InterLab®

Final Report on

Jabra SPEAK 810
PHS004W
FCC ID BCE-PHS004W
IC: 2386C-PHS004W

Report Reference:	MDE_GNNET_1509_FCCb_rev1 acc. Title 47 CFR chapter I part 15 subpart C
Date:	September 16, 2015

Test Laboratory:
7layers GmbH
Borsigstraße 11
40880 Ratingen
Germany

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-12140-01-01

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.

1 Administrative Data

1.1 Project Data

Project Responsible:	Patrick Menge
Date Of Test Report:	2015/09/16
Date of first test:	2015/06/02
Date of last test:	2015/09/16

1.2 Applicant Data

Company Name: GN Netcom A/S

Street:	Lautrupbjerg 7
City:	DK-2750 Ballerup
Country:	Denmark

Contact Person: Mr. Tom Ringtved

Phone:	+45 45 75 91 86
E-Mail:	tringtved@jabra.com

1.3 Test Laboratory Data

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

7 layers DE

Company Name :	7 layers GmbH
Street :	Borsigstrasse 11
City :	40880 Ratingen
Country :	Germany
Contact Person :	Mr. Michael Albert
Phone :	+49 2102 749 201
Fax :	+49 2102 749 444
E Mail :	Michael.Albert@7Layers.com

Laboratory Details

Lab ID	*Identification*	*Responsible*	*Accreditation Info*
Lab 1	Conducted Emissions	Mr. Andreas Petz Mr. Wolfgang Richter	DAkkS-Registration no. D-PL-12140-01-01
Lab 2	Radiated Emissions	Mr. Marco Kullik Mr. Robert Machulec	DAkkS-Registration no. D-PL-12140-01-01
Lab 3	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

Imad Hjije

Imad Hjije
responsible for tests performed in: Lab 1, Lab 2, Lab 3

1.5 Signature of the Accreditation Responsible

Accreditation scope responsible person
responsible for Lab 1, Lab 2, Lab 3

2 Test Object Data

2.1 General OUT Description

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

OUT: Jabra SPEAK 810

Type / Model / Family:	Jabra SPEAK 810 PHS004W FCC ID BCE-PHS004W IC: 2386C-PHS004W
Product Category:	Office Equipment
Manufacturer:	
Company Name:	See applicant data:
Contact Person:	-

Parameter List:

Parameter name	*Value*
AC Power Supply	120 (V)
Antenna Gain	2,06 (dBi)
DC Power Supply	12 (V)
highest channel (BT)	2480 (MHz)
highest internal frequency of host equipment	26 MHz
lowest channel (BT)	2402 (MHz)
mid channel (BT)	2441 (MHz)

2.2 Detailed Description of OUT Samples

Sample : ab01

OUT Identifier	Jabra SPEAK 810		
Sample Description	radiated sample		
Serial No.	Alpha 1 219		
HW Status	28-04370		
SW Status	0-0-26		
Date of Receipt	2015/06/01		
Low Voltage	11.4 V	*Low Temp.*	-10 °C
High Voltage	12.6 V	*High Temp.*	55 °C
Nominal Voltage	12 V	*Normal Temp.*	25 °C

Parameter List:

Parameter Description	*Value*	
Parameter for Scope FCC_v2		
Antenna Gain	2,06	(dBi)
Frequency_high	2480	(MHz)
Frequency_low	2402	(MHz)
Frequency_mid	2441	(MHz)

Sample : ac01

OUT Identifier	Jabra SPEAK 810		
Sample Description	conducted sample		
Serial No.	Alpha 1 314		
HW Status	28-04370		
SW Status	0-0-26		
Date of Receipt	2015/06/01		
Low Voltage	11.4 V	*Low Temp.*	-10 °C
High Voltage	12.6 V	*High Temp.*	55 °C
Nominal Voltage	12 V	*Normal Temp.*	25 °C

Parameter List:

Parameter Description	*Value*	
Parameter for Scope FCC_v2		
Antenna Gain	2.06	(dBi)
Frequency_high	2480	(MHz)
Frequency_low	2402	(MHz)
Frequency_mid	2441	(MHz)

2.3 OUT Features

Features for OUT: Jabra SPEAK 810

Designation	*Description*	*Allowed Values*	*Supported Value(s)*
Features for scope: FCC_v2			
AC	The OUT is powered by or connected to AC Mains		
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		
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		
Iant	Integral Antenna: permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment		
TantC	temporary antenna connector, which may be only built-in for testing, designed as an example part of the equipment		

2.4 Auxiliary Equipment

AE No.	*Type Designation*	*Serial No.*	*HW Status*	*SW Status*	*Description*
AE AE06	CHERRY RS 6000 USB ON	G 0000273 2P28			Keyboard
AE AE04	FUJITSU	13300281B	Model: PJW1942NA		AC Adapter
AE AE03	FUJITSU LIFEBOOK E Series E781	DSCK013817			Laptop
AE AE05	Logitech M-BT58	HC60915A2XC			PC Mouse
AE AE01	Phihong PSAA30R-120	P151301251A1			Switching Power Supply
AE AE02	SAMSUNG S22B350H	0166H4MC402328Y			Monitor

2.5 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.

Setup No.	*List of OUT samples*		*List of auxiliary equipment*	
	Sample No.	*Sample Description*	*AE No.*	*AE Description*
S01_AC01	**(conducted setup)**			
	Sample: ac01	conducted sample	AE AE06	Keyboard
			AE AE04	AC Adapter
			AE AE03	Laptop
			AE AE05	PC Mouse
			AE AE01	Switching Power Supply
			AE AE02	Monitor
S02_AB01	**(radiated setup)**			
	Sample: ab01	radiated sample	AE AE01	Switching Power Supply

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. This report contains the abbreviated information content pertaining to services rendered. Supporting documentation not included herein is maintained and available at the laboratory.

2. All tests are performed under environmental conditions within the requirements of the specifications. Environmental conditions are available at the laboratory.

3. This test report covers only the normal Bluetooth functionality of this device. Bluetooth low energy is reported separatly.

3. This report is revision of MDE_GNNET_1509_FCCb. Corresponding revision table can be found in the Annex.

3.2 List of the Applicable Body

(Body for Scope: FCC_v2)

Designation	*Description*
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

Test Specification:	**FCC part 2 and 15**
Version	10-1-13 Edition
Title:	PART 2 - GENERAL RULES AND REGULATIONS PART 15 - RADIO FREQUENCY DEVICES

3.4 Summary

Test Case Identifier / Name Test (condition)	*Result*	*Date of Test*	*Lab Ref.*	*Setup*
15c.1 Conducted emissions (AC power line) §15.207				
15c.1; Mode = transmit	Passed	2015/06/24	Lab 1	S02_AB01
15c.2 Spurious radiated emissions §15.247 (d), §15.35 (b), §15.209				
15c.2; Frequency = 2402 - 2480, Mode = BT transmit using GFSK/PSK Modulation, Maximum Output Power	Passed	2015/06/06	Lab 2	S02_AB01
15c.3 Occupied bandwidth §15.247 (a) (1)				
15c.3; Frequency = 2402, Mode = BT transmit using 1 Mbps with GFSK modulation	Passed	2015/09/16	Lab 3	S01_AC01
15c.3; Frequency = 2402, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation	Passed	2015/09/16	Lab 3	S01_AC01
15c.3; Frequency = 2402, Mode = BT transmit using 3 Mbps with 8DPSK modulation	Passed	2015/09/16	Lab 3	S01_AC01
15c.3; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation	Passed	2015/09/16	Lab 3	S01_AC01
15c.3; Frequency = 2441, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation	Passed	2015/09/16	Lab 3	S01_AC01
15c.3; Frequency = 2441, Mode = BT transmit using 3 Mbps with 8DPSK modulation	Passed	2015/09/16	Lab 3	S01_AC01
15c.3; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation	Passed	2015/09/16	Lab 3	S01_AC01
15c.3; Frequency = 2480, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation	Passed	2015/09/16	Lab 3	S01_AC01
15c.3; Frequency = 2480, Mode = BT transmit using 3 Mbps with 8DPSK modulation	Passed	2015/09/16	Lab 3	S01_AC01
15c.4 Peak power output §15.247 (b) (1)				
15c.4; Peak power output Summary	Passed	2015/08/25	Lab 3	S01_AC01
15c.5 Spurious RF conducted emissions §15.247 (d)				
15c.5; Frequency = 2402, Mode = BT transmit using 1 Mbps with GFSK modulation	Passed	2015/08/26	Lab 3	S01_AC01
15c.5; Frequency = 2402, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation	Passed	2015/08/26	Lab 3	S01_AC01
15c.5; Frequency = 2402, Mode = BT transmit using 3 Mbps with 8DPSK modulation	Passed	2015/08/26	Lab 3	S01_AC01
15c.5; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation	Passed	2015/08/26	Lab 3	S01_AC01
15c.5; Frequency = 2441, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation	Passed	2015/08/26	Lab 3	S01_AC01
15c.5; Frequency = 2441, Mode = BT transmit using 3 Mbps with 8DPSK modulation	Passed	2015/08/26	Lab 3	S01_AC01
15c.5; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation	Passed	2015/08/26	Lab 3	S01_AC01
15c.5; Frequency = 2480, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation	Passed	2015/08/26	Lab 3	S01_AC01
15c.5; Frequency = 2480, Mode = BT transmit using 3 Mbps with 8DPSK modulation	Passed	2015/08/26	Lab 3	S01_AC01

Test Case Identifier / Name Test (condition)	Result	Date of Test	Lab Ref.	Setup
15c.6 Band edge compliance §15.247 (d)				
15c.6; Frequency = 2402, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = conducted, band edge = 2400 MHz	Passed	2015/08/26	Lab 3	S01_AC01
15c.6; Frequency = 2402, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method = conducted, band edge = 2400 MHz	Passed	2015/08/26	Lab 3	S01_AC01
15c.6; Frequency = 2402, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = conducted, band edge = 2400 MHz	Passed	2015/08/26	Lab 3	S01_AC01
15c.6; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = conducted, band edge = 2483.5 MHz	Passed	2015/08/26	Lab 3	S01_AC01
15c.6; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = radiated	Passed	2015/06/06	Lab 2	S02_AB01
15c.6; Frequency = 2480, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method = conducted, band edge = 2483.5 MHz	Passed	2015/08/26	Lab 3	S01_AC01
15c.6; Frequency = 2480, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method = radiated	Passed	2015/06/06	Lab 2	S02_AB01
15c.6; Frequency = 2480, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = conducted, band edge = 2483.5 MHz	Passed	2015/08/26	Lab 3	S01_AC01
15c.6; Frequency = 2480, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = radiated	Passed	2015/06/06	Lab 2	S02_AB01
15c.6; Frequency = hopping, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = conducted, band edge = 2400 MHz	Passed	2015/06/02	Lab 3	S01_AC01
15c.6; Frequency = hopping, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = conducted, band edge = 2483.5 MHz	Passed	2015/06/02	Lab 3	S01_AC01
15c.6; Frequency = hopping, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method = conducted, band edge=2400 MHz	Passed	2015/06/02	Lab 3	S01_AC01
15c.6; Frequency = hopping, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method=conducted, band edge=2483.5 MHz	Passed	2015/06/02	Lab 3	S01_AC01
15c.6; Frequency = hopping, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = conducted, band edge = 2400 MHz	Passed	2015/06/02	Lab 3	S01_AC01
15c.6; Frequency = hopping, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = conducted, band edge = 2483.5 MHz	Passed	2015/06/02	Lab 3	S01_AC01
15c.7 Dwell time §15.247 (a) (1) (iii)				
15c.7; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation	Passed	2015/06/02	Lab 3	S01_AC01
15c.8 Channel separation §15.247 (a) (1)				
15c.8; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation	Passed	2015/06/02	Lab 3	S01_AC01
15c.9 Number of hopping frequencies §15.247 (a) (1) (iii)				
15c.9; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation	Passed	2015/06/02	Lab 3	S01_AC01

3.5 Detailed Results

3.5.1 15c.1 Conducted emissions (AC power line) §15.207

Test: 15c.1; Mode = transmit

Result:	Passed
Setup No.:	S02_AB01
Date of Test:	2015/06/24 17:41
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

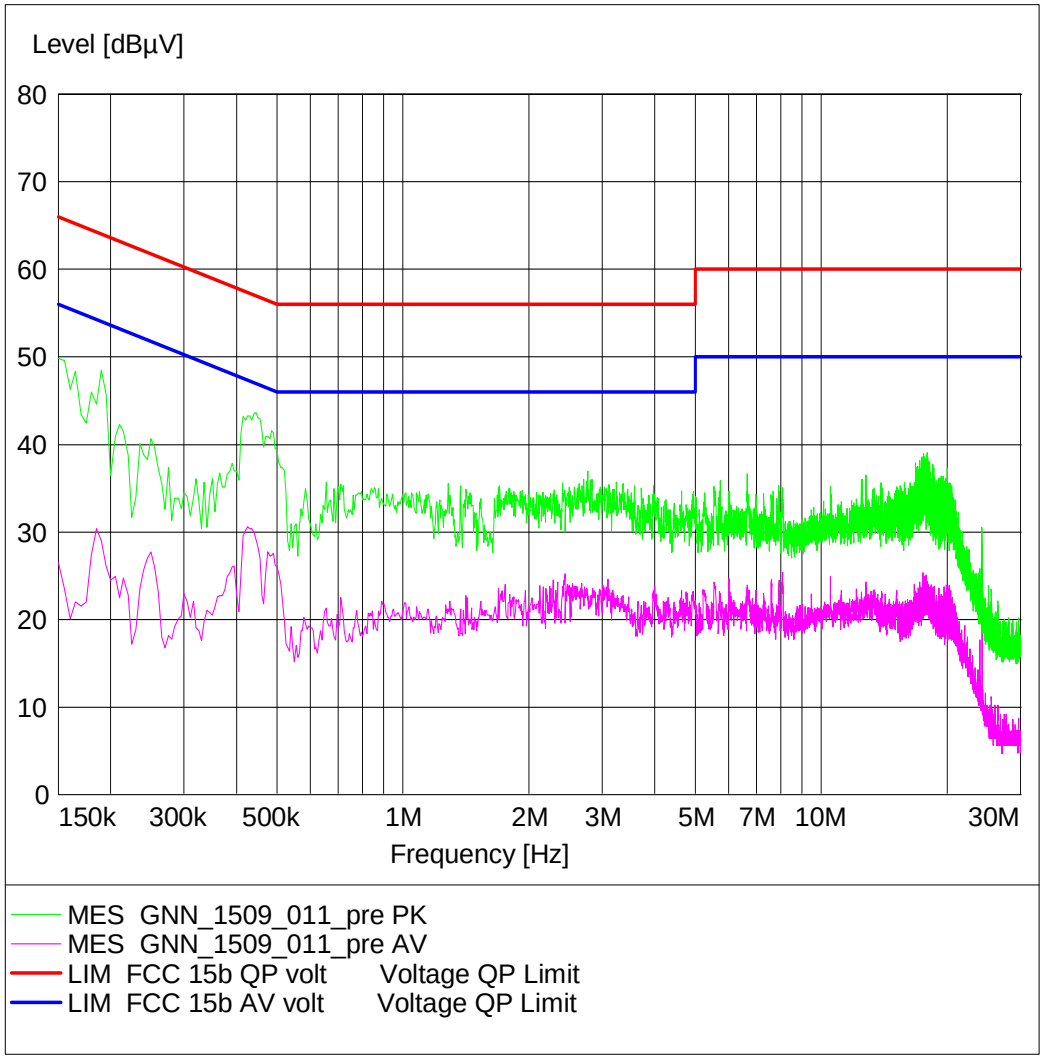
Detailed Results:

AC MAINS CONDUCTED

```
EUT:                 (DE1021008ab01)
Manufacturer:        GNNET
Operating Condition: music playback via USB cable from laptop
Test Site:           7 layers Ratingen
Operator:            URO
Test Specification:  ANSI C63.4; FCC 15.107 / 15.207
Comment:             computer peripheral setup, 120 V / 60 Hz
Start of Test:       24.06.2015 / 12:37:05
```

SCAN TABLE: "FCC Voltage"

Short Description:			FCC Voltage			
Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
150.0 kHz	30.0 MHz	5.0 kHz	MaxPeak Average	20.0 ms	9 kHz	ESH3-Z5



3.5.2 15c.2 Spurious radiated emissions §15.247 (d), §15.35 (b), §15.209

Test: 15c.2; Frequency = 2402 - 2480, Mode = BT transmit using GFSK/PSK Modulation, Maximum Output Power

Result: Passed

Setup No.: S02_AB01

Date of Test: 2015/06/06 17:49

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

Detailed Results:

Test	TX freq.	EUT	Diagram no.	Result	Measure-ment Range	EUT	Diagram no.	Result	Measure-ment Range
FCC 15c247	Ch./MHz	GFSK Modulation				PSK Modulation			
H-Field	39 / 2441	ab01	020-023	Passed	9k-30M	-	-	-	-
30M-1G	0 / 2402	ab01	018	Passed	30M-1G	-	-	-	-
	39 / 2441	ab01	FCC15B	Passed	30M-1G	-	-	-	-
	78 / 2480	ab01	019	Passed	30M-1G	-	-	-	-
1G-18G	0 / 2402	ab01	001	Passed	1G-3G	ab01	004	Passed	1G-3G
	39 / 2441	ab01	002	Passed	1G-3G	ab01	005	Passed	1G-3G
	78 / 2480	ab01	003	Passed	1G-3G	ab01	006	Passed	1G-3G
	2480 BE	ab01	003_BE	Passed	78/2.48G-2.5G	ab01	006_BE	Passed	78/2.48G-2.5G
	0 / 2402	ab01	001	Passed	3G-18G	ab01	004	Passed	3G-8G
	39 / 2441	ab01	002	Passed	3G-18G	ab01	005	Passed	3G-8G
	78 / 2480	ab01	003	Passed	3G-18G	ab01	006	Passed	3G-8G
18G-25G	0 / 2402	ab01	008	Passed	18G-25G	-	-	-	-
	39 / 2441	ab01	009	Passed	18G-25G	-	-	-	-
	78 / 2480	ab01	010	Passed	18G-25G	-	-	-	-

** REMARK: Emissions which are within 20 dB of the limit are listed in the tables below.
** Remark: Because no emission where found within 20 dB of the limit under GFSK modulation, PSK modulation was tested using a reduced frequency range of 1-18GHz

Diagram No.	Ant. Polar.	Limit QPK [dBµV]	Frequency [MHz]	Corrected value QPK [dBµV]	Margin QPK [dB]	Result
	Ver + Hor					Passed

Frequency range 1 GHz - 25 GHz

Diagram No.	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: The device is powered via AC/DC adapter, as it is the worst case

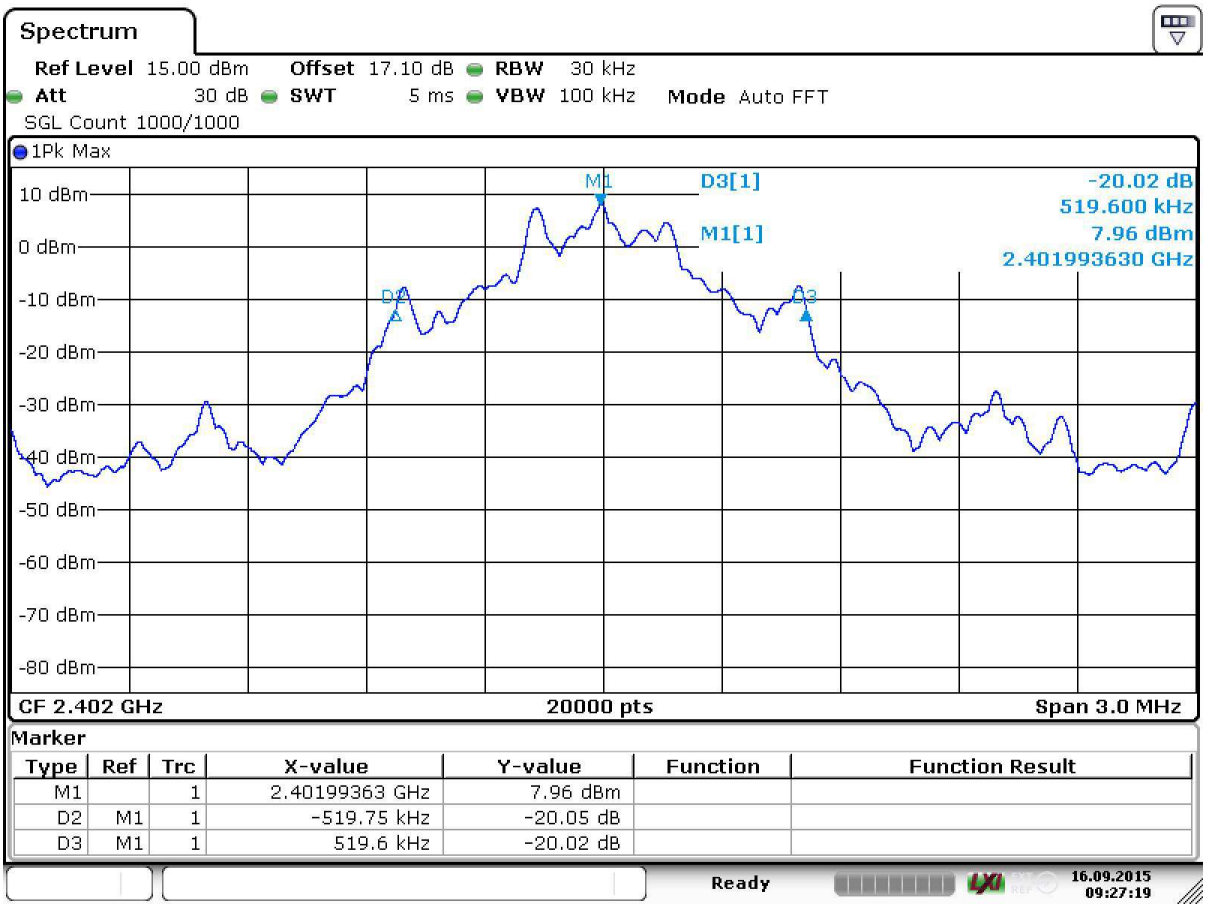
3.5.3 15c.3 Occupied bandwidth §15.247 (a) (1)

