STC Test Report

Date : 2013-05-29
No. : DM110485

Applicant (SHF513): Hip Shing Electronics Ltd.
Units 1, 2 & 3, 20/F., New Treasure Centre, 10., Ng Fong Street, San Po Kong, Kowloon, Hong Kong

Manufacturer: Dongguan Zhi Cheng Electronic Products Co., Ltd.
China, Dongguanshi, Tangxia, Ping San 188 Ind. Zone

Description of Sample(s):

Product:	AUDIO SPEAKER UNIT
Brand Name:	Damson
Model Number:	DA3D05
FCC ID:	BZADDA3D05

Date Sample(s) Received: 2013-03-07

Date Tested: 2013-03-08 to 2013-05-28

Investigation Requested: Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2012. FCC Pubic Notice DA 00-705and 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): Bluetooth (1MBps): GFSK
Bluetooth 2.1 EDR(2 MBps): π/4-DQPSK
Bluetooth 2.1 EDR (3 MBps): 8DPSK

LONG Yun Jian, Along
Authorized Signatory
ElectroMagnetic Compatibility Department
For and on behalf of
STC (Dongguan) Company Limited

CONTENT:

1.0 General Details

1.1 Test Laboratory

STC (Dongguan) Company Limited
EMC Laboratory
68 Fumin Nan Road, Dalang, Dongguan, China

Telephone: (86 769) 81119888
Fax: (86 769) 81116222

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

Product:	AUDIO SPEAKER UNIT
Manufacturer:	Dongguan zhi cheng electronic products co., Ltd. China, Dongguanshi, Tangxia, Ping San 188 Ind. Zone
Brand Name:	Damson
Model Number:	DA3D05
Input Voltage:	18Vd.c. with Jack

The AC/DC adaptor was provided by the applicant with following details:
Brand name: GPE; Model no.: GPE248-180133-Z; Input: 100-240Va.c. 50/60Hz 0.75A; Output: 18Vd.c. 1330mA 23.94W.

1.2.1 Description of EUT Operation

The Equipment Under Test (EUT) is a Hip Shing Electronics Ltd., AUDIO SPEAKER UNIT, it is Audio System, modulation by IC; and type is frequency hopping speed spectrum Modulation.

1.3 Date of Order

2013-03-07

1.4 Submitted Sample(s):

1 Sample

1.5 Test Duration

2013-03-08 to 2013-05-28

1.6 Country of Origin

China

1.7 RF Module Details

Module Model Number:	JS-BTM8645
Module FCC ID:	
Module Transmission Type:	Bluetooth V4.0
Modulation:	FHSS (GFSK / π/4-DQPSK / 8DPSK)
Data Rates:	Bluetooth (1MBps): GFSK
	Bluetooth 2.1 EDR(2 MBps): π/4-DQPSK
	Bluetooth 2.1 EDR (3 MBps): 8DPSK
Frequency Range:	2400-2483.5MHz
Carrier Frequencies:	2402MHz – 2480MHz

Module Specification (specification provided by manufacturer)

1.8 Antenna Details

Antenna Type:	PCB layout internal antenna
Antenna Length:	17mm
Antenna Gain:	0.0dBi

2.0 Technical Details

2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2012 Regulations. FCC Pubic Notice DA 00-705 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
Maximum Peak Conducted Output Power	FCC 47CFR 15.247(b)(1)	FCC Pubic Notice DA 00-705	N/A	☒	☐	☐
Radiated Spurious Emissions	FCC 47CFR 15.209	ANSI C63.4:2009	N/A	☒	☐	☐
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.4:2009	N/A	☒	☐	☐
Number of Hopping Frequency	FCC 47CFR 15.247(a)(2)(b)(1)	FCC Pubic Notice DA 00-705	N/A	☒	☐	☐
20dB Bandwidth	FCC 47CFR 15.247(a)(2)	FCC Pubic Notice DA 00-705	N/A	☒	☐	☐
Hopping Channel Separation	FCC 47CFR 15.247(a)(1)	FCC Pubic Notice DA 00-705	N/A	☒	☐	☐
Band-edge compliance of RF Conducted Emission	FCC 47CFR 15.247(c)	FCC Pubic Notice DA 00-705	N/A	☒	☐	☐
Time of Occupancy (Dwell Time)	FCC 47CFR 15.247(a)(1)(iii)	FCC Pubic Notice DA 00-705	N/A	☒	☐	☐
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	☒	☐	☐
RF Exposure	FCC 47CFR 15.247(i)	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
Maximum Peak Conducted Output Power	GFSK / π/4-DQPSK / 8DPSK	1MBps / 2MBps / 3MBps
Hopping Channel Separation	GFSK / π/4-DQPSK/ 8DPSK	1MBps / 2MBps / 3MBps
Number of Hopping Frequency	π/4-DQPSK	2MBps
Time of Occupancy(Dwell Time)	DH1 / DH3 / DH5	2MBps
Radiated Spurious Emissions	GFSK / π/4-DQPSK/ 8DPSK	1MBps / 2MBps / 3MBps
Band-edge compliance of Conducted Emission	π/4-DQPSK	2MBps

3.0 Test Results

3.1 Emission

3.1.1 Maximum Peak Conducted Output Power

Test Requirement:	FCC 47CFR 15.247(b)(1)
Test Method:	FCC Pubic Notice DA 00-705
Test Date:	2013-03-26
Mode of Operation:	Tx mode

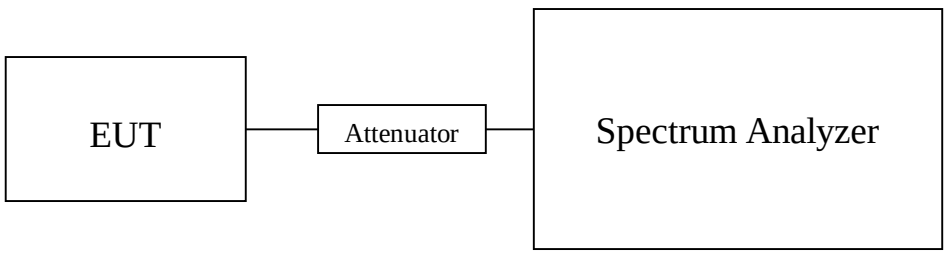
Test Method:

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 Maximum Peak Conducted Output Power [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

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.00093

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.00193

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.00251

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

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.00166

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2442	0.00286

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.00347

Results of Bluetooth Communication mode (8 DPSK) (Fundamental Power): Pass

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.00100

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2442	0.00209

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.00264

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

Remark:
1. All test data for each data rate were verified, but only the worst case was reported.
2. The EUT is programmed to transmit signals continuously for all testing.

3.1.2 Radiated Spurious Emissions

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.4:2009
Test Date:	2013-03-23
Mode of Operation:	Bluetooth Communication mode （GFSK / π/4-DQPSK/ 8DPSK）

Test Method:

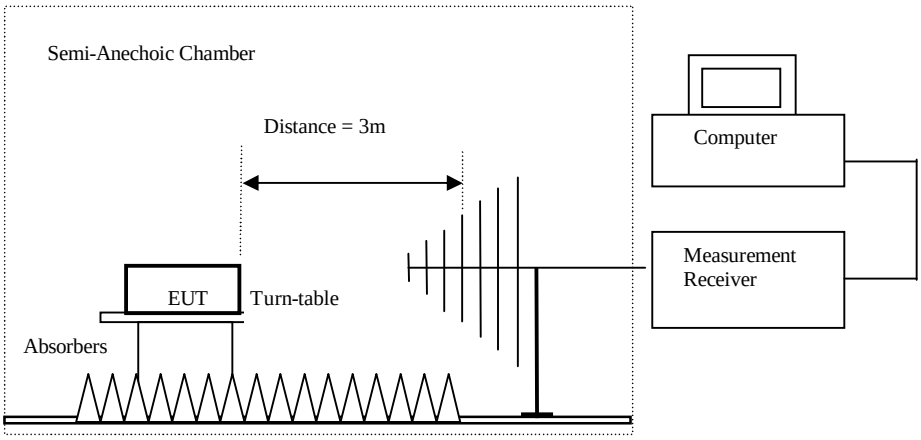
The sample was placed 0.8m above the ground plane of semi-anechoic Chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarization s. The emissions worst-case are shown in Test Results of the following pages.

*: Semi-anechoic chamber located on the STC (Dongguan) Company Ltd. 68 Fumin Nan Road, Dalang, Dongguan, Guangdong, PRC with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 629686.

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:	1MHz
	VBW:	3MHz
	Sweep:	Auto
	Span:	Fully capture the emissions being measured
	Trace:	Max. hold

Test Setup:



- Absorbers placed on top of the ground plane are for measurements above 1000MHz only.
- Measurements between 30MHz to 1000MHz made with Bi-log antennas, above 1000MHz horn antennas are used, 9kHz to 30MHz loop antennas are used.

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 mode / π/4-DQPSK mode / 8 DPSK) (9kHz – 30MHz): Pass

The Low Frequency, which started from 9kHz to 30MHz, was Pre-scan and the result which was more than 20dB lower than the Limit line.

Result of Tx mode (2402.0 MHz) (GFSK mode) (Above 1GHz): Pass

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	
4804.0	11.2	41.5	52.7	74.0	21.3	Horizontal
4804.0	13.6	41.5	55.1	74.0	18.9	Vertical
7206.0	5.9	48.8	54.7	74.0	19.3	Horizontal
7206.0	6.8	48.8	55.6	74.0	18.4	Vertical

Result of Tx mode (2402.0 MHz) (GFSK mode) (Above 1GHz): Pass

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	
4804.0	-2.6	41.5	38.9	54.0	15.1	Horizontal
4804.0	-0.3	41.5	41.2	54.0	12.8	Vertical
7206.0	-8.6	48.8	40.2	54.0	13.8	Horizontal
7206.0	-7.9	48.8	40.9	54.0	13.1	Vertical

Result of Tx mode (2441.0 MHz) (GFSK mode) (Above 1GHz): Pass

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	
4882.0	12.1	41.4	53.5	74.0	20.5	Horizontal
4882.0	14.5	41.4	55.9	74.0	18.1	Vertical
7323.0	4.5	48.7	53.2	74.0	20.8	Horizontal
7323.0	6.9	48.7	55.6	74.0	18.4	Vertical

Result of Tx mode (2441.0 MHz) (GFSK mode) (Above 1GHz): Pass

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	
4882.0	-2.3	41.4	39.1	54.0	14.9	Horizontal
4882.0	-0.1	41.4	41.3	54.0	12.7	Vertical
7323.0	-10.1	48.7	38.6	54.0	15.4	Horizontal
7323.0	-7.5	48.7	41.2	54.0	12.8	Vertical

Result of Tx mode (2480.0 MHz) (GFSK mode) (Above 1GHz): Pass

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	
4960.0	12.4	41.4	53.8	74.0	20.2	Horizontal
4960.0	14.2	41.4	55.6	74.0	18.4	Vertical
7440.0	3.8	48.6	52.4	74.0	21.6	Horizontal
7440.0	6.5	48.6	55.1	74.0	18.9	Vertical

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	
2400.0	23.5	35.4	58.9	74.0	15.1	Vertical
2483.5	15.0	35.4	50.4	74.0	23.6	Vertical

Result of Tx mode (2480.0 MHz) (GFSK mode) (Above 1GHz): Pass

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	
4960.0	-1.7	41.4	39.7	54.0	14.3	Horizontal
4960.0	-0.9	41.4	40.5	54.0	13.5	Vertical
7440.0	-10.3	48.6	38.3	54.0	15.7	Horizontal
7440.0	-7.1	48.6	41.5	54.0	12.5	Vertical

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	
2400.0	5.1	35.4	40.5	54.0	13.5	Vertical
2483.5	-2.8	35.4	32.6	54.0	21.4	Vertical

Result of Tx mode (2402.0 MHz) (π/4-DQPSK mode) (Above 1GHz): Pass

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	
4804.0	13.9	41.5	55.4	74.0	18.6	Horizontal
4804.0	14.6	41.5	56.1	74.0	17.9	Vertical
7206.0	4.7	48.8	53.5	74.0	20.5	Horizontal
7206.0	7.6	48.8	56.4	74.0	17.6	Vertical

Result of Tx mode (2402.0 MHz) (π/4-DQPSK mode) (Above 1GHz): Pass

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	
4804.0	-1.6	41.5	39.9	54.0	14.1	Horizontal
4804.0	0.7	41.5	42.2	54.0	11.8	Vertical
7206.0	-10.0	48.8	38.8	54.0	15.2	Horizontal
7206.0	-6.2	48.8	42.6	54.0	11.4	Vertical

Result of Tx mode (2441.0 MHz) (π/4-DQPSK mode) (Above 1GHz): Pass

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	
4882.0	12.7	41.4	54.1	74.0	19.9	Horizontal
4882.0	14.3	41.4	55.7	74.0	18.3	Vertical
7323.0	4.9	48.7	53.6	74.0	20.4	Horizontal
7323.0	6.6	48.7	55.3	74.0	18.7	Vertical

Result of Tx mode (2441.0 MHz) (π/4-DQPSK mode) (Above 1GHz): Pass

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	
4882.0	-1.6	41.4	39.8	54.0	14.2	Horizontal
4882.0	0.1	41.4	41.5	54.0	12.5	Vertical
7323.0	-9.3	48.7	39.4	54.0	14.6	Horizontal
7323.0	-8.8	48.7	39.9	54.0	14.1	Vertical

Result of Tx mode (2480.0 MHz) (π/4-DQPSK mode) (Above 1GHz): Pass

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	
4960.0	12.0	41.4	53.4	74.0	20.6	Horizontal
4960.0	14.2	41.4	55.6	74.0	18.4	Vertical
7440.0	6.2	48.6	54.8	74.0	19.2	Horizontal
7440.0	7.3	48.6	55.9	74.0	18.1	Vertical

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	
2400.0	21.4	35.4	56.8	74.0	17.2	Vertical
2483.5	19.0	35.4	54.4	74.0	19.6	Vertical

Result of Tx mode (2480.0 MHz) (π/4-DQPSK mode) (Above 1GHz): Pass

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	
4960.0	-1.7	41.4	39.7	54.0	14.3	Horizontal
4960.0	-0.5	41.4	40.9	54.0	13.1	Vertical
7440.0	-9.1	48.6	39.5	54.0	14.5	Horizontal
7440.0	-6.9	48.6	41.7	54.0	12.3	Vertical

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	
2400.0	4.3	35.4	39.7	54.0	14.3	Vertical
2483.5	3.5	35.4	38.9	54.0	15.1	Vertical

Result of Tx mode (2402.0 MHz) (8DPSK) (Above 1GHz): Pass

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	
4804.0	11.7	41.5	53.2	74.0	20.8	Horizontal
4804.0	14.8	41.5	56.3	74.0	17.7	Vertical
7206.0	5.8	48.8	54.6	74.0	19.4	Horizontal
7206.0	7.6	48.8	56.4	74.0	17.6	Vertical

Result of Tx mode (2402.0 MHz) (8DPSK) (Above 1GHz): Pass

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	
4804.0	-2.5	41.5	39.0	54.0	15.0	Horizontal
4804.0	0.6	41.5	42.1	54.0	11.9	Vertical
7206.0	-8.3	48.8	40.5	54.0	13.5	Horizontal
7206.0	-6.7	48.8	42.1	54.0	11.9	Vertical

Result of Tx mode (2441.0 MHz) (8DPSK) (Above 1GHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dBµV/m	E-Field Polarity
4882.0	12.8	41.4	54.2	74.0	19.8	Horizontal
4882.0	14.4	41.4	55.8	74.0	18.2	Vertical
7323.0	5.9	48.7	54.6	74.0	19.4	Horizontal
7323.0	7.1	48.7	55.8	74.0	18.2	Vertical

Result of Tx mode (2441.0 MHz) (8DPSK) (Above 1GHz): Pass

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dBµV/m	E-Field Polarity
4882.0	-1.5	41.4	39.9	54.0	14.1	Horizontal
4882.0	-0.7	41.4	40.7	54.0	13.3	Vertical
7323.0	-8.0	48.7	40.7	54.0	13.3	Horizontal
7323.0	-7.4	48.7	41.3	54.0	12.7	Vertical

Result of Tx mode (2480.0 MHz) (8DPSK) (Above 1GHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dBµV/m	E-Field Polarity
4960.0	13.8	41.4	55.2	74.0	18.8	Horizontal
4960.0	12.7	41.4	54.1	74.0	19.9	Vertical
7440.0	6.3	48.6	54.9	74.0	19.1	Horizontal
7440.0	5.2	48.6	53.8	74.0	20.2	Vertical

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBµV	Correction Factor dB/m	Field Strength dBµV/m	Limit @3m dBµV/m	Margin dBµV/m	E-Field Polarity
2400.0	20.1	35.4	55.5	74.0	18.5	Vertical
2483.5	16.6	35.4	52.0	74.0	22.0	Vertical

Result of Tx mode (2480.0 MHz) (8DPSK) (Above 1GHz): Pass

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	
4960.0	-1.3	41.4	40.1	54.0	13.9	Horizontal
4960.0	-2.7	41.4	38.7	54.0	15.3	Vertical
7440.0	-9.8	48.6	38.8	54.0	15.2	Horizontal
7440.0	-11.3	48.6	37.3	54.0	16.7	Vertical

