DIGITAL EMC CO., LTD.

683-3, Yubang-Dong, Yongin-Si, Kyunggi-Do, Korea. 449-080
Tel: +82-31-321-2664 Fax: +82-31-321-1664
http://www.digitalemc.com

CERTIFICATION OF COMPLIANCE

VK Corporation
VK B/D, 548-6, Anyang 8dong, Manan-gu,
Anyang City, Kyonggi do, 430-716, Korea

Dates of Tests: October 28 ~ November 04,2005
Test Report S/N: DR50110511B
Test Site : DIGITAL EMC CO., LTD.

FCC ID **SBWVBH100**

APPLICANT **VK Corporation**

FCC Classification	**:**	**Frequency Hopping Spread Spectrum (FHSS)**
Device name	**:**	**Bluetooth Headset**
Manufacturer	**:**	**VK Corporation**
FCC ID	**:**	**SBWVBH100**
Model name	**:**	**VBH-100**
Test Device Serial number	**:**	**Identical prototype**
FCC Rule Part(s)	**:**	**FCC Part 15.247 Subpart C**
		ANSI C-63.4-2003
Frequency Range	**:**	**2402 ~ 2480 MHz**
Max. Output power	**:**	**6.33dBm Conducted**
Data of issue	**:**	**November 07, 2005**

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

NVLAP LAB CODE 200559-0

TABLE OF CONTENTS

1. General information

This report contains the result of tests performed by:

DIGITAL EMC CO., LTD.
Address : 683-3, Yubang-Dong, Yongin-Si, Kyunggi-Do, Korea. 449-080
http://www.digitalemc.com E-mail : demc@unitel.co.kr
Tel: +82-31-321-2664 Fax: +82-31-321-1664

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the "General requirements for the competent of calibration and testing laboratory".
This laboratory is accredited by NVLAP for NVLAP Lab. Code : 200559-0.

Test operator: engineer

Data	Name	Signature
November 07, 2005	Won -Jung LEE	

Report Reviewed By: manager

Data	Name	Signature
November 07, 2005	Harvay Sung	

Ordering party:

Company name	:	VK Corporation
Address	:	VK B/D, 548-6, Anyang 8dong, Manan-gu, Anyang City,
Zip code	:	430-716
City/town	:	Kyonggi do,
Country	:	Korea
Date of order	:	October 12, 2005

2. Information about test item

SBWVBH100

2.1 Equipment information

Equipment model name	VBH-100
Type of equipment	Bluetooth headset
Frequency band	2402 ~ 2480 MHz
Type of Modulation	GFSK
Channel Spacing	1.0 MHz
Type of antenna	Multilayer Chip Antenna
Power	DC 3.7 V – Lithium Battery

- This device has only DH1 packet type.

2.2 Tested frequency

Frequency	TX	RX
Low frequency	2402MHz	2402MHz
Middle frequency	2441MHz	2441MHz
High frequency	2480MHz	2480MHz

2.4 Tested environment

Temperature	:	15 ~ 35 (°C)
Relative humidity content	:	20 ~ 75 %
Air pressure	:	86 ~ 103 kPa
Details of power supply	:	3.7 VDC

2.5 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
AC-DC Adaptor	TA300A	NA	Jen Lin Electronics(Shenzhen)Industrial CO., LTD

2.6 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing

-> None

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
I. Test Items				
15.247(a)	Carrier Frequency Separation	> 25 kHz	Conducted	C
	Number of Hopping Frequencies	> 75 hops		C
	20 dB Bandwidth	< 1 MHz		C
	Dwell Time	0.4 seconds within a 30 second period per any frequency		C
15.247(b)	Transmitter Output Power	< 1Watt		C
15.247(c)	Band-edge /Conducted	The radiated emission to any 100 kHz of outband shall be at least 20dB below the highest inband spectral density.		C
	Conducted Spurious Emissions			C
15.205 15.209	Radiated Emissions	FCC 15.209 Limits	Radiated	C
15.207	AC Conducted Emissions	EN 55022	AC Line Conducted	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

The sample was tested according to the following specification:

FCC Parts 15.247; ANSI C-63.4-2003

3.2 Transmitter requirements

3.2.1 Carrier Frequency Separation

Procedure:

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:

Span = 3 MHz (wide enough to capture the peaks of two adjacent channels)

RBW = 30 kHz (1% of the span or more) Sweep = auto

VBW = 30 kHz Detector function = peak

Trace = max hold

Measurement Data:

Frequency of marker #1 (MHz)	Frequency of marker #2 (MHz)	Test Results	
		Carrier Frequency Separation (MHz)	Result
2441.035	2442.040	1.005	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:

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

Measurement Setup

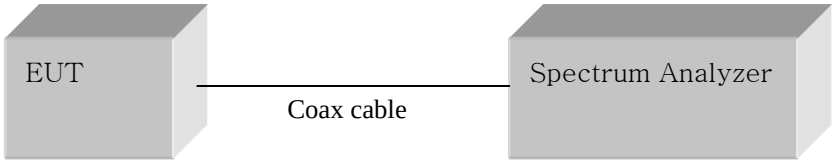
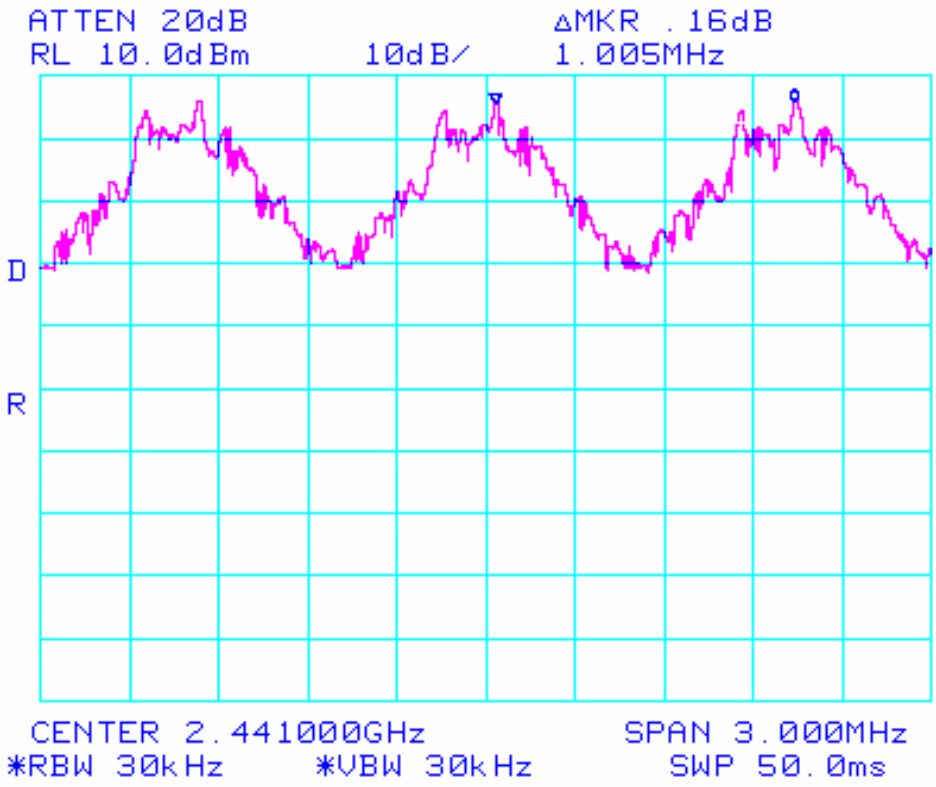


Figure 1: Measurement setup for the carrier frequency separation

TEST EQUIPMENT USED: 03, 18, 50

Carrier Frequency Separation



3.2.2 Number of Hopping Frequencies

Procedure:

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

To get higher resolution, four frequency ranges within the 2400 ~ 2483.5 MHz FH band were examined.

The spectrum analyzer is set to:

Frequency range 1: Start = 2389.5MHz, Stop = 2414.5 MHz
2: Start = 2414.5MHz, Stop = 2439.5 MHz
3: Start = 2439.5MHz, Stop = 2464.5 MHz
4: Start = 2464.5MHz, Stop = 2489.5 MHz

RBW = 300 kHz (1% of the span or more) Sweep = auto

VBW = 300 kHz (VBW ≥ RBW) Detector function = peak

Trace = max hold Span = 25MHz

Measurement Data: Complies

Total number of Hopping Channels	79

- See next pages for actual measured spectrum plots.

Minimum Standard:

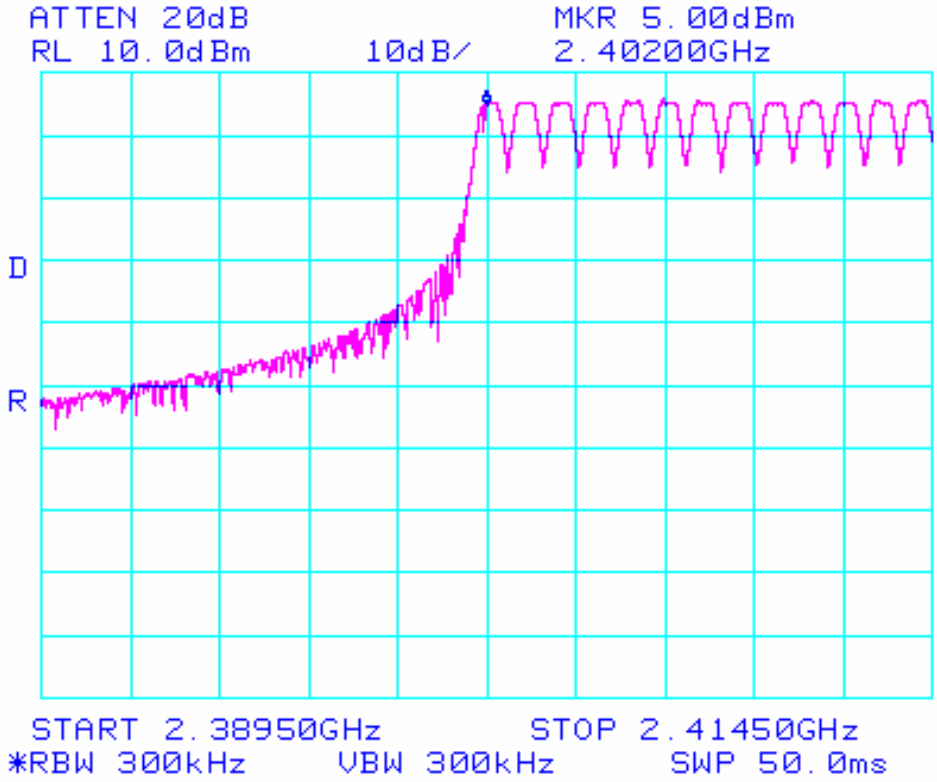
At least 75 hopes

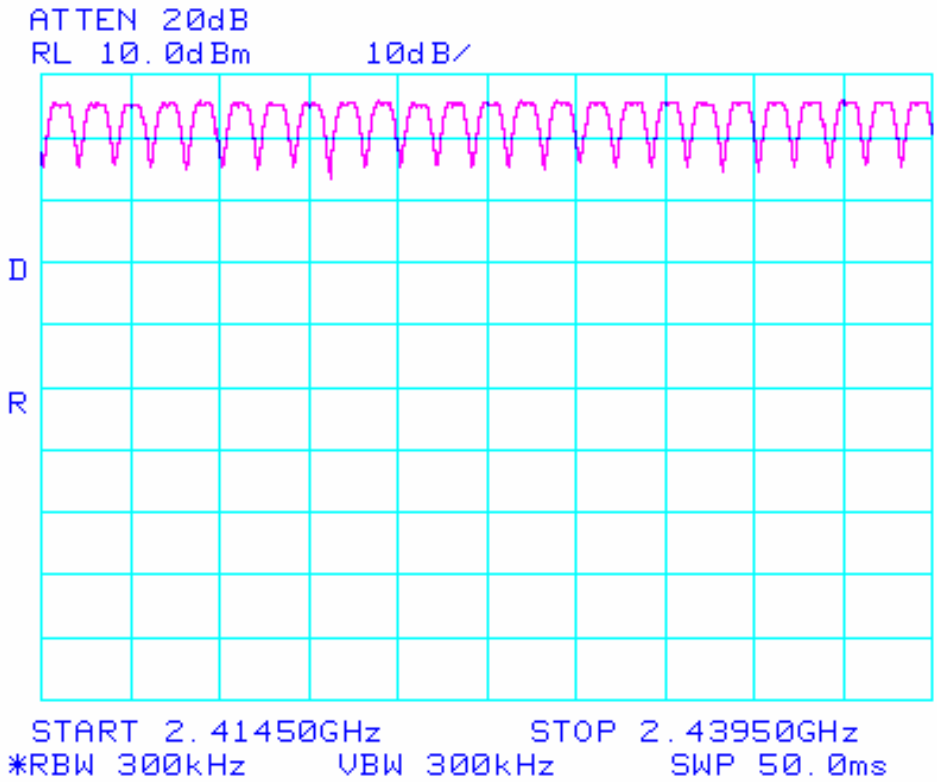
Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

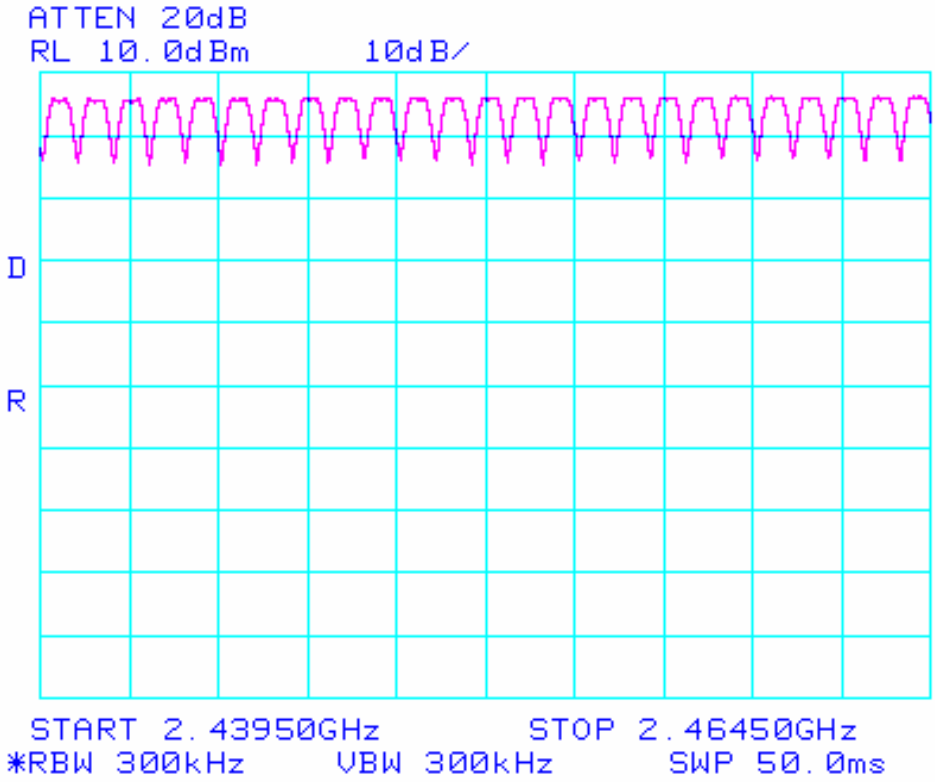
TEST EQUIPMENT USED: 03, 18, 50

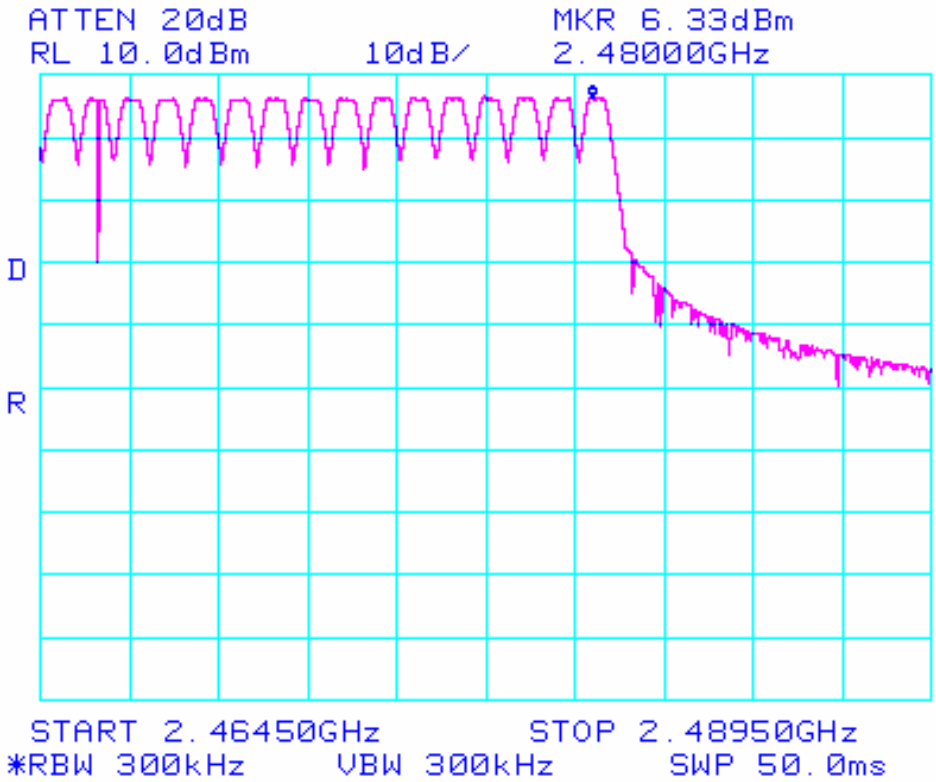
Number of Hopping Frequencies





Number of Hopping Frequencies





3.2.3 20 dB Bandwidth

Procedure:

The bandwidth at 20 dB below the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

Span = 2 MHz (approximately 2 or 3 times of the 20 dB bandwidth)

RBW = 10 kHz (1% of the 20dB bandwidth or more) Sweep = auto

VBW = 30 kHz (VBW ≥ RBW) Detector function = peak

Trace = max hold

Measurement Data:

Frequency (MHz)	Channel No.	Test Results	
		Measured Bandwidth (MHz)	Result
2402	1	0.623	Complies
2441	40	0.647	Complies
2480	79	0.687	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:

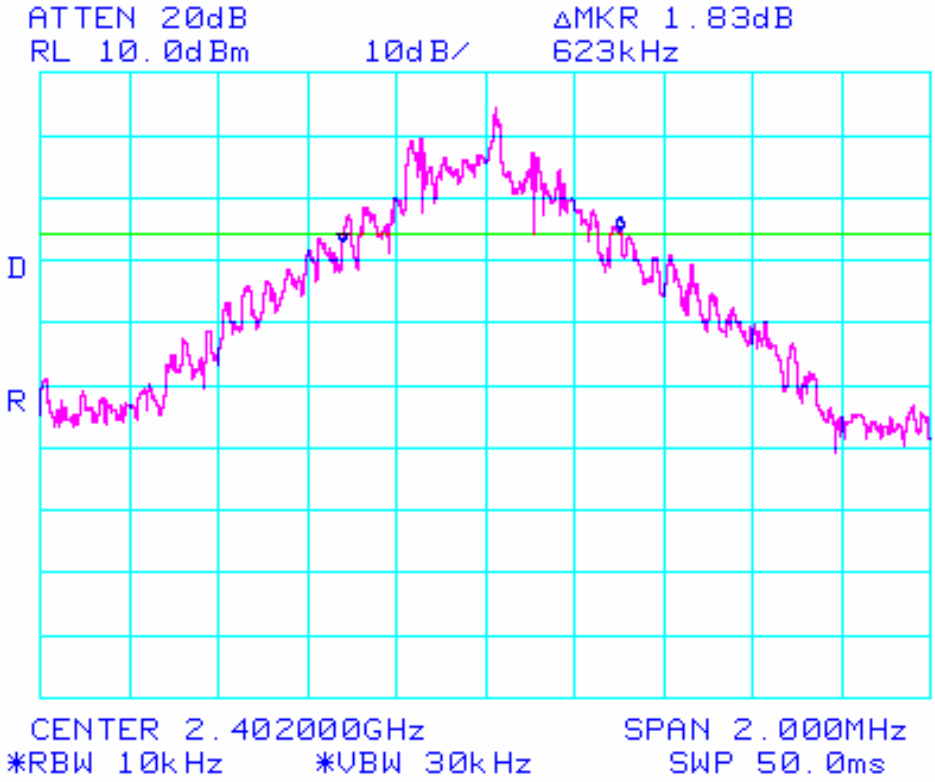
The transmitter shall have a maximum 20dB bandwidth of 1 MHz.

