FCC Test Report

FCC ID	:	**2ACAHTVA3**
Equipment	:	**TV Adapter**
Model No.	:	**TVA3**
Applicant	:	**SBO Hearing A/S**
Address	:	**Kongebakken 9 DK-2765 Smoerum, Denmark**
Standard	:	**47 CFR FCC Part 15.247**
Received Date	:	**Apr. 25, 2016**
Tested Date	:	**Apr. 25 ~ May 04, 2016**

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Approved & Reviewed by:

Gary Chang / Manager

Testing Laboratory
2732

Table of Contents

Release Record

Report No.	Version	Description	Issued Date
FR642501	Rev. 01	Initial issue	May 24, 2016
FR642501	Rev. 02	Modified HW version / SW version description (page 5.)	May 26, 2016
FR642501	Rev. 03	Revised Modulation type 2GFSK (Page 5)	Jun. 07, 2016

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.195MHz 60.58 (Margin -3.22dB) - QP	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 44.55MHz 34.03 (Margin -5.97dB) - PK	Pass
15.247(d)	Band Edge	Meet the requirement of limit	Pass
15.247(b)(1)	Conducted Output Power	Power [dBm]: 13.31	Pass
15.247(a)(1)(iii)	Number of Hopping Channels	Meet the requirement of limit	Pass
15.247(a)(1)	Hopping Channel Separation	Meet the requirement of limit	Pass
15.247(a)(1)(iii)	Dwell Time	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information				
Frequency Range (MHz)	**Modulation Mode**	**Ch. Frequency (MHz)**	**Channel Number**	**Data Rate**
2400-2483.5	FHSS	2404-2476	0-35 [36]	2 Mbps
Note 1: FHSS uses a 2GFSK. Note 2: HW version: B3 / SW version: 0.9.3				

1.1.2 Antenna Details

Ant. No.	Type	Gain (dBi)	Connector	Remark
1	Metal plate	3.2	N/A	---

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	5Vdc from adapter

1.1.4 Accessories

No.	Equipment	Description
1	AC adapter	Brand Name: PHIHONG Model Name: A M05A-050A-R I/P: 100-240Vac, 50-60Hz, 0.2A O/P: 5Vdc, 1A Power Line: 1.82m non-shielded without core
2	AC adapter	Brand Name: PHIHONG Model Name: PSAC05R-050T1 I/P: 100-240Vac, 300mA, 50-60Hz, 12-18VA O/P: 5Vdc, 1A Power Line: 1.81m non-shielded without core

1.1.5 Channel List

Frequency band (MHz)				2400~2483.5			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2404	9	2422	18	2442	27	2460
1	2406	10	2424	19	2444	28	2462
2	2408	11	2428	20	2446	29	2464
3	2410	12	2430	21	2448	30	2466
4	2412	13	2432	22	2450	31	2468
5	2414	14	2434	23	2452	32	2470
6	2416	15	2436	24	2454	33	2472
7	2418	16	2438	25	2456	34	2474
8	2430	17	2440	26	2458	35	2476

1.1.6 Test Tool and Duty Cycle

Test Tool	NebulaDeveloper, ver. 0.9.3

1.1.7 Power Setting

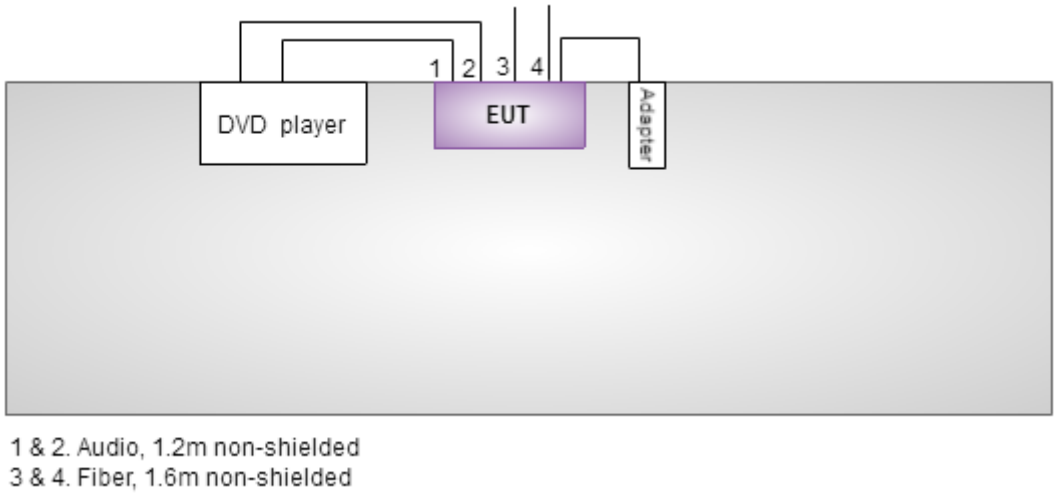
Modulation Mode	Test Frequency (MHz)		
	2404	2440	2476
FHSS/2Mbps	Default	Default	Default

1.2 Local Support Equipment List

Support Equipment List					
No.	**Equipment**	**Brand**	**Model**	**FCC ID**	**Signal cable / Length (m)**
1	DVD player	SONY	BDP-S190	3224521	Audio, 1.2m non-shielded
2	Notebook	DELL	Latitude E6430	F2JB4X1	Fiber, 1.6m non-shielded

1.3 Test Setup Chart

Test Setup Diagram



1 & 2. Audio, 1.2m non-shielded
3 & 4. Fiber, 1.6m non-shielded

Note: The support notebook was disconnected from EUT and removed from test table when EUT is set to transmit continuously.

1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
EMC Receiver	R&S	ESCS 30	100169	Oct. 21, 2015	Oct. 20, 2016
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 13, 2015	Nov. 12, 2016
LISN (Support Unit)	SCHWARZBECK	Schwarzbeck 8127	8127-666	Nov. 26, 2015	Nov. 25, 2016
RF Cable-CON	EMC	EMCCFD300-BM-BM-6000	50821	Dec. 21, 2015	Dec. 20, 2016
50 ohm terminal (Support Unit)	NA	50	04	Apr. 12, 2016	Apr. 11, 2017
Measurement Software	AUDIX	e3	6.120210k	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission				
Test Site	966 chamber 3 / (03CH03-WS)				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	Agilent	N9010A	MY53400091	Sep. 14, 2015	Sep. 13, 2016
Receiver	Agilent	N9038A	MY53290044	Oct. 14, 2015	Oct. 13, 2016
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-562	Nov. 16, 2015	Nov. 15, 2016
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Feb. 24, 2016	Feb. 23, 2017
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 04, 2015	Nov. 03, 2016
Loop Antenna	R&S	HFH2-Z2	11900	Nov. 16, 2015	Nov. 15, 2016
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 10, 2015	Dec. 09, 2016
Preamplifier	EMC	EMC02325	980187	Sep. 21, 2015	Sep. 20, 2016
Preamplifier	Agilent	83017A	MY53270014	Sep. 07, 2015	Sep. 06, 2016
Preamplifier	EMC	EMC184045B	980192	Sep. 01, 2015	Aug. 31, 2016
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Feb. 05, 2016	Feb. 04, 2017
RF cable-8M	HUBER+SUHNER	SUCOFLEX104	MY22600/4	Feb. 05, 2016	Feb. 04, 2017
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Feb. 05, 2016	Feb. 04, 2017
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Feb. 05, 2016	Feb. 04, 2017
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Feb. 05, 2016	Feb. 04, 2017
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Feb. 05, 2016	Feb. 04, 2017
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101063	Feb. 17, 2016	Feb. 16, 2017
Power Meter	Anritsu	ML2495A	1241002	Sep. 21, 2015	Sep. 20, 2016
Power Sensor	Anritsu	MA2411B	1207366	Sep. 21, 2015	Sep. 20, 2016
DC POWER SOURCE	GW INSTEK	GPC-3060D	EM884797	Oct. 20, 2015	Oct. 19, 2016
AC POWER SOURCE	APC	AFC-500W	F312060012	Oct. 26, 2015	Oct. 25, 2016
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.247
FCC Public notice DA 00-705
ANSI C63.10-2013

1.6 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Measurement Uncertainty	
Parameters	**Uncertainty**
Bandwidth	±34.134 Hz
Conducted power	±0.808 dB
Power density	±0.463 dB
Conducted emission	±2.670 dB
AC conducted emission	±2.90 dB
Radiated emission ≤ 1GHz	±3.66 dB
Radiated emission > 1GHz	±5.37 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	21°C / 60%	Howard Huang
Radiated Emissions	03CH03-WS	24°C / 62%	Allen Yu
RF Conducted	TH01-WS	22°C / 63%	Alex Huang

