Test of
Ear Force PX4 RX Wireless Audio Headset

To: FCC 47 CFR Part 15.247 & IC RSS-210

Test Report Serial No.: COMM56-U2 Rev A

TEST REPORT

FROM

Test of Ear Force PX4 RX Wireless Audio Headset

to

To FCC 47 CFR Part 15.247 & IC RSS-210

Test Report Serial No.: COMM56-U2 Rev A

This report supersedes: None

Applicant: Voyetra Turtle Beach Inc
100 Summit Lake Drive, Suite 100
Valhalla
New York, 10595, USA

Product Function: Wireless Audio Headset

Copy No: pdf Issue Date: 25th November 2013

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
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ACCREDITED
TESTING CERT #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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ACCREDITATION, LISTINGS & RECOGNITION

TESTING ACCREDITATION

MiCOM Labs, Inc. an accredited laboratory complies with the international standard BS EN ISO/IEC 17025. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-01.pdf

RECOGNITION

MiCOM Labs, Inc has widely recognized Electrical testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA** countries. Our test reports are widely accepted for global type approvals.

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	US0159 Listing #: 4143A-2 4143A-3
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	APEC MRA 2	RCB 210
	VCCI	--	--	A-0012
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

**APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.
Phase I - recognition for product testing
Phase II – recognition for both product testing and certification
N/A – Not Applicable

**EU MRA – European Union Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the EU member countries.

**NB – Notified Body

PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard EN ISO/IEC Guide 65. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-02.pdf

United States of America – Telecommunication Certification Body (TCB)
TCB Identifier – US0159

Industry Canada – Certification Body
CAB Identifier – US0159

Europe – Notified Body
Notified Body Identifier - 2280

Japan – Recognized Certification Body (RCB)
RCB Identifier - 210

DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
Rev A	25th November 2013	Initial release.

1. TEST RESULT SUMMARY

Manufacturer:	Voyetra Turtle Beach Inc 100 Summit Lake Drive, Suite 100 Valhalla New York, 10595, USA	Tested By:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California, 94566, USA
EUT:	Wireless Audio Headset	Telephone:	+1 925 462 0304
Model:	Ear Force PX4 RX (TB300-3276-01)	Fax:	+1 925 462 0306
S/N's:	001		
Test Date(s):	4th to 6th November '13	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 15.247 & IC RSS-210	EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

Approved & Released for MiCOM Labs, Inc. by:

A2LA ACCREDITED
TESTING CERT #2381.01

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

COMPLIANCE STATEMENT

Applicant:	Voyetra Turtle Beach Inc 100 Summit Lake Drive, Suite 100 Valhalla, New York, 10595, USA	Tested By:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California, 94566 USA
Product:	Wireless Audio Headset	Telephone: Fax:	+1 925 462 0304 +1 925 462 0306
Model No.:	Ear Force PX4 RX (TB300-3276-01)	Website:	www.micomlabs.com

STANDARD(S)

FCC 47 CFR Part 15.247 & IC RSS-210

MiCOM Labs attests that the above noted model(s) meet the requirements set forth in the above standard(s) based on testing of samples as noted in the Test Result Summary and the manufacturer's declaration of similarity.

Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. None.

2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
i.	FCC 47 CFR Part 15, Subpart C	2012	Title 47: Telecommunication PART 15—RADIO FREQUENCY DEVICES Subpart C—Intentional Radiators
ii.	RSS-210 Annex 8	2010	Radio Standards Specification 210, Issue 8, Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment
iii.	FCC OET KDB 662911	4th April 2011	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
iv.	DA 00-705	2000	FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems" released March 30, 2000
v.	RSS-GEN	2010	Radio Standards Specification-Gen, Issue 3, General Requirements and Information for the Certification of Radiocommunication Equipment
vi.	FCC 47 CFR Pt 15, Subpart B	2012	47 CFR Part 15, SubPart B; Unintentional Radiators
vii.	ICES-003	2004	Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard Digital Apparatus; Issue 4
viii.	ANSI C63.4	2009	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ix.	CISPR 22/ EN 55022	2008 2006+A1: 2007	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
x.	M 3003	Edition 2 Jan. 2007	Expression of Uncertainty and Confidence in Measurements
xi.	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
xii.	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
xiii.	A2LA	July 2012	Reference to A2LA Accreditation Status – A2LA Advertising Policy

2.2. Test and Uncertainty Procedures

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

Details	Description
Purpose:	Test of the Ear Force PX4 RX Wireless Audio Headset to FCC Part 15.247 and Industry Canada RSS-210 regulations.
Applicant:	Voyetra Turtle Beach Inc 100 Summit Lake Drive, Suite 100 Valhalla New York, 10595, USA
Manufacturer:	As applicant.
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton, California 94566 USA
Test report reference number:	COMM56-U2 Rev A
Date EUT received:	29th October 2013
Standard(s) applied:	FCC 47 CFR Part 15.247 & IC RSS-210
Dates of test (from - to):	4th to 6th November '13
No of Units Tested:	Two
Type of Equipment:	Wireless Audio Headset
Manufacturers Trade Name:	Ear Force
Model(s):	Ear Force PX4 RX (TB300-3276-01)
Location for use:	Indoor
Declared Frequency Range(s):	2400 - 2483.5 MHz
Hardware Rev	PP
Software Rev	N/A
Rated Input Voltage and Current:	Nominal: 3.7V, Charger (USB) supply: 5V +/- 10%
Operating Temperature Range:	Min: 0 °C Max: 50 °C
Equipment Dimensions:	9 x 6 x 3.5 inches
Weight:	7 oz
Primary function of equipment:	Wireless Audio Headset

3.2. Scope of Test Program

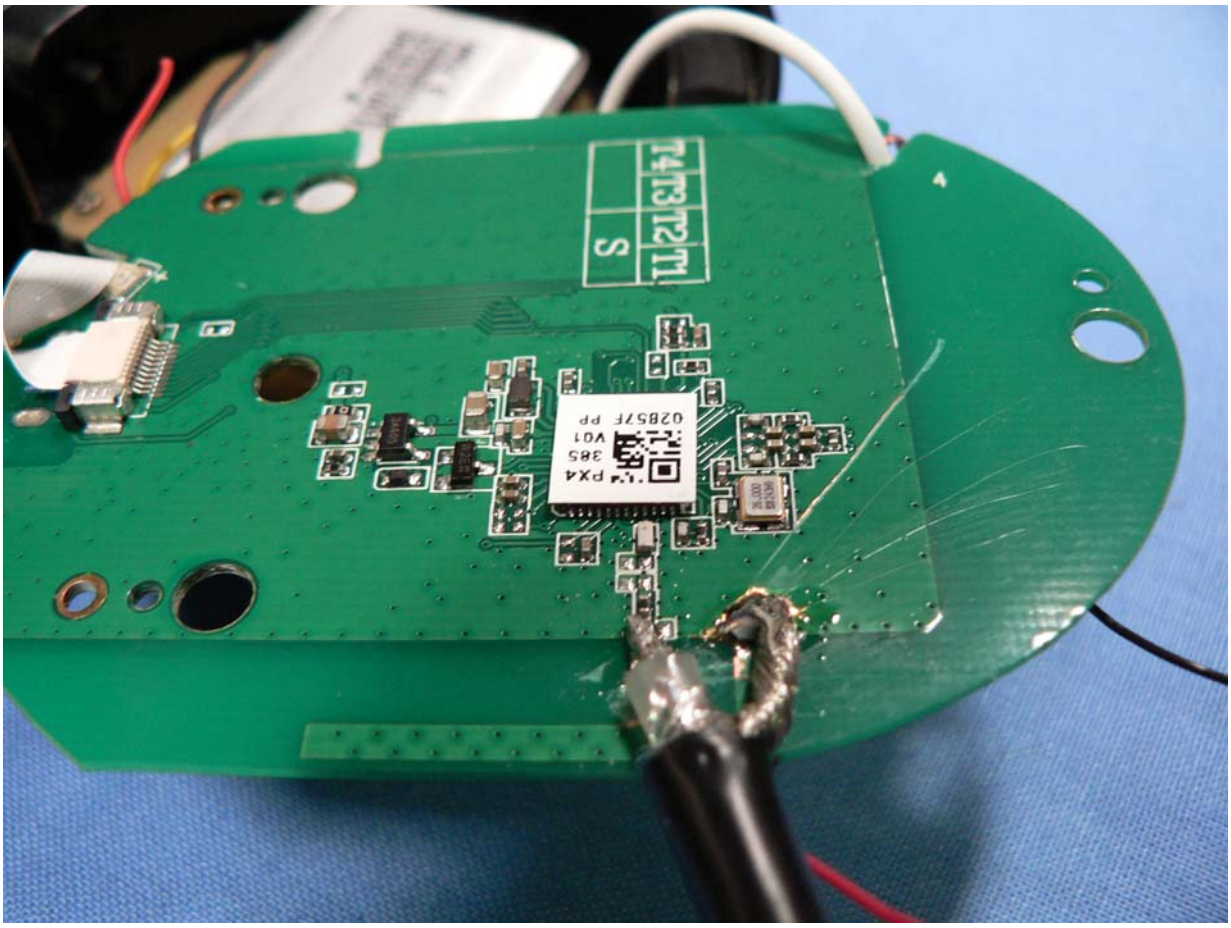
Ear Force PX4 RX Wireless Audio Headset **RF Testing**

The scope of the test program was to test the Ear Force PX4 RX Wireless Audio **Headset**, in the frequency ranges 2400 - 2483.5 MHz for compliance against FCC 47 CFR Part 15.247 and Industry Canada RSS-210 specifications.

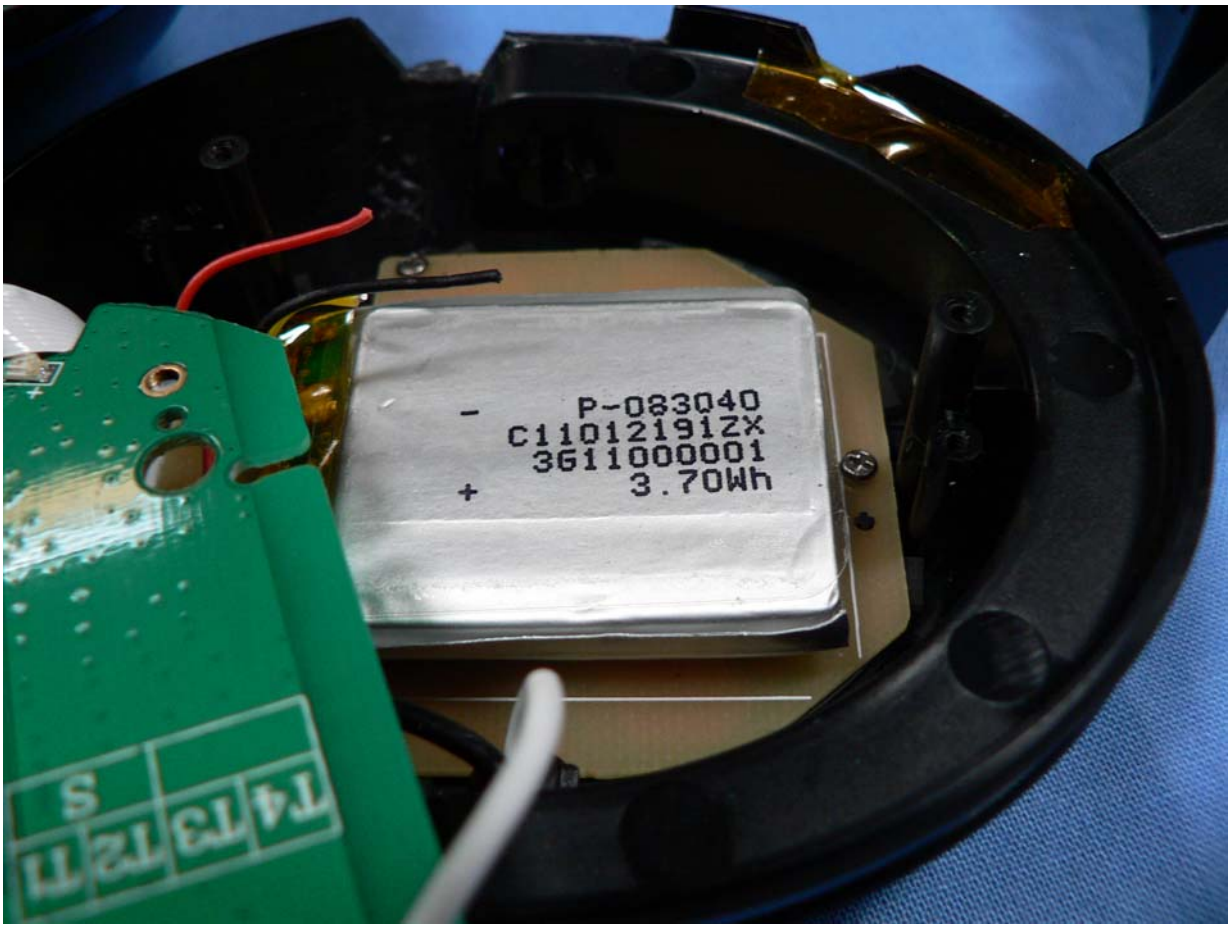
Ear Force PX4 RX Wireless Audio Headset

Ear Force PX4 RX Wireless Audio Headset

Ear Force PX4 RX Wireless Audio Headset – Bluetooth PCB



Ear Force PX4 RX Wireless Audio Headset – Battery



3.3. Equipment Model(s) and Serial Number(s)

Equipment Type	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	Wireless Audio Headset	Voyetra Turtle Beach	Ear Force PX4 RX	001
Support	Laptop PC	Dell	Latitude	None

3.4. Antenna Details

Antenna Type	Manufacturer	Model Number	Antenna Gain (dBi)	
			2.4 GHz	5 GHz
On Board Folded F - Bluetooth	Turtle Beach	PCB	2.8	--
Chip	Fractus	FR05-S1-NO-1-004	-1.5	--
Chip	Fractus	FR05-S1-NO-1-004	--	3.3

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. 1 x USB (charge only)
2. 1 x 2.5 mm Analog Audio Input

3.6. Types of Modulation Supported

Operational Mode(s) (802.15.2)	Packet type	Date Rate (Mbits/s)	Frequencies (MHz)
FHSS: GFSK π/4 DQPSK 8DPSK	DH1	1, 2, 3	2,402 2,441 2,480
	DH3	1, 2, 3	
	DH5	1, 2, 3	

3.7. EUT Configurations

Band (GHz)	Mode	Freq Band (MHz)	Freq Range (MHz	Low Ch.	Mid Ch.	High Ch.	# Ch.	Ch. Spacing (MHz)
2.4	Bluetooth	2400-2483.5	2402-2480	2402	2441	2480	79	1 MHz

3.8. Equipment Modifications

None.

3.9. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. NONE

4. TEST EQUIPMENT CONFIGURATION(S)

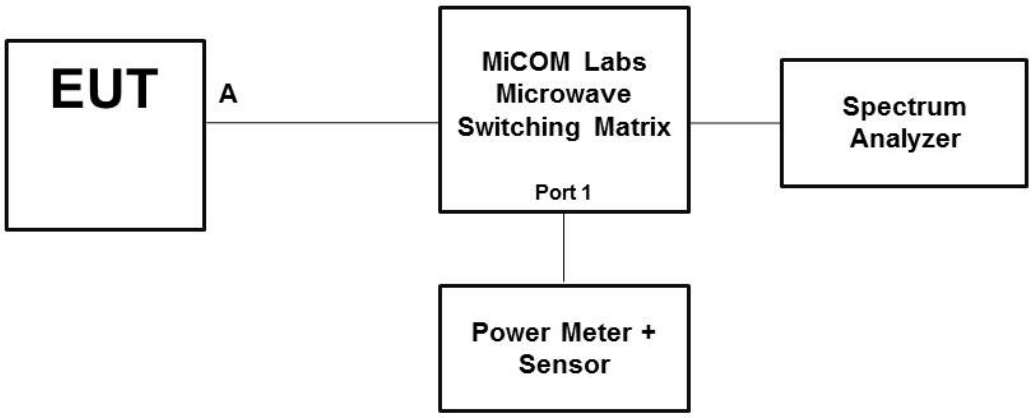
4.1. Conducted RF Emission Test Set-up

The following tests were performed using the conducted test set-up shown in the diagram below.

1. Section 6.1.1.1. 20 dB Bandwidth
2. Section 6.1.1.2. Carrier Frequency Separation
3. Section 6.1.1.3. Number of Hopping Frequencies
4. Section 6.1.1.4. Time of Occupancy (Dwell Time)
5. Section 6.1.1.5 Channel Occupancy
6. Section 6.1.1.5 Peak Output Power
7. Section 6.1.1.7 Band-Edge
8. Section 6.1.1.8 Spurious RF Conducted – Transmitter
9. Section 6.1.1.9 Spurious RF Conducted - Receiver

Conducted Test Set-Up Pictorial Representation

Test Measurement set up



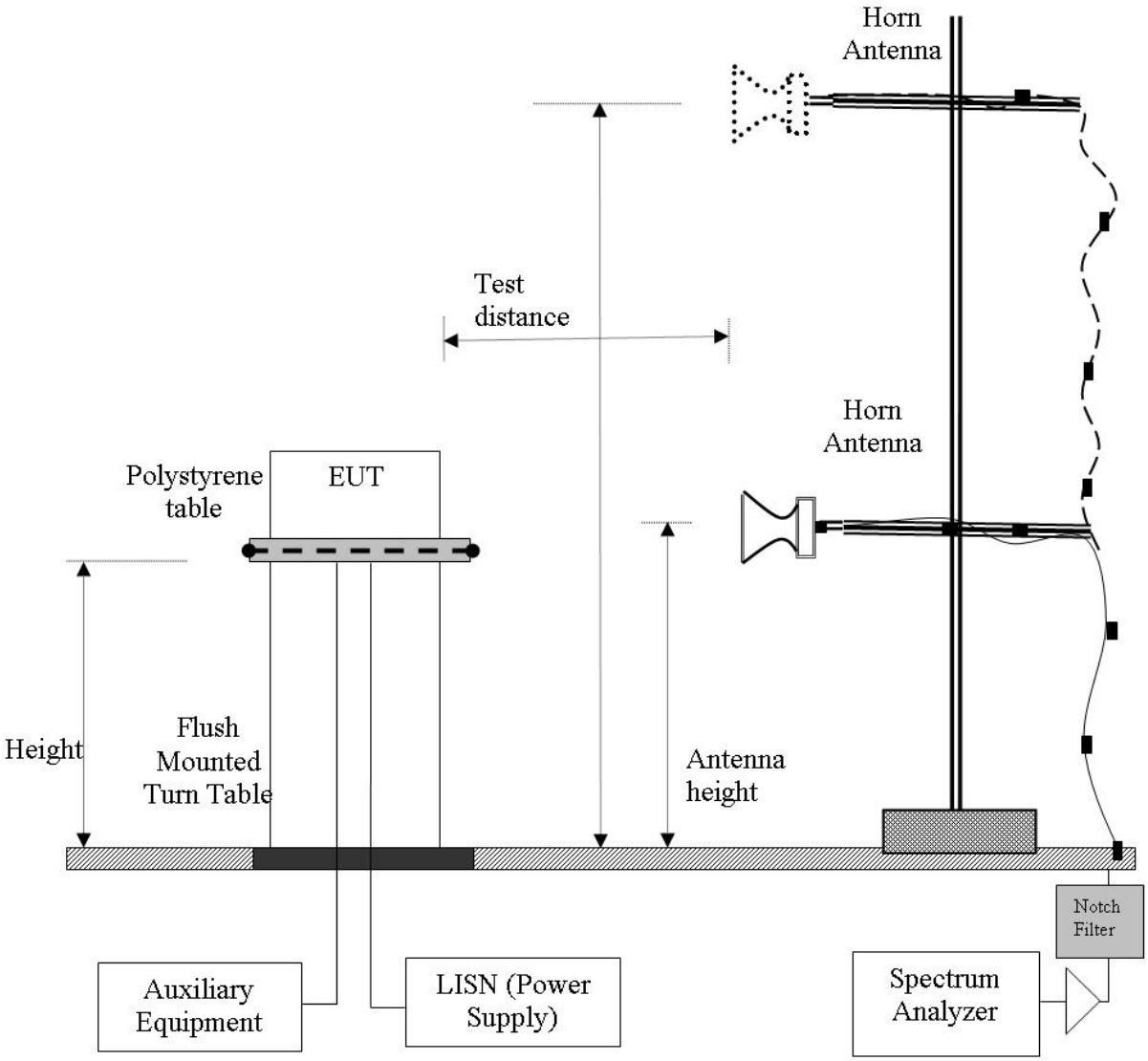
Conducted Test Measurement Setup

4.2. Radiated Spurious Emission Test Set-up > 1 GHz

The following tests were performed using the conducted test set-up shown in the diagram below.

