



Inter**Lab**<sup>®</sup>

Final Report on  
Car Sharing Main module

FCC ID QWY-CSM3-MM-US  
IC: 6588A-CSM3MMUS

**Report Reference:** MDE\_PEIKER\_1219\_FCCe  
According to: Title 47 CFR chapter I part 15 subpart C

**Date:** December 01, 2015

**Test Laboratory:**

7layers GmbH  
Borsigstraße 11  
40880 Ratingen  
Germany



**Note:**

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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USt-IdNr VAT No.:  
DE203159652  
TAX No. 147/5869/0385  
A Bureau Veritas Group Company

## 1 Administrative Data

### 1.1 Project Data

*Project Responsible:* Abdellah Ahakki  
*Date Of Test Report:* 2015/12/01  
*Date of first test:* 2015/06/11  
*Date of last test:* 2015/06/23

### 1.2 Applicant Data

*Company Name:* peiker acustic GmbH & Co. KG  
*Street:* Max-Planck-Strasse 28-32  
*City:* 61381 Friedrichsdorf/Ts.  
*Country:* Germany  
*Contact Person:* Mr. Stefan Hofmann  
*Function:* Technical Project Manager  
*Phone:* +49 (0) 6172-767-1087  
*Fax:* +49 (0) 6172-767-220  
*E-Mail:* stefan.hofmann@peiker.de

### 1.3 Test Laboratory Data

The following list shows all places and laboratories involved for test result generation:

#### 7 layers DE

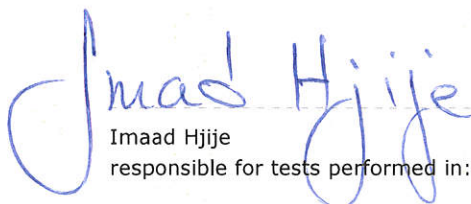
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*Company Name :* 7layers GmbH  
*Street :* Borsigstrasse 11  
*City :* 40880 Ratingen  
*Country :* Germany  
*Contact Person :* Mr. Michael Albert  
*Phone :* +49 2102 749 201  
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*E Mail :* Michael.Albert@7Layers.com

#### Laboratory Details

<i>Lab ID</i>	<i>Identification</i>	<i>Responsible</i>	<i>Accreditation Info</i>
Lab 1	Radiated Emissions	Mr. Marco Kullik Mr. Jens Dörwald	DAkKS-Registration no. D-PL-12140-01-01
Lab 2	Regulatory Bluetooth RF Test Solution	Mr. Jimmy Chatheril Mr. Sören Berentzen	DAkKS-Registration no. D-PL-12140-01-01

### 1.4 Signature of the Testing Responsible



Imaad Hjije  
responsible for tests performed in: Lab 1, Lab 2



### 1.5 Signature of the Accreditation Responsible

Accreditation scope responsible person  
responsible for Lab 1, Lab 2

## 2 Test Object Data

### 2.1 General OUT Description

The following section lists all OUTs (Object's Under Test) involved during testing.

#### OUT: BMW - CSM 3.0

Type / Model / Family: Car Sharing Main module  
FCC ID QWY-CSM3-MM-US  
IC: 6588A-CSM3MMUS  
Product Category: Others  
**Manufacturer:**  
Company Name: Please see applicant data  
Contact Person: -

#### Parameter List:

Parameter name	Value
<b>Parameter for Scope FCC_v2:</b>	
Antenna Gain	2
highest channel (BT)	2480 (MHz)
lowest channel (BT)	2400 (MHz)
mid channel (BT)	2440 (MHz)

## 2.2 Detailed Description of OUT Samples

### Sample : d06

<i>OUT Identifier</i>	BMW - CSM 3.0		
<i>Sample Description</i>	Radiated Sample		
<i>Serial No.</i>	P13002493410		
<i>HW Status</i>	D1-AI02		
<i>SW Status</i>	4.2.2-V1.0-V1.1A		
<i>Date of Receipt</i>	2013/11/20		
<i>Low Voltage</i>	6 V	<i>Low Temp.</i>	-40 °C
<i>High Voltage</i>	16 V	<i>High Temp.</i>	+85 °C
<i>Nominal Voltage</i>	12 V	<i>Normal Temp.</i>	+23 °C

### Sample : w06

<i>OUT Identifier</i>	BMW - CSM 3.0		
<i>Sample Description</i>	Conducted Sample		
<i>Serial No.</i>	P14000558684		
<i>HW Status</i>	D1-AI02		
<i>SW Status</i>	4.2.2-V1.0-V1.1A		
<i>Date of Receipt</i>	2013/11/20		
<i>Low Voltage</i>	9 V	<i>Low Temp.</i>	-40 °C
<i>High Voltage</i>	16 V	<i>High Temp.</i>	+85 °C
<i>Nominal Voltage</i>	12 V	<i>Normal Temp.</i>	+24 °C

## 2.3 OUT Features

### Features for OUT: BMW - CSM 3.0

<i>Designation</i>	<i>Description</i>	<i>Allowed Values</i>	<i>Supported Value(s)</i>
<b>Features for scope: FCC_v2</b>			
BT	EUT supports Bluetooth data rate of 1 Mbps with GFSK modulation in the band 2400 MHz - 2483.5 MHz		
BTLE	Support of Bluetooth Low Energy		
DC	The OUT is powered by or connected to DC		
EDGE850	EUT supports EDGE in the band 824 MHz - 849 MHz		
EDGE1900	EUT supports EDGE in the band 1850 MHz - 1910 MHz		
EDR2	EUT supports Bluetooth using data rate of 2 Mbps with PI/4 DQPSK modulation in the band 2400 MHz - 2483.5 MHz		
EDR3	EUT supports Bluetooth using data rate of 3 Mbps with 8DPSK modulation in the band 2400 MHz - 2483.5 MHz		
FDD2	EUT supports UMTS FDD2 in the band 1850 MHz - 1910 MHz		
FDD5	EUT supports UMTS FDD5 in the band 824 MHz - 849 MHz		
GSM850	EUT supports GSM850 band 824MHz - 849MHz		
HSDPA-FDD2	EUT supports UMTS FDD2 HSDPA in the band 1850 MHz - 1910 MHz		
HSDPA-FDD5	EUT supports UMTS FDD5 HSDPA in the band 824 MHz - 849 MHz		
HSUPA-FDD2	EUT supports UMTS FDD2 HSUPA in the band 1850 MHz - 1910 MHz		
HSUPA-FDD5	EUT supports UMTS FDD5 HSUPA in the band 824 MHz - 849 MHz		
Iant	Integral Antenna: permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment		
PCS1900	EUT supports PCS1900 band 1850MHz - 1910MHz		
TantC	temporary antenna connector, which may be only built-in for testing, designed as an example part of the equipment		

## 2.4 Setups used for Testing

For each setup a relation is given to determine if and which samples and auxiliary equipment is used. The left side list all OUT samples and the right side lists all auxiliary equipment for the given setup.

<i>Setup No.</i>	<i>List of OUT samples</i>	<i>List of auxiliary equipment</i>		
	<i>Sample No.</i>	<i>Sample Description</i>	<i>AE No.</i>	<i>AE Description</i>
<b>D06</b>	<b>(sample # Radiated)</b>			
	<i>Sample: d06</i>	Radiated Sample		
<b>W06</b>	<b>(sample #10 Conducted)</b>			
	<i>Sample: w06</i>	Conducted Sample		

### 3 Results

#### 3.1 General

**Documentation of tested devices:**

Available at the test laboratory.

**Interpretation of the test results:**

The results of the inspection are described on the following pages, where 'Conformity' or 'Passed' means that the certification criteria were verified and that the tested device is conform to the applied standard.

In cases where 'Declaration' is printed, the required documents are available in the manufacturers product documentation.

In cases where 'not applicable' is printed, the test case requirements are not relevant to the specific equipment implementation.

**Note:**

1. All tests are performed under environmental conditions within the requirements of the specifications. Environmental conditions are available at the test facility.

2. This report only pertains to the Bluetooth LE Transceiver and not any other radios which are present in the end product.

#### 3.2 List of the Applicable Body

(Body for Scope: FCC\_v2)

<i>Designation</i>	<i>Description</i>
FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES	Subpart C - Intentional Radiators; 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

#### 3.3 List of Test Specification

<i>Test Specification:</i>	<b>FCC part 2 and 15</b>
<i>Version</i>	10-1-14 Edition
<i>Title:</i>	PART 2 - GENERAL RULES AND REGULATIONS PART 15 - RADIO FREQUENCY DEVICES



### 3.4 Summary

<i>Test Case Identifier / Name</i> <i>Test (condition)</i>	<i>Result</i>	<i>Date of Test</i>	<i>Lab</i> <i>Ref.</i>	<i>Setup</i>
<b>15c.10 Power density §15.247 (e)</b> 15c.10; Frequency = Low/Mid/High	Passed	2015/06/11	Lab 2	W06
<b>15c.11 6dB Bandwidth §15.247 (a) (2)</b> 15c.11; Frequency = Low/Mid/High	Passed	2015/06/11	Lab 2	W06
<b>15c.2 Spurious radiated emissions §15.247 (d), §15.35 (b), §15.209</b> 15c.2; Mode = Bluetooth Low Energy	Passed	2015/06/20	Lab 1	D06
<b>15c.4 Peak power output §15.247 (b) (1)</b> 15c.4; Mode = Bluetooth Low Energy	Passed	2015/06/11	Lab 2	W06
<b>15c.5 Spurious RF conducted emissions §15.247 (d)</b> 15c.5; Mode = Bluetooth Low Energy	Passed	2015/06/11	Lab 2	W06
<b>15c.6 Band edge compliance §15.247 (d)</b> 15c.6; Frequency = 2402, Mode = Bluetooth Low Energy	Passed	2015/06/11	Lab 2	W06
15c.6; Frequency = 2480, Mode = Bluetooth Low Energy	Passed	2015/06/11	Lab 2	W06
15c.6; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = radiated	Passed	2015/06/23	Lab 1	D06

### **3.5 Detailed Results**

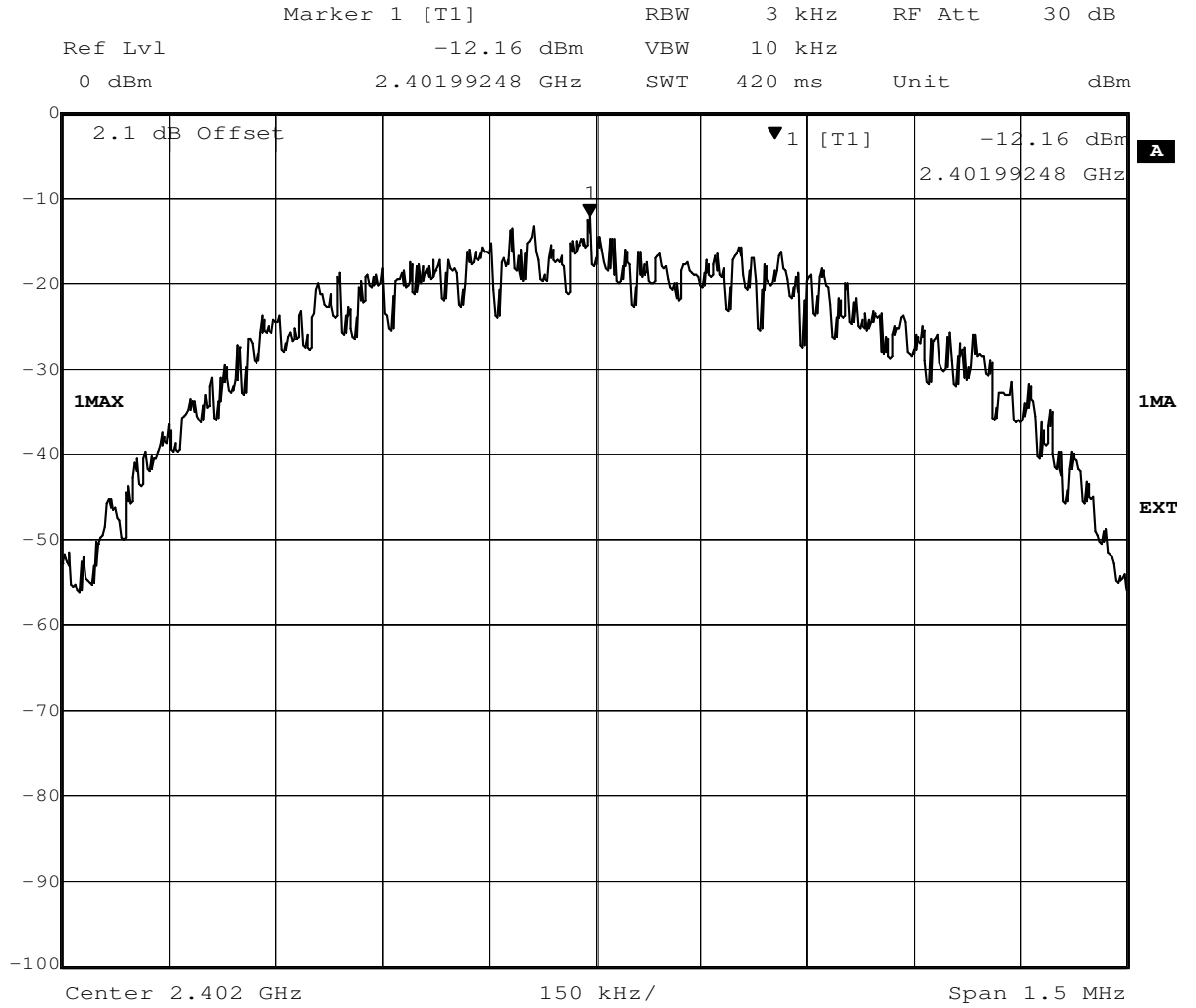
#### **3.5.1 15c.10 Power density §15.247 (e)**