- FCC site registration No.: 207696
- IC site registration No.: 10807C-1

2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Data Rate (Mbps)	Test Configuration
Conducted Emissions	FHSS	2440	2Mbps	---
Radiated Emissions ≤ 1GHz	FHSS	2440	2Mbps	---
Radiated Emissions > 1GHz	FHSS	2404, 2440, 2476	2Mbps	---
Conducted Output Power	FHSS	2404, 2440, 2476	2Mbps	---
Number of Hopping Channels	FHSS	2404 ~ 2476	2Mbps	---
Hopping Channel Separation	FHSS	2404, 2440, 2476	2Mbps	---
Dwell Time	FHSS	2404	2Mbps	---

NOTE:
1. Two adapters (model A M05A-050A-R and model PSAC05R-050T1) had been covered during the pretest, and found that model **PSAC05R-050T1** was the worst case and was selected for final test.
2. S/N of test samples are as below
   00J9999651469
   00J9999651472
   00J9999651416
   00J9999651417
3. S/N of test adapter is P160303352A1

3 Transmitter Test Results

3.1 Conducted Emissions

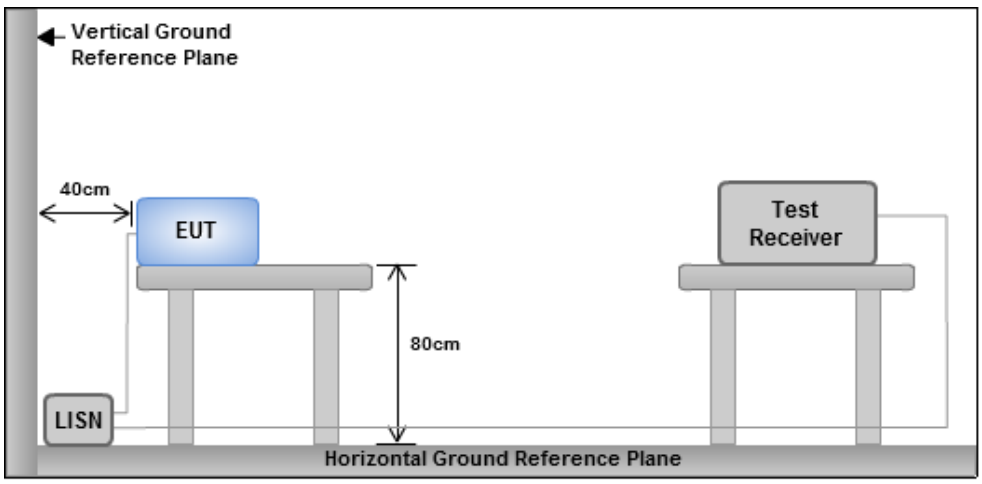
3.1.1 Limit of Conducted Emissions

Conducted Emissions Limit		
Frequency Emission (MHz)	**Quasi-Peak**	**Average**
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50
Note 1: * Decreases with the logarithm of the frequency.		

3.1.2 Test Procedures

1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50 Ω LISN port.
3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
4. This measurement was performed with AC 120V/60Hz

3.1.3 Test Setup

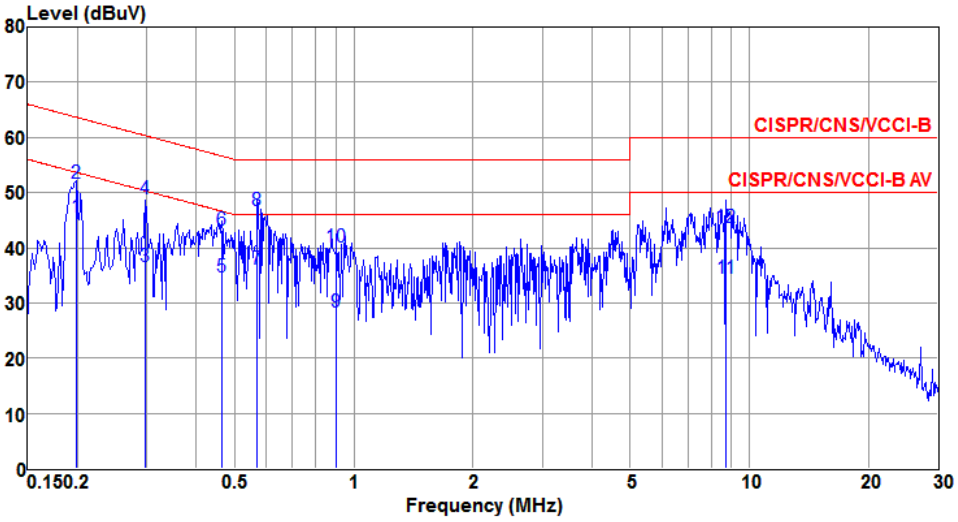


Note: 1. Support units were connected to second LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.1.4 Test Result of Conducted Emissions

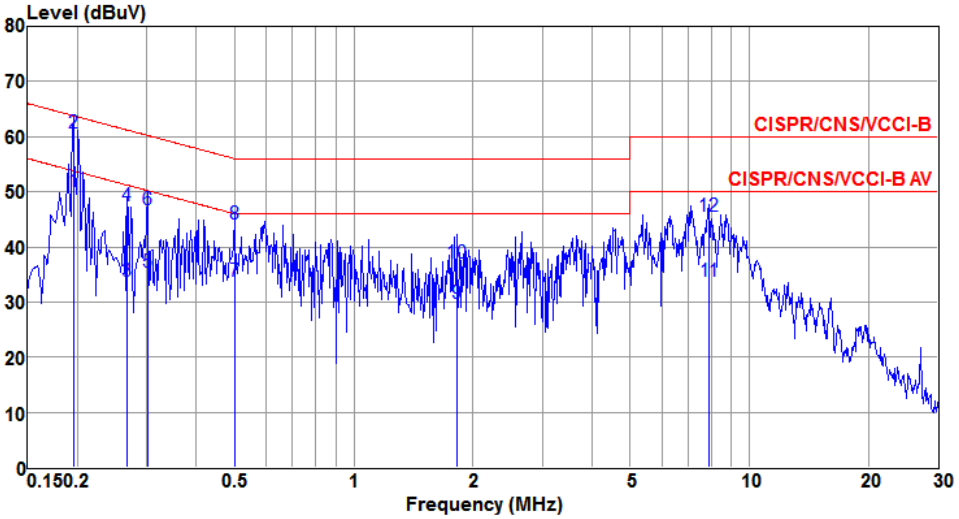
Modulation Mode	FHSS	Test Freq. (MHz)	2440
Power Phase	Line		



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuA	dBuA	dB	dBuA	dB	dB	
1@	0.199	45.52	53.67	-8.15	45.23	0.27	0.02	Average
2	0.199	51.81	63.67	-11.86	51.52	0.27	0.02	QP
3	0.297	36.55	50.32	-13.77	36.31	0.21	0.03	Average
4	0.297	48.83	60.32	-11.49	48.59	0.21	0.03	QP
5	0.464	34.59	46.63	-12.04	34.39	0.17	0.03	Average
6	0.464	43.27	56.63	-13.36	43.07	0.17	0.03	QP
7	0.570	36.16	46.00	-9.84	35.97	0.15	0.04	Average
8	0.570	46.68	56.00	-9.32	46.49	0.15	0.04	QP
9	0.904	28.41	46.00	-17.59	28.25	0.10	0.06	Average
10	0.904	40.20	56.00	-15.80	40.04	0.10	0.06	QP
11	8.729	34.37	50.00	-15.63	33.61	0.61	0.15	Average
12	8.729	43.65	60.00	-16.35	42.89	0.61	0.15	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

Modulation Mode	FHSS	Test Freq. (MHz)	2440
Power Phase	Neutral		



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuA	dBuA	dB	dBuA	dB	dB	
1	0.195	49.92	53.80	-3.88	49.61	0.29	0.02	Average
2@	0.195	60.58	63.80	-3.22	60.27	0.29	0.02	QP
3	0.267	33.76	51.20	-17.44	33.55	0.19	0.02	Average
4	0.267	47.47	61.20	-13.73	47.26	0.19	0.02	QP
5	0.300	35.52	50.24	-14.72	35.31	0.18	0.03	Average
6	0.300	46.69	60.24	-13.55	46.48	0.18	0.03	QP
7	0.499	33.76	46.01	-12.25	33.56	0.16	0.04	Average
8	0.499	44.12	56.01	-11.89	43.92	0.16	0.04	QP
9	1.819	29.67	46.00	-16.33	29.36	0.23	0.08	Average
10	1.819	37.04	56.00	-18.96	36.73	0.23	0.08	QP
11	7.935	33.84	50.00	-16.16	33.11	0.58	0.15	Average
12	7.935	45.46	60.00	-14.54	44.73	0.58	0.15	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

3.2 Radiated Emission

3.2.1 Limit of Emissions in Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	**Field Strength (uV/m)**	**Field Strength (dBuV/m)**	**Measure Distance (m)**
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:
Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit
Note 2:
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

