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## TEST REPORT

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Report No.: SRTC2013-H024-E0020

Product Name: Pulse Oximeter

Product Model: CMS50EW

Applicant: Contec Medical Systems Co.,Ltd.

Manufacturer: Contec Medical Systems Co.,Ltd.

Specification: FCC Part 15, Subpart C (October 9, 2012 edition)

FCC ID: 2ABOGCMS50EW

The State Radio\_monitoring\_center Testing Center (SRTC)

No.80 Beilishi Road Xicheng District Beijing, China

Tel: 86-10-68009202 Fax: 86-10-68009205

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## 1. General information

### 1.1 Notes of the test report

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The test results relate only to individual items of the samples which have been tested.

### 1.2 Information about the testing laboratory

Company: The State Radio\_monitoring\_center Testing Center (SRTC)  
Address: No.80 Beilishi Road, Xicheng District, Beijing China  
City: Beijing  
Country or Region: China  
Contacted person: Wang Junfeng  
Tel: +86 10 68009181 +86 10 68009202  
Fax: +86 10 68009195 +86 10 68009205  
Email: wangjf@srrc.org.cn / wangjunfeng@srtc.org.cn

### 1.3 Applicant's details

Company: Contec Medical Systems Co., Ltd.  
Address: No.112 Qinhuang West Street, Economic & Technical Development Zone, 066004  
City: Qinhuangdao, Hebei Province  
Country or Region: P.R.China  
Grantee Code: 2ABOG  
Contacted person: Xiao Jie  
Tel: +86-0335-8015489  
Fax: +86-0335-8015490  
Email: contecpinzhibu@163.com

### 1.4 Manufacturer's details

Company: Contec Medical Systems Co., Ltd.  
Address: No.112 Qinhuang West Street, Economic & Technical Development Zone, 066004  
City: Qinhuangdao, Hebei Province  
Country or Region: P.R.China  
Contacted person: Xiao Jie  
Tel: +86-0335-8015489  
Fax: +86-0335-8015490  
Email: contecpinzhibu@163.com

## 1.5 Application details

Date of reception of test sample: 25<sup>th</sup> December 2013

Date of test: 25<sup>th</sup> December 2013 to 15<sup>th</sup> January 2014

## 1.6 Reference specification

FCC Part 15, Subpart C (October 9, 2012 edition)

## 1.7 Information of EUT

### 1.7.1 General information

Name of EUT	Pulse Oximeter
FCC ID	2ABOGCMS50EW
Frequency Range	2.4GHz~2.4835GHz
Number of Channel	79
Modulation Type	GFSK
Duplex Mode	TDD
Channel Spacing	1MHz
Emission Designator	1M00Q1D
Data Rate	1Mbps
Antenna Type	Fixed Internal
Power Supply	Battery or Charger
Rated Power Supply Voltage	3.7V
HW Version	ver 1.1
SW Version	ver 1.4

### 1.7.2 EUT details

Product Name	Product Model	Serial Number
Pulse Oximeter	CMS50EW	DX1210100211

### 1.7.3 Auxiliary equipment details

Equipment	Charger
Manufacturer	SHENZHEN KOSUN INDUSTRIAL CO.,LTD
Model Number	K669008ULR0200
Input Voltage	100V-240V a.c.
Output Voltage	5.0V d.c.
Frequency	50/60Hz

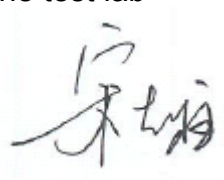
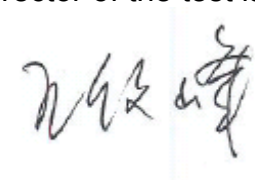

Equipment	Battery
Manufacturer	ShenZhen Rexpower Electronics CO.,LTD
Model Number	552540P
Capacity	480mAh
Rated Voltage	3.7V d.c.

Equipment	Accessory Circuit
Manufacturer	Jinan Huamao Technology
Model Number	HM-DEV-01
Note	Only used in test

## 2. Test information

### 2.1 Summary of the test results

No.	Test case	FCC reference	Verdict
1	Occupied Bandwidth	15.247(a)(1)	Pass
2	Peak Power Output	15.247(b)(1)	Pass
3	Spurious RF Conducted Emissions	15.247(d)	Pass
4	Spurious Radiated Emissions	15.247(d)/15.35(b)/15.209	Pass
5	Band Edge Compliance	15.247(d)	Pass
6	Dwell Time	15.247(a)(1)(iii)	Pass
7	Channel Separation	15.247(a)(1)	Pass
8	Number of Hopping Frequencies	15.247(a)(1)(iii)	Pass

<p>This Test Report Is Issued by: Mr. Song Qizhu Director of the test lab</p> 	<p>Checked by: Mr. Wang Junfeng Deputy director of the test lab</p> 
<p>Tested by: Mr. Li Bin Test engineer</p> 	<p>Issued date:</p> <p><b>2014.01.17</b></p>

## 2.2 Test result

### 2.2.1 Occupied Bandwidth

#### 2.2.1.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

#### 2.2.1.2 Test Description

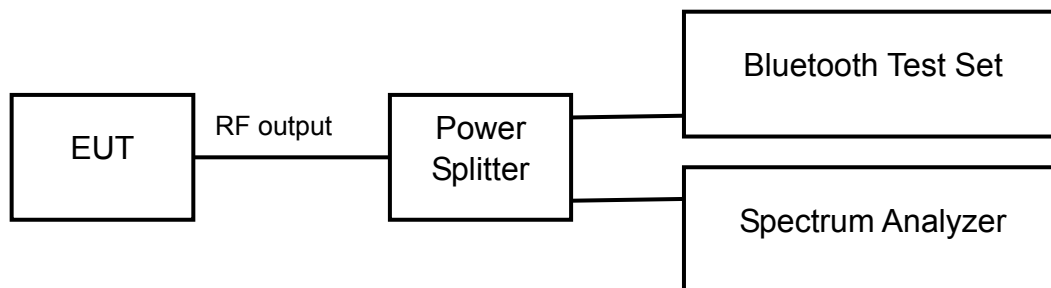
The measurement is made according to Public notice DA 00-705 and ANSI C63.4-2009.

The Equipment Under Test (EUT) was setup in a shielded room to perform the occupied bandwidth measurements.

The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

The results recorded were measured with the modulation which produces the worst-case (widest) occupied bandwidth. The resolution bandwidth for measuring the reference level and the occupied bandwidth was 10 kHz.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.



#### 2.2.1.3 Test limit

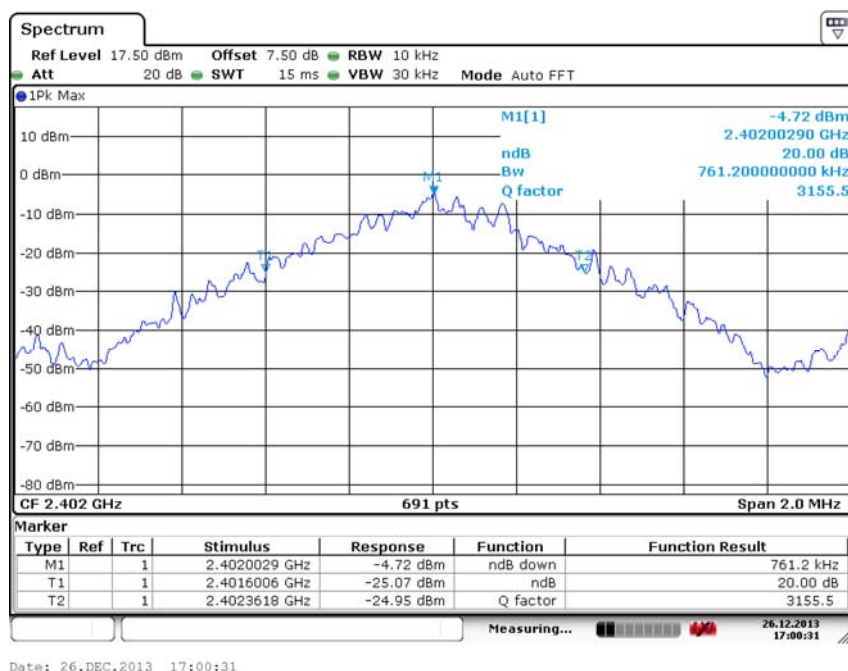
FCC Part15.247(a)(1):

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.