**Test: 15c.10; Frequency = Low/Mid/High**

<i>Result:</i>	Passed
<i>Setup No.:</i>	W06
<i>Date of Test:</i>	2015/06/11 13:00
<i>Body:</i>	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
<i>Test Specification:</i>	FCC part 2 and 15



**Detailed Results:**



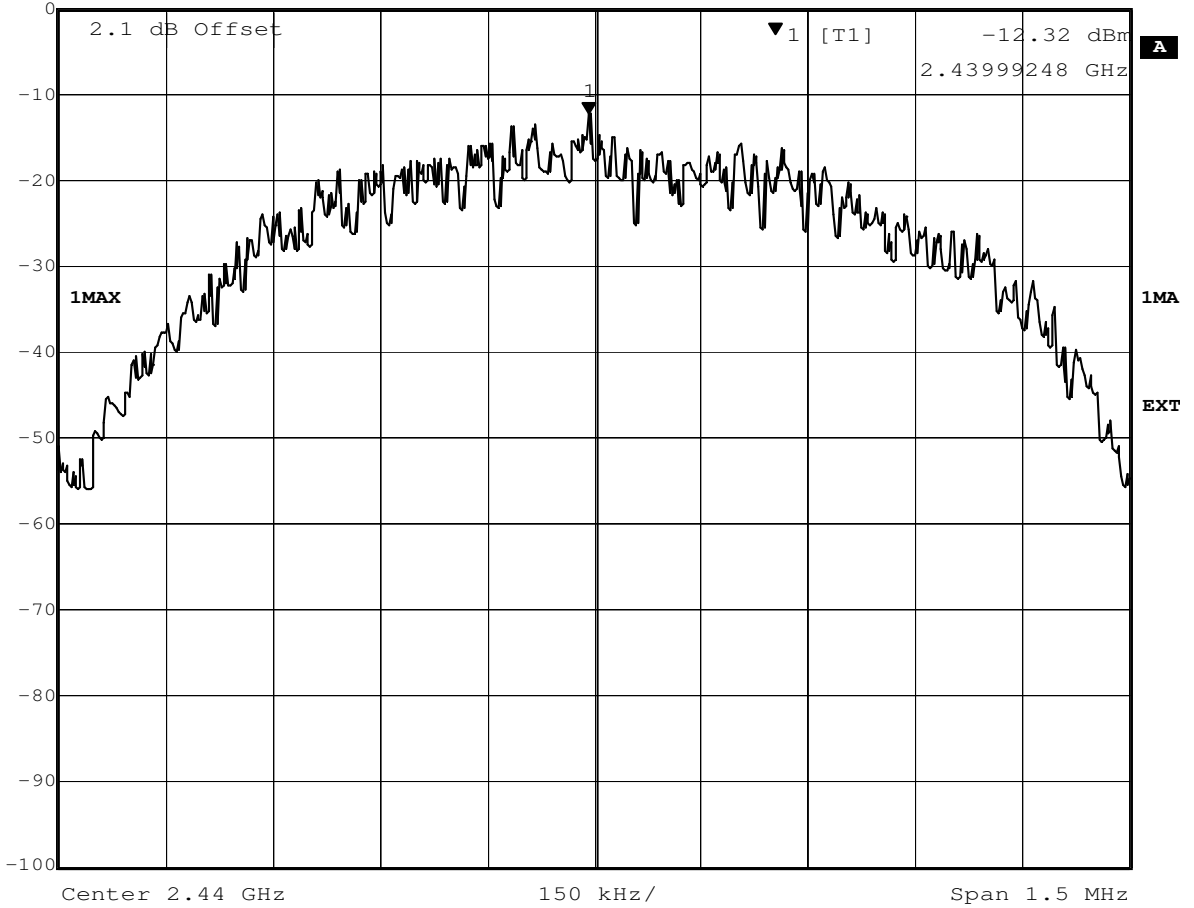
Date: 10.JUN.2015 13:29:35



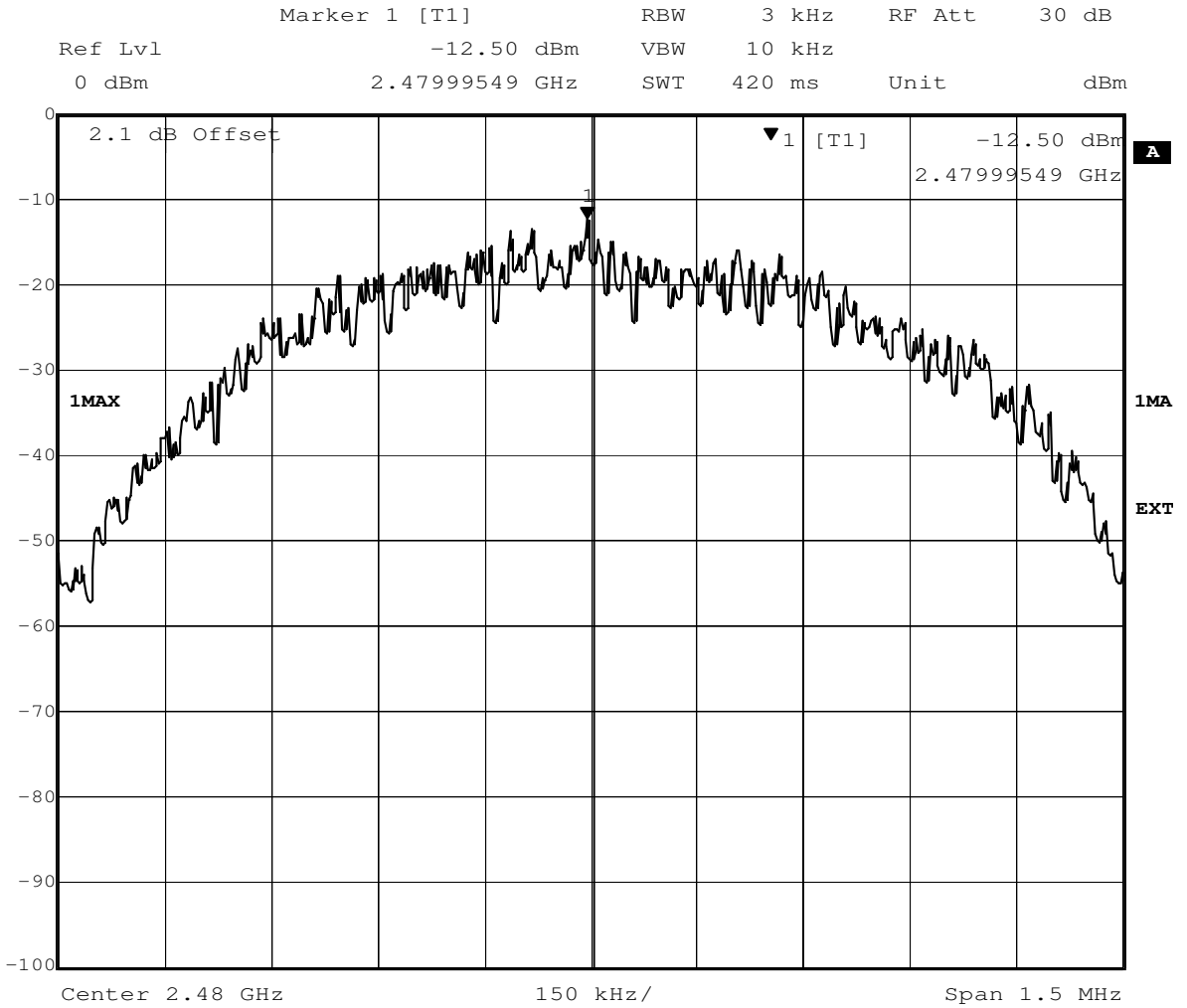
Reference: MDE\_PEIKER\_1219\_FCCe

According to: Title 47 CFR chapter I part 15 subpart C

	Marker 1 [T1]	RBW	3 kHz	RF Att	30 dB
Ref Lvl	-12.32 dBm	VBW	10 kHz		
0 dBm	2.43999248 GHz	SWT	420 ms	Unit	dBm



Date: 10.JUN.2015 13:28:19



Date: 10.JUN.2015 13:26:58

		Power Density			
		2402 MHz	2426 MHz	2440 MHz	2480 MHz
Modulation	Conditions	Power Density (dBm)	Power Density (dBm)	Power Density (dBm)	Power Density (dBm)
GFSK	TN, VN	-12.16	XXX	-12.32	-12.5
<b>Maximum Power Density</b>		<b>-12.16</b>		<b>dBm</b>	

