

## TEST REPORT For FCC

Test Report No. : 2007100029  
Date of Issue : October 22, 2007  
FCC ID : UF8SFK411  
Model/Type No. : SFK411  
Kind of Product : Bluetooth Rear-view Mirror Handsfree kit  
Applicant : Elentec Co.Ltd.  
Applicant Address : 337-17 Wonchun-Dong, Yeongtong-gu, Suwon-city,  
Kyunggi-province, 443-822, Korea  
Manufacturer : Elentec Co.Ltd.  
Manufacturer Address : 337-17 Wonchun-Dong, Yeongtong-gu, Suwon-city,  
Kyunggi-province, 443-822, Korea  
Contact Person : Hyung Sun Kim / Engineer  
Telephone : +82-31-211-9820  
Received Date : September 27, 2007  
Test period : Start : October 15, 2007 End : October 19, 2007  
Test Results : ☒ In Compliance ☐ Not in Compliance

The test results presented in this report relate only to the object tested.

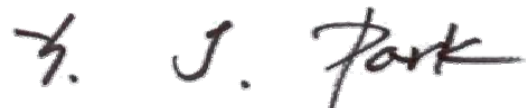
CTK Co., Ltd. is accredited by Korea Laboratory Accreditation Scheme (KOLAS) which signed the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) for the above test item(s) and test method(s).

Tested by



Kyu-Chul, Shin  
Test Engineer  
Date: October 22, 2007

Reviewed by



Young-Joon, Park  
Technical Manager  
Date: October 22, 2007



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### REPORT REVISION HISTORY

Date	Revision	Page No
October 22, 2007	Issued (2007100029)	All

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### 1.0 General Product Description

Equipment model name : SFK411  
Serial number : Prototype  
EUT condition : Pre-production, not damaged  
Antenna type : Chip antenna Gain 2.56dBi  
Frequency Range : 2402 ~ 2480 MHz  
RF output power Range : -6 dBm ~ +4 dBm (Class 2)  
RF power : 0.67dBm - Conducted  
Number of channels : 79  
Channel Spacing : 1MHz  
Channel Access Protocol : Frequency Hopping  
Type of Modulation : GFSK  
Power Source : External battery(DC 5V Lithium Ion)

### 1.1 Tested Frequency

	LOW	MID	HIGH
Frequency (MHz)	2402	2441	2480



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### 1.2 Model Differences

Not applicable

### 1.3 Device Modifications

The following modifications were necessary for compliance:

Not applicable

### 1.4 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.	FCC ID or DoC
Notebook PC	DELL	LATITUDE D505	32775808960	DoC





## 1.5 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

## 1.6 Test Facility

The measurement facility is located at 386-1, Ho-dong, Cheoin-gu, Yongin-si, Gyeonggi-do, 449-100, Korea.

## 1.7 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	 93250
JAPAN	VCCI	10 meter Open Area Test Site and one conducted site.	 R-948, C-986
KOREA	MIC	EMI (10 meter Open Area Test Site and two conducted sites) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 No. 51, KR0025
Europe	GLAS	EMC EN 55011, EN 55022, EN 61000-6-3, EN 61000-6-4, EN 61000-3-2, EN 61000-3-3, EN 61000-6-1, EN 61000-6-2, EN 50130-4, EN 55024, EN 61204-3, EN 60601-1-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11	 No.13000796-02



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## 2.0 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	Carrier Frequency Separation	> 25 kHz	Conducted	C
15.247(a)	Number of Hopping Frequencies	> 75 hops		C
15.247(a)	20 dB Bandwidth	< 1 MHz		C
15.247	Dwell Time	< 0.4 seconds		C
15.247(b)	Transmitter Output Power	< 1Watt		C
15.247(d)	Conducted Spurious emission	> 20 dBc		C
15.247(d)	Band Edge	> 20 dBc		C
15.249 /15.209	Field Strength of Harmonics	< 54 dBuV (at 3m)	Radiated	C
15.207 /15.107	AC Conducted Emissions	EN 55022	Line Conducted	C

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

Note 2: The data in this test report are traceable to the national or international standards.

The sample was tested according to the following specification:  
- FCC Part 15.247, ANSI C63.4-2003

## 2.1 Transmitter Requirements

### 2.1.1 Carrier Frequency Separation

#### Test Location

RF Test Room

#### Test Procedures

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT has 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 ( $\geq 1\%$  of the span) Sweep = auto

VBW = 30 kHz ( $\geq$  RBW) Detector function = peak

Trace = max hold

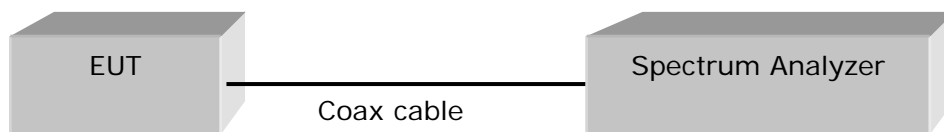


Figure 1 : Measurement setup for the carrier frequency separation

#### Limit

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

#### Test Results

Carrier Frequency Separation (MHz)	Result
1.010	Complies

See next pages for actual measured spectrum plots.



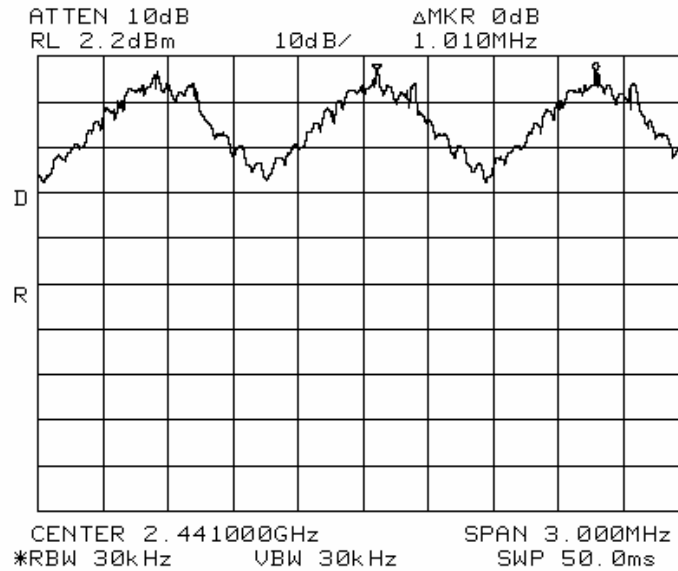


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### Carrier Frequency Separation



## 2.1.2 Number of Hopping Frequencies

### Test Location

RF Test Room

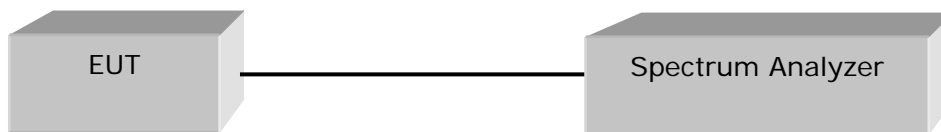
### Test Procedures

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

The spectrum analyzer is set to:

Frequency range      1: Start = 2389.5 MHz, Stop = 2439.5 MHz  
                                 2: Start = 2439.5 MHz, Stop = 2489.5 MHz

Span = 50 MHz  
RBW = 300 kHz ( $\geq 1\%$  of the span)  
VBW = 300 kHz ( $\geq$  RBW)  
Trace = max hold  
Sweep = auto  
Detector function = peak



### Limit

The EUT in the 2400-2483.5 MHz band shall use at least 75 channels.