## 2.2.1.4 Test result

Modulation type: GFSK

Carrier frequency (MHz)	Channel No.	20 dB bandwidth(kHz)
2402	0	761.2
2441	39	758.3
2480	78	758.3

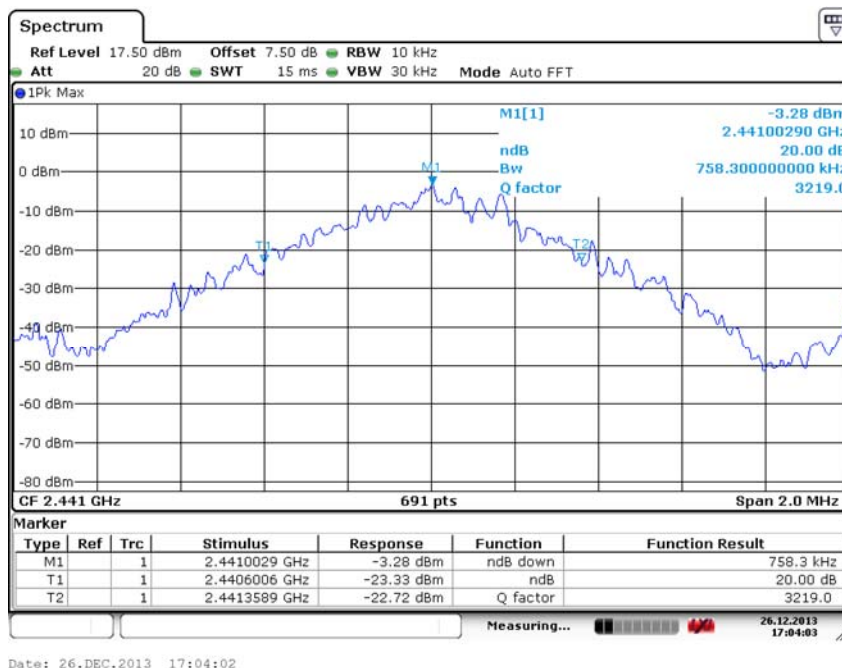


Carrier frequency (MHz): 2402

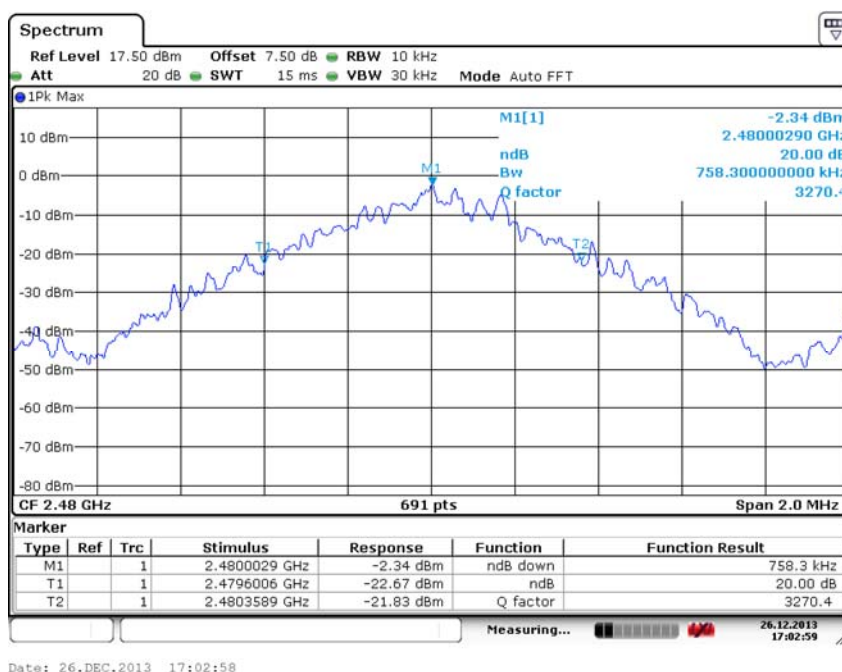
Channel No.:0

Modulation type: GFSK





Carrier frequency (MHz): 2441  
Channel No.:39  
Modulation type: GFSK



Carrier frequency (MHz): 2480  
Channel No.:78  
Modulation type: GFSK

## 2.2.2 Peak Power Output

### 2.2.2.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

### 2.2.2.2 Test Description

The measurement is made according to Public notice DA 00-705 and ANSI C63.4-2009.

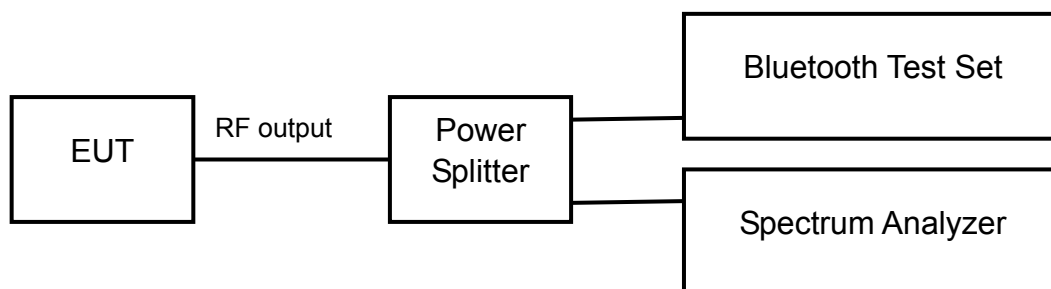
The Equipment Under Test (EUT) was set up in a shielded room to perform the output power measurements.

The results recorded were measured with the modulation which produces the worst-case (highest) output power.

The resolution bandwidth for measuring the output power was 2 MHz.

The reference level of the spectrum analyzer was set higher than the output power of the EUT.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.



### 2.2.2.3 Test limit

FCC Part15.247(b)(1):

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: 1 watt.

For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

Used conversion factor: Limit (dBm) = 10 log (Limit (W)/1mW) →

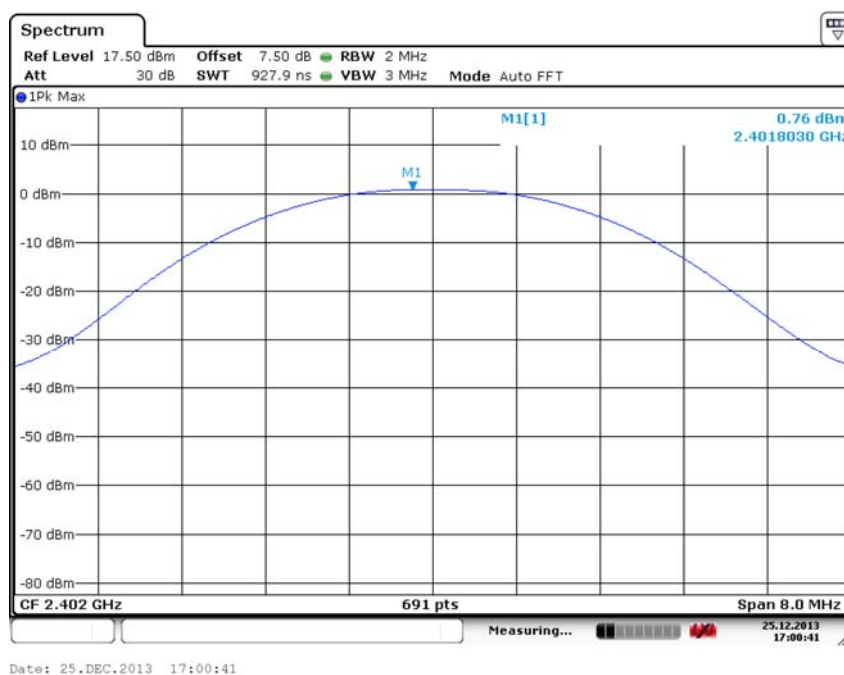
Modulation type	GFSK
Maximum Output Power	30dBm

#### 2.2.2.4 Test Condition

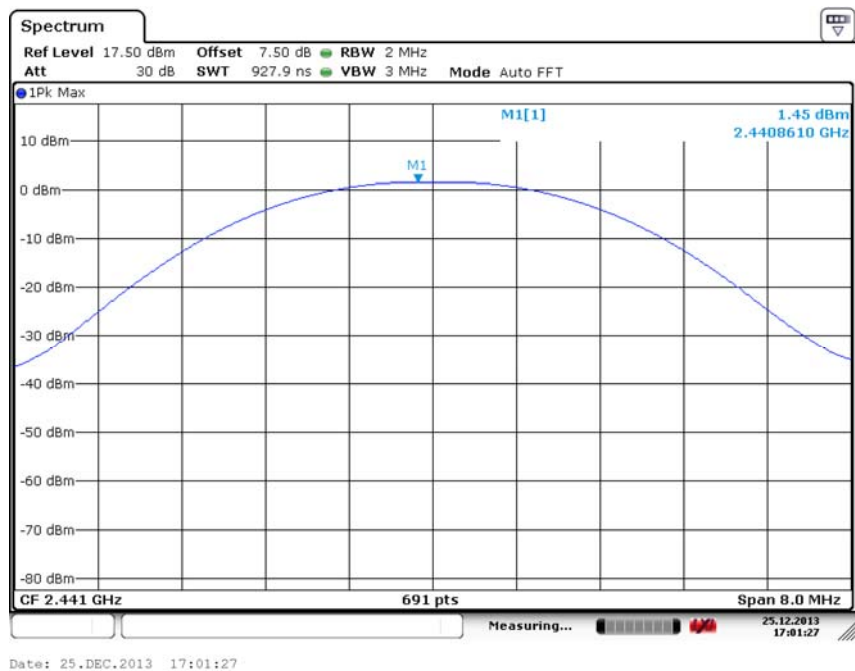
Hopping Mode	Modulation type	RBW	VBW	Span	Sweep time
Hopping OFF	GFSK	2MHz	3MHz	8MHz	1ms

#### 2.2.2.5 Test result

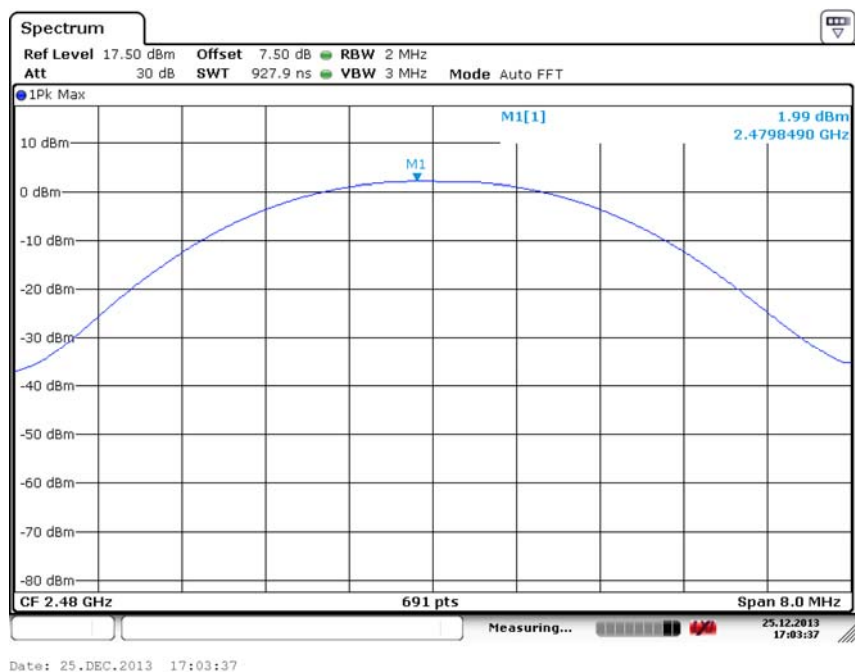
Modulation type	Peak Power Output (dBm)		
	2402MHz (Ch0)	2441MHz (Ch39)	2480MHz (Ch78)
GFSK	0.76	1.45	1.99



Carrier frequency (MHz): 2402  
Channel No.:0  
Modulation type: GFSK



Carrier frequency (MHz): 2441  
Channel No.:39  
Modulation type: GFSK



Carrier frequency (MHz): 2480  
Channel No.:78  
Modulation type: GFSK

## 2.2.3 Spurious RF Conducted Emissions

### 2.2.3.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

### 2.2.3.2 Test Description

The measurement is made according to Public notice DA 00-705 and ANSI C63.4-2009.