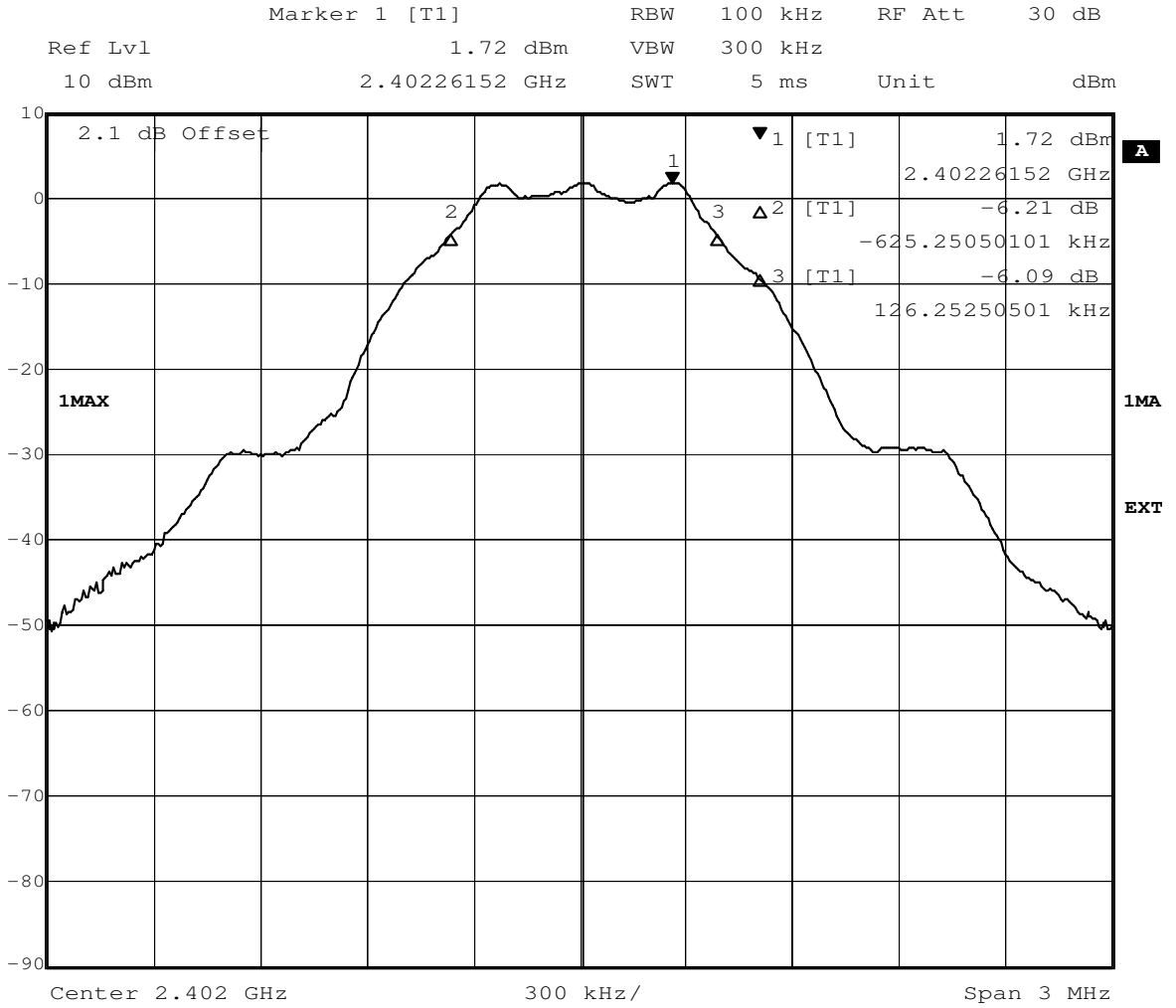


**3.5.2 15c.11 6dB Bandwidth §15.247 (a) (2)**

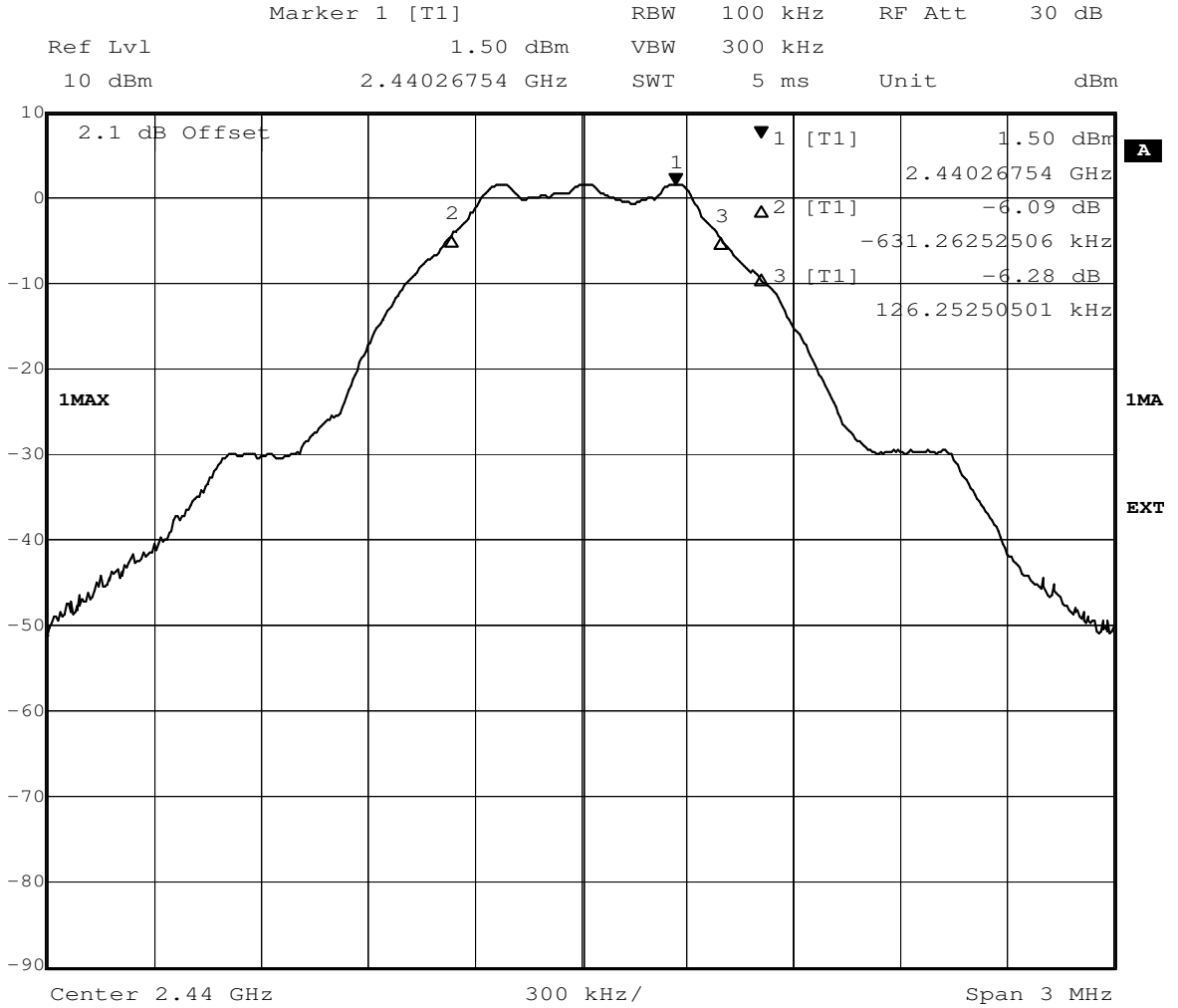
**Test: 15c.11; Frequency = Low/Mid/High**

<i>Result:</i>	Passed
<i>Setup No.:</i>	W06
<i>Date of Test:</i>	2015/06/11 13:05
<i>Body:</i>	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
<i>Test Specification:</i>	FCC part 2 and 15

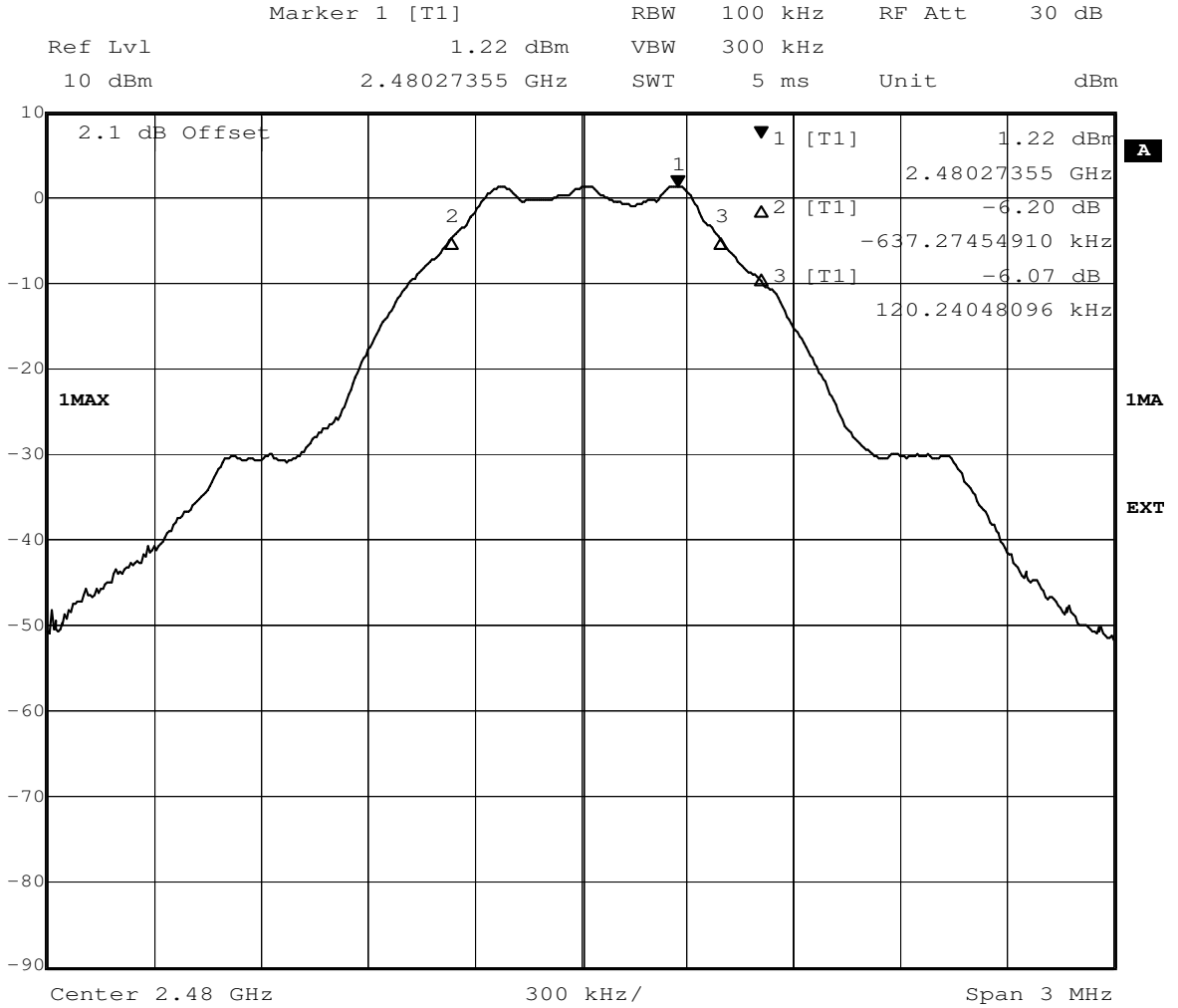
**Detailed Results:**



Date: 10.JUN.2015 13:16:50



Date: 10.JUN.2015 13:15:09



Date: 10.JUN.2015 13:13:32

Modulation	Frequency	6dB Bandwidth KHz
GFSK	2402 MHz	751.503
	2426 MHz	
	2440 MHz	757.515
	2480 MHz	757.515

### 3.5.3 15c.2 Spurious radiated emissions §15.247 (d), §15.35 (b), §15.209

Test: 15c.2; Mode = Bluetooth Low Energy

Result: Passed  
Setup No.: D06  
Date of Test: 2015/06/20 2:02  
Body:  
Test Specification: FCC part 2 and 15

**Detailed Results:**

**Traffic Mode FCC 15.247 (15.35b,15.209) TX on 2402 MHz 1-DH1**

**Frequency range 30 MHz - 1 GHz**

Ant. Polar.	Limit QPK [dBµV]	Frequency [MHz]	Corrected value QPK [dBµV]	Margin QPK [dB]	Result
Ver + Hor					Passed

**Frequency range 1 GHz - 25 GHz**

Ant. Polar.	Limit PK [dBµV]	Limit AV [dBµV]	Frequency [MHz]	Corrected value PK [dBµV]	Corrected value AV [dBµV]	Margin PK [dB]	Margin AV [dB]	Result
Ver + Hor								Passed

Remark: No (further) spurious emissions in the range 20 dB below the limit found.

**Traffic Mode FCC 15.247 (15.35b,15.209) TX on 2440 MHz 1-DH1**

**Frequency range 30 MHz - 1 GHz**

Ant. Polar.	Limit QPK [dBµV]	Frequency [MHz]	Corrected value QPK [dBµV]	Margin QPK [dB]	Result
Ver + Hor					Passed

**Frequency range 1 GHz - 25 GHz**

Ant. Polar.	Limit PK [dBµV]	Limit AV [dBµV]	Frequency [MHz]	Corrected value PK [dBµV]	Corrected value AV [dBµV]	Margin PK [dB]	Margin AV [dB]	Result
Ver + Hor								Passed

Remark: No (further) spurious emissions in the range 20 dB below the limit found.

**Traffic Mode FCC 15.247 (15.35b,15.209) TX on 2480 MHz 1-DH1**

**Frequency range 30 MHz - 1 GHz**

Ant. Polar.	Limit QPK [dBµV]	Frequency [MHz]	Corrected value QPK [dBµV]	Margin QPK [dB]	Result
Ver + Hor					Passed

**Frequency range 1 GHz - 25 GHz**

Ant. Polar.	Limit PK [dBµV]	Limit AV [dBµV]	Frequency [MHz]	Corrected value PK [dBµV]	Corrected value AV [dBµV]	Margin PK [dB]	Margin AV [dB]	Result
Ver + Hor								Passed

Remark: No (further) spurious emissions in the range 20 dB below the limit found.