### Test Results

Total number of Hopping Channels	Result
79	Complies

See next pages for actual measured spectrum plots.

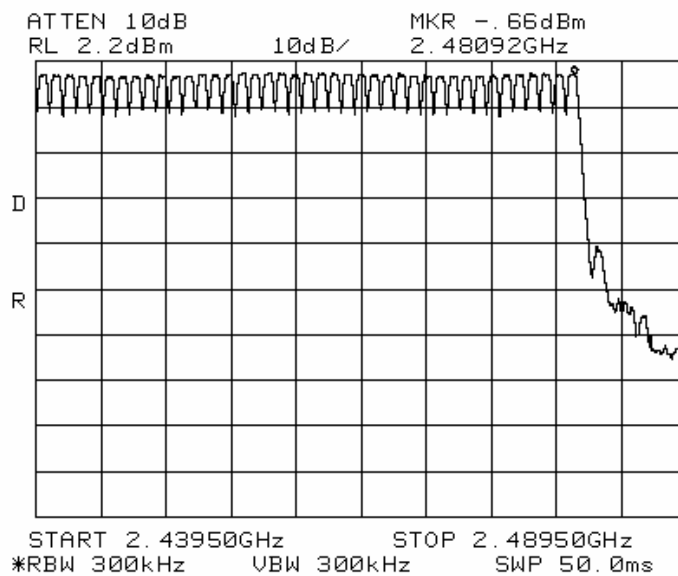
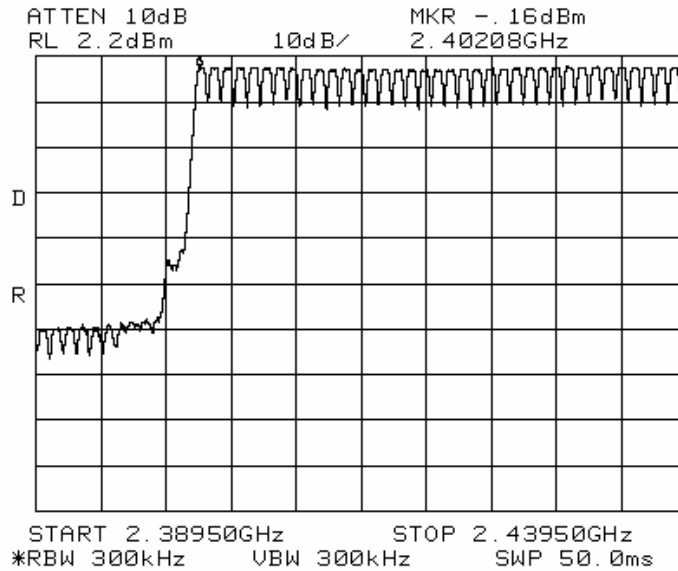


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### Number of Hopping Frequencies



### 2.1.3 20 dB bandwidth

#### Test Location

RF Test Room

#### Test Procedures

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 20 dB 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)

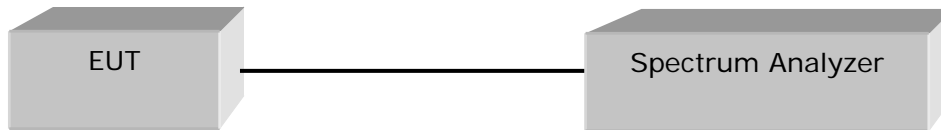
RBW = 30 kHz ( $\geq 1\%$  of the span)

Sweep = auto

VBW = 30 kHz ( $\geq$  RBW)

Detector function = peak

Trace = max hold



#### Limit

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

#### Test Results

Frequency (MHz)	Channel Number.	Measured Bandwidth (MHz)	Result
2441	0	0.857	Complies

See next pages for actual measured spectrum plots.(worst case)

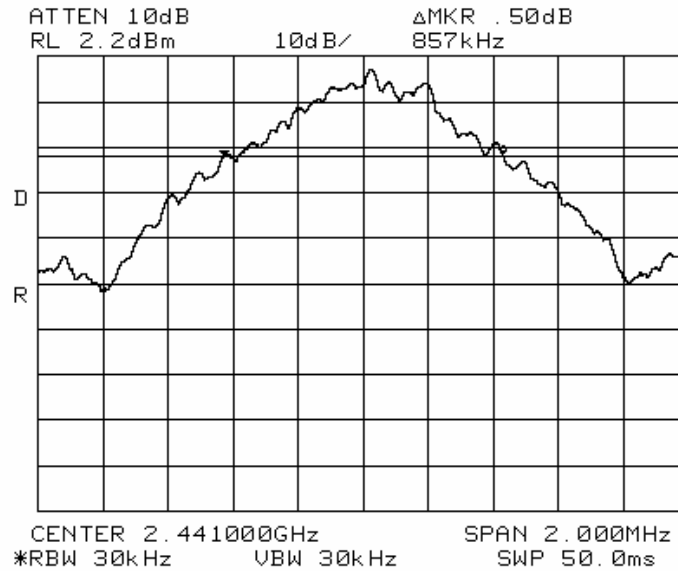


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### 20 dB Bandwidth



## 2.1.4 Time of Occupancy (Dwell Time)

### Test Location

RF Test Room

### Test Procedures

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

The spectrum analyzer is set to:

Center frequency = the highest, middle, and the lowest channels

Span = zero

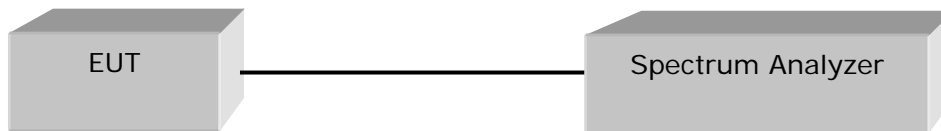
RBW = 1 MHz

Trace = max hold

VBW = 1 MHz ( $\geq$  RBW)

Detector function = peak

Sweep = as necessary to capture the entire dwell time per hopping channel



### Limit

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.

