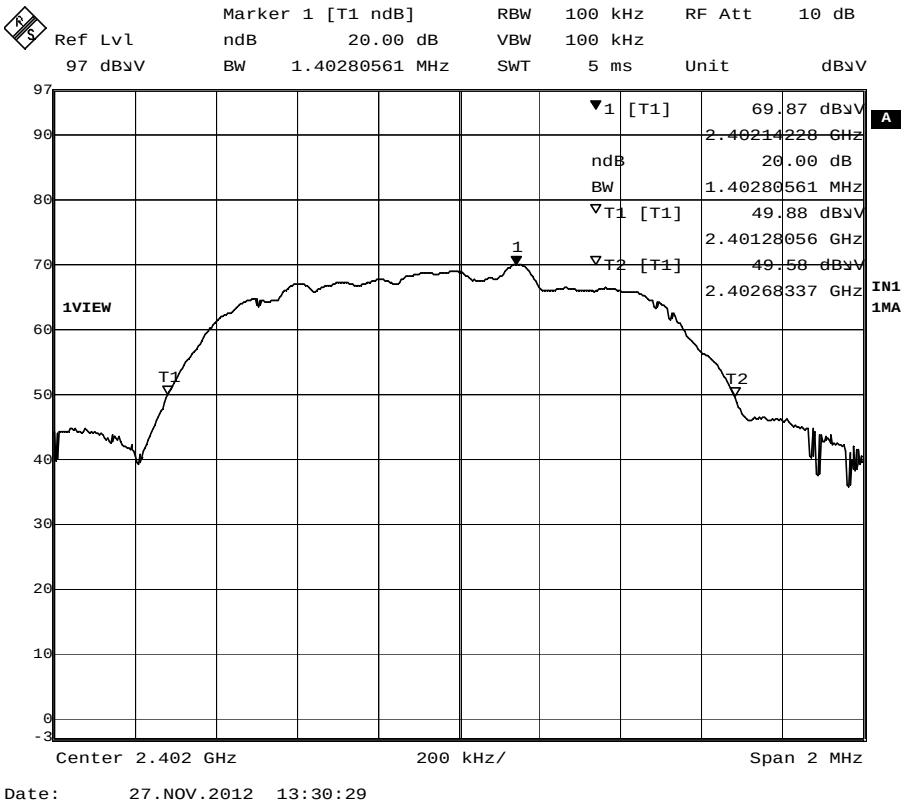
The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with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

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

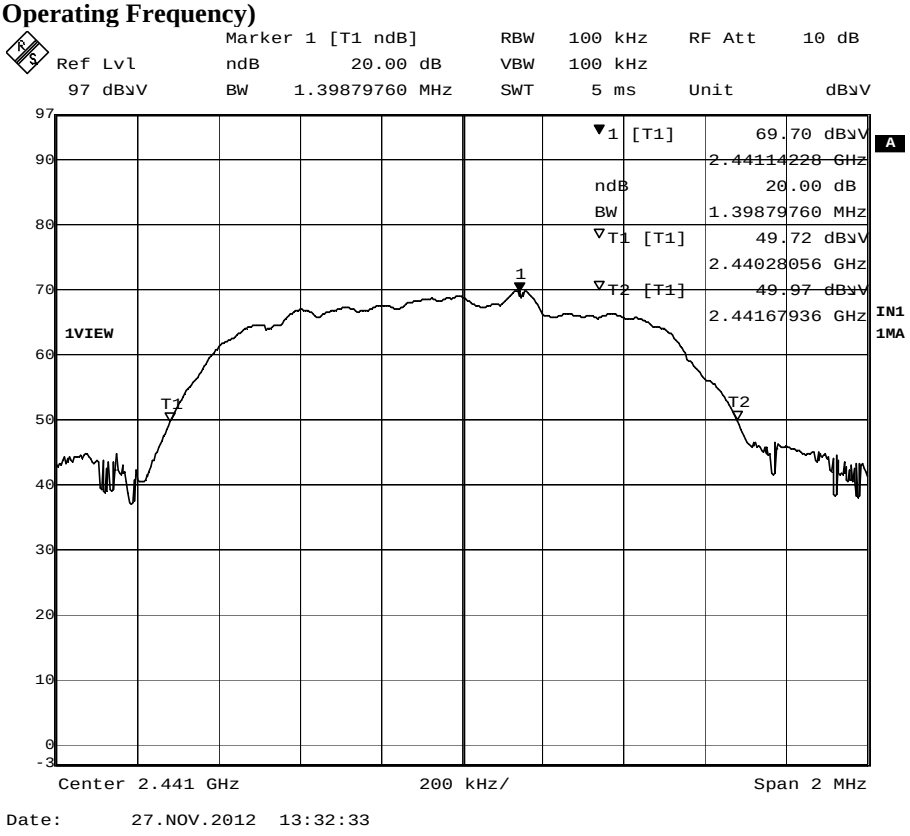
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.40	Within 2400-2483.5

(Lowest Operating Frequency)



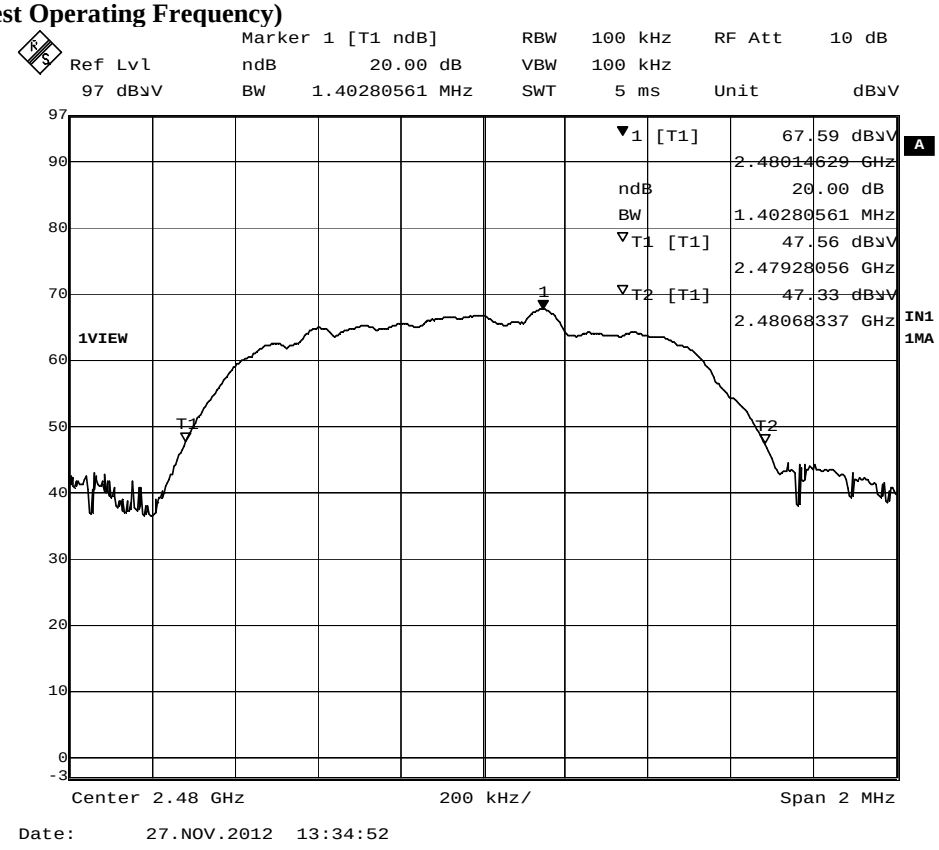
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.40	Within 2400-2483.5