1. Section 6.1.2.1.

Radiated Emission Measurement Setup – Above 1 GHz

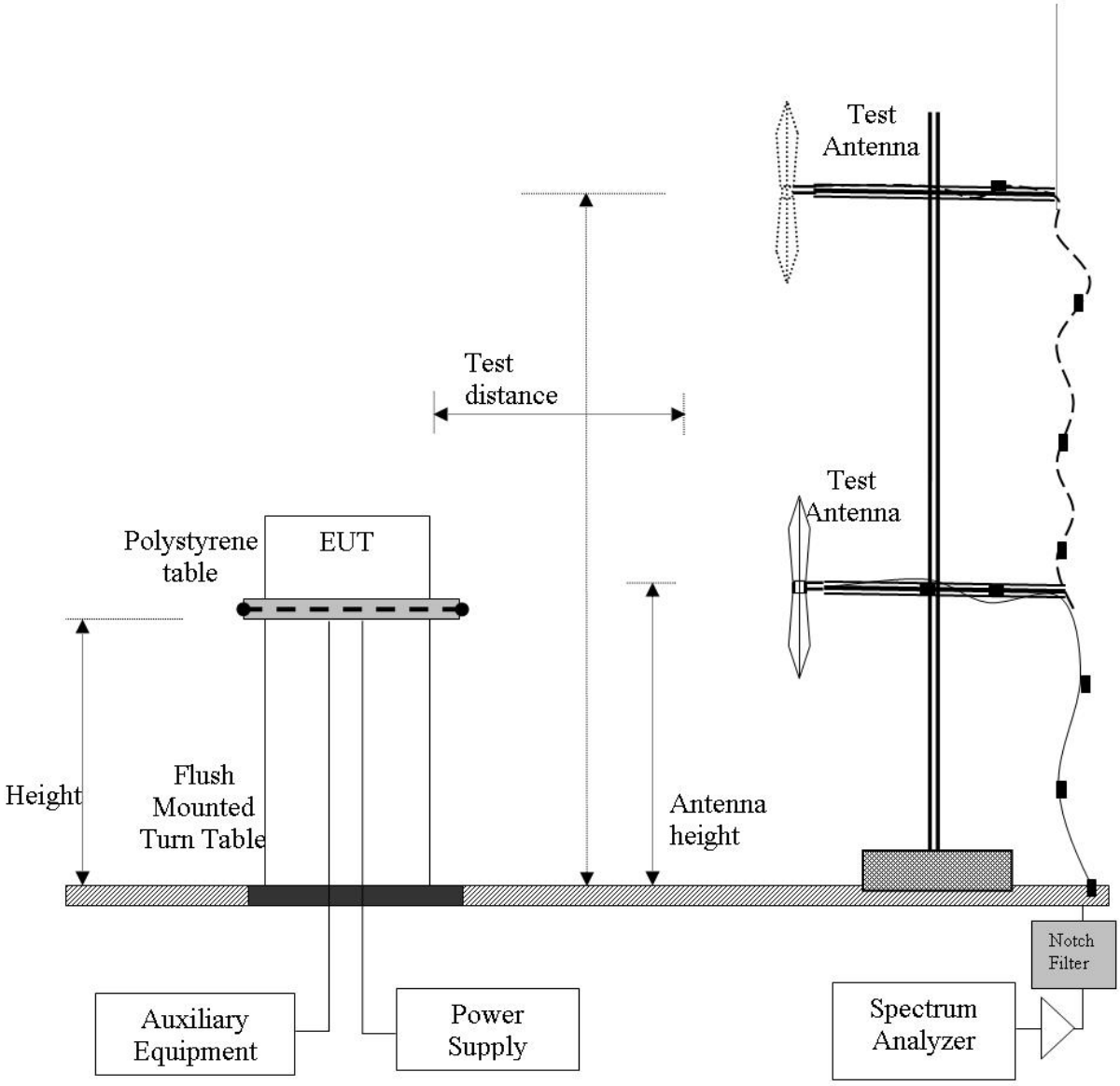


4.3. Digital Emissions Test Set-up (0.03 – 1 GHz)

The following tests were performed using the conducted test set-up shown in the diagram below.

1. Section 6.1.2.2.

Digital Emission Measurement Setup – Below 1 GHz

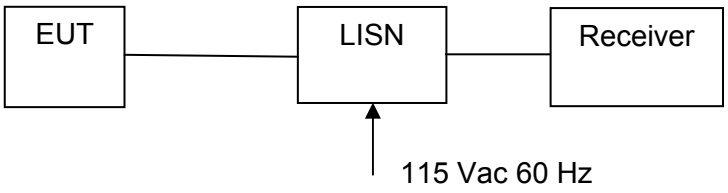


4.4. AC Wireline Emission Test Set-up

The following tests were performed using the conducted test set-up shown in the diagram below.

Not Required EUT not powered by AC.

1. Section 6.1.3 AC Wireline Conducted Emissions



Measurement Setup for Conducted Emissions Test

5. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 15.247** and **Industry Canada RSS-210** and **Industry Canada RSS-Gen.**

Note: as this is an Enhanced Data Rate (EDR) Bluetooth Device.

Section(s)	Test Items / Description	Condition	Result	Test Report Section
15.247(a)(1) **A8.1(a)** **4.4**	20 dB Bandwidths	Conducted	Complies	6.1.1.1
15.247(a)(1) **A8.1(d)**	Carrier Frequency Separation	Conducted	Complies	6.1.1.2
15.247(a)(1) **A8.1(d)**	Number of Hopping Frequencies	Conducted	Complies	6.1.1.3
15.247(a)(1)(iii) **A8.1(d)**	Time of Occupany (Dwell Time)	Conducted	Complies	6.1.1.4
15.247(a)(1)(iii) **A8.1(d)**	Channel Occupancy	Conducted	Complies	6.1.1.5
15.247(b)(2) **A8.4(2)**	Peak Output Power	Conducted	Complies	6.1.1.6
15.247(d) **A8.5**	Spurious RF Conducted Emissions	Conducted	Complies	6.1.1.7

List of Measurements (continued)

The following table represents the list of measurements required under the **FCC CFR47 Part 15.247, Industry Canada RSS-210,** and **Industry Canada RSS-Gen.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(d) **15.205 /** **15.209** **A8.5** **2.2** **2.6** **4.7**	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz	Radiated	Complies	6.1.2.1
	Radiated Band Edge	Band-edge results	Radiated	Complies	
15.205 / **15.209** **2.2**	Radiated Spurious Emissions	Emissions <1 GHz (30M-1 GHz)	Radiated	Complies	*6.1.2.2*
15.207 **7.2.2**	AC Wireline Conducted Emissions 150 kHz–30 MHz	Conducted Emissions	Conducted	N/A EUT is DC powered	*6.1.3*

Note 1: *Test results reported in this document relate only to the items tested*
Note 2: *The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria*
Note 3: *Section 3.8 Equipment Modifications highlights the equipment modifications that were required to bring the product into compliance with the above test matrix*

6. TEST RESULTS

6.1. Device Characteristics

6.1.1. Conducted Testing

6.1.1.1. 20 dB Bandwidth

Conducted Test Conditions for 20 dB Bandwidth			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	18.0 - 27.5
Test Heading:	20 dB Bandwidth	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)(2)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems		

Test Procedure for 20 dB Bandwidth Measurement
The bandwidth at 20 dB was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate centre frequency.
Although there are no limits for 20 dB bandwidth for frequency hopping systems in the 2400-2483.5 MHz band. The 20 dB bandwidth is required to calculate the carrier frequency separation limits.

The EUT was tested at the lowest and highest data rate available (1-3 Mbits/s) for each packet type DH1, DH5.

DH1, 1 Mbs/sec

Equipment Configuration for 6 dB & 99% Bandwidth			
Variant:	802.15 DH1	**Duty Cycle (%):**	100
Data Rate:	DH1	**Antenna Gain (dBi):**	Not Applicable
Modulation:	GFSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured20 dB Bandwidth (MHz)				Maximum 20 dB Bandwidth (MHz)
	Port(s)				
MHz	a	b	c	d	
2402.0	0.968				0.968
2441.0	0.962				0.962
2480.0	0.962				0.962

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the link in the above results matrix to view the plot

DH5, 1 Mbs/sec

Equipment Configuration for 6 dB & 99% Bandwidth			
Variant:	802.15 DH5	**Duty Cycle (%):**	100
Data Rate:	DH5	**Antenna Gain (dBi):**	Not Applicable
Modulation:	GFSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 20 dB Bandwidth (MHz)				Maximum 20 dB Bandwidth (MHz)
	Port(s)				
MHz	a	b	c	d	
2402.0	1.365				1.365
2441.0	1.359				1.359
2480.0	1.359				1.359

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the link in the above results matrix to view the plot

3-DH1, 3 Mbs/sec

Equipment Configuration for 6 dB & 99% Bandwidth			
Variant:	802.15 3-DH1	**Duty Cycle (%):**	100
Data Rate:	3-DH1	**Antenna Gain (dBi):**	Not Applicable
Modulation:	8DPSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 20 dB Bandwidth (MHz)				Maximum 20 dB Bandwidth (MHz)
	Port(s)				
MHz	a	b	c	d	
2402.0	1.371				1.371
2441.0	1.365				1.365
2480.0	1.371				1.371

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the link in the above results matrix to view the plot

3-DH5, 3 Mbs/sec

Equipment Configuration for 20 dB Bandwidth			
Variant:	802	**Duty Cycle (%):**	100
Data Rate:	3-DH5	**Antenna Gain (dBi):**	Not Applicable
Modulation:	8-DPSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				Maximum 20 dB Bandwidth (MHz)
MHz	a	b	c	d	
2402.0	1.247				1.247
2441.0	1.359				1.359
2480.0	1.359				1.359

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the link in the above results matrix to view the plot

Specification

Limits

§15.247 (a)

(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

(2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

RSS-210 §A8.1

a. The bandwidth of a frequency hopping channel is the -20 dB emission bandwidth, measured with the hopping stopped. The system radio frequency (RF) bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, while the long-term distribution appears evenly distributed.

b. 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 band 2400–2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W. 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.

Traceability

Test Equipment Used
0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117

6.1.1.2. Carrier Frequency Separation

Conducted Test Conditions for Carrier Frequency Separation			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	18.0 – 24.0
Test Heading:	Carrier Frequency Separation	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)(1)	**Pressure (mBars):**	999 - 1004
Reference Document(s):	FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems		

Test Procedure for Carrier Frequency Separation Measurement
The EUT must have its hopping function enabled.
The transmitter terminal of EUT was connected to the input of the spectrum analyzer set to measure carrier frequency separation.
The Span was set wide enoug to campture two adjacent peaks. The resolution bandwidth (RBW) was set to ≥ 1% of the span, video bandwidth (VBW) ≥ RBW, peak detector selected and mox hold trace selected. After the trace is stabilized use marker delta function to determine the separation between adjacent channels.
The limit is > 2/3 of the 20 dB bandwidth.

Equipment Configuration for Carrier Frequecy Separation			
Variant:	802.15.2	**Duty Cycle (%):**	100%
Data Rate:	1-3 Mbit/s	**Antenna Gain (dBi):**	2.8
Modulation:	GFSK,π/4 DQPSK, 8DPSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	N/A		
Engineering Test Notes:	all 3 supported modes were measured		

Test Measurement Results

Centered on Channel	Center Frequency	Packet Type	Chan Separation	Maximum 20 dB Bandwidth	Limit	Result
	MHz		MHz	MHz	MHz	
39	2441	DH1	1.002	0.968	> 2/3 of 20 dB Bandwidth	Pass
39	2441	DH3	1.002	1.359	> 2/3 of 20 dB Bandwidth	Pass
39	2441	DH5	1.002	1.365	> 2/3 of 20 dB Bandwidth	Pass
39	2441	2-DH1	1.002	1.004	> 2/3 of 20 dB Bandwidth	Pass
39	2441	2-DH3	1.008	1.359	> 2/3 of 20 dB Bandwidth	Pass
39	2441	2-DH5	1.002	1.365	> 2/3 of 20 dB Bandwidth	Pass
39	2441	3-DH1	1.014	1.371	> 2/3 of 20 dB Bandwidth	Pass
39	2441	3-DH3	1.018	1.359	> 2/3 of 20 dB Bandwidth	Pass
39	2441	3-DH5	1.020	1.359	> 2/3 of 20 dB Bandwidth	Pass

Traceability to Industry Recognized Test Methodologies	
Measurement Uncertainty:	±2.81 dB (Spectrum/Amplitude), ±0.86 ppm (Frequency)

Note: click the link in the above results matrix to view the plot

Specification

Limits

§15.247 (a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(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.

RSS-210 §**A8.1**

b. 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 band 2400–2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W. 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.

Traceability

Test Equipment Used
0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117

6.1.1.3. Number of Hopping Frequencies

Conducted Test Conditions for Number of Hopping Frequencies			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	18.0 - 27.5
Test Heading:	Carrier Hopping Frequencies	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)	**Pressure (mBars):**	999 - 1008
Reference Document(s):	FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems		

Test Procedure for Number of Hopping Frequencies

The EUT must have its hopping function Enabled

The transmitter output was connected to a spectrum analyzer and the span was set for the frequency of operation (Note 2 or more spans may be necessary for an accurate count). RBW ≥ 1% of the span, VBW ≥ RBW, Sweep = auto, detector function = peak, trace = max hold.

Allow trace to stabilize. It may prove necessary to break the span up into sections to clearly show the hopping frequencies.

Equipment Configuration for Hopping Sequence			
Variant:	802.15.2	**Duty Cycle (%):**	100%
Data Rate:	1-3 Mbit/s	**Antenna Gain (dBi):**	2.8
Modulation:	GFSK,π/4 DQPSK, 8DPSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	N/A		
Engineering Test Notes:			

Test Measurement Results						
Test Frequency	**Number of Hopping Frequencies**				**Limit**	**Result**
	Port(s)					
MHz	**a**	**b**	**c**	**d**	**No of Hopping Channels**	
NA	79	--	--	--	≥ 20	Pass

Traceability to Industry Recognized Test Methodologies	
Measurement Uncertainty:	±2.81 dB (Spectrum/Amplitude), ±0.86 ppm (Frequency)

Note: click the link in the above results matrix to view the plot

Specification
Number of Hopping Frequencies

§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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

RSS-210 §A8.1 (d) Frequency hopping systems operating in the 2400–2483.5 MHz band shall use at least 15 hopping 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. Transmissions on particular frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

Traceability

Method	Test Equipment Used
FCC DA 00-175	0078, 0134, 0158, 0184, 0193, 0287, 0250, 0252, 0310, 0312

6.1.1.4. Time of Occupancy (Dwell Time)

Conducted Test Conditions for Time of Occupancy (Dwell Time)			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Time of Occupancy (Dwell Time)	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems		

Test Procedure for Time of Occupancy (Dwell Time)

The EUT must have its hopping function Enabled

The transmitter output was connected to a spectrum analyzer and the span was set for the frequency of operation. RBW = 1 MHz, VBW ≥ RBW, Sweep = as necessary to capture the entire dwell time period, detector function = peak, trace = max hold.

If possible use the marker-delta function to detrmine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

Equipment Configuration for Time of Occupancy (Dwell Time)			
Variant:	802.15.2	**Duty Cycle (%):**	100%
Data Rate:	1-3 Mbit/s	**Antenna Gain (dBi):**	2.8
Modulation:	GFSK,π/4 DQPSK, 8DPSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	N/A		
Engineering Test Notes:			

Test Measurement Results

Centered on Channel	Center Frequency	Packet Type	Dwell Time (Single Channel)	Limit (Single Channel)	Result
	MHz		mS	mS	
0	2402	DH1	0.385	400	Pass
0	2402	DH3	1.62	400	Pass
0	2402	DH5	2.895	400	Pass
0	2402	2-DH1	0.399	400	Pass
0	2402	2-DH3	1.623	400	Pass
0	2402	2-DH5	2.870	400	Pass
0	2402	3-DH1	0.389	400	Pass
0	2402	3-DH3	1.611	400	Pass
0	2402	3-DH5	2.830	400	Pass

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	FCC DA 00-0705
Measurement Uncertainty:	±2.81 dB (Spectrum/Amplitude), ±0.86 ppm (Frequency)

Note: click the link in the above results matrix to view the plot

Specification

Limits Channel Occupancy (Dwell Time)

§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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

RSS-210 §A8.1 (d) Frequency hopping systems operating in the 2400–2483.5 MHz band shall use at least 15 hopping 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. Transmissions on particular frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

Traceability

Method	Test Equipment Used
FCC DA 00-175	0078, 0134, 0158, 0184, 0193, 0287, 0250, 0252, 0310, 0312

6.1.1.5. Channel Occupancy

Conducted Test Conditions for Channel Occupancy			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Channel Occupancy	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems		

Test Procedure for Time of Occupancy (Dwell Time)

The EUT must have its hopping function Enabled

The transmitter output was connected to a spectrum analyzer and the span was set for the frequency of operation. RBW = 1 MHz, VBW ≥ RBW, Sweep = Dwell time x number of hopping frequencies, detector function = peak, trace = max hold.