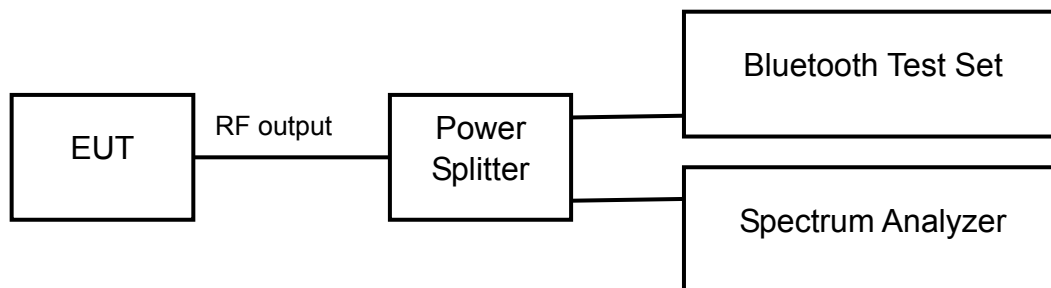
The Equipment Under Test (EUT) was set up in a shielded room to perform the spurious emissions measurements.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

Analyzer settings:

- Detector: Peak-Maxhold
- Frequency range: 30 ~25000 MHz
- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz

The reference value for the measurement of the spurious RF conducted emissions is determined during the test “band edge compliance” (cf. chapter 4.5). This value is used to calculate the 20 dBc limit.



### 2.2.3.3 Test limit

FCC Part15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

#### 2.2.3.4 Test result

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: GFSK

Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta dB
---	---	---	---	---
---	---	---	---	---

Carrier frequency (MHz): 2441

Channel No.:39

Modulation type: GFSK

Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta dB
---	---	---	---	---
---	---	---	---	---

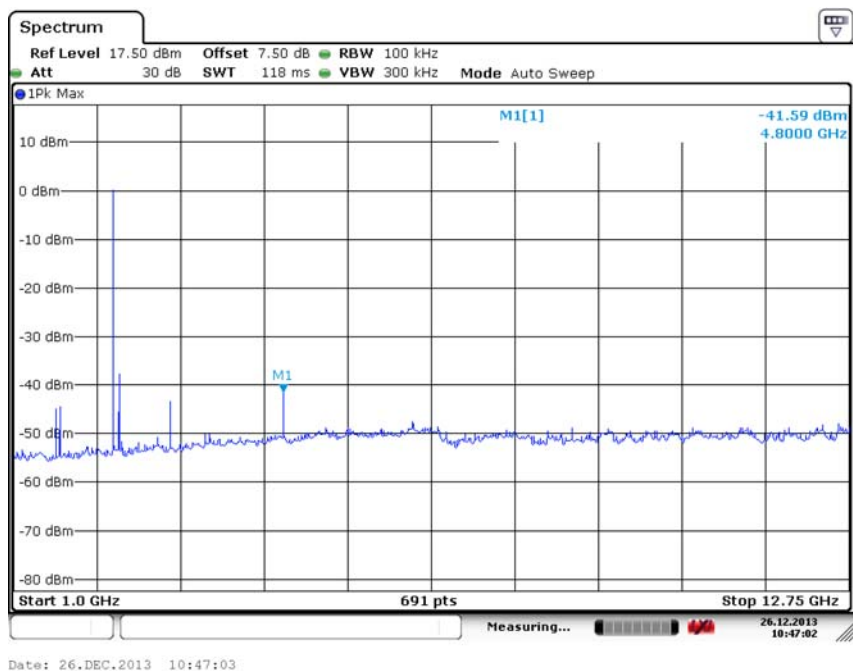
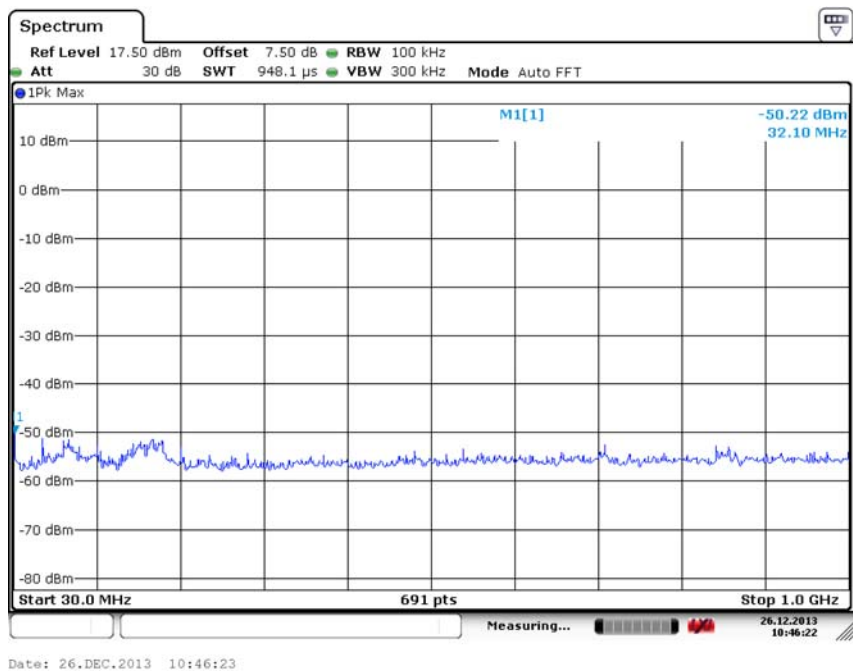
Carrier frequency (MHz): 2480

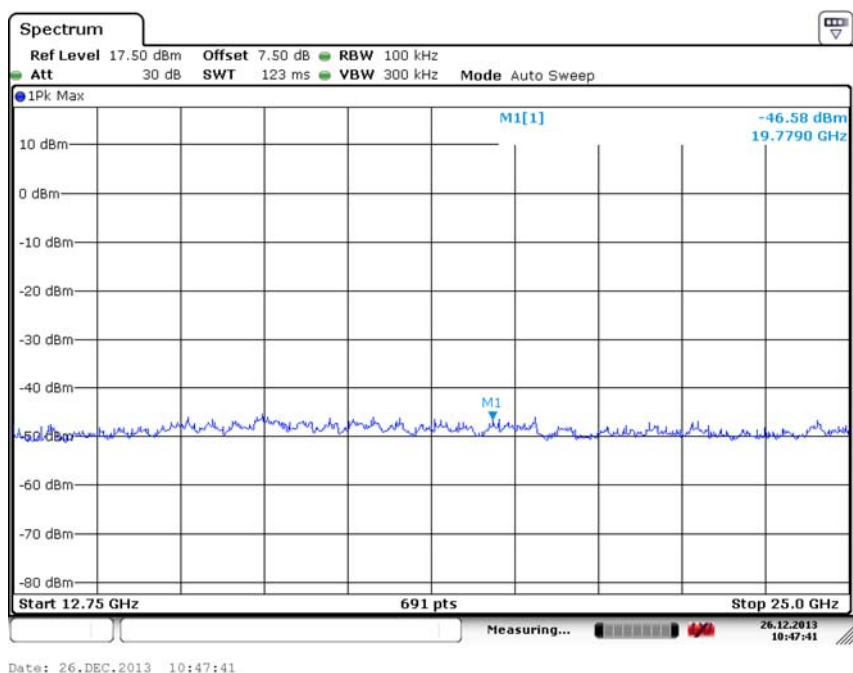
Channel No.:78

Modulation type: GFSK

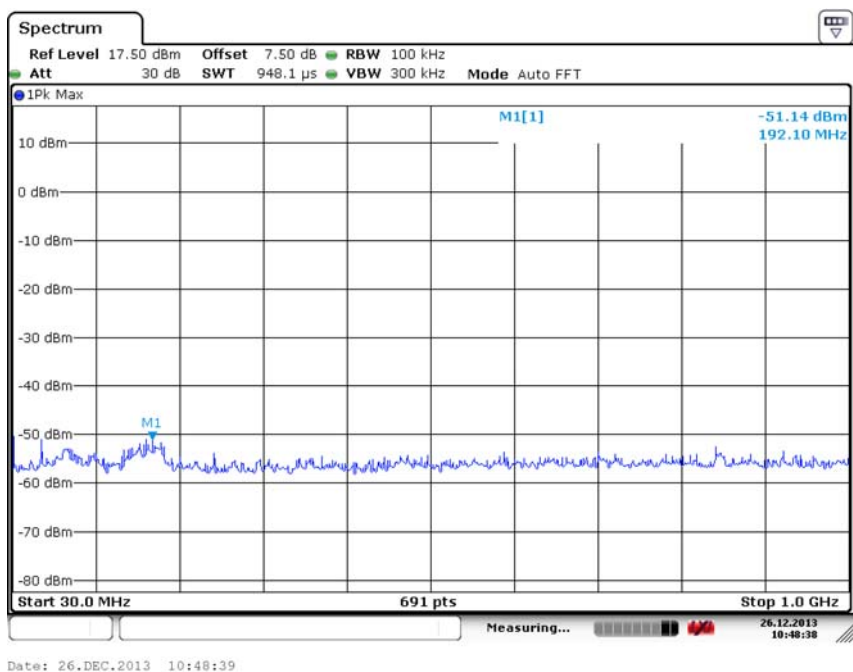
Frequency MHz	Corrected measurement value dBm	Reference value dBm	Limit dBm	Delta dB
---	---	---	---	---
---	---	---	---	---