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	
2400.0	2.4	35.4	37.8	54.0	16.2	Vertical
2483.5	1.2	35.4	36.6	54.0	17.4	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: (9kHz - 30MHz): 3.3dB
(30MHz - 1GHz): 4.6dB
(1GHz - 26GHz): 4.4dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

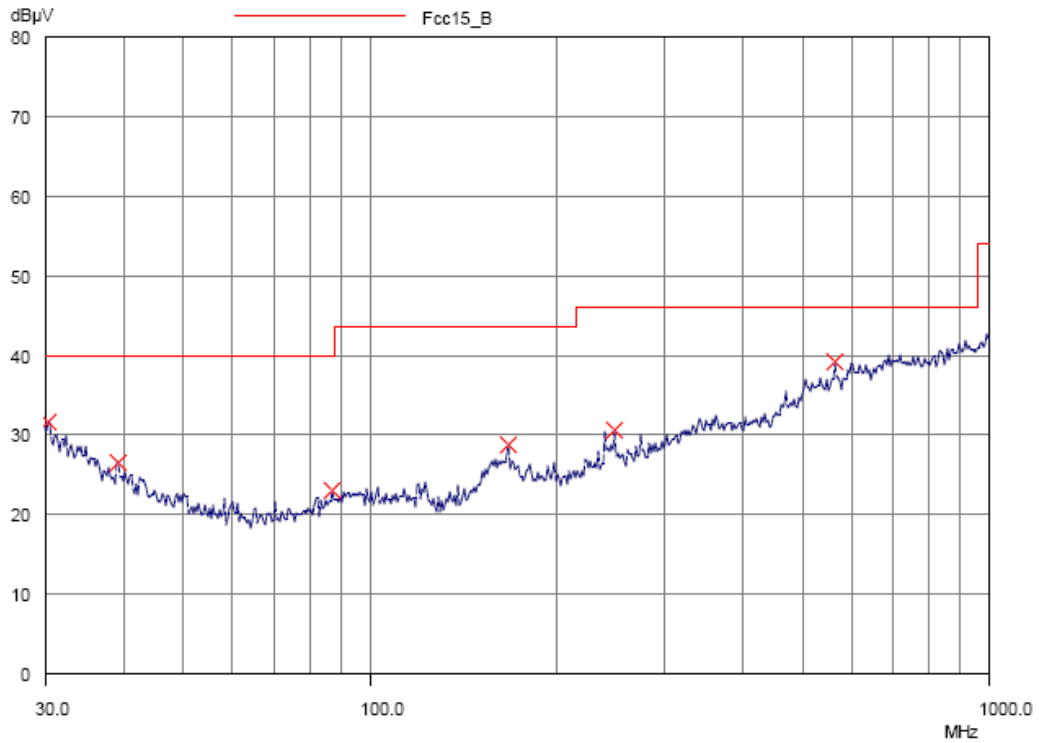
Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

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 / π/4-DQPSK/ 8DPSK) (30MHz – 1GHz): Pass
Please refer to the following table for result details

Horizontal



Result of Bluetooth Communication mode (GFSK / π/4-DQPSK/ 8DPSK) (30MHz – 1GHz): Pass

Radiated Emissions Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @3m dBµV/m	Limit @3m dBµV/m	Level @3m µV/m	Limit @3m µV/m
30.3	Horizontal	31.7	40.0	38.5	100
39.3	Horizontal	26.6	40.0	21.4	100
87.1	Horizontal	23.1	40.0	14.3	100
168.0	Horizontal	28.8	43.5	27.5	150
248.5	Horizontal	30.7	46.0	34.3	200
563.3	Horizontal	39.3	46.0	92.3	200

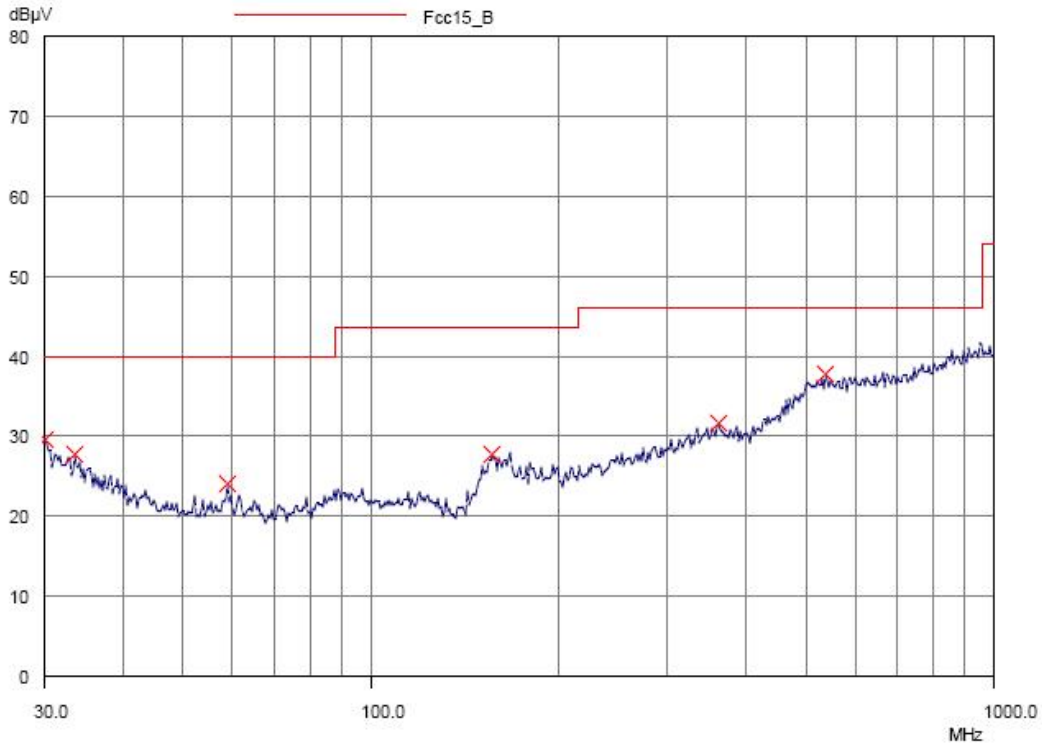
Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

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 / π/4-DQPSK/ 8DPSK) (30MHz – 1GHz): Pass
Please refer to the following table for result details

Vertical



Result of Bluetooth Communication mode (GFSK / π/4-DQPSK/ 8DPSK) (30MHz – 1GHz): Pass

Radiated Emissions Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @3m dBµV/m	Limit @3m dBµV/m	Level @3m µV/m	Limit @3m µV/m
30.1	Vertical	29.7	40.0	30.5	100
33.5	Vertical	27.8	40.0	24.5	100
58.9	Vertical	24.0	40.0	15.8	100
157.4	Vertical	27.9	43.5	24.8	150
361.2	Vertical	31.7	46.0	38.5	200
536.1	Vertical	37.9	46.0	78.5	200

Remarks:
Calculated measurement uncertainty (30MHz – 1GHz): 4.6dB
Emissions in the vertical and horizontal polarizations have been investigated and the worst -case test results are recorded in this report.

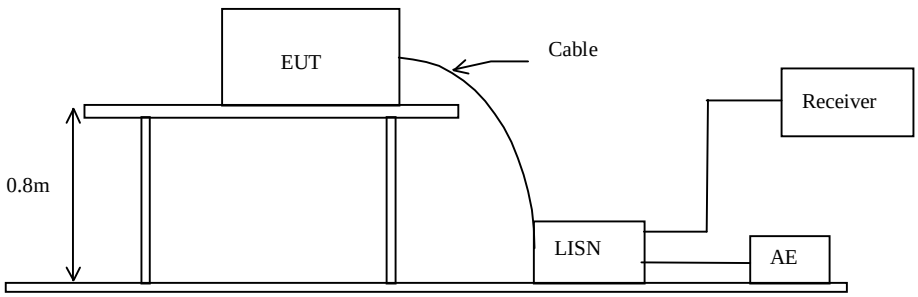
3.1.3 AC Mains Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.4:2009
Test Date:	2013-03-08
Mode of Operation:	Bluetooth Communication mode (GFSK / π/4-DQPSK/ 8DPSK)
Test Voltage:	117Va.c., 60Hz

Test Method:

The test was performed in accordance with ANSI C63.4: 2009, with the following: an initial measurement was performed in peak and average detection mode on the live line, any emissions recorded within 30dB of the relevant limit line 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.

Test Setup:



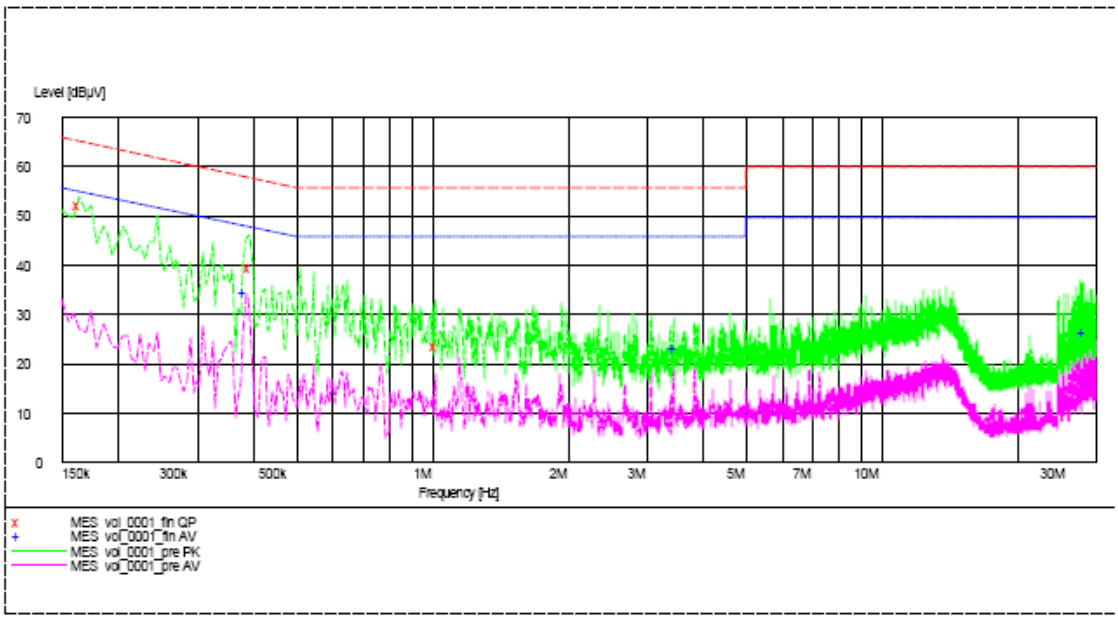
Limit for Conducted Emissions (FCC 47 CFR 15.207):

Frequency Range [MHz]	Quasi-Peak Limits [dBµV]	Average [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.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

Results of Bluetooth Communication mode (GFSK / π/4-DQPSK/ 8DPSK) (L): PASS
Please refer to the following diagram for individual results.



Results of Bluetooth Communication mode (GFSK / π/4-DQPSK/ 8DPSK) (L): PASS

		Quasi-peak		Average	
Conductor	Frequency	Level	Limit	Level	Limit
Live or Neutral	MHz	dBµV	dBµV	dBµV	dBµV
Live	0.385	-*-	-*-	34.5	46.0
Live	3.455	-*-	-*-	23.4	46.0
Live	28.290	-*-	-*-	26.4	50.0
Live	0.165	52.1	65.0	-*-	-*-
Live	0.395	39.6	58.0	-*-	-*-
Live	1.020	23.6	56.0	-*-	-*-

Limit for Conducted Emissions (FCC 47 CFR 15.207):

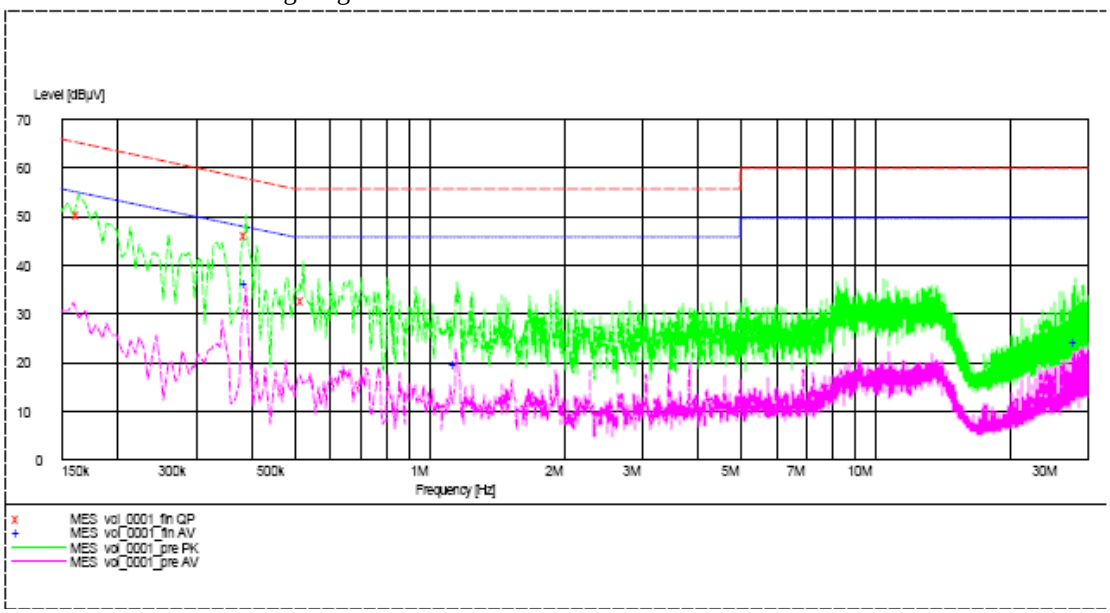
Frequency Range [MHz]	Quasi-Peak Limits [dBµV]	Average [dBµV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

Results of Bluetooth Communication mode (GFSK / π/4-DQPSK/ 8DPSK) (N): PASS

Please refer to the following diagram for individual results.



Results of Bluetooth Communication mode (GFSK / π/4-DQPSK/ 8DPSK) (L): PASS

		Quasi-peak		Average	
Conductor	Frequency	Level	Limit	Level	Limit
Live or Neutral	MHz	dBµV	dBµV	dBµV	dBµV
Neutral	0.390	50.5	65.0	36.5	48.0
Neutral	1.150	-*-	-*-	19.9	46.0
Neutral	28.290	-*-	-*-	24.4	50.0
Neutral	0.165	50.5	58.0	-*-	-*-
Neutral	0.525	32.8	56.0	-*-	-*-

Remarks:
Calculated measurement uncertainty (0.15MHz – 30MHz): 3.2dB
-*- Emission(s) that is far below the corresponding limit line.

3.1.4 Number of Hopping Frequency

Limit of Number of Hopping Frequency

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels

Test Method:

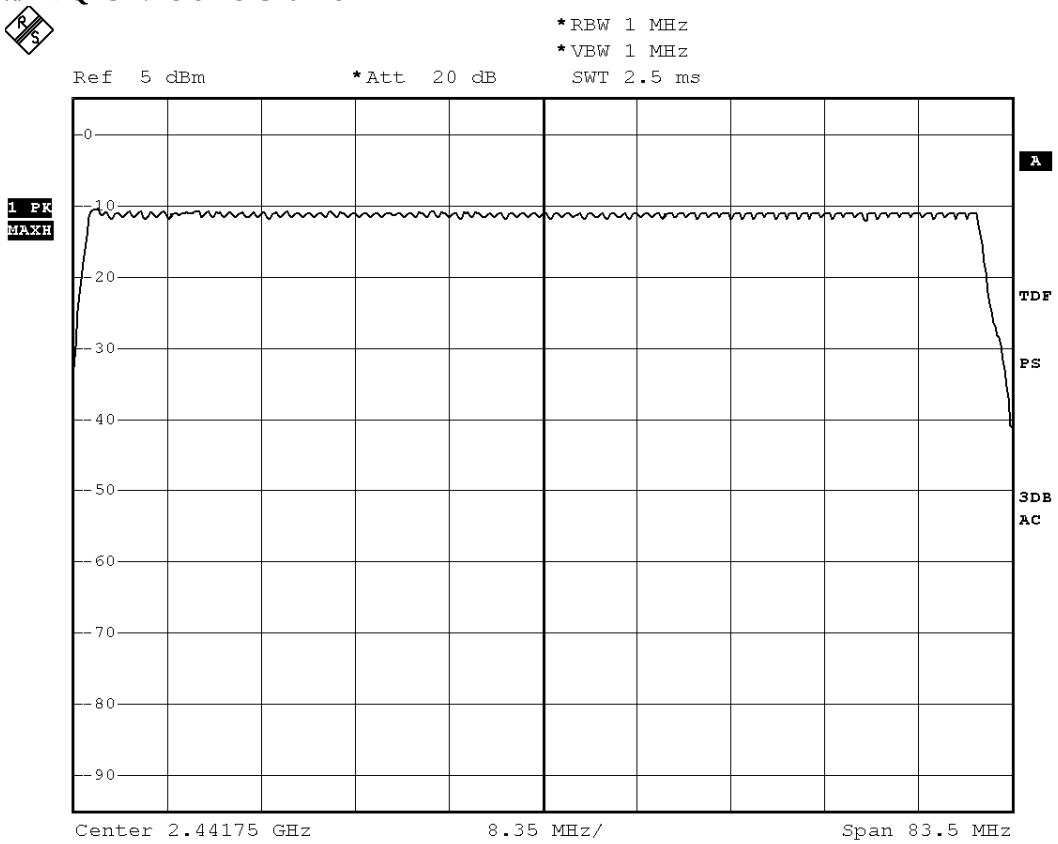
The RF output of the EUT was connected to the spectrum analyzer by a low loss cable.