Equipment Configuration for Channel Occupancy

Variant:	802.15.2	**Duty Cycle (%):**	100%
Data Rate:	1-3 Mbit/s	**Antenna Gain (dBi):**	2.8
Modulation:	GFSK,π/4 DQPSK, 8DPSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	N/A		
Engineering Test Notes:	DH5 Packet types give the highest Dwell time, varying packet length also varies occupancy time		

Test Measurement Results

Centered on Channel	Center Frequency	Data Rate	Mode	Dwell Time (Single Channel)	Number of Hops	Channel Occupancy	Limit	Result
	MHz	Mbs		mS		mS	mS	mS
39	2441	1	DH1	0.379	379	143.64	400	Pass
39	2441	2	DH3	1.622	221	358.79	400	Pass
39	2441	3	DH5	2.874	126	362.12	400	Pass
39	2441	1	2-DH1	0.387	379	146.673	400	Pass
39	2441	2	2-DH3	1.622	221	358.462	400	Pass
39	2441	3	2-DH5	2.865	126	360.99	400	Pass
39	2441	1	3-DH1	0.390	379	147.81	400	Pass
39	2441	2	3-DH3	1.640	221	362.44	400	Pass
39	2441	3	3-DH5	2.883	126	363.258	400	Pass

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	FCC DA 00-0705
Measurement Uncertainty:	±2.81 dB (Spectrum/Amplitude), ±0.86 ppm (Frequency)

Channel Occupancy was performed using a sweep time of 32 seconds (79 x 0.4 = 31.6 seconds).
All packet types were then checked with a sweep time of 1 second to verify the number of times the transmitter occupied Channel 0 (2402 MHz). Each packet type transmitted on channel 0 at the following rates:
DH5 packet length 0 = 11
DH5 packet length 510 = 6
DH5 packet length 1021 = 4

The number of hops = hops per one second x 31.6 seconds
Finally the channel occupancy time = number of hops x single channel dwell time

Specification Limits

§15.247 (b) The maximum peak 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 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

RSS-210 §A8.4 (2) For frequency hopping systems operating in the band 2400-2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W. Except as provided in Section A8.4 (5), the e.i.r.p. shall not exceed 4 W..

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

6.1.1.6. Peak Output Power

Conducted Test Conditions for Fundamental Emission Output Power			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Emission Output Power	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)(2)	**Pressure (mBars):**	999 - 1004
Reference Document(s):	KDB 558074 - D01 DTS Measurement Guidance v01: Section 5.2 Fundamental Emission Output Power KDB 662911 was implemented for In-band power measurements. The measure and sum technique was implemented in all cases.		

Test Procedure for Fundamental Emission Output Power Measurement
The transmitter terminal of EUT was connected to the input of the spectrum analyzer set to measure peak power. The resolution filter bandwidth was set to 6 dB, peak detector selected and the analyzer built-in power function was used to integrate peak power over the 20 dB bandwidth.

Supporting Information
Calculated Power = A + G + 10 log (1/x) dBm
A = Total Power [10 Log10 ($10^{a/10}$ + $10^{b/10}$ + $10^{c/10}$ + $10^{d/10}$)], G = Antenna Gain,
x = Duty Cycle

Equipment Configuration for Peak Output Power

Variant:	802.15 DH1 & DH5	**Duty Cycle (%):**	100
Data Rate:	DH1	**Antenna Gain (dBi):**	2.80
Modulation:	GFSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results DH1

Test Frequency	Measured Output Power (dBm) Port(s)				Calculated Total Power Σ Port(s)	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	dBm	dBm	dBm	
2402.0	2.17				2.17	30.00	-27.83	0 dBm
2441.0	2.22				2.22	30.00	-27.78	0 dBm
2480.0	2.32				2.32	30.00	-27.68	0 dBm

Test Measurement Results DH5

Test Frequency	Measured Output Power (dBm) Port(s)				Calculated Total Power Σ Port(s)	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	dBm	dBm	dBm	
2402.0	2.35				2.35	30.00	-27.65	0 dBm
2441.0	2.47				2.47	30.00	-27.53	0 dBm
2480.0	2.59				2.59	30.00	-27.41	0 dBm

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	±1.33 dB

Note: click the link in the above results matrix to view the plot

Equipment Configuration for Peak Output Power			
Variant:	802.15 3-DH1 & 3-DH5	**Duty Cycle (%):**	100
Data Rate:	3-DH1 & 3-DH5	**Antenna Gain (dBi):**	-1.50
Modulation:	8-DPSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results 3DH1

Test Frequency	Measured Output Power (dBm) Port(s)				Calculated Total Power Σ Port(s)	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	dBm	dBm	dBm	
2402.0	2.30				2.30	30.00	-27.70	0 dBm
2441.0	2.47				2.47	30.00	-27.53	0 dBm
2480.0	2.47				2.47	30.00	-27.53	0 dBm

Test Measurement Results 3DH5

Test Frequency	Measured Output Power (dBm) Port(s)				Calculated Total Power Σ Port(s)	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	dBm	dBm	dBm	
2402.0	2.23				2.23	30.00	-27.77	0 dBm
2441.0	2.00				2.00	30.00	-28.00	0 dBm
2480.0	2.19				2.19	30.00	-27.81	0 dBm

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	±1.33 dB

Note: click the link in the above results matrix to view the plot

Specification

Limits

§15.247 (b)(1)

(b) The maximum peakconducted output power of the intentional radiator shall not exceed the following.

(1) For frequency hopping systems in the 2400 – 2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400 – 2483.5 MHz band: 0.125 watts.

§ RSS-210 A8.4(2) For frequency hopping systems operating in the 2400-2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted power shall not exceed 0.125 W. Except as provided in Section A8.4 (5), the e.i.r.p. shall not exceed 4 W.

Frequency hopping systems operating in the band 2400 – 2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.

Traceability

Method	Test Equipment Used
FCC DA 00-0705	0158, 0193, 0287, 0252, 0313, 0314, 0070, 0116, 0117

6.1.1.7. Conducted Spurious Emissions

Conducted Test Conditions for Transmitter Conducted Spurious and Band-Edge Emissions			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Max Unwanted Emission Levels	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (d)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	KDB 558074 - D01 DTS Measurement Guidance v01: Section 5.4 Maximum Unwanted Emission Levels		

Test Procedure for Transmitter Conducted Spurious and Band-Edge Emissions Measurement
Transmitter Conducted Spurious and Band-Edge emissions were measured at a limit of 20 dB below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Measurements were made while EUT was operating in transmit mode of operation at the appropriate centre frequency closest to the band-edge. Emissions were maximized during the measurement and limits derived from the peak spectral power and drawn on each plot.

Equipment Configuration for Transmitter Conducted Spurious Emissions			
Variant:	802.15 DH1	**Duty Cycle (%):**	100
Data Rate:	DH1	**Antenna Gain (dBi):**	Not Applicable
Modulation:	GFSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Frequency Range	Transmitter Conducted Spurious Emissions (dBm)							
		Port a		Port b		Port c		Port d	
MHz	MHz	SE	Limit	SE	Limit	SE	Limit	SE	Limit
2402.0	30.0 - 26000.0	-56.027	-24.53						
2441.0	30.0 - 26000.0	-55.647	-24.35						
2480.0	30.0 - 26000.0	-56.179	-24.13						

Test Frequency	Band-Edge Frequency	Transmitter Conducted Band-Edge Emissions (dBm)							
		Port a		Port b		Port c		Port d	
MHz	MHz	BE	Limit	BE	Limit	BE	Limit	BE	Limit
2402.0	2400.0	-48.81	-24.23						
2480.0	2483.5	-47.46	-24.00						

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the link in the above results matrix to view the plot

Equipment Configuration for Transmitter Conducted Spurious Emissions			
Variant:	802.15 3-DH5	**Duty Cycle (%):**	100
Data Rate:	3-DH5	**Antenna Gain (dBi):**	Not Applicable
Modulation:	8-DPSK	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Frequency Range	Transmitter Conducted Spurious Emissions (dBm)							
		Port a		Port b		Port c		Port d	
MHz	MHz	SE	Limit	SE	Limit	SE	Limit	SE	Limit
2402.0	30.0 - 26000.0	-56.129	-26.17						
2441.0	30.0 - 26000.0	-56.737	-26.24						
2480.0	30.0 - 26000.0	-55.529	-25.89						

Test Frequency	Band-Edge Frequency	3-DH5 Transmitter Conducted Band-Edge Emissions (dBm)							
		Port a		Port b		Port c		Port d	
MHz	MHz	BE	Limit	BE	Limit	BE	Limit	BE	Limit
2402.0	2400.0	-47.56	-25.45						
2480.0	2483.5	-47.46	-25.42						

Test Frequency	Band-Edge Frequency	3-DH5 Hopping Transmitter Conducted Band-Edge Emissions (dBm)							
		Port a		Port b		Port c		Port d	
MHz	MHz	BE	Limit	BE	Limit	BE	Limit	BE	Limit
2402.0	2400.0	-48.47	-35.24						
2480.0	2483.5	-47.30	-25.07						

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-05 MEASUREMENT OF SPURIOUS EMISSIONS
Measurement Uncertainty:	<=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB

Note: click the link in the above results matrix to view the plot

Specification

Limits Band-Edge

Lower Limit Band-edge	Upper Limit Band-edge	Limit below highest level of desired power
2,400 MHz	2,483.5 MHz	≥ 20 dB
5725 MHz	5850 MHz	

§15.247(d) and RSS-210 §A8.5 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Laboratory Measurement Uncertainty for Conducted Spurious Emissions

Measurement uncertainty	±2.37 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-05 'Measurement of Spurious Emissions'	0088, 0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117.

6.1.1.8. Pseudorandom Hopping Frequency Sequence

Test Conditions for Pseudorandom Hopping Frequency Sequence			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	18.0 - 27.5
Test Heading:	Pseudorandom Hopping Sequence	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)(1)	**Pressure (mBars):**	999 - 1004
Reference Document(s):	FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems		

Pseudorandom Frequency Hopping Sequence

Describe how the hopping sequence is generated. Provide an example of the hopping sequence channels, in order to demonstrate that the sequence meets the requirement specified in the definition of a frequency hopping spread spectrum system, found in Section (a)(1).

Declaration from the Manufacturer

The hopping sequence is selected according to the Bluetooth standard. There are a total of 79 channels available in the 2.4 GHz band. The Bluetooth standard defines an algorithmic basis for determining the pseudorandom sequence to use.

Specifications

§15.247 (a) (1)

(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.

6.1.1.9. Equal Hopping Frequency Use

Test Conditions for Equal Hopping Frequency Use			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	18.0 - 27.5
Test Heading:	Equal Hopping Frequency Use	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)(1)	**Pressure (mBars):**	999 - 1004
Reference Document(s):	FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems		

Equal Hopping Frequency Use

Describe how each individual EUT meets the requirement that each of its hopping channels is used equally on average (e.g., that each new transmission event begins on the next channel in the hoppinfg sequence after the final channel used in the previous transmission event). See Section (a)(1).

Declaration from the Manufacturer

Bluetooth uses a packet based air interface with a fixed timing. Each packet goes out on a different channel in the sequence, so all frequencies in the hopping sequence get used equally.

Specifications

§15.247 (a) (1)

(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.

6.1.1.10.System Receiver Input Bandwidth

Test Conditions for System Receiver Input Bandwidth			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	18.0 - 27.5
Test Heading:	System Receiver Input Bandwidth	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)(1)	**Pressure (mBars):**	999 - 1004
Reference Document(s):	FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems		

System Receiver Input Bandwidth

Describe how each individual EUT meets the requirement that each of its hopping channels is used equally on average (e.g., that each new transmission event begins on the next channel in the hoppinfg sequence after the final channel used in the previous transmission event). See Section (a)(1).

Declaration from the Manufacturer

Chipset by Broadcom BT is used in the design and complies with Bluetooth specifications. There are no external channel filters present, but filters are present in the chipset design in order to achieve the receiver sensitivity.

Specifications

§15.247 (a) (1)

(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.

§ RSS-210 A8.1 (b) (b) 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 band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W. 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

6.1.1.11.System Receiver Hopping Capability

Test Conditions for System Receiver Hopping Capability			
Standard:	FCC CFR 47:15.247	**Ambient Temp. (ºC):**	18.0 - 27.5
Test Heading:	System Receiver Hopping Capability	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)(1)	**Pressure (mBars):**	999 - 1004
Reference Document(s):	FCC DA 00-705 "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems		

System Receiver Hopping Capability

Describe how the associated receiver(s) has the ability to shift frequencies in synchronization with the transmitted signals. See Section (a)(1).

Declaration from the Manufacturer

A slave device follows the master device's hopping sequence by quickly scanning through channels to find the master's transmission (this is called discovery). It then uses information in that packet and the same algorithmic process described in the standard to detmine what the hopping sequence is that the master is using. The slave also synchronizes to the master's transmit packet timing so it knows when to hop.

Specifications

§15.247 (a) (1)

(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.

§ RSS-210 A8.1 (b) (b) 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 band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W. 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

6.1.2. Radiated Emission Testing

Transmitter Radiated Spurious Emissions (above 1 GHz); Peak Field Strength Measurements; and Radiated Band Edge Measurements – Restricted Bands

FCC, Part 15 Subpart C §15.247(d) 15.205; 15.209
Industry Canada RSS-210 §A8.5,
Industry Canada RSS-Gen §4.10

Test Procedure

The worst case highest spectral density radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

FS = R + AF + CORR - FO
where: FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

For example:
Given receiver input reading of 51.5 dBμV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 dBμV/m

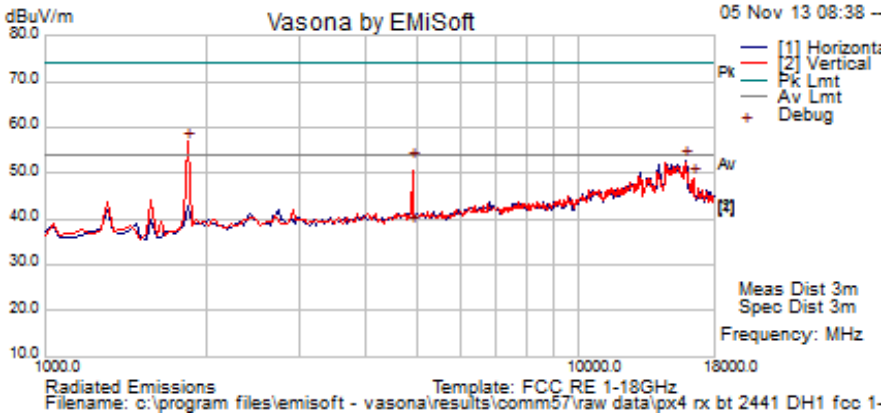
Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

6.1.2.1. Test Results

Test Freq.	2441 MHz	**Engineer**	JMH
Variant	802.15	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	27
Power Setting	0 dBm	**Press. (mBars)**	1008
Antenna	2.8 dBi	**Duty Cycle (%)**	100
Test Notes 1	PX4 RX Headset		
Test Notes 2	Target set to = 0 dBM, BDR GFSK DH1 Packet Type		

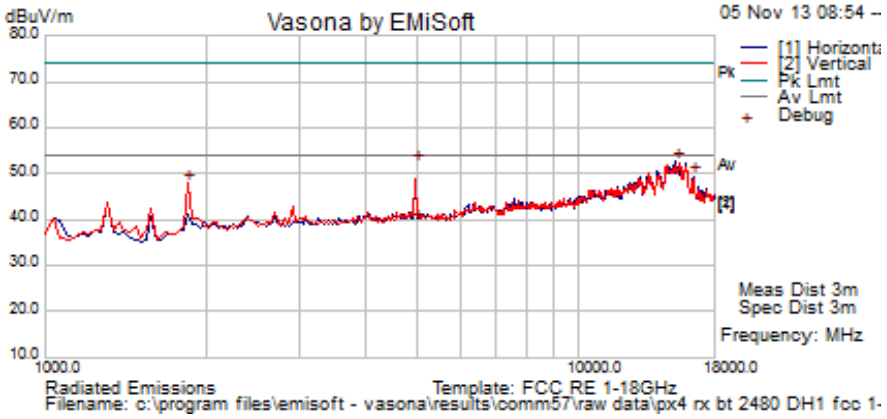


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
4882.315	57.5	4.5	-9.7	52.3	Peak Max	V	126	248	74	-21.7	Pass	RB
4882.315	43.7	4.5	-9.7	38.5	Average Max	V	126	248	54	-15.5	Pass	RB
1851.703407	66.6	2.7	-12.4	56.8	Peak [Scan]	V						NRB
15887.776	44.1	8.8	-0.2	52.7	Peak [Scan]	H						Noise
16432.866	40.0	8.9	0.2	49.1	Peak [Scan]	V						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	2480 MHz	**Engineer**	JMH
Variant	802.15	**Temp (ºC)**	17.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	27
Power Setting	0 dBm	**Press. (mBars)**	1008
Antenna	2.8 dBi	**Duty Cycle (%)**	100
Test Notes 1	PX4 RX Headset		
Test Notes 2	Target set to = 0 dBM, BDR GFSK DH1 Packet Type		

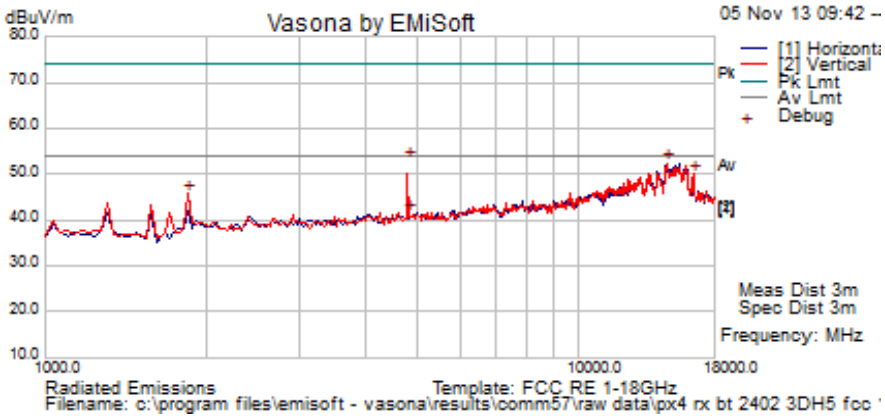


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
4960.184	57.4	4.6	-9.9	52.1	Peak Max	V	100	245	74	-21.9	Pass	RB
4960.184	44.4	4.6	-9.9	39.2	Average Max	V	100	245	54	-14.8	Pass	RB
15240.481	45.8	8.2	-1.4	52.5	Peak [Scan]	H						NRB
16398.798	40.3	8.9	0.2	49.3	Peak [Scan]	H						NRB
1852.349	57.5	2.7	-12.4	47.7	Peak [Scan]	V						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	2402 MHz	**Engineer**	JMH
Variant	802.15	**Temp (ºC)**	18.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	27
Power Setting	0 dBm	**Press. (mBars)**	1008
Antenna	2.8 dBi	**Duty Cycle (%)**	100
Test Notes 1	PX4 RX Headset		
Test Notes 2	Target set to 0 dBM, EDR 8 DPSK 3-DH5 Packet Type		