### Test Results

Channel Number	Channel Frequency (MHz)	Packet Type	Test Results	
			Dwell Time (ms)	Result
39	2441	DH 1	130.92	Complies
		DH 3	268.17	Complies
		DH 5	312.12	Complies

See next pages for actual measured spectrum plots. (Worst case)

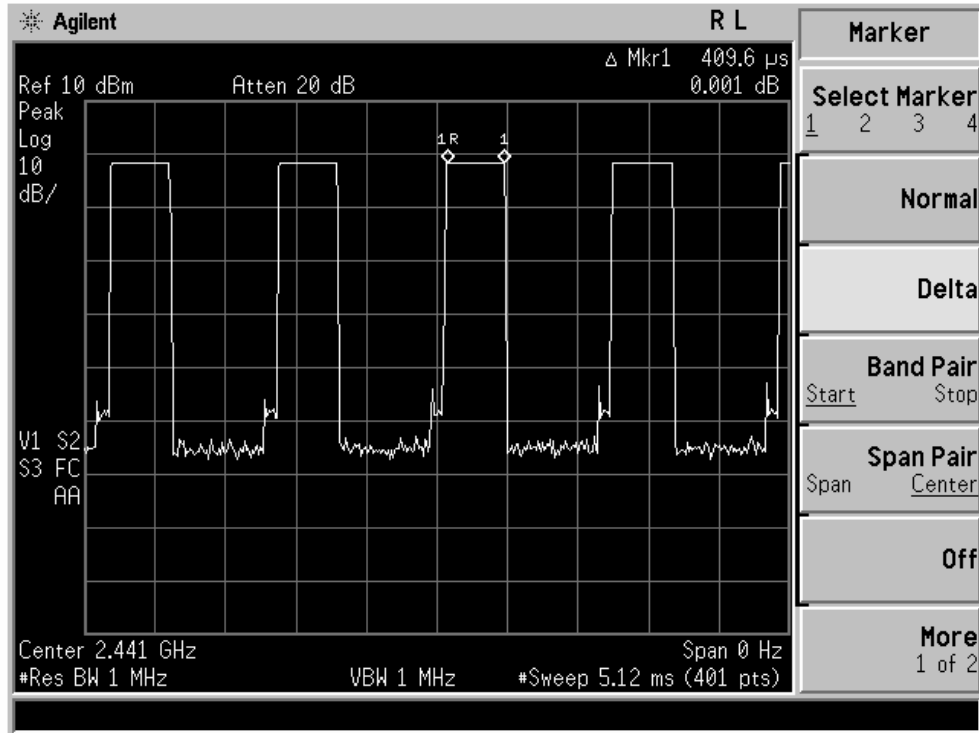


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### Time of Occupancy for PACKET Type DH 1



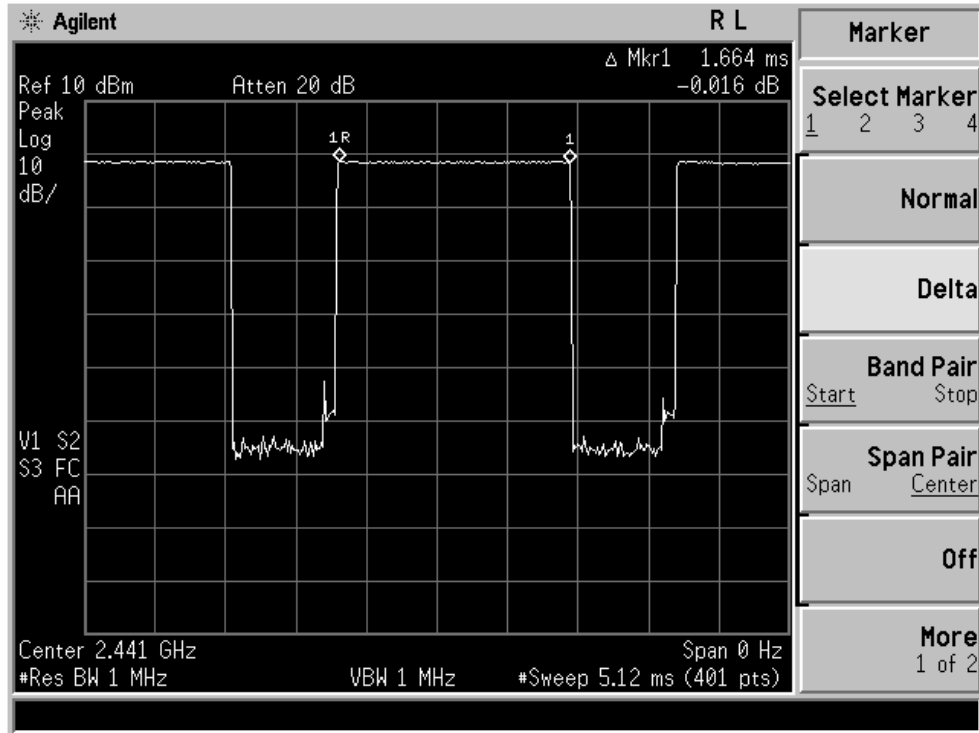


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### Time of Occupancy for PACKET Type DH 3





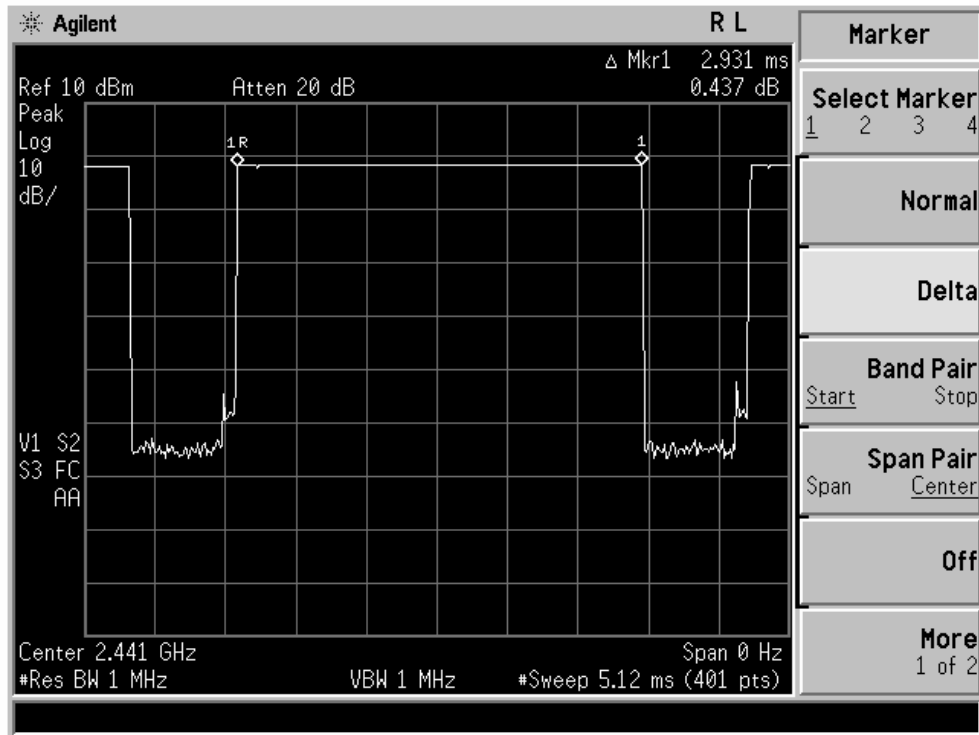


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### Time of Occupancy for PACKET Type DH 5