Test: 15c.3; Frequency = 2402, Mode = BT transmit using 1 Mbps with GFSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/09/16 10:41
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

20 dB bandwidth MHz
1.039



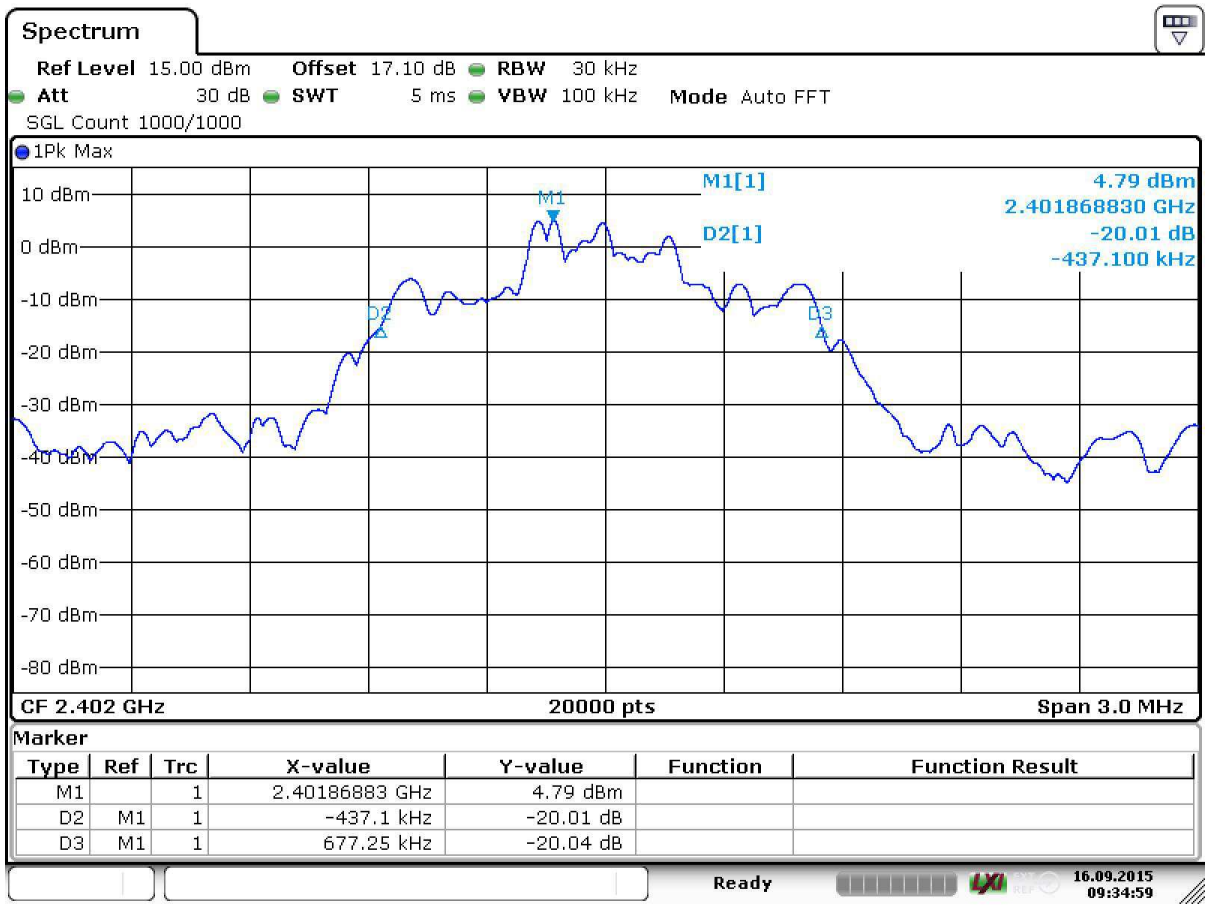
Date: 16.SEP.2015 09:27:19

Test: 15c.3; Frequency = 2402, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/09/16 10:45
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

20 dB bandwidth MHz
1.114



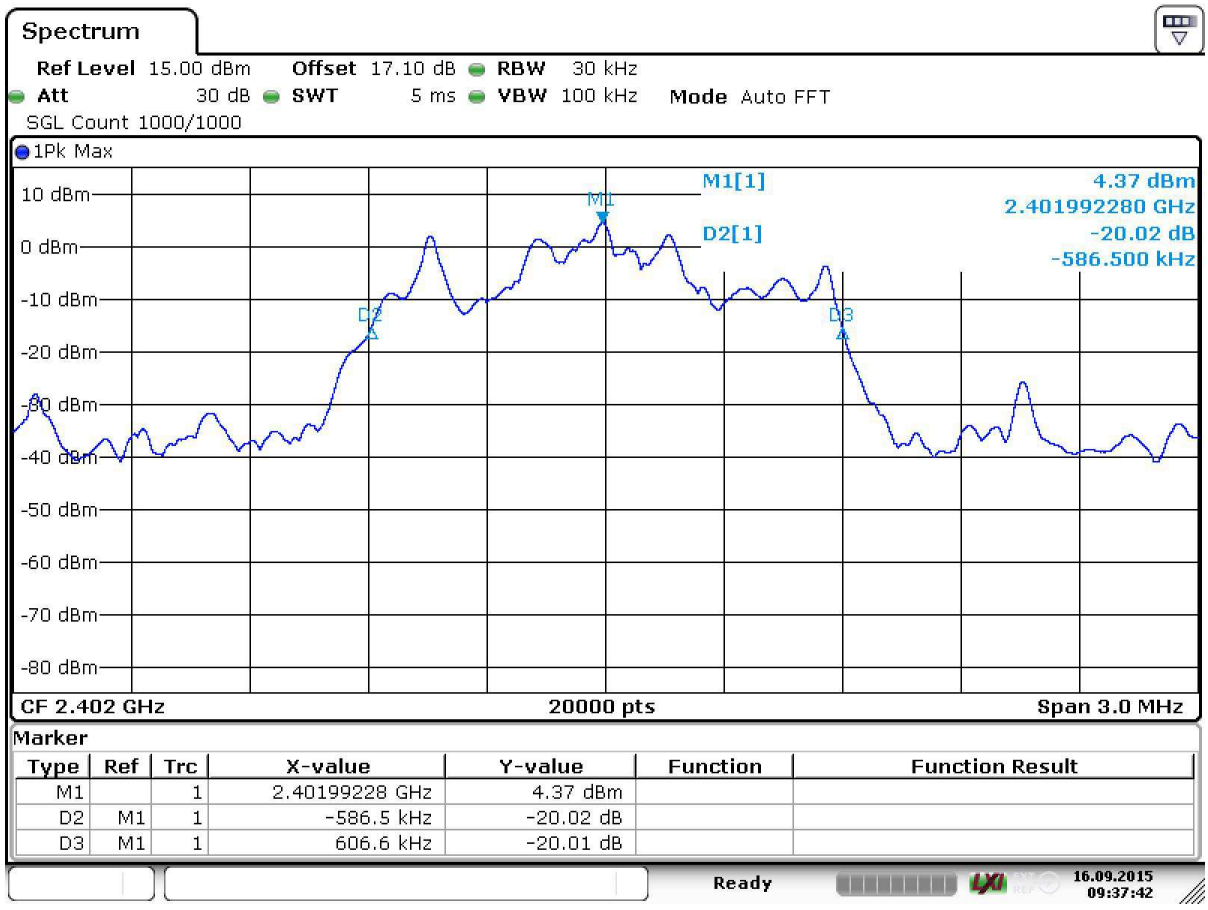
Date: 16.SEP.2015 09:34:59

Test: 15c.3; Frequency = 2402, Mode = BT transmit using 3 Mbps with 8DPSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/09/16 11:01
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

20 dB bandwidth MHz
1.193



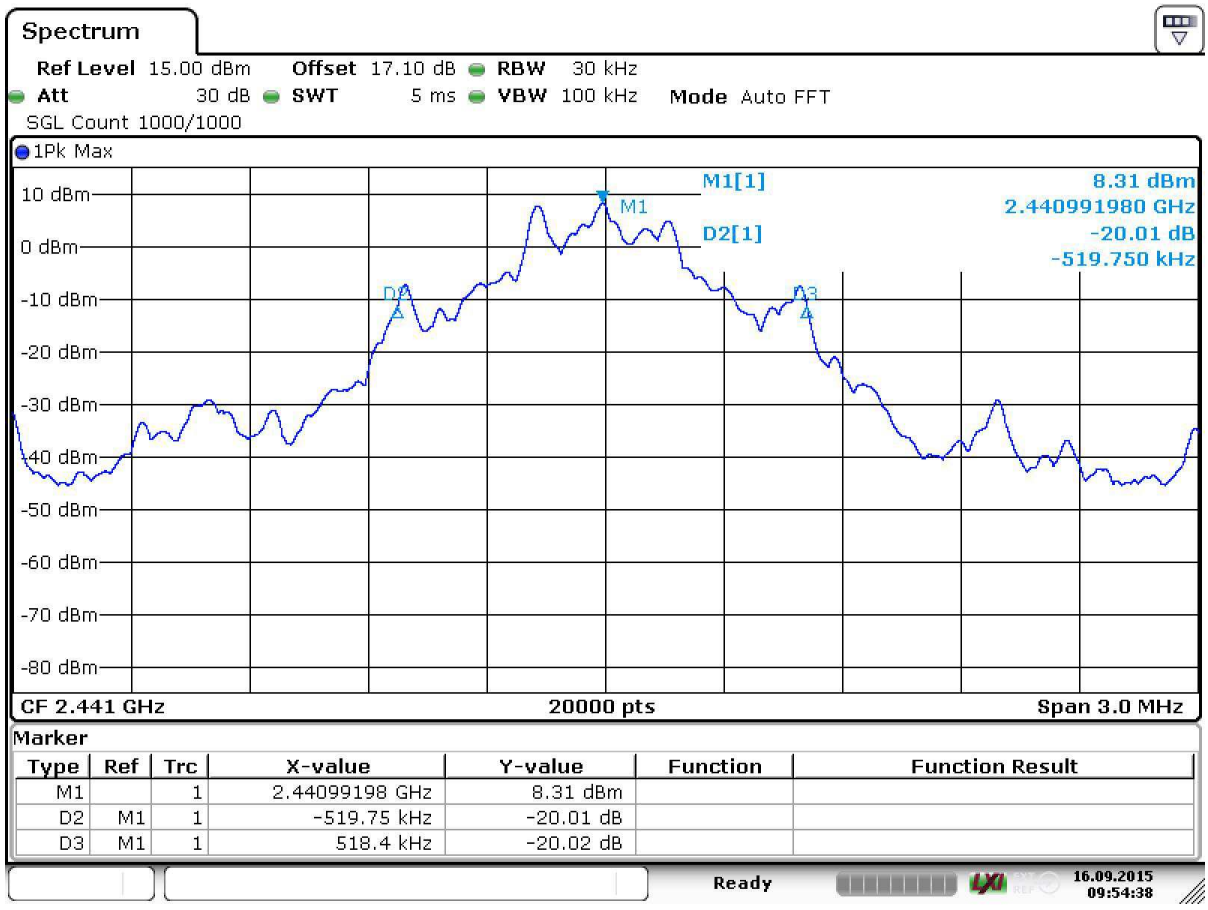
Date: 16.SEP.2015 09:37:42

Test: 15c.3; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/09/16 10:41
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

20 dB bandwidth MHz
1.038



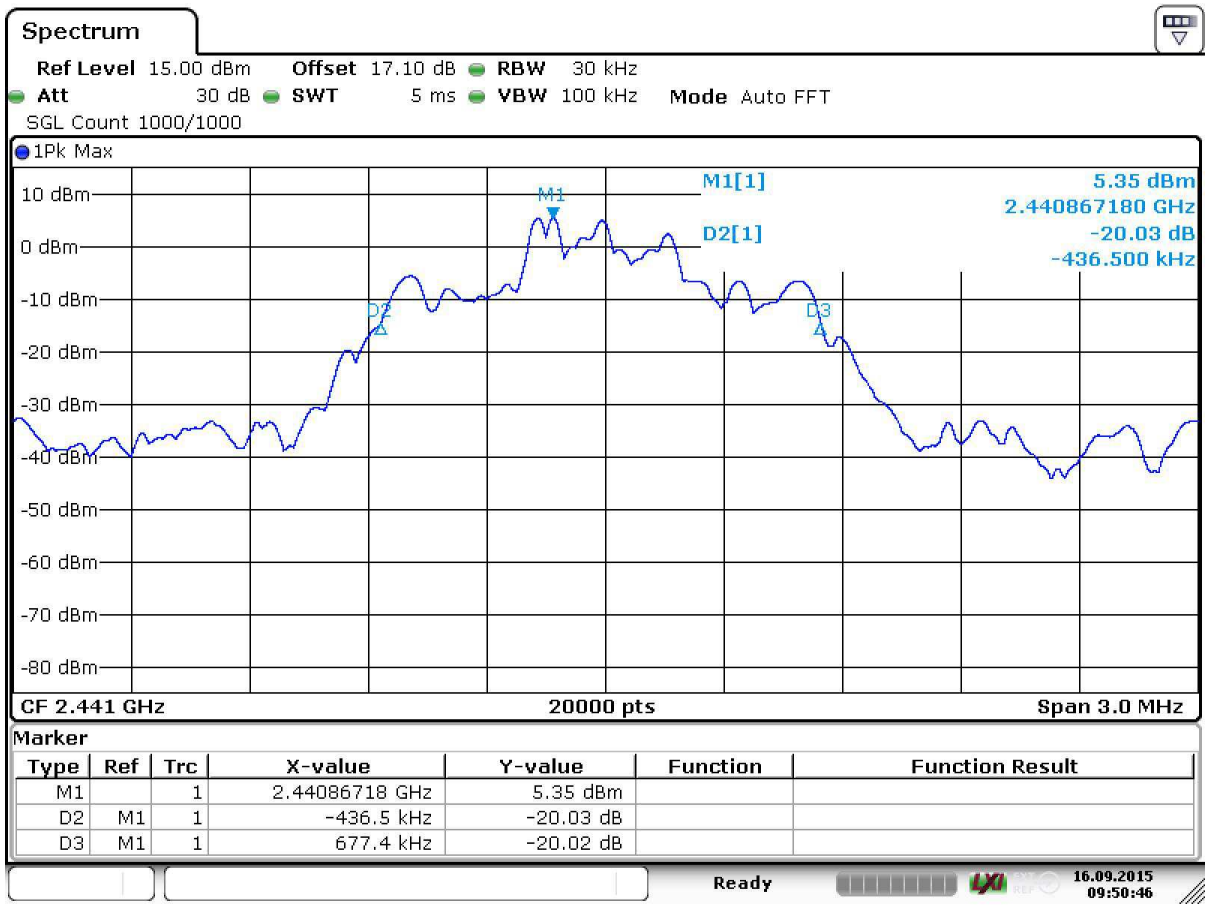
Date: 16.SEP.2015 09:54:37

Test: 15c.3; Frequency = 2441, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/09/16 10:45
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

20 dB bandwidth MHz
1.114



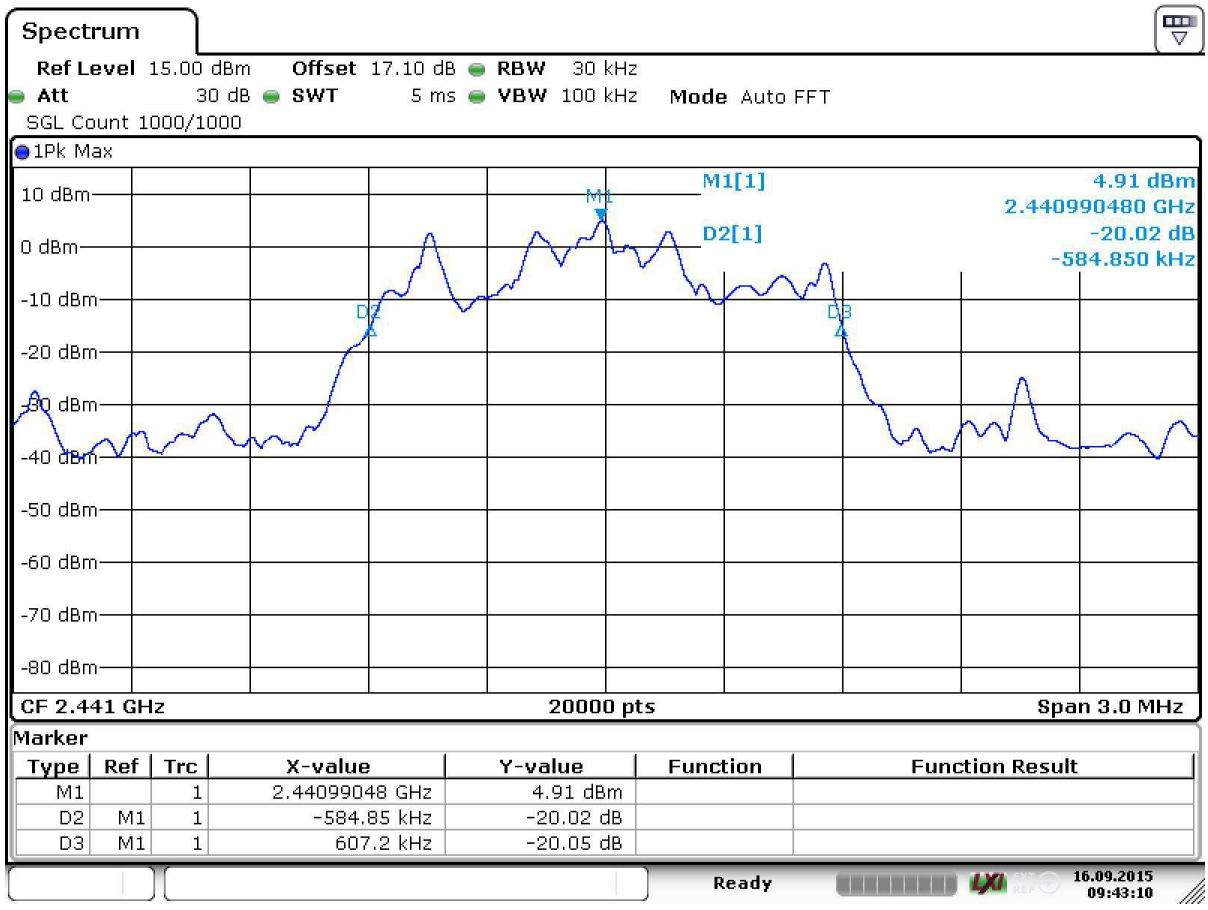
Date: 16.SEP.2015 09:50:46

Test: 15c.3; Frequency = 2441, Mode = BT transmit using 3 Mbps with 8DPSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/09/16 11:01
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

20 dB bandwidth MHz
1.192



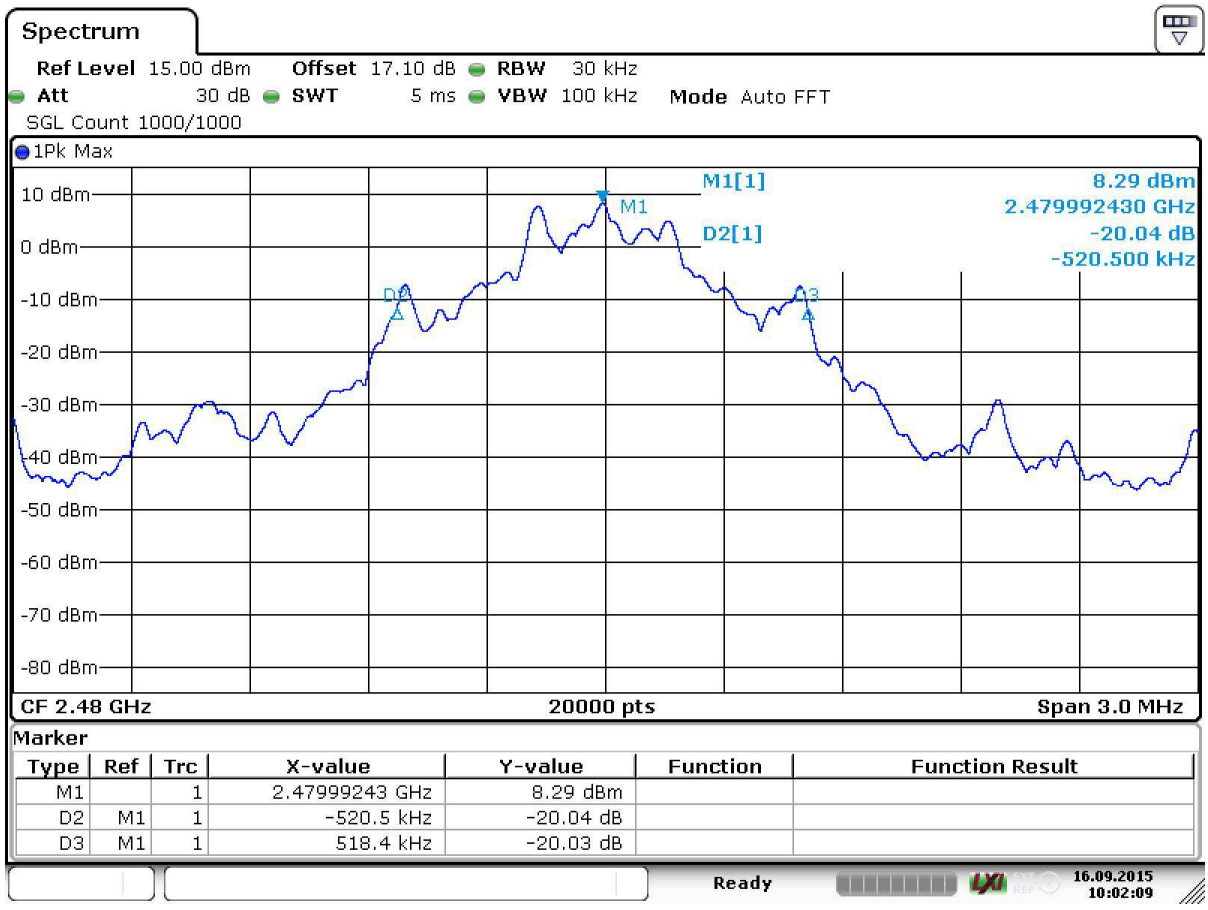
Date: 16.SEP.2015 09:43:10

Test: 15c.3; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/09/16 10:41
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