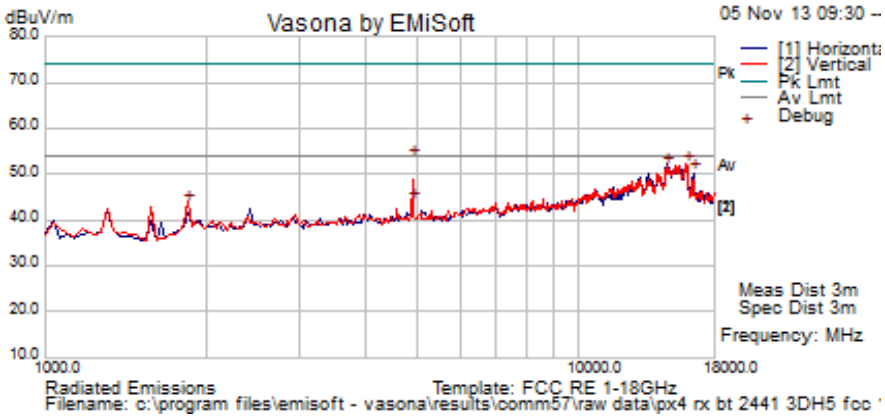


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
4804.760	58.3	4.5	-9.7	53.1	Peak Max	V	129	247	74.0	-20.9	Pass	
4804.76	46.4	4.5	-9.7	41.2	Average Max	V	129	247	54.0	-12.8	Pass	
14627.255	46.9	8.2	-2.7	52.5	Peak [Scan]	H	200	0	54	-1.5	Pass	
16398.798	40.9	8.9	0.2	50.0	Peak [Scan]	V	100	0	54	-4.0	Pass	
1853.142	55.5	2.7	-12.4	45.8	Peak [Scan]	V	128	247	54	-8.2	Pass	

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	2441	**Engineer**	JMH
Variant	802.15	**Temp (ºC)**	18.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	27
Power Setting	0 dBm	**Press. (mBars)**	1008
Antenna	2.8 dBi	**Duty Cycle (%)**	100
Test Notes 1	PX4 RX Headset		
Test Notes 2	Target set to 0 dBM, EDR 8 DPSK 3-DH5 Packet Type		

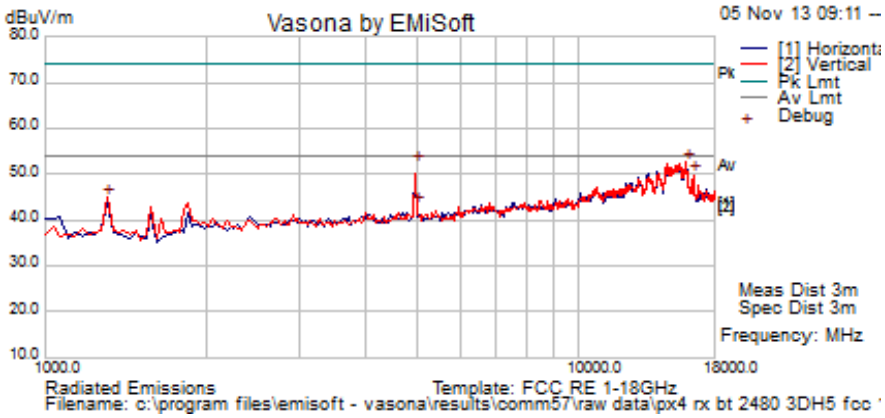


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
4882.214	58.7	4.5	-9.7	53.5	Peak Max	V	99	248	74.0	-20.5	Pass	RB
4882.214	49.3	4.5	-9.7	44.1	Average Max	V	99	248	54.0	-9.9	Pass	RB
15921.844	43.4	8.9	-0.1	52.2	Peak [Scan]	V	100	0	54	-1.9	Pass	Noise
16432.866	41.1	8.9	0.2	50.2	Peak [Scan]	H						NRB
14668.935	46.2	8.2	-2.6	51.8	Peak [Scan]	H						NRB
1853.605	53.4	2.7	-12.4	43.7	Peak [Scan]	V						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	2480	**Engineer**	JMH
Variant	802.15	**Temp (ºC)**	18.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	27
Power Setting	0 dBm	**Press. (mBars)**	1008
Antenna	2.8 dBi	**Duty Cycle (%)**	100
Test Notes 1	PX4 RX Headset		
Test Notes 2	Target set to 0 dBM, EDR 8 DPSK 3-DH5 Packet Type		

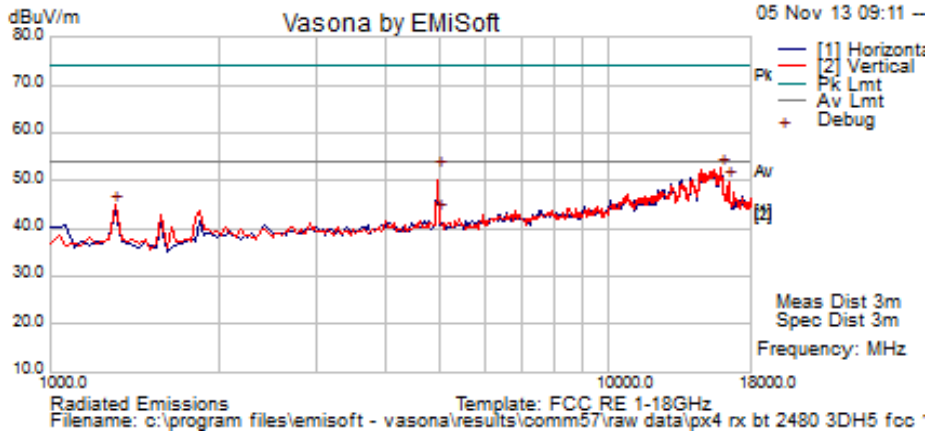


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
4959.970	57.5	4.6	-9.9	52.3	Peak Max	V	116	228	74	-21.7	Pass	RB
4959.970	48.2	4.6	-9.9	42.9	Average Max	V	116	228	54	-11.1	Pass	RB
15921.844	43.9	8.9	-0.1	52.7	Peak [Scan]	V						Noise
16398.798	40.8	8.9	0.2	49.8	Peak [Scan]	H						NRB
1306.396	56.2	2.2	-13.6	44.9	Peak [Scan]	V	98	361	54	-9.1	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	HOPPING	**Engineer**	JMH
Variant	802.15	**Temp (ºC)**	19.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	26
Power Setting	0 dBm	**Press. (mBars)**	1008
Antenna	2.8 dBi	**Duty Cycle (%)**	100
Test Notes 1	PX4 RX Headset		
Test Notes 2	Target set to 0 dBM, EDR 8 DPSK 3-DH5 Packet Type		

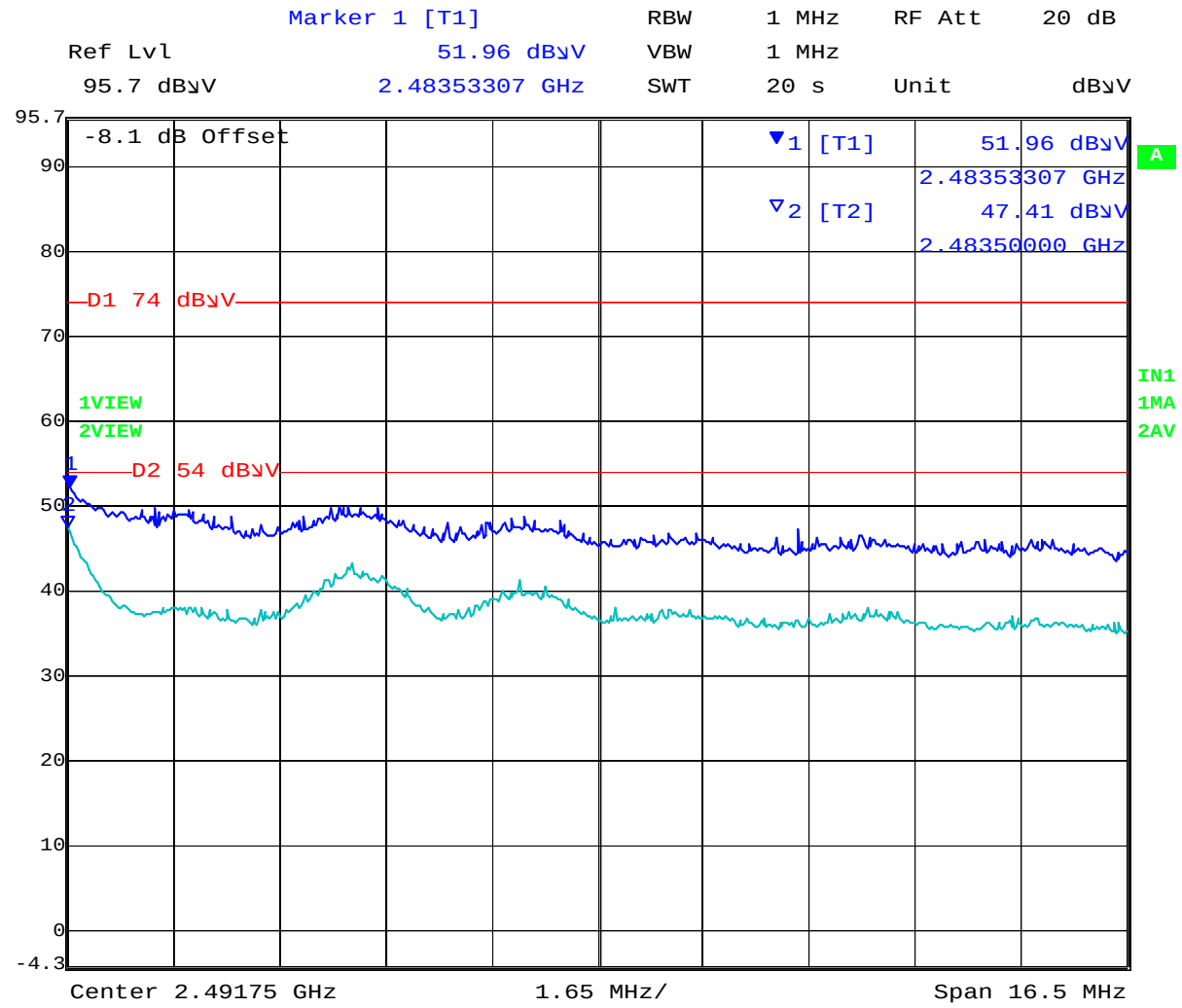


Formally measured emission peaks

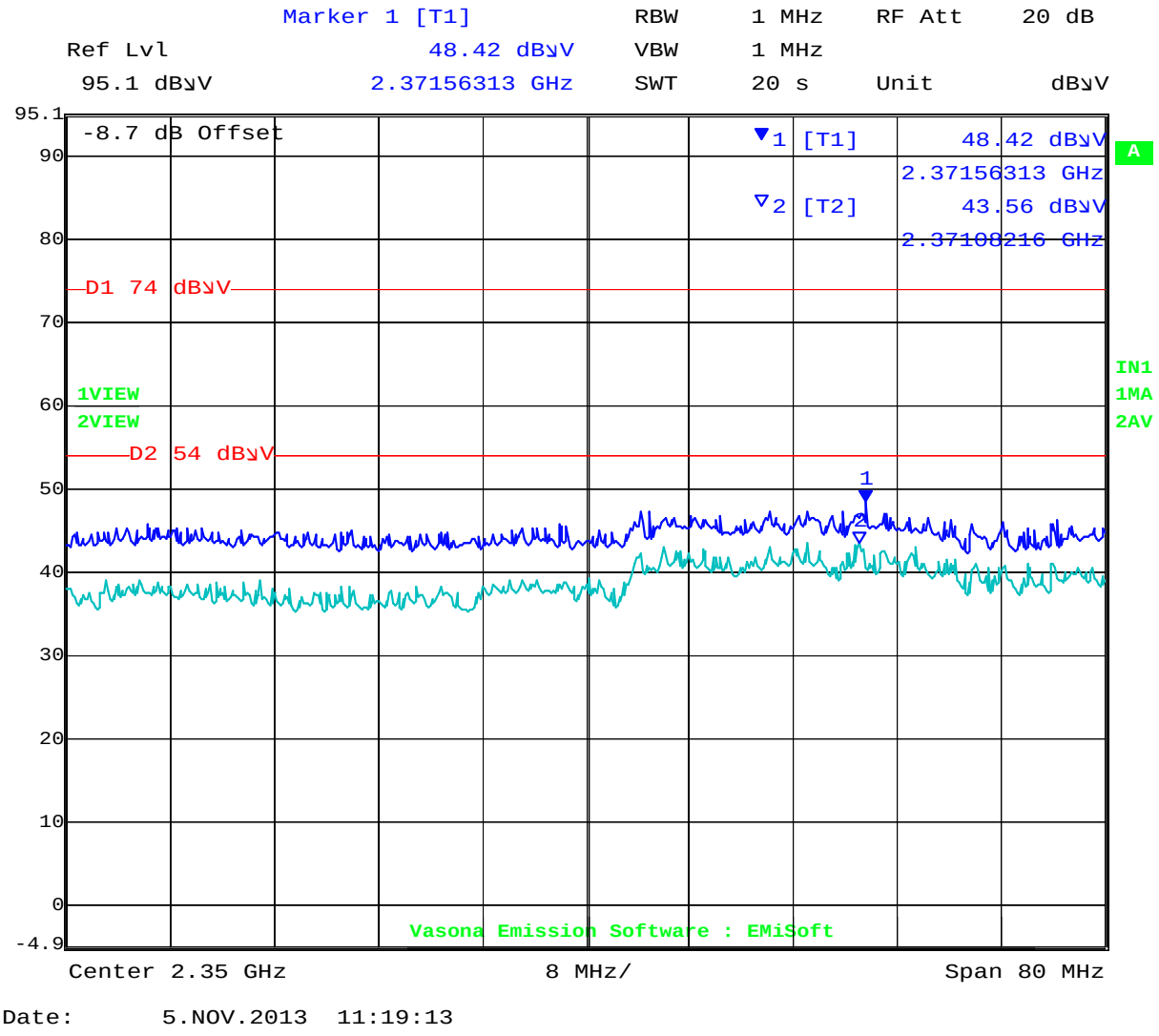
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
4904.209	57.2	4.5	-9.8	52.0	Peak Max	V	125	287	74	-22.1	Pass	RB
4904.209	35.0	4.5	-9.8	29.7	Average Max	V	125	287	54	-24.3	Pass	RB
15921.844	44.8	8.9	-0.1	53.6	Peak [Scan]	H						Noise
16432.866	40.5	8.9	0.2	49.6	Peak [Scan]	H						NRB
14634.15	46.6	8.2	-2.7	52.1	Peak [Scan]	H						NRB
15239.659	45.3	8.2	-1.4	52.1	Peak [Scan]	H						NRB
1854.002	56.4	2.7	-12.4	46.6	Peak [Scan]	V						NRB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

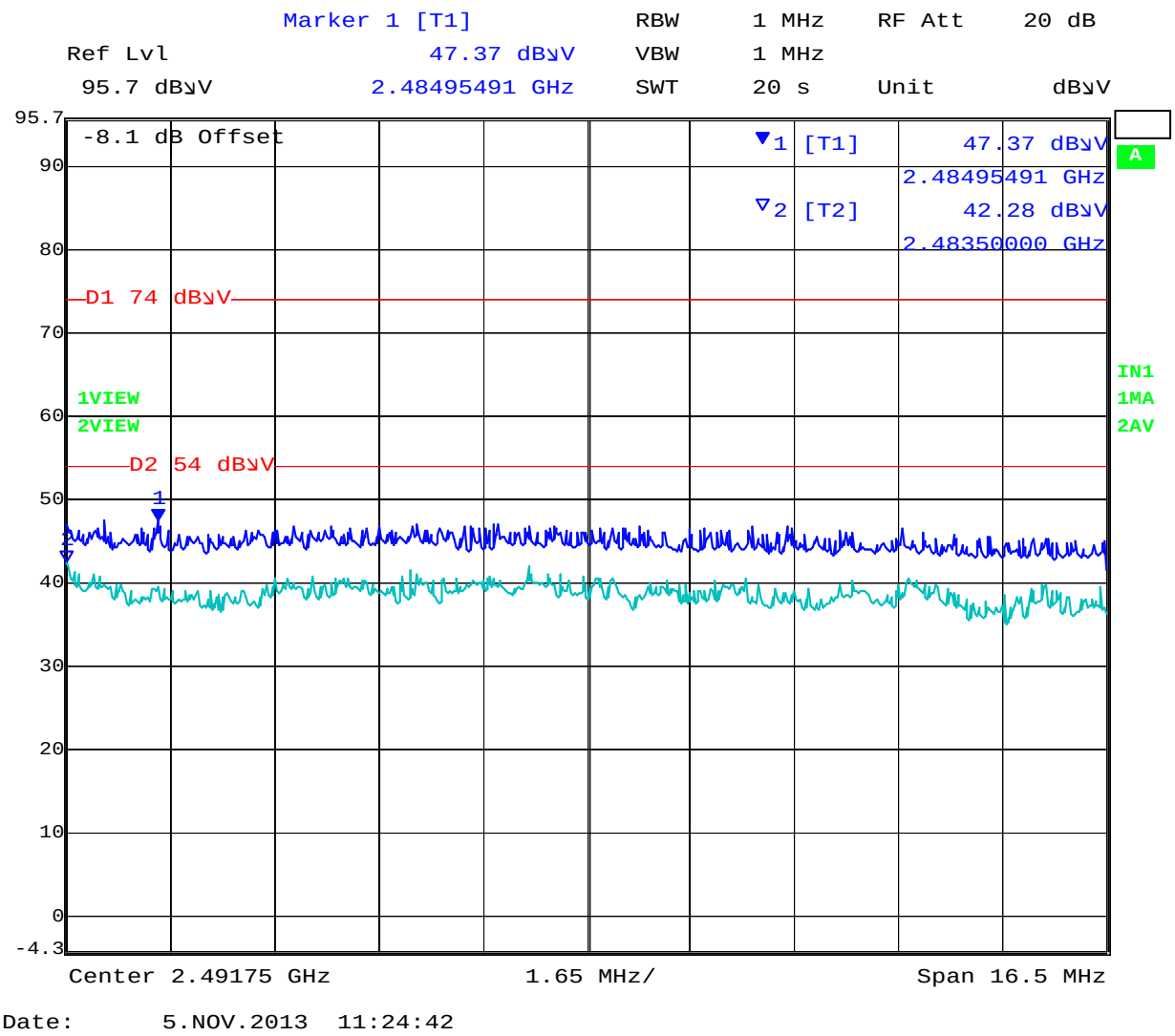
3-DH5 2483.5 MHz Band Edge



Hopping Band Edge: 2390-2400



Hopping Band Edge: 2483.5-2500



Specification Limits

FCC §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 radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified §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(a)).