(Middle Operating Frequency)



Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.40	Within 2400-2483.5

(Highest Operating Frequency)



Channel Centre Frequency

Requirements:
Frequency hopping system in the 2400-2483.5MHz band shall use at least 79 (Channel 0 to 78) non-overlapping channels.

The EUT operates in according with the Bluetooth system specification within the 2400 - 2483.5 MHz frequency band.
RF channels for Bluetooth systems are spaced 1 MHz and are ordered in channel number k. In order to comply with out-of-band regulations, a lower frequency guard band of 2.0 MHz and a higher frequency guard band of 3.5MHz is used.

The operating frequencies of each channel are as follows:

First RF channel start from 2400MHz + 2MHz guard band = 2402MHz
Frequency of RF Channel = 2402+k MHz, k = 0,…,78 (Channel separation = 1MHz)

Hopping Channel Separation

Requirements:

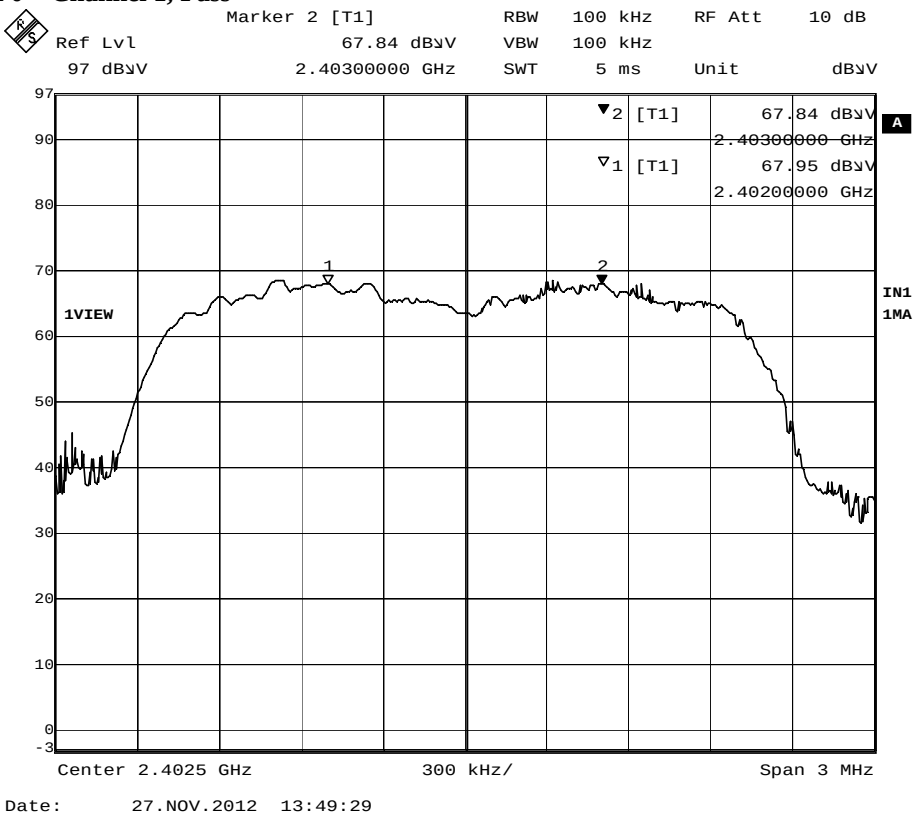
Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Limit:

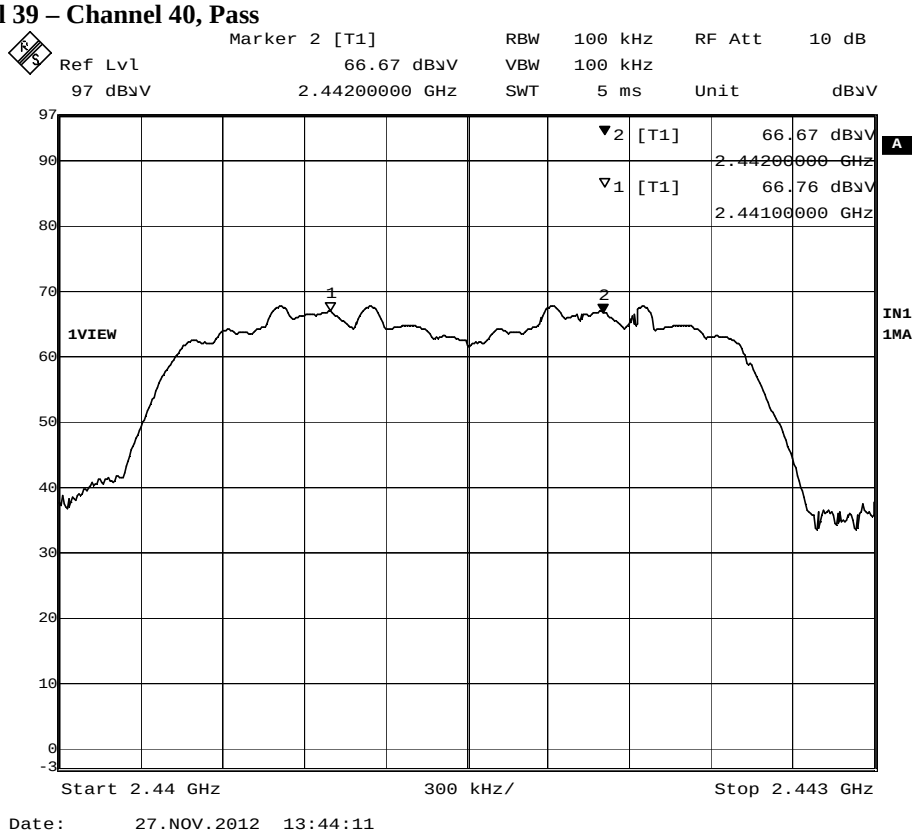
The measured minimum bandwidth * 2/3 = 1.320MHz * 2/3 = 880kHz

Channel separation = 1MHz (>880kHz)