3.2.2 Test Procedures

1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

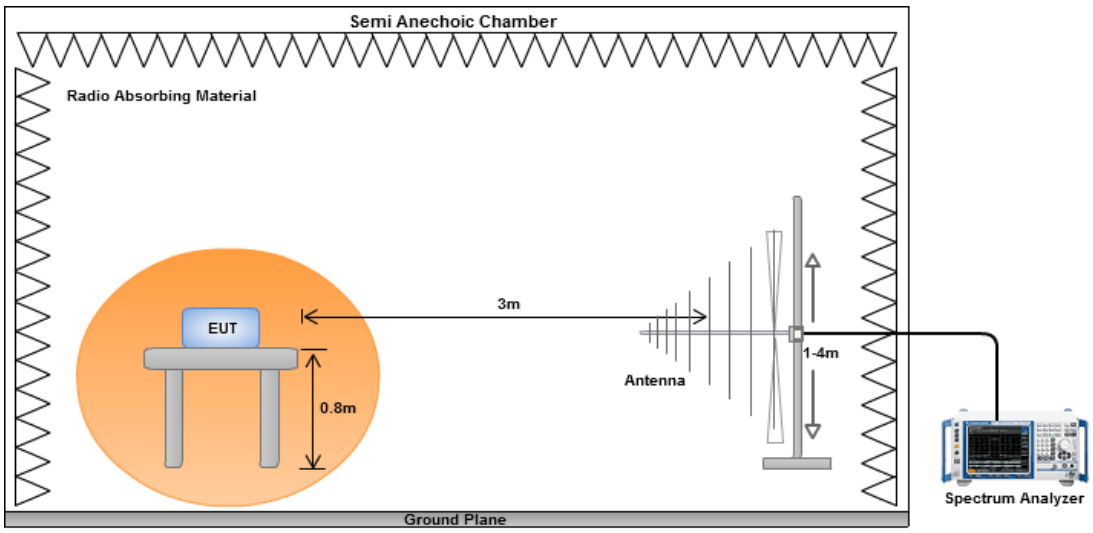
1. Radiated emission below 1GHz
   120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission
2. Radiated emission above 1GHz / Peak value
   RBW=1MHz, VBW=3MHz and Peak detector

   Radiated emission above 1GHz / Average value for harmonics
   The average value is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
3. $$20\log(\text{Duty cycle}) = 20\log\frac{4^* 0.47754\ \text{ms}}{100\ \text{ms}} = -34.38\text{dB}$$

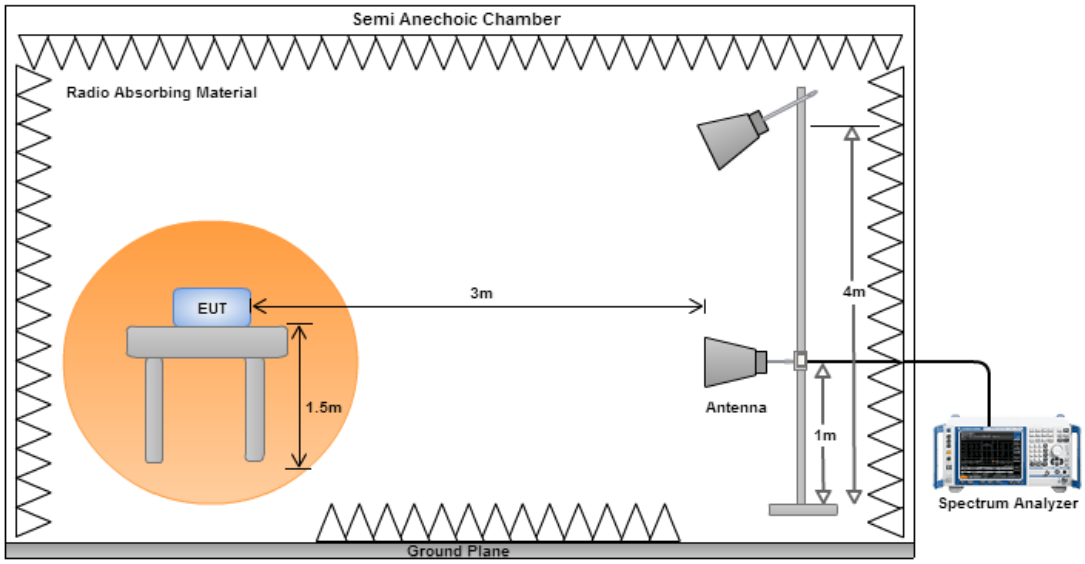
   Please see page 25 for plotted duty
4. Radiated emission above 1GHz / Average value for other emissions
   RBW=1MHz, VBW=10Hz and Peak detector

3.2.3 Test Setup

Radiated Emissions below 1 GHz

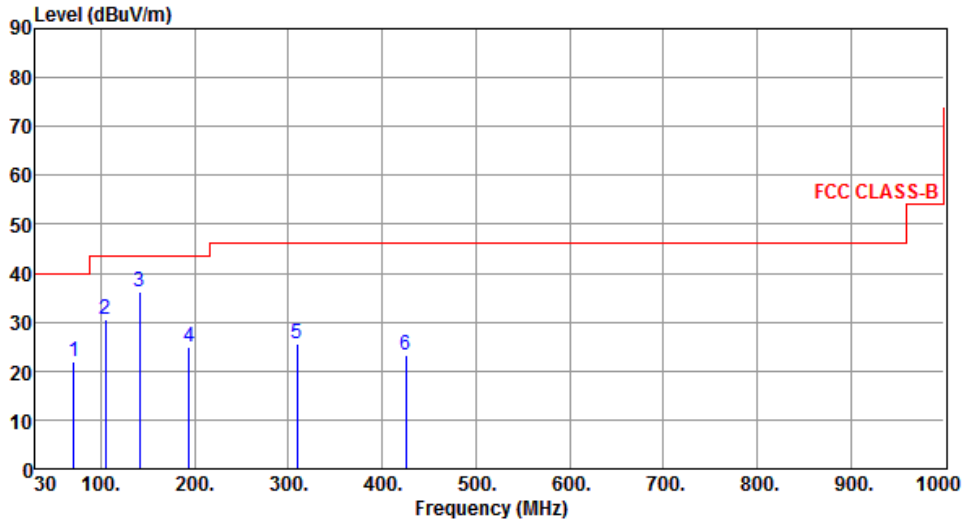


Radiated Emissions above 1 GHz



3.2.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

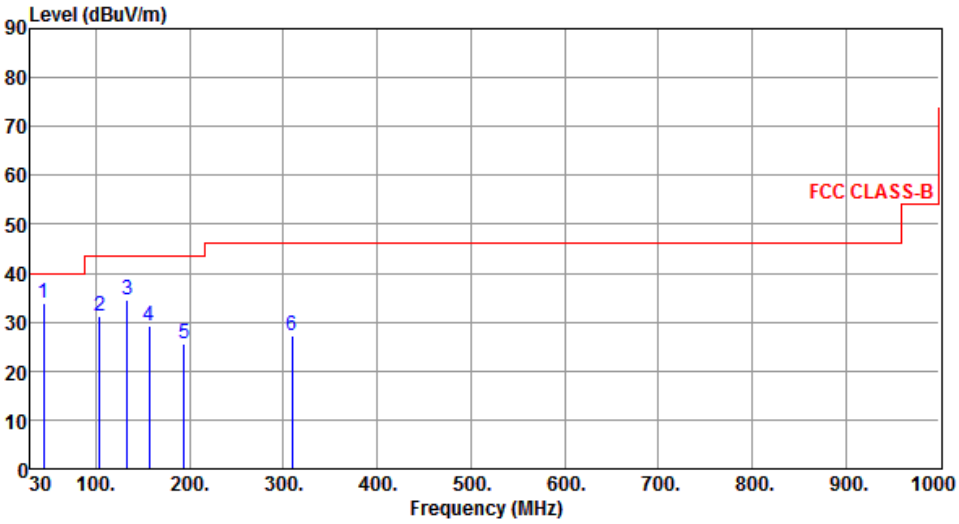
Modulation	FHSS	Test Freq. (MHz)	2440
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	70.74	22.00	40.00	-18.00	37.75	-15.75	Peak	---	---
2	104.69	30.44	43.50	-13.06	47.88	-17.44	Peak	---	---
3	141.55	36.34	43.50	-7.16	49.97	-13.63	Peak	---	---
4	193.93	25.02	43.50	-18.48	41.24	-16.22	Peak	---	---
5	309.36	25.60	46.00	-20.40	38.18	-12.58	Peak	---	---
6	425.76	23.18	46.00	-22.82	32.65	-9.47	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Modulation	FHSS	Test Freq. (MHz)	2440
Polarization	Vertical		