## 2.1.5 Maximum peak Conducted Output Power

### Test Location

RF Test Room

### Test Procedures

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

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)

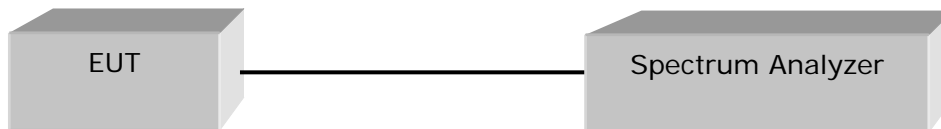
RBW = 1 MHz (greater than the 20 dB bandwidth of the emission being measured)

VBW = 1 MHz ( $\geq$  RBW)

Detector function = peak

Trace = max hold

Sweep = auto



### Limit

< 1 W

### Test Results

Frequency (MHz)	Channel No.	Peak output power(dBm)	Peak output power(mW)	Result
2402	0	0.17	1.040	Complies
2441	39	-0.33	0.927	Complies
2480	78	0.67	1.167	Complies

See next pages for actual measured spectrum plots.



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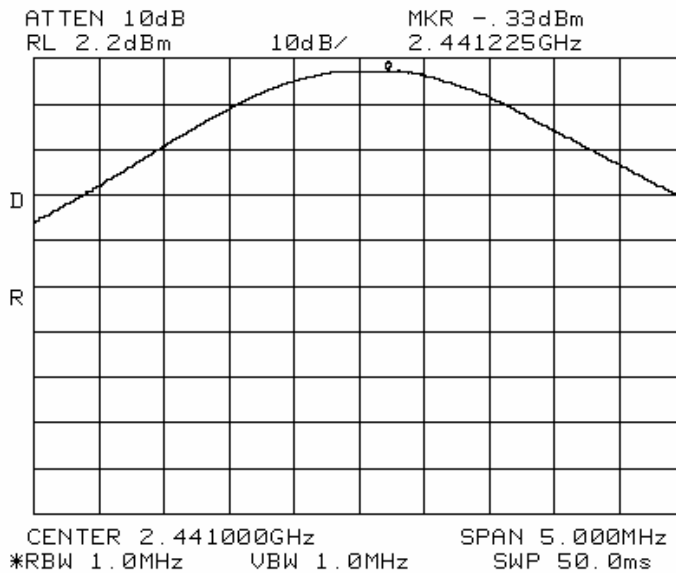
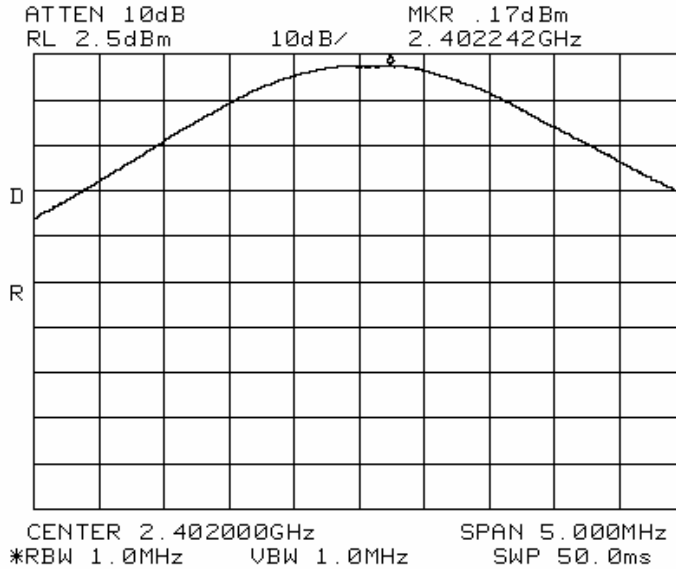
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### Maximum peak Conducted Output Power





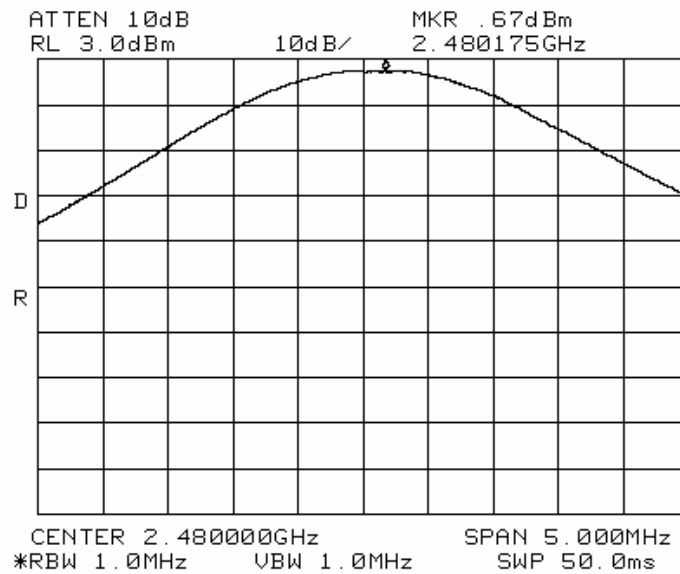
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## 2.1.6 Band-edge

### Test Location

RF Test Room

### Test Procedures

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

The spectrum analyzer is set to:

Center frequency = the highest, middle, and the lowest channels

RBW = 100 kHz

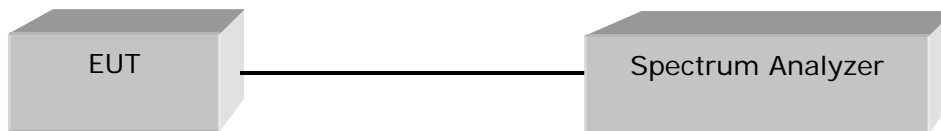
VBW = 100 kHz ( $\geq$  RBW)