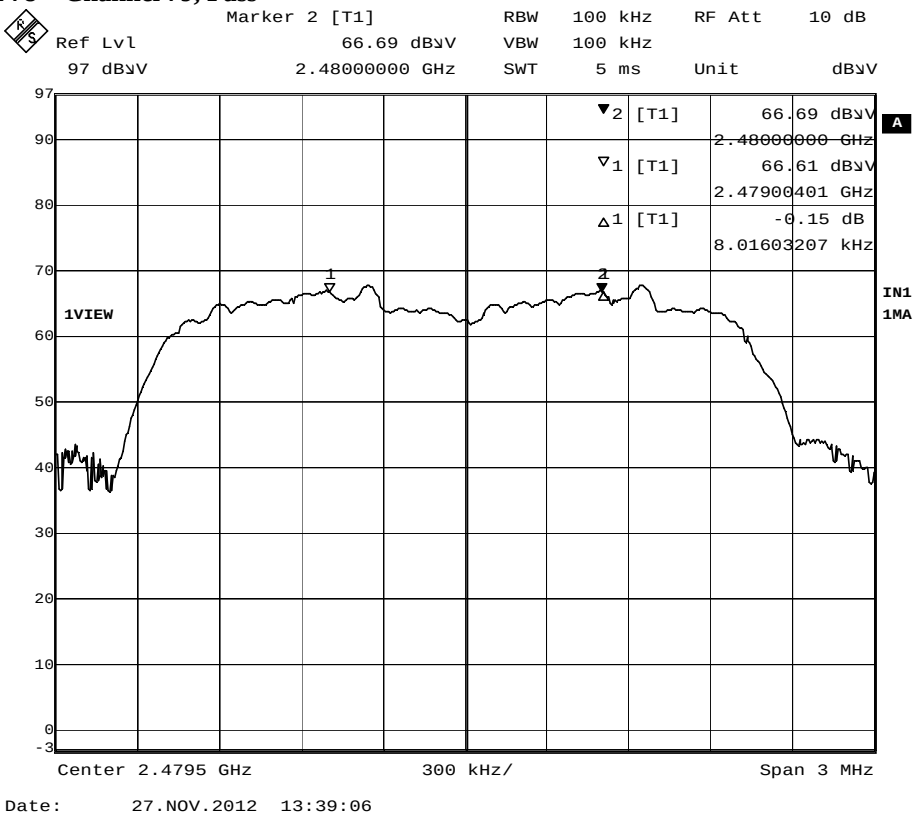
Channel 0 – Channel 1, Pass



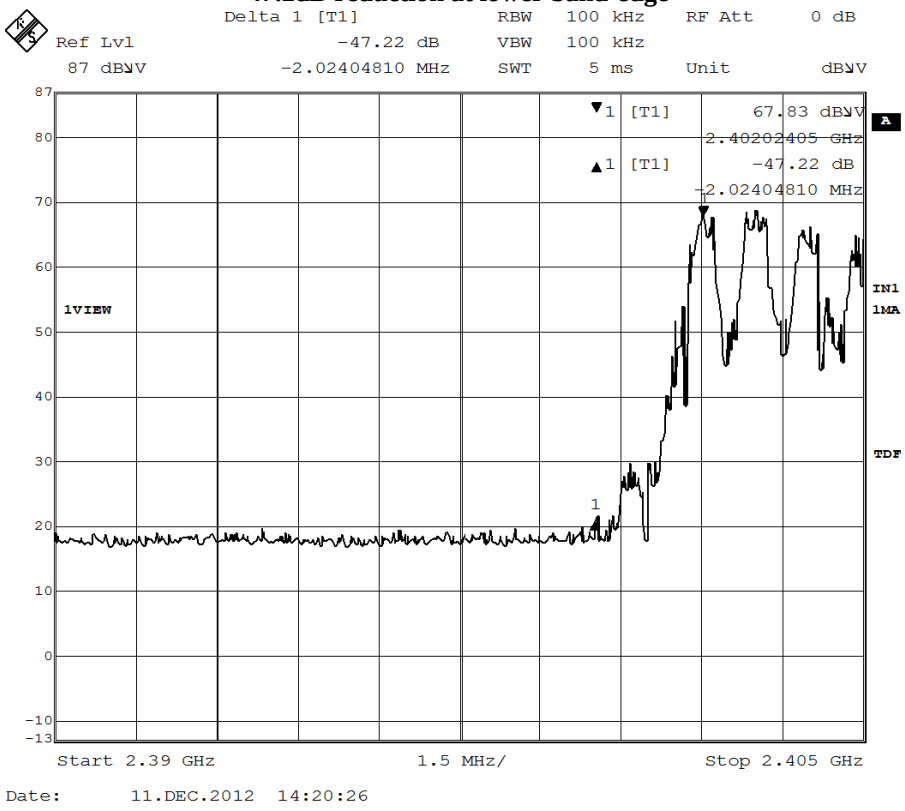
Channel 39 – Channel 40, Pass



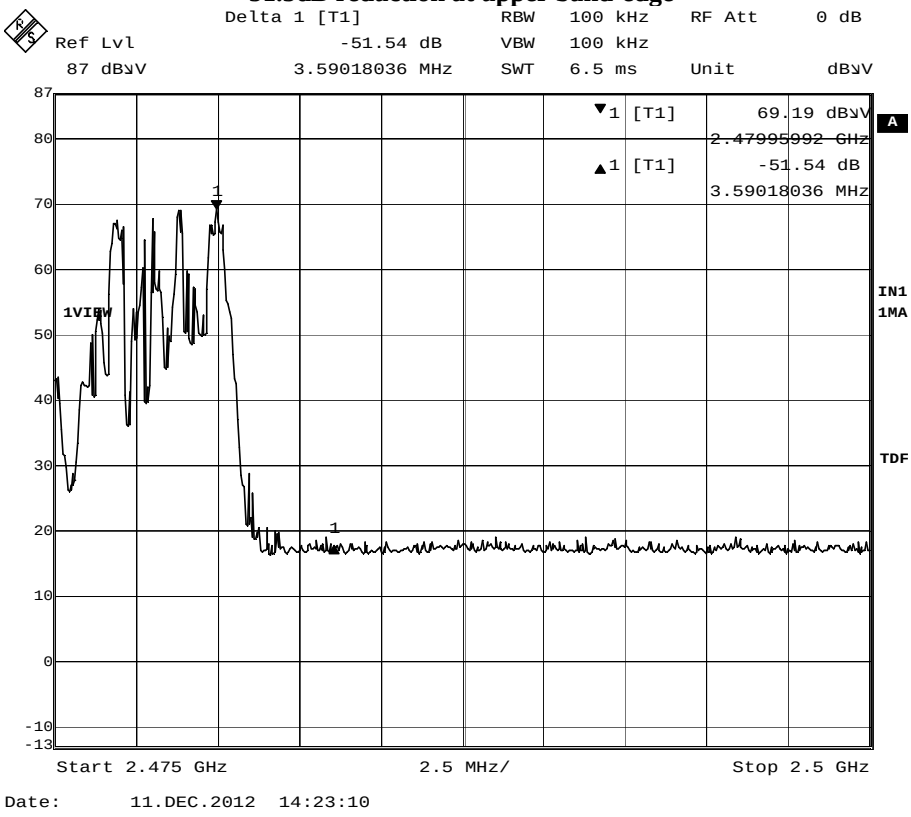
Channel 78 – Channel 79, Pass



47.2dB reduction at lower band-edge



51.5dB reduction at upper band-edge



Antenna Requirement

Test Requirements: § 15.203

Test Specification:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Test Results:

The EUT has 1 [Inverted-F Antenna (PCB layout)] which is permanently attached to the main unit and attached on PCB board, the antenna gain = 0dBi. All component install on inside of EUT. User unable to remove or changed the Antenna.