20 dB bandwidth MHz
1.039



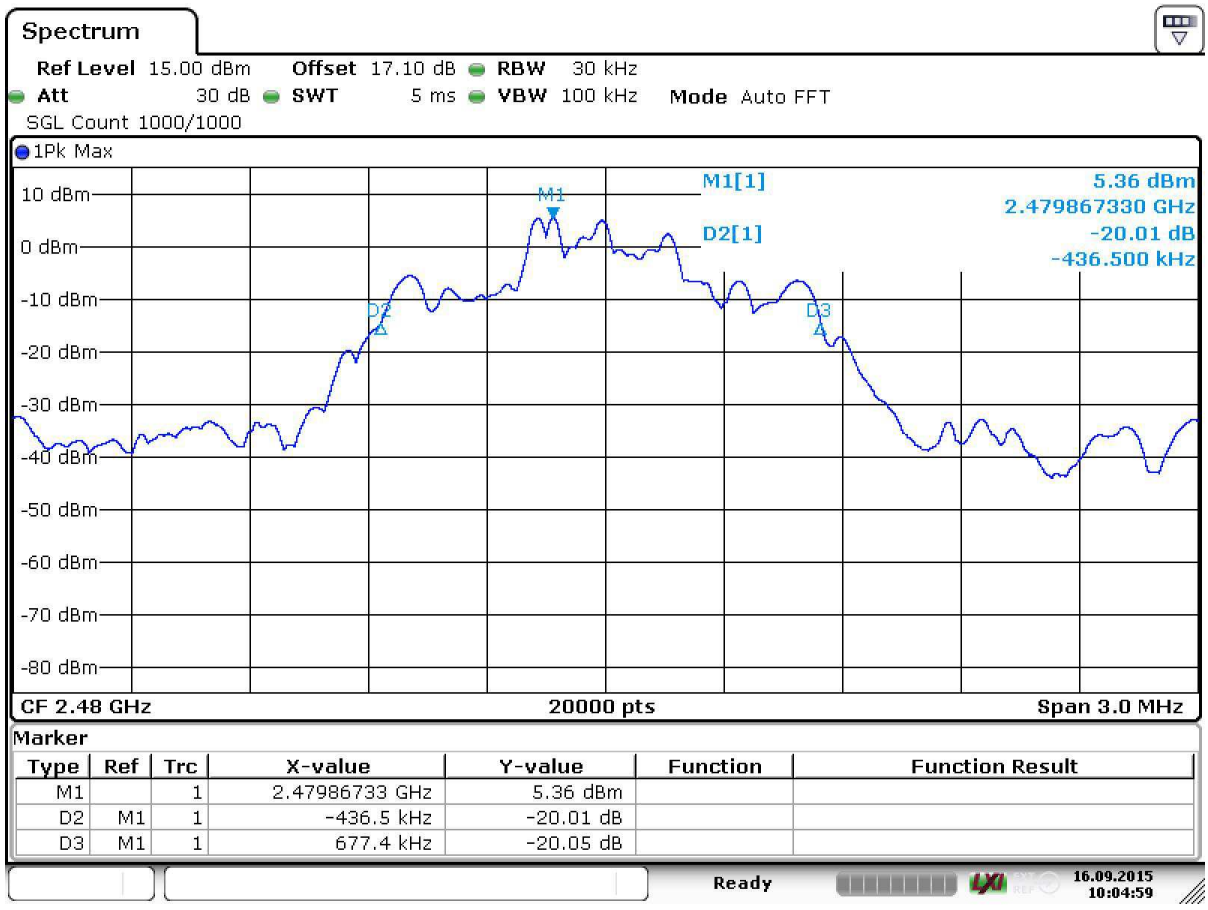
Date: 16.SEP.2015 10:02:09

Test: 15c.3; Frequency = 2480, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/09/16 10:45
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

20 dB bandwidth MHz
1.114



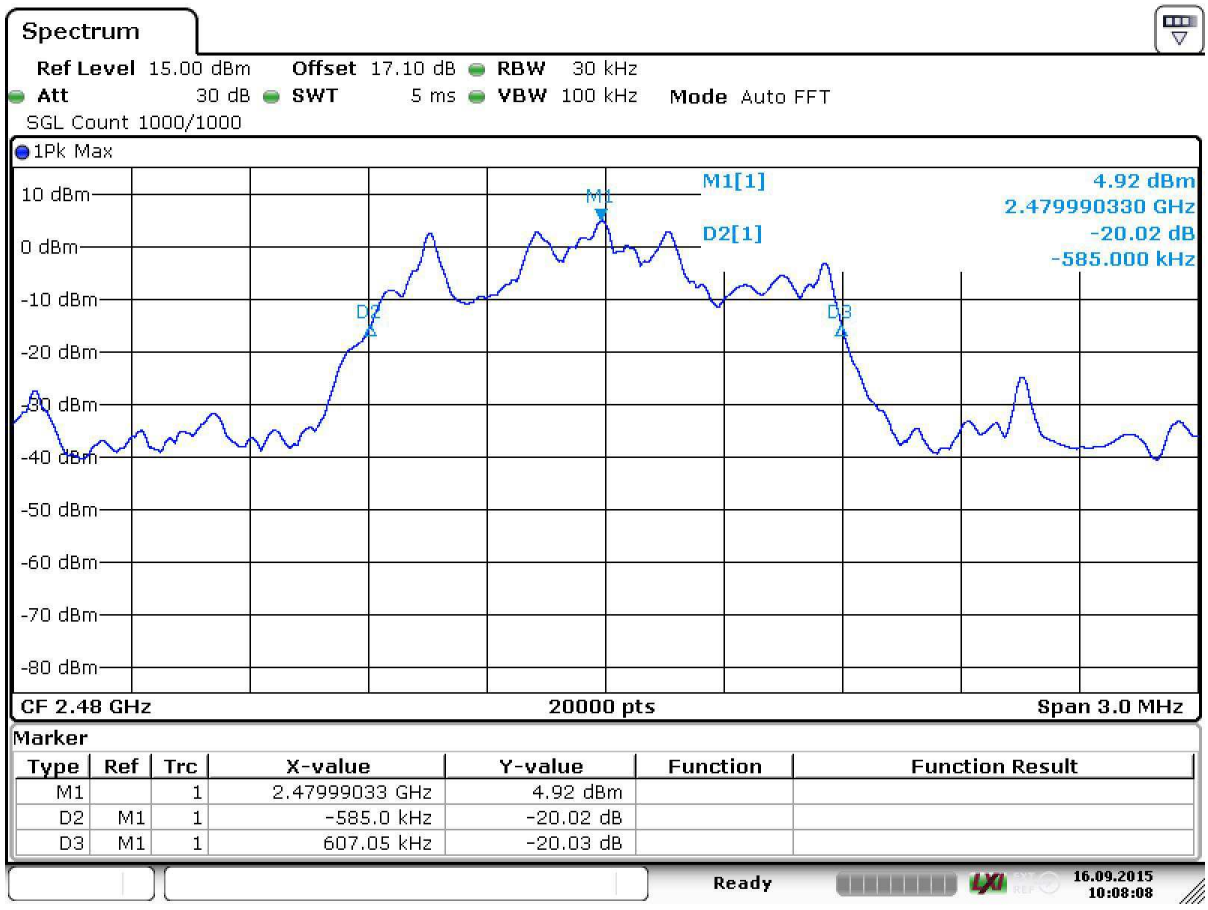
Date: 16.SEP.2015 10:04:59

Test: 15c.3; Frequency = 2480, Mode = BT transmit using 3 Mbps with 8DPSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/09/16 11:01
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

20 dB bandwidth MHz
1.192



Date: 16.SEP.2015 10:08:08

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

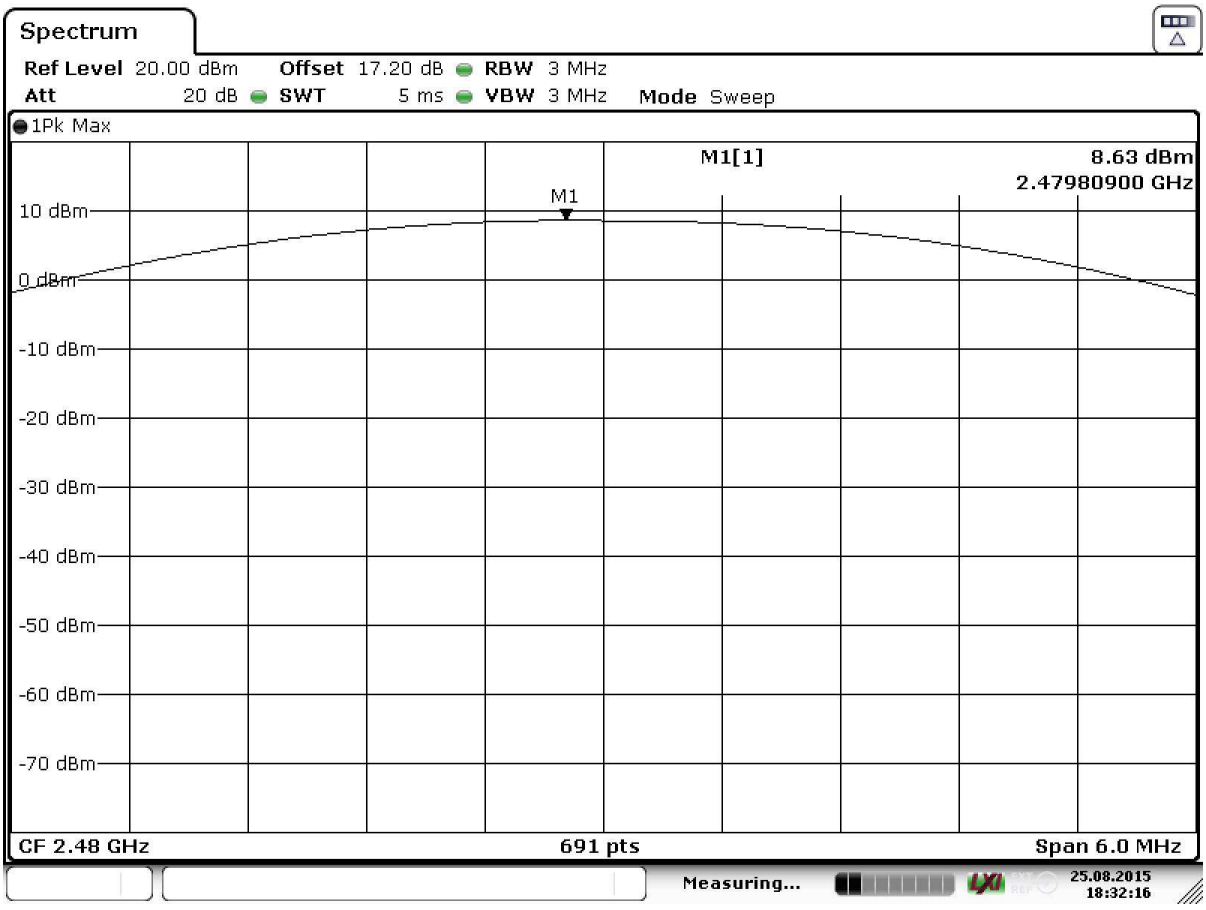
Test: 15c.4; Peak power output Summary

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/25 12:47
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

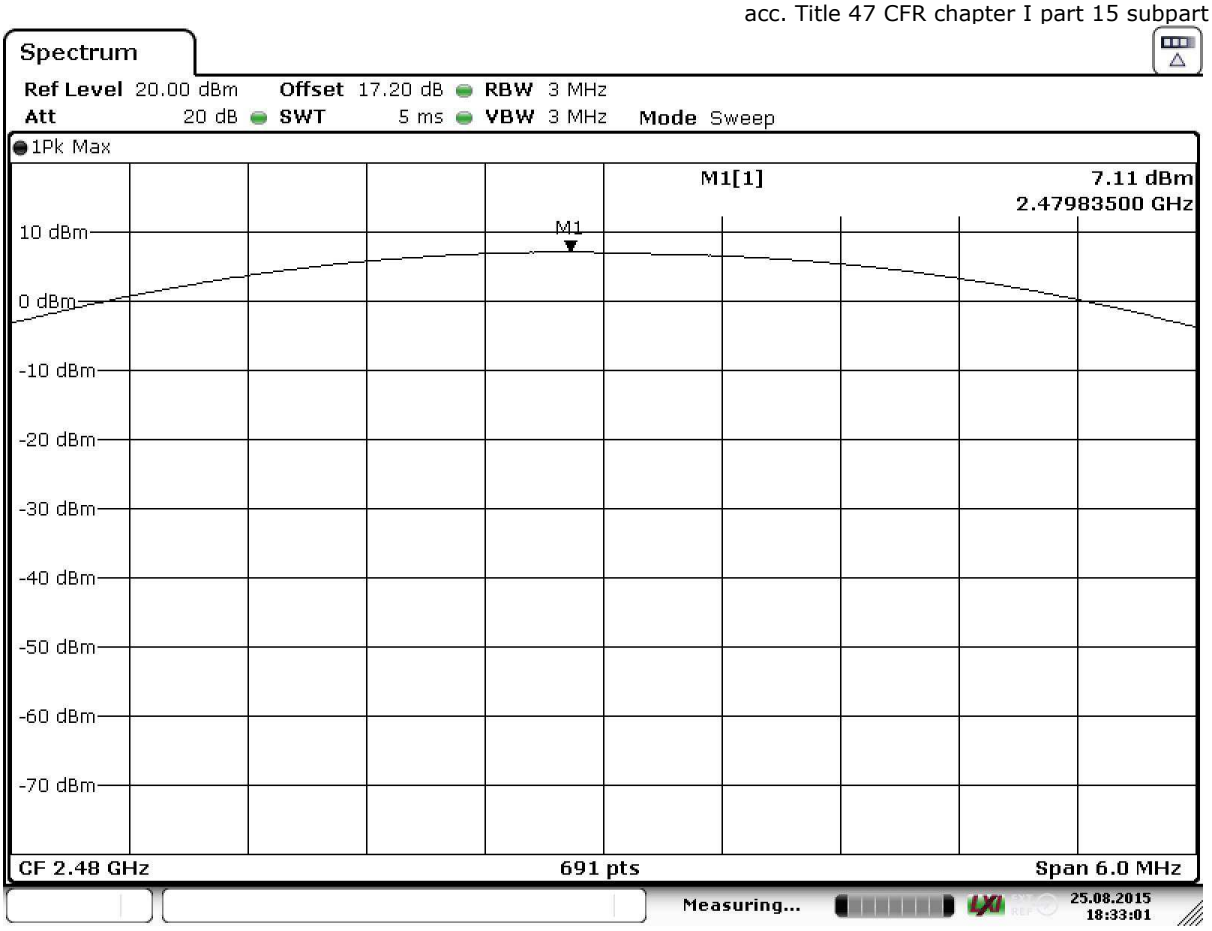
Detailed Results:

		Conducted Transmitter Power					
		2402 MHz		2441 MHz		2480 MHz	
Modulation	Conditions	Output Power (dBm)	Output Power (mW)	Output Power (dBm)	Output Power (mW)	Output Power (dBm)	Output Power (mW)
GFSK	TN, VN	8.18	6.58	8.59	7.23	8.63	7.29
π/4 DQPSK	TN, VN	6.47	4.44	7.06	5.08	7.11	5.14
8-DPSK	TN, VN	6.38	4.35	6.95	4.95	7.03	5.05

Max Conducted Output Power (FSK Modulation)	8.63	dBm	7.29	mW
Max Conducted Output Power (PSK Modulation)	7.11	dBm	5.14	mW



Date: 25.AUG.2015 18:32:16



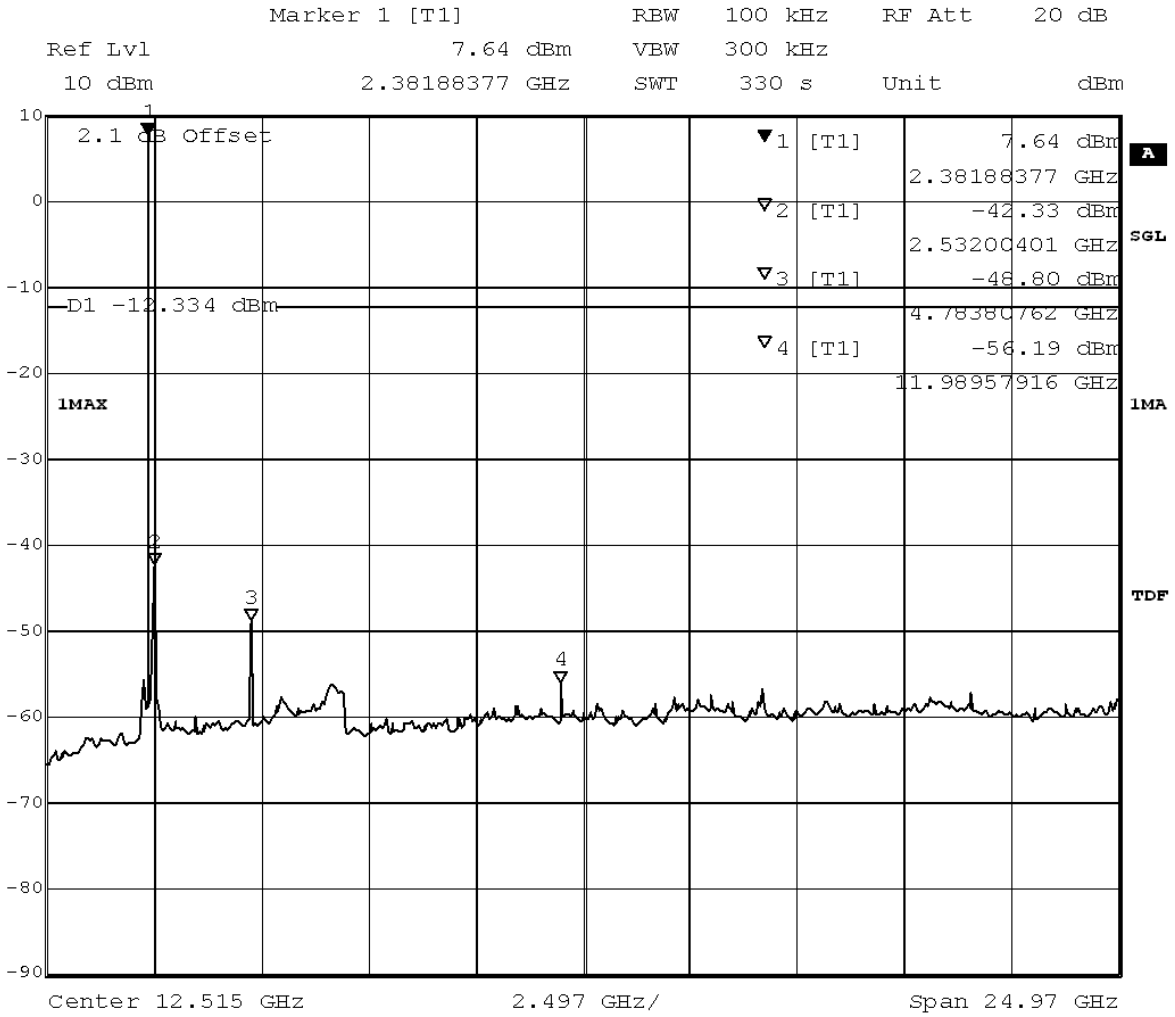
Date: 25.AUG.2015 18:33:00

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

Test: 15c.5; Frequency = 2402, Mode = BT transmit using 1 Mbps with GFSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 10:43
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:



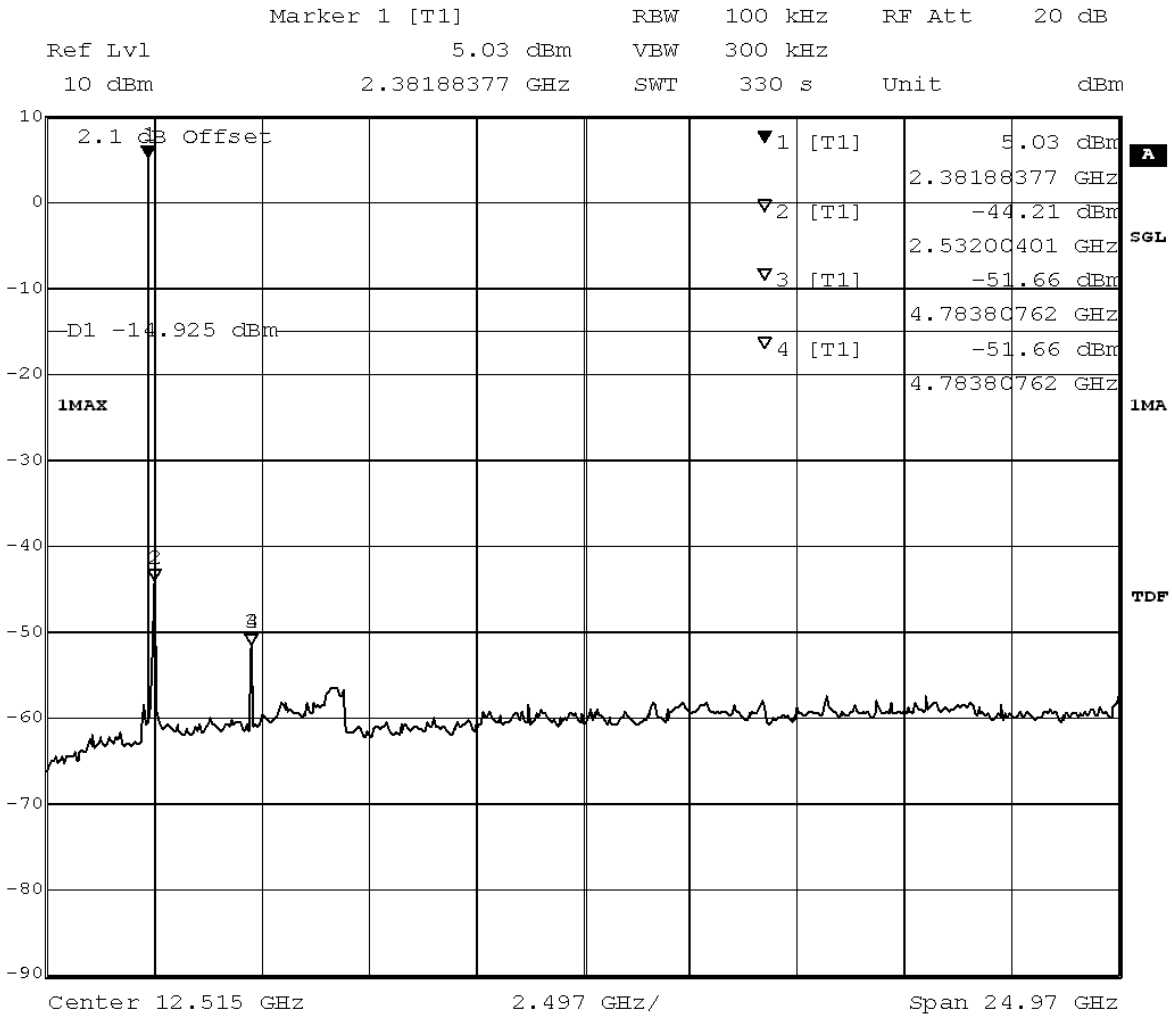
Title: spurious emissions
Comment A: CH B: 2402 MHz
Date: 26.AUG.2015 10:52:10

No further spurious emissions found within 20 dB to the limit

Test: 15c.5; Frequency = 2402, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 10:50
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:



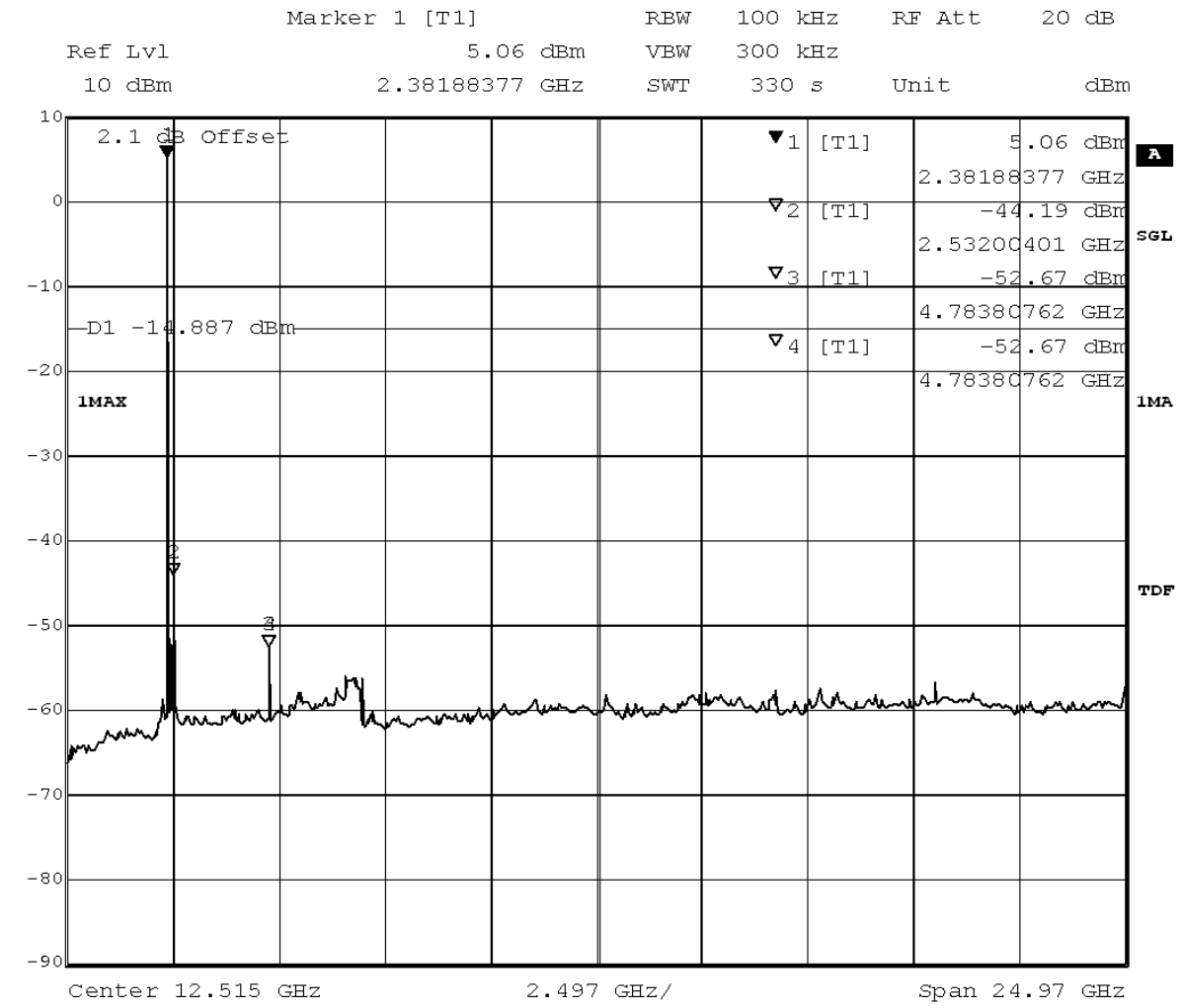
Title: spurious emissions
Comment A: CH B: 2402 MHz
Date: 26.AUG.2015 12:11:59

No further spurious emissions found within 20 dB to the limit

Test: 15c.5; Frequency = 2402, Mode = BT transmit using 3 Mbps with 8DPSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 11:02
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:



Title: spurious emissions
Comment A: CH B: 2402 MHz
Date: 26.AUG.2015 13:10:39

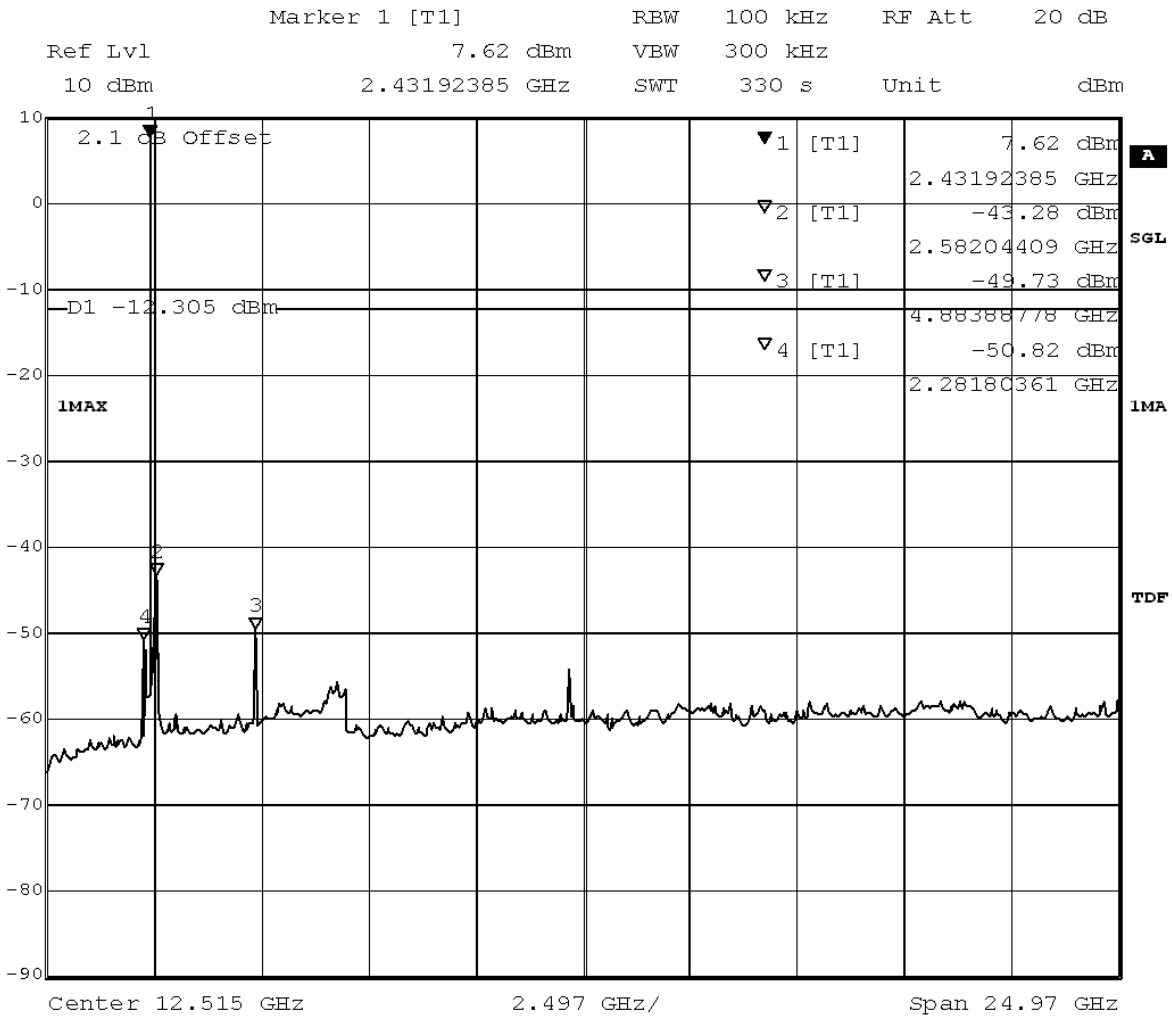
No further spurious emissions found within 20 dB to the limit

Test: 15c.5; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 10:43
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
2441		7.69		



Title: spurious emissions
Comment A: CH M: 2441 MHz
Date: 26.AUG.2015 11:10:47

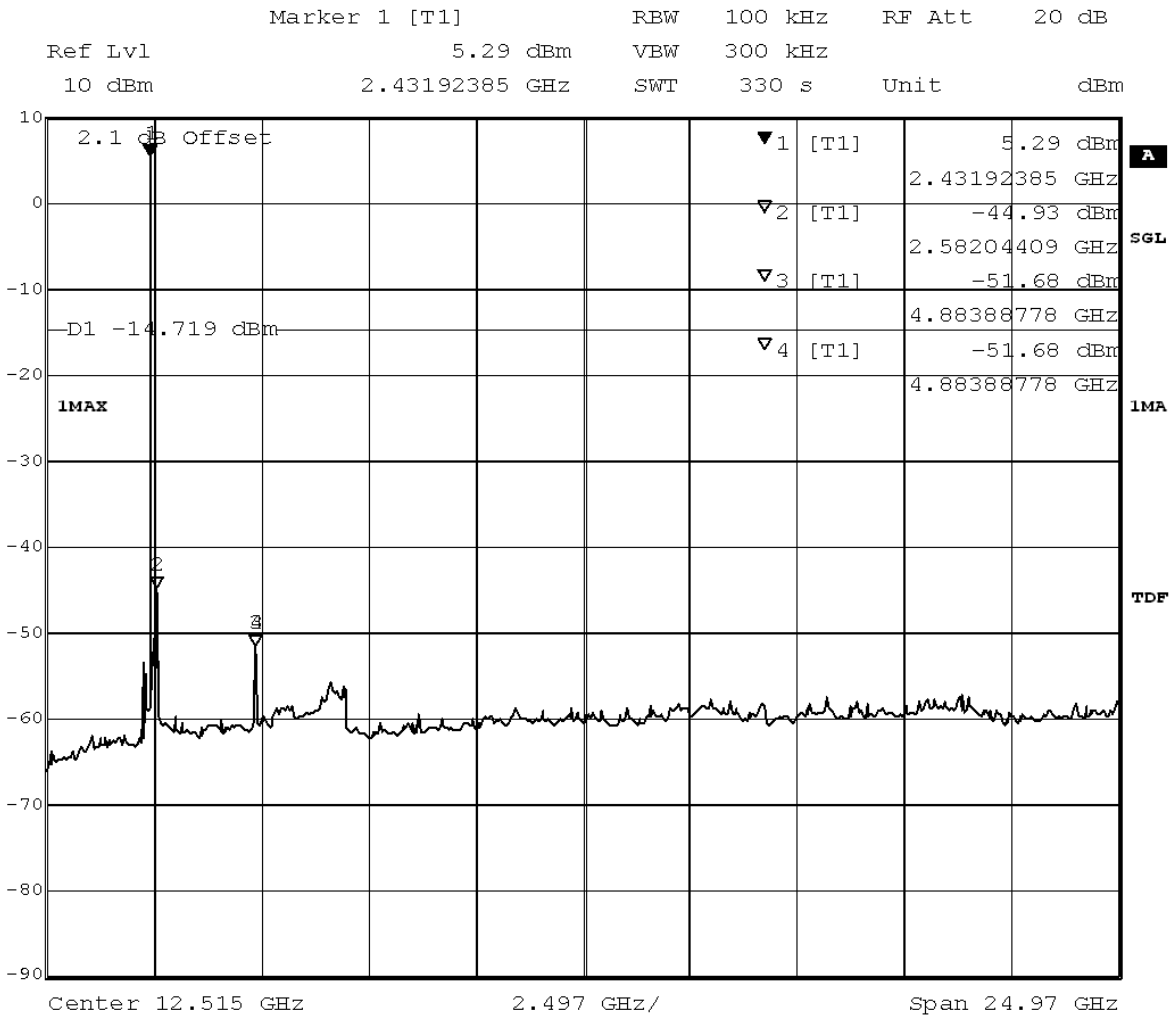
No further spurious emissions found within 20 dB to the limit

Test: 15c.5; Frequency = 2441, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 10:50
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
2441		5.28		



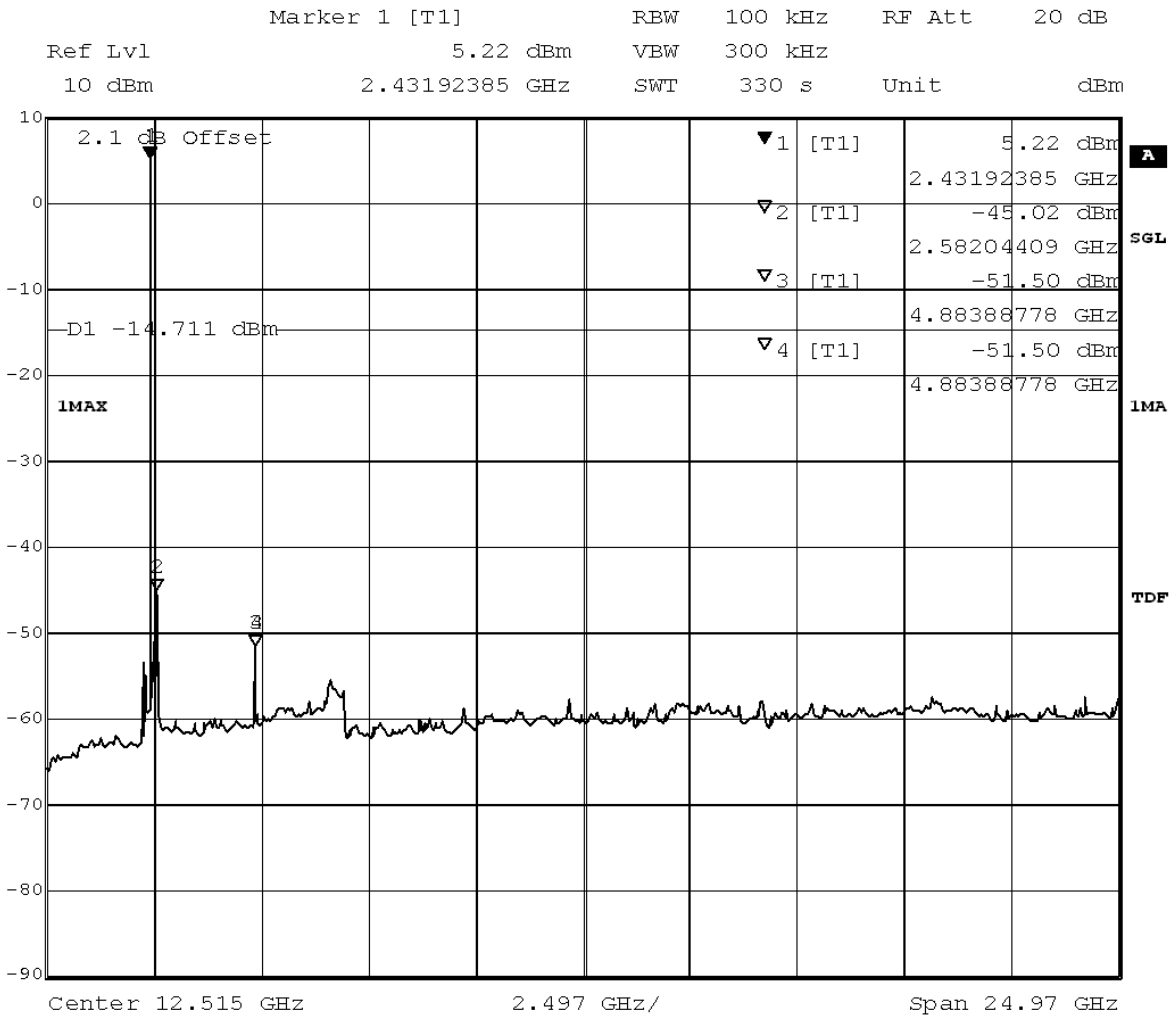
No further spurious emissions found within 20 dB to the limit

Test: 15c.5; Frequency = 2441, Mode = BT transmit using 3 Mbps with 8DPSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 11:02
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
2441		5.29		



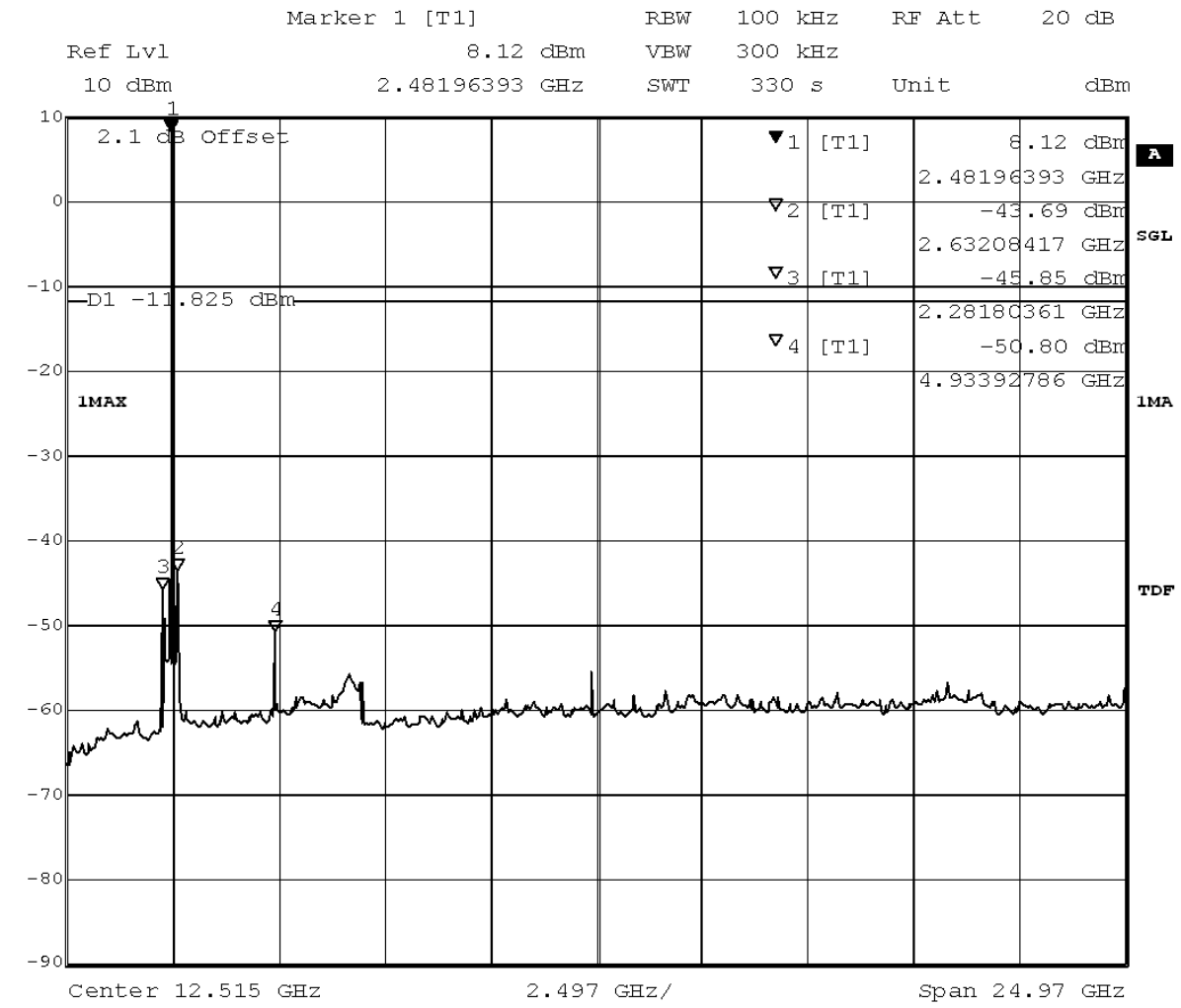
Title: spurious emissions
Comment A: CH M: 2441 MHz
Date: 26.AUG.2015 13:27:32