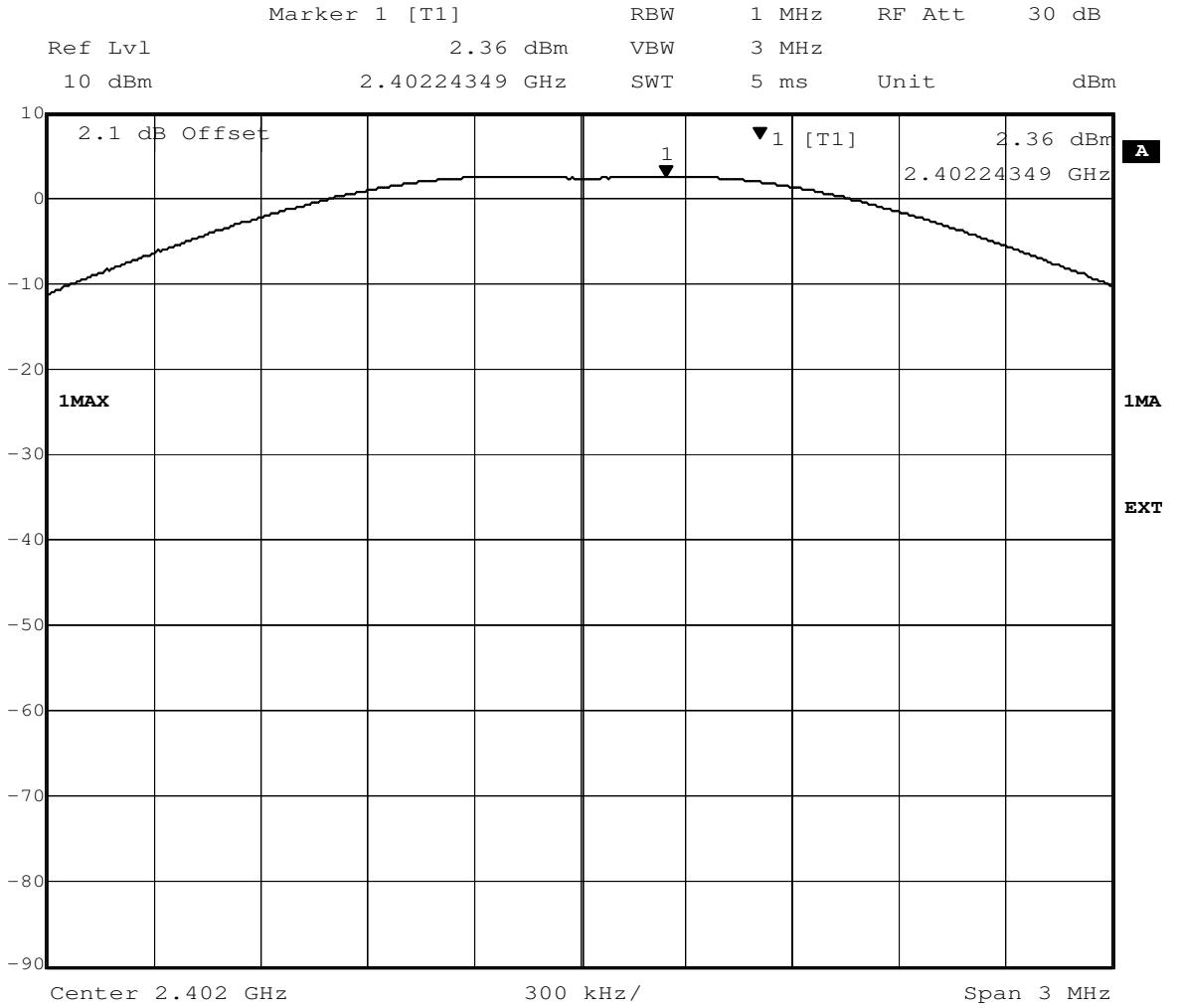


### **3.5.4 15c.4 Peak power output §15.247 (b) (1)**

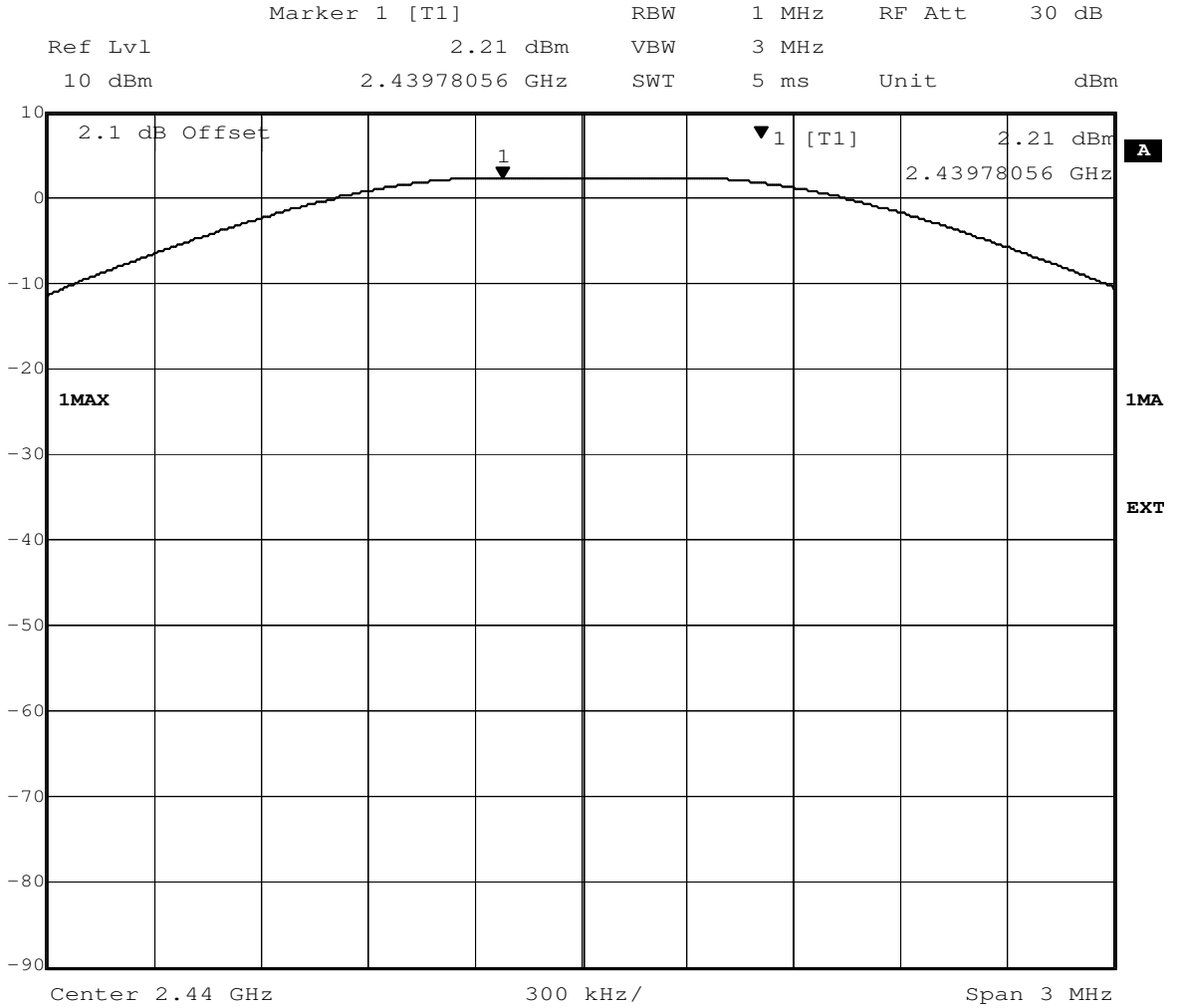
**Test: 15c.4; Mode = Bluetooth Low Energy**

<i>Result:</i>	Passed
<i>Setup No.:</i>	W06
<i>Date of Test:</i>	2015/06/11 13:07
<i>Body:</i>	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
<i>Test Specification:</i>	FCC part 2 and 15

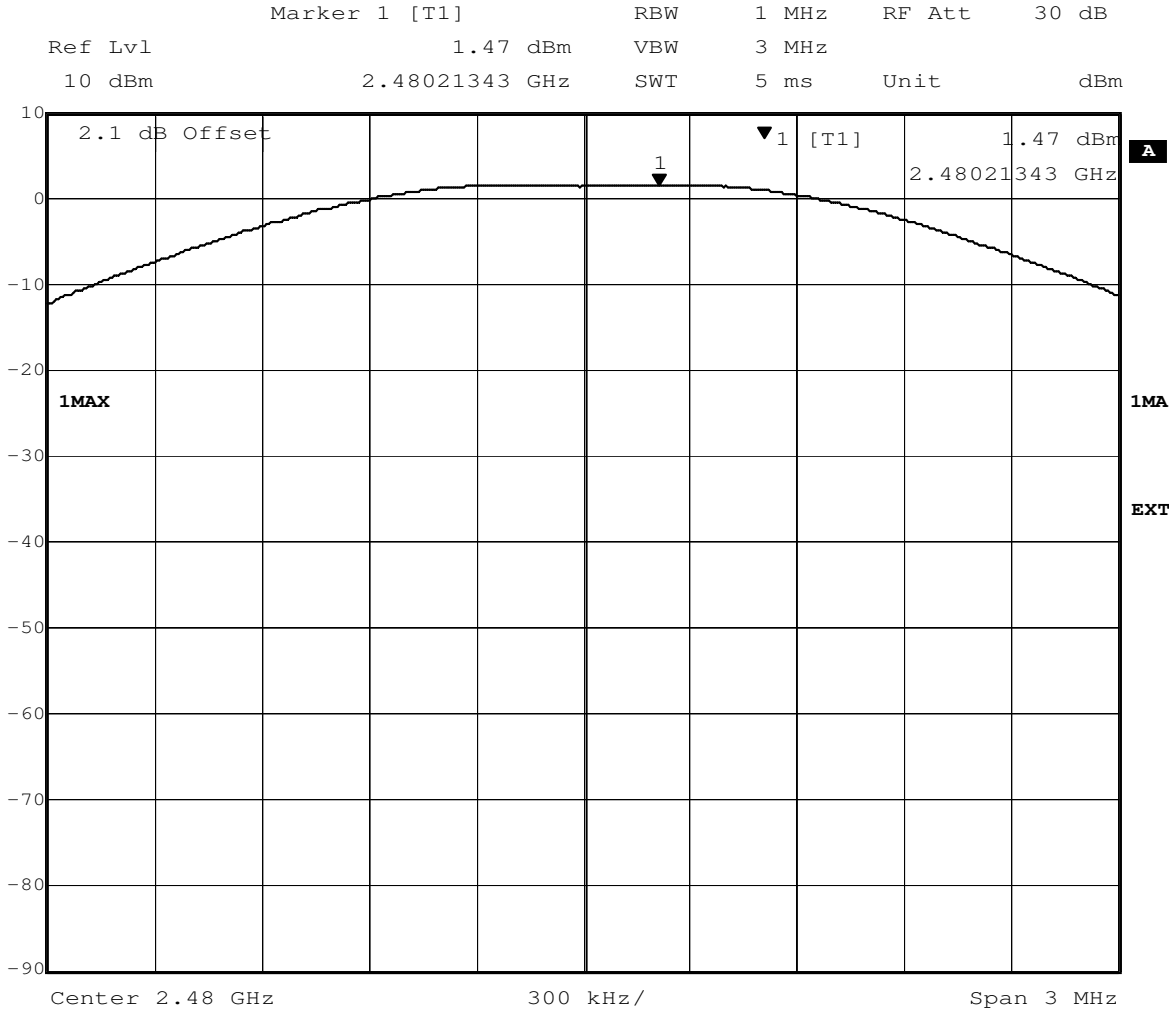
**Detailed Results:**



Date: 10.JUN.2015 13:21:55



Date: 10.JUN.2015 13:22:52



Date: 10.JUN.2015 13:23:47

**Transmitter Power (including antenna gain)**

		2402 MHz		2440 MHz		2480 MHz	
Modulation	Conditions	Output Power (dBm)	Margin to Limit (dB)	Output Power (dBm)	Margin to Limit (dB)	Output Power (dBm)	Margin to Limit (dB)
<b>GFSK Bluetooth Low Energy</b>	TN, VN	2.36	7.64	2.21	7.79	1.47	8.53