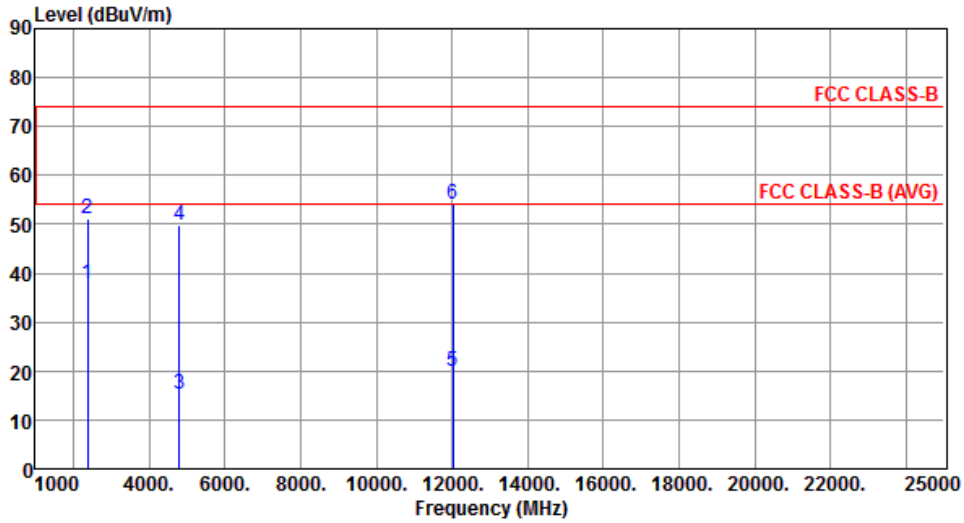


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	44.55	34.03	40.00	-5.97	47.08	-13.05	Peak	---	---
2	103.72	31.08	43.50	-12.42	48.69	-17.61	Peak	---	---
3	133.79	34.43	43.50	-9.07	48.65	-14.22	Peak	---	---
4	157.07	29.35	43.50	-14.15	42.68	-13.33	Peak	---	---
5	193.93	25.67	43.50	-17.83	41.89	-16.22	Peak	---	---
6	309.36	27.07	46.00	-18.93	39.65	-12.58	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.2.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

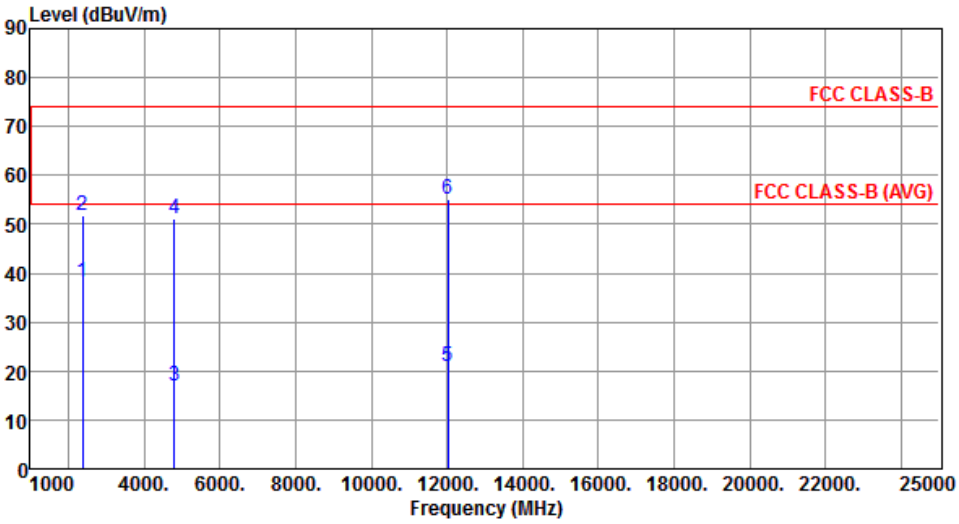
Modulation	FHSS	Test Freq. (MHz)	2404
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	37.94	54.00	-16.06	39.04	-1.10	Average	139	260
2	2390.00	50.98	74.00	-23.02	52.08	-1.10	Peak	139	260
3	4808.00	15.33	54.00	-38.67	10.06	5.27	Average	107	226
4	4808.00	49.71	74.00	-24.29	44.44	5.27	Peak	107	226
5	12020.00	19.77	54.00	-34.23	4.71	15.06	Average	100	134
6	12020.00	54.15	74.00	-19.85	39.09	15.06	Peak	100	134

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

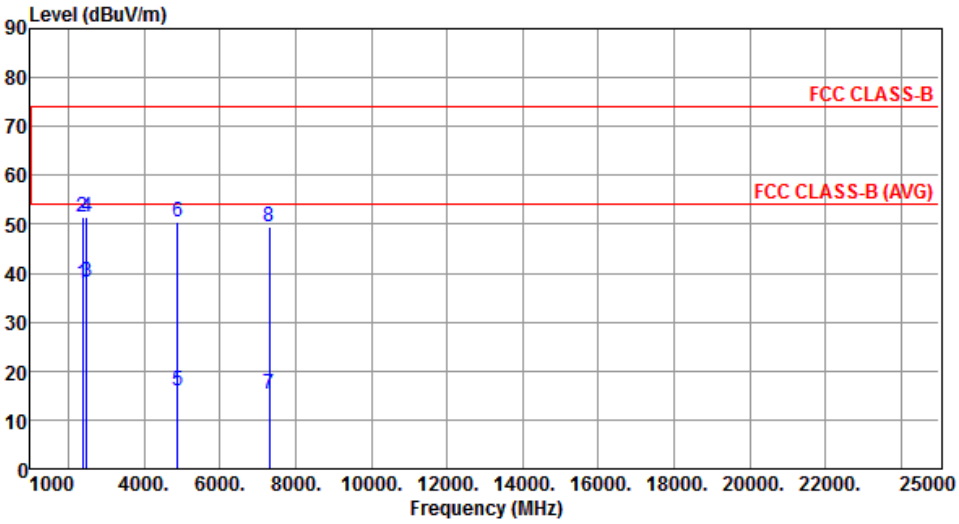
Modulation	FHSS	Test Freq. (MHz)	2404
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	38.19	54.00	-15.81	39.29	-1.10	Average	368	11
2	2390.00	51.92	74.00	-22.08	53.02	-1.10	Peak	368	11
3	4808.00	16.90	54.00	-37.10	11.63	5.27	Average	363	73
4	4808.00	51.28	74.00	-22.72	46.01	5.27	Peak	363	73
5	12020.00	20.89	54.00	-33.11	5.83	15.06	Average	100	149
6	12020.00	55.27	74.00	-18.73	40.21	15.06	Peak	100	149

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

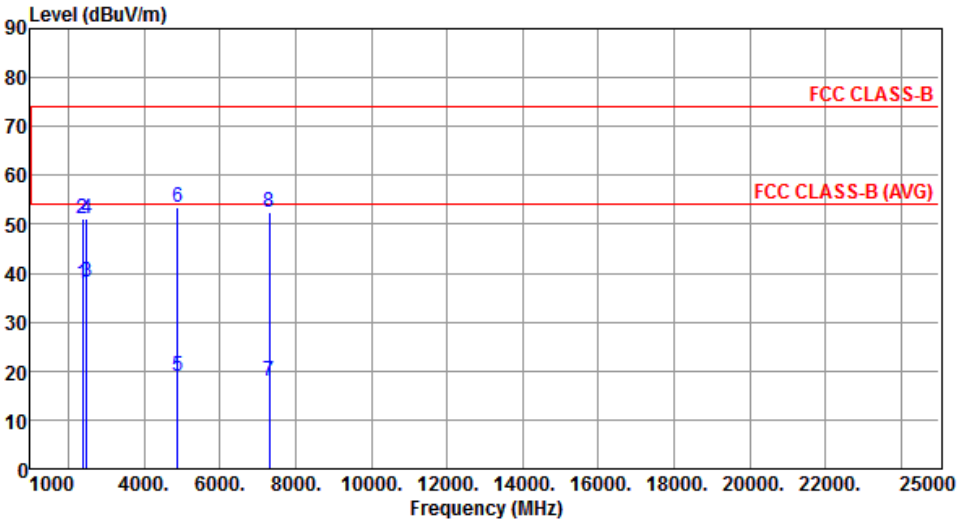
Modulation	FHSS	Test Freq. (MHz)	2440
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	37.87	54.00	-16.13	38.97	-1.10	Average	248	235
2	2390.00	51.45	74.00	-22.55	52.55	-1.10	Peak	248	235
3	2483.50	38.29	54.00	-15.71	38.90	-0.61	Average	248	235
4	2483.50	51.31	74.00	-22.69	51.92	-0.61	Peak	248	235
5	4880.00	16.04	54.00	-37.96	10.61	5.43	Average	399	162
6	4880.00	50.42	74.00	-23.58	44.99	5.43	Peak	399	162
7	7320.00	15.18	54.00	-38.82	4.91	10.27	Average	248	235
8	7320.00	49.56	74.00	-24.44	39.29	10.27	Peak	248	235