IC RSS-210 §A8.5 In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required

FCC §15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

FCC §15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

FCC §15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

§15.209 (a) Limit Matrix

Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

6.1.2.2. Digital Emissions (0.03-1 GHz)

FCC, Part 15 Subpart C §15.205/ §15.209
Industry Canada RSS-Gen §7.2.5

Test Procedure

Testing 30M-1 GHz was performed in a 3-meter anechoic chamber using a CISPR compliant receiver. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. To further maximize emissions the receive antenna was varied between 1 and 4 meters. The emissions are recorded with receiver in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed. The anechoic chamber test set-up is identified in Section 6 Test Set-Up Photographs.

The EUT had two methods of powering on ac/dc converter and Power over Ethernet (POE). Both modes were tested for emissions below 1GHz.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver.

$$FS = R + AF + CORR$$

where:

FS = Field Strength
R = Measured Receiver Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain

For example:
Given a Receiver input reading of 51.5dBμV; Antenna Factor of 8.5dB; Cable Loss of 1.3dB; Falloff Factor of 0dB, an Amplifier Gain of 26dB and Notch Filter Loss of 1dB. The Field Strength of the measured emission is:

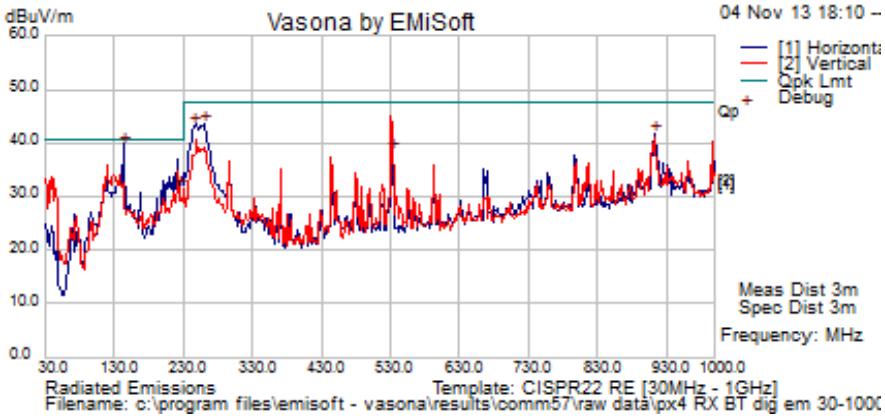
FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100μV/m
48 dBμV/m = 250μV/m

Test Freq.	NA	**Engineer**	JMH
Variant	Digital Emissions	**Temp (ºC)**	22.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	23
Power Setting	NA	**Press. (mBars)**	1001
Antenna			
Test Notes 1			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
144.013	53.1	4.3	-18.2	39.2	Quasi Max	H	128	25	40.5	-1.3	Pass	
259.379	56.9	4.9	-18.3	43.6	Peak [Scan]	H	100	0	47.5	-4.0	Pass	
245.612	57.1	4.8	-18.8	43.1	Peak [Scan]	H	98	0	47.5	-4.4	Pass	
912.525	41.6	7.1	-7.1	41.6	Peak [Scan]	H	200	0	47.5	-5.9	Pass	
530.907	44.6	5.9	-12.2	38.3	Quasi Max	V	181	322	47.5	-9.2	Pass	
222.445	46.0	4.7	-19.5	31.2	Quasi Max	H	179	227	40.5	-9.3	Pass	

Legend:	DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency
	NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band

Specification

Limits

§15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

§15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

§15.209 (a) and **Industry Canada RSS-Gen §7.2.5** Limit Matrix

Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

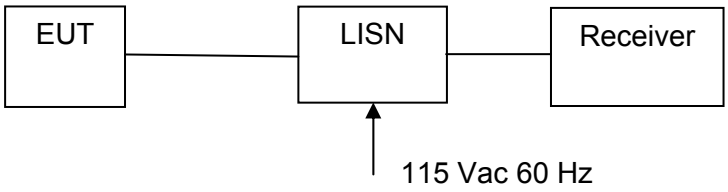
6.1.3. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

Not required - EUT is power by Battery only.

FCC, Part 15 Subpart C §15.207
Industry Canada RSS-Gen §7.2.4

Test Procedure
The EUT is configured in accordance with ANSI C63.4. The conducted emissions are measured in a shielded room with a spectrum analyzer in peak hold in the first instance. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

Test Measurement Set up



Measurement set up for AC Wireline Conducted Emissions Test

Measurement Results for AC Wireline Conducted Emissions (150 kHz – 30 MHz)

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Not required - EUT is power by Battery only.

Specification

Limit

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μΩ line impedance stabilization network (LISN), see §15.207 (a) matrix below. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

RSS-Gen §7.2.4
Except when the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply, either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table below. The more stringent limit applies at the frequency range boundaries. The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network (LISN).

§15.207 (a) and **RSS-Gen §7.2.4** Limit Matrix
The lower limit applies at the boundary between frequency ranges

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Laboratory Measurement Uncertainty for Conducted Emissions

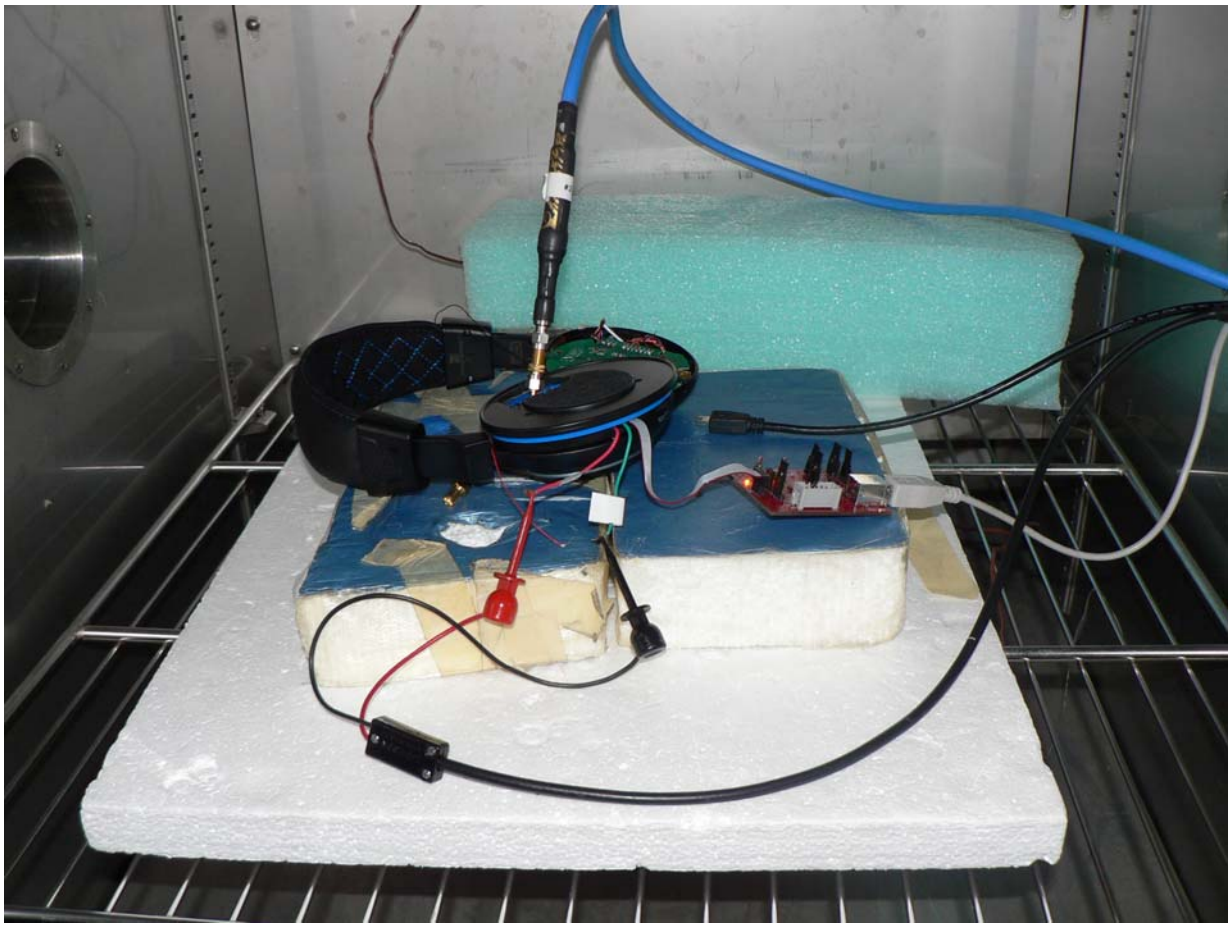
Measurement uncertainty	±2.64 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-EMC-01 'Measurement of Conducted Emissions'	0158, 0184, 0287, 0190, 0293, 0307

7. PHOTOGRAPHS

7.1. Conducted Test Setup



7.2. Radiated Emissions Test Setup < 1 GHz

7.3. Radiated Emissions Test Setup > 1 GHz

8. TEST EQUIPMENT

Asset #	Instrument	Manufacturer	Part #	Serial #	Calibration Due Date
0117	Power Sensor	Hewlett Packard	8487D	3318A00371	18th Oct 14
0223	Power Meter	Hewlett Packard	EPM-442A	US37480256	18th Oct 14
0376	Power Sensor	Agilent	U2000A	MY51440005	28th Oct 14
0390	Power Sensor	Agilent	U2002A	MY50000103	17th Oct 14
0158	Barometer /Thermometer	Control Co.	4196	E2846	8th Jan 14
0287	EMI Receiver	Rhode & Schwartz	ESIB40	100201	31st Jul 14
0338	30 - 3000 MHz Antenna	Sunol	JB3	A052907	14th Aug 14
0399	1-18 GHz Horn Antenna	EMCO	3117	00154575	10th Oct 14
0252	SMA Cable	Megaphase	Sucoflex 104	None	N/A
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001	N/A
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	209092-001	N/A
0314	30dB N-Type Attenuator	ARRA	N9444-30	1623	N/A
0359	DFS Test System	Aeroflex	PXI-1042	300001/004	21st Oct 14
0299	DFS Test Software	Aeroflex	PXIModule	Version 7.1.0	N/A
0502	EMC Test Software	EMISoft	Vasona	5.0051	N/A
0503	RF Conducted Test Software	National Instruments	Labview	Version 8.2	N/A
0398	RF Conducted Test Software	MiCOM Labs ATS	--	Version 1.8	N/A
0380	RF Switch	MiCOM Labs	MIC001	MIC001	20th Dec 13

APPENDIX

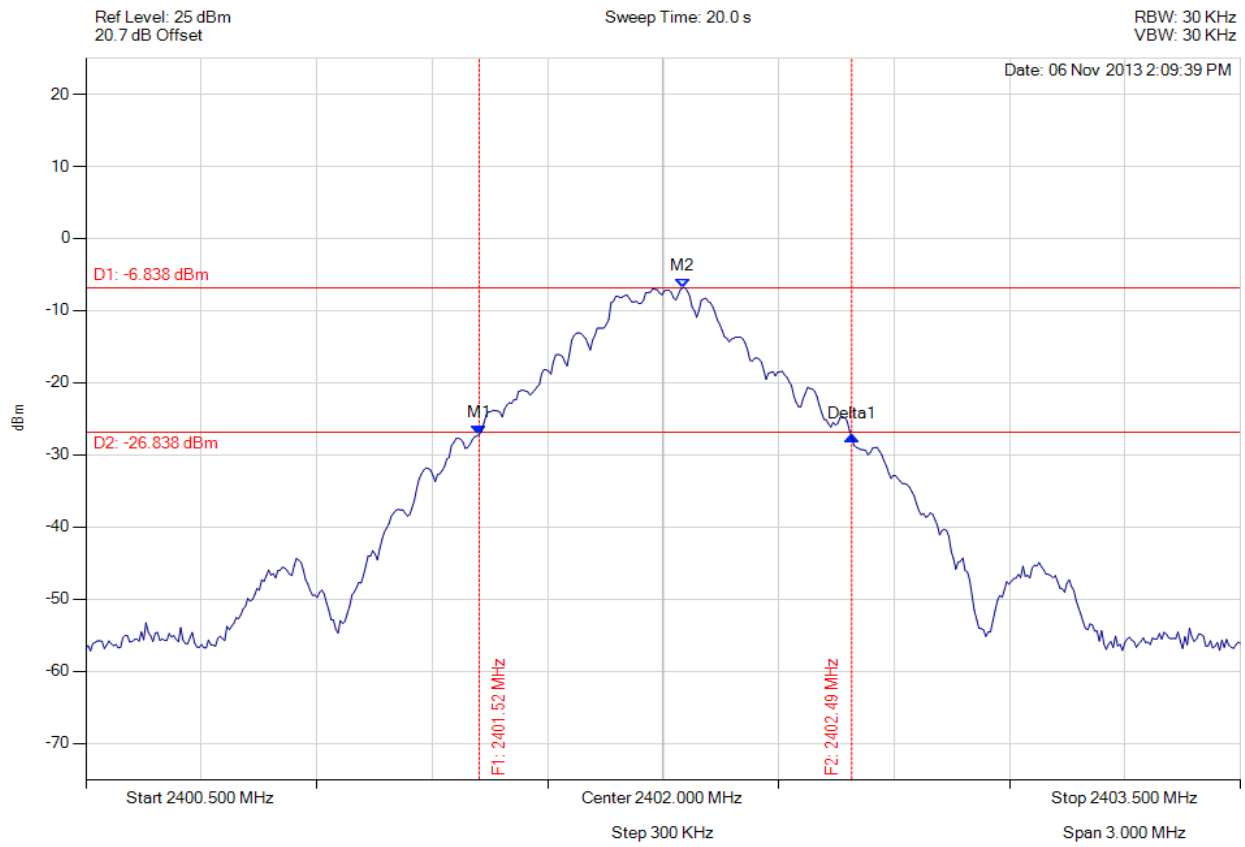
A. SUPPORTING INFORMATION

A.1. CONDUCTED TEST PLOTS

A.1.1. 6 dB & 99% Bandwidth

6 dB &20 dB BANDWIDTH

Variant: 802.15 DH1, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

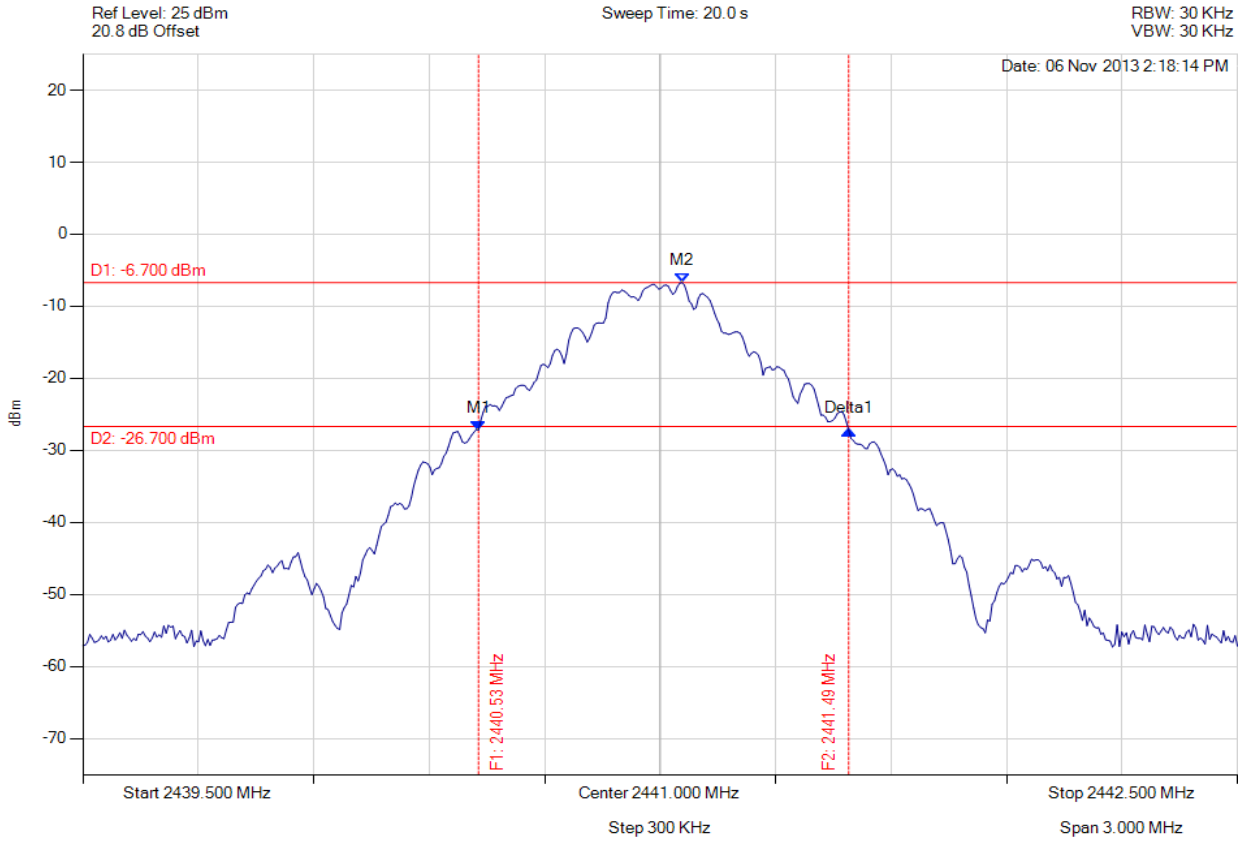


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2401.522 MHz : -27.155 dBm M2 : 2402.051 MHz : -6.838 dBm 20 dB bandwidth : 968 KHz	Measured 20 dB Bandwidth: 0.968 MHz