Pseudorandom Hopping Algorithm

Requirements:

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

EUT Pseudorandom Hopping Algorithm

The EUT is a Bluetooth device, the Pseudo-random hopping pattern; hopping characteristics and algorithm are based on the Bluetooth specification.

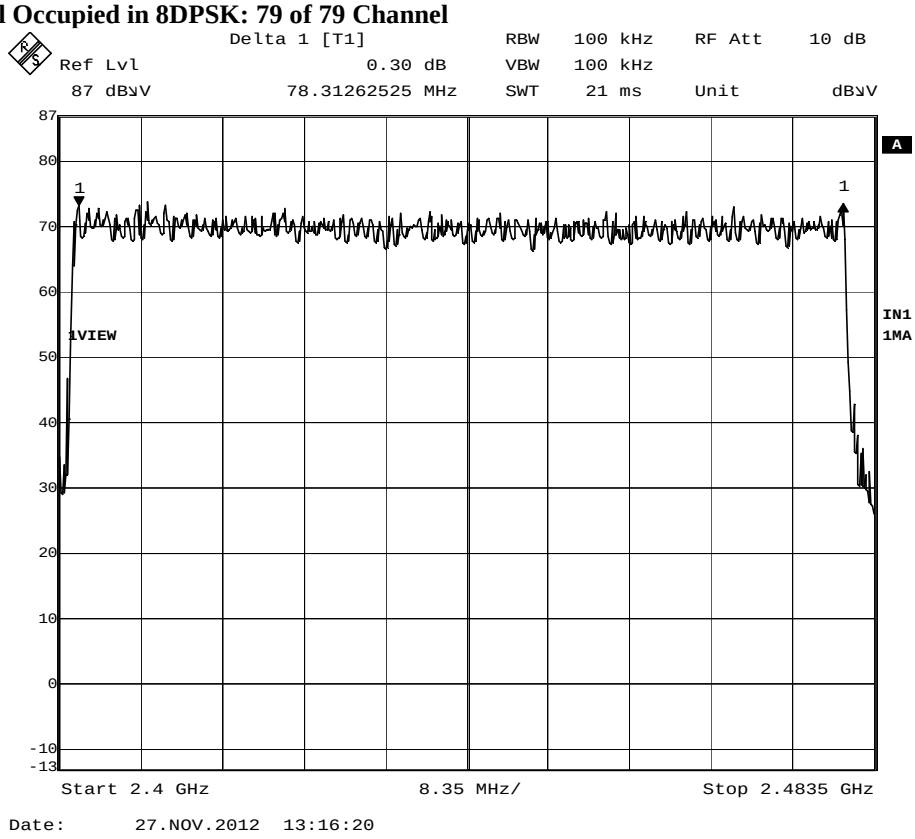
Occupancy Time

Requirements:

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channel employed.
No requirements for Digital Transmission System.

Measurement Data:

Channel Occupied in 8DPSK: 79 of 79 Channel



DH5 Packet:

DH5 Packet permit maximum 1600/79/6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times 3.37 x 31.6 = 106.6 within 31.6 seconds

Fig. A
[Pulse duration of Lowest Channel]

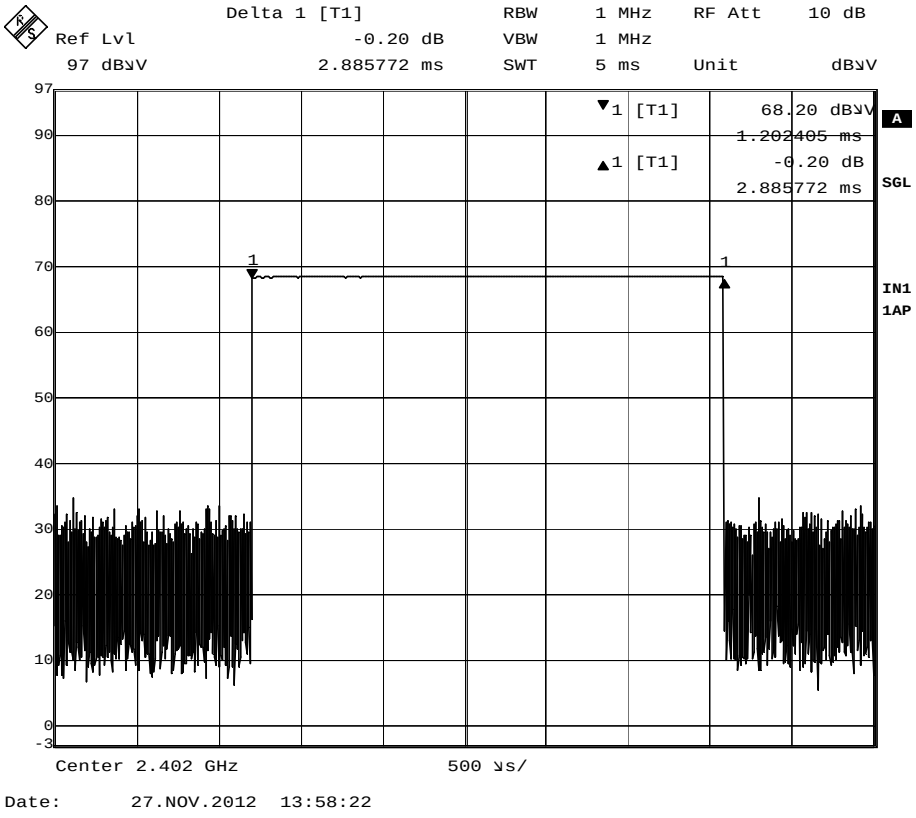


Fig. B
[Pulse duration of Middle Channel]