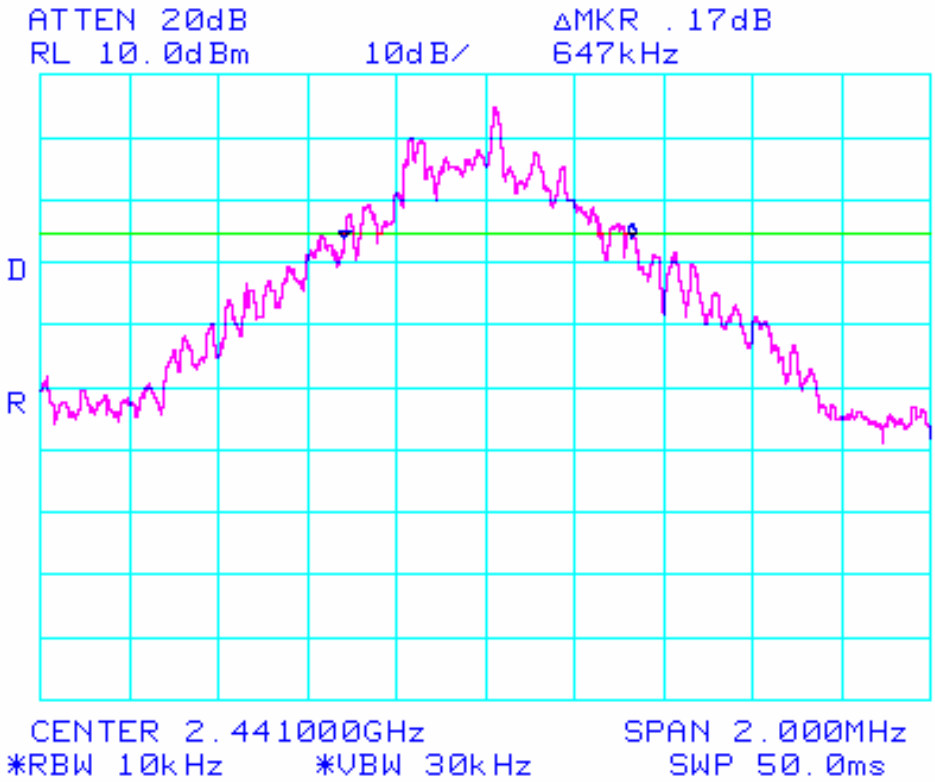
Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

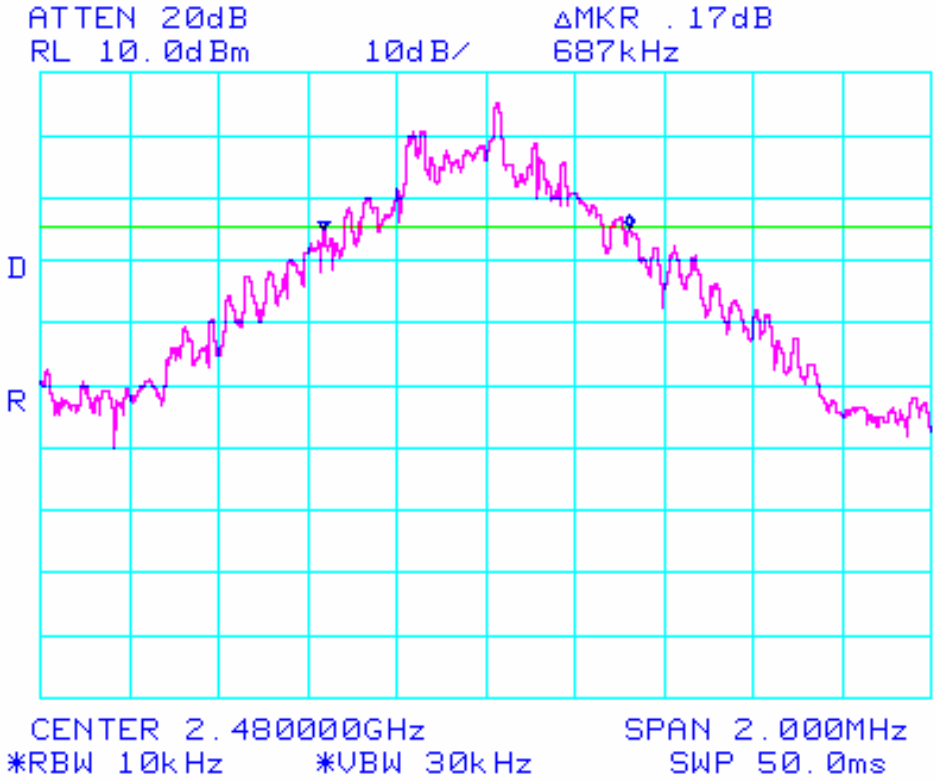
TEST EQUIPMENT USED: 03, 18, 50

20 dB Bandwidth





20 dB Bandwidth



3.2.4 Time of Occupancy (Dwell Time)

Procedure:

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

Center frequency = 2441 MHz Span = zero

RBW = 1 MHz VBW = 1 MHz (VBW ≥ RBW)

Trace = max hold Detector function = peak

Measurement Data:

Packet Type	Burst duration in one hop (us)	Test Results	
		Dwell Time (ms)	Result
DH 1	443.3	141.905	Complies

- This device has only DH1 packet type.
- See next pages for actual measured spectrum plots.

Minimum Standard:

0.4 seconds within a 30 second period per any frequency

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

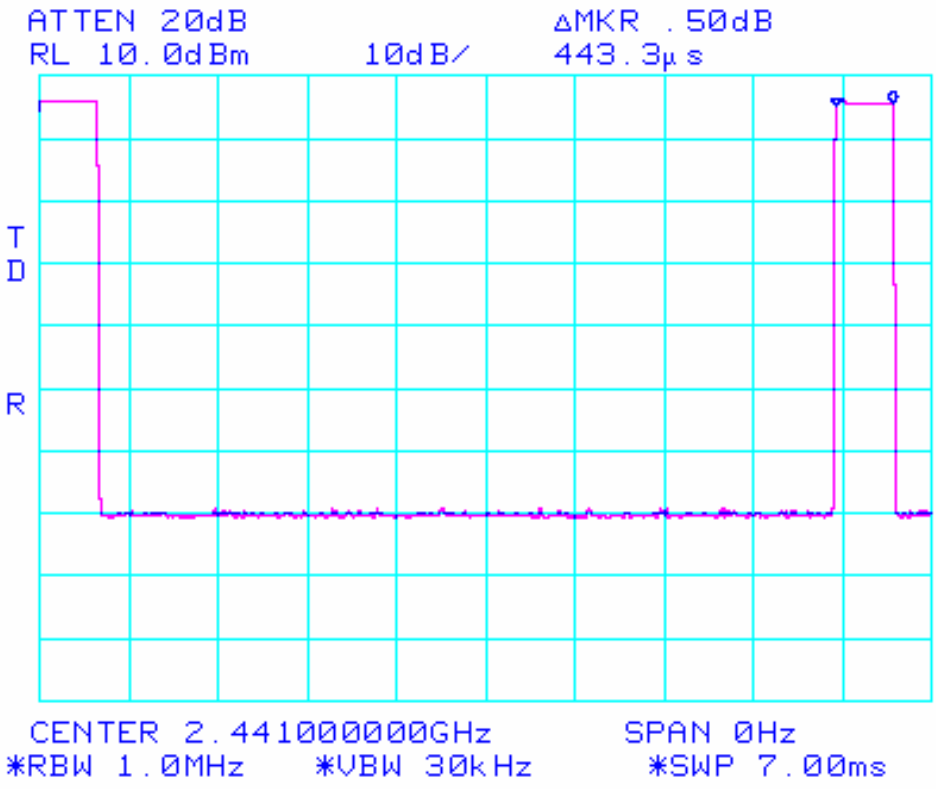
TEST EQUIPMENT USED: 03, 18, 50

Time of Occupancy for Packet Type DH 1

The system makes worst case 1600 hopes per second or 1 time slot has a length of 625 us with 79 channels. A DH 1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/2 = 800 hops per second with 79 channels. So you have each channel 800/79 = 10.13 times per second and so for a period of 0.4 x 79 = 31.6 seconds you have 10.13 x 31.6 = 320.11 times of appearance.

Each Tx-time per appearance is 443.3 us

So we have 320.11 x 443.3, us = 141.905 ms per 31.6 seconds.



3.2.5 Peak Output Power

Procedure:

The peak output power was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

Span = 5 MHz (approximately 5 times of the 20 dB bandwidth)

RBW = 1 MHz (greater than the 20dB bandwidth of the emission being measured)

VBW = 1 MHz (VBW ≥ RBW) Detector function = peak

Trace = max hold Sweep = auto

Measurement Data:

Frequency (MHz)	Ch.	Test Results		
		dBm	mW	Result
2402	1	**5.50**	**3.55**	**Complies**
2441	40	**5.83**	**3.83**	**Complies**
2480	79	**6.33**	**4.30**	**Complies**

- See next pages for actual measured spectrum plots.