No further spurious emissions found within 20 dB to the limit

Test: 15c.5; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 10:43
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:



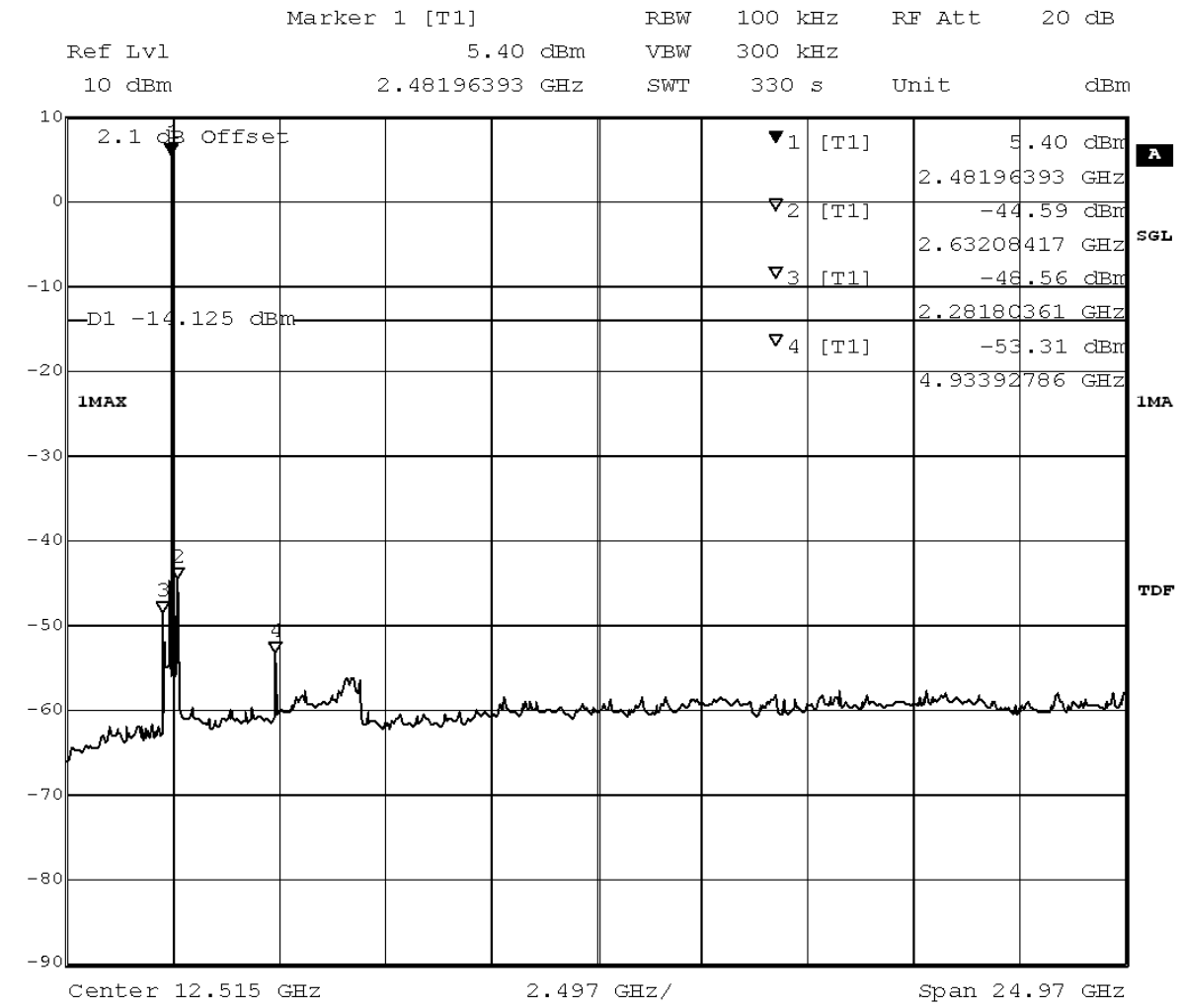
Title: spurious emissions
Comment A: CH T: 2480 MHz
Date: 26.AUG.2015 11:26:04

No further spurious emissions found within 20 dB to the limit

Test: 15c.5; Frequency = 2480, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 10:50
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:



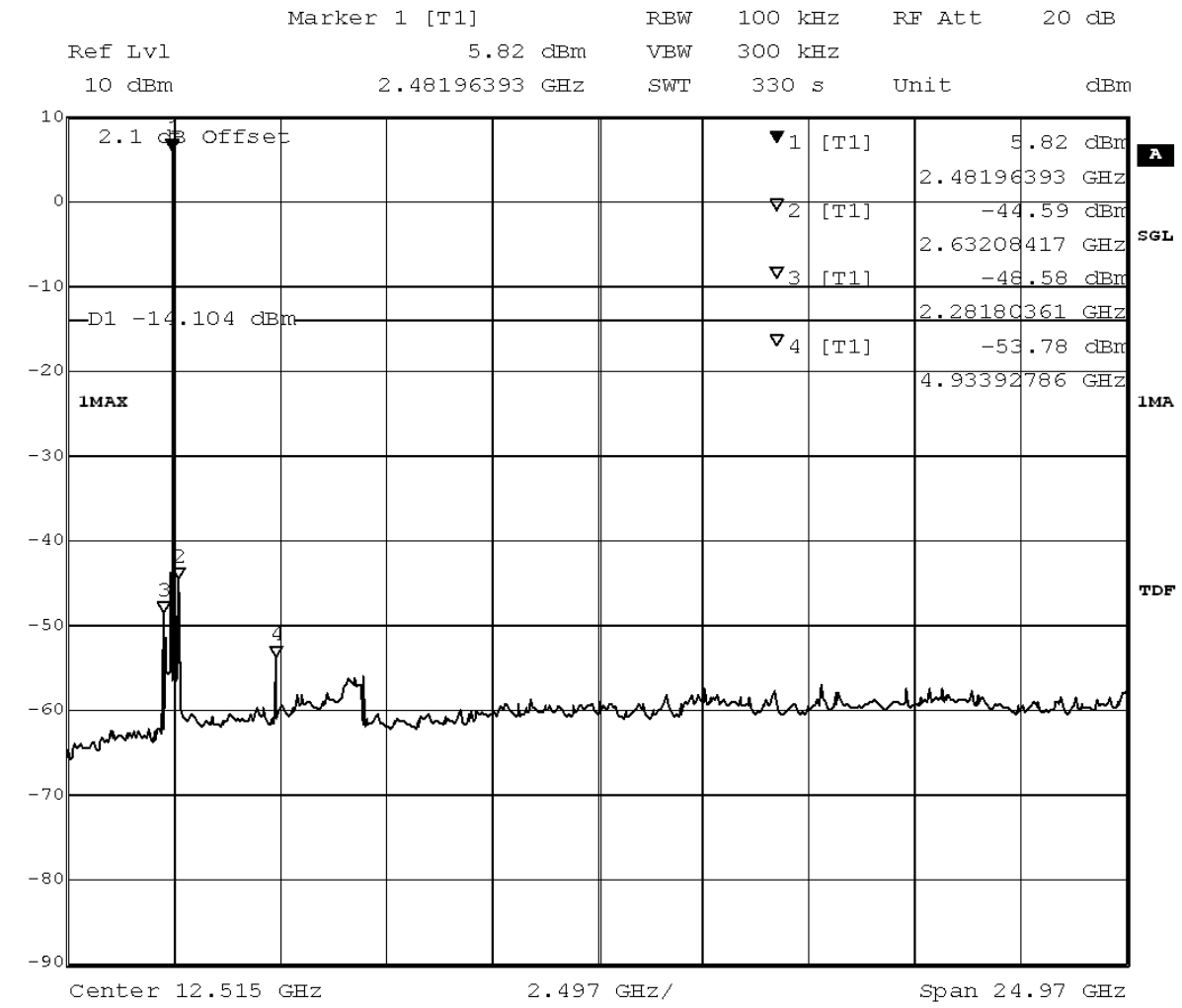
Title: spurious emissions
Comment A: CH T: 2480 MHz
Date: 26.AUG.2015 11:41:22

No further spurious emissions found within 20 dB to the limit

Test: 15c.5; Frequency = 2480, Mode = BT transmit using 3 Mbps with 8DPSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 11:02
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:



Title: spurious emissions
Comment A: CH T: 2480 MHz
Date: 26.AUG.2015 13:43:04

No further spurious emissions found within 20 dB to the limit

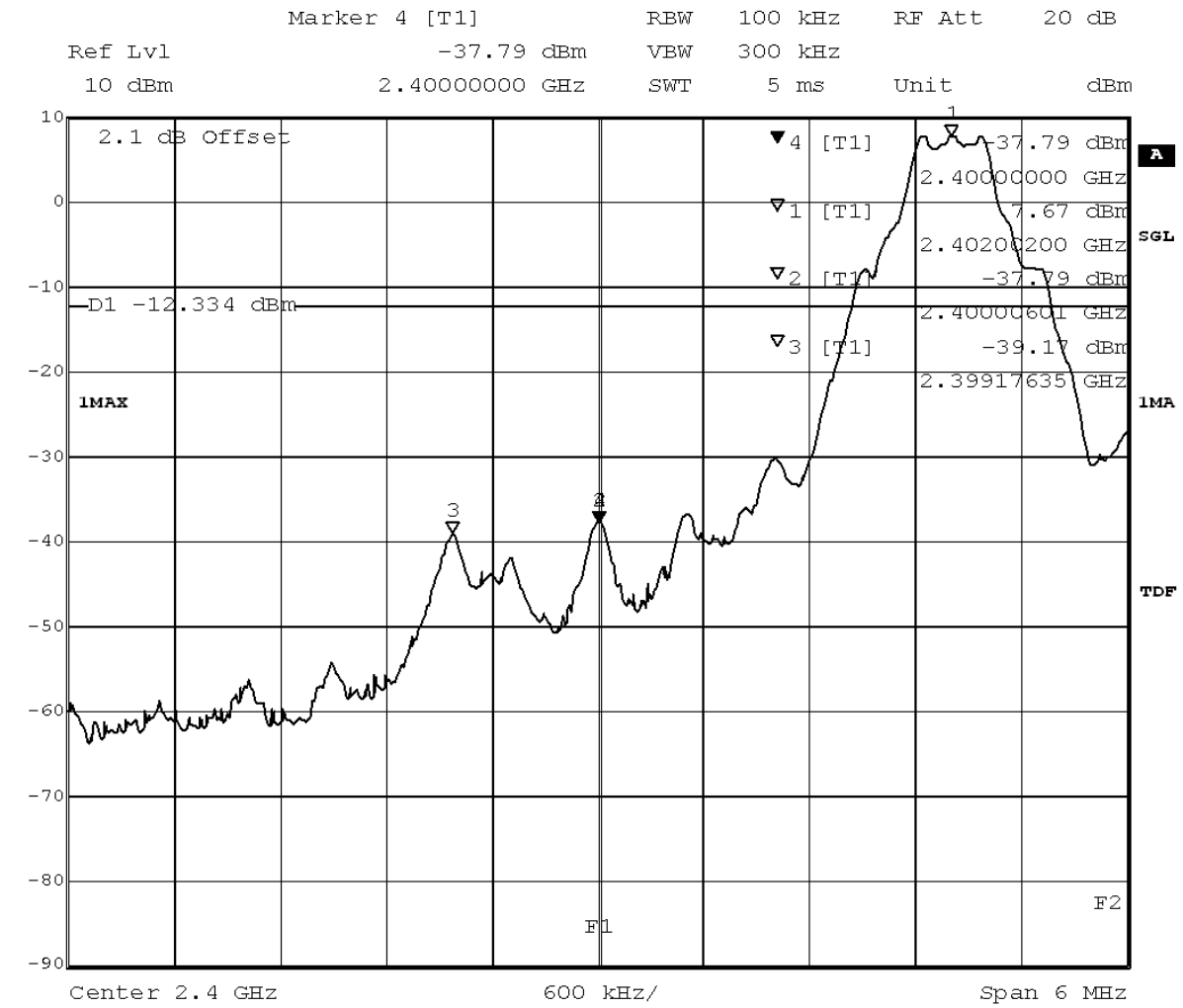
3.5.6 15c.6 Band edge compliance §15.247 (d)

Test: 15c.6; Frequency = 2402, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = conducted, band edge = 2400 MHz

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 10:52
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	-37.79	7.67	-12.33	25.46



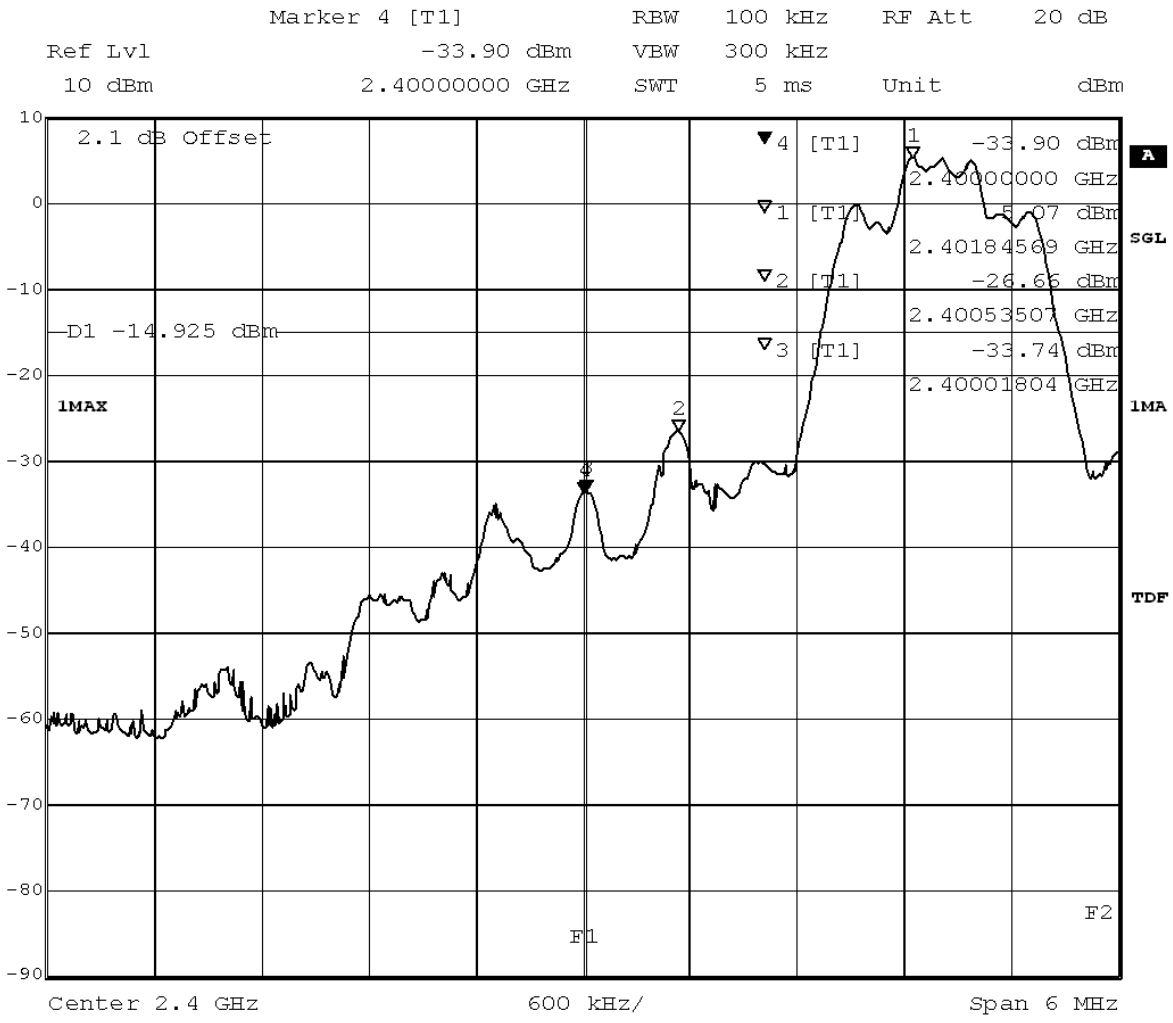
Title: Band Edge Compliance
Comment A: CH B: 2402 MHz
Date: 26.AUG.2015 10:39:30

Test: 15c.6; Frequency = 2402, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method = conducted, band edge = 2400 MHz

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 10:54
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	-33.90	5.07	-14.93	18.98



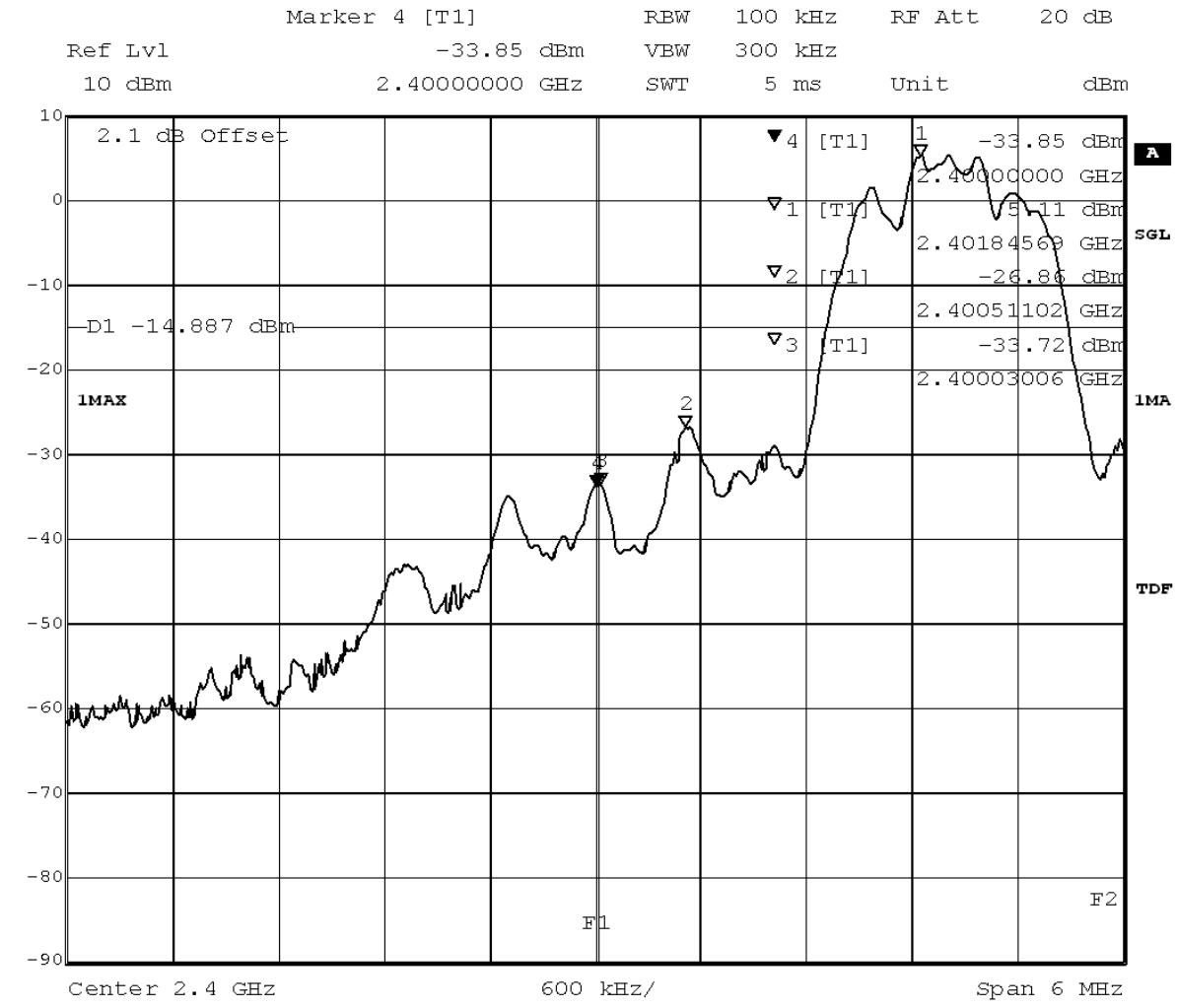
Title: Band Edge Compliance
Comment A: CH B: 2402 MHz
Date: 26.AUG.2015 11:59:21

Test: 15c.6; Frequency = 2402, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = conducted, band edge = 2400 MHz

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 10:59
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	-33.85	5.11	-14.89	18.96