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

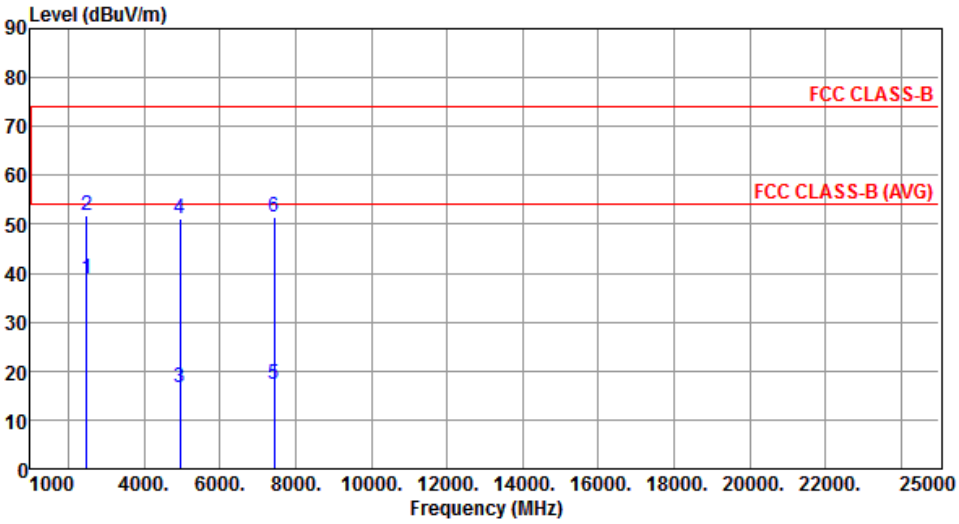
Modulation	FHSS	**Test Freq. (MHz)**	2440
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	37.78	54.00	-16.22	38.88	-1.10	Average	117	192
2	2390.00	50.98	74.00	-23.02	52.08	-1.10	Peak	117	192
3	2483.50	38.28	54.00	-15.72	38.89	-0.61	Average	117	192
4	2483.50	50.98	74.00	-23.02	51.59	-0.61	Peak	117	192
5	4880.00	19.04	54.00	-34.96	13.61	5.43	Average	375	75
6	4880.00	53.42	74.00	-20.58	47.99	5.43	Peak	375	75
7	7320.00	18.00	54.00	-36.00	7.73	10.27	Average	287	279
8	7320.00	52.38	74.00	-21.62	42.11	10.27	Peak	287	279

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

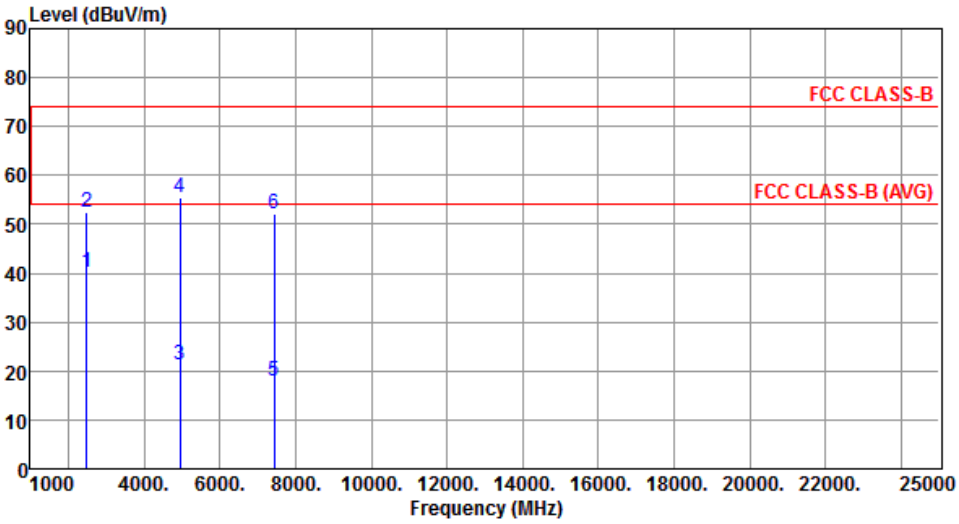
Modulation	FHSS	**Test Freq. (MHz)**	2476
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	38.78	54.00	-15.22	39.39	-0.61	Average	100	230
2	2483.50	51.79	74.00	-22.21	52.40	-0.61	Peak	100	230
3	4952.00	16.77	54.00	-37.23	11.17	5.60	Average	100	307
4	4952.00	51.15	74.00	-22.85	45.55	5.60	Peak	100	307
5	7428.00	17.16	54.00	-36.84	6.64	10.52	Average	100	230
6	7428.00	51.54	74.00	-22.46	41.02	10.52	Peak	100	230

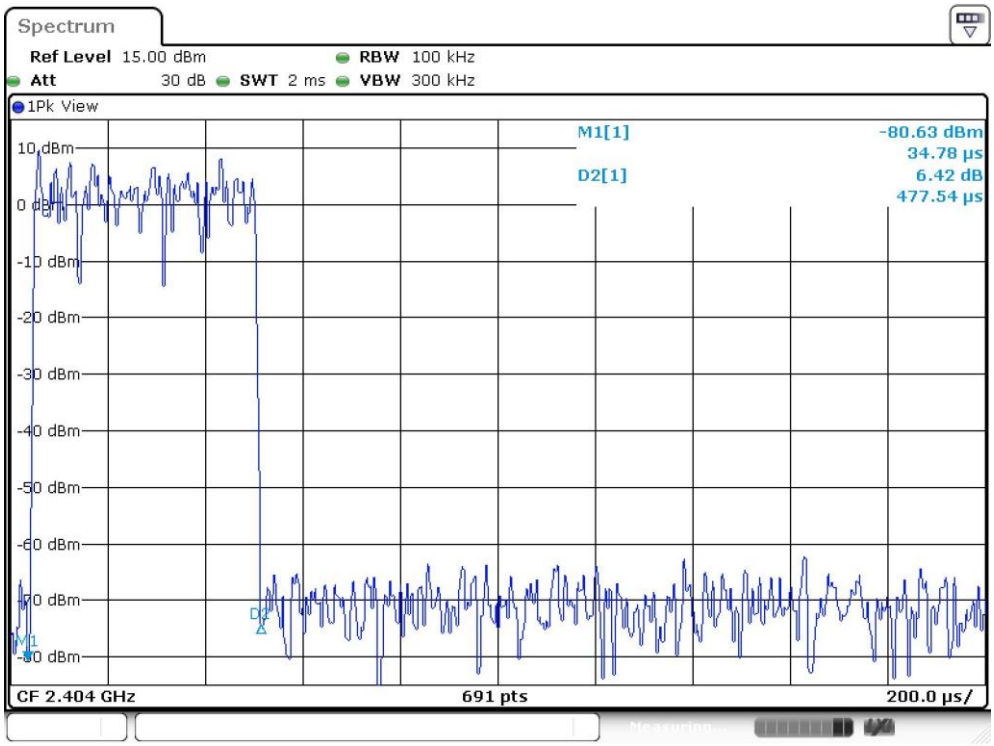
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

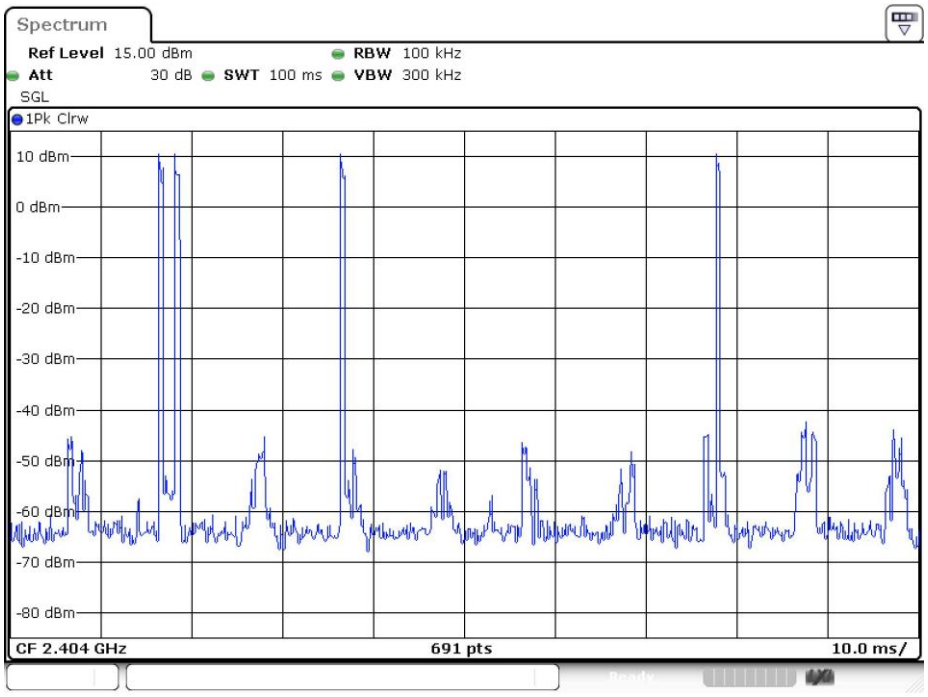
Modulation	FHSS	**Test Freq. (MHz)**	2476
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	40.06	54.00	-13.94	40.67	-0.61	Average	385	46
2	2483.50	52.63	74.00	-21.37	53.24	-0.61	Peak	385	46
3	4952.00	21.14	54.00	-32.86	15.54	5.60	Average	381	80
4	4952.00	55.52	74.00	-18.48	49.92	5.60	Peak	381	80
5	7428.00	17.81	54.00	-36.19	7.29	10.52	Average	100	40
6	7428.00	52.19	74.00	-21.81	41.67	10.52	Peak	100	40

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).





$$20\log(\text{Duty cycle}) = 20\log\frac{4*0.47754\ \text{ms}}{100\ \text{ms}} = -34.38\text{dB}$$

3.3 Unwanted Emissions into Non-Restricted Frequency Bands

3.3.1 Limit of Unwanted Emissions into Non-Restricted Frequency Bands

The peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz.