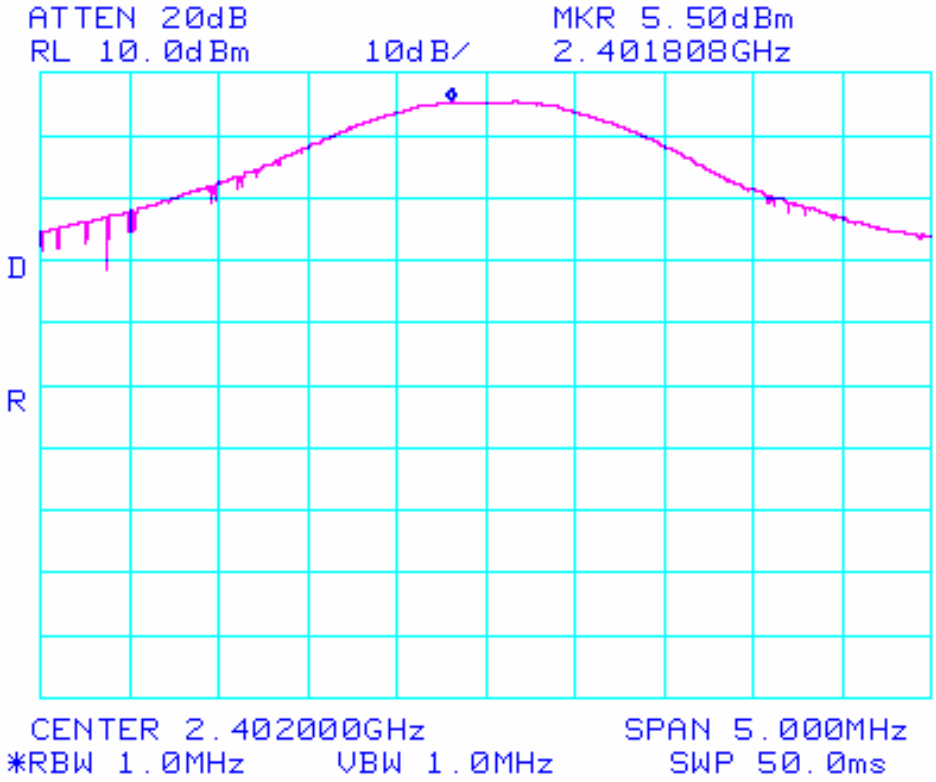
Minimum Standard:	< 1W

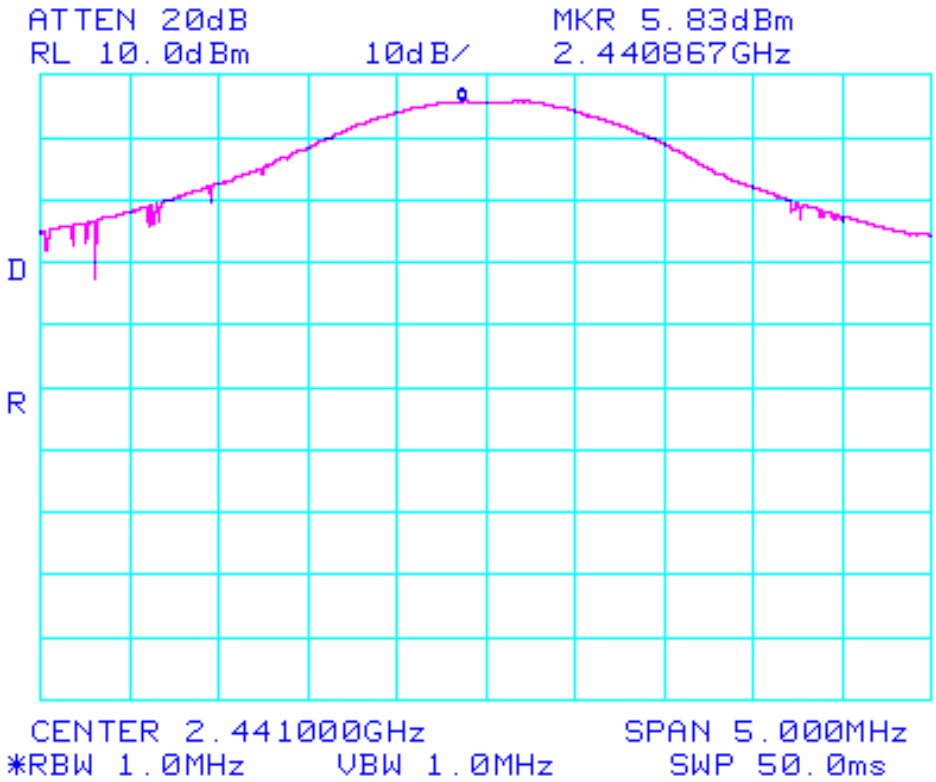
Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

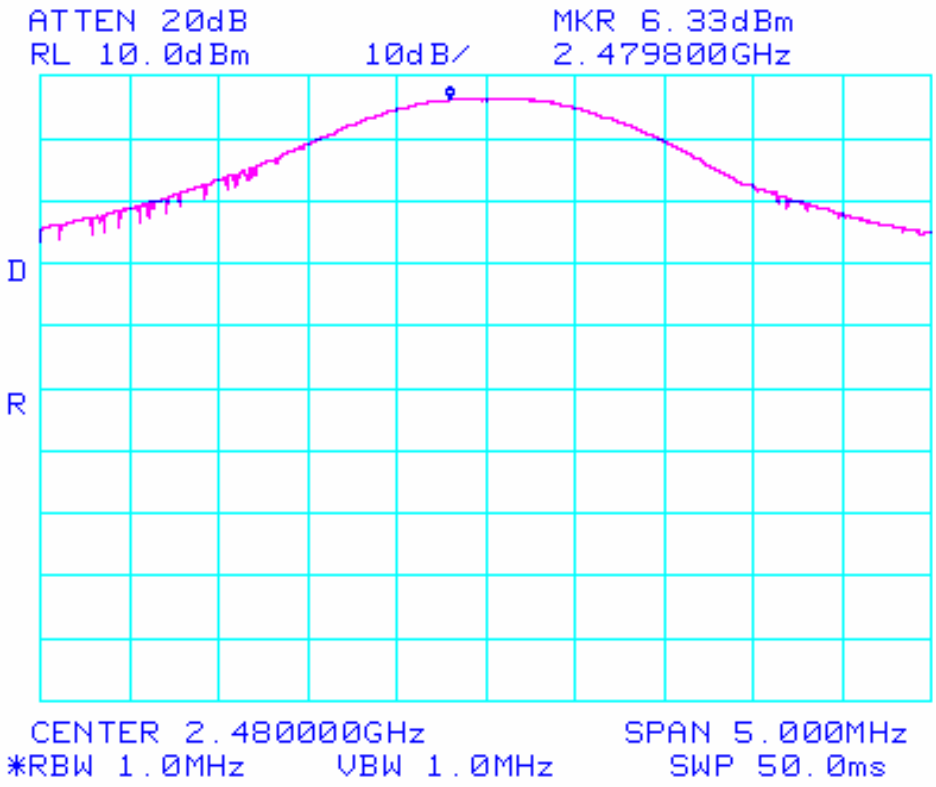
TEST EQUIPMENT USED: 03, 18, 50

Peak Output Power





Peak Output Power



3.2.6 Conducted Spurious Emissions

Procedure:

The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz	VBW = 100 kHz
Span = 100 MHz	Detector function = peak
Trace = max hold	Sweep = auto

Measurement Data: Complies

- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

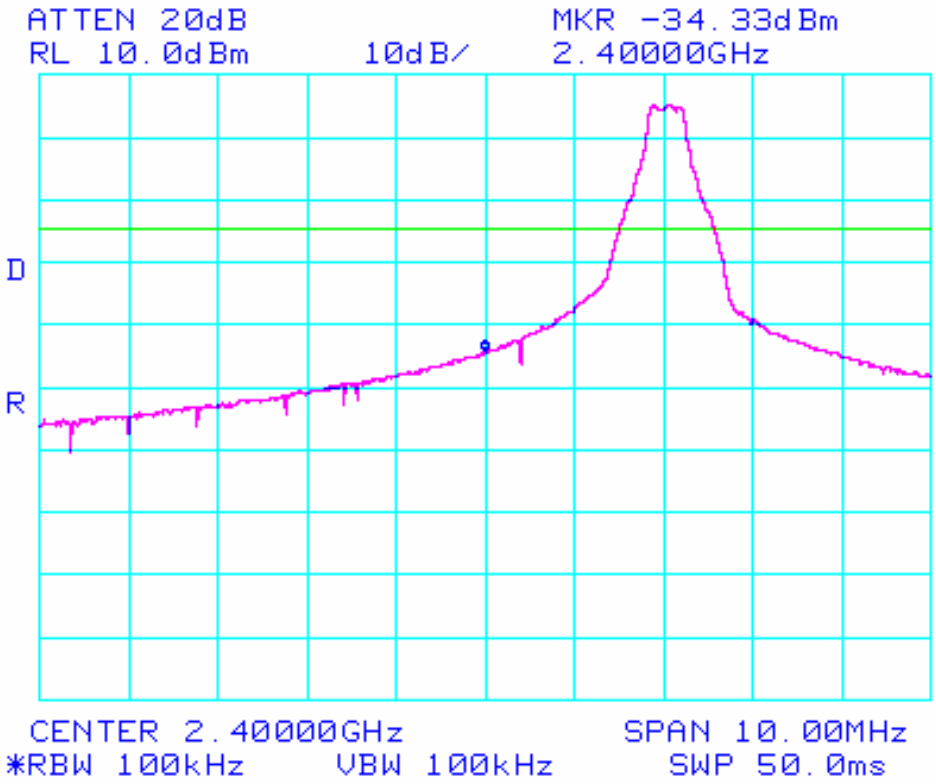
Minimum Standard:	> 20 dBc

Measurement Setup

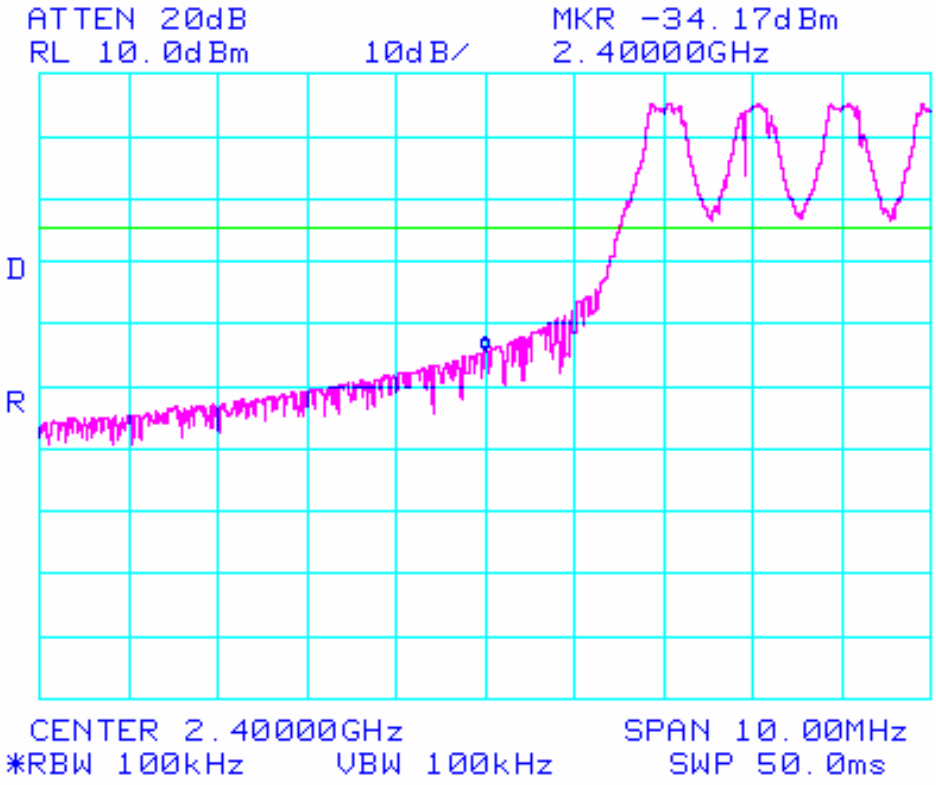
Same as the Chapter 3.2.1 (Figure 1)