Back to the Matrix

20 dB BANDWIDTH

Variant: 802.15 DH1, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

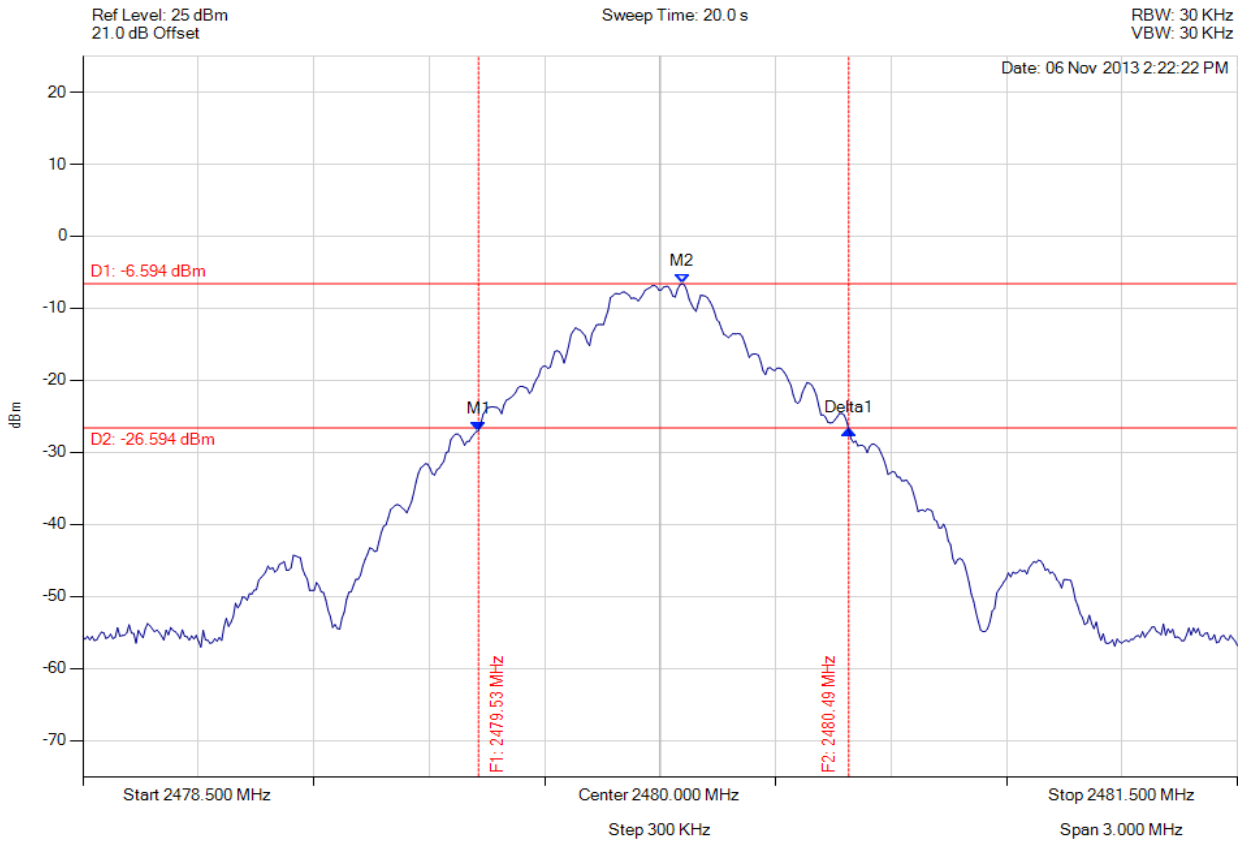


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.528 MHz : -27.188 dBm M2 : 2441.057 MHz : -6.700 dBm 20 dB Bandwidth: 962 KHz	Measured 20 dB Bandwidth: 0.962 MHz

Back to the Matrix

20 dB BANDWIDTH

Variant: 802.15 DH1, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

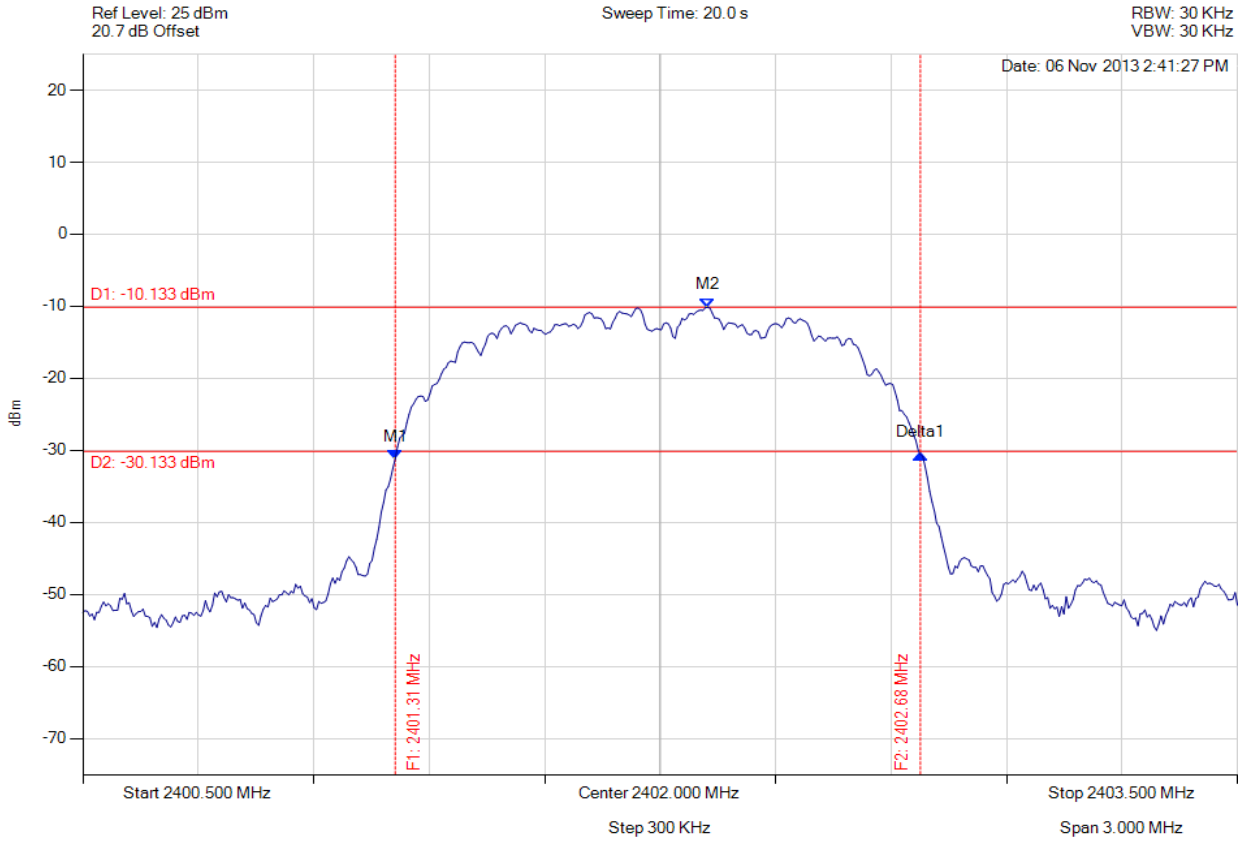


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2479.528 MHz : -27.009 dBm M2 : 2480.057 MHz : -6.594 dBm 20 dB Bandwidth : 962 KHz	Measured 20 dB Bandwidth: 0.962 MHz

Back to the Matrix

20 dB BANDWIDTH

Variant: 802.15 DH5, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

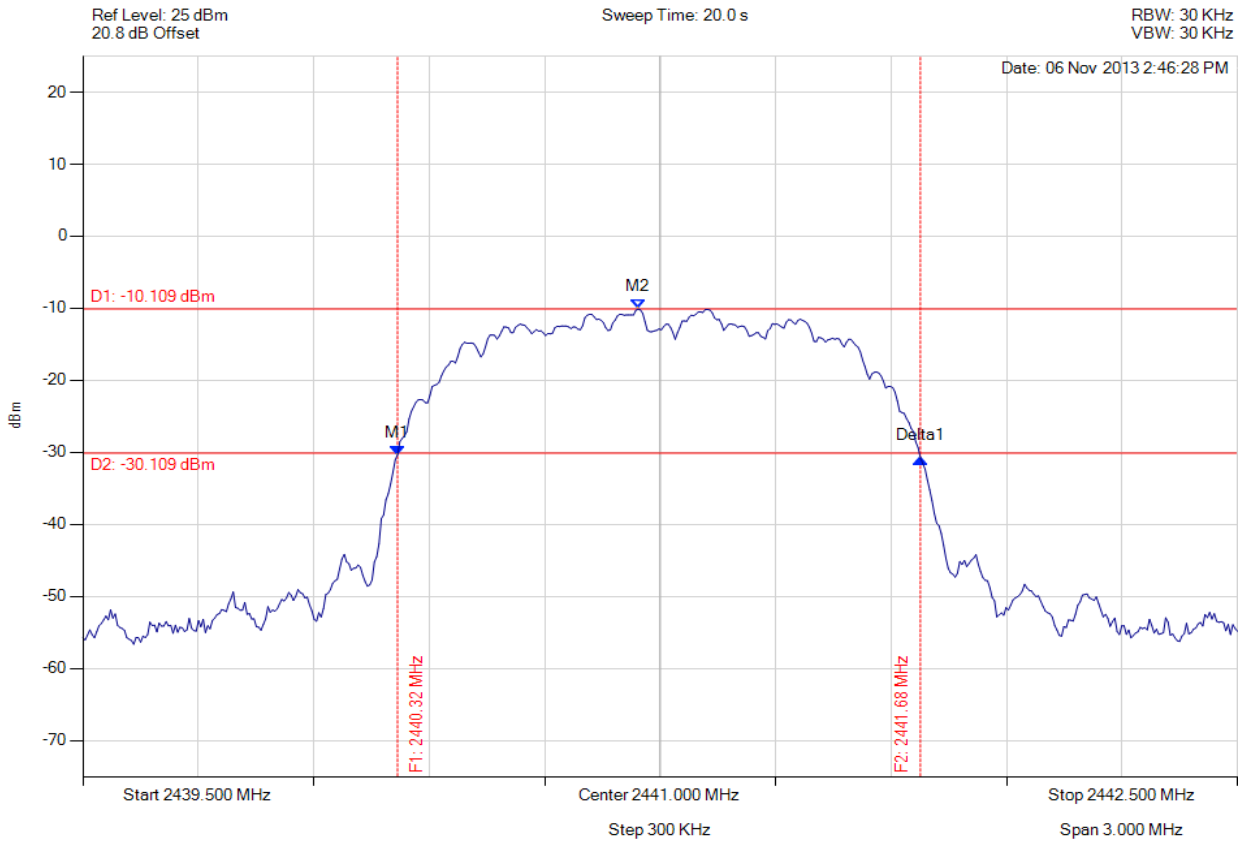


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2401.312 MHz : -31.176 dBm M2 : 2402.123 MHz : -10.133 dBm 20 dB Bandwidth: 1.365 MHz	Measured 20 dB Bandwidth: 1.365 MHz

Back to the Matrix

20 dB BANDWIDTH

Variant: 802.15 DH5, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

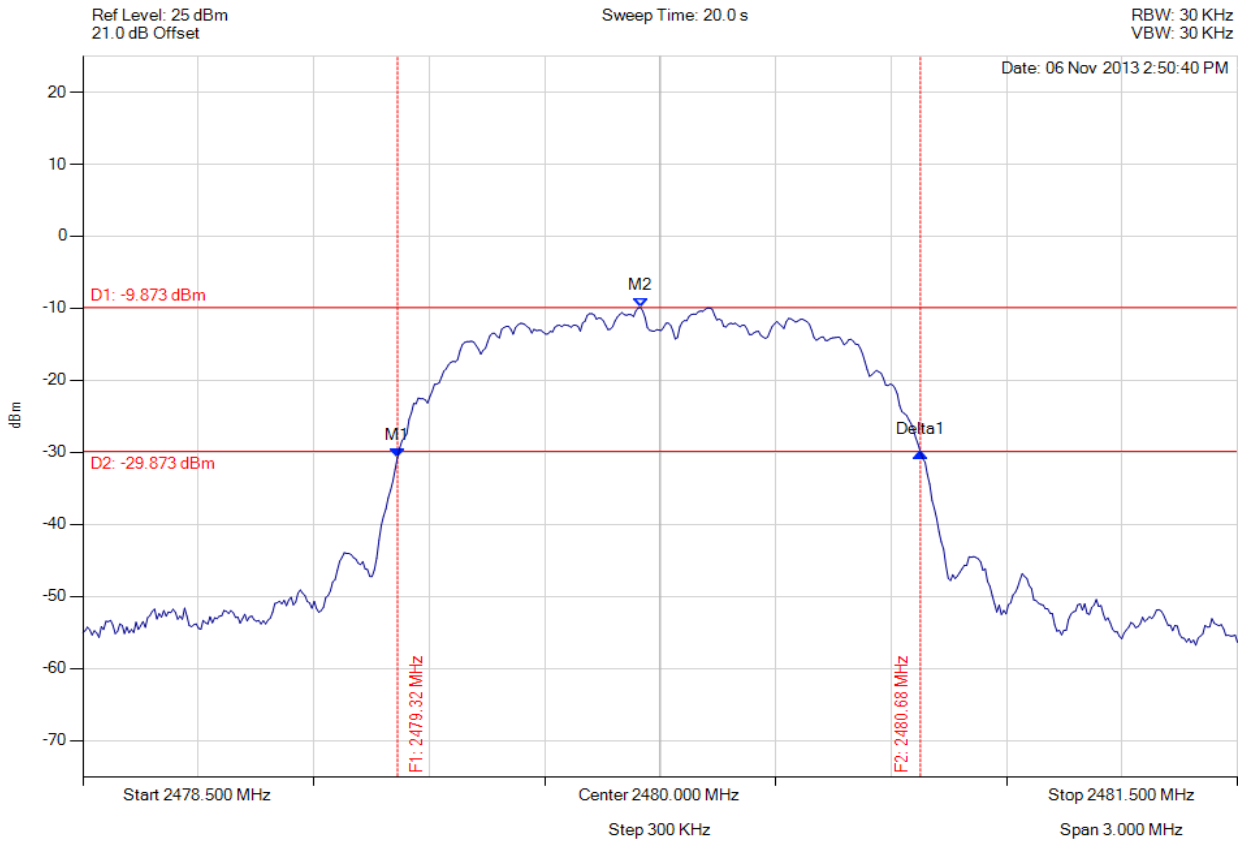


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.318 MHz : -30.350 dBm M2 : 2440.943 MHz : -10.109 dBm 20 dB Bandwidth : 1.359 MHz	Measured 20 dB Bandwidth: 1.359 MHz

Back to the Matrix

20 dB BANDWIDTH

Variant: 802.15 DH5, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

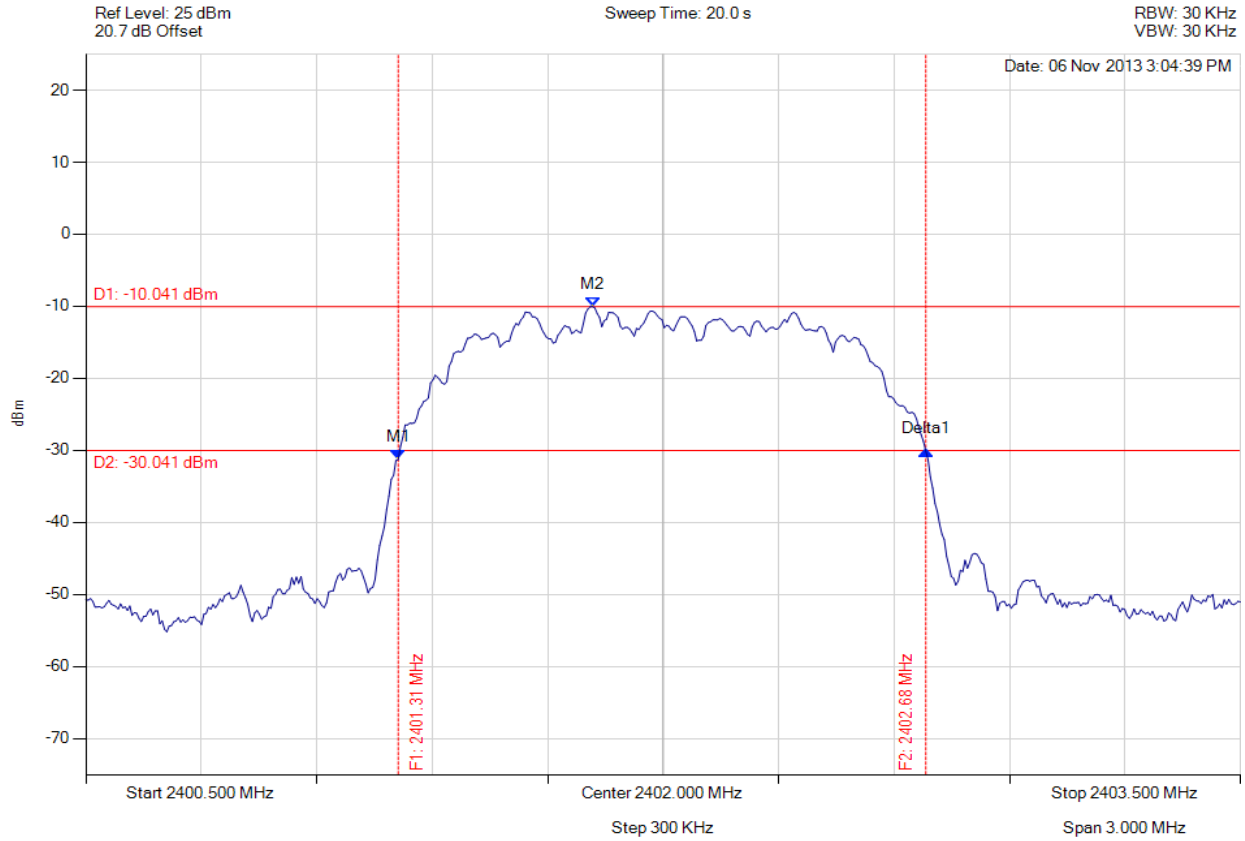


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2479.318 MHz : -30.672 dBm M2 : 2479.949 MHz : -9.873 dBm 20 dB Bandwidth : 1.359 MHz	Measured 20 dB Bandwidth: 1.359 MHz