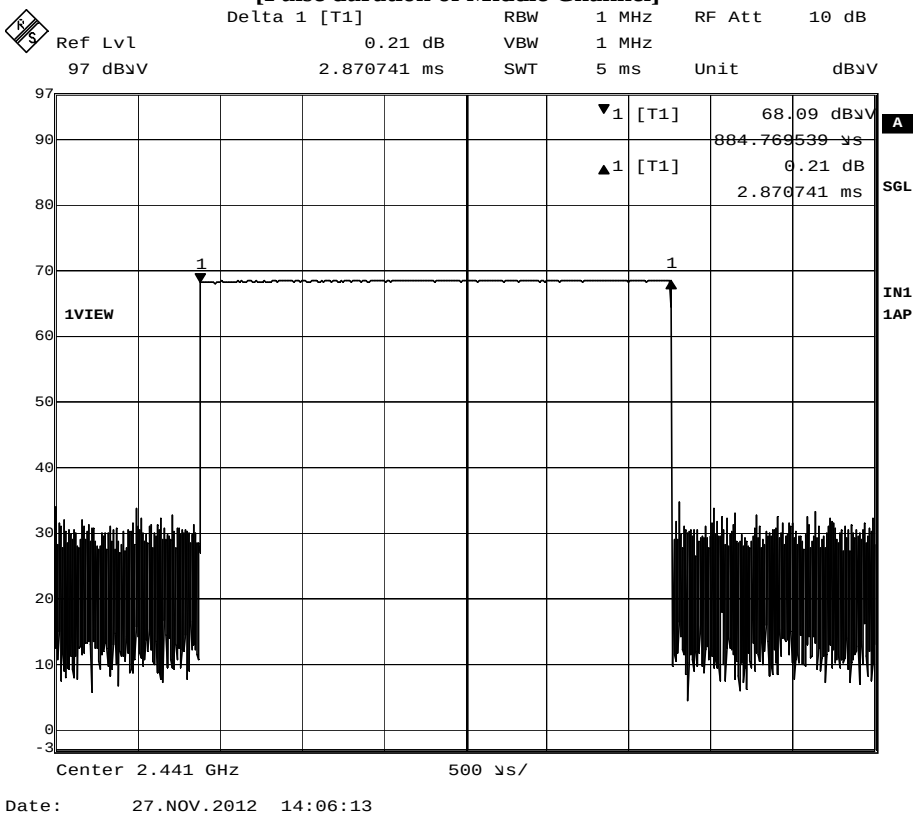
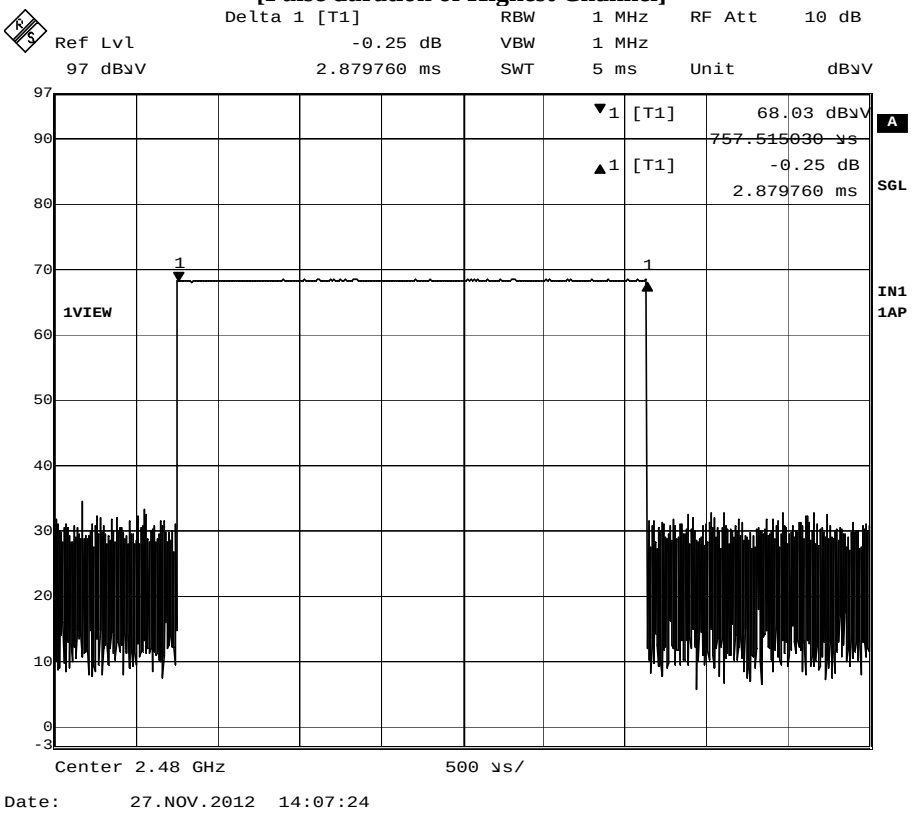


Fig. C
[Pulse duration of Highest Channel]



DH3 Packet:

DH3 Packet permit maximum 1600/79/4 = 5.06 hops per second in each channel (3 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times 5.06 x 31.6 = 160 within 31.6 seconds

Fig. D
[Pulse duration of Lowest Channel]

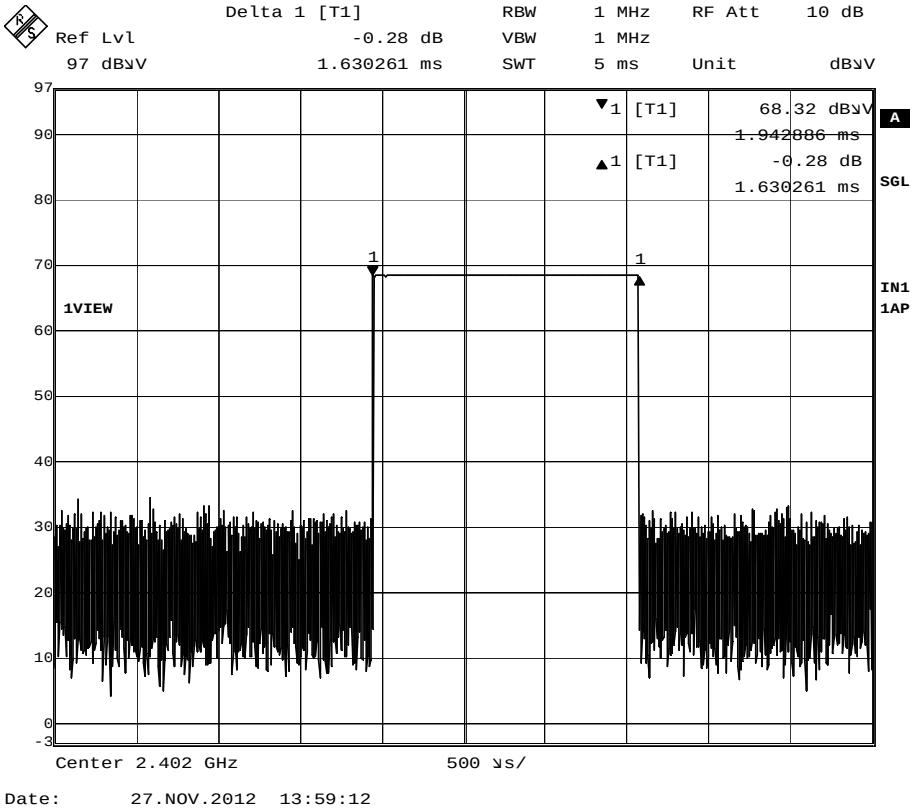


Fig. E
[Pulse duration of Middle Channel]