TEST EQUIPMENT USED: 03, 18, 50

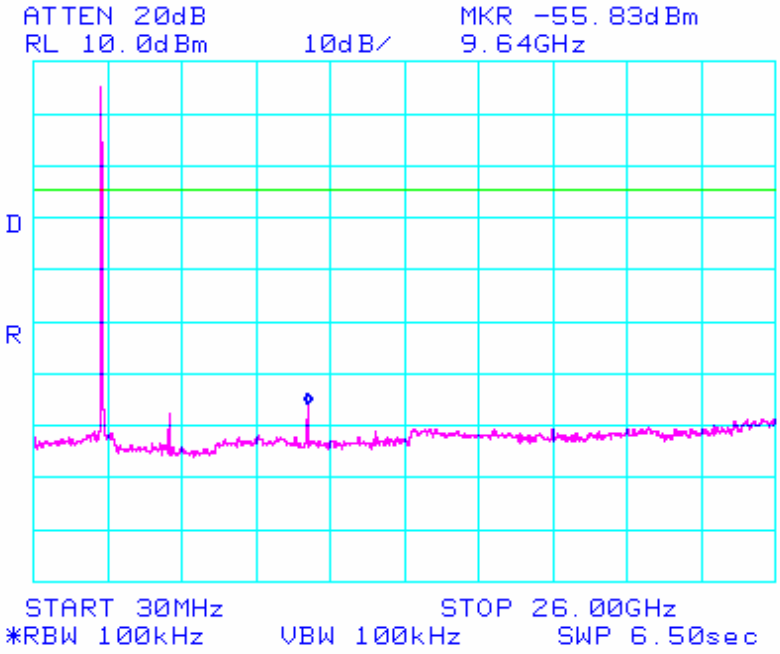
Low band with hopping disabled



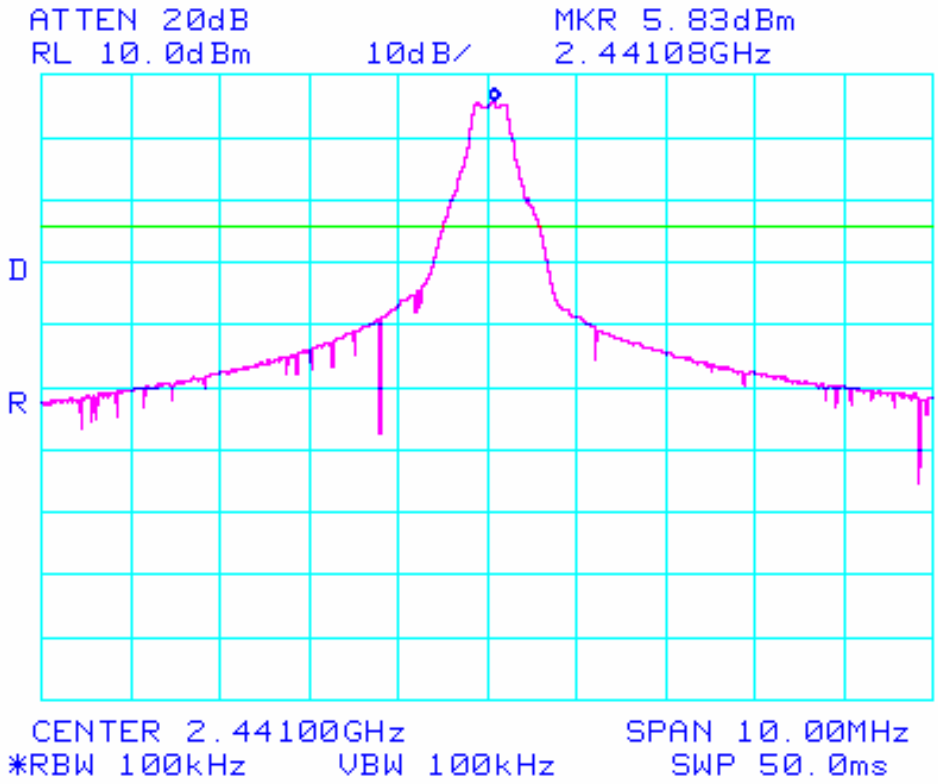
Low band with hopping enabled



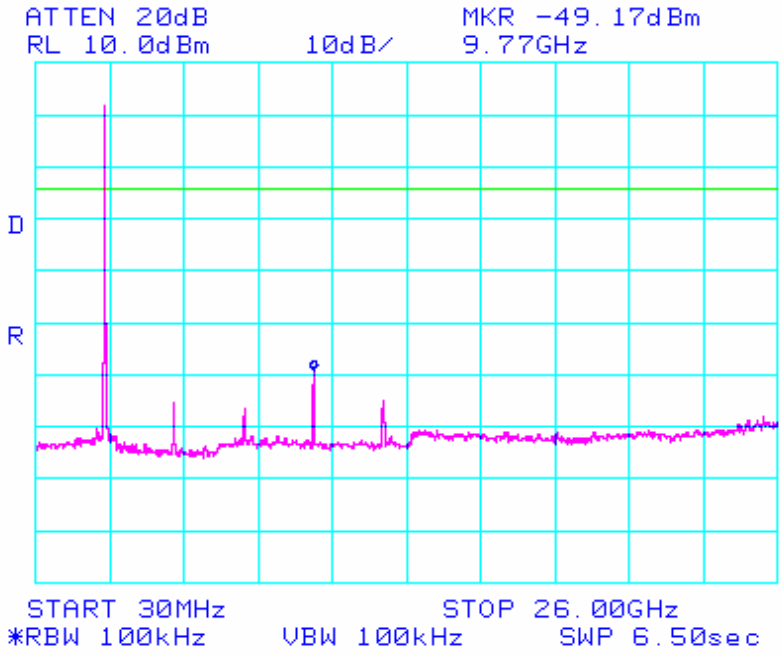
Low channel spurious



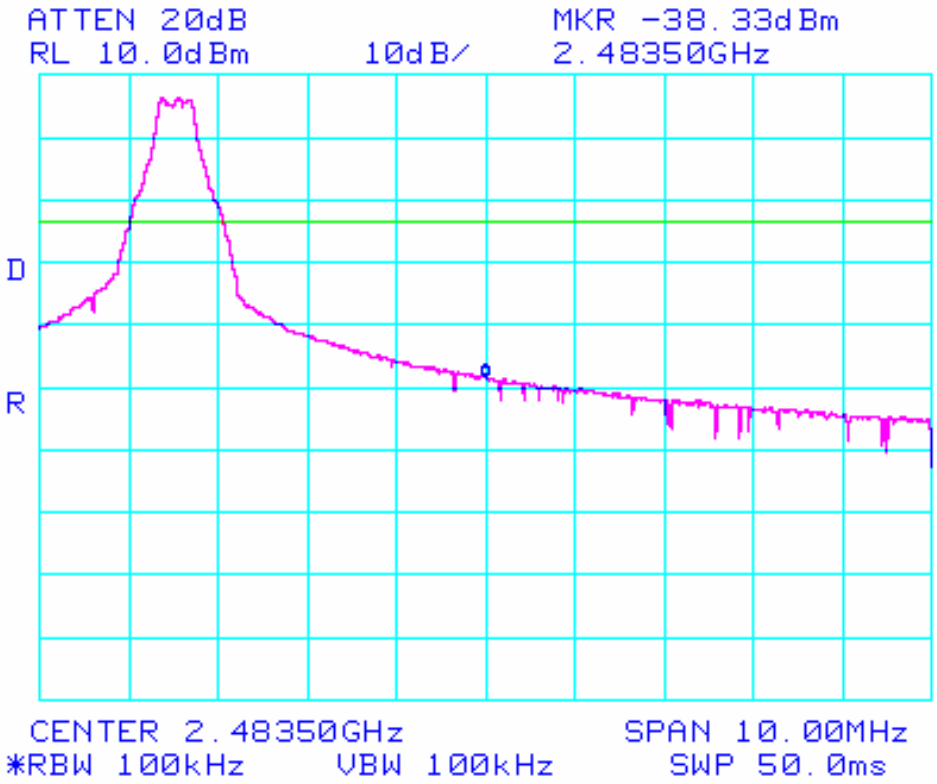
Mid channel ref



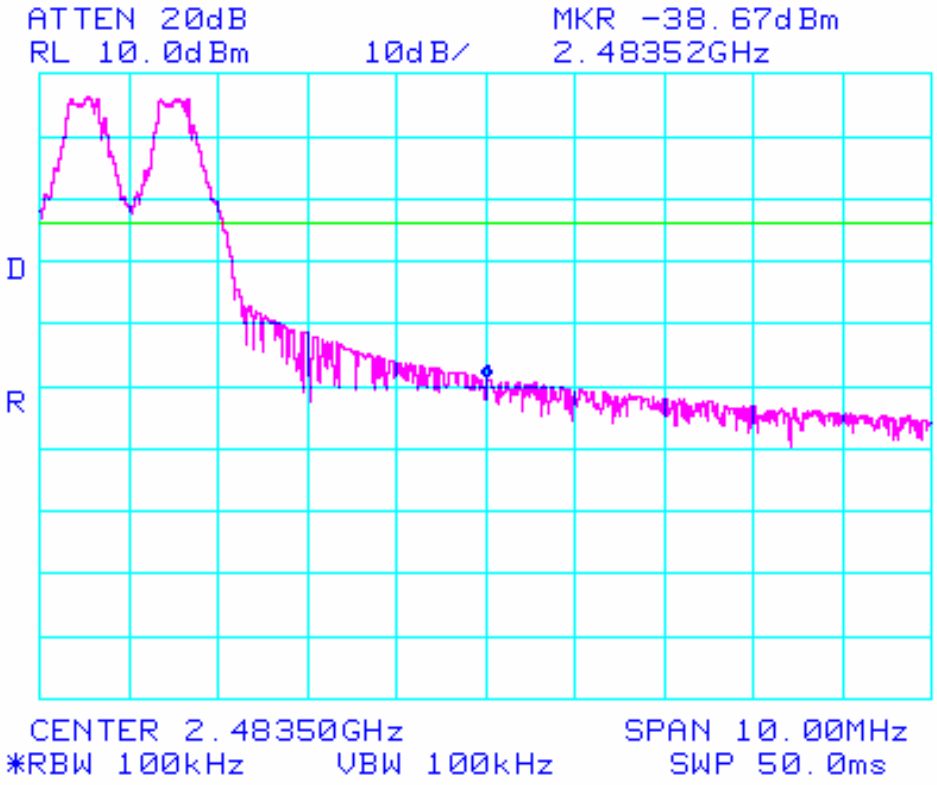
Mid channel spurious



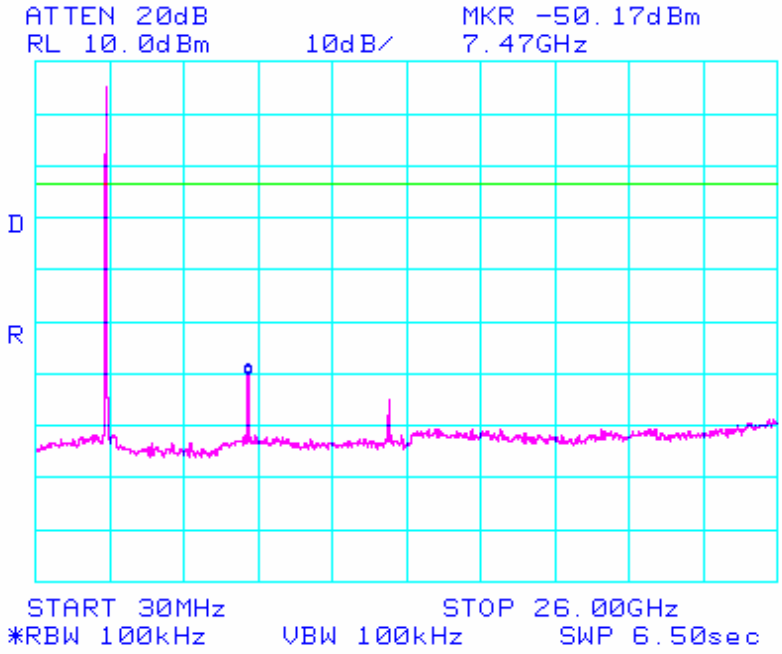
High band with hopping disabled



High band with hopping enabled



High channel spurious



3.2.7 Radiated Emissions

Procedure:

The EUT was placed on a 0.8m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 30 MHz ~ 10th harmonic.