3.3.2 Test Procedures

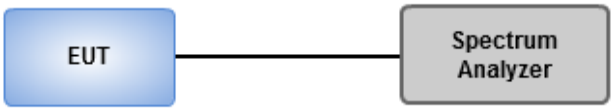
Reference Level Measurement

1. Set the RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Set Sweep time = auto couple, Trace mode = max hold.
3. Allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

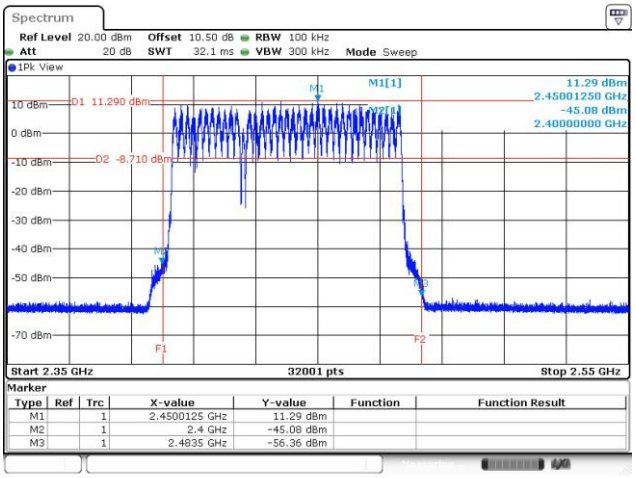
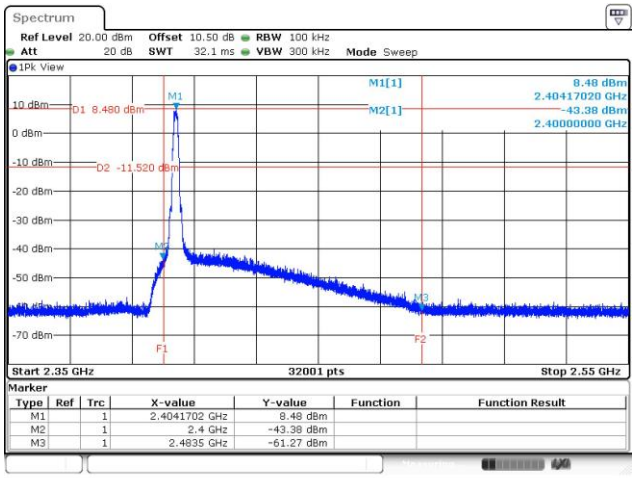
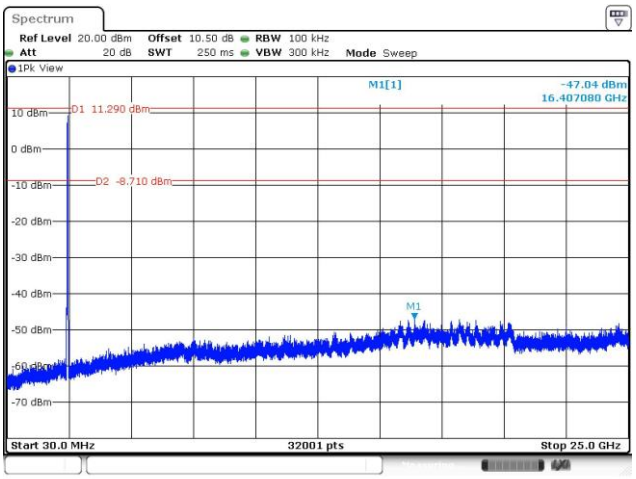
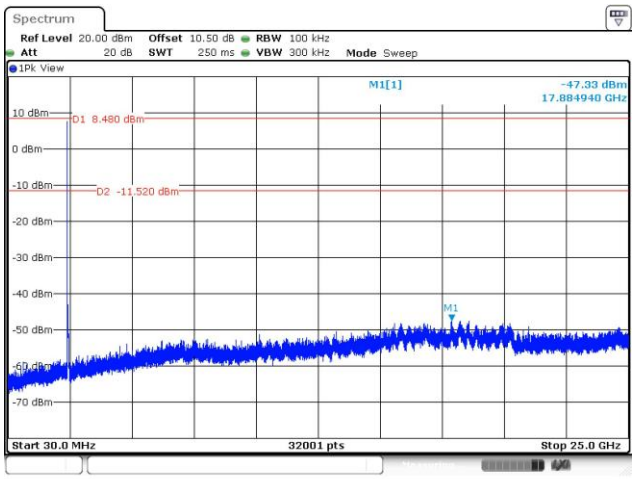
Unwanted Emissions Level Measurement

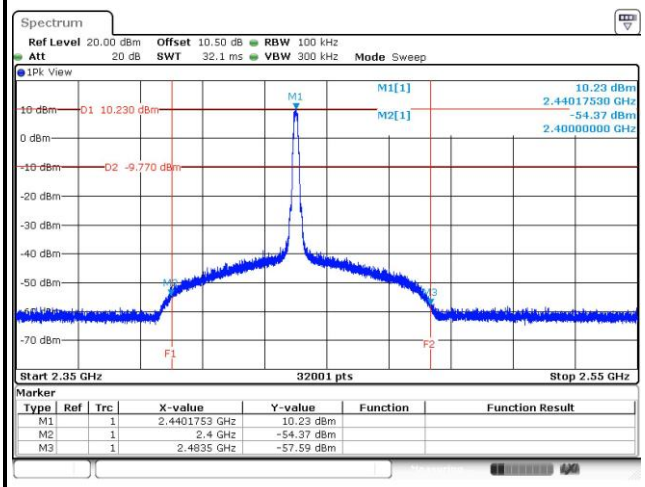
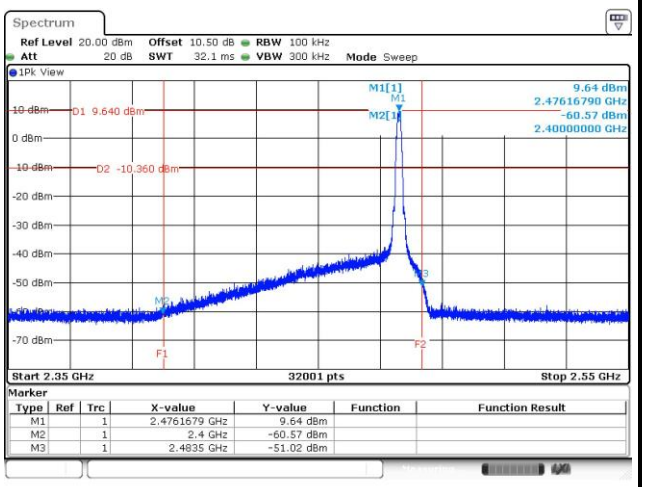
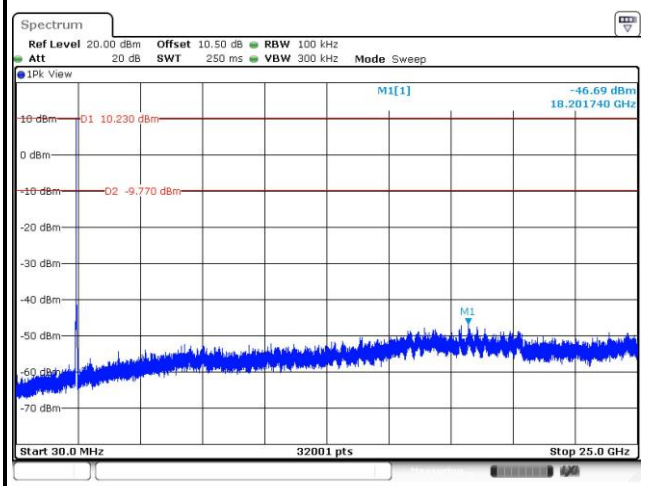
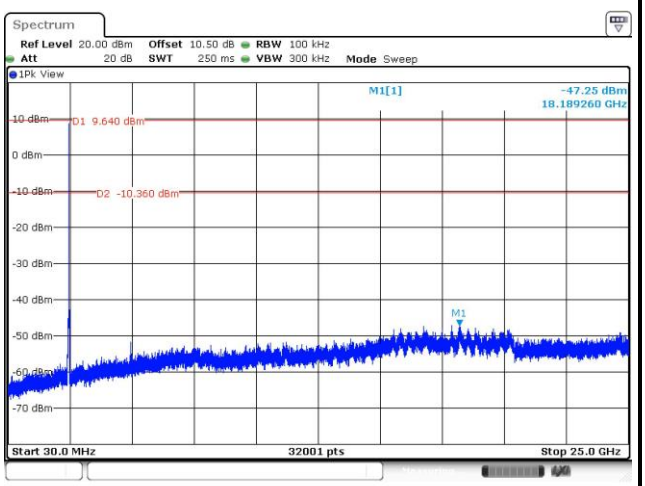
1. Set RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Trace Mode = max hold, Sweep = auto couple.
3. Allow the trace to stabilize.
4. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