<b>Maximum Output Power (including antenna gain)</b>	<b>2.36</b>	<b>dBm</b>
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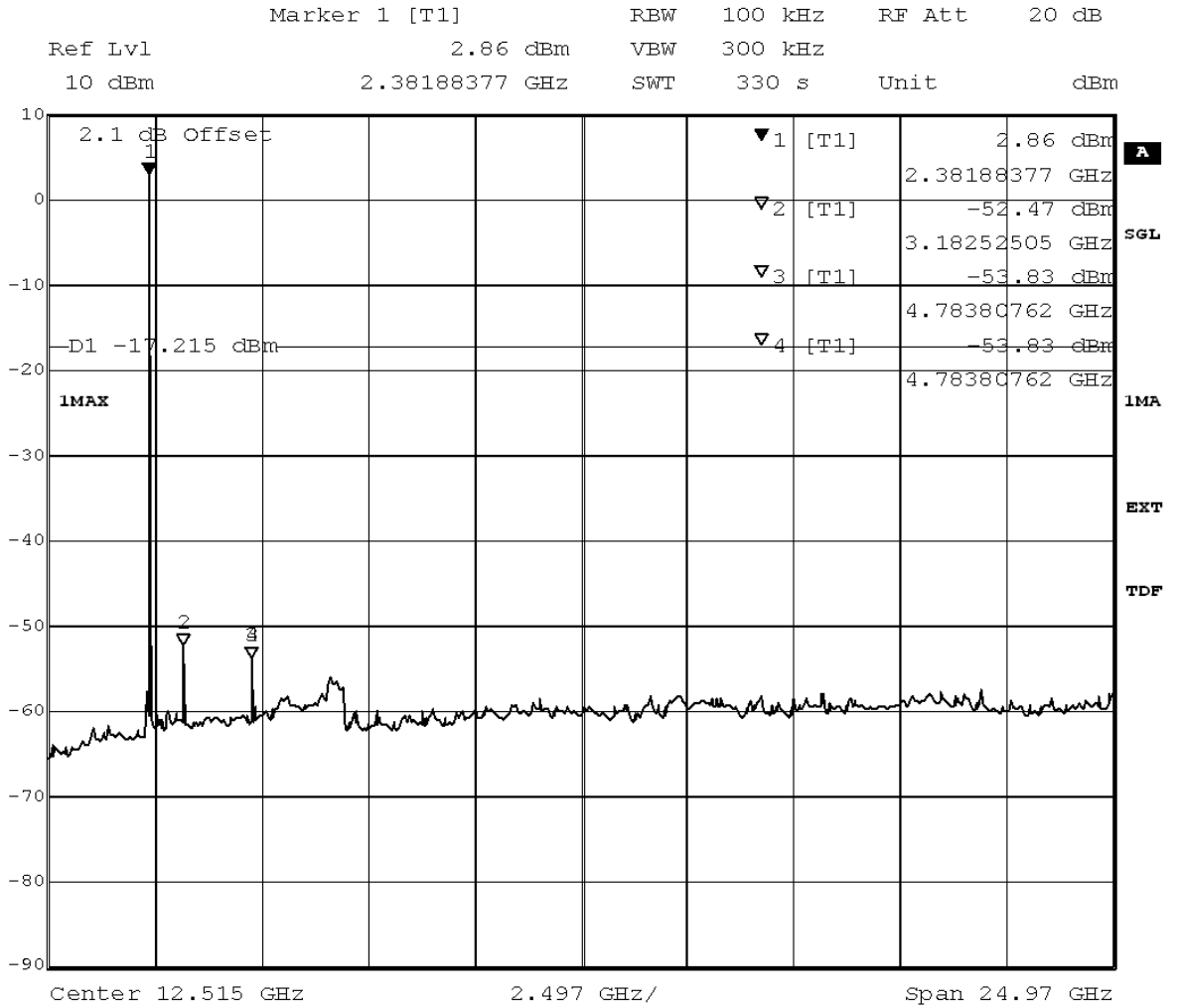


### **3.5.5 15c.5 Spurious RF conducted emissions §15.247 (d)**

#### **Test: 15c.5; Mode = Bluetooth Low Energy**

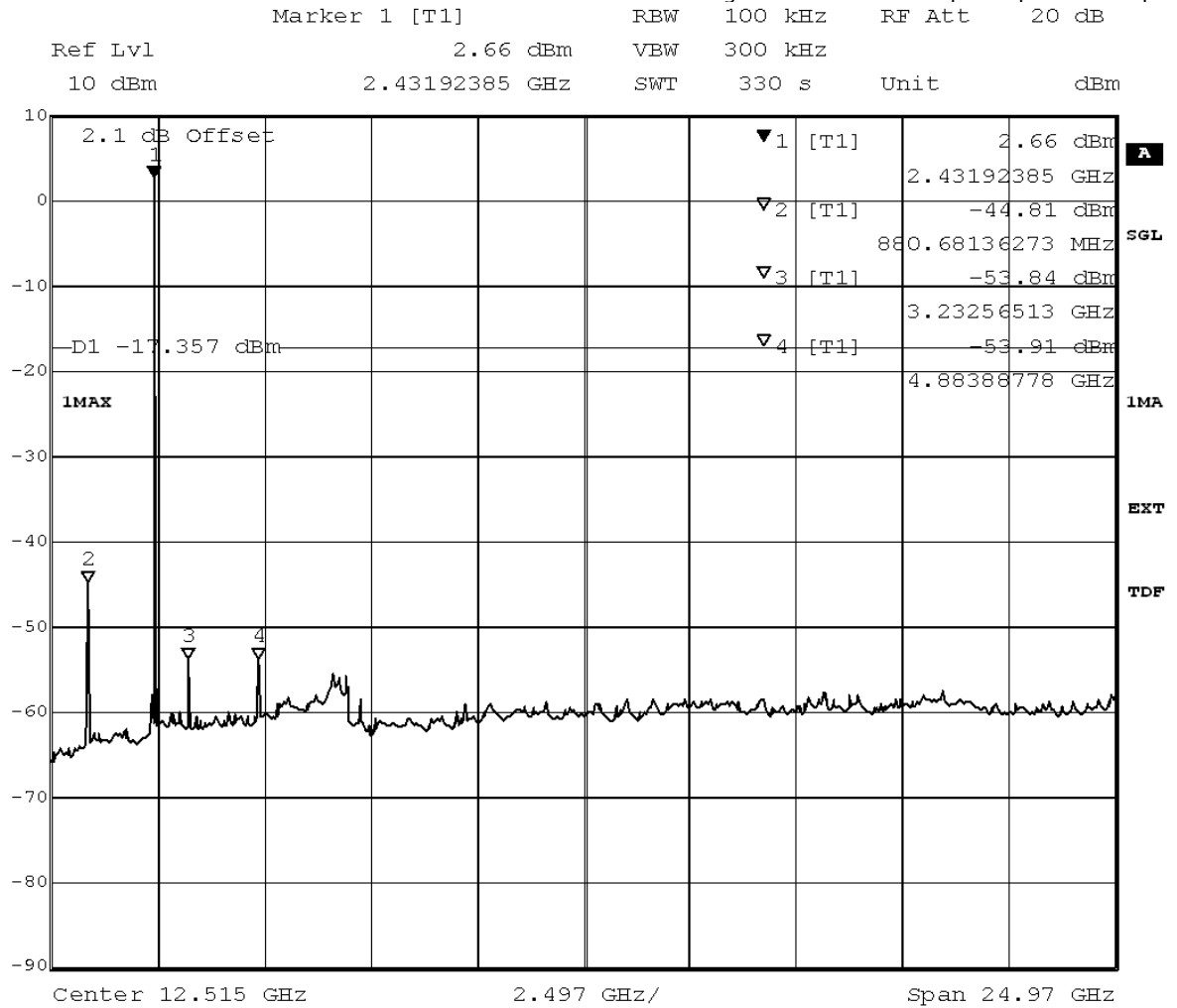
<i>Result:</i>	Passed
<i>Setup No.:</i>	W06
<i>Date of Test:</i>	2015/06/11 13:09
<i>Body:</i>	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
<i>Test Specification:</i>	FCC part 2 and 15

**Detailed Results:**



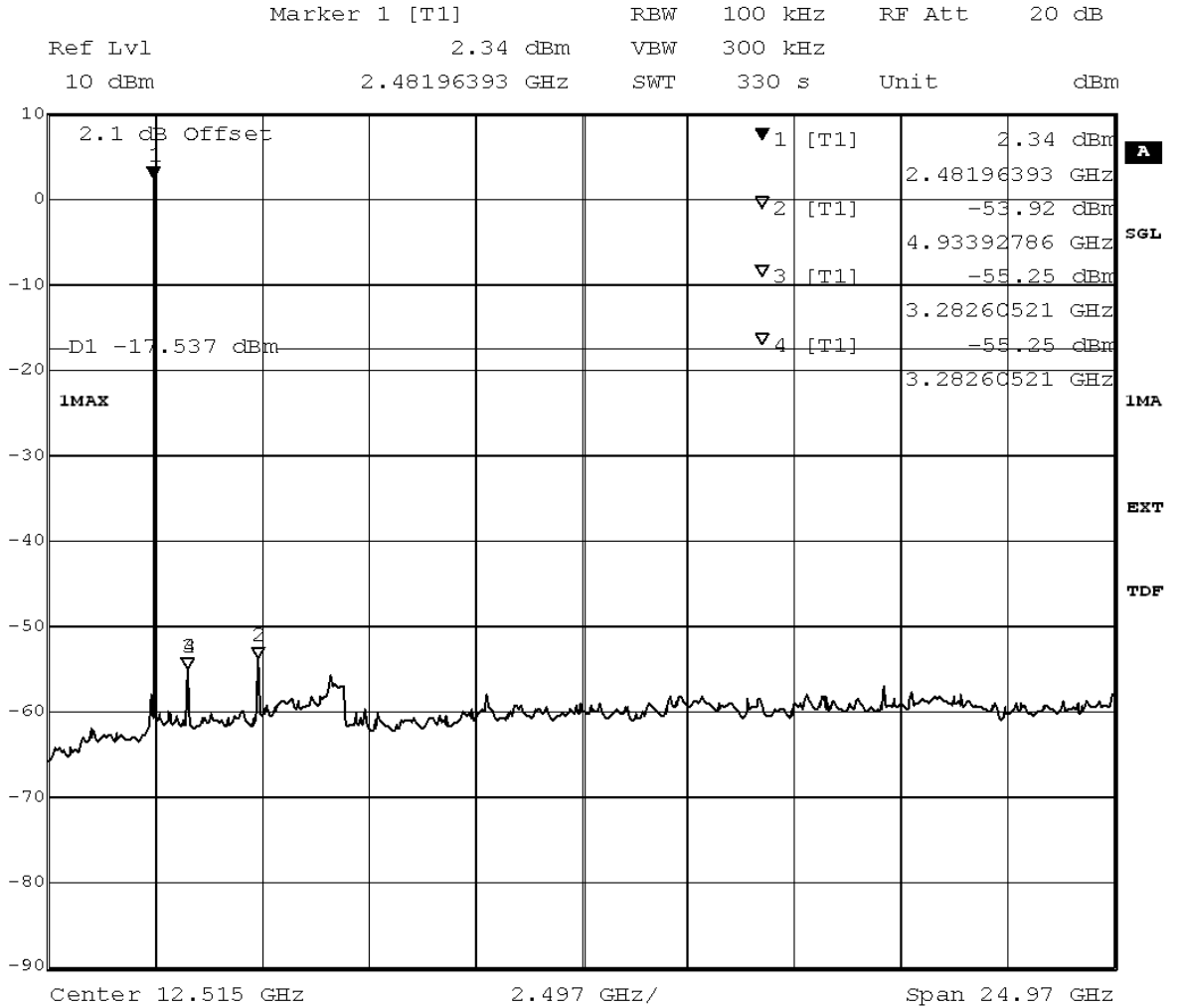
Title: spurious emissions  
 Comment A: CH B: 2402 MHz  
 Date: 10.JUN.2015 13:46:17

Remark: No spurious found within 20 dB to the limit



Title: spurious emissions  
 Comment A: CH M2: 2440 MHz  
 Date: 10.JUN.2015 13:59:12

Remark: No spurious found within 20 dB to the limit



Title: spurious emissions  
 Comment A: CH T:2480 MHz  
 Date: 10.JUN.2015 14:13:11