RBW = 120 kHz (30MHz ~ 1 GHz) VBW ≥ RBW (Peak)

= 1 MHz (1 GHz ~ 10th harmonic) VBW = 10Hz (Average)

Trace = max hold Sweep = auto

Measurement Data: Complies

- No emissions were detected at a level greater than 10dB below limit.
- Refer to the next page.

Minimum Standard: FCC Part 15.205 (a), 15.205(b), 15.209(a) and (b)

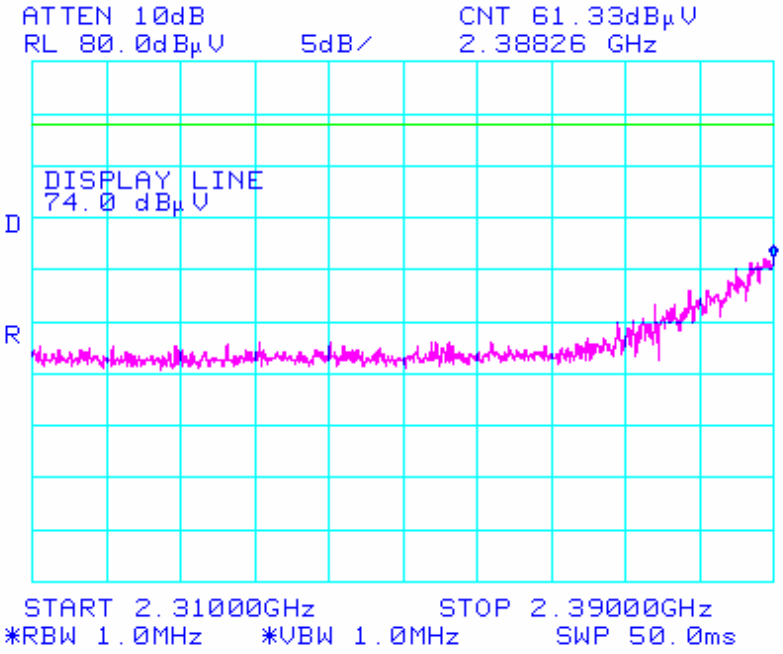
Limit : FCC P15.209(a)

Frequency (MHz)	Limit (uV/m) @ 3m
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

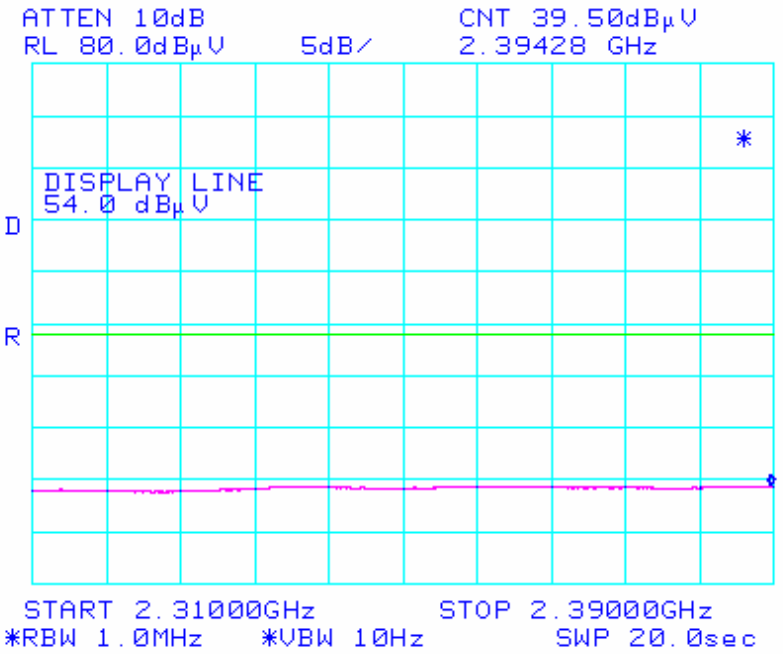
** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

TEST EQUIPMENT USED: : 03, 18, 21, 32, 33, 38, 39, 40, 41, 47, 49

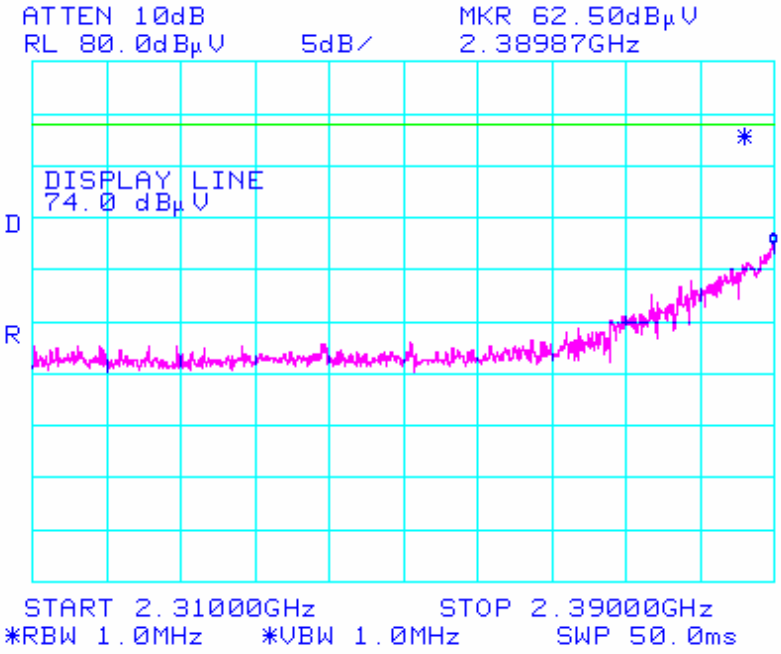
Restricted Band Edge: Low Channel (Peak, Horizontal)



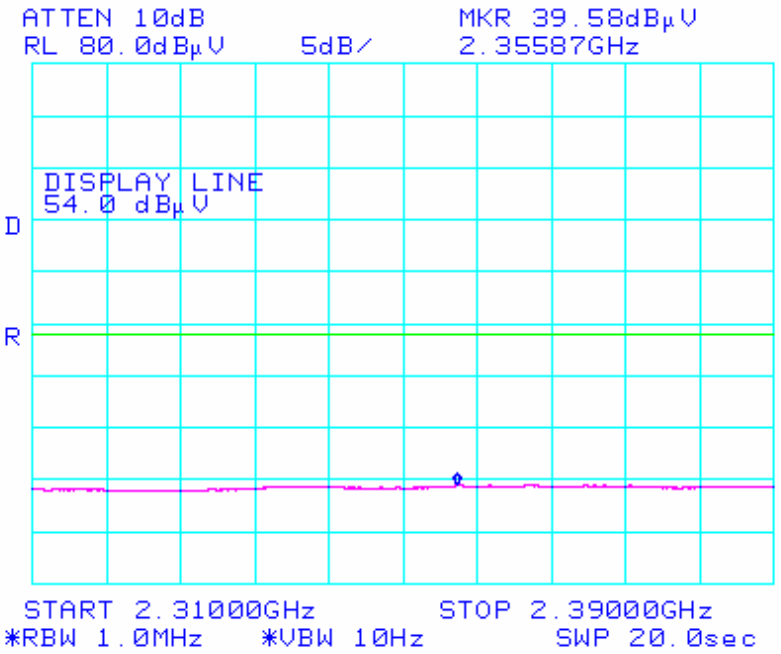
Restricted Band Edge: Low Channel (Average, Horizontal)



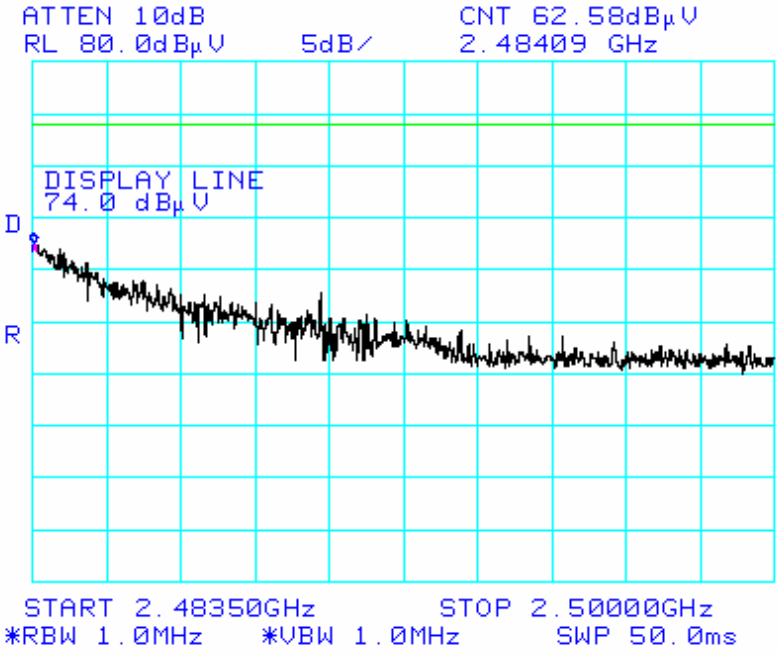
Restricted Band Edge: Low Channel (Peak, Vertical)