Span = 100 MHz

Trace = max hold

Detector function = peak

Sweep = auto



### Limit

> 20 dBc

### Test Results

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

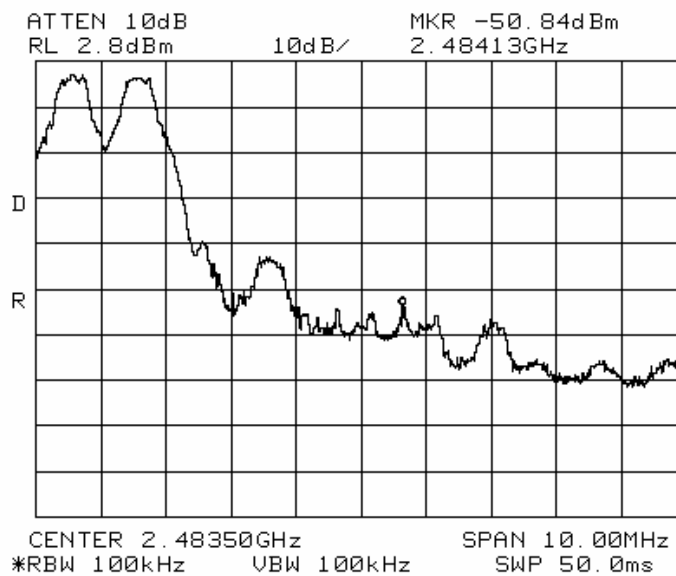
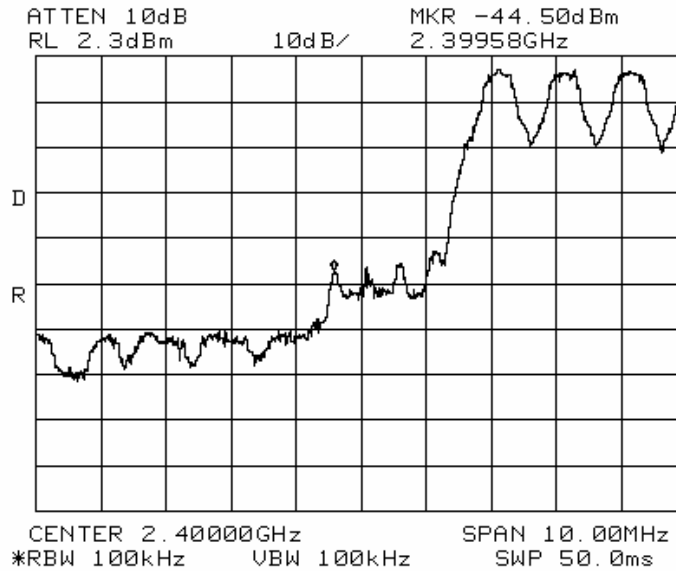


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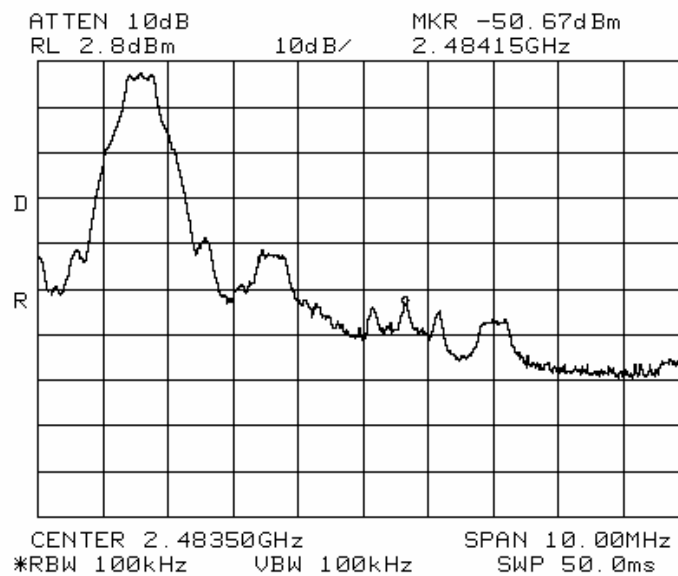
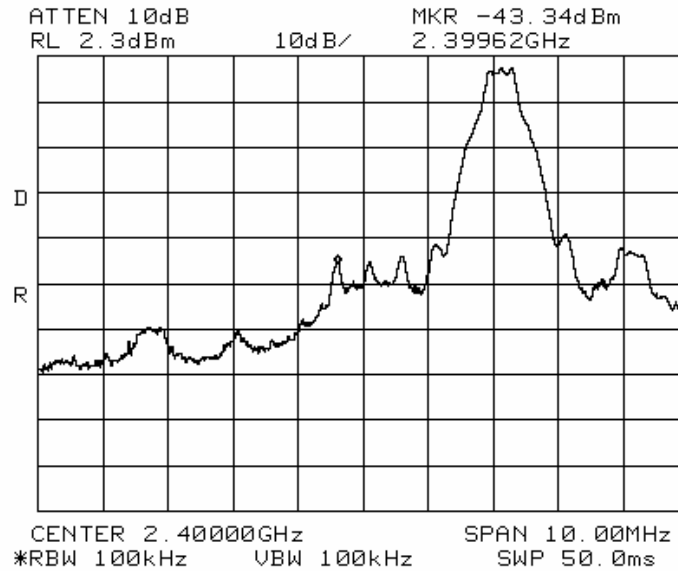
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### Band – edge (with Hopping)