Note: The Reference value see 2.2.5 Band Edge Compliance

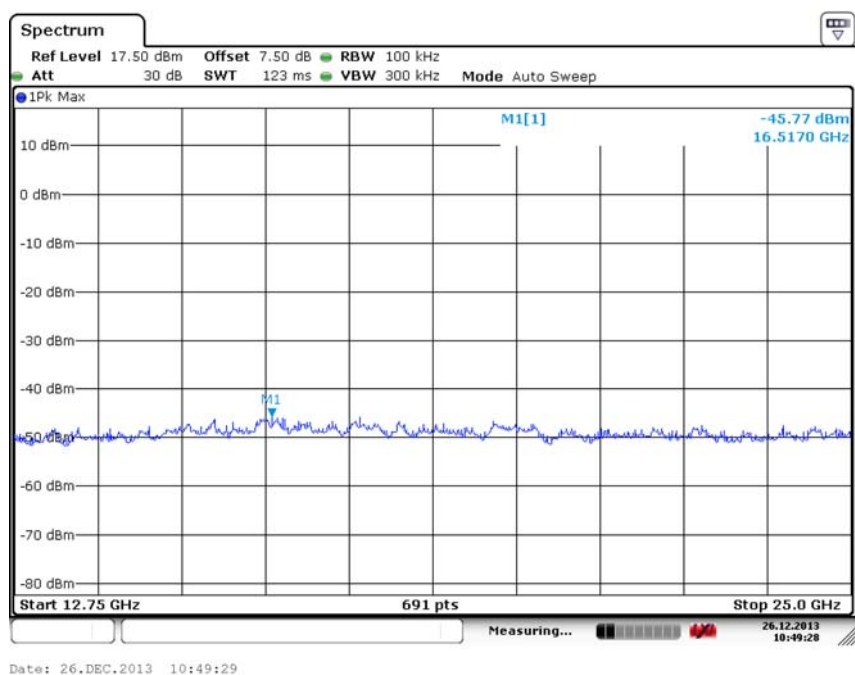
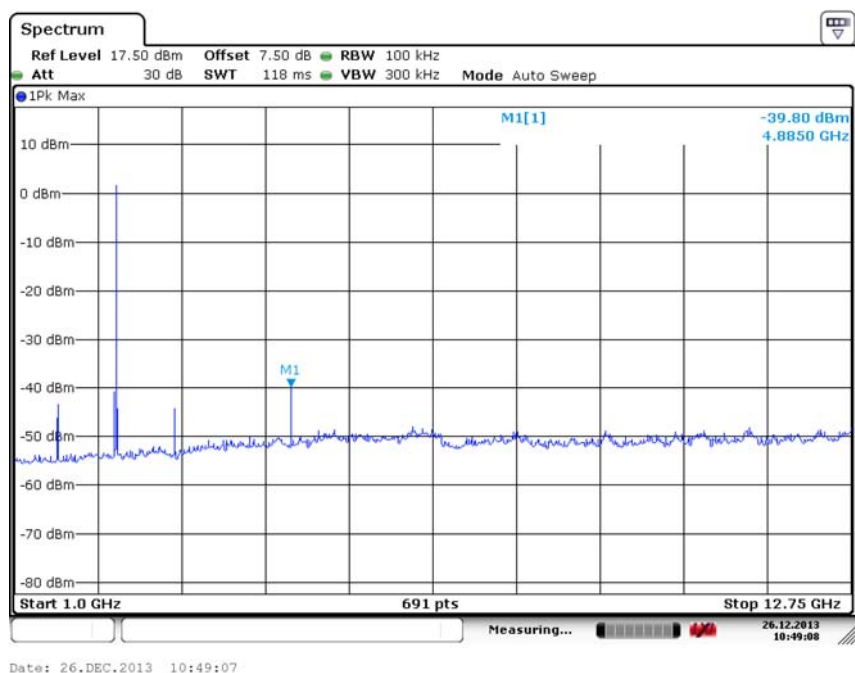




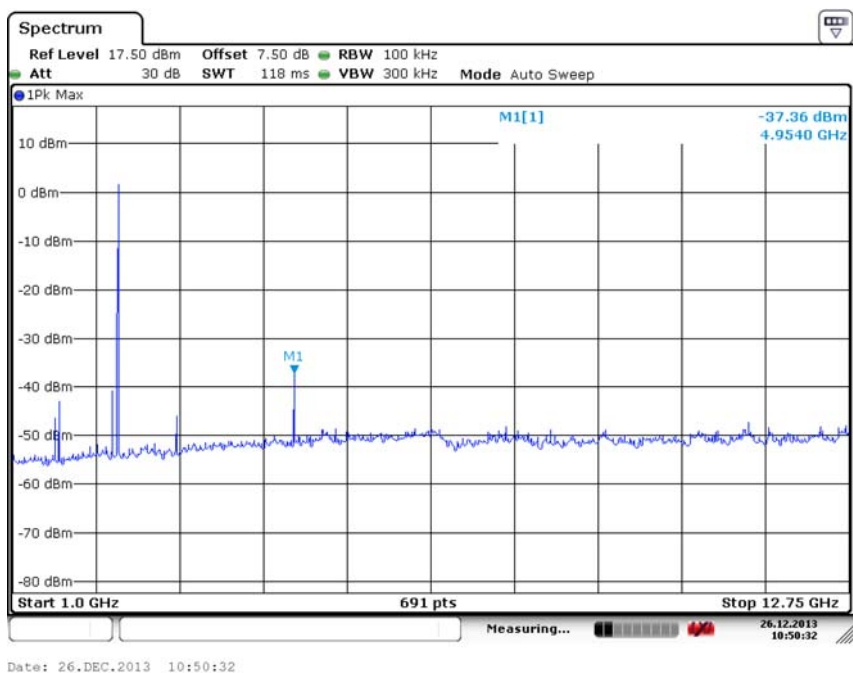
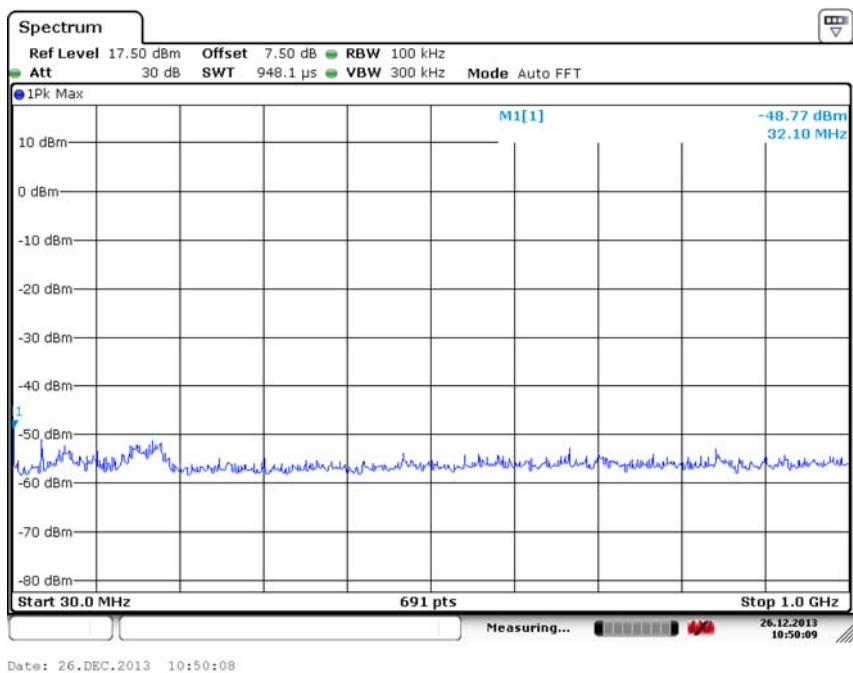
Carrier frequency (MHz): 2402  
Channel No.:0  
Modulation type: GFSK