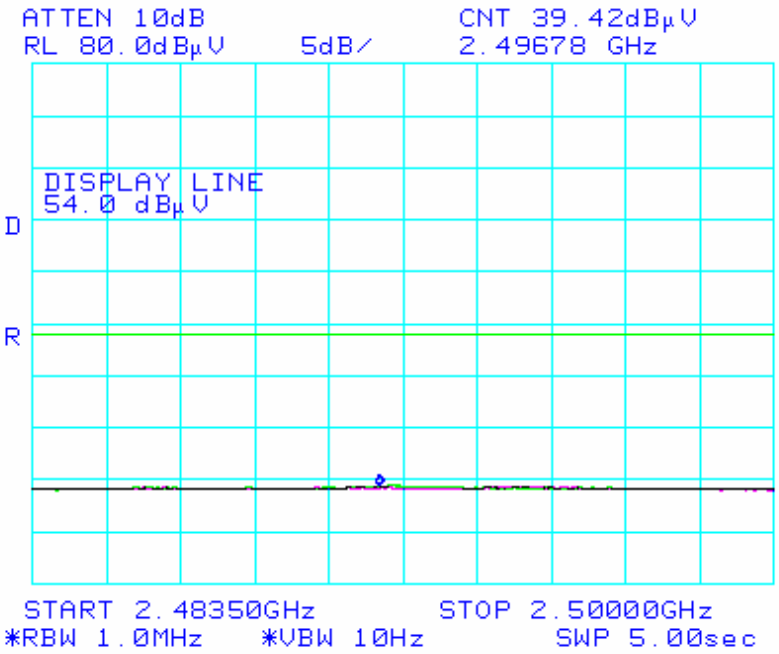
Restricted Band Edge: Low Channel (Average, Vertical)



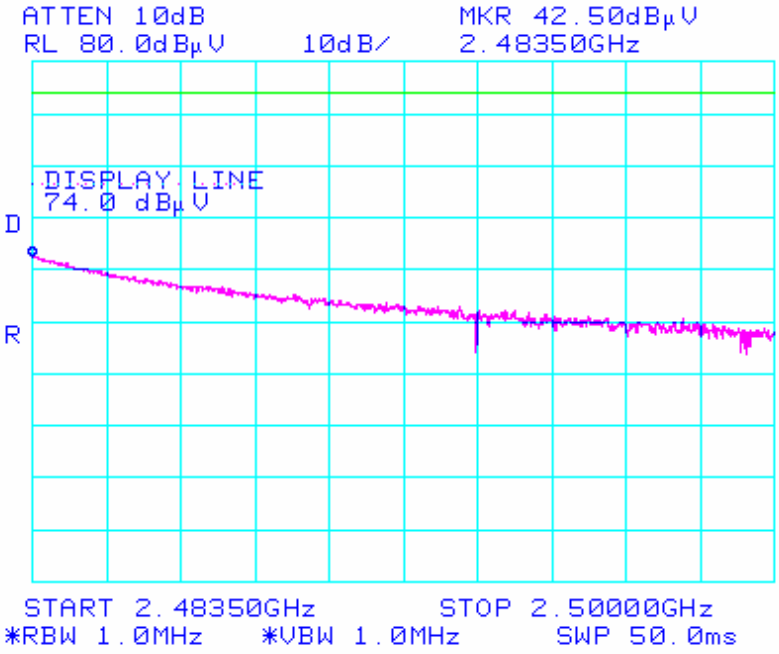
Restricted Band Edge: High Channel (Peak, Horizontal)



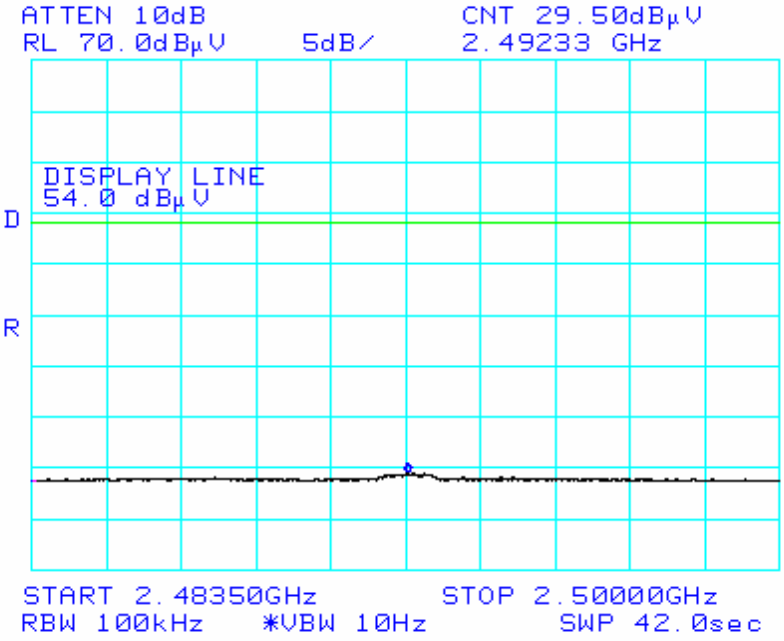
Restricted Band Edge: High Channel (Average, Horizontal)



Restricted Band Edge: High Channel (Peak, Vertical)



Restricted Band Edge: High Channel (Average, Vertical)



Radiated Spurious Emission Data

Low Channel(2402MHz)

Frequency (MHz)	ANT Pol. (H/V)	Reading Value (dBuV)		T.F (dB)	Result (dBuV)		Limit (dBuV)		Margin (dB)	
		PK	AV		PK	AV	PK	AV	PK	AV
4804	V	49.2	31.33	9.28	58.48	40.61	74	54	15.52	13.39
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

Middle Channel(2441MHz)

Frequency (MHz)	ANT Pol. (H/V)	Reading Value (dBuV)		T.F (dB)	Result (dBuV)		Limit (dBuV)		Margin (dB)	
		PK	AV		PK	AV	PK	AV	PK	AV
4882	V	49.13	30.7	9.78	58.91	40.48	74	54	15.09	13.52
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

High Channel(2480MHz)

Frequency (MHz)	ANT Pol. (H/V)	Reading Value (dBuV)		T.F (dB)	Result (dBuV)		Limit (dBuV)		Margin (dB)	
		PK	AV		PK	AV	PK	AV	PK	AV
4960	V	49.93	30.73	10.28	60.21	41.01	74	54	13.79	12.99
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

Not. 1. " ** " : No other emissions were detected at a level greater than 30dB below limit.

2. T.F(Total Factor) = Cable Loss + Ant Factor –AMP Gain

3. Result = Reading Value + T.F

4. Margin = Limit - Result

-

3.2.8 AC Line Conducted Emissions

Procedure:

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

Measurement Data: **Complies**

- Refer to the next page.

Minimum Standard: FCC Part 15.207(a)/EN 55022

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

Measurement Setup

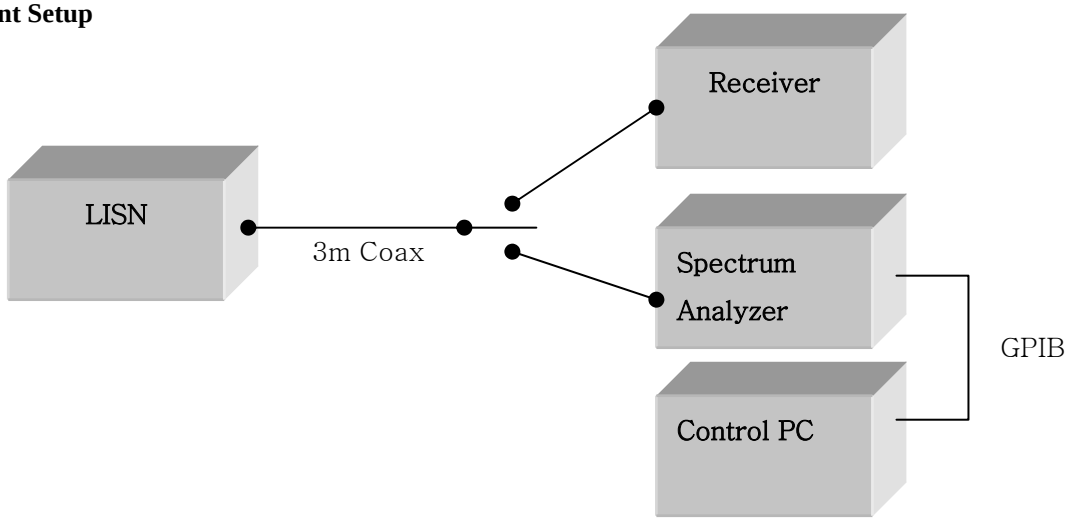
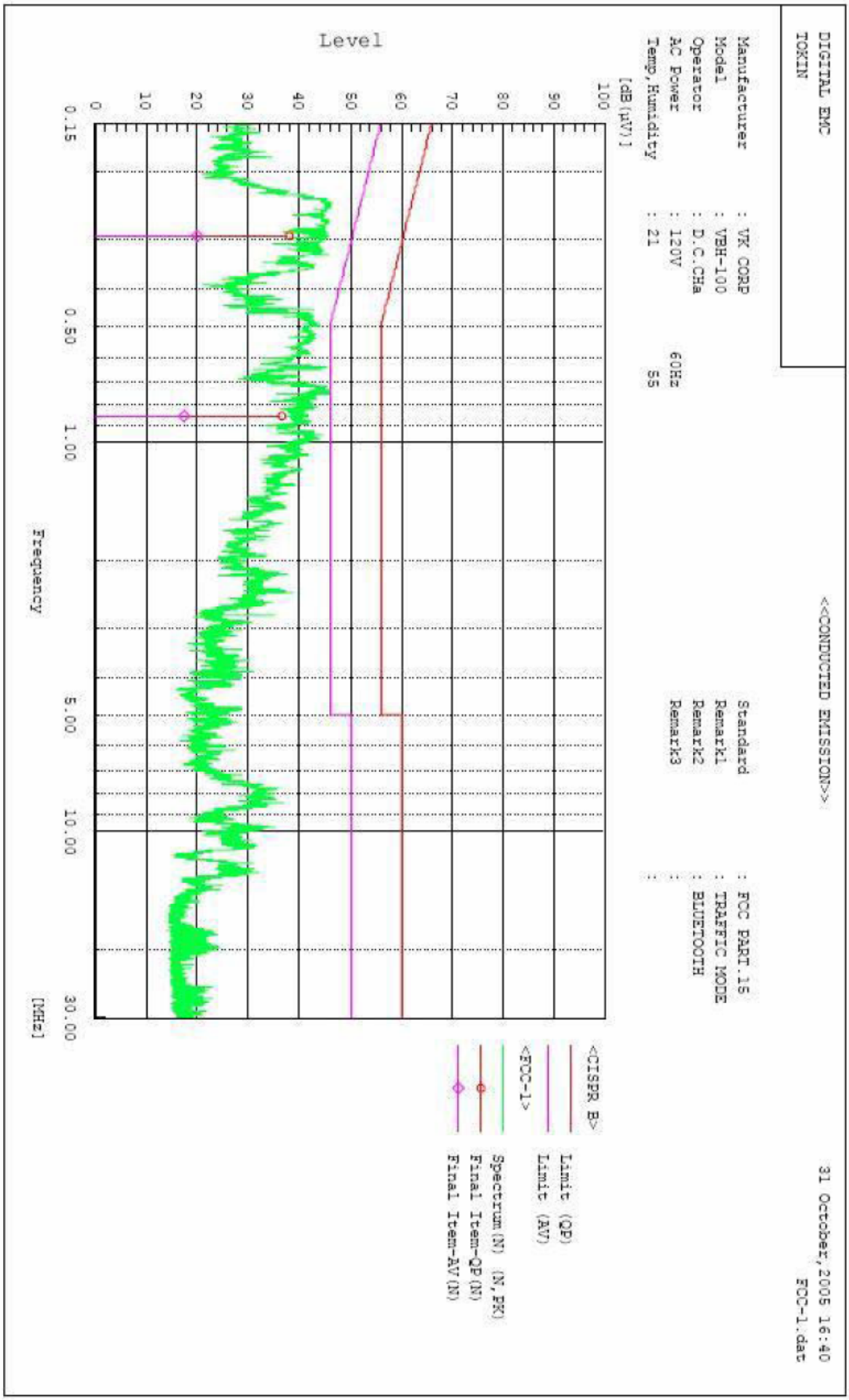