Spectrum Analyzer Setting:

RBW = 100kHz, VBW= 3 KHz, Sweep = Auto, Span = the frequency band of operation
Detector = Peak, Trace = Max. hold

Test Setup:
As Test Setup of clause 3.1.1 in this test report.

Measurement Data:
π/4-DQPSK: 79 of 79 Channel



3.1.5 20dB Bandwidth

Test Requirement:	FCC 47CFR 15.247(a)(1)
Test Method:	ANSI C63.4:2009
Test Date:	2013-03-15
Mode of Operation:	Communication mode

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

Test Method:

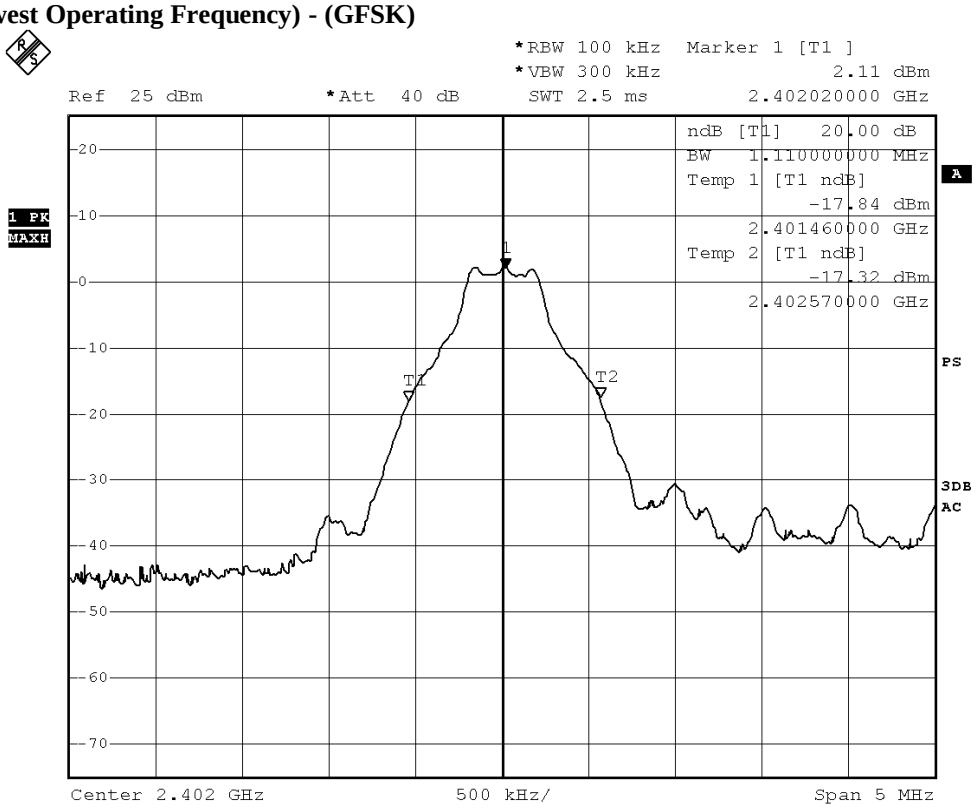
The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with 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.

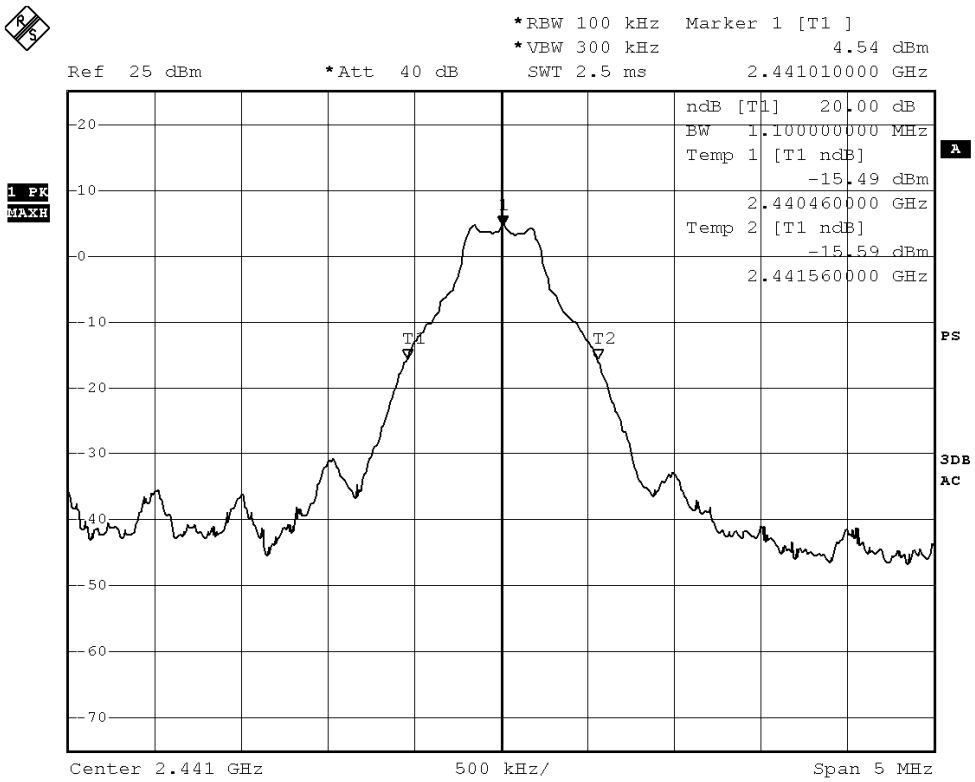
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.11	Within 2400-2483.5

(Lowest Operating Frequency) - (GFSK)



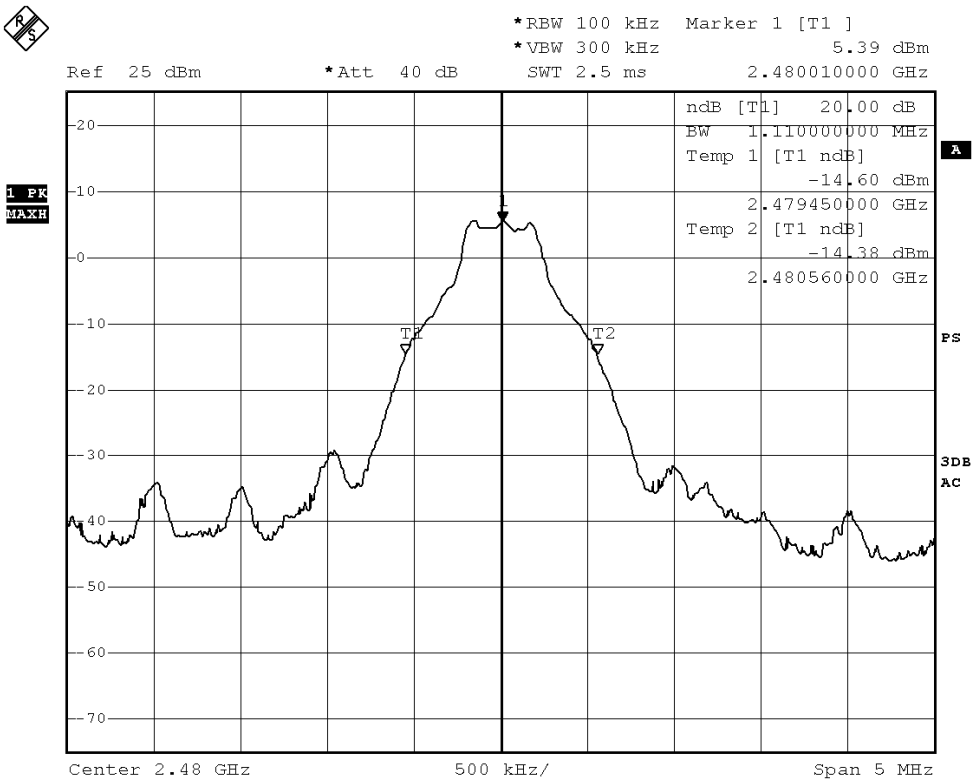
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.10	Within 2400-2483.5

(Middle Operating Frequency) - (GFSK)



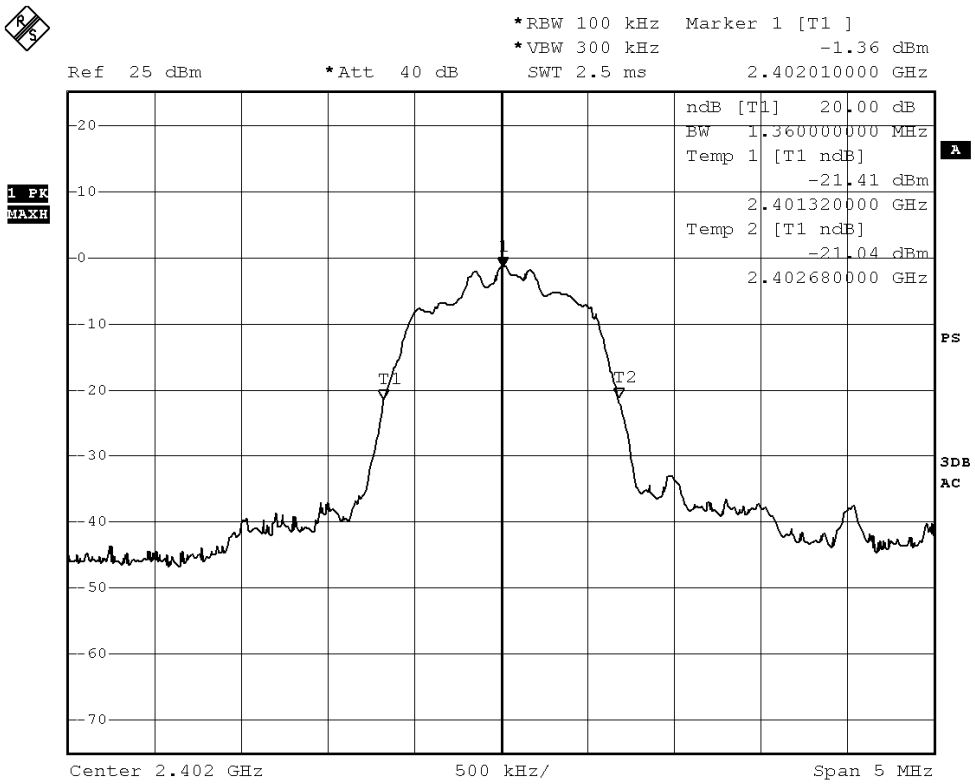
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.11	Within 2400-2483.5

(Highest Operating Frequency) - (GFSK)



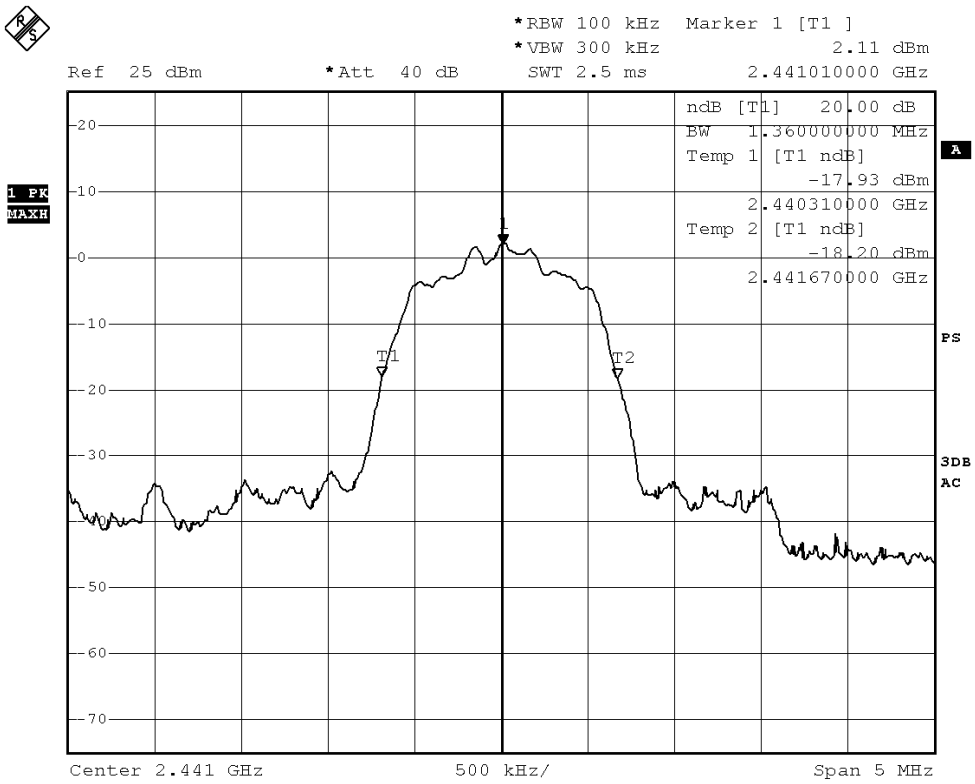
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.36	Within 2400-2483.5

(Lowest Operating Frequency) - (π/4-DQPSK)



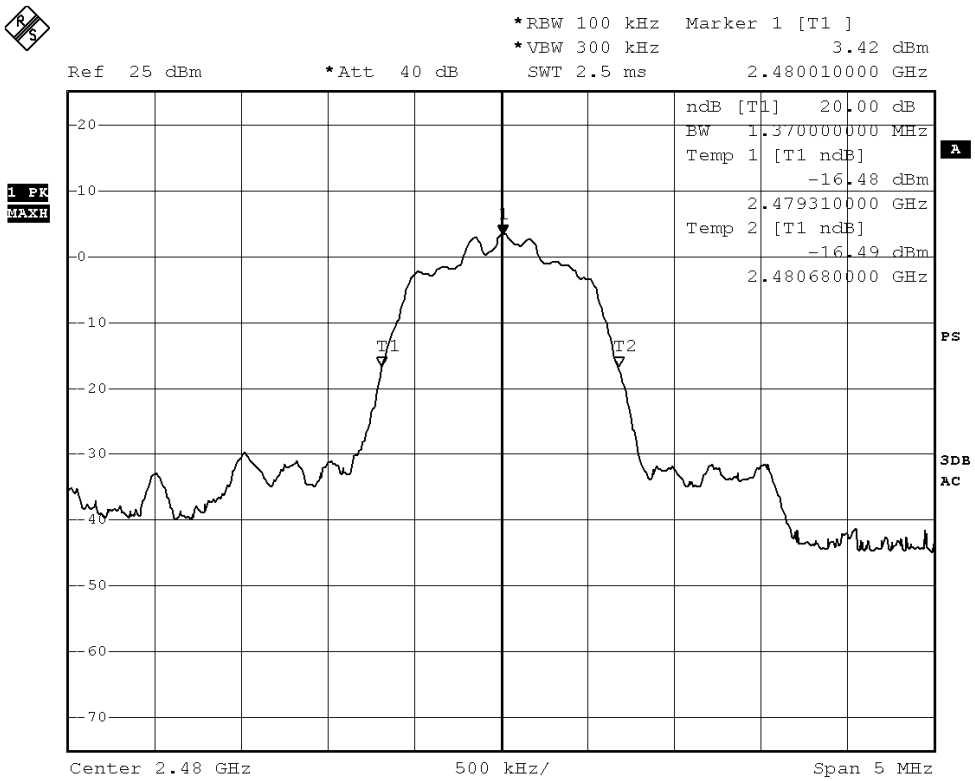
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.36	Within 2400-2483.5

(Middle Operating Frequency) - (π/4 -DQPSK)



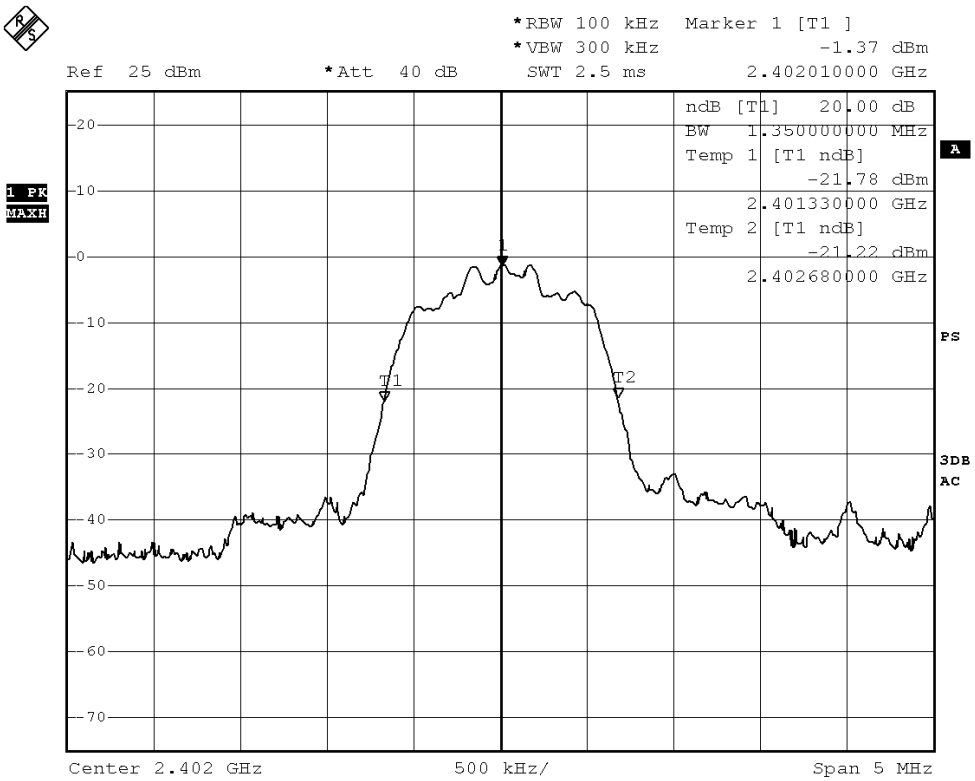
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.37	Within 2400-2483.5