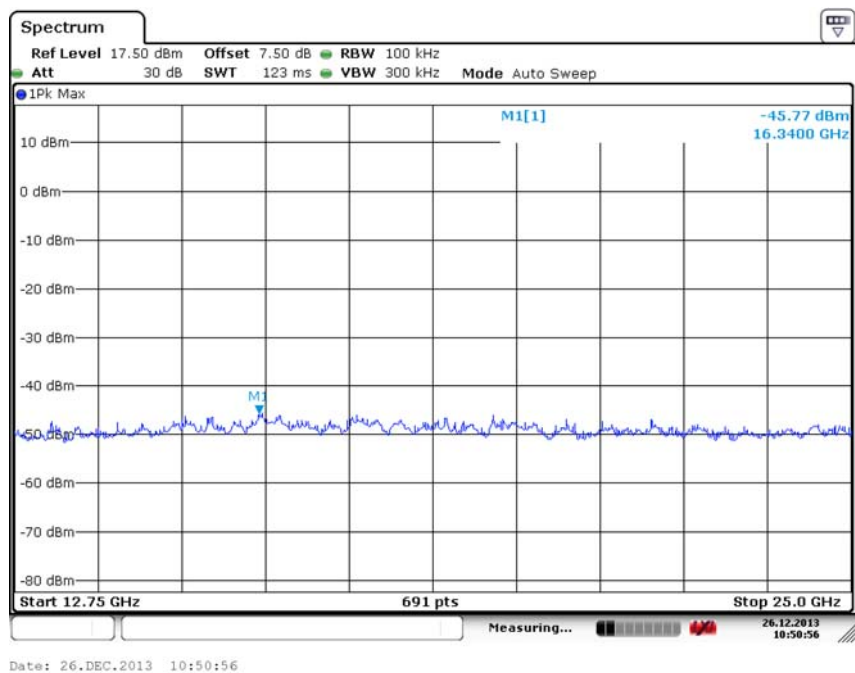






Carrier frequency (MHz): 2441  
Channel No.:39  
Modulation type: GFSK





Carrier frequency (MHz): 2480  
Channel No.:78  
Modulation type: GFSK

## 2.2.4 Spurious Radiated Emissions

### 2.2.4.1 Ambient condition

Temperature	Relative humidity	Pressure
24.3°C	36.2%	100.2kPa

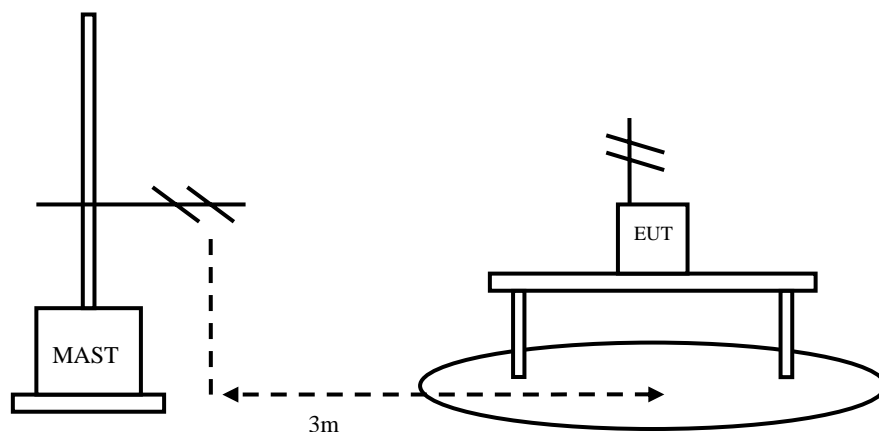
### 2.2.4.2 Test Description

The measurement is made according to Public notice DA 00-705 and ANSI C63.4-2009. The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The radiated emissions measurements were made in a typical installation configuration. Then start the test software ES-K1. Sweep the whole frequency band through the range from 30MHz to 1GHz or above, using receive log period antenna HL562 or Ridge horn antenna HF906.

During the test, the antenna height and EUT azimuth were varied in order to identify the maximum level of emission from the EUT. The height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turn table shall be rotated from 0 to 360 degrees. The measurements shall be repeated with orthogonal polarization of the test antenna.

The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.



### 2.2.4.3 Test limit

FCC Part15.247(d):

... In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

FCC Part15.209:

### Radiated Emission Limits

Frequency of Emission(MHz)	Limits	
	Detector	Unit (dBμV/m)
30~88	Quasi-peak	40.0
88~216	Quasi-peak	43.5
216~960	Quasi-peak	46.0
960~1000	Quasi-peak	54.0
1000~5th harmonic of the highest frequency or 40GHz, whichever is lower	Average	54.0
	Peak	74.0

FCC Part15.35(b):

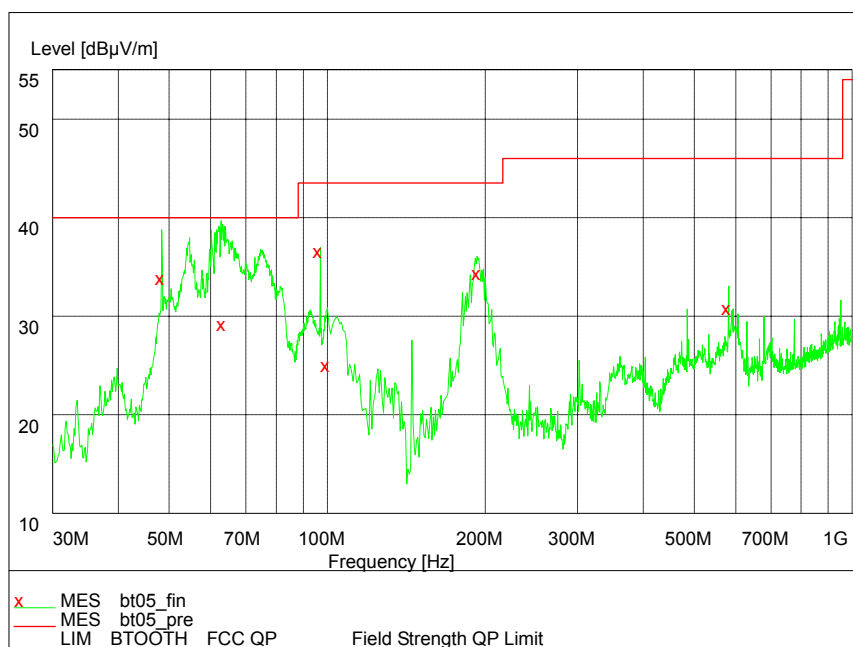
..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor:  $\text{Limit (dB}\mu\text{V/m)} = 20 \log (\text{Limit } (\mu\text{V/m})/1\mu\text{V/m})$

### 2.2.4.4 Test result

Carrier frequency (MHz): 2441

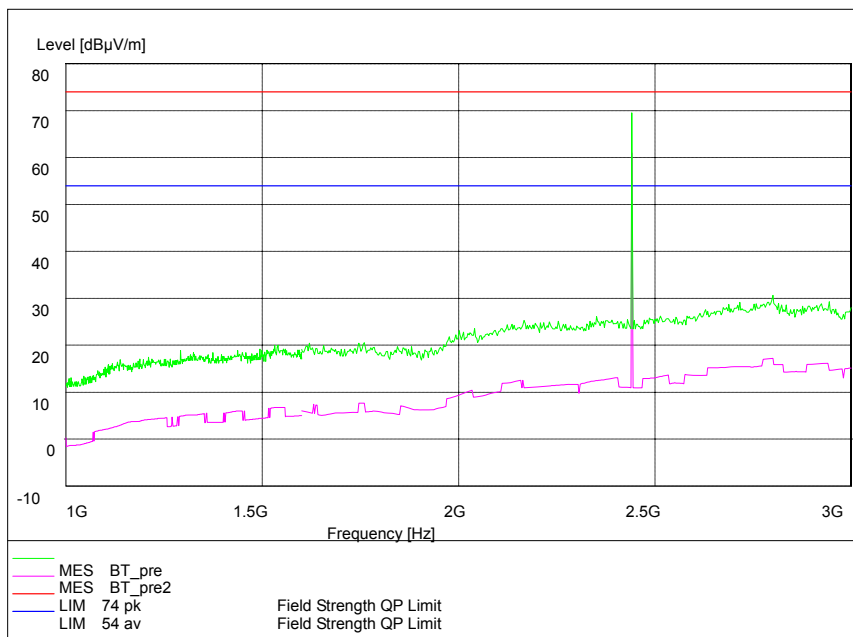
Channel No.:39



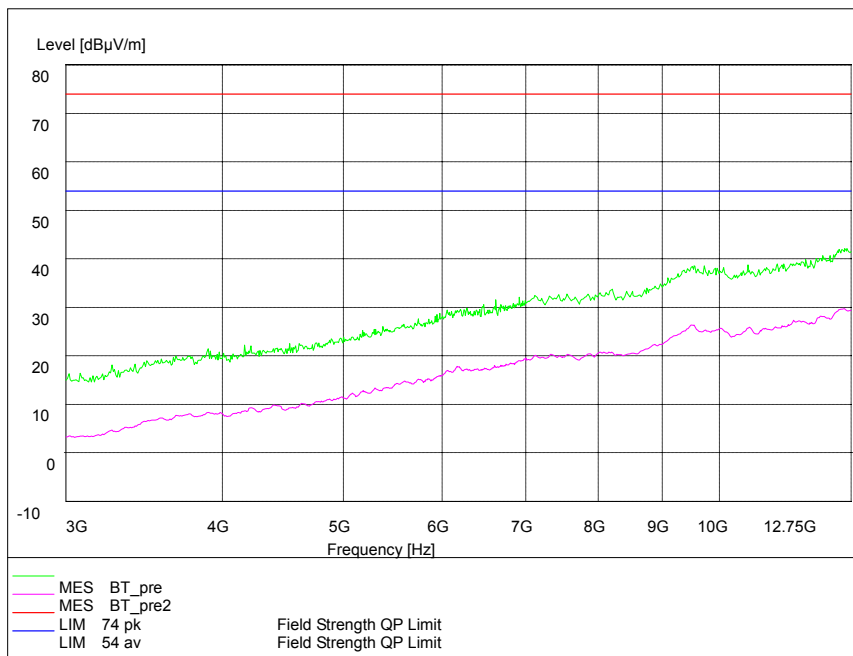
Frequency Range: 30MHz-1000MHz

Detector: QP mode

Modulation type: GFSK



Frequency Range: 1GHz-3GHz  
Detector: Av mode and PK mode  
Modulation type: GFSK



Frequency Range: 3GHz-12.75GHz  
Detector: Av mode and PK mode  
Modulation type: GFSK

## 2.2.5 Band Edge Compliance

### 2.2.5.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

### 2.2.5.2 Test Description

The measurement is made according to Public notice DA 00-705 and ANSI C63.4-2009.