Back to the Matrix

20 dB BANDWIDTH

Variant: 802.15 3-DH1, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

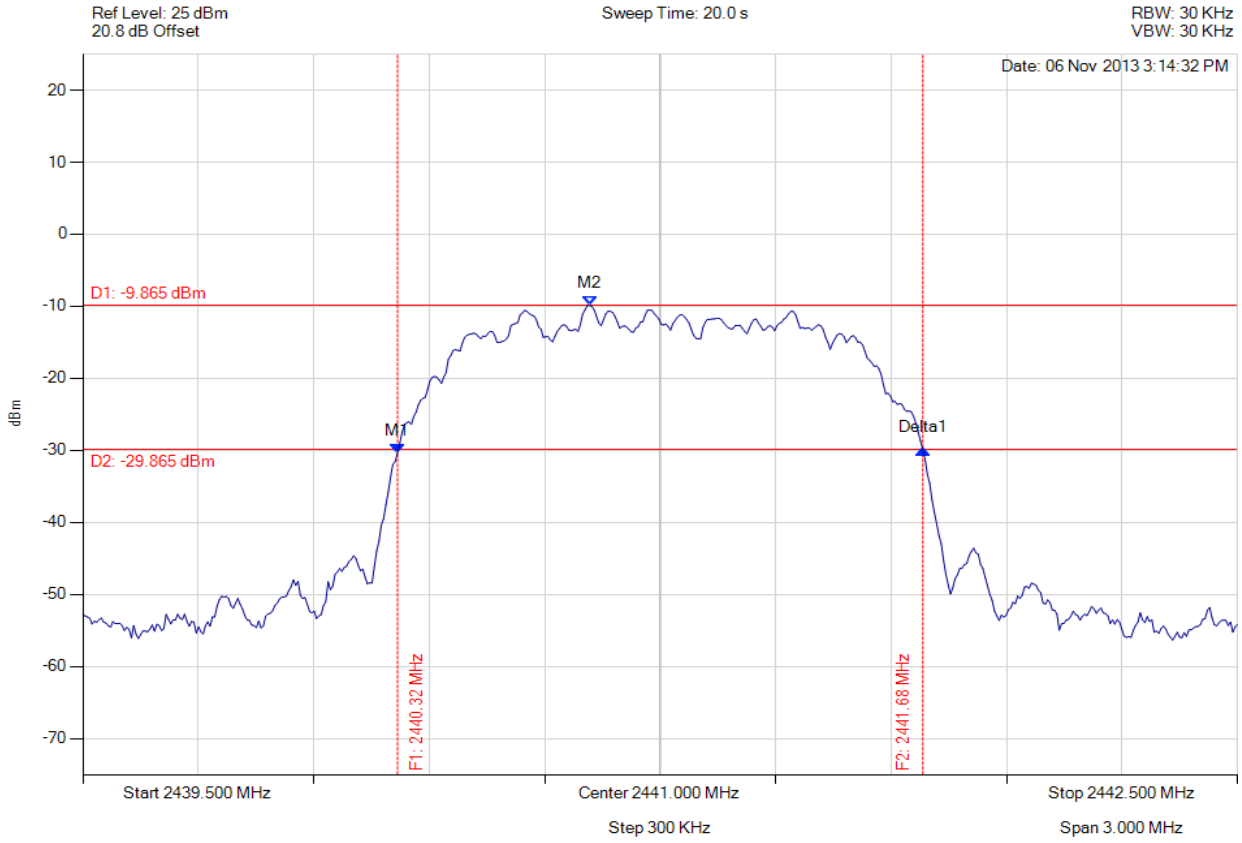


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2401.312 MHz : -31.278 dBm M2 : 2401.817 MHz : -10.041 dBm 20 dB Bandwidth : 1.371 MHz	Measured 20 dB Bandwidth: 1.371 MHz

Back to the Matrix

20 dB BANDWIDTH

Variant: 802.15 3-DH1, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

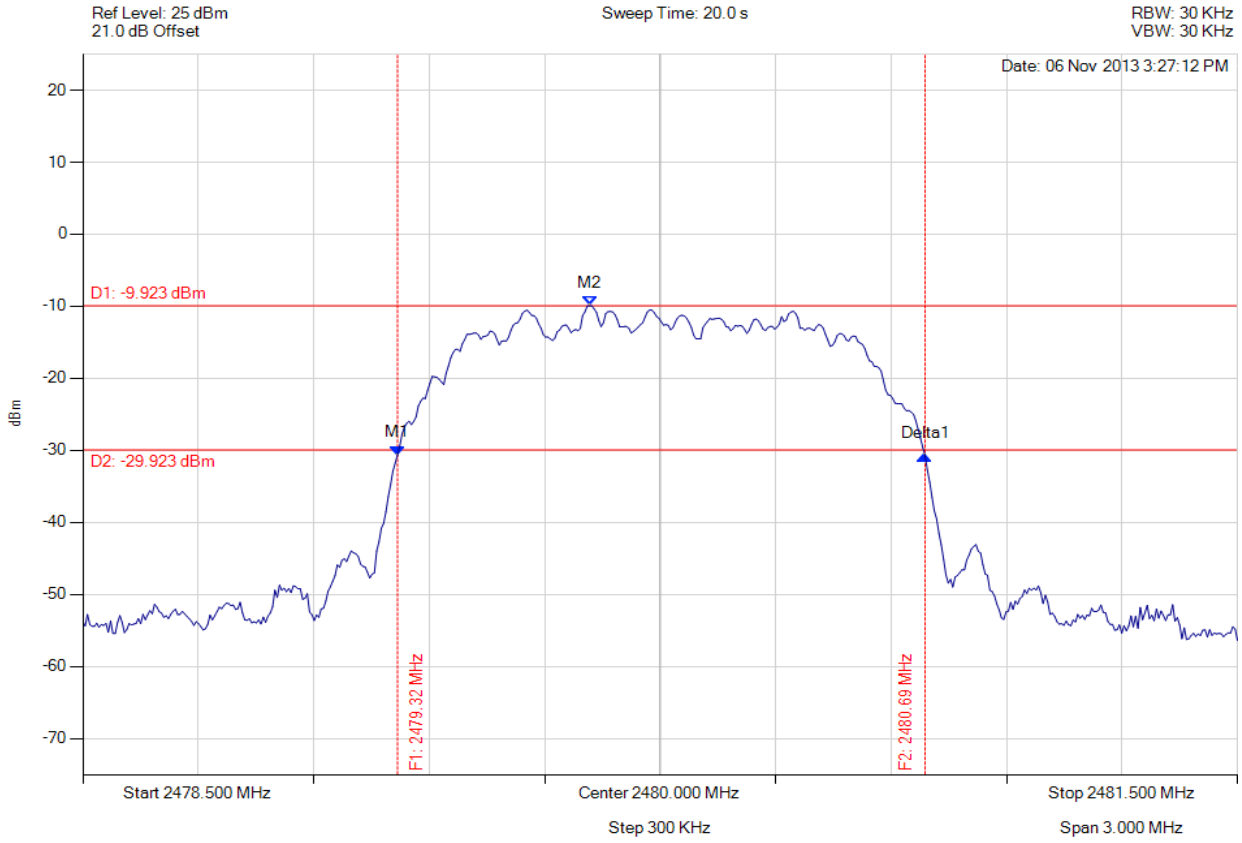


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.318 MHz : -30.363 dBm M2 : 2440.817 MHz : -9.865 dBm 20 dB Bandwidth : 1.365 MHz	Measured 20 dB Bandwidth: 1.365 MHz

Back to the Matrix

20 dB BANDWIDTH

Variant: 802.15 3-DH1, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

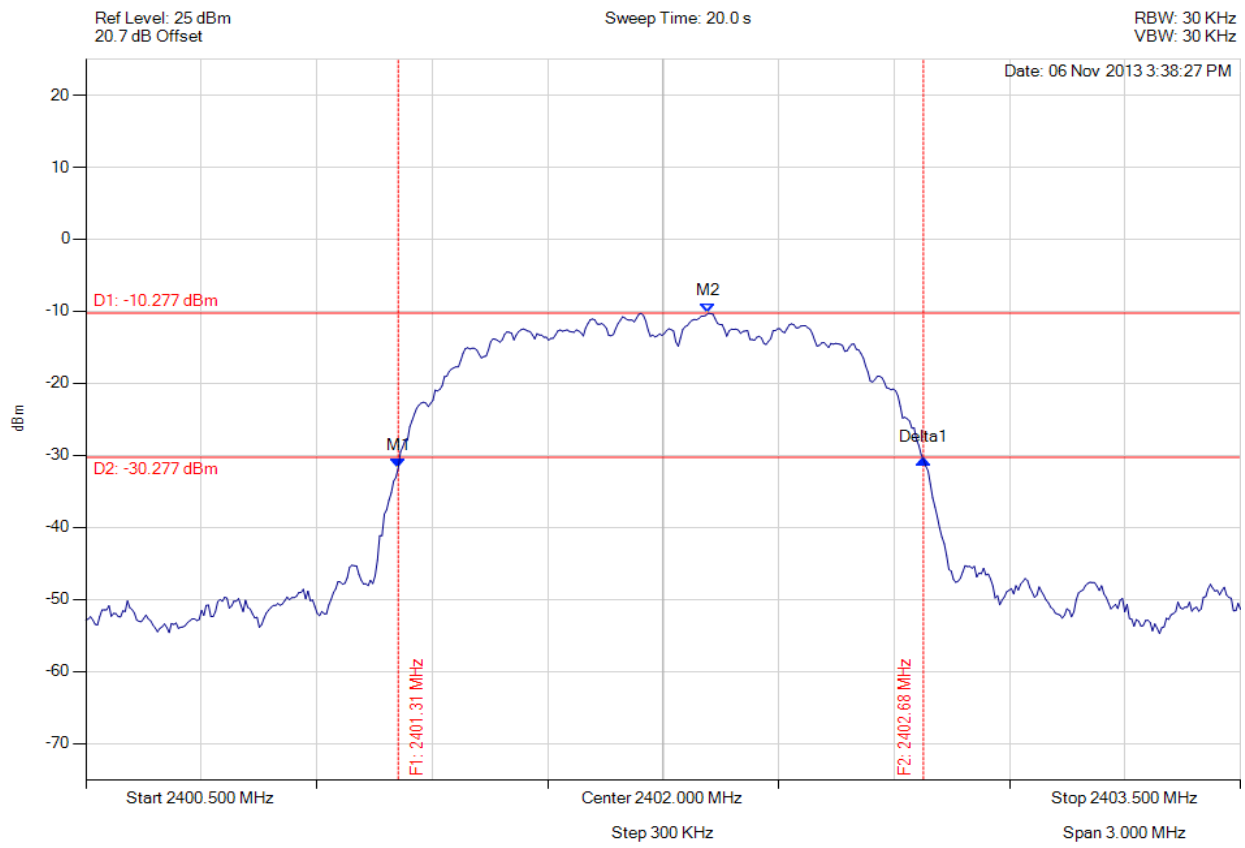


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2479.318 MHz : -30.639 dBm M2 : 2479.817 MHz : -9.923 dBm 20 dB Bandwidth : 1.371 MHz	Measured 20 dB Bandwidth: 1.371 MHz

Back to the Matrix

20 dB BANDWIDTH

Variant: 802.15, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

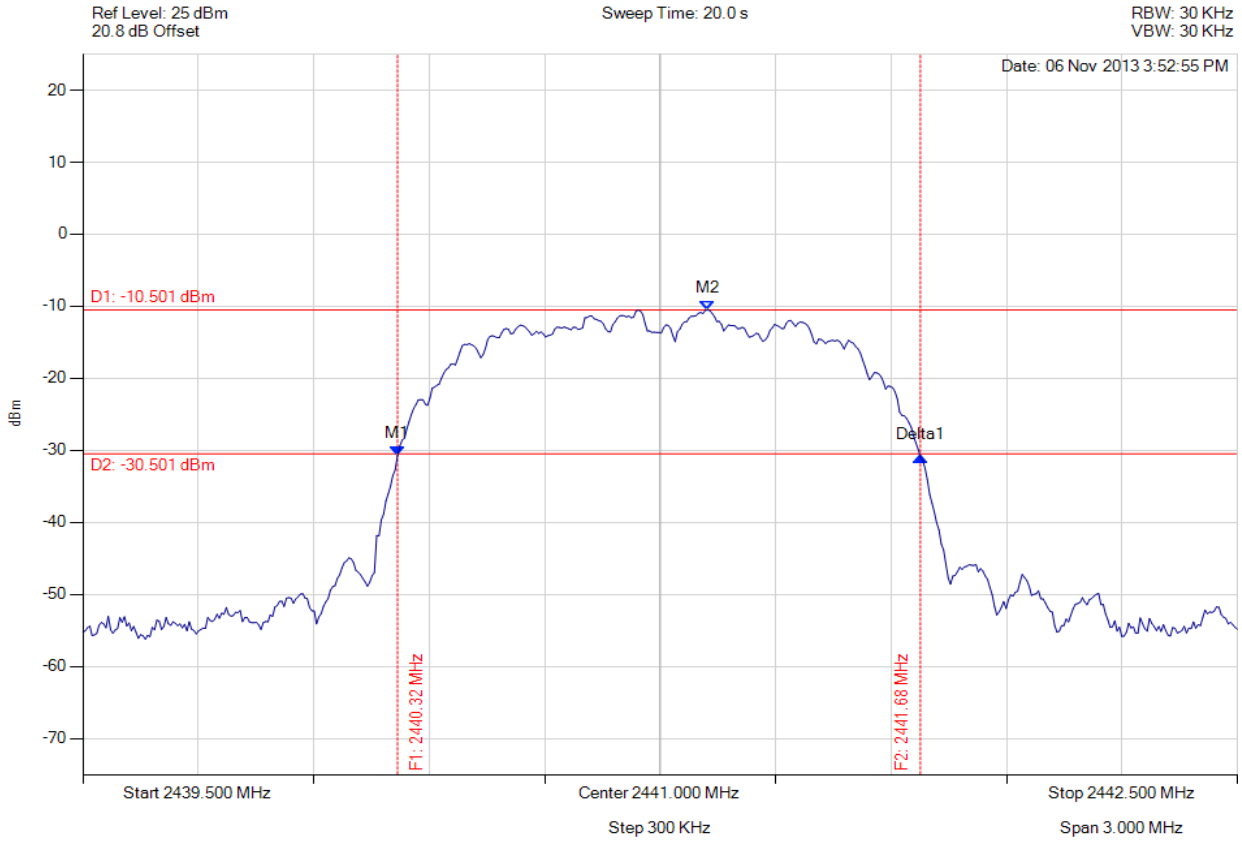


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2401.312 MHz : -31.768 dBm M2 : 2402.117 MHz : -10.277 dBm 20 dB Bandwidth : 1.247 MHz	Measured 20 dB Bandwidth: 1.359 MHz

Back to the Matrix

20 dB BANDWIDTH

Variant: 802.15, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

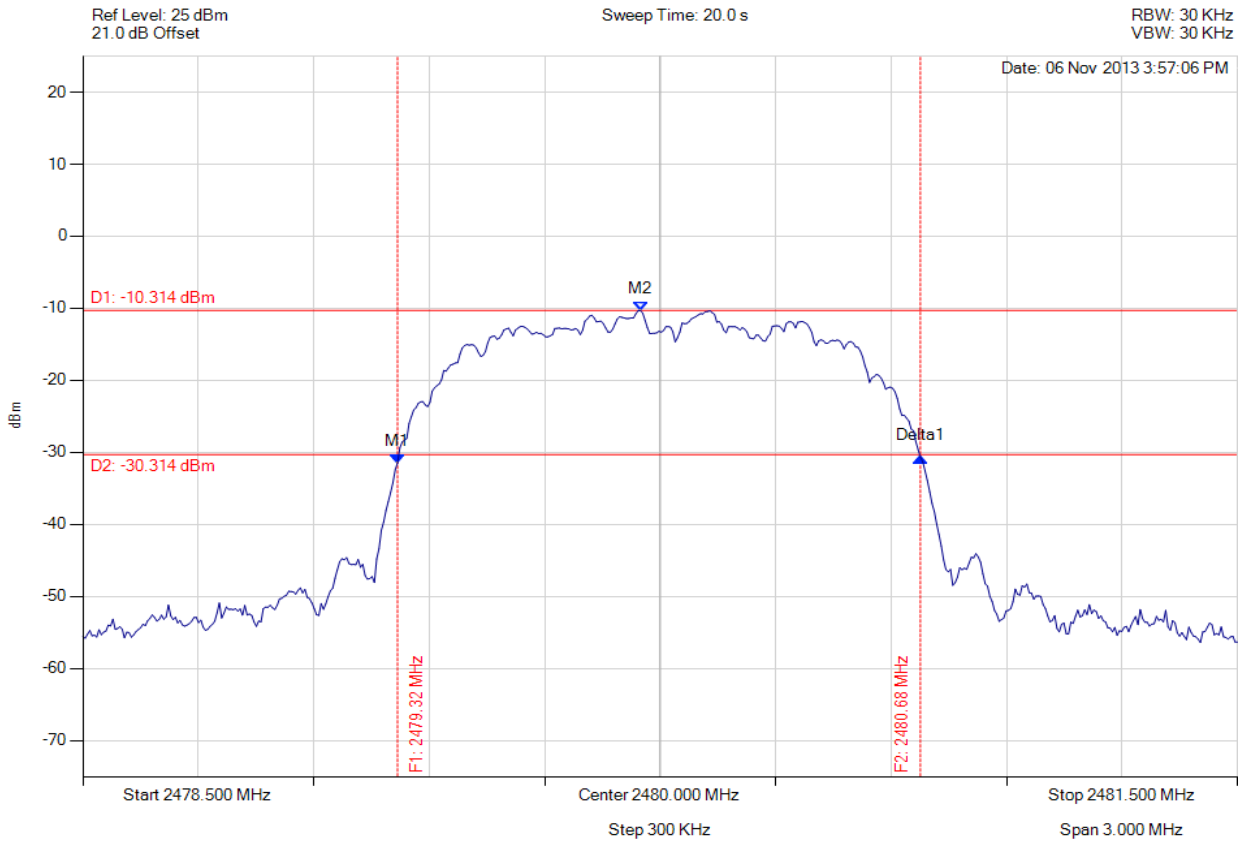


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.318 MHz : -30.692 dBm M2 : 2441.123 MHz : -10.501 dBm 20 dB Bandwidth : 1.359 MHz	Measured 20 dB Bandwidth: 1.359 MHz