Remark: No spurious found within 20 dB to the limit



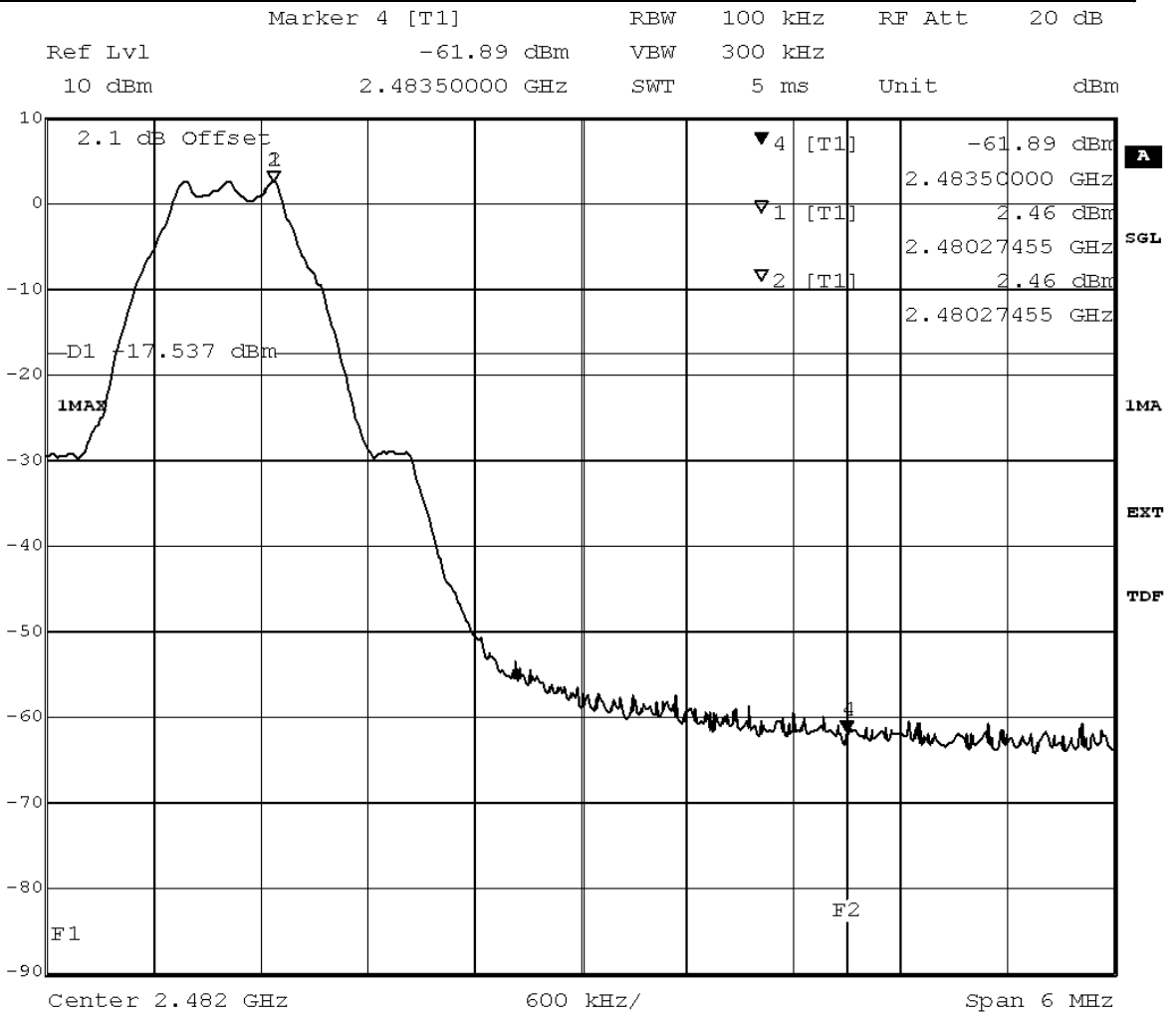
### 3.5.6 15c.6 Band edge compliance §15.247 (d)

Test: 15c.6; Frequency = 2402, Mode = Bluetooth Low Energy

Result: Passed  
 Setup No.: W06  
 Date of Test: 2015/06/11 13:11  
 Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
 Test Specification: FCC part 2 and 15

Detailed Results:

Frequency MHz	Measured value dBm	Reference value dBm	Limit dBm	Margin to limit dB
2484	-61.89	2.46	-17.54	44.35



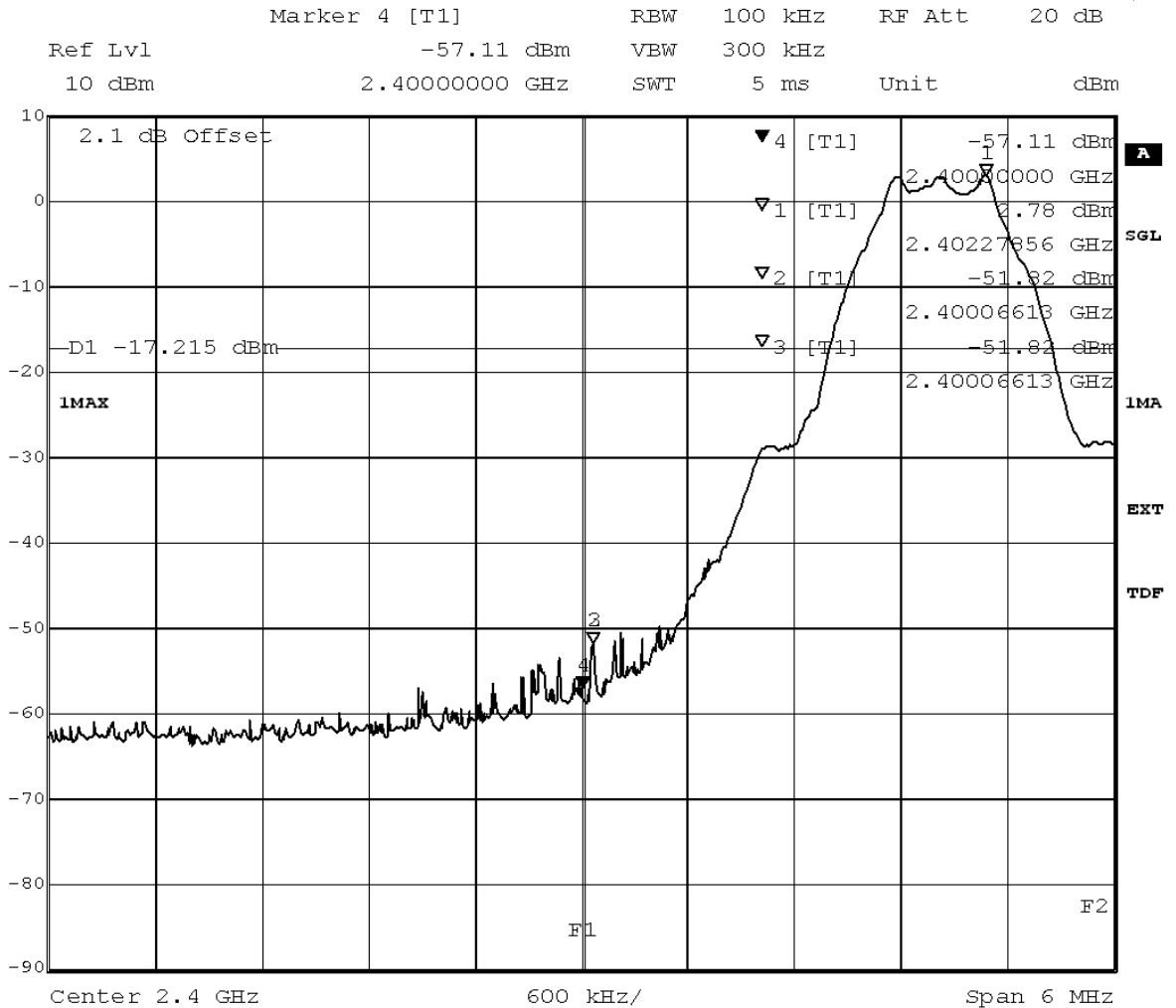
Title: Band Edge Compliance  
 Comment A: CH T:2480 MHz  
 Date: 10.JUN.2015 14:01:11

**Test: 15c.6; Frequency = 2480, Mode = Bluetooth Low Energy**

Result: Passed  
 Setup No.: W06  
 Date of Test: 2015/06/11 13:10  
 Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
 Test Specification: FCC part 2 and 15

**Detailed Results:**

Frequency MHz	Measured value dBm	Reference value dBm	Limit dBm	Margin to limit dB
2400	-57.11	2.78	-17.22	39.89



Title: Band Edge Compliance  
 Comment A: CH B: 2402 MHz  
 Date: 10.JUN.2015 13:34:16



**Test: 15c.6; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = radiated**

*Result:* Passed  
*Setup No.:* D06  
*Date of Test:* 2015/06/23 13:26  
*Body:* FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES  
*Test Specification:* FCC part 2 and 15

**Detailed Results:**

Diagram No.	TX on	Ant. Polar.	Limit PK [dBμV]	Limit AV [dBμV]	Frequency [MHz]	Corrected value PK [dBμV]	Corrected value AV [dBμV]	Margin PK [dB]	Margin AV [dB]	Result
PEI_1425_003	2480 MHz	Ver + Hor	74	54	2483.5	50.00	37.40	24.00	16.60	Passed

## 4 Test Equipment Details

### 4.1 List of Used Test Equipment

The calibration, hardware and software states are shown for the testing period.

#### Test Equipment Anechoic Chamber

<b>Lab ID:</b>	<b>Lab 1</b>		
<i>Manufacturer:</i>	Frankonia		
<i>Description:</i>	Anechoic Chamber for radiated testing		
<i>Type:</i>	10.58x6.38x6.00 m <sup>3</sup>		
	<i>Calibration Details</i>	<i>Last Execution</i>	<i>Next Exec.</i>
	NSA (FCC)	2014/01/09	2017/01/09

#### Single Devices for Anechoic Chamber

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
Air compressor	none	-	Atlas Copco
Anechoic Chamber	10.58 x 6.38 x 6.00 m <sup>3</sup>	none	Frankonia
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	FCC listing 96716 3m Part15/18		2014/01/09 2017/01/08
Controller Maturo	MCU	961208	Maturo GmbH
EMC camera	CE-CAM/1	-	CE-SYS
EMC camera Nr.2	CCD-400E	0005033	Mitsubishi
Filter ISDN	B84312-C110-E1		Siemens&Matsushita
Filter Universal 1A	BB4312-C30-H3	-	Siemens&Matsushita

### Test Equipment Auxiliary Equipment for Radiated emissions

**Lab ID:** Lab 1  
**Description:** Equipment for emission measurements  
**Serial Number:** see single devices

### Single Devices for Auxiliary Equipment for Radiated emissions

Single Device Name	Type	Serial Number	Manufacturer
Antenna mast	AM 4.0	AM4.0/180/11920 513	Maturo GmbH
Biconical Broadband Antenna	SBA 9119	9119-005	Schwarzbeck Mess-Elektronik OHG
Biconical dipole	VUBA 9117	9117-108	Schwarzbeck Mess-Elektronik OHG
Broadband Amplifier 1 GHz - 4 GHz	AFS4-01000400-1Q-10P-4	-	Miteq
Broadband Amplifier 18 GHz - 26 GHz	JS4-18002600-32-5P	849785	Miteq
Broadband Amplifier 30 MHz - 18 GHz	JS4-00101800-35-5P	896037	Miteq
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01- 2+W38.01-2	Kabel Kusch
Cable "ESI to Horn Antenna"	SucoFlex	W18.02- 2+W38.02-2	HUBER+SUHNER
Cable "ESI to Horn Antenna"	UFB311A+UFB293C	W18.02- 2+W38.02-2	Rosenberger Micro-Coax
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz GmbH & Co. KG
			<i>Calibration Details</i>
			<i>Last Execution</i> <i>Next Exec.</i>
			Standard Calibration    2012/06/26    2015/06/25
			Standard Calibration    2015/06/23    2018/06/22
Double-ridged horn	HF 907	102444	Rohde & Schwarz GmbH & Co. KG
			<i>Calibration Details</i>
			<i>Last Execution</i> <i>Next Exec.</i>
			Standard Calibration    2015/05/11    2018/05/10
Double-ridged horn-duplicated 2015-07-15 10:47:55	HF 906	357357/001	Rohde & Schwarz GmbH & Co. KG
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic
High Pass Filter	5HC3500/18000-1.2-KK	200035008	Trilithic
High Pass Filter	WHKX 7.0/18G-8SS	09	Wainwright
Horn Antenna Schwarzbeck 15-26.5 GHz BBHA 9170	BBHA 9170	BBHA9170262	Schwarzbeck Mess-Elektronik OHG
Log.-per. Antenna	HL 562 Ultralog	100609	Rohde & Schwarz GmbH & Co. KG
			<i>Calibration Details</i>
			<i>Last Execution</i> <i>Next Exec.</i>
			Standard Calibration    2012/12/18    2015/12/17
Log.-per. Antenna (upgraded)	HL 562 Ultralog new biconicals	830547/003	Rohde & Schwarz GmbH & Co. KG
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG

**Single Devices for Auxiliary Equipment for Radiated emissions (continued)**

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	DKD Calibration		2014/11/27 2017/11/27
Standard Gain / Pyramidal Horn Antenna 26.5 GHz	3160-09	00083069	EMCO Elektronik GmbH
Standard Gain / Pyramidal Horn Antenna 40 GHz	3160-10	00086675	EMCO Elektronik GmbH
Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	TD1.5- 10kg/024/379070 9	Maturo GmbH