#### 2.2.5.2.1 RF Conducted Measurement

The Equipment Under Test (EUT) was set up in a shielded room to perform the spurious emissions measurements.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

For the first measurement the EUT is set to transmit on the lowest channel (2402 MHz). The lower band edge is 2390 MHz.

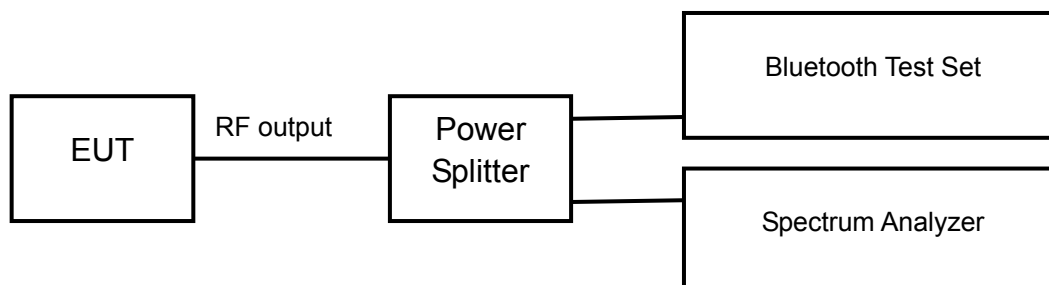
Analyzer settings:

- Detector: Peak
- RBW= 100 kHz
- VBW= 300 kHz

For the second measurement the EUT is set to transmit on the highest channel (2480MHz). The higher band edge is 2483.5 MHz.

Analyzer settings:

- Detector: Peak
- RBW= 100 kHz
- VBW= 300 kHz



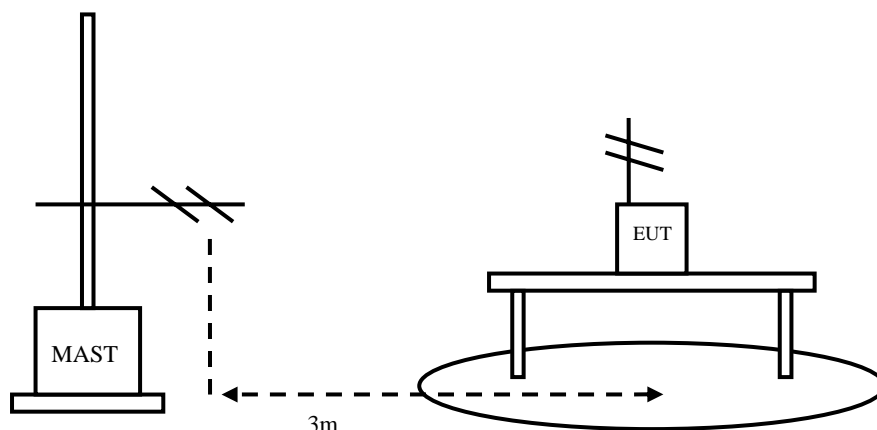
#### 2.2.5.2.2 RF Radiated Measurement

The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The radiated emissions measurements were made in a typical installation configuration.

During the test, the antenna height and EUT azimuth were varied in order to identify the maximum level of emission from the EUT. The height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turn table shall be rotated from 0 to 360 degrees.

The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.



#### 2.2.5.3 Test limit

FCC Part15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.



## 2.2.5.4 Test result

### RF Conducted Measurement

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: GFSK

Frequency MHz	Hopping Mode	Measured value dBm	Reference value dBm	Limit dBm	Delta dB
2390	Hopping OFF	-54.38	0.59	-19.41	54.97

Carrier frequency (MHz): 2480

Channel No.:78

Modulation type: GFSK

Frequency MHz	Hopping Mode	Measured value dBm	Reference value dBm	Limit dBm	Delta dB
2483.5	Hopping OFF	-43.44	2.60	-17.40	46.04

### RF Radiated Measurement

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: GFSK

Frequency MHz	Hopping Mode	Correction Factor dB/m	Reading Level dBuV	Emission Level dBuV/m	Detector
2402	Hopping OFF	2.60	68.42	71.02	Peak

Carrier frequency (MHz): 2480

Channel No.:78

Modulation type: GFSK

Frequency MHz	Hopping Mode	Correction Factor dB/m	Reading Level dBuV	Emission Level dBuV/m	Detector
2480	Hopping OFF	2.50	69.03	71.53	Peak

### Band Edge Test Data

Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: GFSK

Frequency MHz	Hopping Mode	Fundamental (dBuV/m)	Delta dB	Band Edge Field Strength (dBuV/m)	Detector
2390	Hopping OFF	71.02	54.97	16.05	Peak

Carrier frequency (MHz): 2480

Channel No.:78

Modulation type: GFSK

Frequency MHz	Hopping Mode	Fundamental (dBuV/m)	Delta dB	Band Edge Field Strength (dBuV/m)	Detector
2483.5	Hopping OFF	71.53	46.04	25.49	Peak

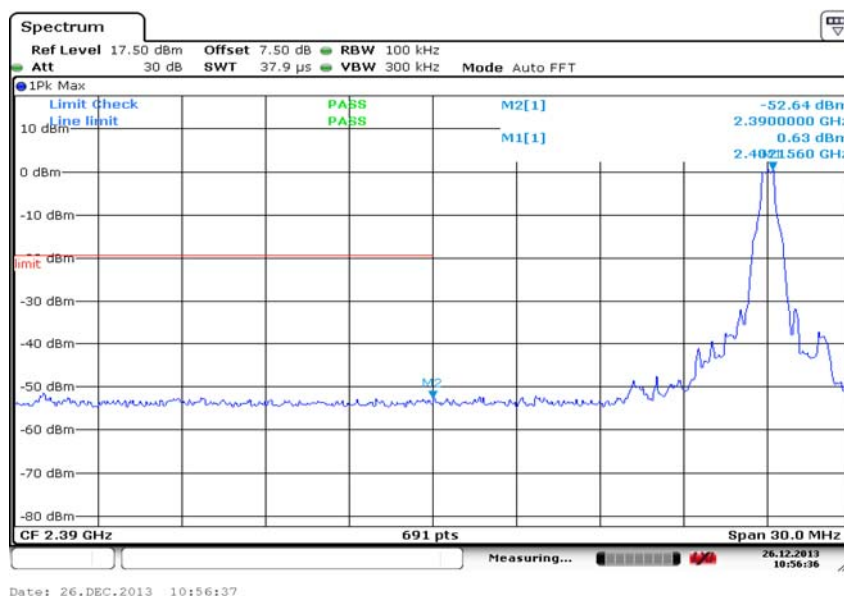
Note:

The Band Edge Field Strength was calculated using the Fundamental and Conducted Band Edge measurements per the Marker-Delta Method with the following formula:

Band Edge field Strength = F - Delta

F = Fundamental field Strength (Peak or Average)

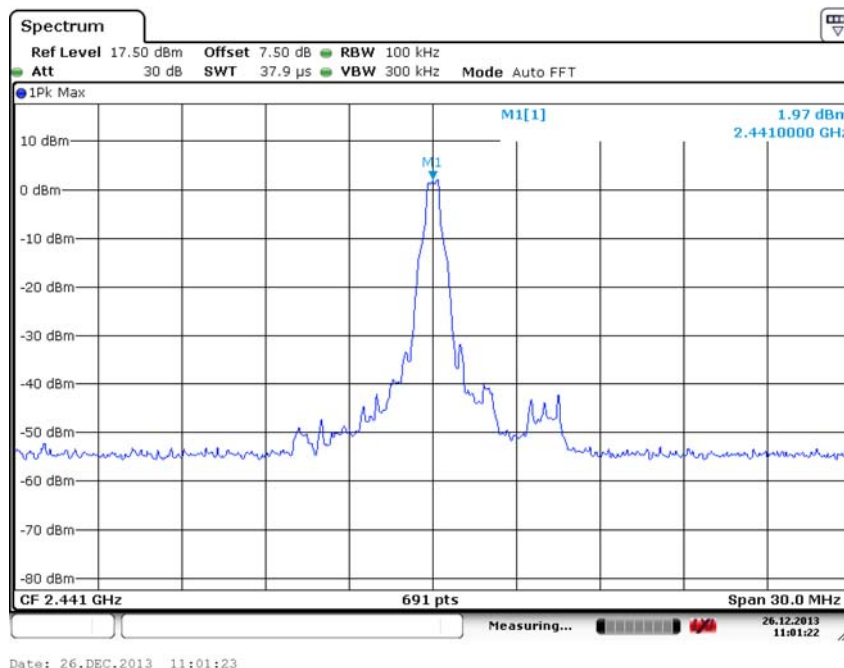
Delta= Conducted Band Edge Delta (Peak or Average)