(Highest Operating Frequency) - (π/4 -DQPSK)



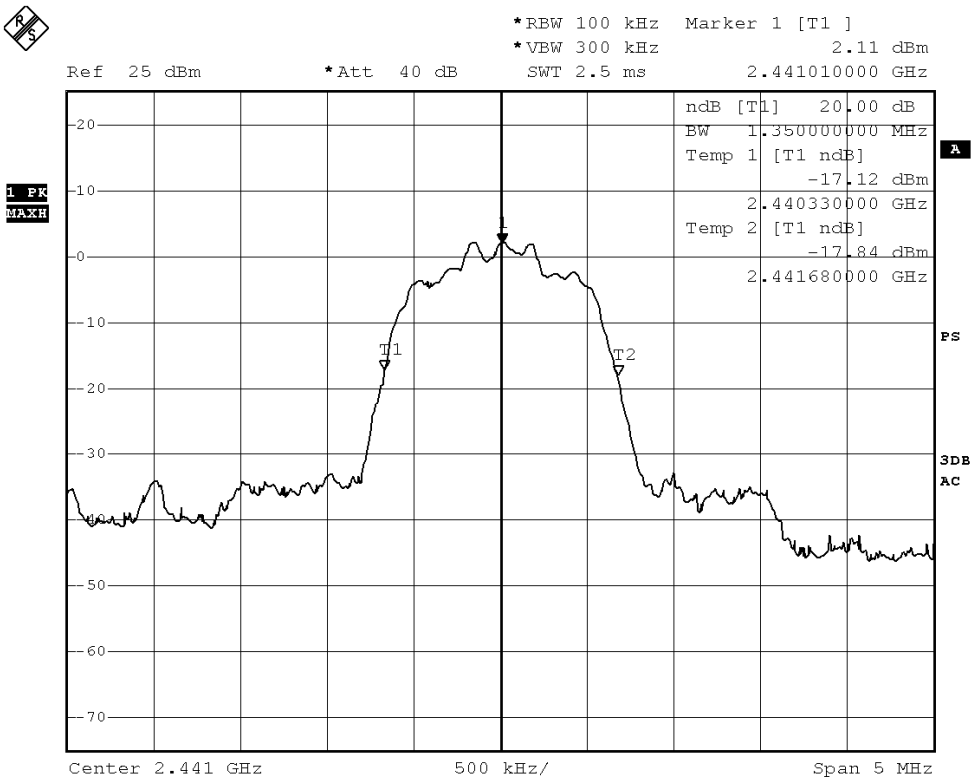
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.35	Within 2400-2483.5

(Lowest Operating Frequency) - (8DPSK)



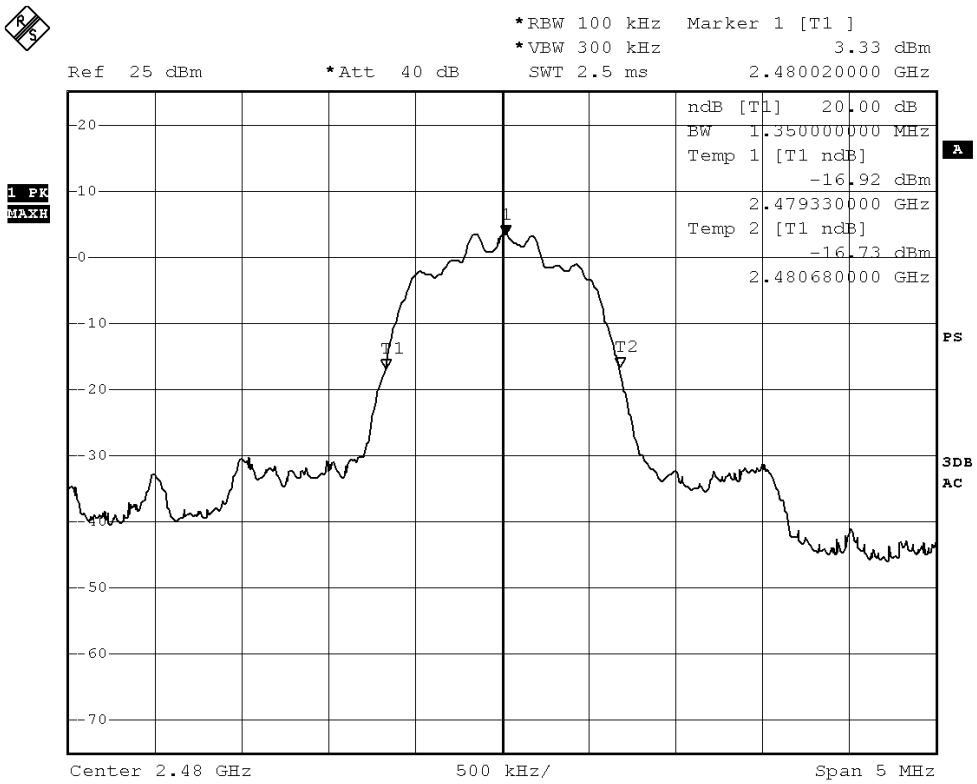
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.35	Within 2400-2483.5

(Middle Operating Frequency) - (8DPSK)



Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.35	Within 2400-2483.5

(Highest Operating Frequency) - (8DPSK)



3.1.6 Hopping Channel Separation

Requirements:

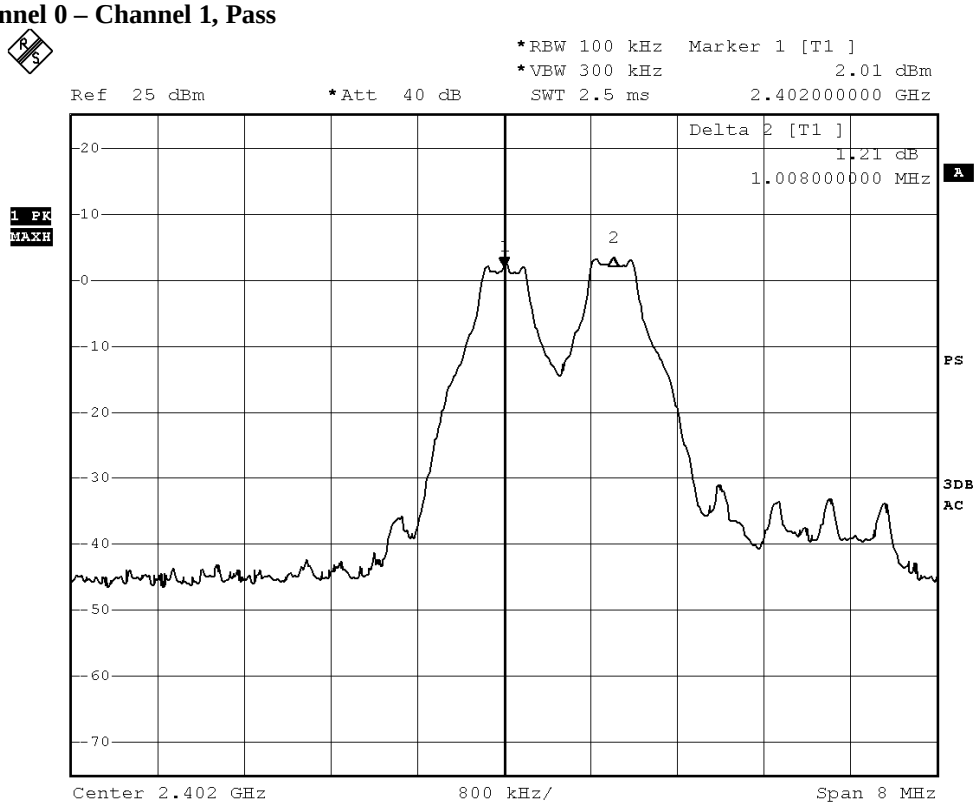
Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Limit:

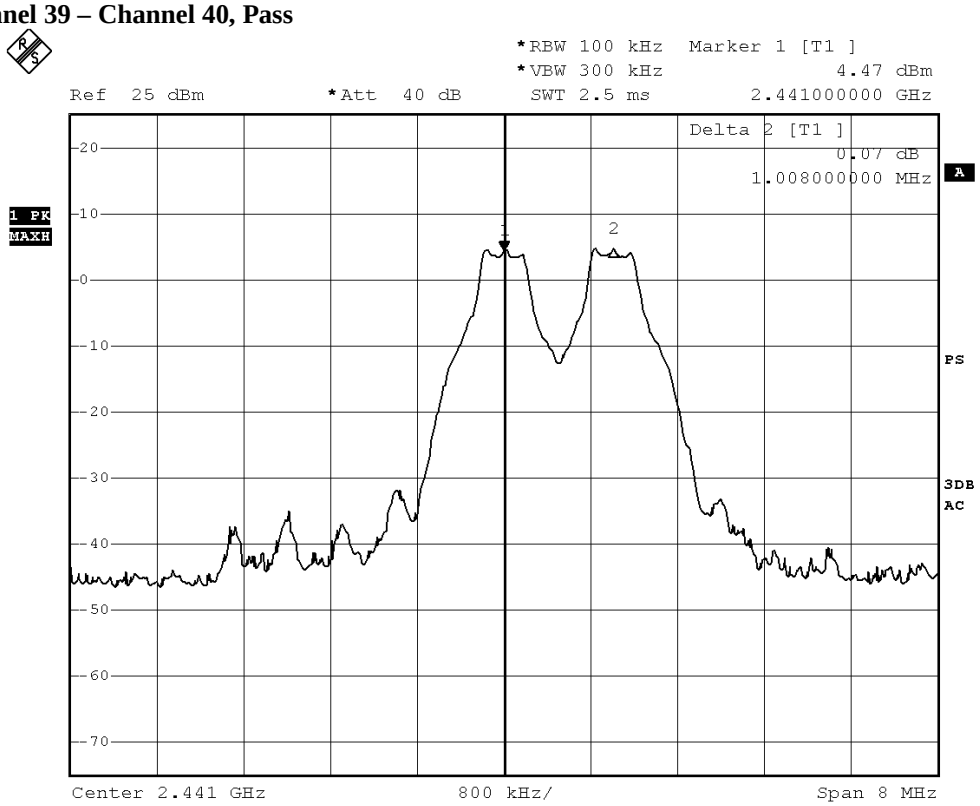
The measured Maximum 20dB bandwidth * 2/3 = 1.370MHz * 2/3 = 913kHz

Channel separation = 1MHz (>913kHz) (GFSK)

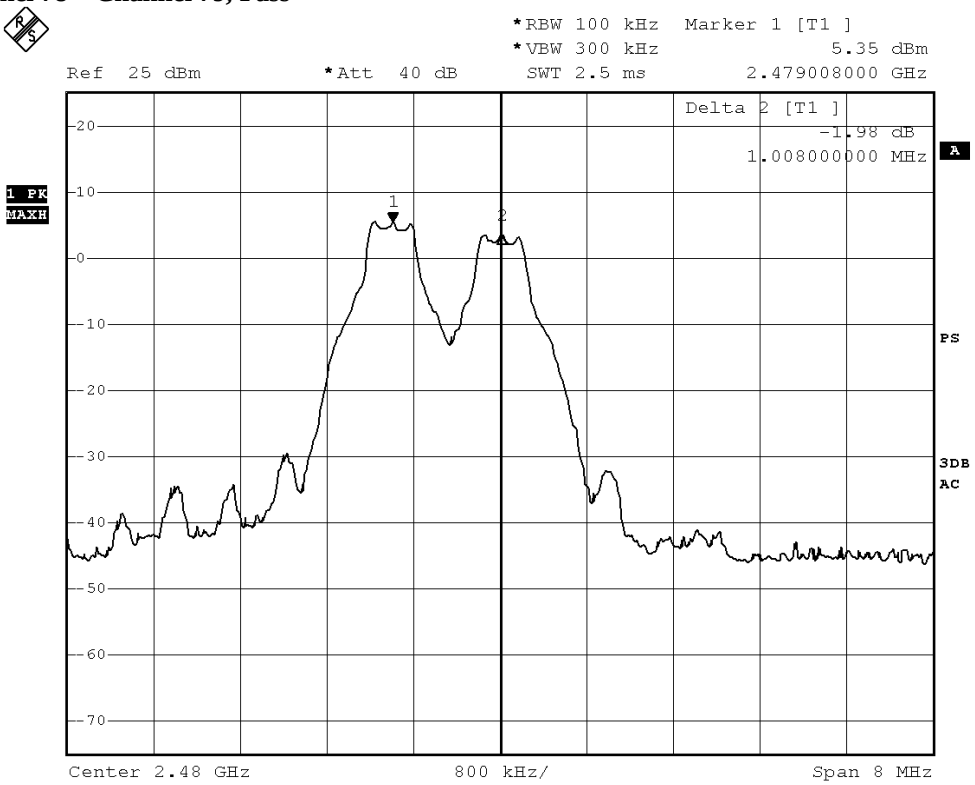
Channel 0 – Channel 1, Pass



Channel 39 – Channel 40, Pass

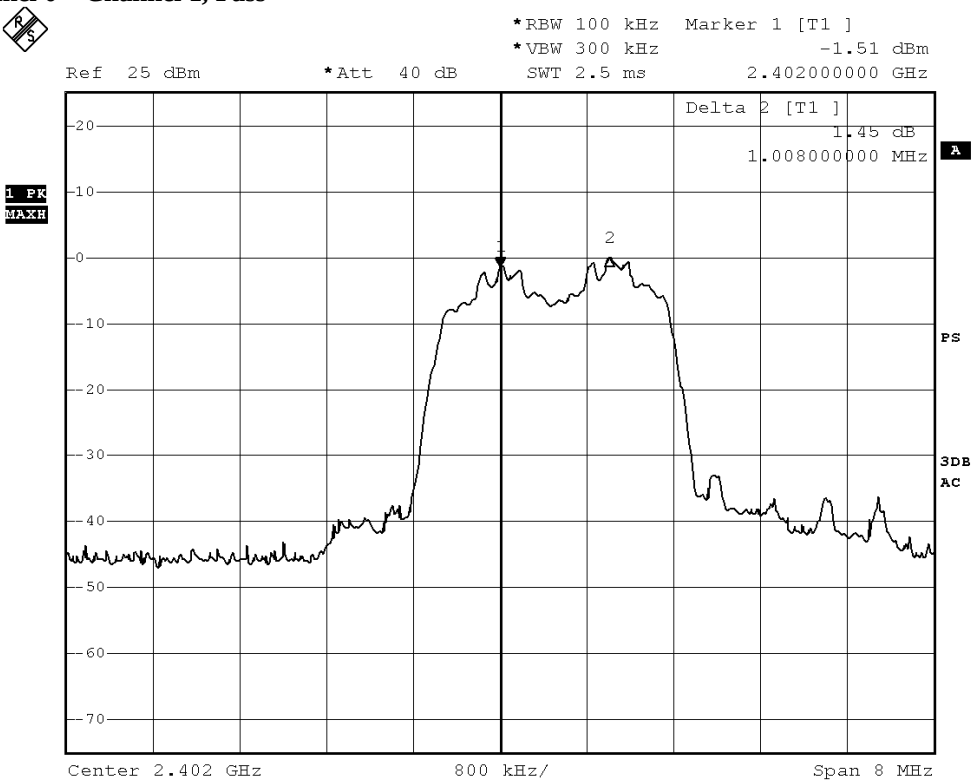


Channel 78 – Channel 79, Pass

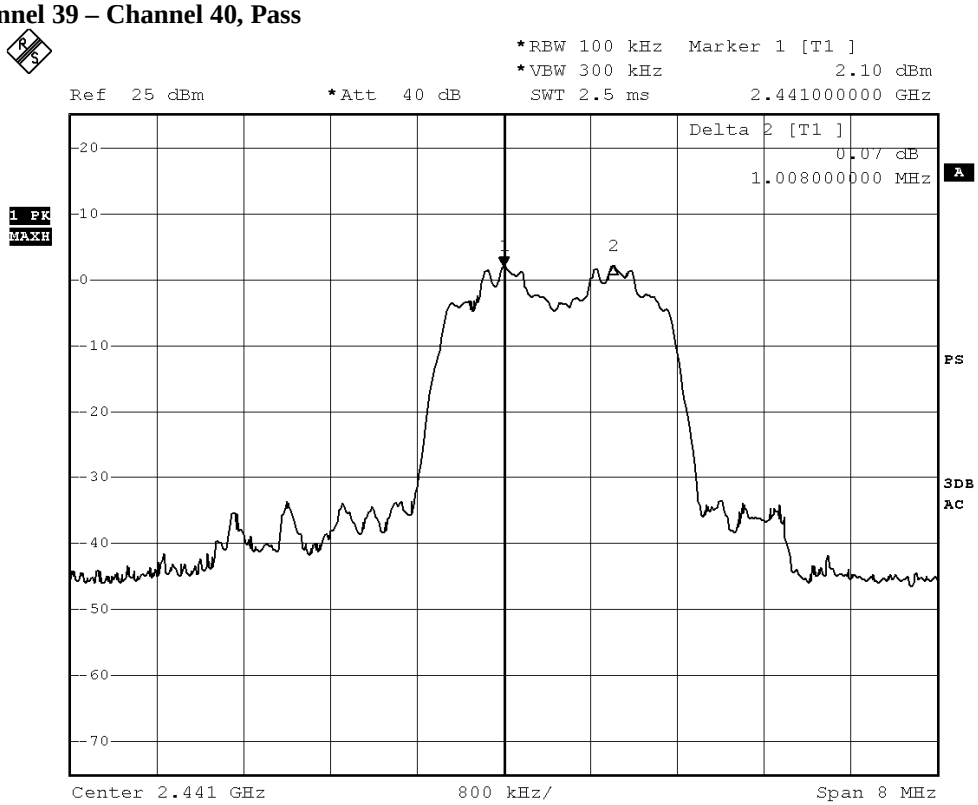


Channel separation = 1MHz (>913kHz) (π/4- DQPSK)