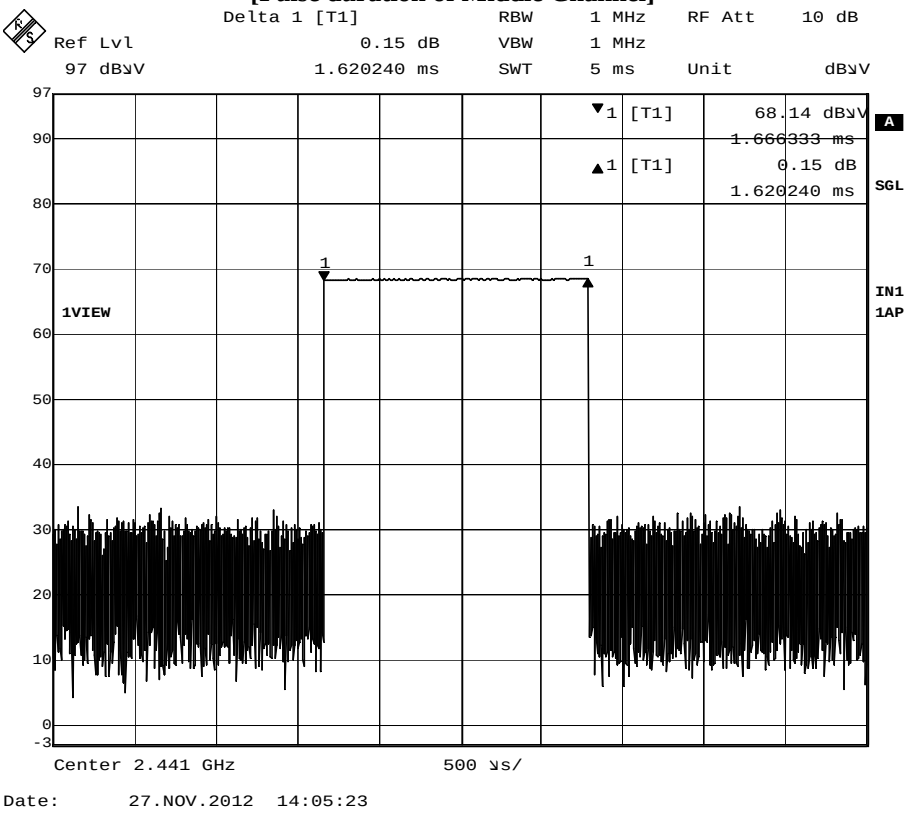
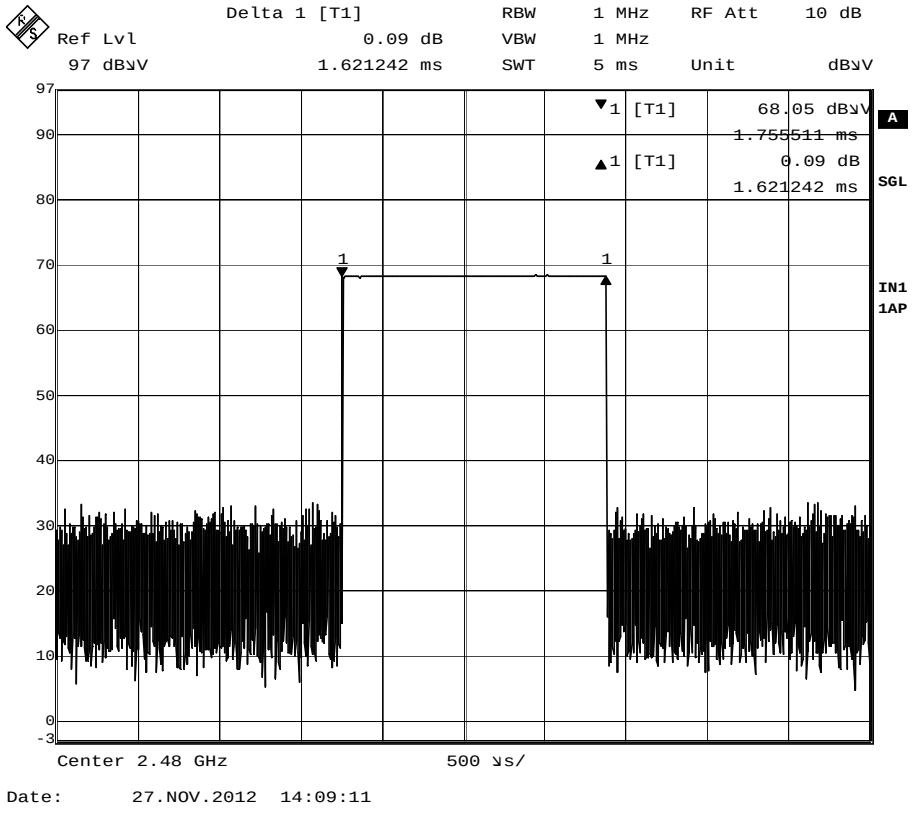


Fig. F
[Pulse duration of Highest Channel]



DH1 Packet:

DH1 Packet permit maximum 1600/79/2 = 10.12 hops per second in each channel (3 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times 10.12 x 31.6 = 320 within 31.6 seconds

Fig. G
[Pulse duration of Lowest Channel]