**Test Equipment Auxiliary Test Equipment**

<b>Lab ID:</b>	<b>Lab 1</b>
<i>Manufacturer:</i>	see single devices
<i>Description:</i>	Single Devices for various Test Equipment
<i>Type:</i>	various
<i>Serial Number:</i>	none

**Single Devices for Auxiliary Test Equipment**

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
Broadband Power Divider N (Aux)	1506A / 93459	LM390	Weinschel Associates
Broadband Power Divider SMA	WA1515	A855	Weinschel Associates
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Customized calibration		2013/12/04 2015/12/03
Fibre optic link Satellite (Aux)	FO RS232 Link	181-018	Pontis
Fibre optic link Transceiver (Aux)	FO RS232 Link	182-018	Pontis
Isolating Transformer	LTS 604	1888	Thalheimer Transformatorwerke GmbH
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	Wainwright
Signal Analyzer	FSV30	103005	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Standard		2014/02/10 2016/02/09
Spectrum Analyser	FSU26	200418	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Standard calibration		2014/07/29 2015/07/28
Spectrum Analyzer	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Standard		2012/06/13 2015/06/12
	DKD calibration		2015/06/23 2018/06/22
Vector Signal Generator	SMIQ 03B	832492/061	Rohde & Schwarz GmbH & Co.KG

### Test Equipment Digital Signalling Devices

**Lab ID:** Lab 1  
**Description:** Signalling equipment for various wireless technologies.

#### Single Devices for Digital Signalling Devices

Single Device Name	Type	Serial Number	Manufacturer
CMW500	CMW500	107500	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/01/27 2016/01/26
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	DKD calibration		2014/12/02 2017/12/01
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz GmbH & Co. KG
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	Hardware: B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04 Software: K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21, K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22, K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22, K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22 Firmware: µP1 8v50 02.05.06 ---		2007/07/16
Universal Radio Communication Tester	CMU 200	837983/052	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	DKD calibration		2014/12/03 2017/12/02
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	HW options: B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02 SW options: K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10, K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10, K66 4v10, K68 4v10, Firmware: µP1 8v40 01.12.05 ---		2007/01/02
	SW: K62, K69		2008/11/03
Vector Signal Generator	SMU200A	100912	Rohde & Schwarz GmbH & Co. KG

### Test Equipment Emission measurement devices

**Lab ID:** Lab 1  
**Description:** Equipment for emission measurements  
**Serial Number:** see single devices

#### Single Devices for Emission measurement devices

Single Device Name	Type	Serial Number	Manufacturer
EMI Receiver / Spectrum Analyzer	ESR 7	101424	Rohde & Schwarz
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Initial Factory Calibration		2014/11/13 2016/11/12
Personal Computer	Dell	30304832059	Dell
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2015/05/11 2016/05/10
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2015/05/11 2016/05/10
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2014/06/24 2017/06/23
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2014/01/07 2016/01/31
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	Firmware-Update 4.34.4 from 3.45 during calibration		2009/12/03
Spectrum Analyzer	FSW 43	103779	Rohde & Schwarz
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Initial Factory Calibration		2014/11/17 2016/11/16

### Test Equipment Multimeter 03

**Lab ID:** Lab 1  
**Description:** Fluke 177  
**Serial Number:** 86670383

#### Single Devices for Multimeter 03

Single Device Name	Type	Serial Number	Manufacturer
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Customized calibration		2013/12/04 2015/12/03



### Test Equipment Multimeter 12

**Lab ID:** Lab 2  
**Description:** Ex-Tech 520  
**Serial Number:** 05157876

#### Single Devices for Multimeter 12

Single Device Name	Type	Serial Number	Manufacturer
Digital Multimeter 12 (Multimeter)	EX520	05157876	Extech Instruments Corp.
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Customized calibration			2013/12/04 2015/12/03

### Test Equipment Regulatory Bluetooth RF Test Solution

**Lab ID:** Lab 2  
**Description:** Regulatory Bluetooth RF Tests  
**Type:** Bluetooth RF  
**Serial Number:** 001

#### Single Devices for Regulatory Bluetooth RF Test Solution

Single Device Name	Type	Serial Number	Manufacturer
ADU 200 Relay Box 7	Relay Box	A04380	Ontrak Control Systems Inc.
Bluetooth Signalling Unit CBT	CBT	100302	Rohde & Schwarz GmbH & Co.KG
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Standard calibration			2014/08/29 2015/08/28
Power Meter NRVD	NRVD	832025/059	
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Standard calibration			2014/08/29 2015/08/28
Power Sensor NRV Z1 A	PROBE	832279/013	
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Standard calibration			2014/08/28 2015/08/27
Power Supply	NGSM 32/10	2725	
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Standard calibration			2013/06/20 2015/06/19
Standard calibration			2015/06/22 2017/06/21
Rubidium Frequency Normal MFS	Datum MFS	002	Datum GmbH
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Standard calibration			2014/08/29 2015/08/28
Signal Analyser FSQ26	1119.6001.26	832695/007	Rohde & Schwarz GmbH & Co.KG
Vector Signal Generator SMIQ03B	SMIQ03B	832870/017	
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Standard calibration			2013/06/21 2016/06/20

### Test Equipment Shielded Room 07

**Lab ID:** Lab 2  
**Description:** Shielded Room 4m x 6m

### Test Equipment T/A Logger 13

**Lab ID:** Lab 1  
**Description:** Lufft Opus10 TPR  
**Type:** Opus10 TPR  
**Serial Number:** 13936

#### Single Devices for T/A Logger 13

Single Device Name	Type	Serial Number	Manufacturer
ThermoAirpressure Datalogger 13 (Environ)	Opus10 TPR (8253.00)	13936	Lufft Mess- und Regeltechnik GmbH
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Customized calibration			2015/02/27 2017/02/26

### Test Equipment T/H Logger 12

**Lab ID:** Lab 1  
**Description:** Lufft Opus10  
**Serial Number:** 12482

#### Single Devices for T/H Logger 12

Single Device Name	Type	Serial Number	Manufacturer
ThermoHygro Datalogger 12 (Environ)	Opus10 THI (8152.00)	12482	Lufft Mess- und Regeltechnik GmbH
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Customized calibration			2015/03/10 2017/03/09

### Test Equipment T/H Logger 15

**Lab ID:** Lab 2  
**Description:** Lufft Opus10  
**Serial Number:** 13985

#### Single Devices for T/H Logger 15

Single Device Name	Type	Serial Number	Manufacturer
ThermoHygro Datalogger 15 (Environ)	Opus10 THI (8152.00)	13985	Lufft Mess- und Regeltechnik GmbH
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Customized calibration			2015/03/10 2017/03/09

### Test Equipment Temperature Chamber 01

**Lab ID:** Lab 2  
**Manufacturer:** see single devices  
**Description:** Temperature Chamber KWP 120/70  
**Type:** Weiss  
**Serial Number:** see single devices

#### Single Devices for Temperature Chamber 01

Single Device Name	Type	Serial Number	Manufacturer
Temperature Chamber Weiss 01	KWP 120/70	59226012190010	Weiss Umwelttechnik GmbH
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Customized calibration			2014/03/12 2016/03/11



**5 Annex**

**5.1 Additional Information for Report**

## Summary of Test Results

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The EUT complied with all performed tests as listed in the summary section of this report.

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## Technical Report Summary

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### Type of Authorization :

Certification for an Intentional Radiator (Digital Device / Spread Spectrum).

### Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 15. The following subparts are applicable to the results in this test report:

- Part 2, Subpart J - Equipment Authorization Procedures, Certification
- Part 15, Subpart C – Intentional Radiators
- § 15.201 Equipment authorization requirement
- § 15.207 Conducted limits
- § 15.209 Radiated emission limits; general requirements
- § 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

### Additional documents

The tests were selected and performed with reference to the FCC Public Notice "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, 558074 D01 DTS Meas Guidance v03r03, 2015-06-09".

ANSI C63.10-2013 is applied.

### Description of Methods of Measurements

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#### Conducted emissions (AC power line)

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Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C 63.10,

#### Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.10. The Equipment Under Test (EUT) was setup in a shielded room to perform the conducted emissions measurements in a typical installation configuration. The EUT was powered from 50µH || 50 Ohm Line Impedance Stabilization Network (LISN). The LISN's unused connections were terminated with 50 Ohm loads. The measurement procedure consists of two steps. It is implemented into the EMI test software ES-K1 from R&S.

##### Step 1: Preliminary scan

Intention of this step is, to determine the conducted EMI-profile of the EUT.

EMI receiver settings:

- Detector: Peak - Maxhold
- Frequency range: 150 kHz – 30 MHz
- Frequency steps: 5 kHz

- IF-Bandwidth: 9 kHz
- Measuring time / Frequency step: 20 ms
- Measurement on phase + neutral lines of the power cords.

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

#### Step 2: Final measurement

Intention of this step is, to determine the highest emissions with the settings defined in the test specification for the frequencies identified in step 1.

EMI receiver settings:

- Detector: Quasi-Peak
- IF - Bandwidth: 9 kHz
- Measuring time: 1 s / frequency

At each frequency determined in step 1, four measurements are performed in the following combinations:

- 1) Neutral lead - reference ground (PE grounded)
- 2) Phase lead - reference ground (PE grounded)
- 3) Neutral lead - reference ground (PE floating)
- 4) Phase lead - reference ground (PE floating)

The highest value is reported.

#### Test Requirements / Limits

FCC Part 15, Subpart C, §15.207

Frequency Range (MHz)	QP Limit (dBµV)	AV Limit (dBµV)
0.15 – 0.5	66 to 56	56 to 46
0.5 – 5	56	46
5 – 30	60	50

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

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#### Occupied bandwidth

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Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

#### Test Description

The Equipment Under Test (EUT) was set up 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 EUT was connected to spectrum analyzer via a short coax cable with a known loss.

Analyzer settings:

- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Span: 3
- Detector: Peak / Sample (6 dB bandwidth / 99% bandwidth)

#### Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (a) (2)

Systems using digital modulation techniques may operate in the 902-928 MHz and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Used conversion factor: Output power (dBm) =  $10 \log (\text{Output power (W)} / 1\text{mW})$

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#### Peak power output

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Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

#### Test Description

The Equipment Under Test (EUT) was set up to perform the output power measurements. The results recorded were measured with the modulation which produces the worst-case (highest) output power. 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 via a short coax cable with a known loss.

Analyzer settings:

- Detector: Peak

#### Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (b) (3)

For systems using digital modulation techniques in the 902-928 MHz and 2400-2483.5 MHz bands: 1 watt.

==> Maximum conducted peak output power: 30 dBm (excluding antenna gain, if antennas with directional gains that do not exceed 6 dBi are used).

Used conversion factor: Limit (dBm) =  $10 \log (\text{Limit (W)}/1\text{mW})$

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#### Spurious RF conducted emissions

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Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

#### Test Description

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

The EUT was connected to spectrum analyzer via a short coax cable with a known loss.

Analyzer settings:

- Detector: Peak-Maxhold
- Frequency range: 30 – 25000 MHz
- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Sweep Time: 330 s

The reference value for the measurement of the spurious RF conducted emissions is determined during the test "band edge compliance" (cf. chapter 3.6). This value is used to calculate the 20 dBc limit.

#### Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (c)

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

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## Spurious radiated emissions

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Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C 63.10,

### Test Description

The test set-up was made in accordance to the general provisions of ANSI C63.10 in a typical installation configuration.

The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m<sup>2</sup> in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.

The measurement procedure is implemented into the EMI test software ES-K1 from R&S. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is performed at 2 axes. A pre-check is also performed while the EUT is powered from both AC and DC (battery) power in order to find the worst-case operating condition.

#### 1. Measurement up to 30 MHz

The Loop antenna HFH2-Z2 is used.

Step 1: pre-measurement

- Anechoic chamber
- Antenna distance: 10 m
- Detector: Peak-Maxhold
- Frequency range: 0.009 – 0.15 and 0.15 – 30 MHz
- Frequency steps: 0.1 kHz and 5 kHz
- IF-Bandwidth: 0.2 kHz and 10 kHz
- Measuring time / Frequency step: 100 ms

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: final measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is to find the maximum emission level.

- Open area test side
- Antenna distance: according to the Standard
- Detector: Quasi-Peak
- Frequency range: 0.009 – 30 MHz
- Frequency steps: measurement at frequencies detected in step 1
- IF-Bandwidth: 200 Hz – 10 kHz
- Measuring time / Frequency step: 100 ms

#### 2. Measurement above 30 MHz and up to 1 GHz

Step 1: Preliminary scan

Preliminary test to identify the highest amplitudes relative to the limit.