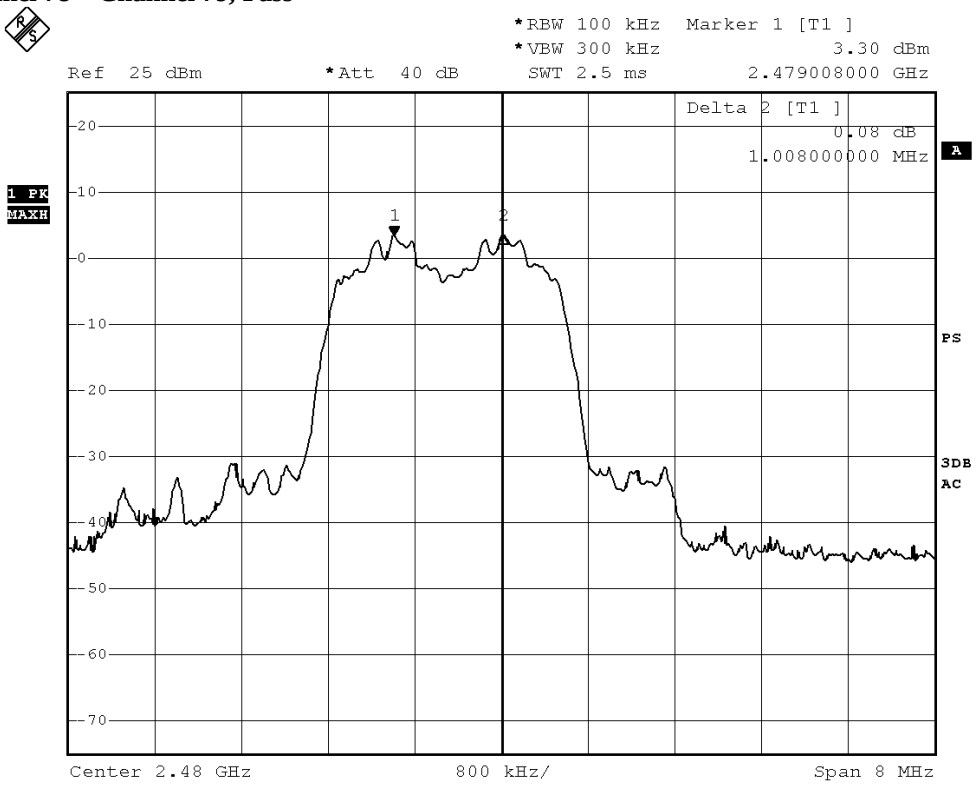
Channel 0 – Channel 1, Pass



Channel 39 – Channel 40, Pass

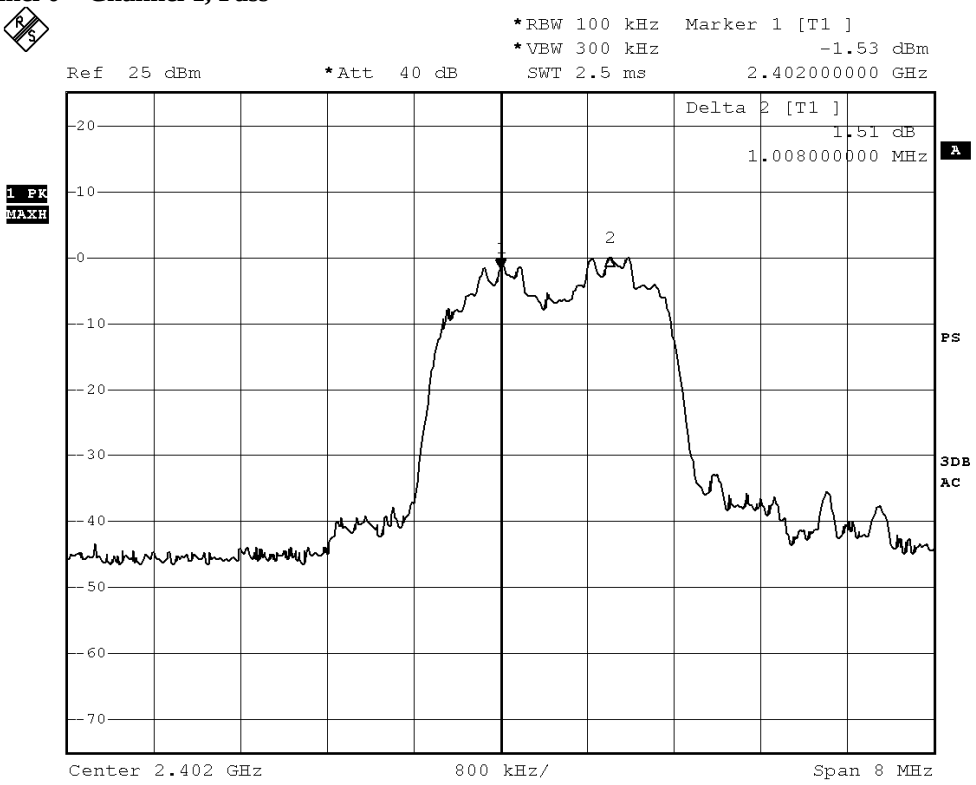


Channel 78 – Channel 79, Pass

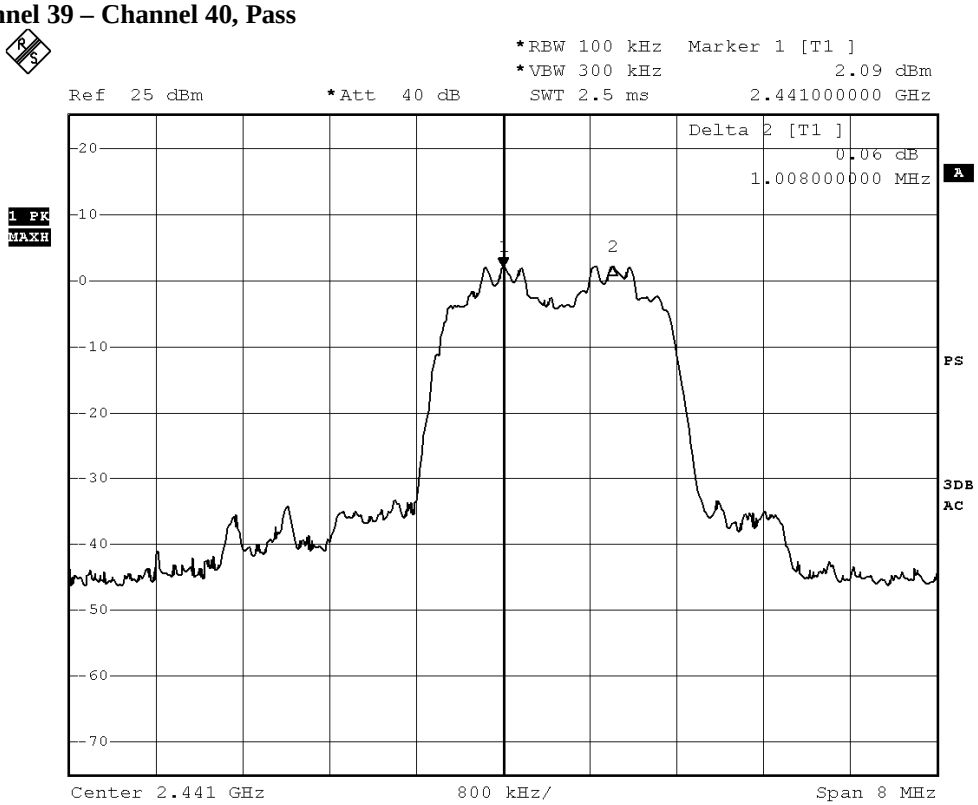


Channel separation = 1MHz (>913kHz) (8DPSK)

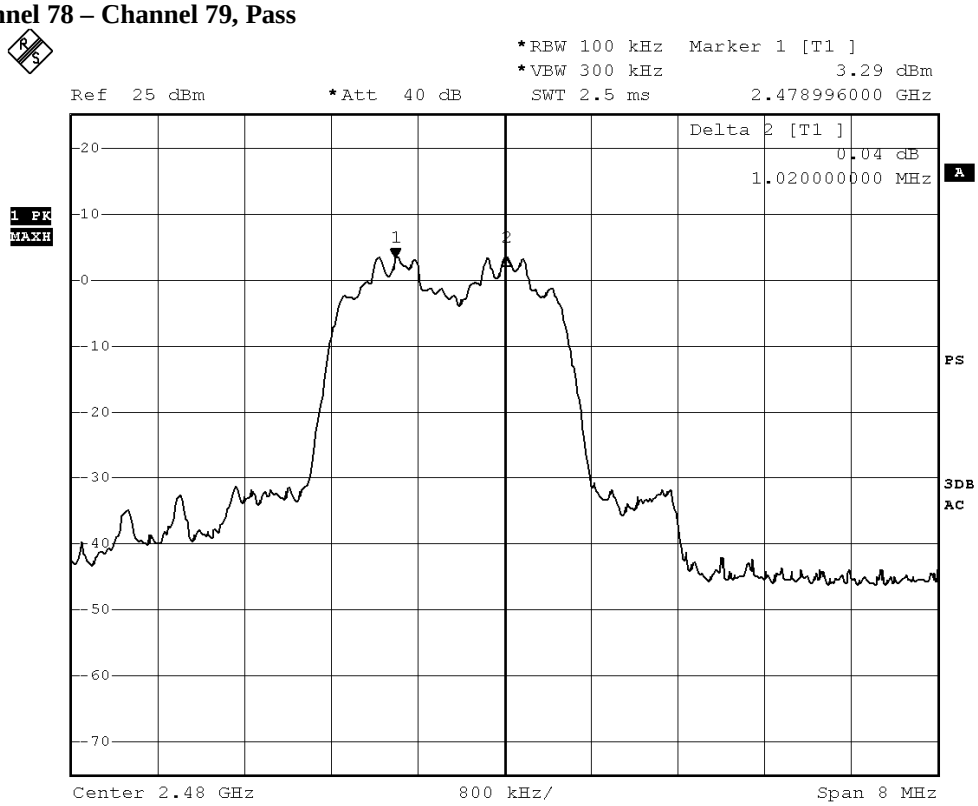
Channel 0 – Channel 1, Pass



Channel 39 – Channel 40, Pass

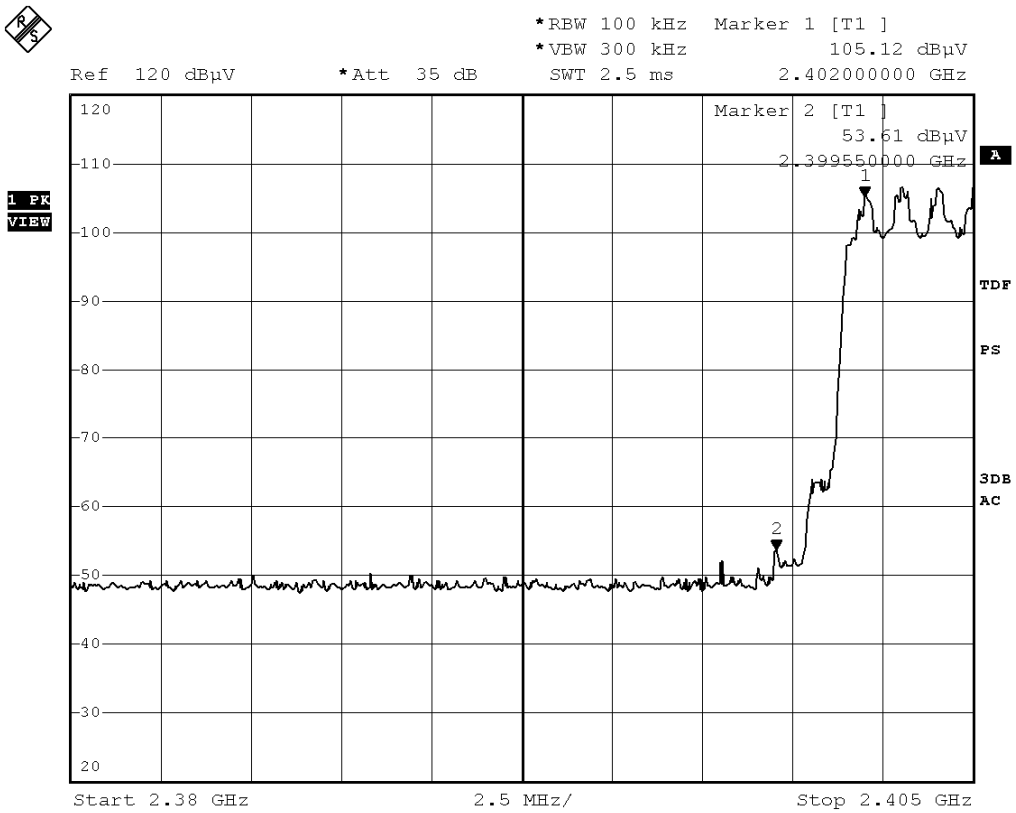


Channel 78 – Channel 79, Pass

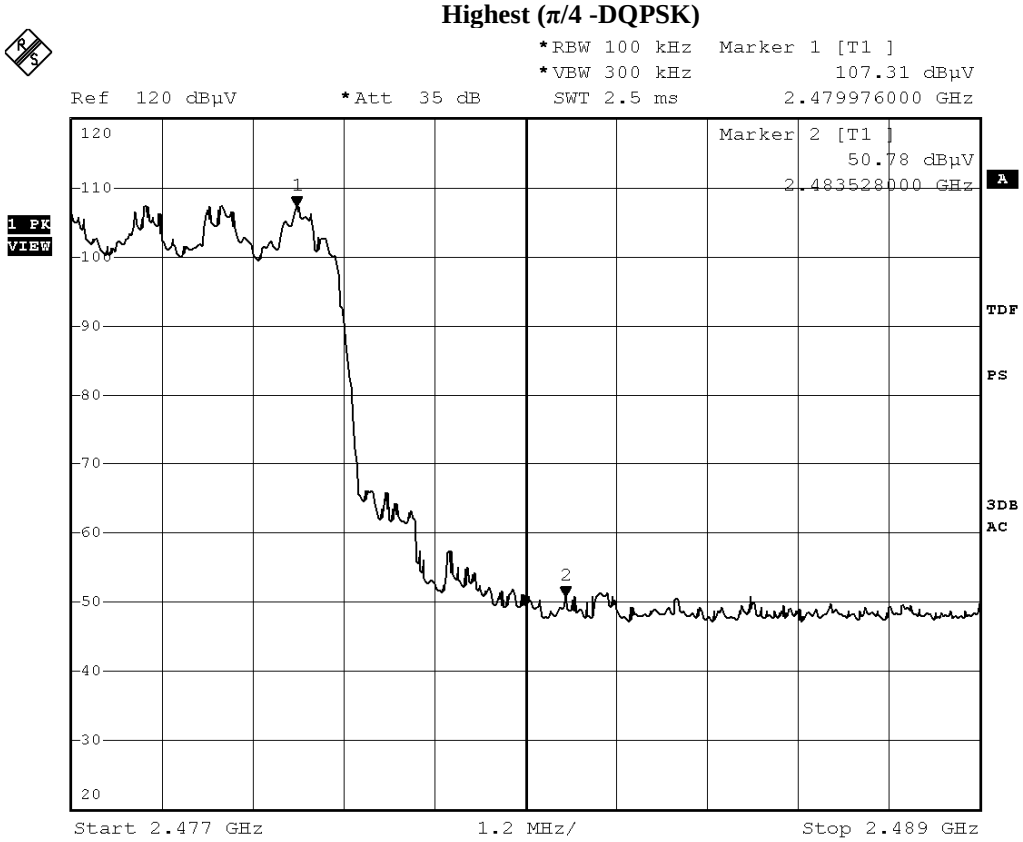


3.1.7 Band-edge Compliance of RF Conducted Emissions

Lowest (π/4 -DQPSK)