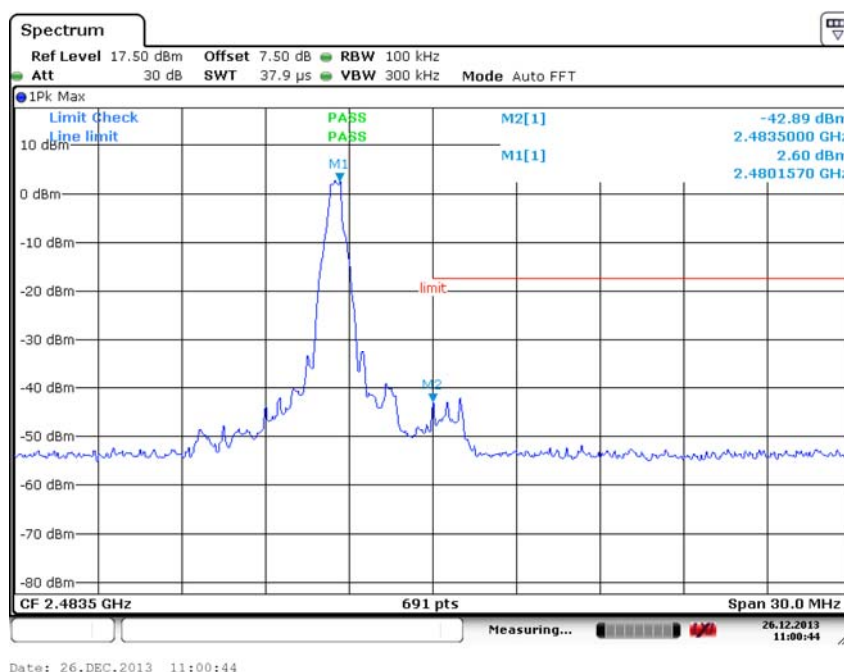
Carrier frequency (MHz): 2402

Channel No.:0

Modulation type: GFSK



Carrier frequency (MHz): 2441  
Channel No.:39  
Modulation type: GFSK



Carrier frequency (MHz): 2480  
Channel No.:78  
Modulation type: GFSK

## 2.2.6 Dwell Time

### 2.2.6.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

### 2.2.6.2 Test Description

The measurement is made according to Public notice DA 00-705 and ANSI C63.4-2009.

The Equipment Under Test (EUT) was set up in a shielded room to perform the dwell time measurements.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

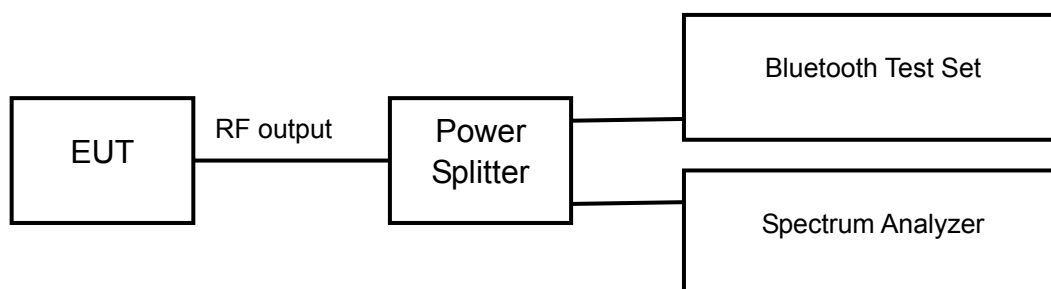
The time slot length is measured of three different packet types which are available in the Bluetooth technology. Those are DH1, DH3 and DH5 packets.

The dwell time is calculated by:

Dwell time = time slot length \* hop rate \* 31.6/ number of hopping channels

with:

- hop rate =  $1600/2 * 1/s$  for DH1 packets = 800
- hop rate =  $1600/4 * 1/s$  for DH3 packets = 400
- hop rate =  $1600/6 * 1/s$  for DH5 packets = 266.67
- number of hopping channels = 79
- $31.6 s = 0.4$  seconds multiplied by the number of hopping channels =  $0.4s * 79$



### 2.2.6.3 Test limit

FCC Part15.247(a)(1)(iii)

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

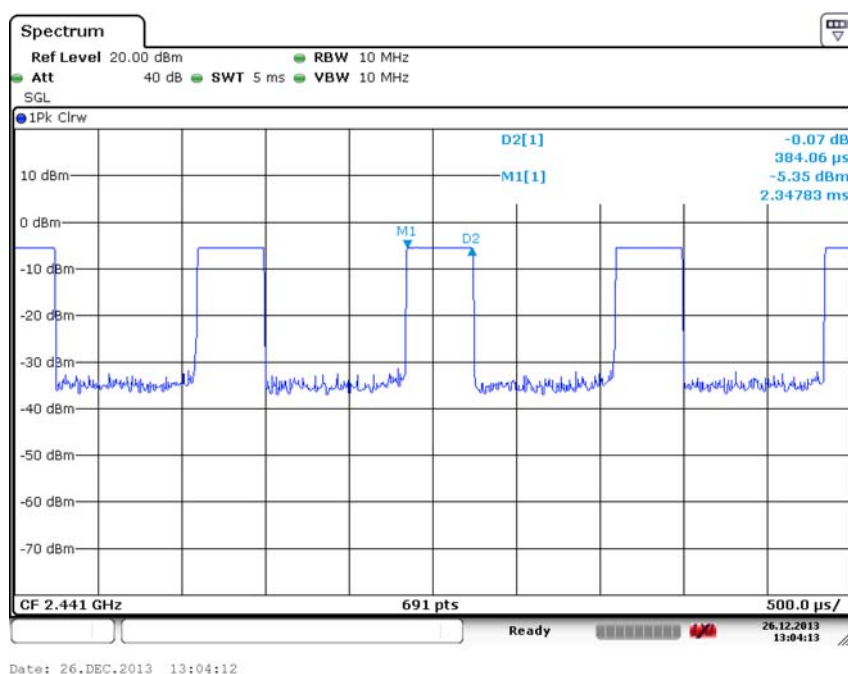
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Since the Bluetooth technology uses 79 channels this period is calculated to be 31.6 seconds.

## 2.2.6.4 Test result

Modulation type: GFSK

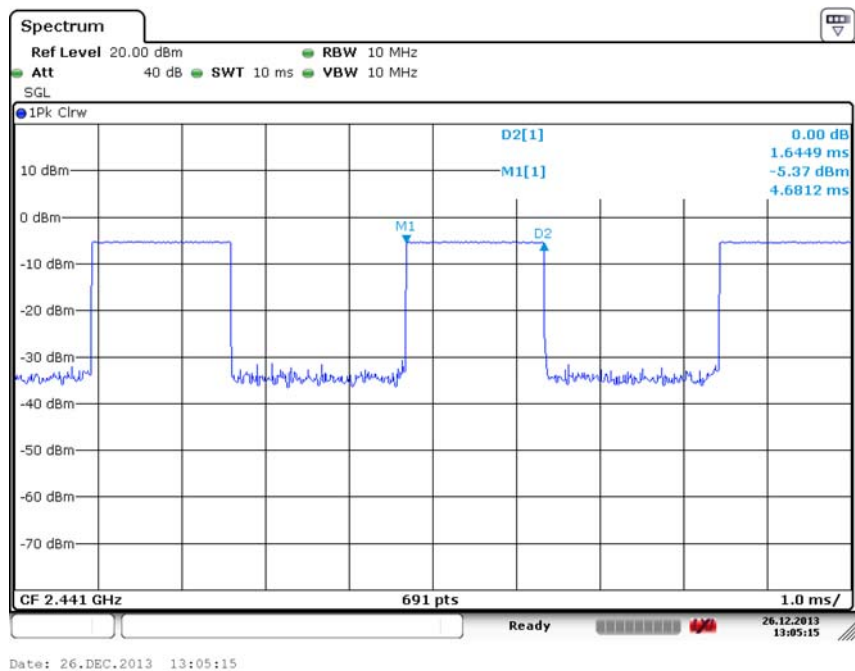
Packet type	Time slot length ms	Dwell time	Dwell time ms
DH1	0.38406	time slot length *31.6 *1600/2 /79	122.899
DH3	1.6449	time slot length * 31.6 *1600/4 /79	263.184
DH5	2.8841	time slot length * 31.6 *1600/6 /79	307.637



Carrier frequency (MHz): 2441

Packet type: DH1

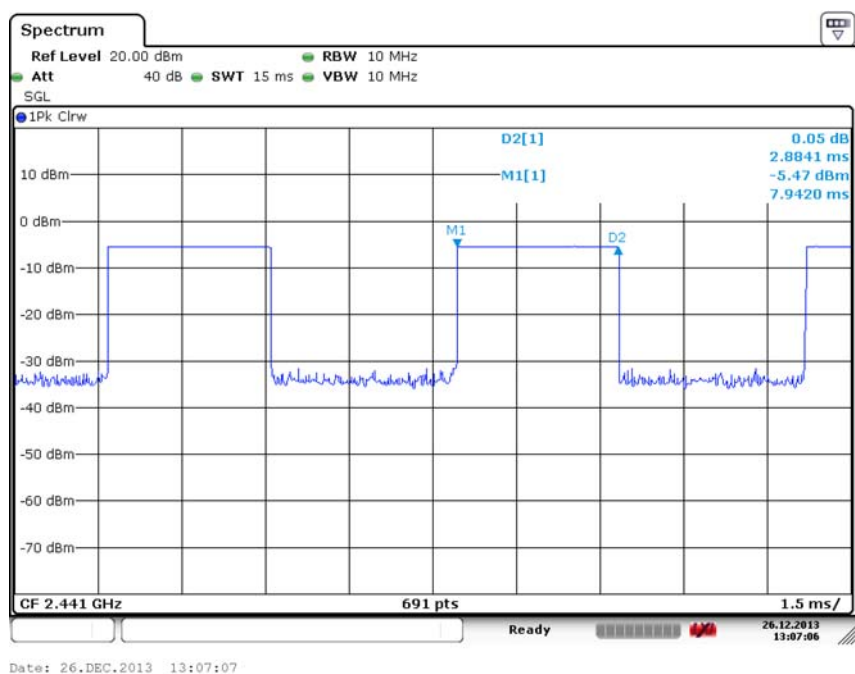
Modulation type: GFSK



Carrier frequency (MHz): 2441

Packet type: DH3

Modulation type: GFSK



Carrier frequency (MHz): 2441

Packet type: DH5

Modulation type: GFSK

## 2.2.7 Channel Separation

### 2.2.7.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

### 2.2.7.2 Test Description

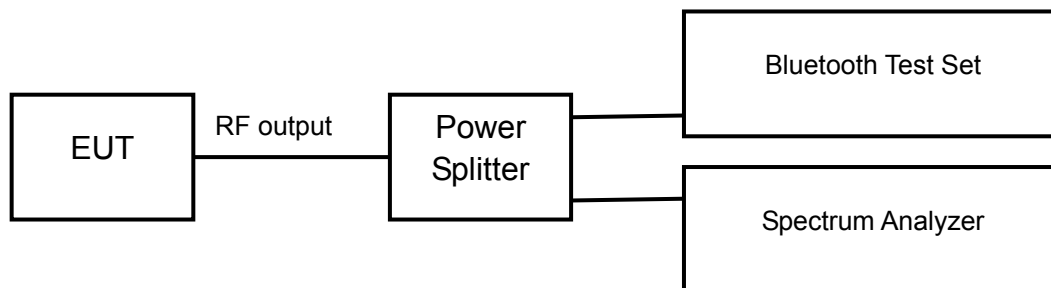
The measurement is made according to Public notice DA 00-705 and ANSI C63.4-2009.