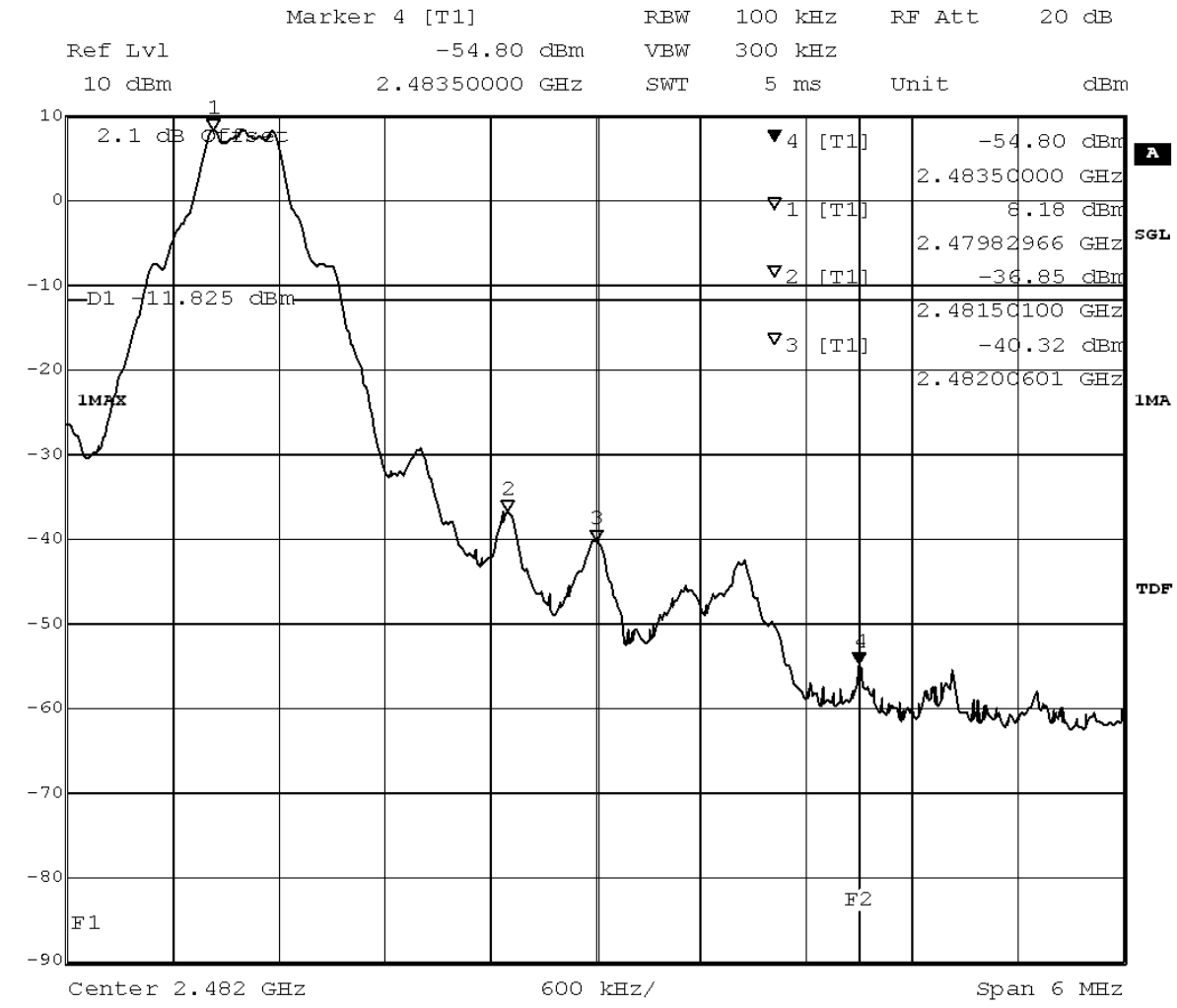
Title: Band Edge Compliance
Comment A: CH B: 2402 MHz
Date: 26.AUG.2015 12:58:02

Test: 15c.6; Frequency = 2480, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = conducted, band edge = 2483.5 MHz

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 10:52
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	-54.80	8.18	-11.82	42.97



Title: Band Edge Compliance
Comment A: CH T: 2480 MHz
Date: 26.AUG.2015 11:13:27

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

Result: Passed

Setup No.: S02_AB01

Date of Test: 2015/06/06 17:32

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

Detailed Results:

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
2480 MHz	Ver + Hor	74	54	2483.5	47.10	35.10	26.90	18.90	Passed

Test: 15c.6; Frequency = 2480, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method = conducted, band edge = 2483.5 MHz

Result: Passed

Setup No.: S01_AC01

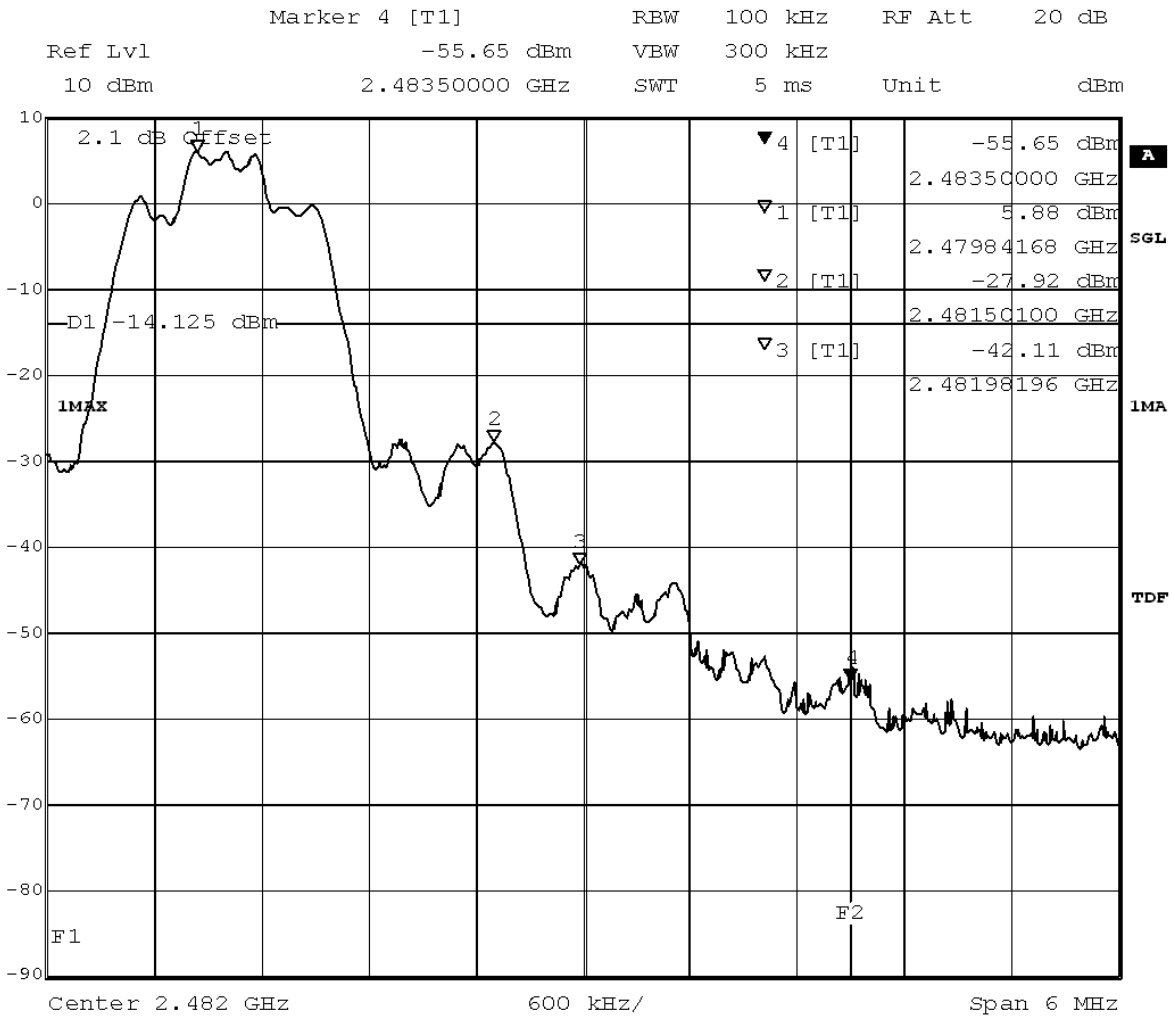
Date of Test: 2015/08/26 10:54

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	-55.65	5.88	-14.12	41.52



Test: 15c.6; Frequency = 2480, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method = radiated

Result:	Passed
Setup No.:	S02_AB01
Date of Test:	2015/06/06 17:30
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

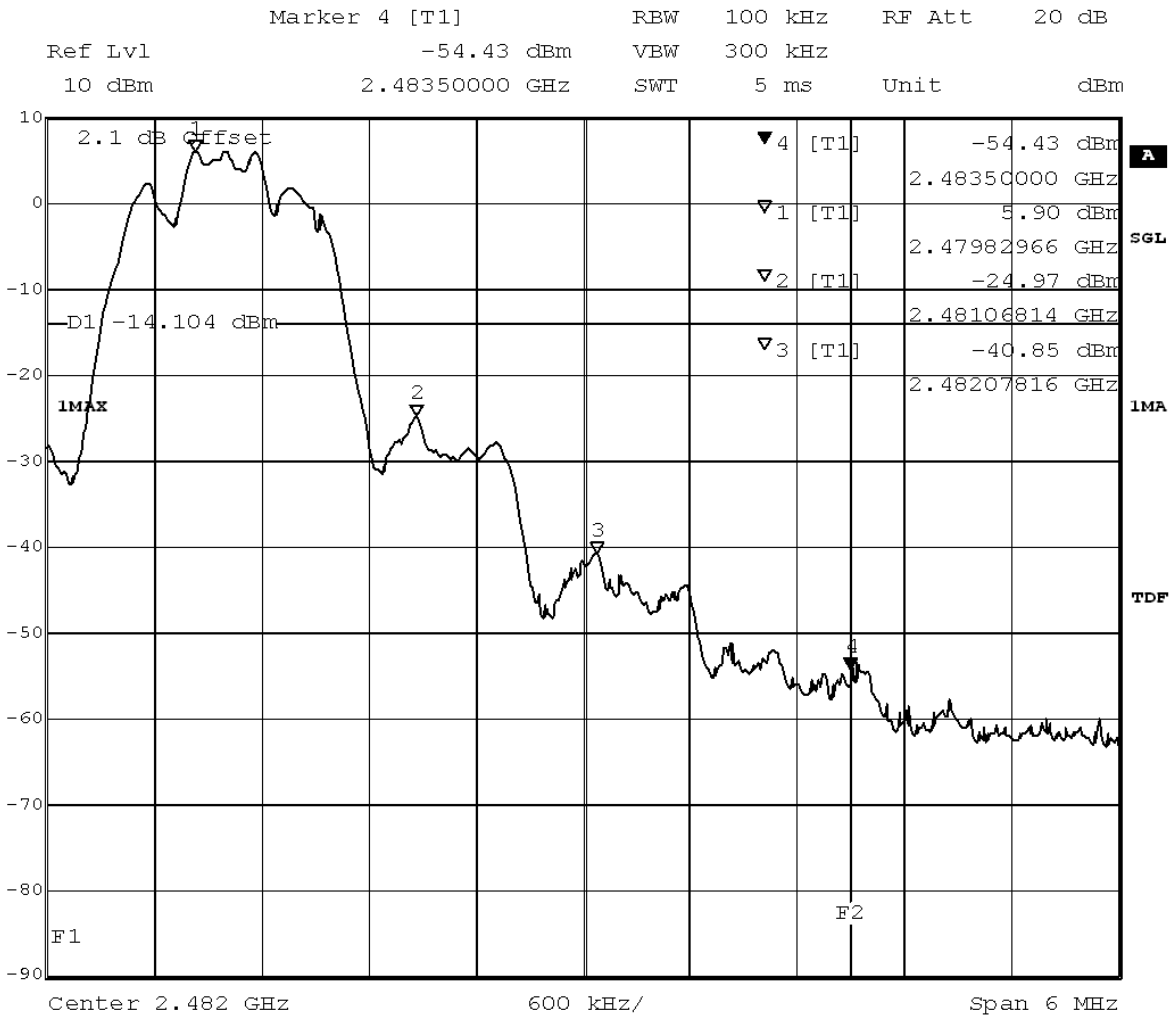
TX on	Ant. Polar.	Limit PK [dBµV]	Limit AV [dBµV]	Frequency [MHz]	Corrected value PK [dBµV]	Corrected value AV [dBµV]	Margin PK [dB]	Margin AV [dB]	Result
2480 MHz	Ver + Hor	74	54	2483.5	48.40	35.00	25.60	19.00	Passed

Test: 15c.6; Frequency = 2480, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = conducted, band edge = 2483.5 MHz

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/08/26 10:59
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	-54.43	5.90	-14.10	40.32



Title: Band Edge Compliance
Comment A: CH T: 2480 MHz
Date: 26.AUG.2015 13:30:24

Test: 15c.6; Frequency = 2480, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = radiated

Result:	Passed
Setup No.:	S02_AB01
Date of Test:	2015/06/06 17:31
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

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
2480 MHz	Ver + Hor	74	54	2483.5	48.10	35.40	25.90	18.60	Passed

Test: 15c.6; Frequency = hopping, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = conducted, band edge = 2400 MHz

Result: Passed

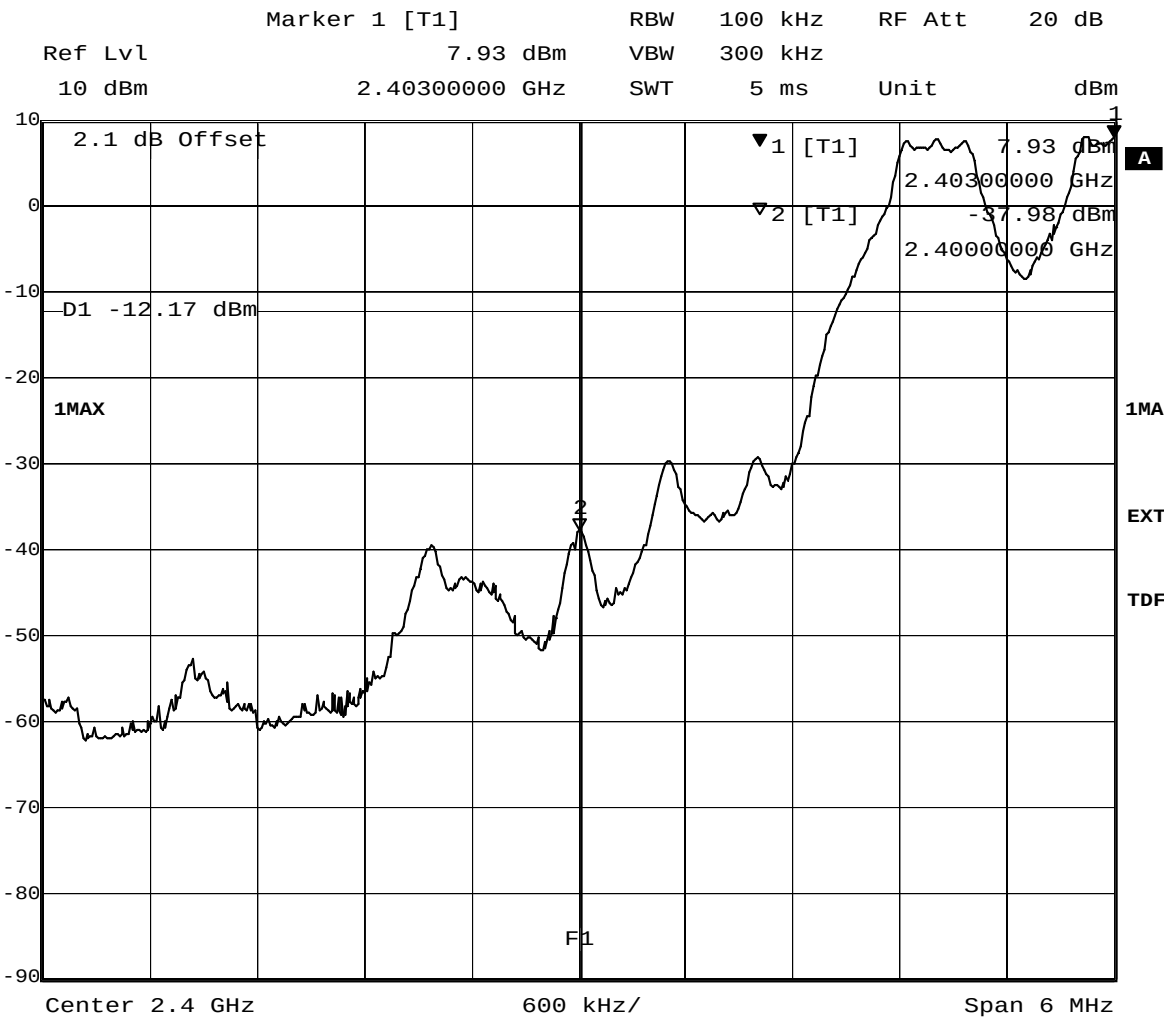
Setup No.: S01_AC01

Date of Test: 2015/06/02 11:28

Body: FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

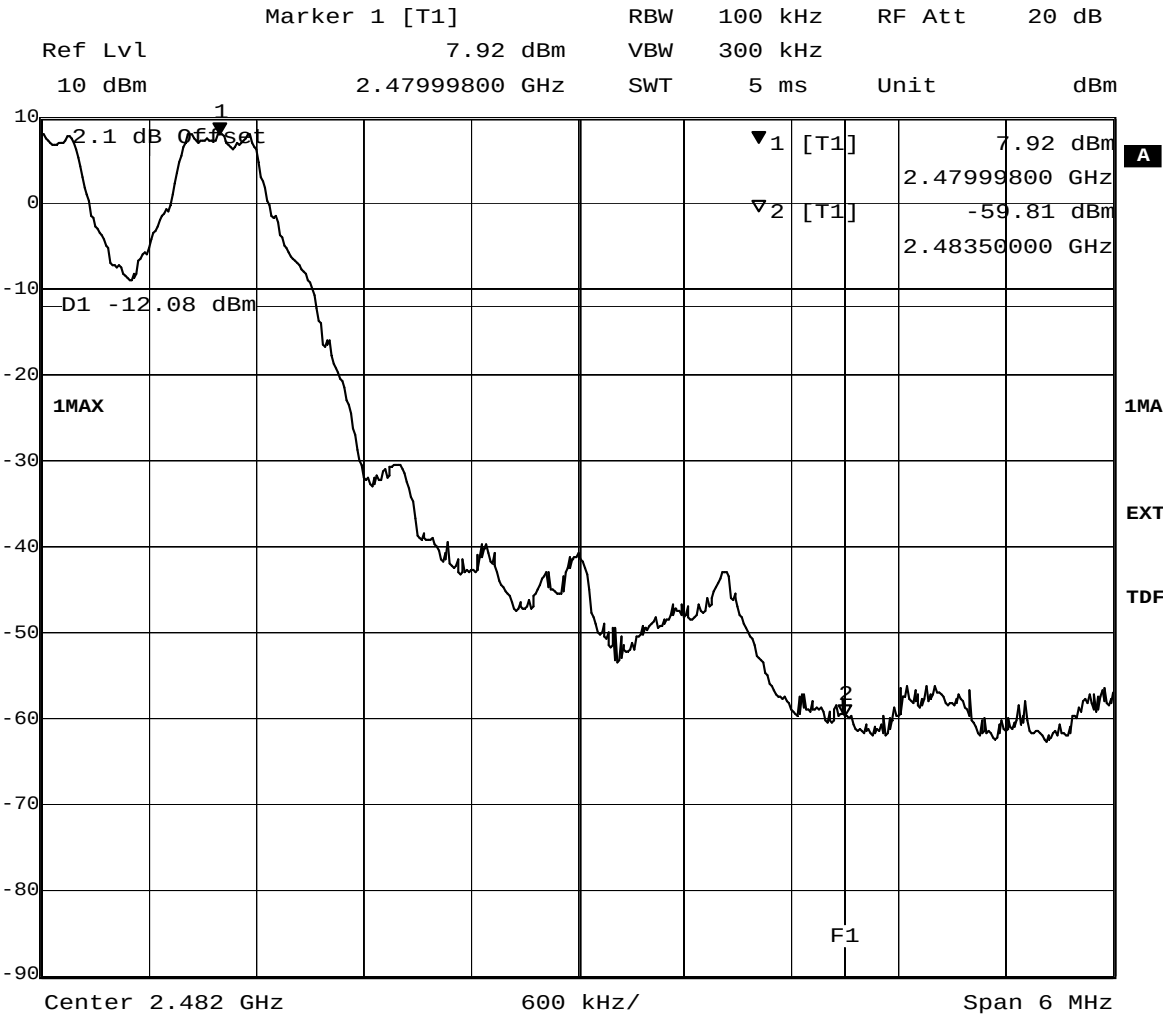
Detailed Results:



Test: 15c.6; Frequency = hopping, Mode = BT transmit using 1 Mbps with GFSK modulation, Method = conducted, band edge = 2483.5 MHz

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/06/02 11:34
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