Highest (π/4 -DQPSK)



3.1.8 Time of Occupancy (Dwell Time)

Requirements:

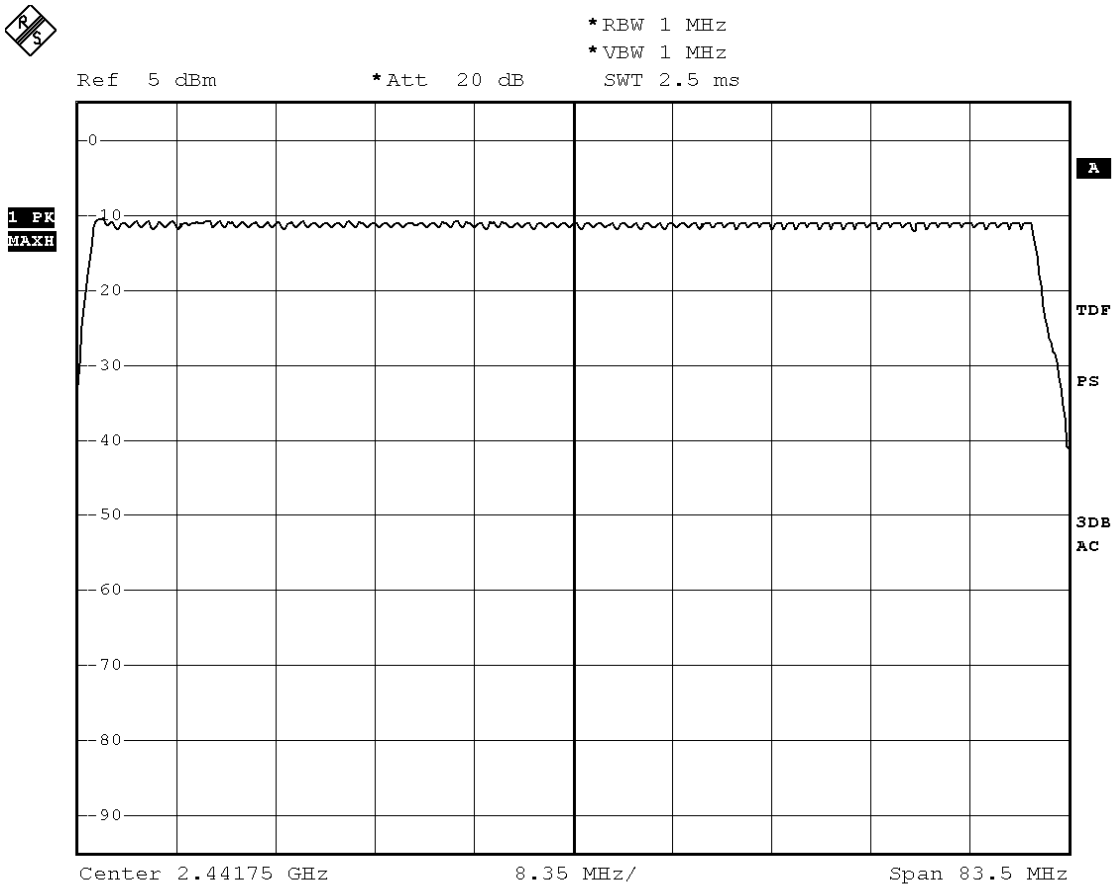
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channel employed.
No requirements for Digital Transmission System.

Dwell Time = Pulse Duration * hop rate / number of channel * observation duration

Observed duration: 0.4s x79 = 31.6s

Measurement Data:

Channel Occupied in π/4-DQPSK: 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 Channel 0(2402.0MHz)

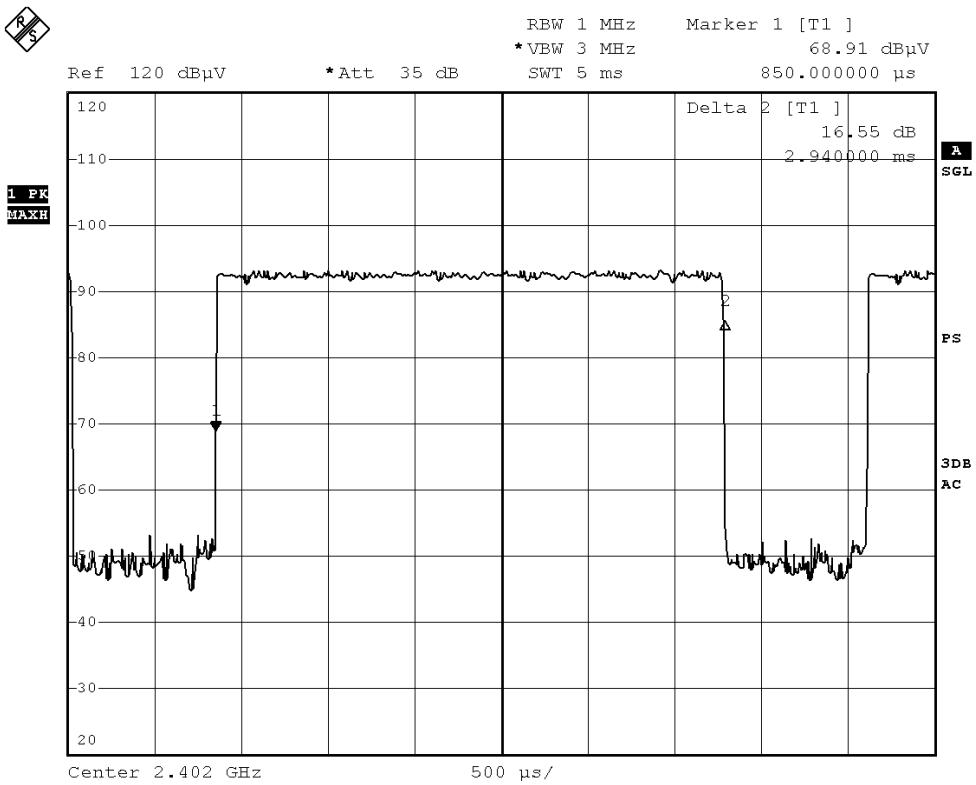


Fig. B
Pulse duration of Middle Channel 39(2441.0MHz)

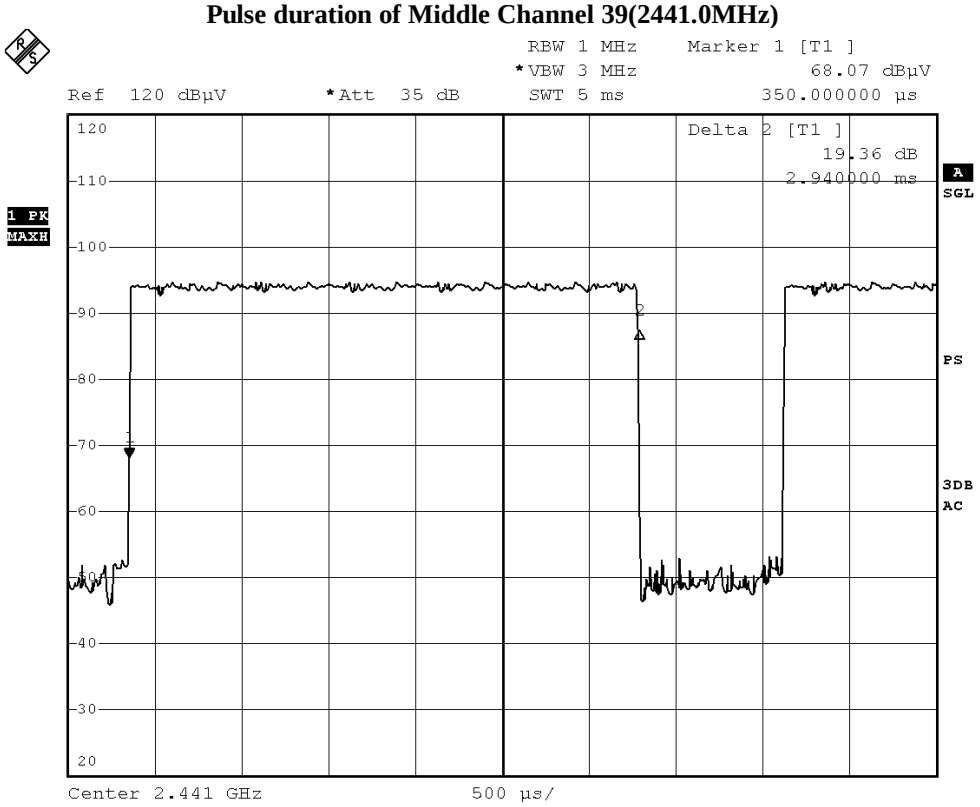
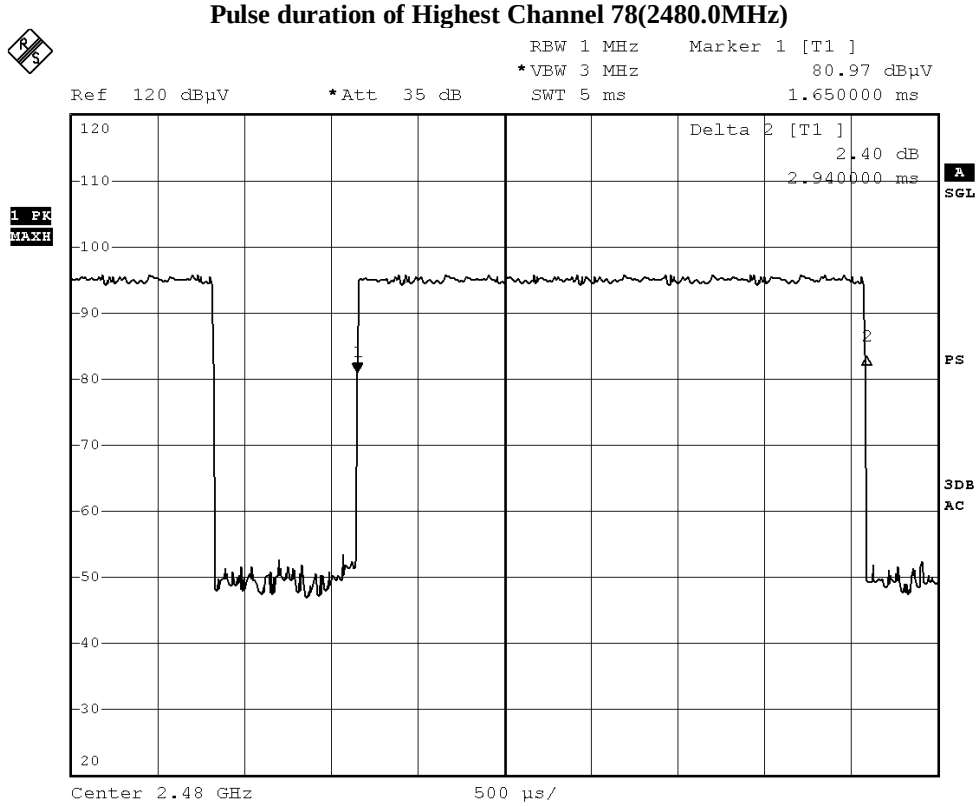


Fig. C
Pulse duration of Highest Channel 78(2480.0MHz)



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 Channel 0(2402.0MHz)

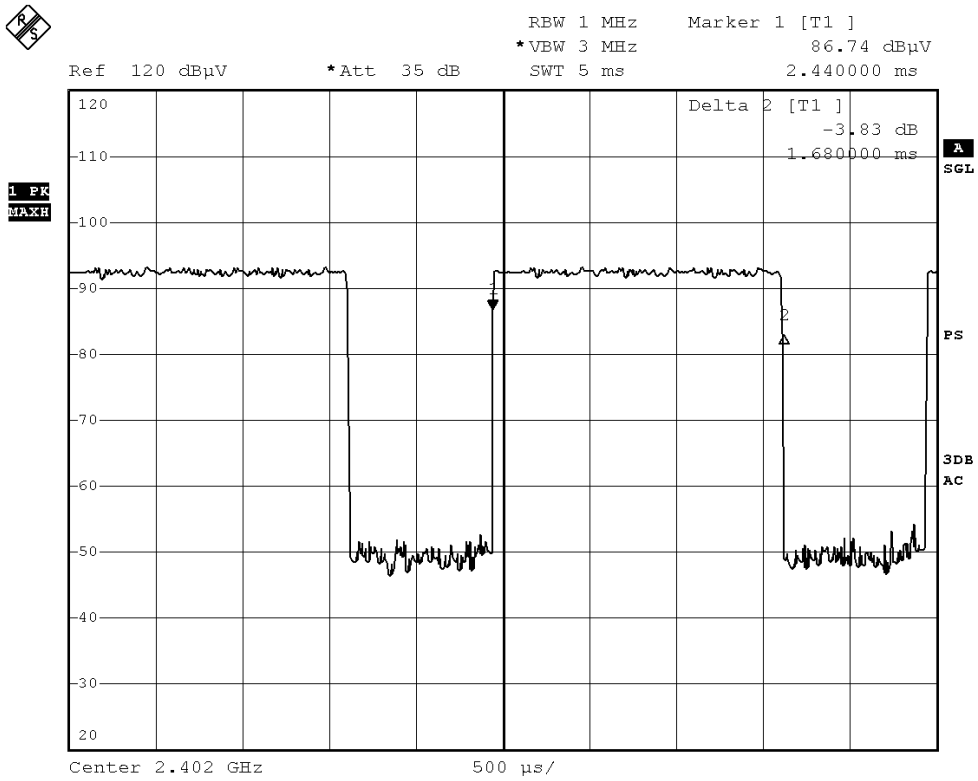


Fig. E
Pulse duration of Middle Channel 39(2441.0MHz)

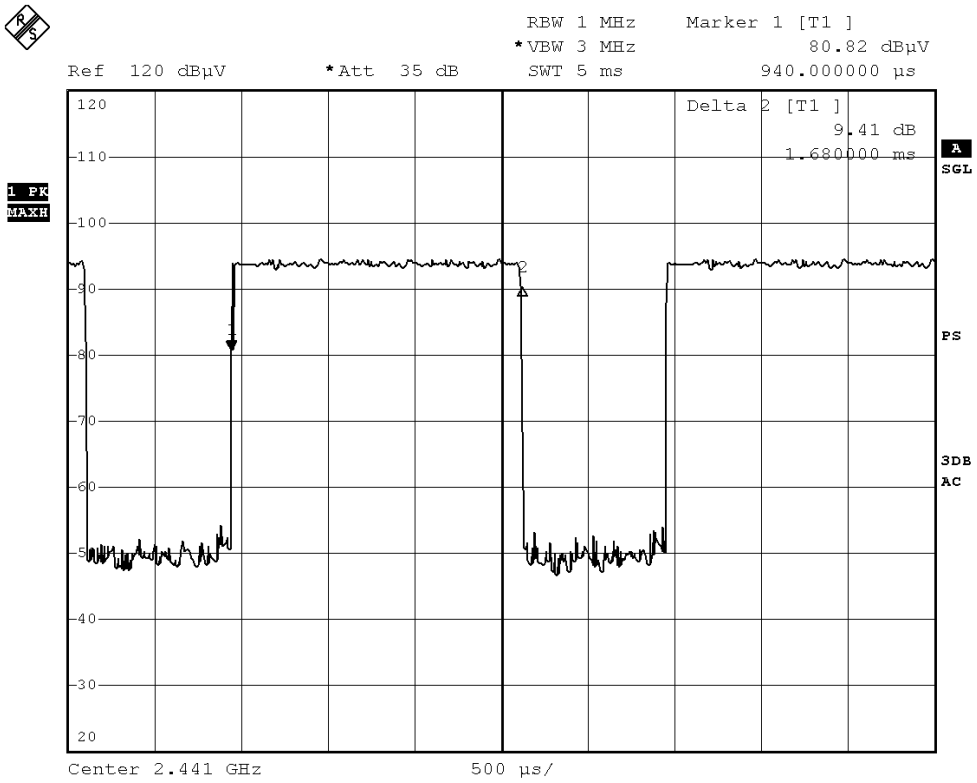
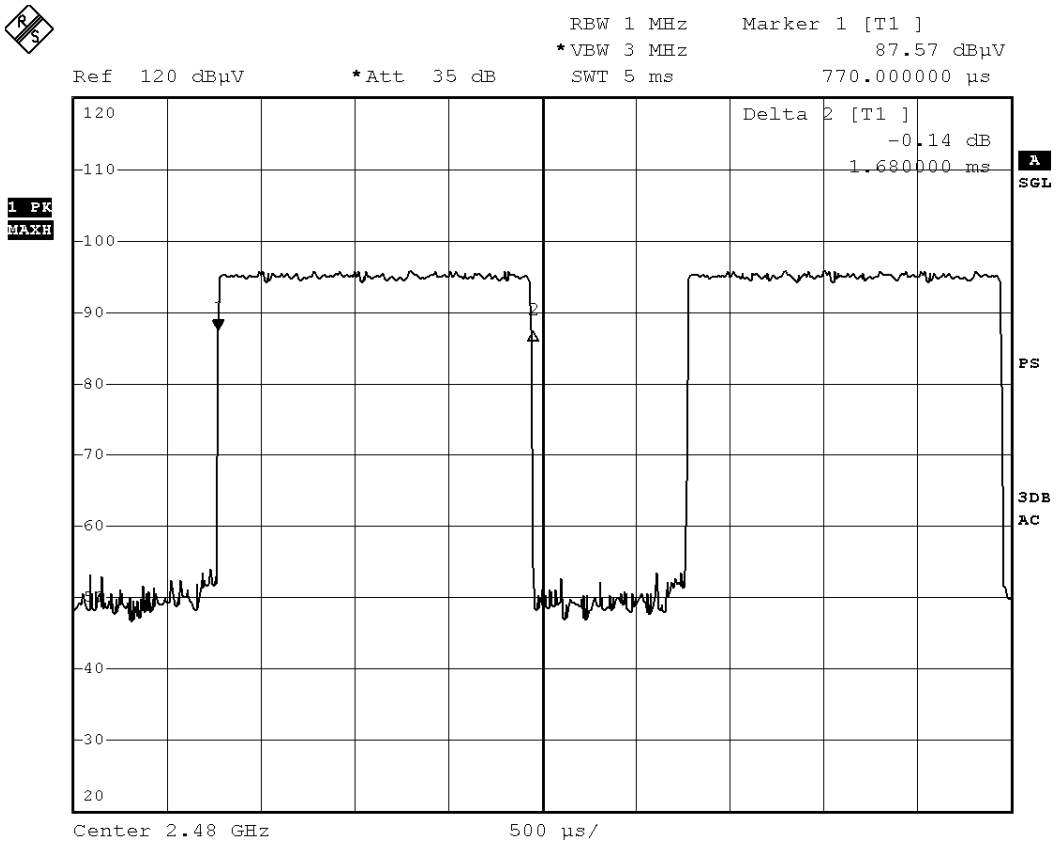