## Band – edge (without Hopping)



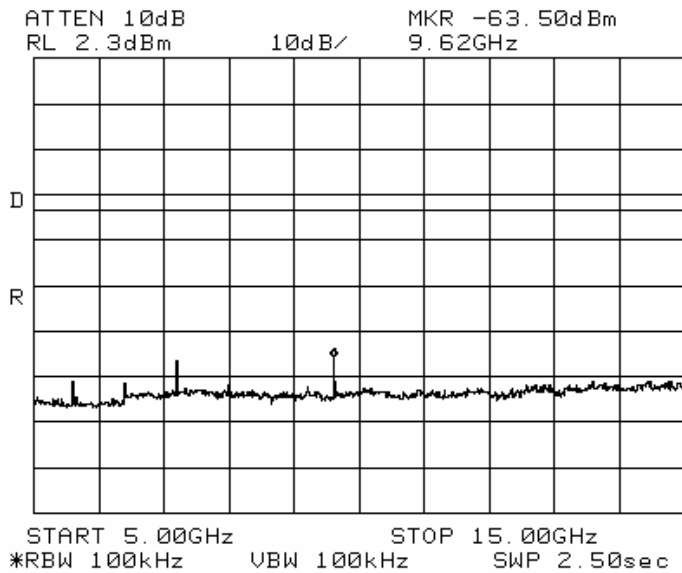
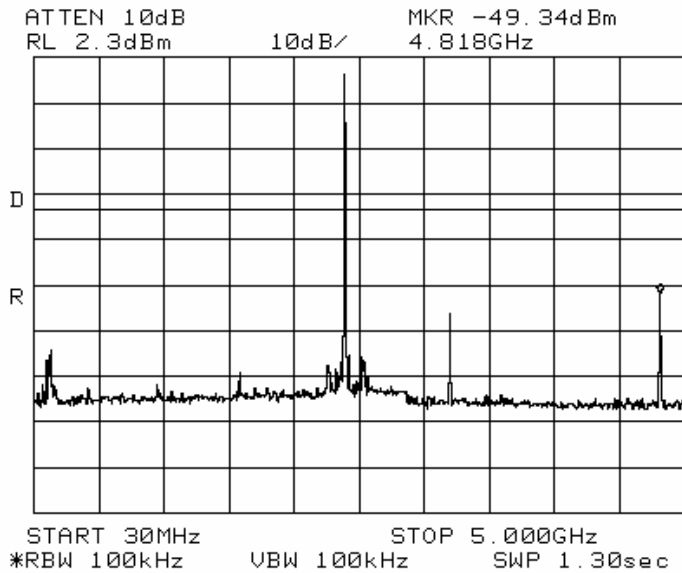


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### Band – edge (at 20 dB blow) – Low channel Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic





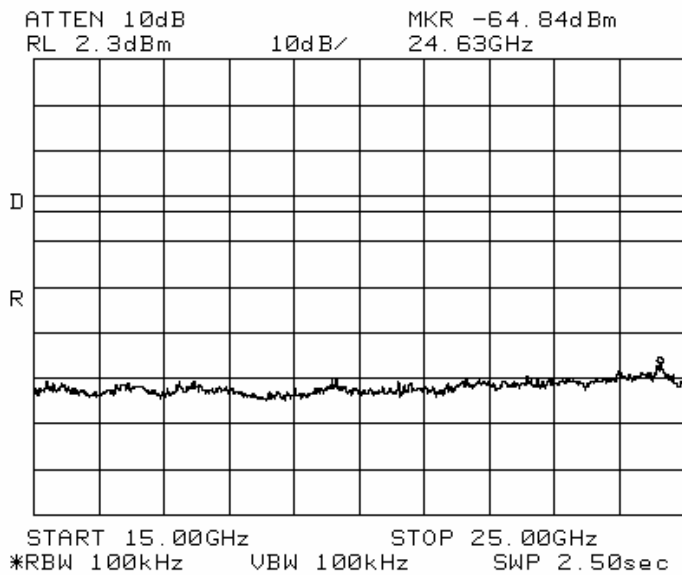


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### Band – edge (at 20 dB blow) – Low channel Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic



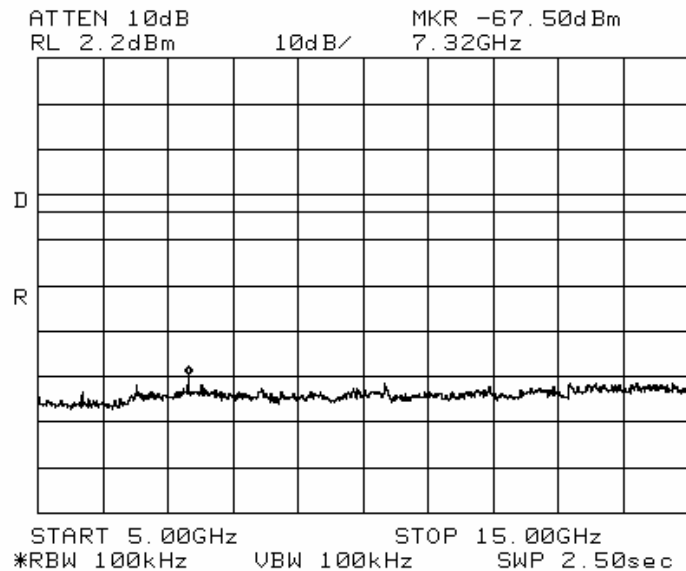
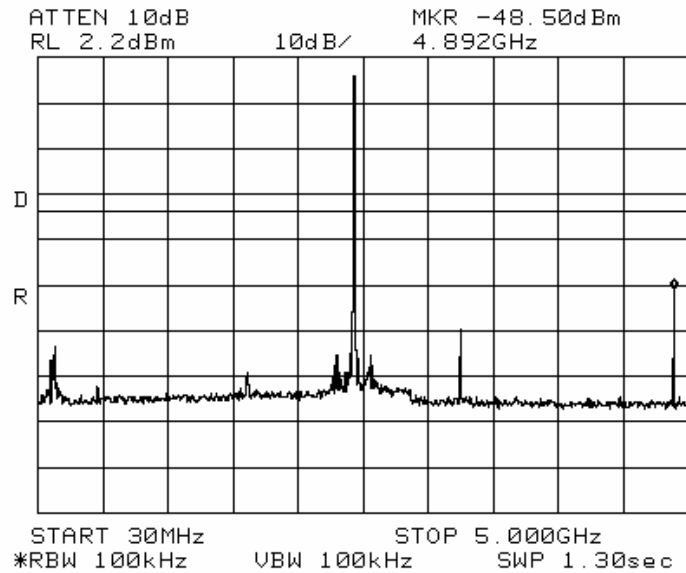


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### Band – edge (at 20 dB blow) – Mid channel Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic



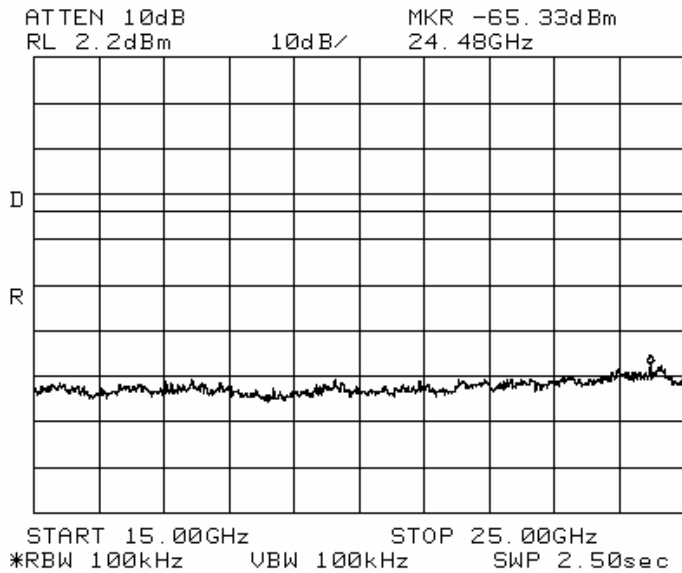


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### Band – edge (at 20 dB blow) – Mid channel Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic



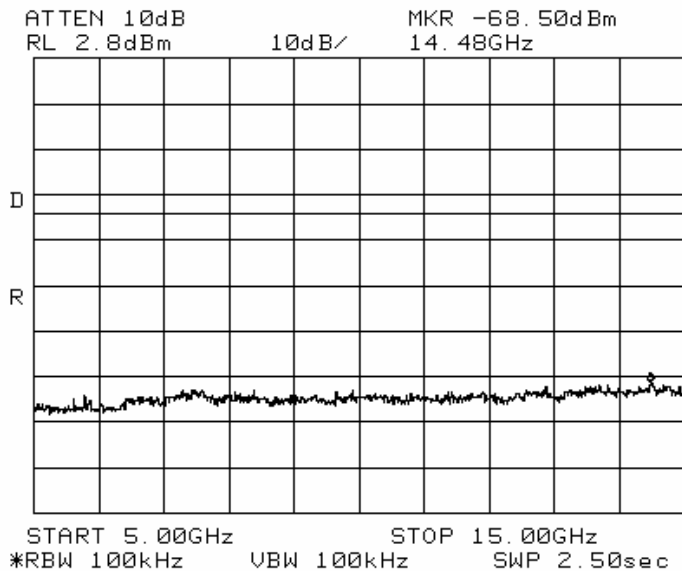
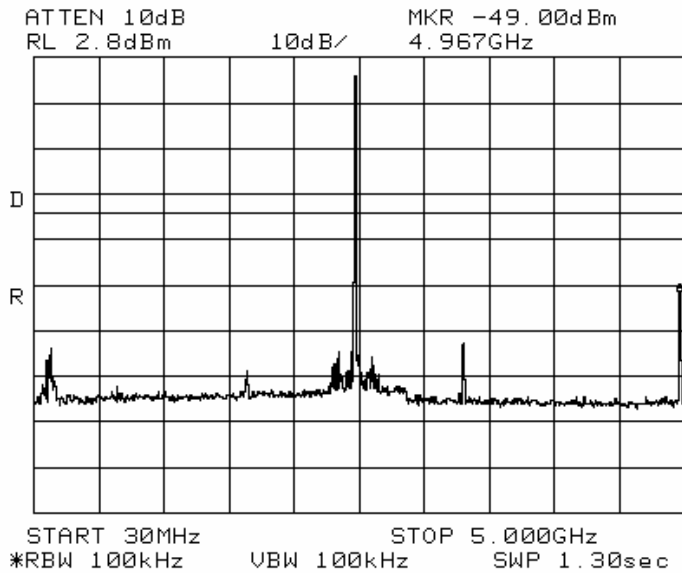


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### Band – edge (at 20 dB blow) – High channel Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic



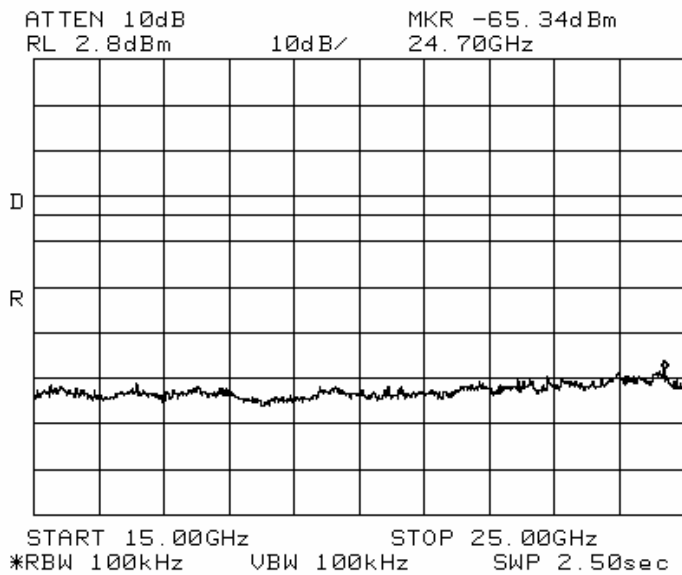


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### Band – edge (at 20 dB blow) – High channel Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic



## 2.1.7 Field Strength of Emissions

### Test Location

☒ Testing was performed at a test distance of 3 meter Open Area Test Site

### Test Procedures

The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity. The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

The spectrum analyzer is set to:

Center frequency = the worst channel

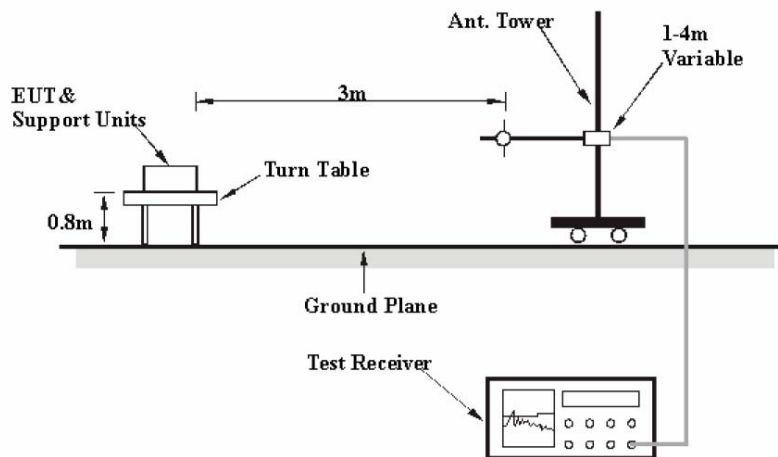
Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic

RBW = 120 kHz (30 MHz ~ 1 GHz)      VBW ≥ RBW  
= 1 MHz (1 GHz ~ 10<sup>th</sup> harmonic)

Span = 100 MHz

Detector function = Quasi-peak

Trace = max hold



### Limit

#### - 15.209(a)

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m
30-88	100**	40
88-216	150**	43.5
216-960	200**	46
Above 960	500	54

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



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### Test Results

EUT	Bluetooth Rear-view Mirror Handsfree kit	Measurement Detail	
Model	SFK411	Frequency Range	Below 1000MHz
Channel	Channel 0	Detector function	Quasi-Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
881.15	37.2	8.8	Quasi-Peak

### Test Data

Frequency	Reading	Pol.	Height	Correction		Limits	Result	Margin
				Factor				
[MHz]	[dBuV/m]		[m]	Antenna	Cable	[dBuV/m]	[dBuV/m]	[dB]
39.65	16.6	V	1.0	14.4	0.2	40.0	31.2	8.8
122.10	22.8	V	1.0	10.1	1.1	43.5	34.0	9.5
194.80	24.4	H	4.0	7.3	1.5	43.5	33.2	10.3
546.45	14.5	H	2.0	16.4	3.8	46.0	34.7	11.3
721.10	13.1	V	1.8	18.9	4.0	46.0	36.0	10.0
881.15	11.8	H	1.0	20.8	4.6	46.0	37.2	8.8

## Test Results

EUT	Bluetooth Rear-view Mirror Handsfree kit	Measurement Detail	
Model	SFK411	Frequency Range	1-25GHz
Channel	Channel 0	Detector function	Average/Peak

## Remarks

We have tested three mode (X, Y, Z). The worst mode (X axis) for final test.