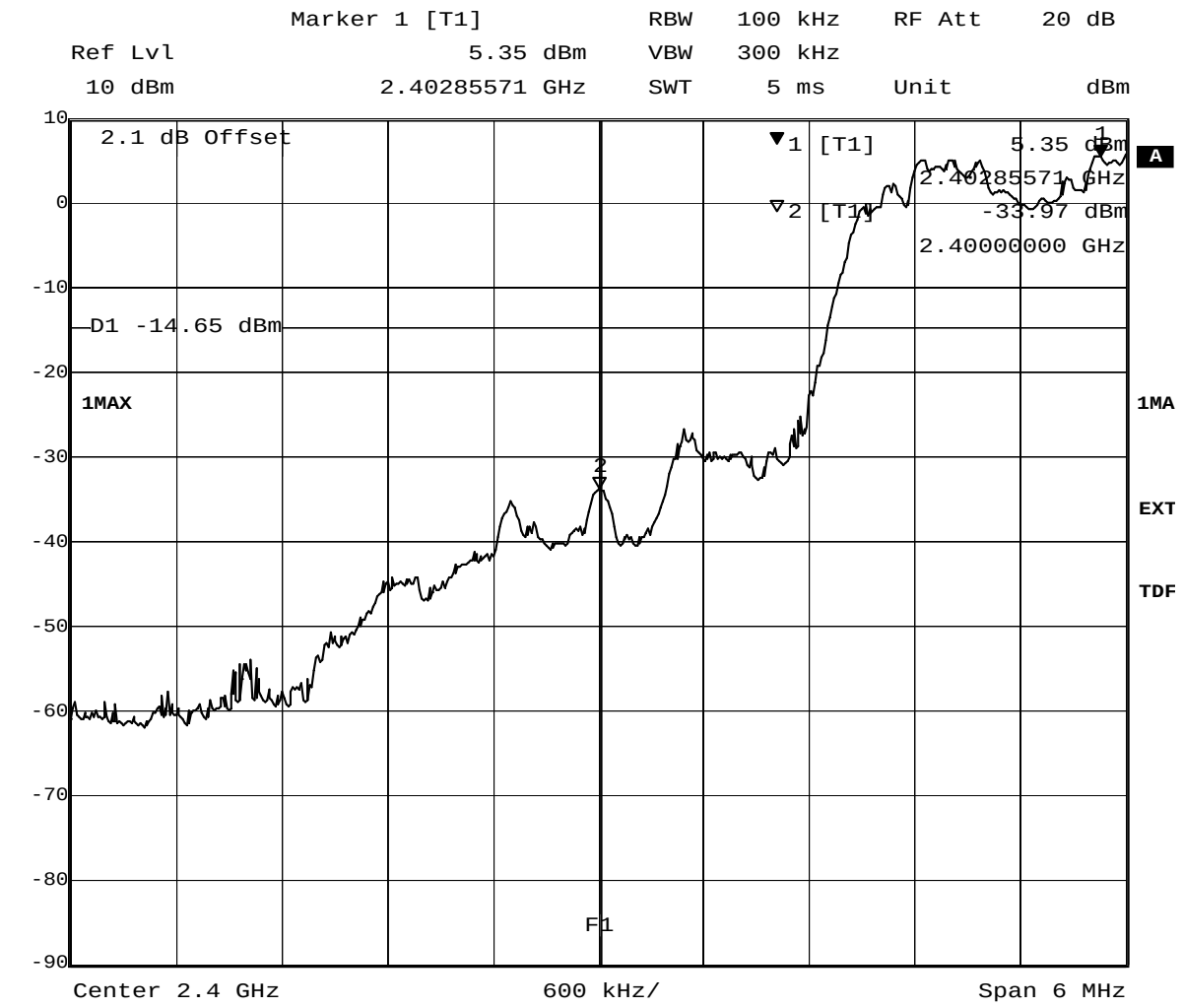


Title: Number of hopping frequencies
Comment A: CH H: Hopping
Date: 2.JUN.2015 11:20:50

Test: 15c.6; Frequency = hopping, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method = conducted, band edge=2400 MHz

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/06/02 11:16
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

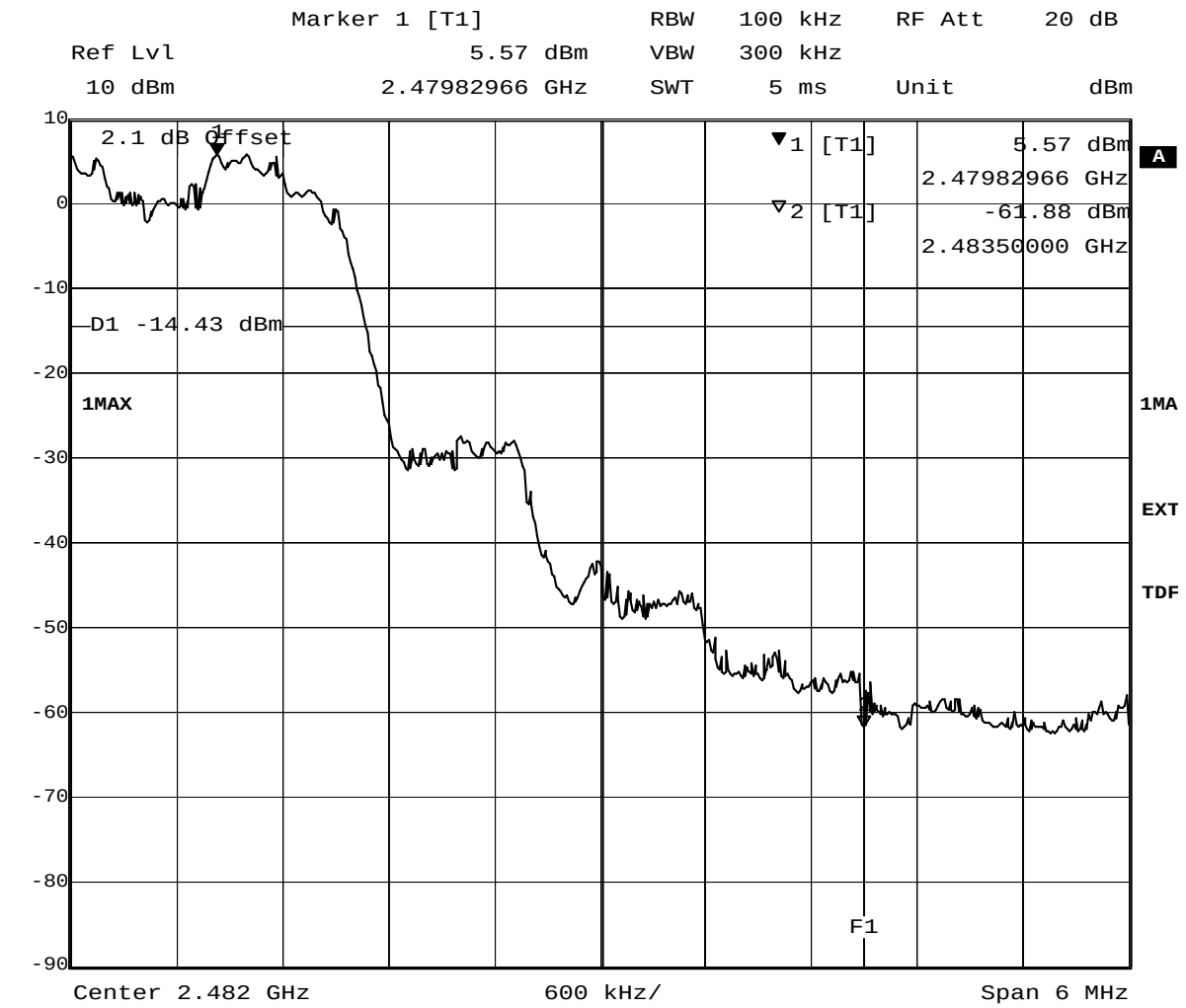


Title: Number of hopping frequencies
Comment A: CH H: Hopping
Date: 2.JUN.2015 11:02:15

Test: 15c.6; Frequency = hopping, Mode = BT transmit using 2 Mbps with PI/4 DQPSK modulation, Method=conducted, band edge=2483.5 MHz

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/06/02 12:46
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

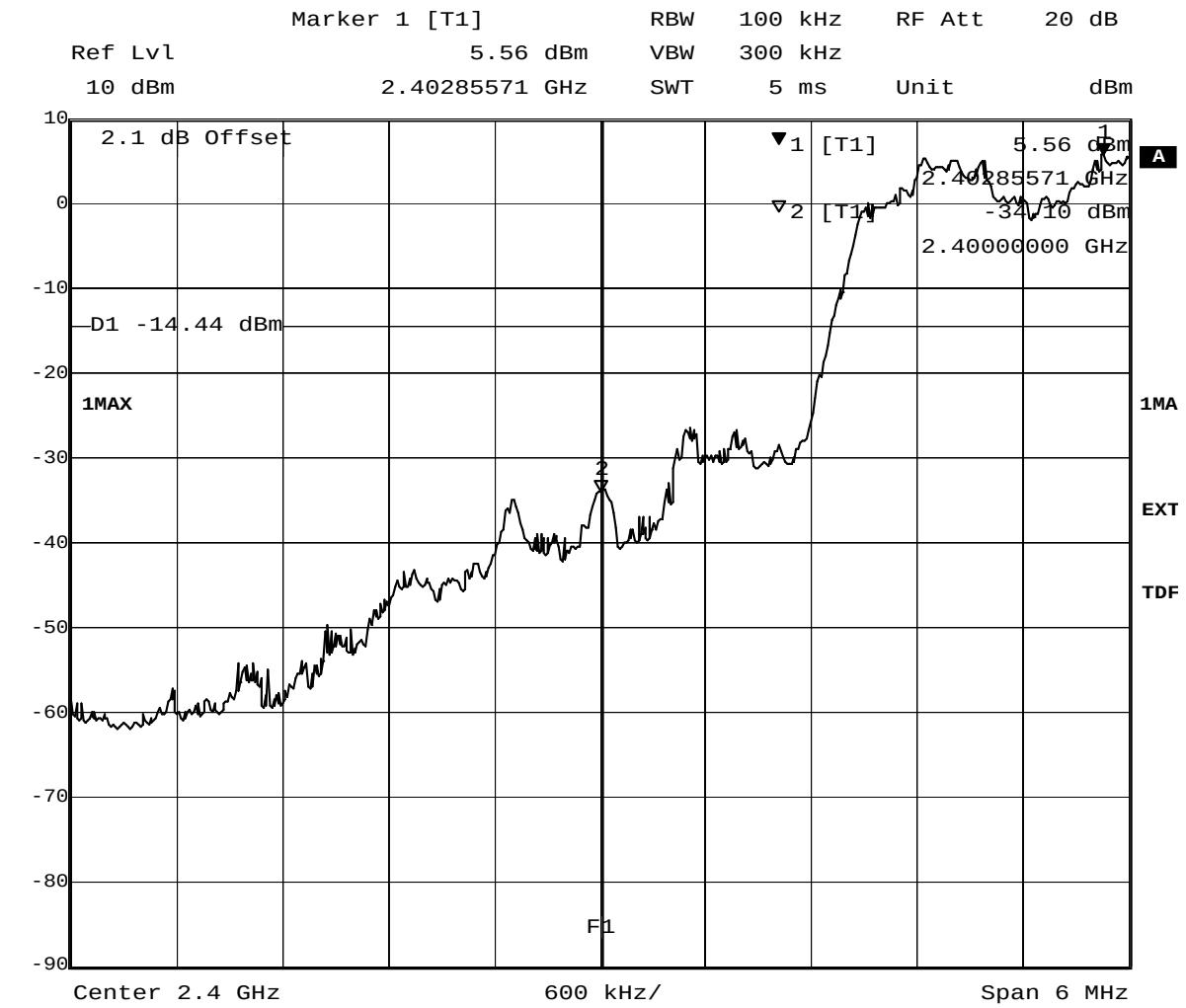


Title: Number of hopping frequencies
Comment A: CH H: Hopping
Date: 2.JUN.2015 11:32:30

Test: 15c.6; Frequency = hopping, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = conducted, band edge = 2400 MHz

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/06/02 11:00
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

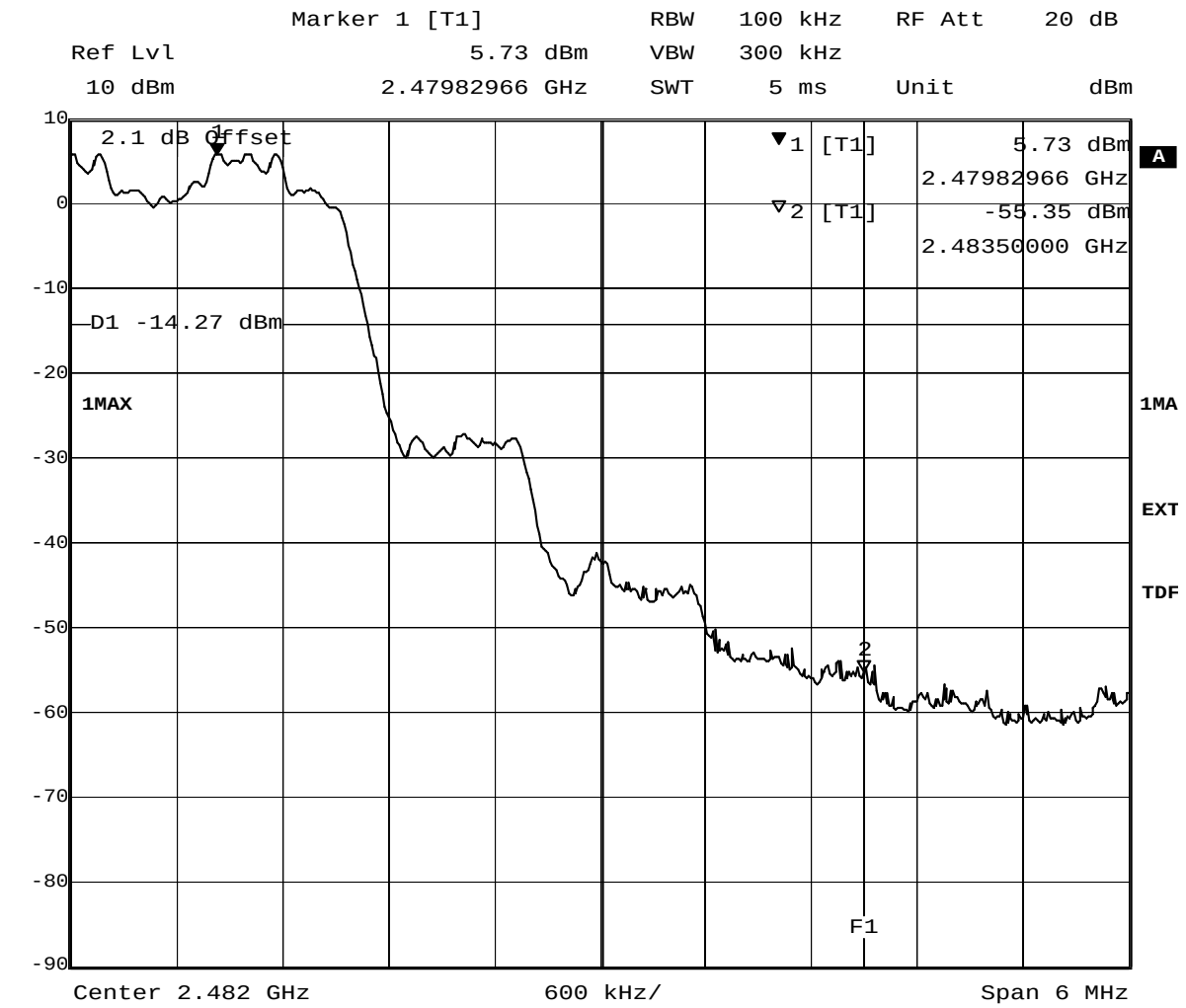


Title: Number of hopping frequencies
Comment A: CH H: Hopping
Date: 2.JUN.2015 10:44:40

Test: 15c.6; Frequency = hopping, Mode = BT transmit using 3 Mbps with 8DPSK modulation, Method = conducted, band edge = 2483.5 MHz

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/06/02 12:46
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:



Title: Number of hopping frequencies
Comment A: CH H: Hopping
Date: 2.JUN.2015 12:31:19

3.5.7 15c.7 Dwell time §15.247 (a) (1) (iii)

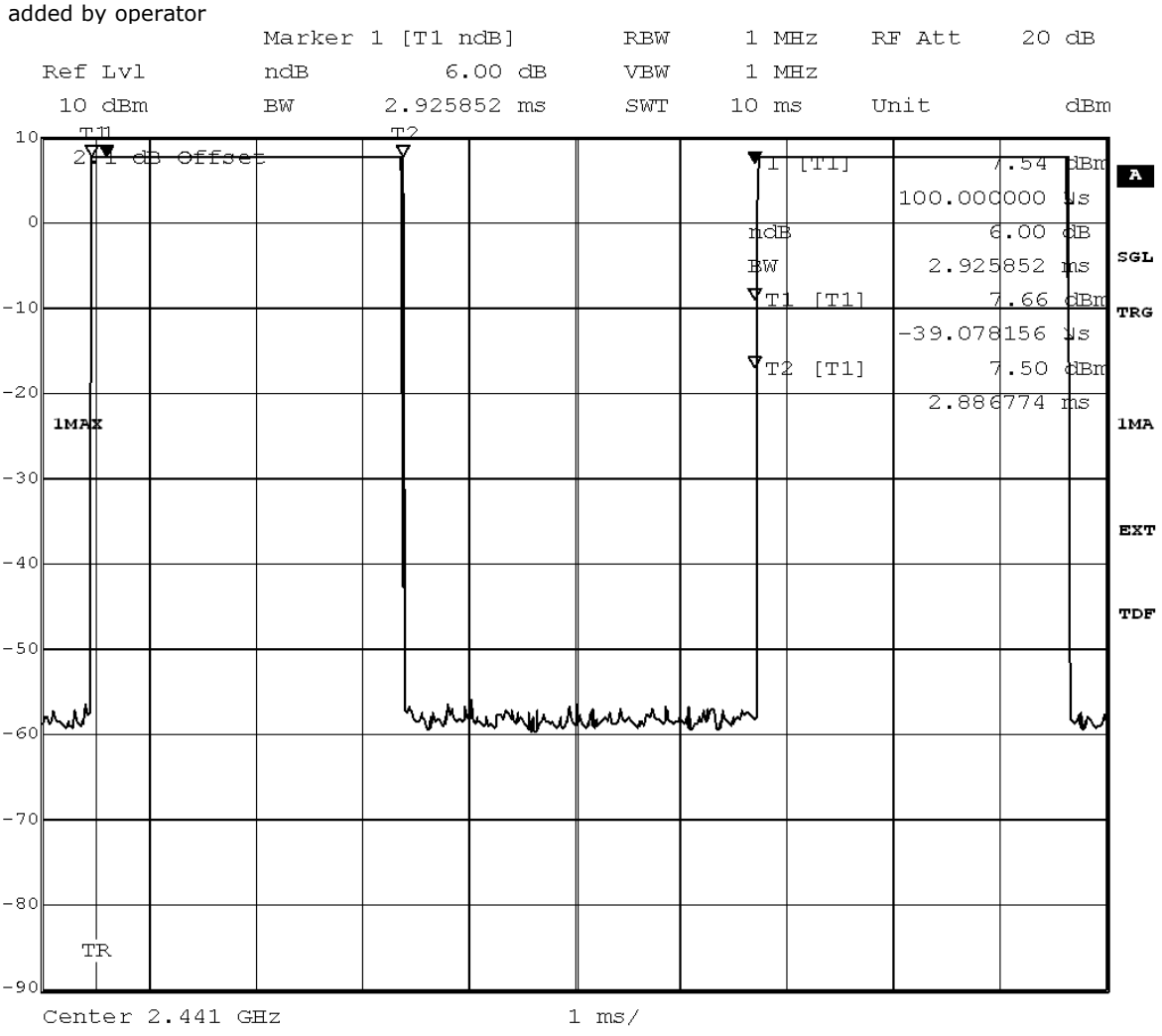
Test: 15c.7; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/06/02 10:44
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

Packet type	Time slot length	Dwell time	Dwell time ms
DH5	2.93	time slot length * 1600/5 /79 * 31.6	374.51

added by operator



Title: Dwell time
Comment A: CH M: 2441 MHz
Date: 2.JUN.2015 09:20:37

added by operator

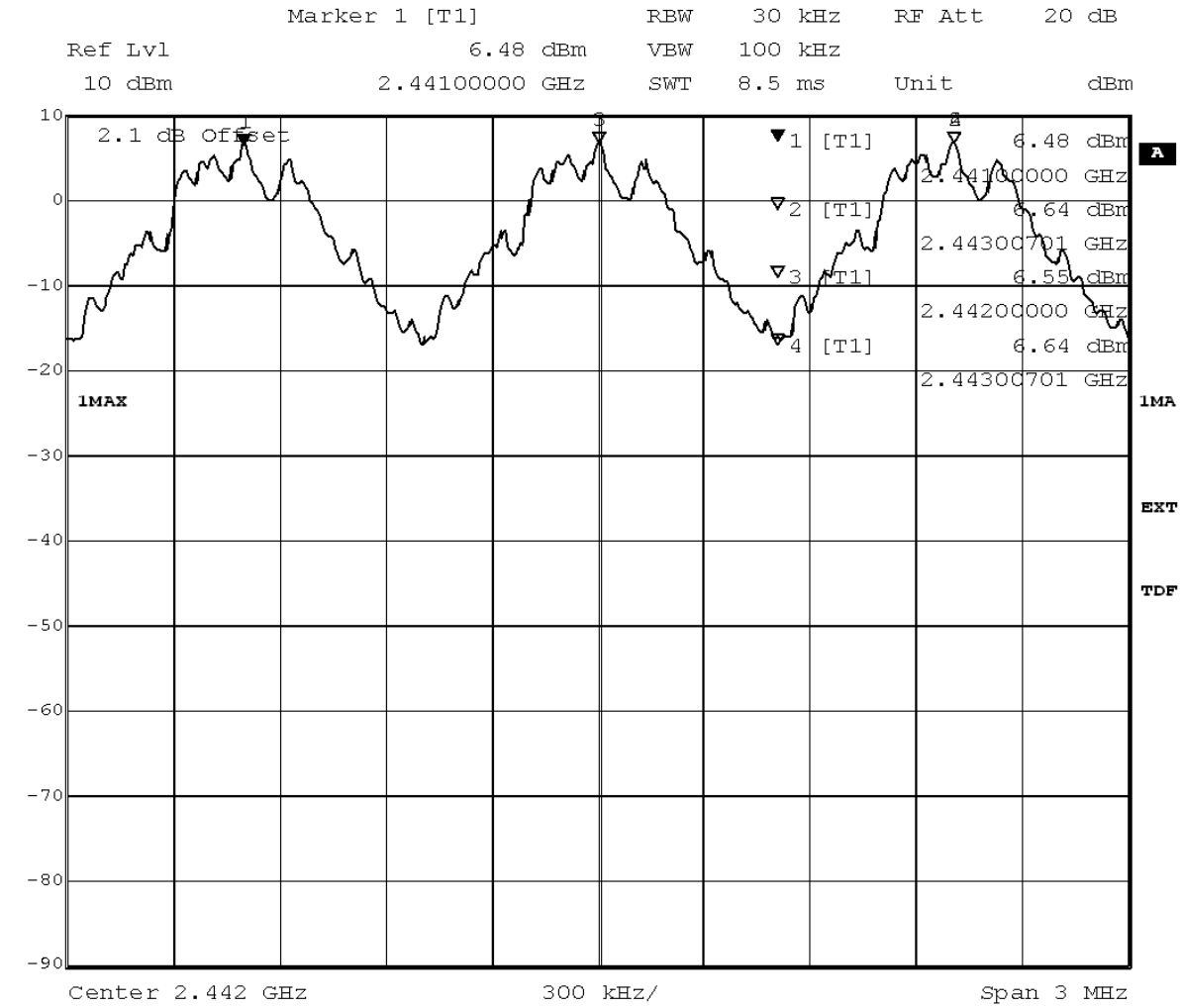
3.5.8 15c.8 Channel separation §15.247 (a) (1)