3.3.3 Test Setup



3.3.4 Unwanted Emissions into Non-Restricted Frequency Bands

Hopping on	Hopping off
30MHz~25GHz (down 20dBc)	TX Freq 2404MHz / 30MHz~25GHz (down 20dBc)
	
	

Hopping off	Hopping off
TX Freq 2440MHz / 30MHz~25GHz (down 20dBc)	TX Freq 2476MHz / 30MHz~25GHz (down 20dBc)
	
	

3.4 Conducted Output Power

3.4.1 Limit of Conducted Output Power

☐ 1 Watt
For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band.

☒ 0.125 Watt
For all other frequency hopping systems in the 2400–2483.5 MHz band.

☐ 0.125 Watt
For Frequency hopping systems operating in the 2400–2483.5 MHz band have hopping channel carrier frequencies that are separated by two-thirds of the 20 dB bandwidth of the hopping channel.

3.4.2 Test Procedures

1. A wideband power meter is used for power measurement. Bandwidth of power senor and meter is 50MHz

2 If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power

3.4.3 Test Setup

3.4.4 Test Result of Conducted Output Power

Modulation Mode	Freq. (MHz)	Output Power (mW)	Output Power (dBm)	Limit (mW)
FHSS	2404	15.17	11.81	125
FHSS	2440	21.43	**13.31**	125
FHSS	2476	19.82	12.97	125

Modulation Mode	Freq. (MHz)	AV Output Power (mW)	AV Output Power (dBm)
FHSS	2404	14.32	11.56
FHSS	2440	21.13	**13.25**
FHSS	2476	18.75	12.73

Note: Average power is for reference only.

3.5 Number of Hopping Frequency

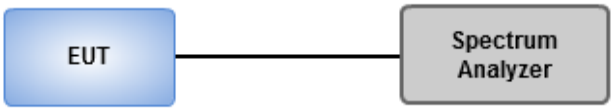
3.5.1 Limit of Number of Hopping Frequency

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

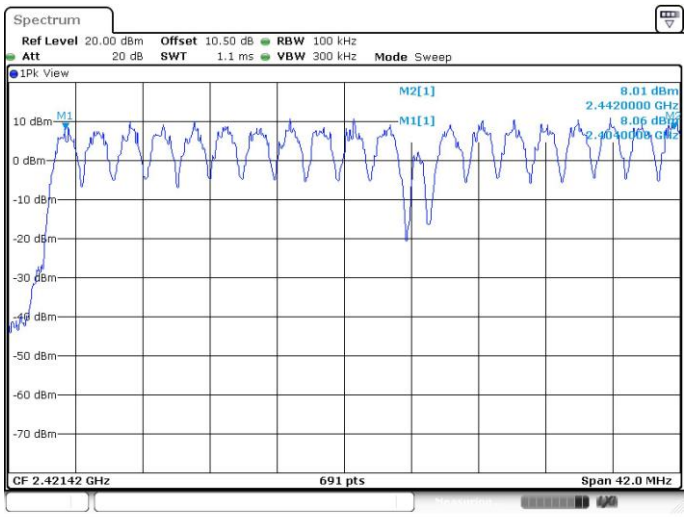
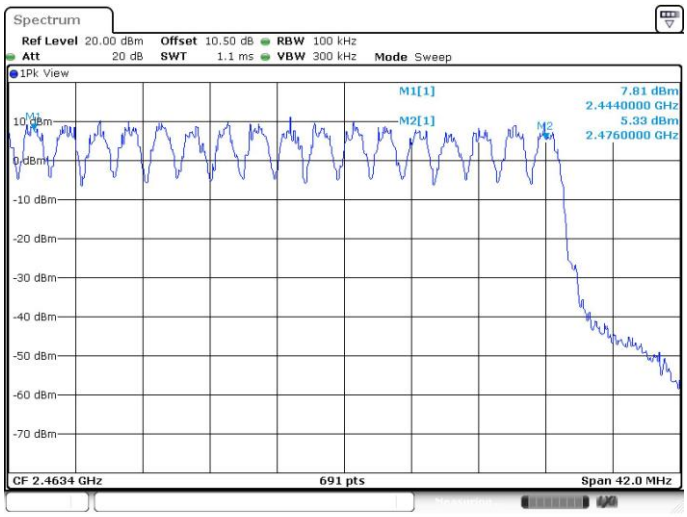
3.5.2 Test Procedures

1. Set RBW = 100kHz, VBW = 300kHz, Sweep time = Auto, Detector = Peak Trace max hold.
2 Allow trace to stabilize.

3.5.3 Test Setup



3.5.4 Test Result of Number of Hopping Frequency

FHSS



3.6 20dB and Occupied Bandwidth

3.6.1 Test Procedures

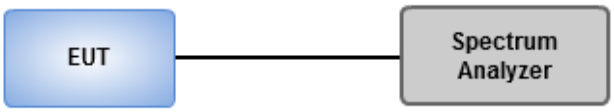
20dB Bandwidth

1. Set RBW=30kHz, VBW=100kHz,Sweep time = Auto, Detector=Peak, Trace max hold
2 Allow trace to stabilize
3 Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

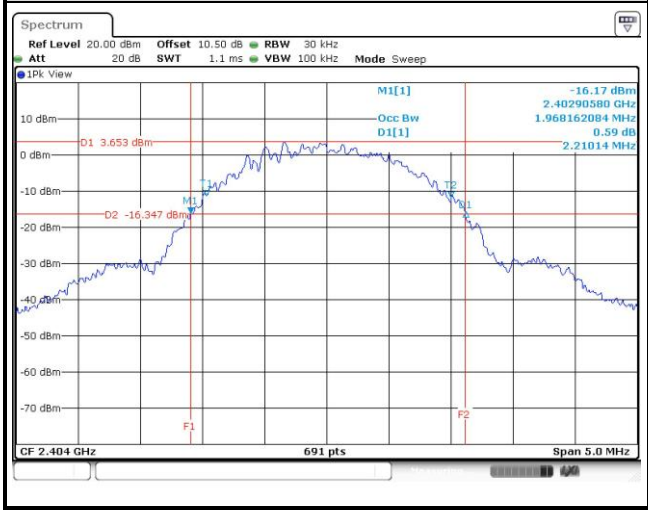
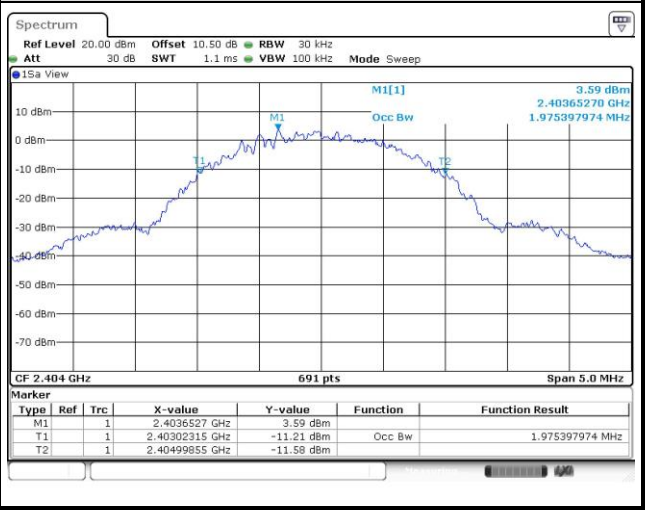
1. Set RBW=30kHz, VBW=100kHz,Sweep time = Auto, Detector=Sample, Trace max hold
2 Allow trace to stabilize
3. Use Occupied bandwidth function of spectrum analyzer to measuring 99% occupied bandwidth

3.6.2 Test Setup



3.6.3 Test result of 20dB and Occupied Bandwidth

Modulation Mode	Freq. (MHz)	20dB Bandwidth (MHz)	Occupied Bandwidth (MHz)
FHSS	2404	2.210	1.975
FHSS	2440	2.210	1.975
FHSS	2476	2.210	1.961

Worst Plot of 20dB Bandwidth	Worst Plot of Occupied Bandwidth
	

3.7 Channel Separation

3.7.1 Limit of Channel Separation

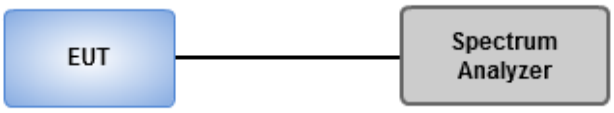
☐ Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

☒ 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.