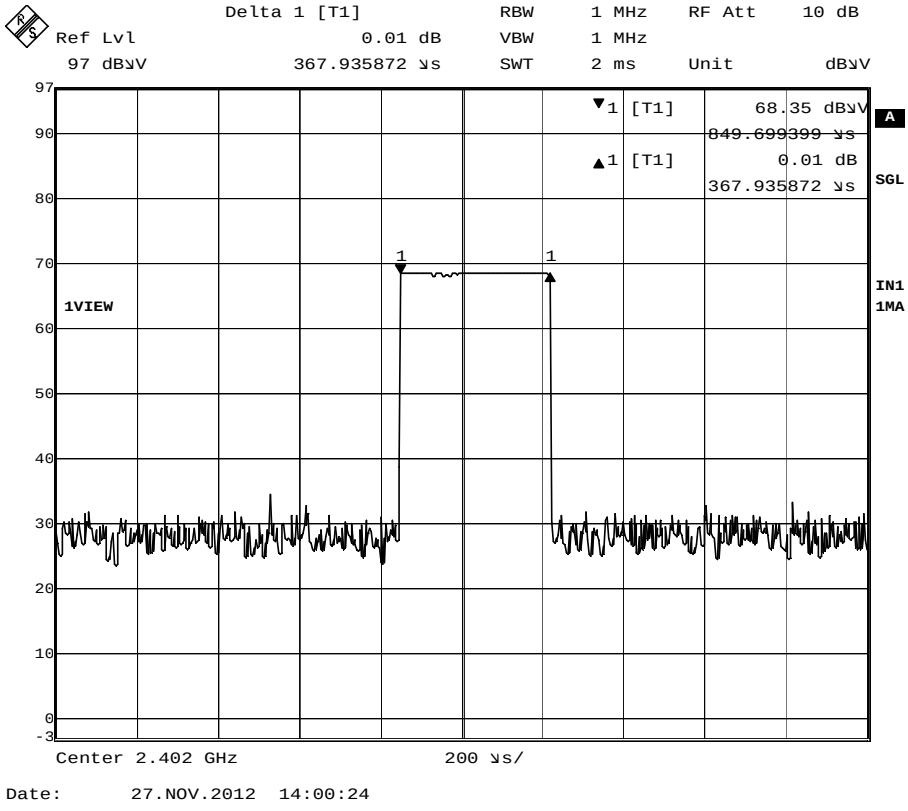


Fig. H
[Pulse duration of Middle Channel]

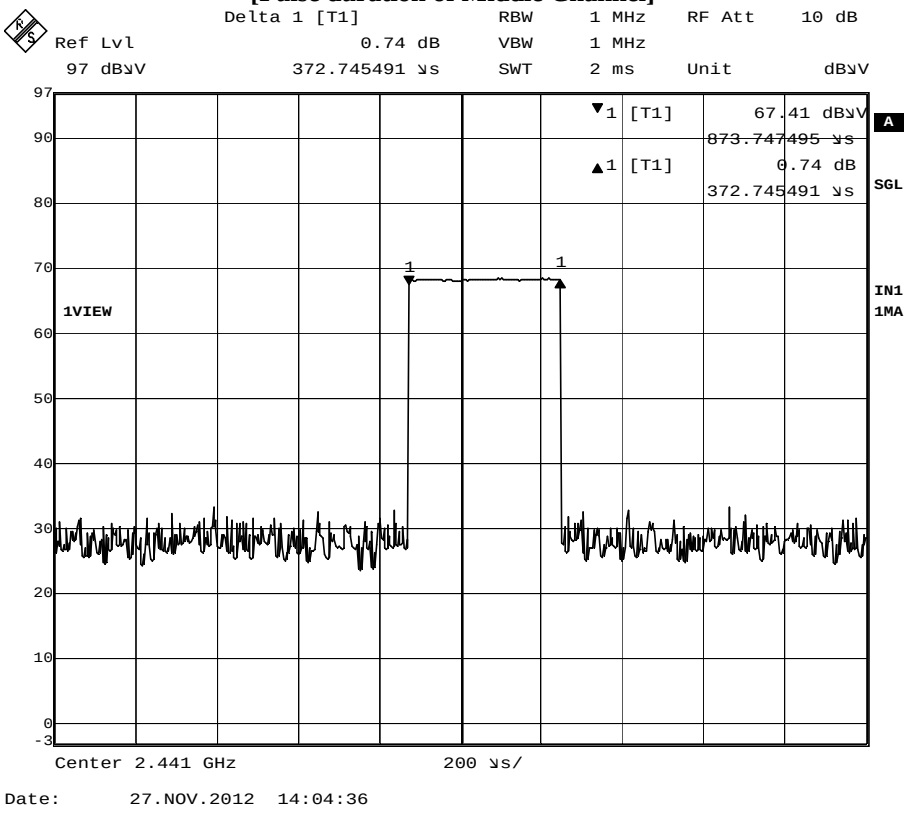
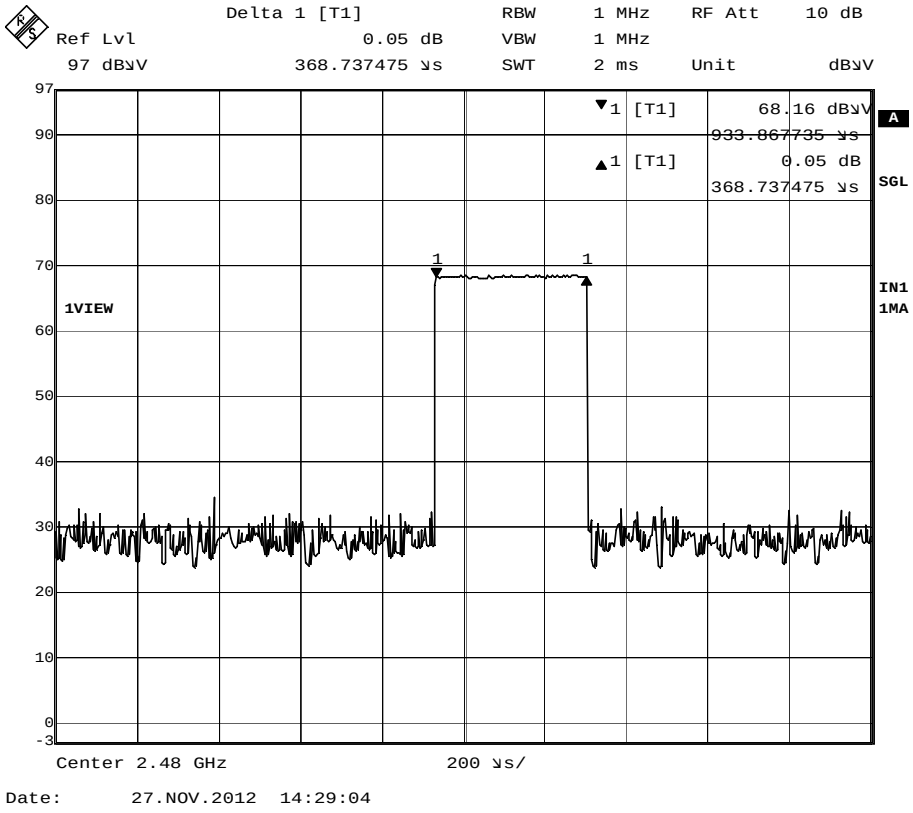


Fig. I
[Pulse duration of Highest Channel]



Time of occupancy:

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Results
DH5	2402	2.886	0.308	0.400	Complies
DH5	2442	2.871	0.308	0.400	Complies
DH5	2480	2.880	0.308	0.400	Complies
DH3	2402	1.630	0.261	0.400	Complies
DH3	2442	1.620	0.263	0.400	Complies
DH3	2480	1.621	0.261	0.400	Complies
DH1	2402	0.368	0.116	0.400	Complies
DH1	2442	0.373	0.116	0.400	Complies
DH1	2480	0.369	0.116	0.400	Complies