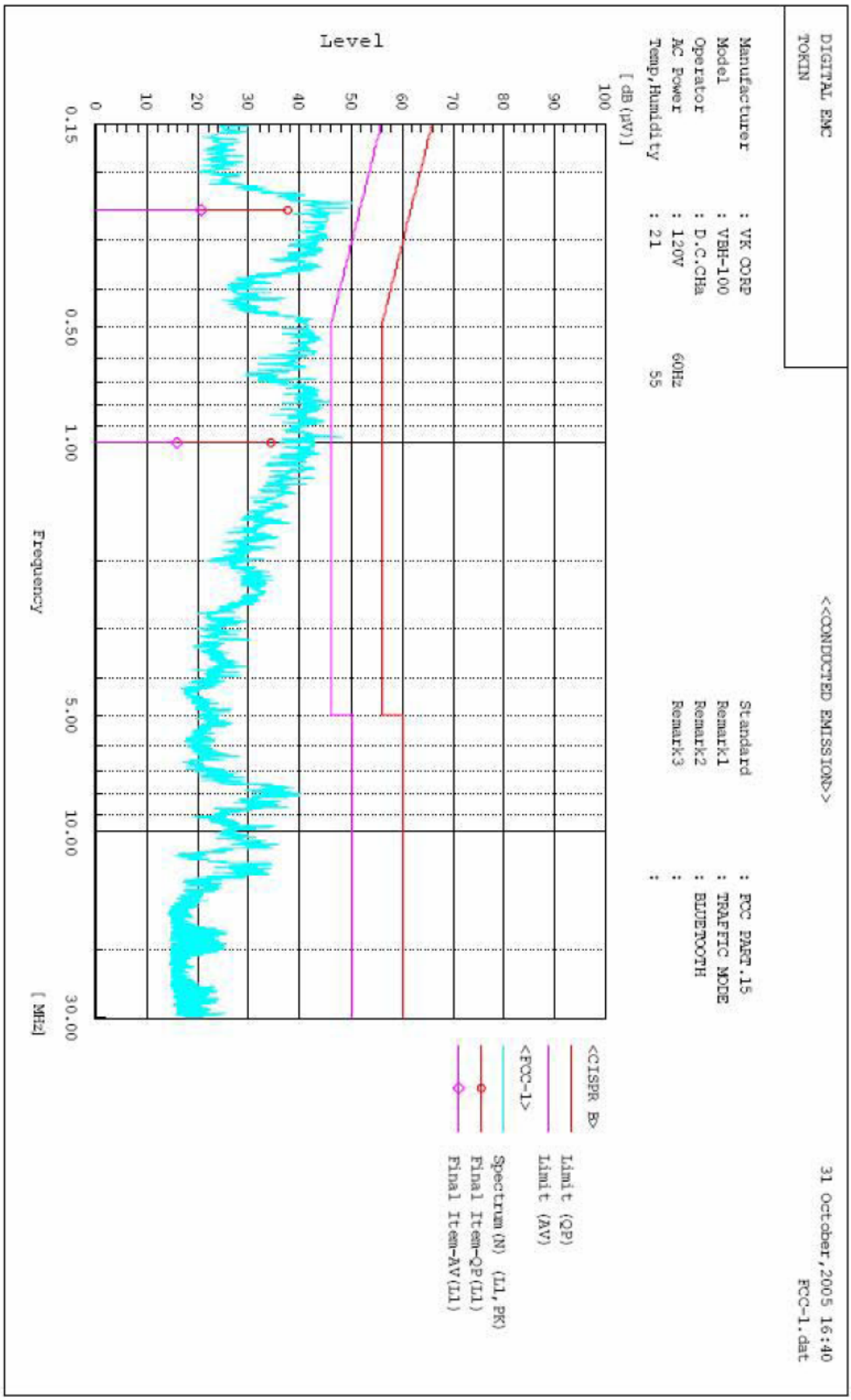
Figure 2: Measurement setup for AC Conducted Emission

TEST EQUIPMENT USED: 42, 43, 44, 45, 46, 48

AC Conducted Emissions (Line)



AC Conducted Emissions (Neutral)



AC Conducted Emissions (DATA)

********** DIGITAL EMC **********

<<CONDUCTED EMISSION>>

31 October,2005 16:40

FCC-1.dat

Standard : FCC PART.15
Manufacturer : VK CORP
Model : VBH-100
Operator : D.C.CHa
AC Power : 120V 60Hz
Temp,Humidity : 21 55
Remark1 : TRAFFIC MODE
Remark2 : BLUETOOTH
Remark3 :
:

****

Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]
1	0.293	37.3	19.2	0.8	38.1	20.0	60.4	50.4	22.3	30.4
2	0.849	36.4	17.0	0.3	36.7	17.3	56.0	46.0	19.3	28.7

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]
1	0.249	36.6	19.8	1.0	37.6	20.8	61.8	51.8	24.2	31.0
2	0.996	34.2	15.5	0.3	34.5	15.8	56.0	46.0	21.5	30.2

APPENDIX

TEST EQUIPMENT FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

	Type	Manufacturer	Model	Cal.Due.Date (dd/mm/yy)	S/N
01	Spectrum Analyzer	Agilent	E4404B	18/04/06	US41061134
02	Spectrum Analyzer	Agilent	E4440A	05/10/07	MY45304199
03	Spectrum Analyzer	H.P	8563E	06/10/07	3551A04634
04	Power Meter	H.P	EPM-442A	04/07/06	GB37170413
05	Power Sensor	H.P	8481A	05/07/06	3318A96332
06	Frequency Counter	H.P	5342A	21/10/06	2119A04450
07	Multifunction Synthesizer	H.P	8904A	21/10/06	3633A08404
08	Signal Generator	Rohde Schwarz	SMR20	17/05/06	101251
09	Signal Generator	H.P	E4421A	05/07/06	US37230529
10	Audio Analyzer	H.P	8903B	07/07/06	3011A0944B
11	Modulation Analyzer	H.P	8901B	05/07/06	3028A03029
12	Oscilloscope	Tektronix	TDS3052	01/10/06	B016821
13	CDMA Mobile Station Test Set	H.P	8924C	21/10/06	US35360688
14	Power Splitter	WEINSCHEL	1593	21/10/06	332
15	BAND Reject Filter	Microwave Circuits	N0308372	21/10/06	3125-01DC0312
16	BAND Reject Filter	Wainwright	WRCG1750	21/10/06	SN2
17	AC Power supply	DAEKWANG	5KVA	18/04/06	N/A
18	DC Power Supply	H.P	6622A	18/04/06	465487
19	Attenuator (30dB)	H.P	8498A	21/10/06	50101
20	Attenuator (10dB)	WEINSCHEL	23-10-34	21/10/06	BP4387
21	HORN ANT	EMCO	3115	06/03/07	6419
22	HORN ANT	EMCO	3115	04/25/07	21097
23	HORN ANT	A.H.Systems	SAS-574	09/11/06	154
24	HORN ANT	A.H.Systems	SAS-574	09/11/06	155
25	Dipole Antenna	Schwarzbeck (curren tthe press)	VHA9103	29/10/05	2116
26	Dipole Antenna	Schwarzbeck (curren t the press)	VHA9103	29/10/05	2117
27	Dipole Antenna	Schwarzbeck (curren t the press)	UHA9105	29/10/05	2261
28	Dipole Antenna	Schwarzbeck (curren t the press)	UHA9105	29/10/05	2262

	Type	Manufacturer	Model	Cal.Due.Date (dd/mm/yy)	S/N
29	RFI/FIELD Intensity Meter	Kyorits	KNM-504D	07/07/06	SN-161-4
30	Frequency Converter	Kyorits	KCV-604C	07/07/06	4-230-3
31	TEMP & HUMIDITY Chamber	JISCO	J-RHC2	13/09/06	021031
32	Log Periodic Antenna	Schwarzbeck	UHALP9108A1	29/09/06	1098
33	Biconical Antenna	Schwarzbeck	VHA9103	18/04/06	2233
34	Digital Multimeter	H.P	34401A	18/04/06	3146A13475
35	Attenuator (10dB)	WEINSCHEL	23-10-34	21/10/06	BP4386
36	High-Pass Filter	ANRITSU	MP526	12/05/06	M27756
37	Attenuator (3dB)	Agilent	8491B	21/10/06	58177
38	Amplifier (25dB)	Agilent	8447D	18/04/06	2944A10144
39	Amplifier (30dB)	Agilent	8449B	21/10/06	3008A01590
40	Position Controller	TOKIN	5901T	N/A	14173
41	Driver	TOKIN	5902T2	N/A	14174
42	Spectrum Analyzer	H.P	8591E	18/04/06	3649A05889
43	RFI/FIELD Intensity Meter	Kyorits	KNW-2402	04/07/06	4N-170-3
44	LISN	Kyorits	KNW-407	11/08/06	8-317-8
45	LISN	Kyorits	KNW-242	11/08/06	8-654-15
46	CVCF	NF Electronic	4400	N/A	344536 4420064
47	Software	ToYo EMI	EP5/RE	N/A	Ver 2.0.800
48	Software	ToYo EMI	EP5/CE	N/A	Ver 2.0.801
49	Software	AUDIX	e3	N/A	Ver 3.0
50	Software	Agilent	Benchlink	N/A	A.01.09 021211