3.7.2 Test Procedures

1. Set RBW=100kHz, VBW=300kHz,Sweep time = Auto, Detector=Peak Trace max hold
2. Allow trace to stabilize
3. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The EUT shall show compliance with the appropriate regulatory limit

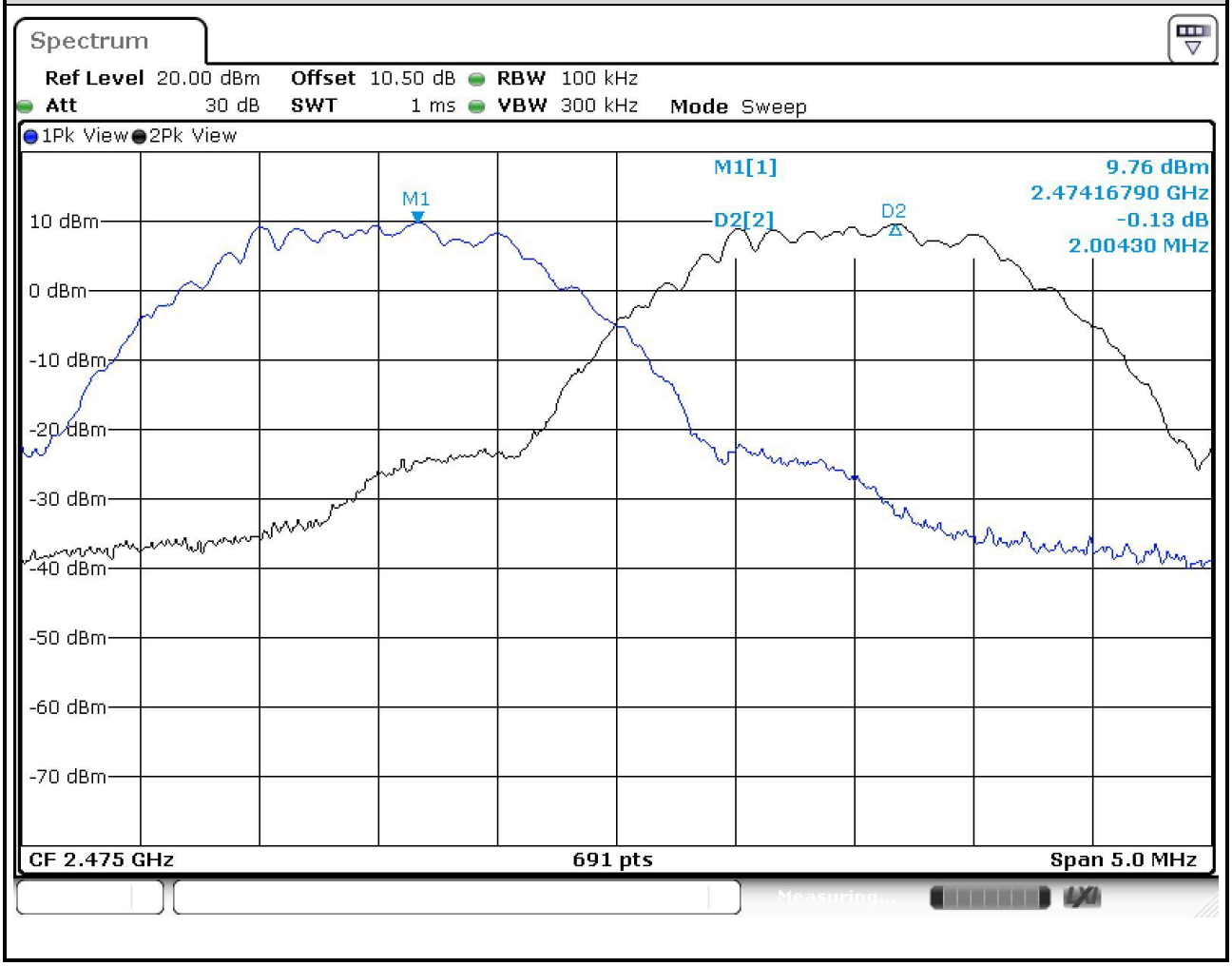
3.7.3 Test Setup



3.7.4 Test result of Channel Separation

Modulation Mode	Freq. (MHz)	Channel Separation (MHz)	20dB Bandwidth (MHz)	Minimum Limit (MHz)
FHSS	2404	1.997	2.210	1.473
FHSS	2440	1.997	2.210	1.473
FHSS	2476	2.004	2.210	1.473

Worst Plot



3.8 Number of Dwell Time

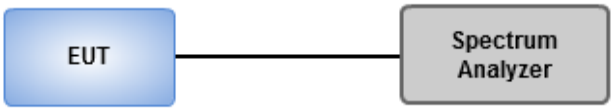
3.8.1 Limit of Dwell time

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 channels employed.

3.8.2 Test Procedures

1. Set RBW=100kHz,VBW=300kHz,Sweep time =1ms / 1s, Detector=Peak, Span=0Hz,Trace max hold
2 Enable gating and trigger function of spectrum analyzer to measure burst on time.

3.8.3 Test Setup

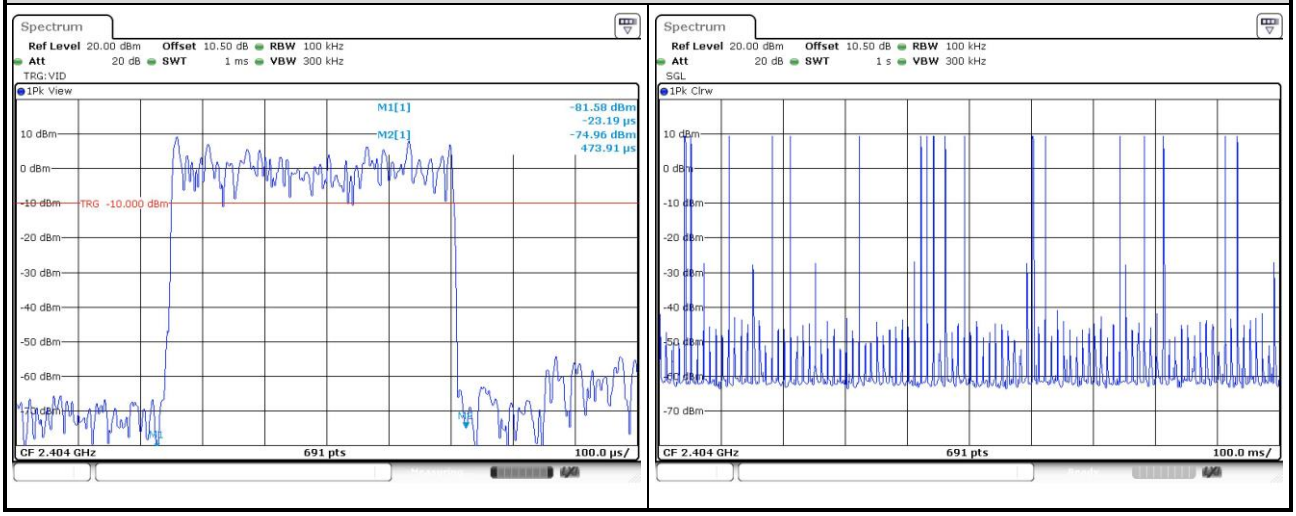


3.8.4 Test Result of Dwell Time

Modulation Mode	Freq. (MHz)	Length of Transmission Time (msec)	Number of Transmission in a 14.4 (36 Hopping*0.4)	Result (s)	Limit (s)
FHSS	2404	0.47391	259.2*	0.123	0.4

Note: 259.2 = 18 pulse/1second * 14.4

FHSS



4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp, it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan Hsiang. Location map can be found on our website http://www.icertifi.com.tw.

Linkou	**Kwei Shan**	**Kwei Shan Site II**
Tel: 886-2-2601-1640	Tel: 886-3-271-8666	Tel: 886-3-271-8640
No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan Hsiang, Tao Yuan Hsien 333, Taiwan, R.O.C.	No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan Hsiang, Tao Yuan Hsien 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information

Tel: 886-3-271-8666
Fax: 886-3-318-0155
Email: ICC_Service@icertifi.com.tw

==END==