Fig. F
Pulse duration of Highest Channel 78(2480.0MHz)



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 Channel 0(2402.0MHz)

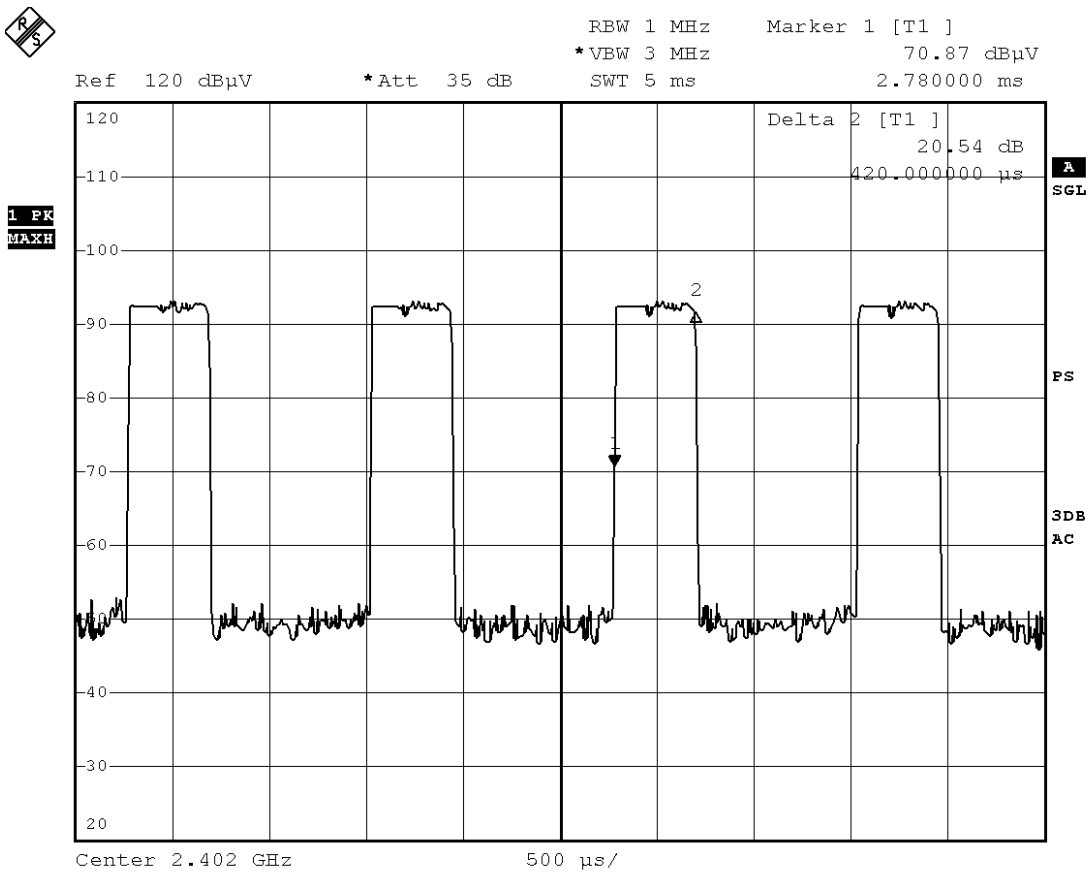


Fig. H
Pulse duration of Middle Channel 39(2441.0MHz)

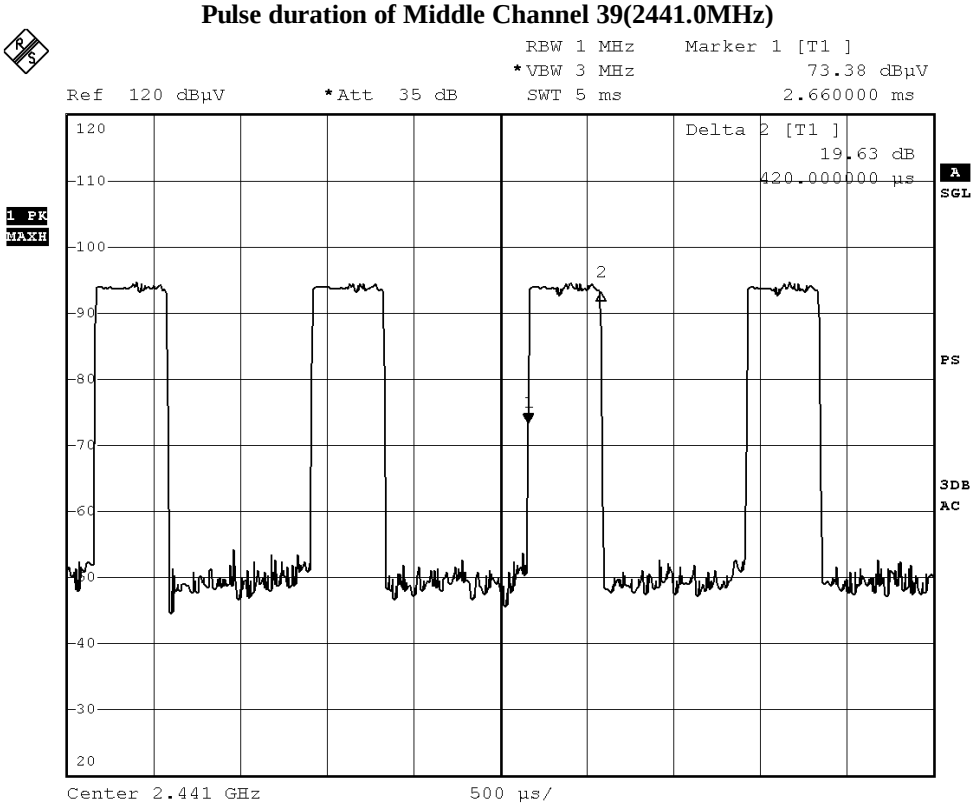
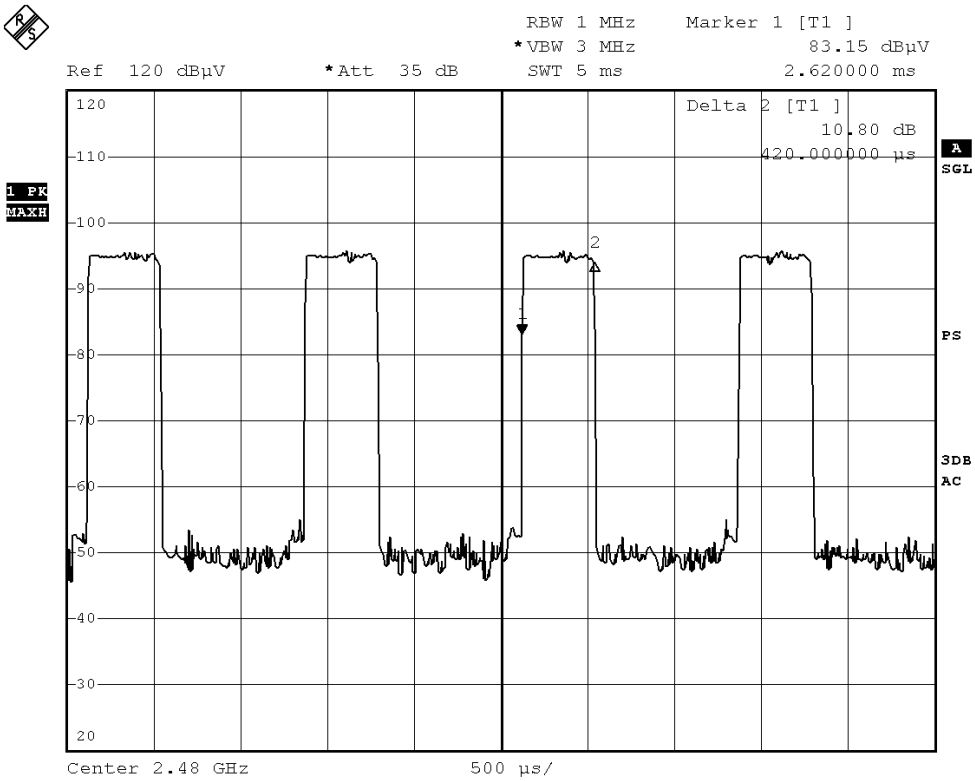


Fig. I
Pulse duration of Highest Channel 78(2480.0MHz)



Time of occupancy (Dwell Time):

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Results
DH5	2402	2.940	0.314	0.400	Complies
DH5	2441	2.940	0.314	0.400	Complies
DH5	2480	2.940	0.314	0.400	Complies
DH3	2402	1.680	0.269	0.400	Complies
DH3	2441	1.680	0.269	0.400	Complies
DH3	2480	1.680	0.269	0.400	Complies
DH1	2402	0.420	0.134	0.400	Complies
DH1	2441	0.420	0.134	0.400	Complies
DH1	2480	0.420	0.134	0.400	Complies

3.1.9Channel 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)

3.1.10 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.

3.1.11 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:

This is PCB layout internal antenna. There is no external antenna, the antenna gain =0.0dBi. All component install on inside of EUT. User unable to remove or changed the Antenna.

3.1.12 RF Exposure

Test Requirement:	FCC 47CFR 15.247(i)
Test Date:	2013-5-28
Mode of Operation:	Tx mode

Test Method:

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

Test Results:

The EUT complied with the requirement(s) of this section.
EUT meets the requirements of these sections as proven through MPE calculation
The MPE calculation for EUT @ 20cm
Based on the highest P =3.47 mW

Pd = PG/ 4pi*R^2 = (3.47 x 1.0)/12.566* $(20)^2$
= (3.47)/12.566x 400= 3.47 /5026.4
= 0.00069mW/cm^2

where:
*Pd = power density in mW/cm2
* G = Antenna numeric gain (1.0); Log G = g/10 (g = 0dBi).
* P = Conducted RF power to antenna (3.47 mW).
* R = Minimum allowable distance.(20 cm)

*The power density Pd = 0.00069 mW/cm^2 is less than 1 mW/cm^2 (listed MPE limit)
*The SAR evaluation is not needed (this is a desk top device, R> 20 cm)
* The EUT(antenna) must be 0.2 meters away from the General Population.

Appendix A

List of Measurement Equipment

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EMD004	LISN	ROHDE & SCHWARZ	ESH3-Z5	100102	2013.03.15	2014.03.14
EMD022	EMI Test Receiver	ROHDE & SCHWARZ	ESCS30	100314	2013.03.15	2014.03.14
EMD035	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	100441	2012.07.06	2013.07.05
EMD036	EMI Test Receiver	ROHDE & SCHWARZ	ESIB 26	100388	2012.07.06	2013.07.05
EMD041	TWO-LINE V-NETWORK	ROHDE & SCHWARZ	ENV216	100261	2012.07.06	2013.07.05
EMD061	Biconilog Antenna	ETS.LINDGREN	3142C	00060439	2012.11.03	2014.11.02
EMD062	Double-Ridged Waveguide (1GHz – 18GHz)	ETS.LINDGREN	3117	00075933	2012.11.28	2014.11.27
EMD084	MULTI-DVICE CONTROLLER	ETS.LINDGREN	2090	00060107	N/A	N/A
EMD088	Video Contol Unit	ETS.LINDGREN	Y21953A	2601073	N/A	N/A
EMD093	Monitor	ViewSonic	VA9036	Q8X064201876	N/A	N/A
EMD102	Intelligent Frequency	Ainuo lnstrument Co., Ltd	AN97005SS	79707454	N/A	N/A
EMD103	Intelligent Frequency	Ainuo lnstrument Co., Ltd	AN97005SS	79707455	N/A	N/A
EMD105	FACT-3 EMC Chamber	ETS.LINDGREN	FACT-3	3803	N/A	N/A
EMD106	Shielding Room #1	ETS.LINDGREN	RFD-100	3802	N/A	N/A
EMD111	Power meter	ROHDE & SCHWARZ	NRVD	102051	2013.03.15	2014.03.14
	100V Insertion Unit	ROHDE & SCHWARZ	URV5-Z4	100464	2013.03.15	2014.03.14
EMD113	Pre-Amplifier	ROHDE & SCHWARZ	N/A	1129588	2013.03.15	2014.03.14
EMD124	Loop Antenna	ETS-Lindgren	6502	00104905	2012.03.26	2014.03.25
EMD131	Standard Gain Horn Antenna (18GHz – 26.5GHz)	Chengdu AINFO lnc.	JXTXLB-42-15-C-KF	J2021100721001	2013.01.25	2015.01.24