Settings for step 1:

- Detector: Peak-Maxhold
- Frequency range: 30 – 1000 MHz
- Frequency steps: 60 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100  $\mu$ s (BT Timing 1.25 ms)
- Turntable angle range: -180 to +180°
- Turntable step size: 90°
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: second measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is, to find out the approximate turntable angle and antenna height for each frequency.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: -180 to +180°
- Turntable step size: 45°

- Height variation range: 1 – 4 m
- Height variation step size: 0.5 m
- Polarisation: horizontal + vertical

After this step the EMI test system has determined the following values for each frequency (of step 1):

- Frequency
- Azimuth value (of turntable)
- Antenna height

The last two values have now the following accuracy:

- Azimuth value (of turntable): 45°
- Antenna height: 0.5 m

Step 3: final measurement

In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.

For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will be slowly varied by +/-22.5° around this value. During this action the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position the antenna height is also slowly varied by +/-25 cm around the antenna height determined. During this action the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: -22.5° to +22.5° around the determined value
- Height variation range: -0.25 m to +0.25 m around the determined value

Step 4: final measurement with QP detector

With the settings determined in step 3, the final measurement will be performed:

EMI receiver settings for step 4:

- Detector: Quasi-Peak (< 1 GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

### 3. Measurement above 1 GHz

The following modifications apply to the measurement procedure for the frequency range above 1 GHz:

The measurement distance was reduced to 1.4 m. The results were extrapolated by the extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements, inverse linear-distance squared for the power reference level measurements). Due to the fact that in this frequency range a double ridged wave guided horn antenna (up to 18 GHz) and a standard gain horn antenna (18–25 GHz) are used, the steps 2–4 are omitted. Step 1 was performed with one height of the receiving antenna only.

EMI receiver settings:

- Detector: Peak, Average
- IF Bandwidth = 1 MHz

After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

For the enhanced data rate packets the test is performed as worst-case-check in order to verify that emissions have a comparable level as found at basic data rate. Typically, the measurement for these packets is performed in the frequency range 1 to 8 GHz but it depends on the emissions found during the test for the basic data rate. Please refer to the results for the used frequency range.

### Test Requirements / Limits

#### FCC Part 15, Subpart C, §15.247 (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 Part 15, Subpart C, §15.209, Radiated Emission Limits

Frequency (MHz)	Limit (µV/m)	Measurement distance (m)	Limit @ 10 m distance (dBµV/m)
0.009 – 0.49	2400/F(kHz)	300	48.5..13.8 + 59.1 dB = 107.6..72.9
0.49 – 1.705	24000/F(kHz)	30	33.8..23.0 + 19.1 dB = 52.9..42.1
1.705 - 30	30	30	29.5 + 19.1 = 48.6

Frequency (MHz)	Limit (µV/m)	Measurement distance (m)	Limit (dBµV/m)
30 - 88	100	3	40.0
88 - 216	150	3	43.5



216 - 960	200	3	46.0
above 960	500	3	54.0

§15.35(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: Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)

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Band edge compliance

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Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C 63.10, FCC §15.31

Test Description

The procedure to show compliance with the band edge requirement is divided into two measurements:  
 1. Show compliance of the lower band edge by a conducted measurement and  
 2. show compliance of the higher band edge by a radiated and conducted measurement.

For the first measurement the EUT is set to transmit on the lowest channel (2402 MHz). The lower band edge is 2400 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 (2480 MHz). The higher band edge is 2483.5 MHz.

Analyzer settings for conducted measurement:

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

EMI receiver settings for radiated measurement:

- Detector: Peak, Average
- IF Bandwidth = 1 MHz

Test Requirements / Limits

FCC Part 15.247 (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.

...  
 Attenuation below the general limits specified in Section 15.209(a) is not required. 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))."

For the measurement of the lower band edge the RF power at the band edge 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..."

For the measurement of the higher band edge the limit is "specified in Section 15.209(a)".

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Power Density

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Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

### Test Description

The EUT was connected to spectrum analyzer via a short coax cable with a known loss.

Analyzer settings:

- Detector: Peak-Maxhold
- Resolution Bandwidth (RBW): 3 kHz
- Video Bandwidth (VBW): 30 kHz
- Sweep Time: Coupled

### Test Requirements / Limits

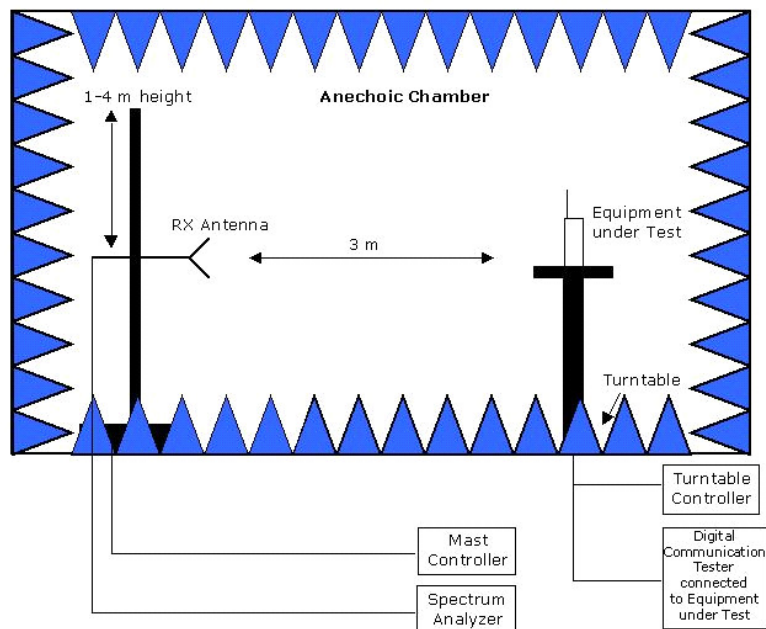
FCC Part 15, Subpart C, §15.247 (e)

For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

...

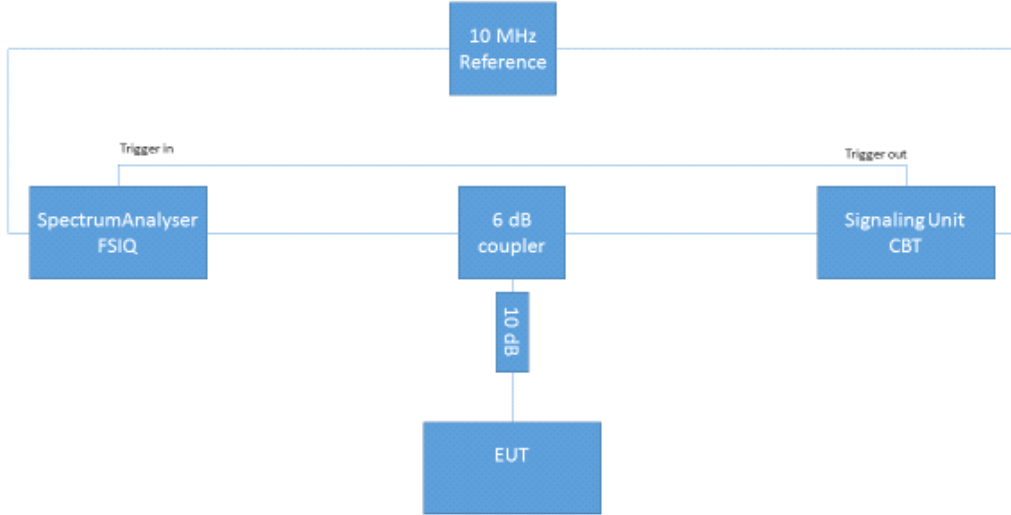
The same method of determining the conducted output power shall be used to determine the power spectral density.

### Setup Drawings

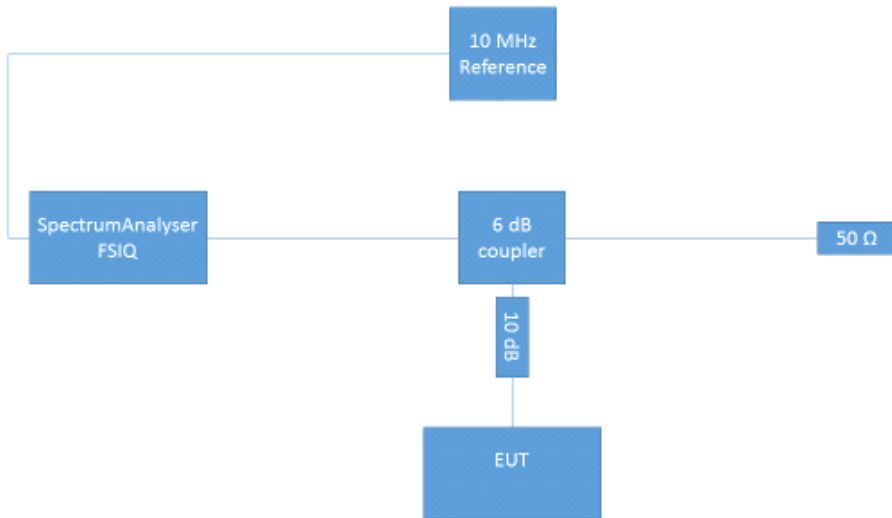


Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Setup in the Anechoic chamber:  
Measurements below 1 GHz: Semi-anechoic, conducting ground plane.  
Measurements above 1 GHz: Fully-anechoic, absorbers on all surfaces



Test Setup; Conducted Tests; Bluetooth normal mode (BDR/EDR)



Test Setup; Conducted Tests; Bluetooth Low Energy Mode

September, 2015

**To Whom This May Concern**

**Correlation of measurement requirements for  
FHSS (e.g. Bluetooth®) equipment  
from  
FCC and IC**

**FHSS equipment**

<b>Measurement</b>	<b>FCC reference</b>	<b>IC reference</b>
Conducted emissions on AC Mains	§ 15.207	RSS-Gen Issue 4: 8.8
Occupied bandwidth	§ 15.247 (a) (1)	RSS-247 Issue 1: 5.1 (2)
Peak conducted output power	§ 15.247 (b) (1), (4)	RSS-247 Issue 1: 5.4 (2)
Transmitter spurious RF conducted emissions	§ 15.247 (d)	RSS-Gen Issue 4: 6.13/8.9/8.10; RSS-247 Issue 1: 5.5
Transmitter spurious radiated emissions	§ 15.247 (d); § 15.209 (a)	RSS-Gen Issue 4: 6.13 / 8.9/8.10; RSS-247 Issue 1: 5.5
Band edge compliance	§ 15.247 (d)	RSS-247 Issue 1: 5.5
Dwell time	§ 15.247 (a) (1) (iii)	RSS-247 Issue 1: 5.1 (4)
Channel separation	§ 15.247 (a) (1)	RSS-247 Issue 1: 5.1 (2)
No. of hopping frequencies	§ 15.247 (a) (1) (iii)	RSS-247 Issue 1: 5.1 (4)
Hybrid systems (only)	§ 15.247 (f); § 15.247 (e)	RSS-247 Issue 1: 5.3
Antenna requirement	§ 15.203 / 15.204	RSS-Gen Issue 4: 8.3
Receiver spurious emissions	-	-

## Measurement Uncertainties

FCC Part 22, 24, 27, 90  
IC RSS-132, RSS-133, RSS-139

Test Case	Parameter	Uncertainty
RF Power Output	Power	± 2.2 dB
Frequency Stability	Frequency	± 25 Hz
Spurious Emissions at antenna terminal	Power	± 2.2 dB
Field strength of spurious radiation	Power	± 4.5 dB
Emission and Occupied Bandwidth	Power Frequency	± 2.9 dB GSM: ± 10.6 kHz UMTS, LTE: ± 120.0 kHz
Band Edge Compliance	Power Frequency	± 2.9 dB GSM: ± 14.6 kHz UMTS, LTE: ± 68.0 kHz

FCC Part 15b  
IC ICES-003

Test Case	Parameter	Uncertainty
AC Power Line	Power	± 3.4 dB
Field Strength of spurious radiation	Power+	± 5.5 dB

FCC Part 15c, 15e  
IC RSS-210, IC RSS-247

Test Case	Parameter	Uncertainty
AC Power Line	Power	± 3.4 dB
Field Strength of spurious radiation	Power	± 5.5 dB
6 dB / 26 dB / 99% Bandwidth	Power Frequency	± 2.9 dB ± 11.2 kHz
Conducted Output Power		± 2.2 dB
Spurious Emissions at antenna terminal	Power	± 2.2 dB
Band Edge Compliance	Power Frequency	± 2.2 dB ± 11.2 kHz
Frequency Stability	Frequency	± 25 Hz
Power Spectral Density	Power	± 2.2 dB

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