Appendix A

List of Measurement Equipment

Radiated Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM299	DOUBLE-RIDGED WAVEGUIDE HORN ANTENNA	ETS-LINDGREN	3115	00114120	2012/01/25	2014/01/25
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A
EM216	MINI MAST SYSTEM	EMCO	2075	00026842	N/A	N/A
EM217	ELECTRIC POWERED TURNTABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANECHOIC CHAMBER	ETS-LINDGREN	FACT-3	--	2012/10/25	2013/10/25
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2012/05/03	2013/05/03
EM022	LOOP ANTENNA	EMCO	6502	1189-2424	2011/09/14	2013/09/14
EM300	PYRAMIDAL STANDARD GAIN HORN ANTENNA	ETS-LINDGREN	3160-09	00130130	2012/01/24	2014/01/24

Appendix B

Ancillary Equipment

ITEM NO.	DESCRIPTION	MODEL NO.	FCC ID	REMARK
1	iPod	A1137	N/A	Serial No. 5U603KHUSZB Rating: 5-30Vd.c. 1A Max.

Remarks:-

CM Corrective Maintenance
N/A Not Applicable or Not Available
TBD To Be Determined

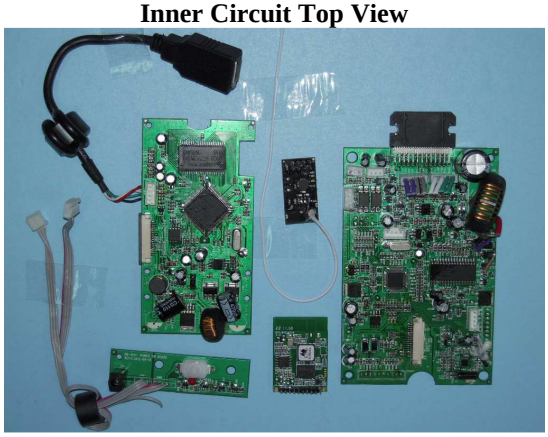
Appendix C

Photographs of EUT

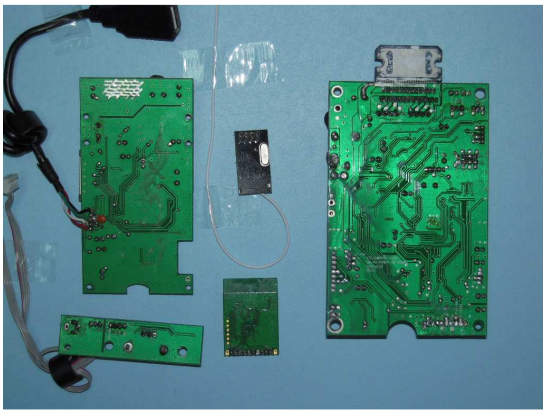
Front View of the product

Rear View of the product

Inner Circuit Top View

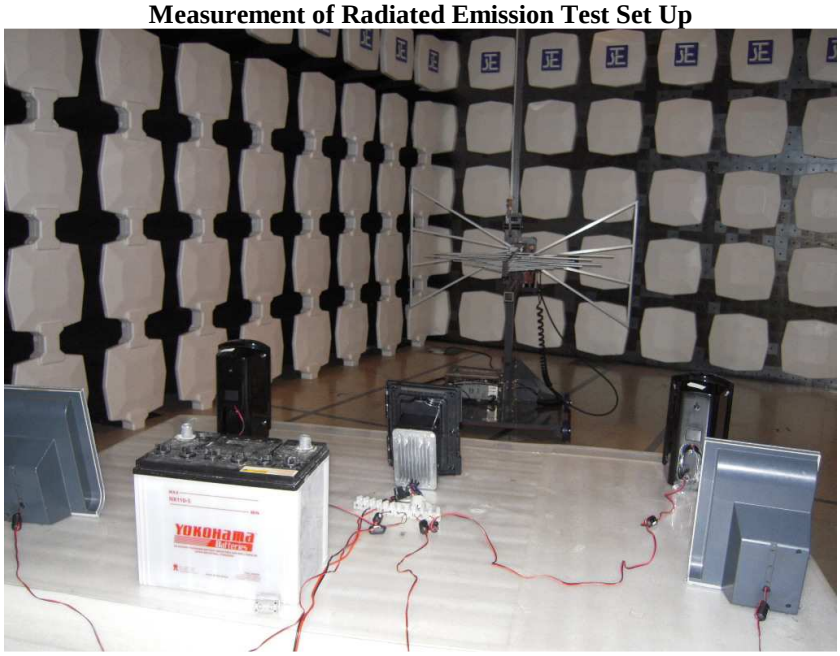


Inner Circuit Bottom View

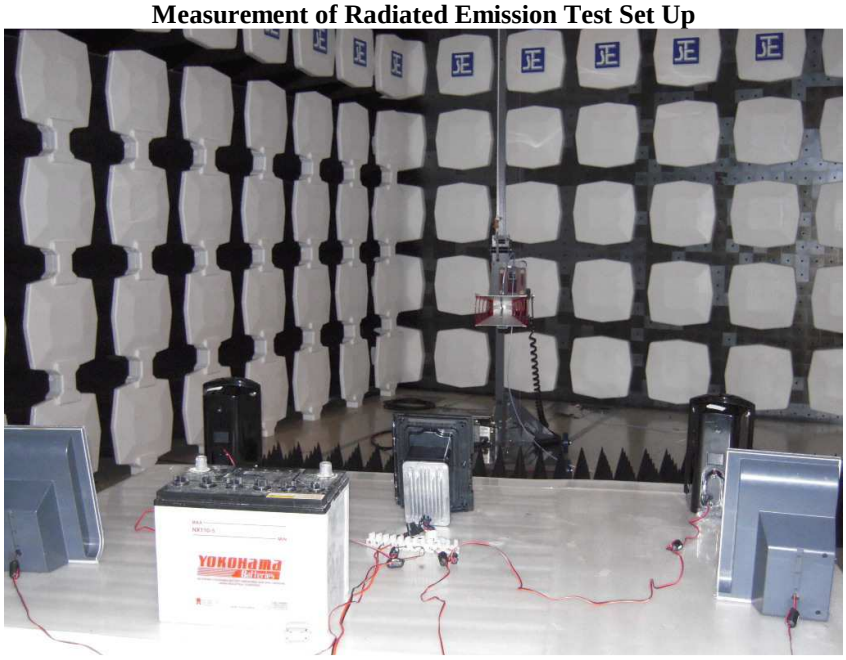


Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Radiated Emission Test Set Up



******* End of Test Report *******