Test: 15c.8; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/06/02 10:44
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

Channel separation / MHz
1.000



Title: Channel separation
Comment A: CH H: Hopping
Date: 2.JUN.2015 09:42:26

added by operator

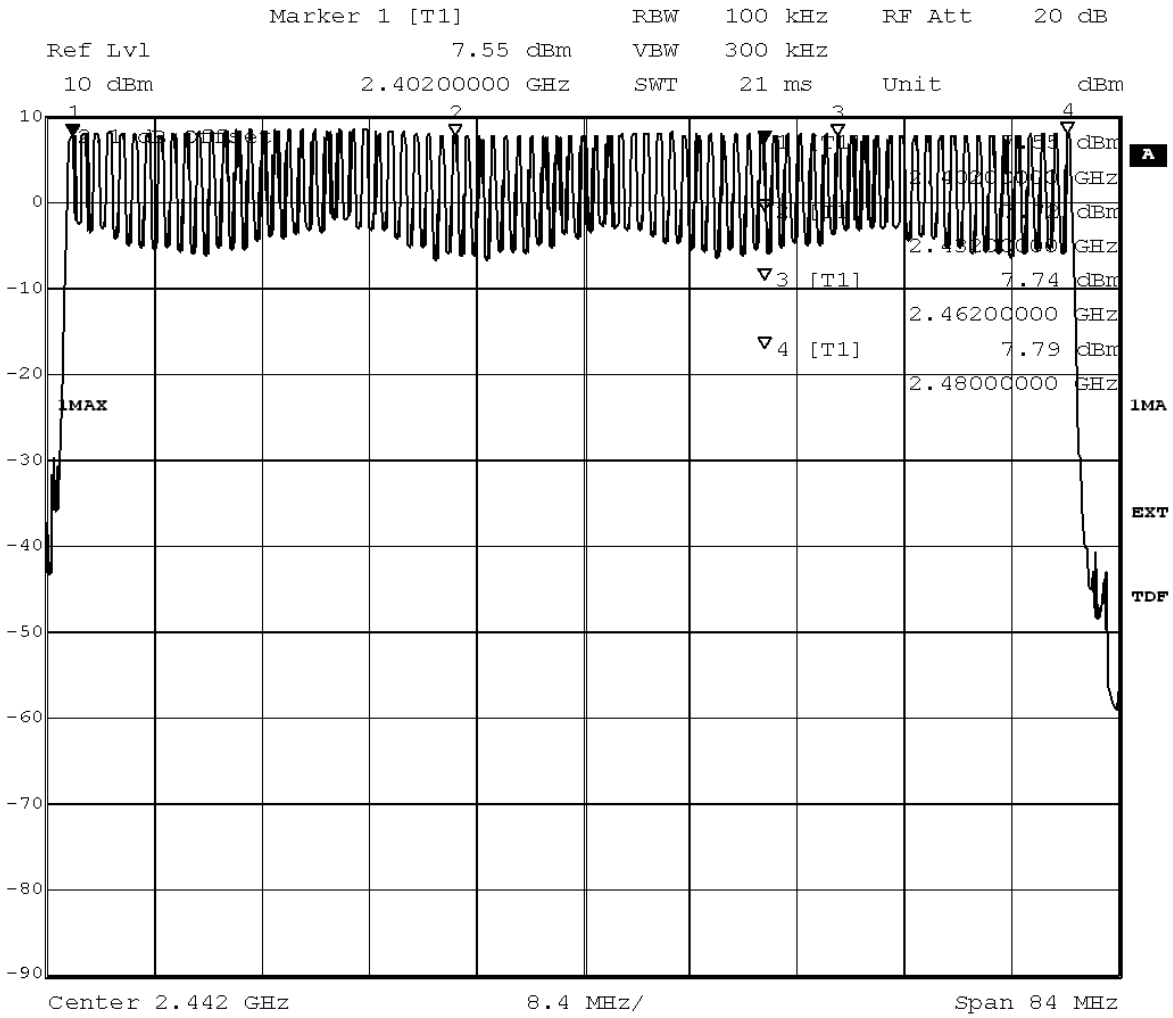
3.5.9 15c.9 Number of hopping frequencies §15.247 (a) (1) (iii)

Test: 15c.9; Frequency = 2441, Mode = BT transmit using 1 Mbps with GFSK modulation

Result:	Passed
Setup No.:	S01_AC01
Date of Test:	2015/06/02 10:44
Body:	FCC47CFRChIPART15c247RADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

Detailed Results:

Number of Hopping Frequencies
79



Title: Number of hopping frequencies
Comment A: CH H: Hopping
Date: 2.JUN.2015 09:54:29

added by operator

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

Lab ID:	**Lab 2**
Manufacturer:	Frankonia
Description:	Anechoic Chamber for radiated testing
Type:	10.58x6.38x6.00 m³

Calibration Details	*Last Execution*	*Next Exec.*
NSA (FCC)	2014/01/09	2017/01/09

Single Devices for Anechoic Chamber

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
Air compressor	none	-	Atlas Copco
Anechoic Chamber	10.58 x 6.38 x 6.00 m³	none	Frankonia
	Calibration Details		*Last Execution* *Next Exec.*
	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 Conducted emissions

Lab ID:	**Lab 1**
Manufacturer:	Rohde & Schwarz GmbH & Co.KG
Description:	EMI Conducted Auxiliary Equipment

Single Devices for Auxiliary Equipment for Conducted emissions

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
Cable "LISN to ESI"	RG214	W18.03+W48.03	Huber&Suhner
Impedance Stabilization Network	ISN T800	36159	Teseq GmbH
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2014/02/06 2016/02/28
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN ENY41	100002	Rohde & Schwarz GmbH & Co. KG
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN ST08	36292	Teseq GmbH
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2014/01/10 2016/01/31
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN T8-Cat6	32187	Teseq GmbH
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2014/01/08 2016/01/31
One-Line V-Network	ESH 3-Z6	100489	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	standard calibration		2014/06/18 2017/11/30
One-Line V-Network	ESH 3-Z6	100570	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2013/11/25 2016/11/24
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	DAkkS Calibration		2015/03/30 2017/03/31
Two-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	DAkks Calibration		2015/03/30 2017/03/31

Test Equipment Auxiliary Equipment for Radiated emissions

Lab ID: **Lab 2**
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	AM4.0/180/11920513	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
	Calibration Details		*Last Execution* *Next Exec.*
	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
	Calibration Details		*Last Execution* *Next Exec.*
	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
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2012/12/18 2015/12/17
Log.-per. Antenna (upgraded)	HL 562 Ultralog new biconicals	830547/003	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2015/06/30 2018/06/29

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	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/024/3790709	Maturo GmbH

Test Equipment Auxiliary Test Equipment

Lab ID:	**Lab 2**
Manufacturer:	see single devices
Description:	Single Devices for various Test Equipment
Type:	various
Serial Number:	none

Single Devices for Auxiliary Test Equipment

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
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.
	Calibration Details		*Last Execution* *Next Exec.*
	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 Transformatorenwerke GmbH
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	Wainwright
Signal Analyzer	FSV30	103005	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard		2014/02/10 2016/02/09
Spectrum Analyser	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard		2012/06/13 2015/06/12
	DKD calibration		2015/06/23 2018/06/22
Spectrum Analyser	FSU26	200418	Rohde & Schwarz GmbH & Co.KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2014/07/29 2015/07/28
Vector Signal Generator	SMIQ 03B	832492/061	Rohde & Schwarz GmbH & Co.KG

Test Equipment Digital Signalling Devices

Lab ID: **Lab 1, Lab 2**
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
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2014/01/27 2016/01/26
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	DKD calibration		2014/12/02 2017/12/01
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz GmbH & Co. KG
	HW/SW Status		*Date of Start* *Date of End*
	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
	Calibration Details		*Last Execution* *Next Exec.*
	DKD calibration		2014/12/03 2017/12/02
	HW/SW Status		*Date of Start* *Date of End*
	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, Lab 2**
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 Analyser	ESR 7	101424	Rohde & Schwarz
	Calibration Details		*Last Execution* *Next Exec.*
	Initial Factory Calibration		2014/11/13 2016/11/12
Personal Computer	Dell	30304832059	Dell
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2015/05/11 2016/05/10
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2015/05/11 2016/05/10
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2014/06/24 2017/06/23
Spectrum Analyser	FSW 43	103779	Rohde & Schwarz
	Calibration Details		*Last Execution* *Next Exec.*
	Initial Factory Calibration		2014/11/17 2016/11/16
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2014/01/07 2016/01/31
	HW/SW Status		*Date of Start* *Date of End*
	Firmware-Update 4.34.4 from 3.45 during calibration		2009/12/03

Test Equipment Multimeter 03

Lab ID:	**Lab 2**
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.
	Calibration Details		*Last Execution* *Next Exec.*
	Customized calibration		2013/12/04 2015/12/03

Test Equipment Multimeter 12

Lab ID: **Lab 3**
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.	
	Calibration Details		*Last Execution*	*Next Exec.*
	Customized calibration		2013/12/04	2015/12/03

Test Equipment Regulatory Bluetooth RF Test Solution

Lab ID: **Lab 3**
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	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2014/08/29	2015/08/28
	Standard Calibration		2015/08/20	2016/08/19
Power Meter NRVD	NRVD	832025/059		
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2014/08/29	2015/08/28
	Standard Calibration		2015/08/19	2016/08/18
Power Sensor NRV Z1 A	PROBE	832279/013		
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2014/08/28	2015/08/27
	Standard Calibration		2015/08/18	2016/08/17
Power Supply	NGSM 32/10	2725		
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2013/06/20	2015/06/19
	Standard calibration		2015/06/22	2016/06/21
Rubidium Frequency Normal MFS	Datum MFS	002	Datum GmbH	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2014/08/29	2015/08/28
	Standard Calibration		2015/08/25	2016/08/24
Signal Analyser FSIQ26	1119.6001.26	832695/007	Rohde & Schwarz GmbH & Co.KG	
Vector Signal Generator SMIQ03B	SMIQ03B	832870/017		
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2013/06/21	2016/06/20

Test Equipment Shielded Room 02

Lab ID:	**Lab 1**
Manufacturer:	Frankonia
Description:	Shielded Room for conducted testing
Type:	12 qm
Serial Number:	none

Test Equipment Shielded Room 07

Lab ID:	**Lab 3**
Description:	Shielded Room 4m x 6m

Test Equipment T/A Logger 13

Lab ID:	**Lab 1, Lab 2**
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	
	Calibration Details		*Last Execution*	*Next Exec.*
	Customized calibration		2015/02/27	2017/02/26

Test Equipment T/H Logger 02

Lab ID:	**Lab 1**
Description:	Lufft Opus10
Serial Number:	7489

Single Devices for T/H Logger 02

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
ThermoHygro Datalogger 02 (Environ)	Opus10 THI (8152.00)	7489	Lufft Mess- und Regeltechnik GmbH	
	Calibration Details		*Last Execution*	*Next Exec.*
	Customized calibration		2015/02/27	2017/02/26

Test Equipment T/H Logger 12

Lab ID:	**Lab 2**
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	
	Calibration Details		*Last Execution*	*Next Exec.*
	Customized calibration		2015/03/10	2017/03/09

Test Equipment T/H Logger 15

Lab ID:	**Lab 3**
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

Calibration Details	*Last Execution*	*Next Exec.*
Customized calibration	2015/03/10	2017/03/09

Test Equipment Temperature Chamber 01

Lab ID:	**Lab 3**
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

Calibration Details	*Last Execution*	*Next Exec.*
Customized calibration	2014/03/12	2016/03/11

5 Annex

5.1 Additional Information for Report

Summary of Test Results

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

Technical Report Summary

Type of Authorization :

Certification for an Intentional Radiator (Frequency Hopping 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 DA 00-705, released March 30, 2000. Instead of applying ANSI C63.4-1992 which is referenced in the FCC Public Note, the newer ANSI C63.4-2014 is applied.

Description of Methods of Measurements

Conducted emissions (AC power line)

Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C 63.4,

Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4.
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: Limit (dBµV) = 20 log (Limit (µV)/1µV).

Occupied bandwidth

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

Test Description

The Equipment Under Test (EUT) was setup 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 30 kHz.
The EUT was connected to the spectrum analyzer via a short coax cable.

Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (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. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Implication by the test laboratory:
Since the Bluetooth technology defines a fixed channel separation of 1 MHz this design parameter defines the maximum allowed occupied bandwidth depending on the EUT's output power:
1. Under the provision that the system operates with an output power not greater than 125 mW (21.0 dBm):
   Implicit Limit: Max. 20 dB BW = 1.0 MHz / 2/3 = 1.5 MHz

2. If the system output power exceeds 125 mW (21.0 dBm):
   Implicit Limit: Max. 20 dB BW = 1.0 MHz

Used conversion factor: Output power (dBm) = 10 log (Output power (W) / 1mW)

The measured output power of the system is below 125 mW (21.0 dBm). For the results, please refer to the related chapter of this report. Therefore the limit is determined as 1.5 MHz.

Peak power output

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 resolution bandwidth for measuring the output power was set to 3 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 via a short coax cable with a known loss.

Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (b) (1)
(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt.

Used conversion factor: Limit (dBm) = 10 log (Limit (W)/1mW)
==> Maximum Output Power: 30 dBm

Spurious RF conducted emissions

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

Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C 63.4,

Test Description

The test set-up was made in accordance to the general provisions of ANSI C63.4 in a typical installation configuration.
The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m² 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 µs (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)

Band edge compliance

Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C 63.4, 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)".

Dwell time

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 dwell time measurements. The EUT was connected to the spectrum analyzer via a short coax cable. The dwell time is independent from the modulation pattern.The dwell time is calculated by:

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

with:
- hop rate = 1600 * 1/s for DH1 packets = 1600 s-1
- hop rate = 1600/3 * 1/s for DH3 packets = 533.33 s-1
- hop rate = 1600/5 * 1/s for DH5 packets = 320 s-1
- number of hopping channels = 79
- 31.6 s = 0.4 seconds multiplied by the number of hopping channels = 0.4 s * 79

The highest value of the dwell time is reported.

Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (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.

Channel separation

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 channel separation measurements. The channel separation is independent from the modulation pattern.
The EUT was connected to spectrum analyzer via a short coax cable.
Analyzer settings:
- Detector: Peak-Maxhold
- Span: 3 MHz
- Centre Frequency: a mid frequency of the 2.4 GHz ISM band
- Resolution Bandwidth (RBW): 30 kHz
- Video Bandwidth (VBW): 100 kHz
- Sweep Time: Coupled

Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (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. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are

separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Number of hopping frequencies

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

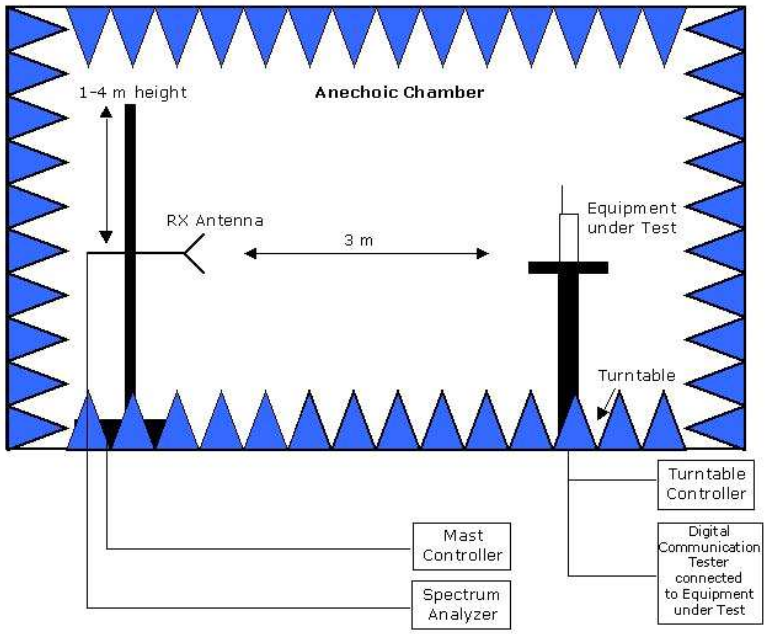
Test Description

The Equipment Under Test (EUT) was set up to perform the number of hopping frequencies measurement.
The number of hopping frequencies is independent from the modulation pattern.
The EUT was connected to spectrum analyzer via a short coax cable.
Analyzer settings:
- Detector: Peak-Maxhold
- Centre frequency: 2442 MHz
- Frequency span: 84 MHz
- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Sweep Time: Coupled

Test Requirements / Limits

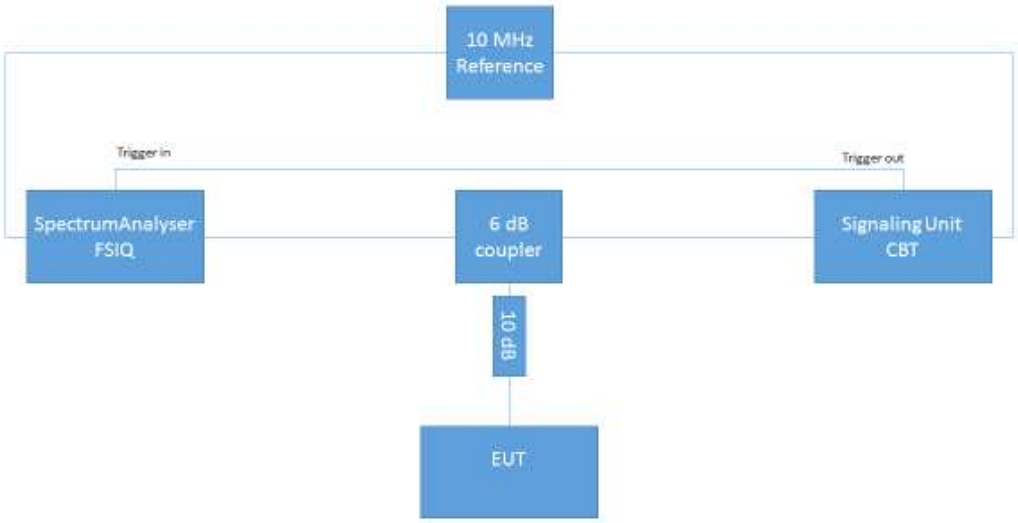
FCC Part 15, Subpart C, §15.247 (a) (iii)
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Setup Drawings

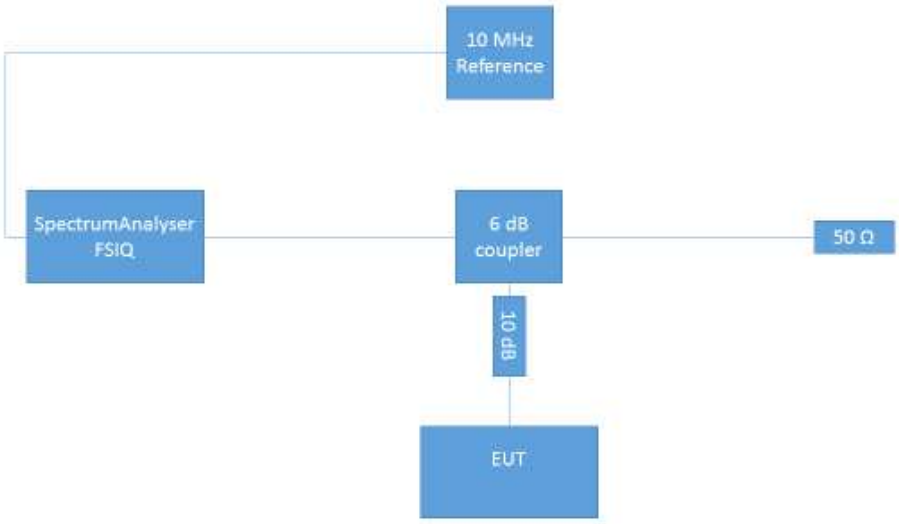


Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

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

Measurement	FCC reference	IC reference
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-210 Issue 8: A8.5
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

Revision History

Report version control			
Version	**Release date**	**Change Description**	**Version validity**
initial	2015-08-26	--	invalid
rev1	2015-09-16	• Added the measurement uncertainty Annex • Added New measurement results of the occupied bandwidth • Added test setups document as appendix3 • Added new correlation table referencing RSS-247	valid

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