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4804.18	43.1/52.6	4.7/15.2	Average/Peak

## Test Data

Frequency [MHz]	Reading A/P [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits/ Detector A/P [dBuV/m]	Result A/P [dBuV/m]
				Antenna	Amp.Gain	Cable		
2147.14	26.5/35.7	H	1.0	28.2	35.3	5.8	54.0 /74.0	25.2/34.4
3137.50	34.4/43.4	H	1.0	31.1	35.3	6.6	54.0 /74.0	36.8/45.8
4804.18	43.1/52.6	H	1.5	33.7	34.8	7.3	54.0 /74.0	49.3/58.8
9627.68	24.1/31.4	H	1.1	38.4	35.4	13.7	54.0 /74.0	40.8/48.1

\*No emission Were detected at level greater than 20dB below limit.

## Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency	Reading	Pol.	Height	Correction			Limits	Result
				Factor				
[MHz]	[dBuV/m]		[m]	Antenna	Amp. Gain	Cable	[dBuV/m]	[dBuV/m]
No emissions were detected at a level greater than 20dB below limit.								





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### Test Results

EUT	Bluetooth Rear-view Mirror Handsfree kit	Measurement Detail	
Model	SFK411	Frequency Range	1-25GHz
Channel	Channel 39	Detector function	Average/Peak

### Remarks

We have tested three mode (X, Y, Z). The worst mode (X axis) for final test.

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4882.18	49.9/59.4	4.1/14.6	Average/Peak

### Test Data

Frequency [MHz]	Reading A/P [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits/ Detector A/P [dBuV/m]	Result A/P [dBuV/m]
				Antenna	Amp.Gain	Cable		
2580.40	28.1/37.3	H	1.0	28.5	35.4	6.0	54.0 /74.0	27.2/36.4
3253.18	32.2/41.5	H	1.0	31.1	35.3	6.6	54.0 /74.0	34.6/43.9
4882.18	43.7/53.2	H	1.5	33.7	34.8	7.5	54.0 /74.0	49.9/59.4
7324.62	21.0/28.6	H	1.1	38.4	34.9	11.7	54.0 /74.0	36.2/43.8

\*No emission Were detected at level greater than 20dB below limit.

### Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency	Reading	Pol.	Height	Correction			Limits	Result
				Factor				
[MHz]	[dBuV/m]		[m]	Antenna	Amp. Gain	Cable	[dBuV/m]	[dBuV/m]
No emissions were detected at a level greater than 20dB below limit.								



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### Test Results

EUT	Bluetooth Rear-view Mirror Handsfree kit	Measurement Detail	
Model	SFK411	Frequency Range	1-25GHz
Channel	Channel 78	Detector function	Average/Peak

### Remarks

We have tested three mode (X, Y, Z). The worst mode (X axis) for final test.

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4967.24	50.4/59.7	3.6/14.3	Average/Peak

### Test Data

Frequency [MHz]	Reading A/P [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits/ Detector A/P [dBuV/m]	Result A/P [dBuV/m]
				Antenna	Amp.Gain	Cable		
2533.26	25.7/34.1	H	1.0	28.5	35.4	6.0	54.0 /74.0	24.8/33.2
3307.49	31.6/40.7	H	1.0	31.2	35.3	6.9	54.0 /74.0	34.4/43.5
4967.24	43.6/52.9	H	1.5	33.7	34.8	7.9	54.0 /74.0	50.4/59.7

\*No emission Were detected at level greater than 20dB below limit.

### Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency	Reading	Pol.	Height	Correction			Limits	Result
				Factor				
[MHz]	[dBuV/m]		[m]	Antenna	Amp. Gain	Cable	[dBuV/m]	[dBuV/m]
No emissions were detected at a level greater than 20dB below limit.								



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### APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
1	Spectrum Analyzer	Agilent	8564E	3551A0041	2007-11-03
2	EMI Test Receiver	Rohde & Schwarz	ESVS30	826638/008	2008-05-30
3	ULTRA Broadband Antenna	Rohde & Schwarz	HL562	361324/014	2008-06-12
4	Biconical Antenna	EMCO	3110	9202-1510	2008-04-25
5	Log-periodic Antenna	EMCO	3146	9607-4567	2008-04-25
6	Field Strength Meter	Rohde & Schwarz	ESHS30	828144/002	2008-02-15
7	LISN	EMCO	3825/2	9607-2575	2008-09-01
8	LISN	EMCO	3825/2	9409-2246	2008-09-01
9	Field Strength Meter	Rohde & Schwarz	ESHS30	862024/001	2008-02-15
10	System Power Supply	HP	6032A	3440A-10521	2008-07-06
11	EPM Series Power Meter	HP	E4418A	GB38272734	2007-11-03
12	Power Sensor	HP	8481A	331BA92056	2007-11-01
13	Power Sensor	HP	8482B	331BA05406	2007-10-27
14	Audio Analyzer	HP	8903B	2747A03432	2007-11-03
15	ESG-D Series Signal Generator	Agilent	E4432B	US40054094	2007-11-03
16	Modulation Analyzer	HP	8901B	3438A05228	2007-11-06
17	Attenuator	HP	8494A	3308A33351	2007-10-27
18	Attenuator	HP	8496A	3308A15142	2007-10-27
19	Temp&Humi Chamber	Kunpoong	KP-1000	2002KP050041	2008-01-15
20	EMC Analyzer	Agilent	E7403A	MY42000054	2008-10-18
22	Horn Antenna	ETS-Lindgren	3115	00078894	2008-11-29
23	Horn Antenna	ETS-Lindgren	3116	00062504	2008-11-27
24	OPT H64 AMPLIFIER	HP	8447F	3113A06814	2008-03-03
25	PREAMPLIFIER	Agilent	8449B	3008A02307	2007-11-20