The Equipment Under Test (EUT) was set up in a shielded room to perform the channel separation measurements.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

Analyzer settings:

- Detector: Peak-Max hold
- Span: 3 MHz
- Centre Frequency: 2441 MHz
- Resolution Bandwidth (RBW): 30 kHz
- Video Bandwidth (VBW): 100 kHz
- Sweep Time: Coupled



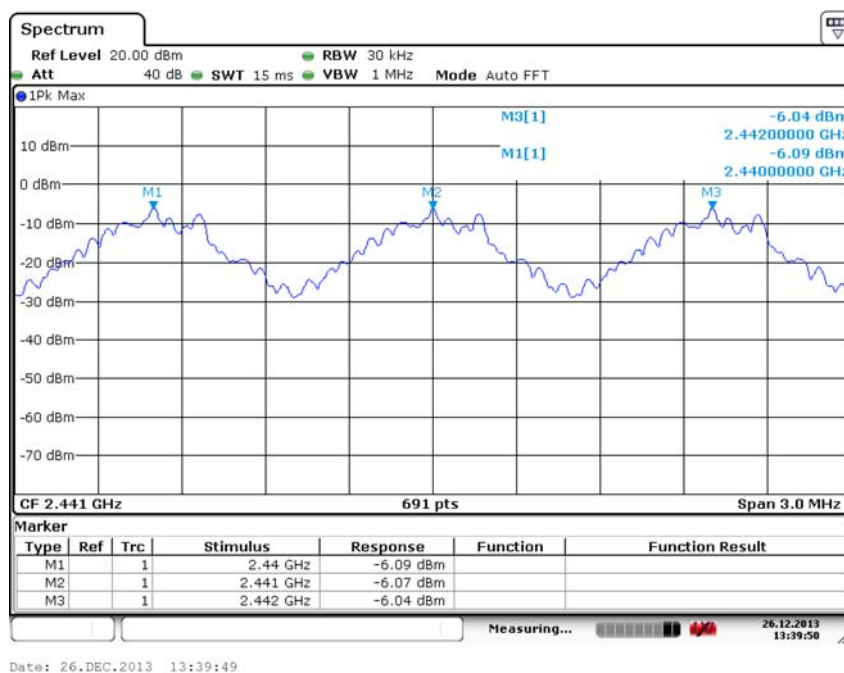
### 2.2.7.3 Test limit

FCC Part15.247(a)(1)

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.

## 2.2.7.4 Test result

Op-mode	Channel separation MHz
Hopping mode	1



Op-mode: Hopping mode



## 2.2.8 Number of Hopping Frequencies

### 2.2.8.1 Ambient condition

Temperature	Relative humidity	Pressure
22°C	40%	101.1kPa

### 2.2.8.2 Test Description

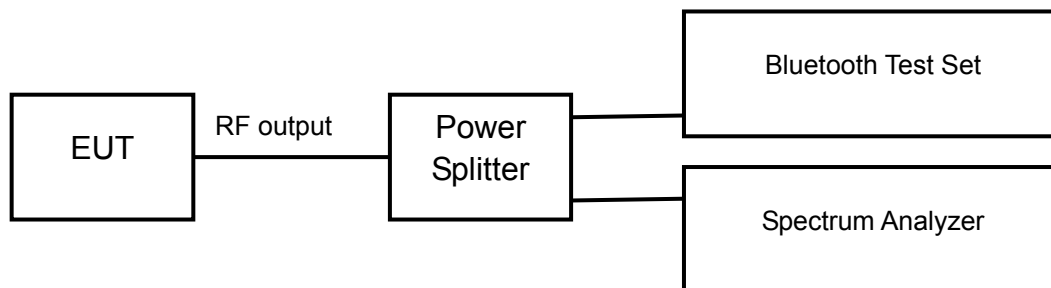
The measurement is made according to Public notice DA 00-705 and ANSI C63.4-2009.

The Equipment Under Test (EUT) was set up in a shielded room to perform the number of hopping frequencies measurement.

The EUT was connected to the spectrum analyzer and Bluetooth test set via a power splitter with a known loss.

Analyzer settings:

- Detector: Peak-Maxhold
- Start frequency: 2400 MHz
- Stop frequency: 2483.5 MHz
- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Sweep Time: Coupled



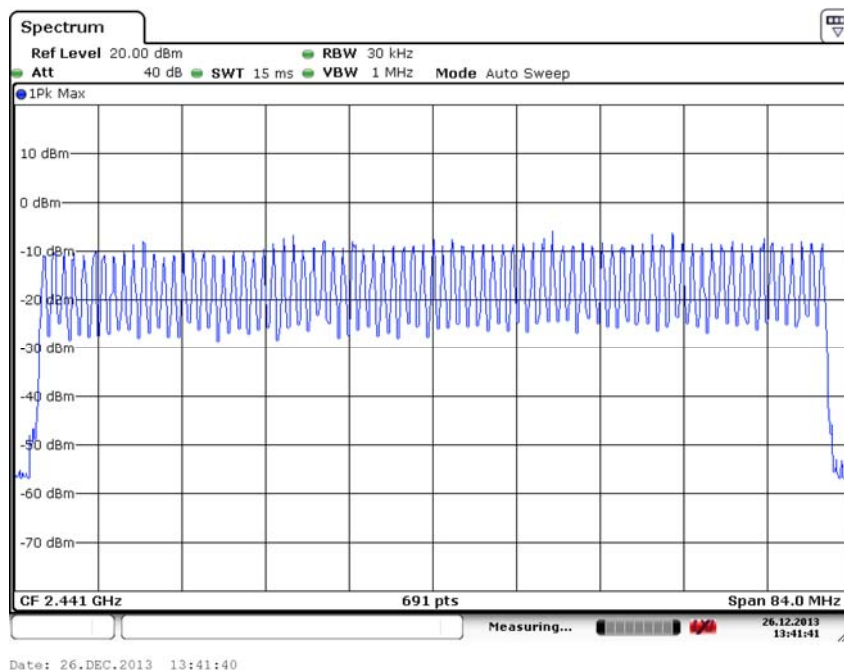
### 2.2.8.3 Test limit

FCC Part15.247(a)(1)(iii)

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

## 2.2.8.4 Test result

Op-mode	Result
Hopping mode	79



Op-mode: Hopping mode

### 2.3. Measurement Uncertainty

Items	Uncertainty	
Occupied Bandwidth	3kHz	
Peak power output	0.67dB	
Band edge compliance	1.20dB	
Spurious emissions	30MHz~1GHz	2.83dB
	1GHz~12.75GHz	2.50dB
	12.75GHz~25GHz	2.75dB

## 2.4. List of test equipment

No.	Name/ Model	Manufacturer	S/N	Cal Due date
1.	Spectrum Analyzer FSV	ROHDE&SCHWARZ	101065	2014.8
2.	Signal Generator MG3700A	Anritsu	6200677084	2014.8
3.	Bluetooth Test Set MT8852B	Anritsu	1142010	2014.2
4.	Cable 104EA	SUCOFLEX	9272/4EA	2014.8
5.	Cable 104EA	SUCOFLEX	9266/4EA	2014.8
6.	Power Splitter 11850C	Agilent	026057	2014.8
7.	12.65m×8.03m×7.50m Fully-Anechoic Chamber	FRANKONIA	-----	-----
8.	23.18m×16.88m×9.60m Semi-Anechoic Chamber	FRANKONIA	---	-----
9.	Turn table Diameter:1m	HD	-----	-----
10.	Turn table Diameter:5m	HD	-----	-----
11.	Antenna master FAC(MA4.0)	MATURO	-----	-----
12.	Antenna master SAC(MA4.0)	MATURO	-----	-----
13.	9.080m×5.255m×3.525m Shielding room	FRANKONIA	-----	-----
14.	HF 906 Double-Ridged Waveguide Horn Antenna	R&S	100030	2014.8
15.	HF 906 Double-Ridged Waveguide Horn Antenna	R&S	100029	2014.8
16.	HL562 Ultra log antenna	R&S	100016	2014.8
17.	3160-09 Receive antenna	SCHWARZ-BECK	002058-002	2014.8
18.	ESI 40 EMI test receiver	R&S	100015	2014.8
19.	Radio tester	CMU 200	114667	2014.8
20.	ESCS30 EMI test receiver	R&S	100029	2014.8
21.	HL562 Receive antenna	R&S	100167	2014.8
22.	ESH3-Z5 LISN	R&S	100020	2014.8

## Appendix

### Appendix1 Test Setup