Remarks:-

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

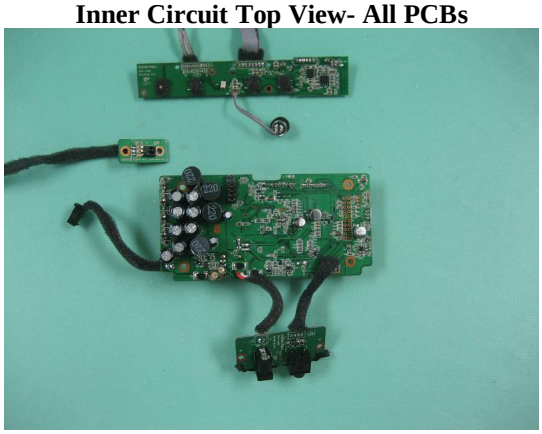
Appendix B

Photographs of EUT

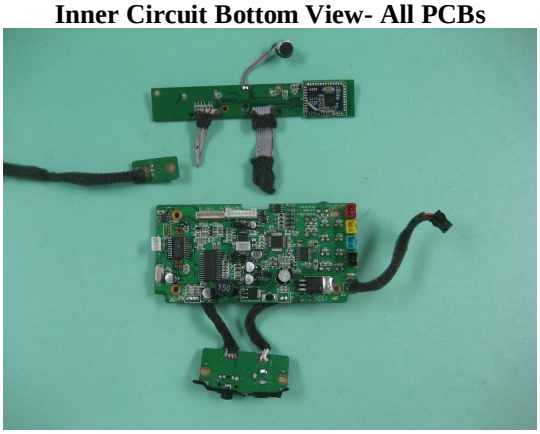
Front View of the product

Rear View of the product

Inner Circuit Top View- All PCBs

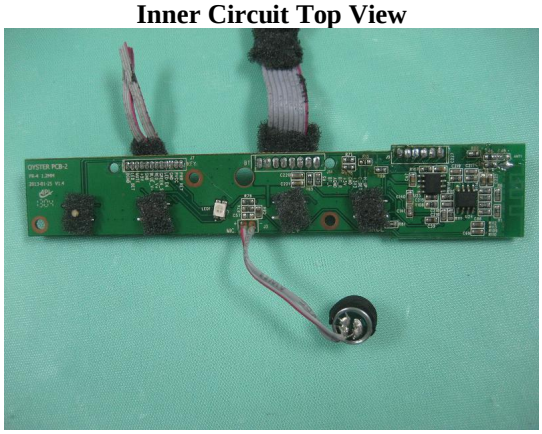


Inner Circuit Bottom View- All PCBs

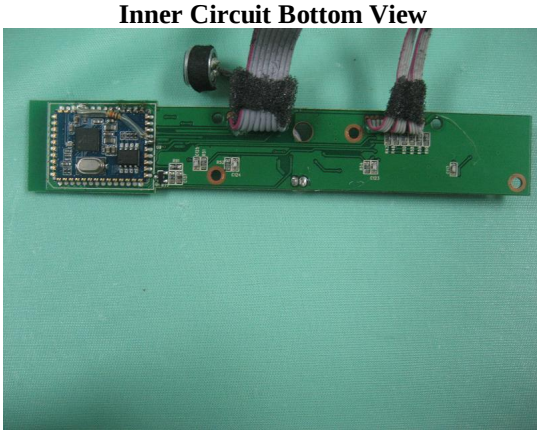


Photographs of EUT

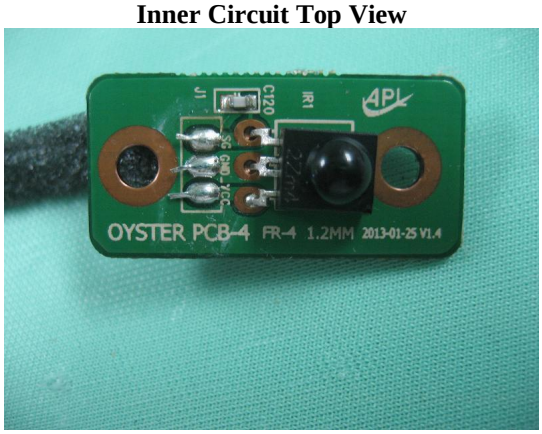
Inner Circuit Top View



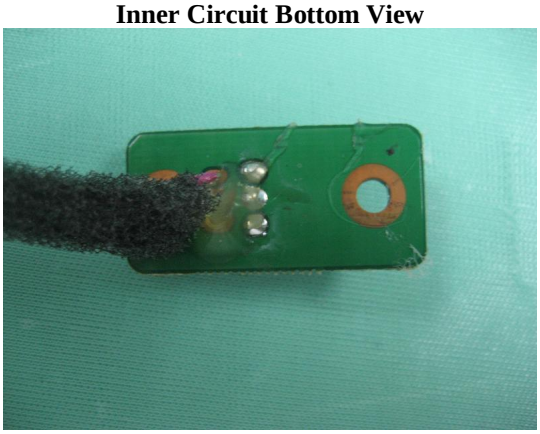
Inner Circuit Bottom View



Inner Circuit Top View

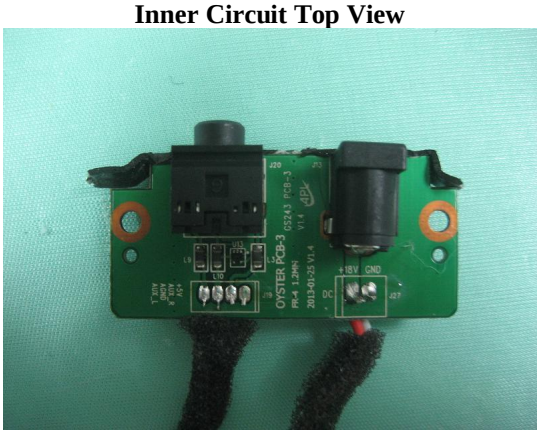


Inner Circuit Bottom View

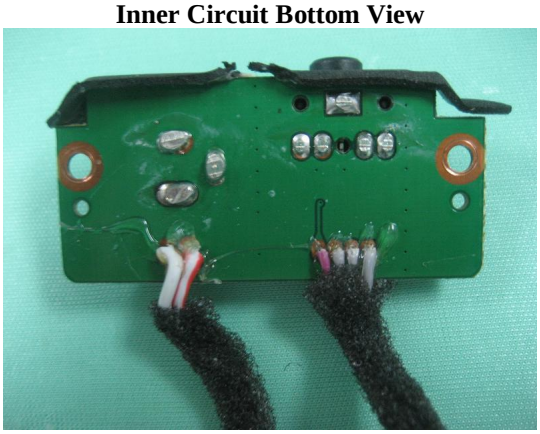


Photographs of EUT

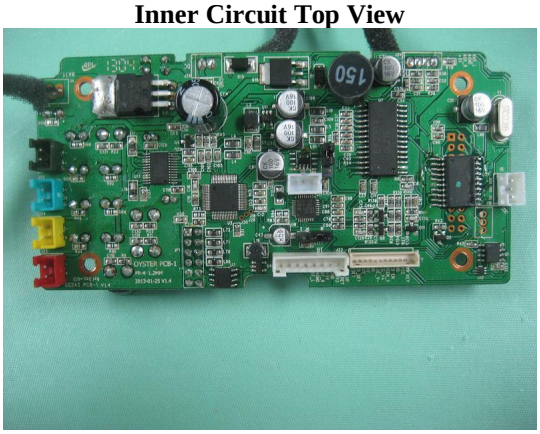
Inner Circuit Top View



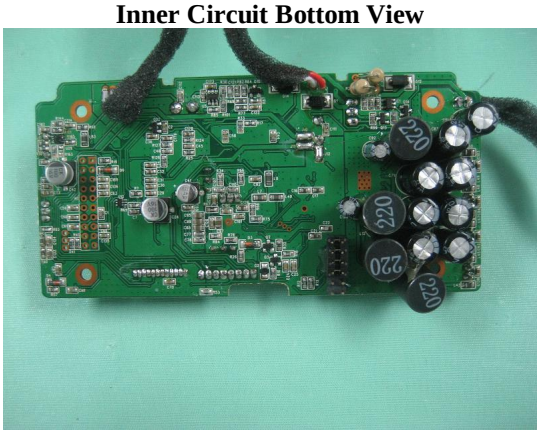
Inner Circuit Bottom View



Inner Circuit Top View

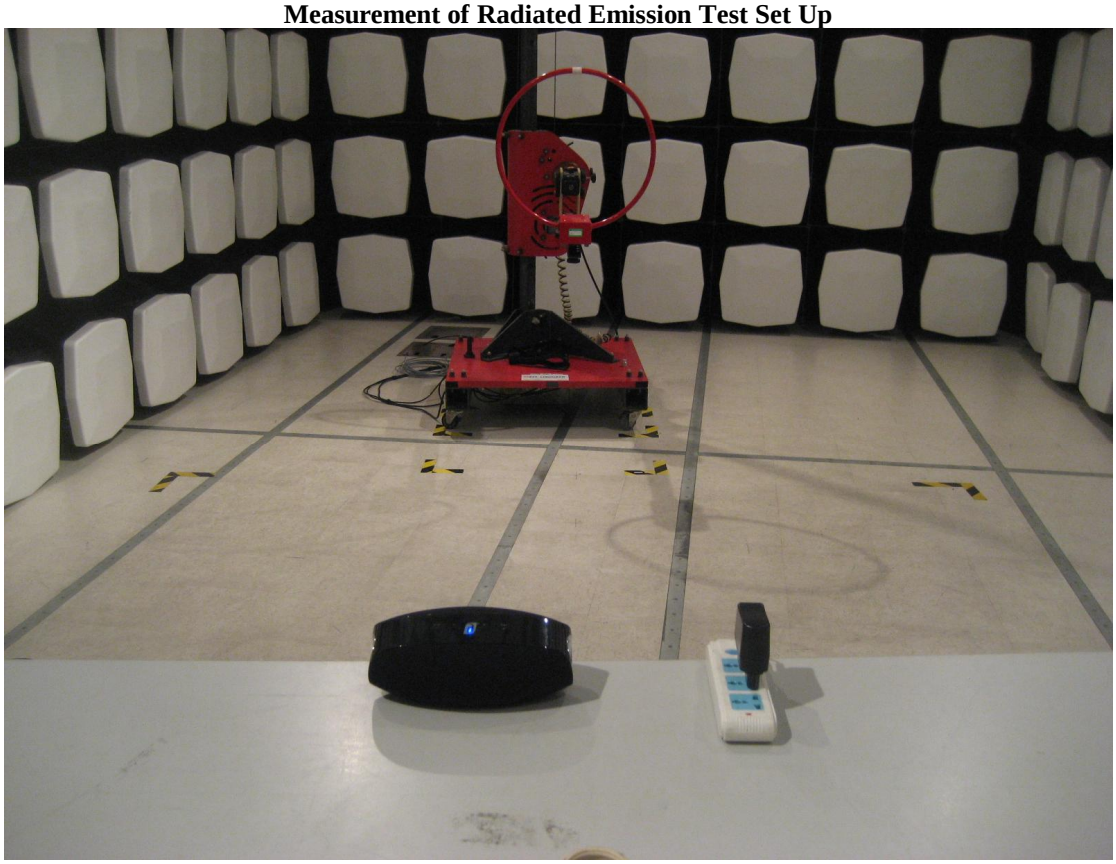


Inner Circuit Bottom View



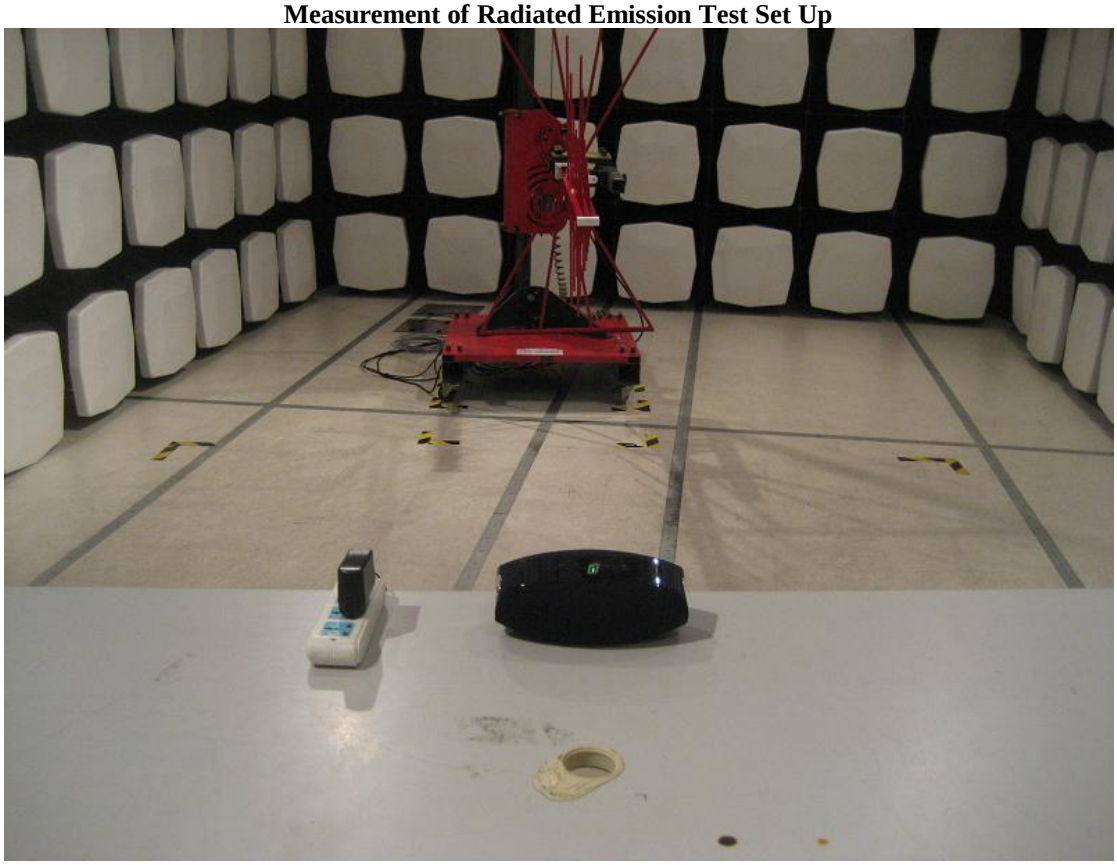
Photographs of EUT

Measurement of Radiated Emission Test Set Up



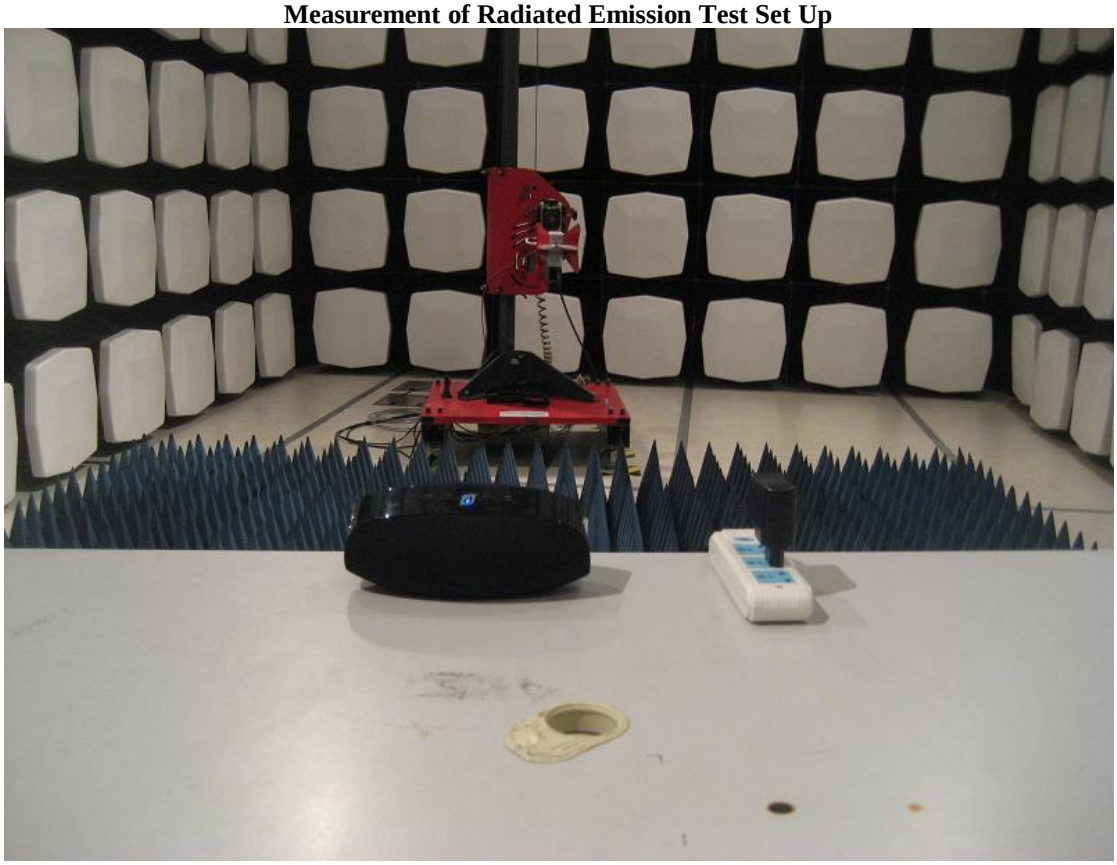
Photographs of EUT

Measurement of Radiated Emission Test Set Up



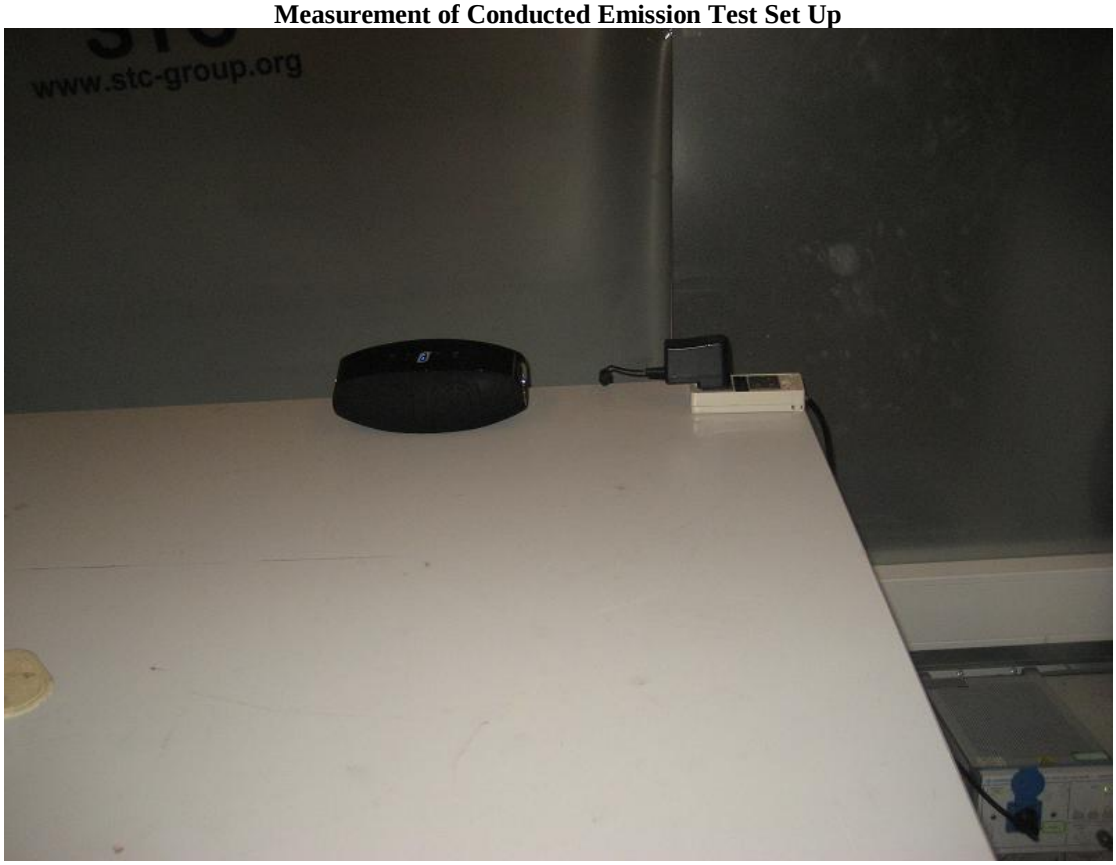
Photographs of EUT

Measurement of Radiated Emission Test Set Up



Photographs of EUT

Measurement of Conducted Emission Test Set Up



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