Back to the Matrix

20 dB BANDWIDTH

Variant: 802.15, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



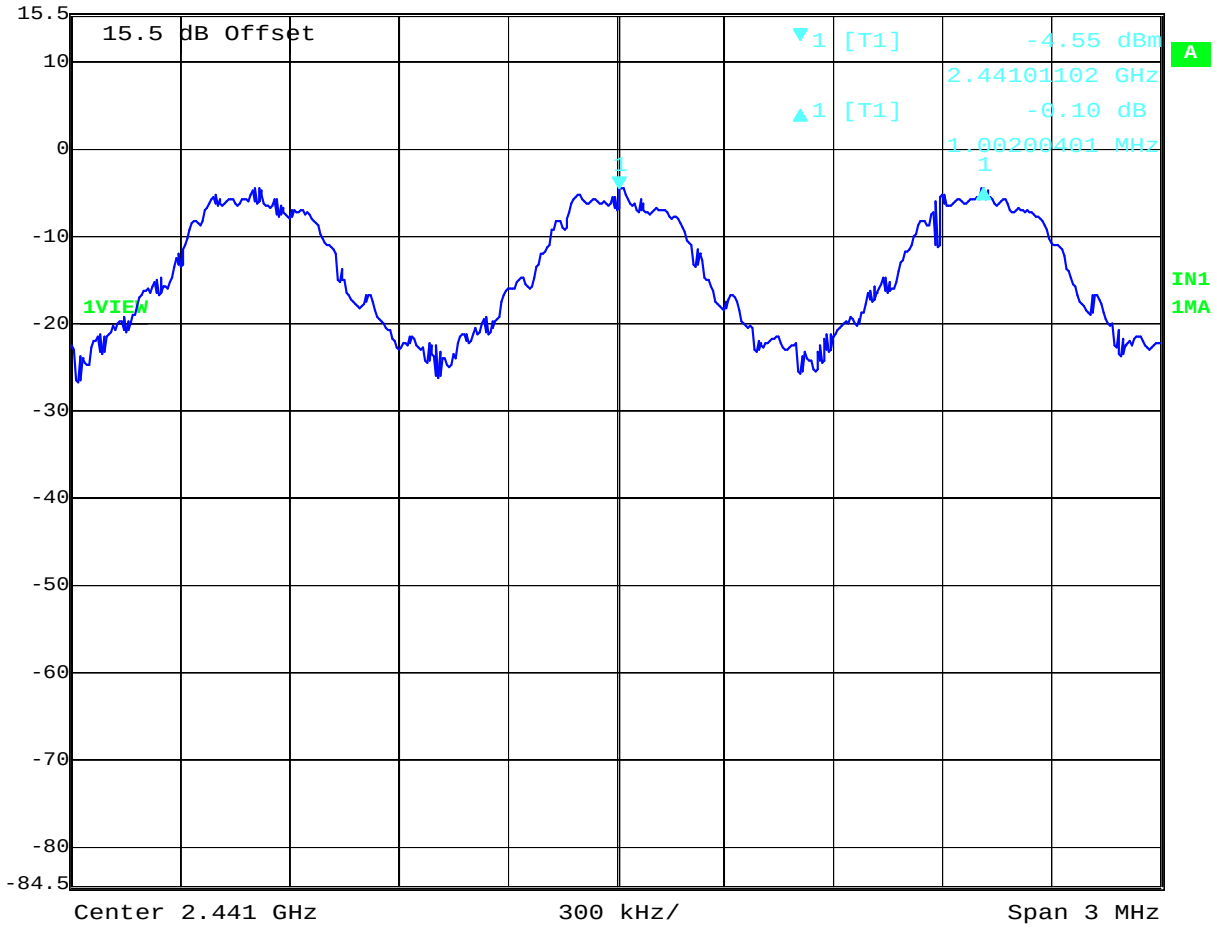
Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2479.318 MHz : -31.491 dBm M2 : 2479.949 MHz : -10.314 dBm 20 dB Bandwidth : 1.359 MHz	Measured 20 dB Bandwidth: 1.359 MHz

Back to the Matrix

A.1.2. Channel Separation

Channel Separation DH1

Variant: 802.15 DH1, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

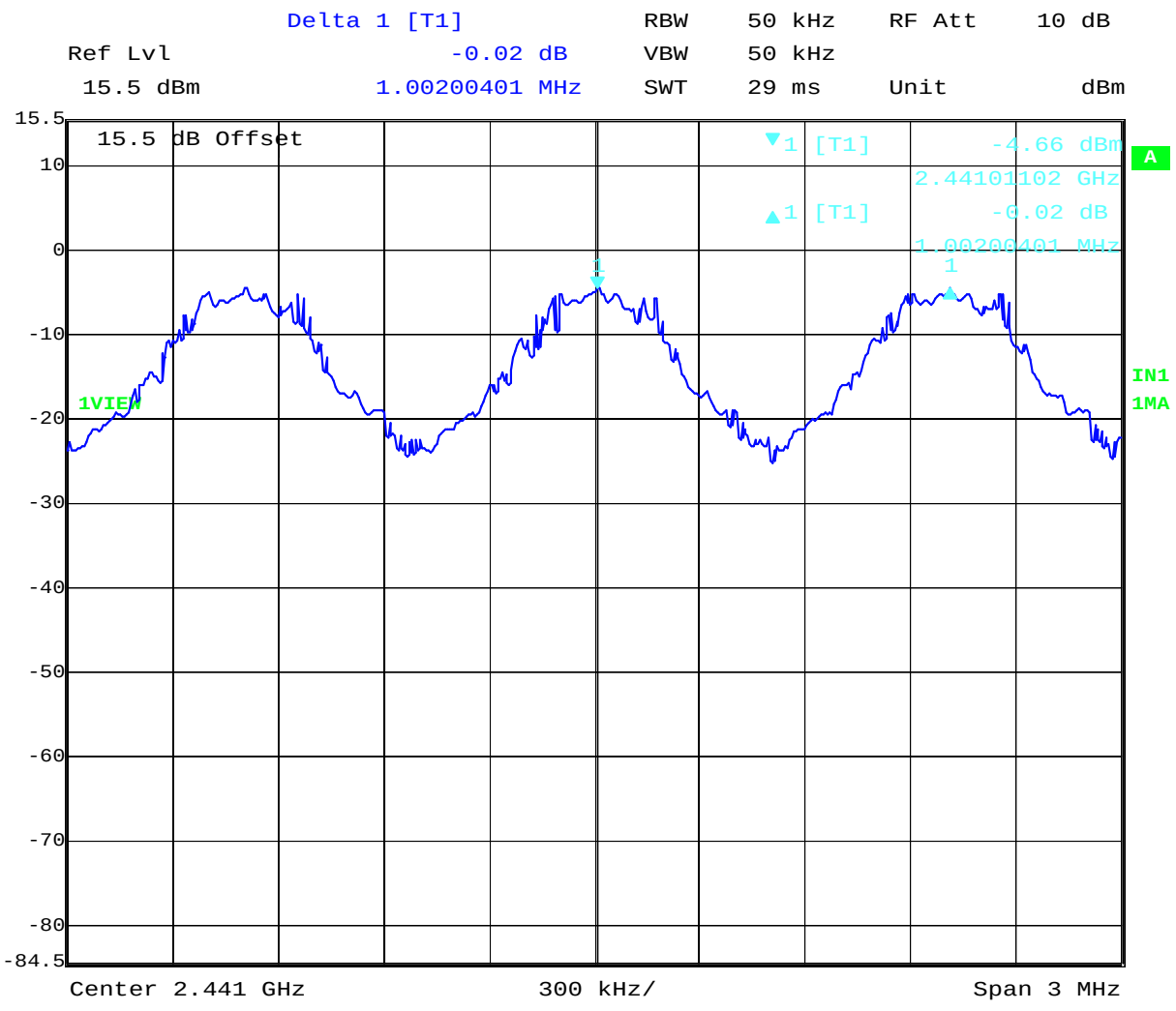


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -4.55 dBm	Channel Separation: 1.002 MHz Limit: > 1 MHz Margin: 0.002 MHz

Back to the Matrix

Channel Separation DH3

Variant: 802.15 DH3, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



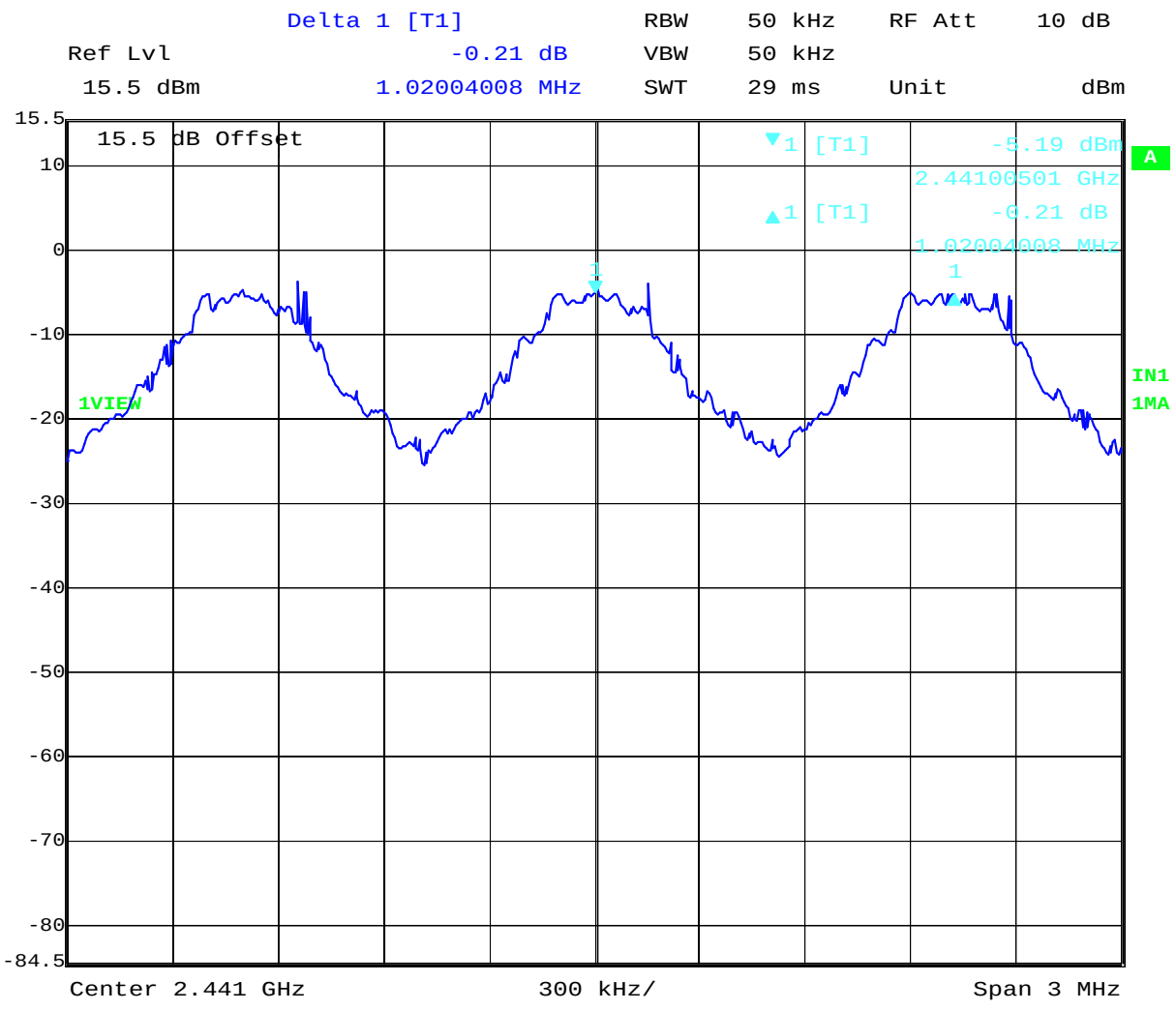
Date: 6.NOV.2013 17:47:24

Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -4.66 dBm	Channel Separation: 1.002 MHz Limit: > 1 MHz Margin: 0.002 MHz

Back to the Matrix

Channel Separation DH5

Variant: 802.15 DH5, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

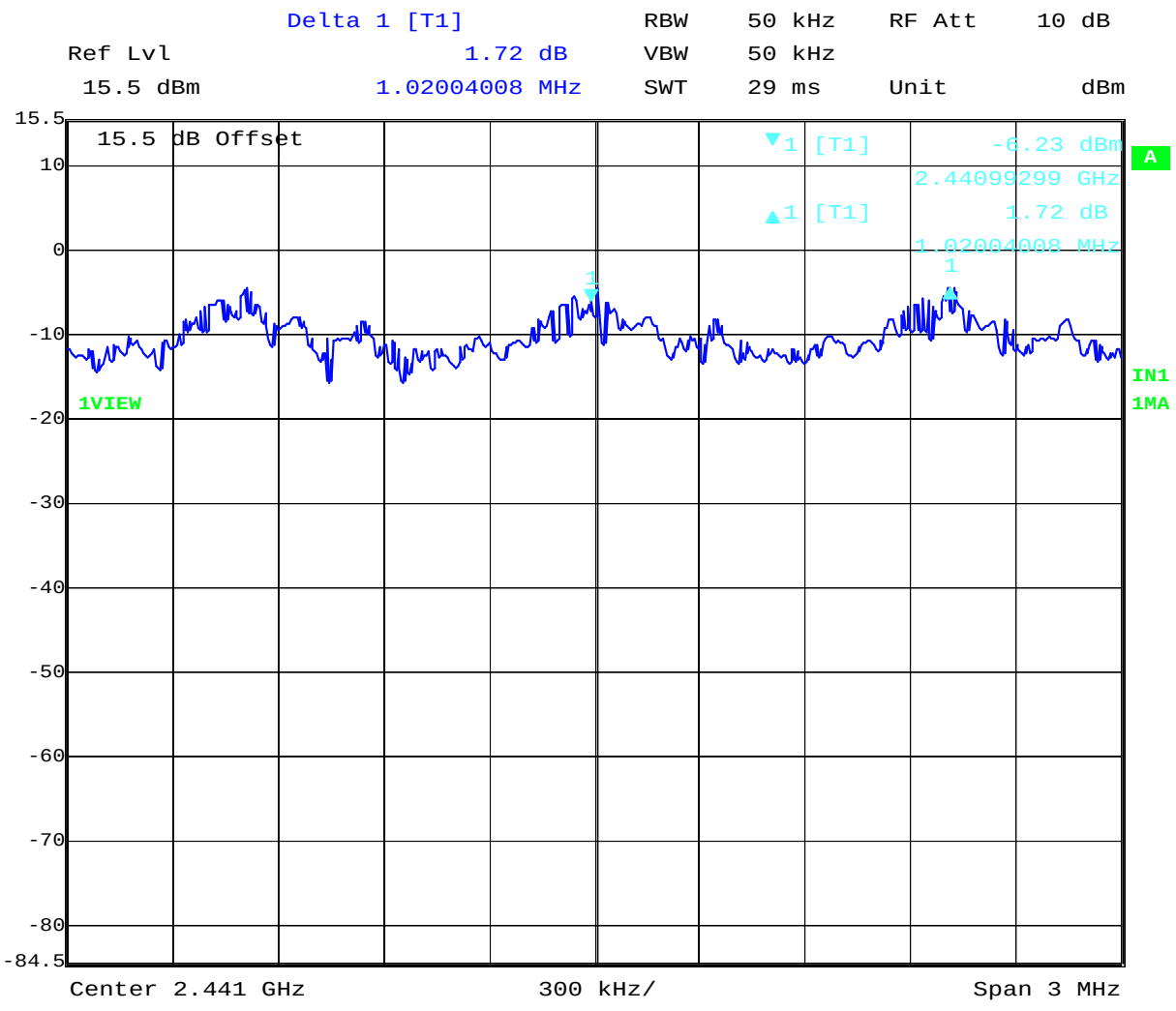


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -5.19 dBm	Channel Separation: 1.020 MHz Limit: > 1 MHz Margin: 0.020 MHz

Back to the Matrix

Channel Separation 2 DH1

Variant: 802.15 2 DH1, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

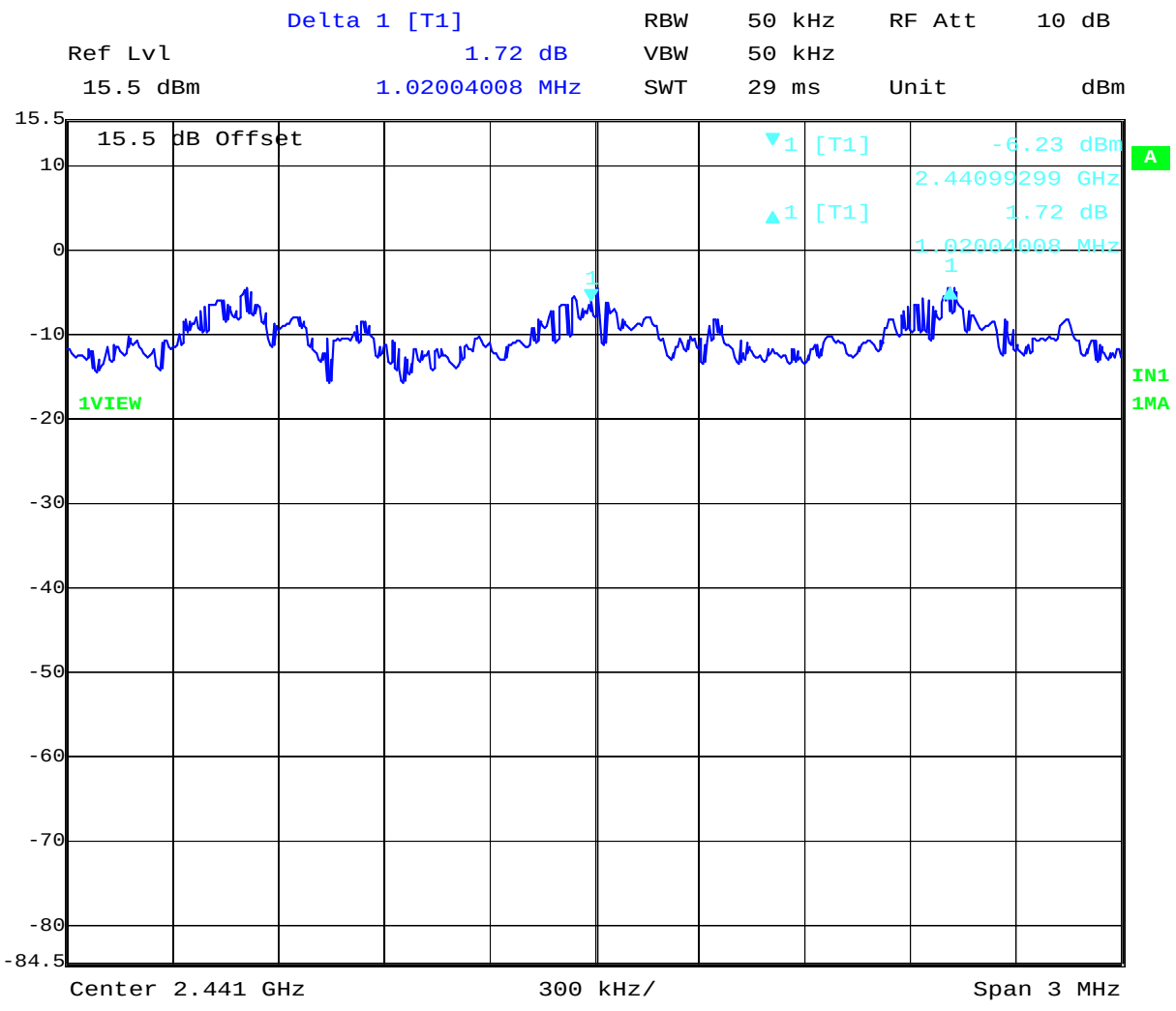


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -6.23 dBm	Channel Separation: 1.020 MHz Limit: > 1 MHz Margin: 0.020 MHz

Back to the Matrix

Channel Separation 2 DH3

Variant: 802.15 2 DH3, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

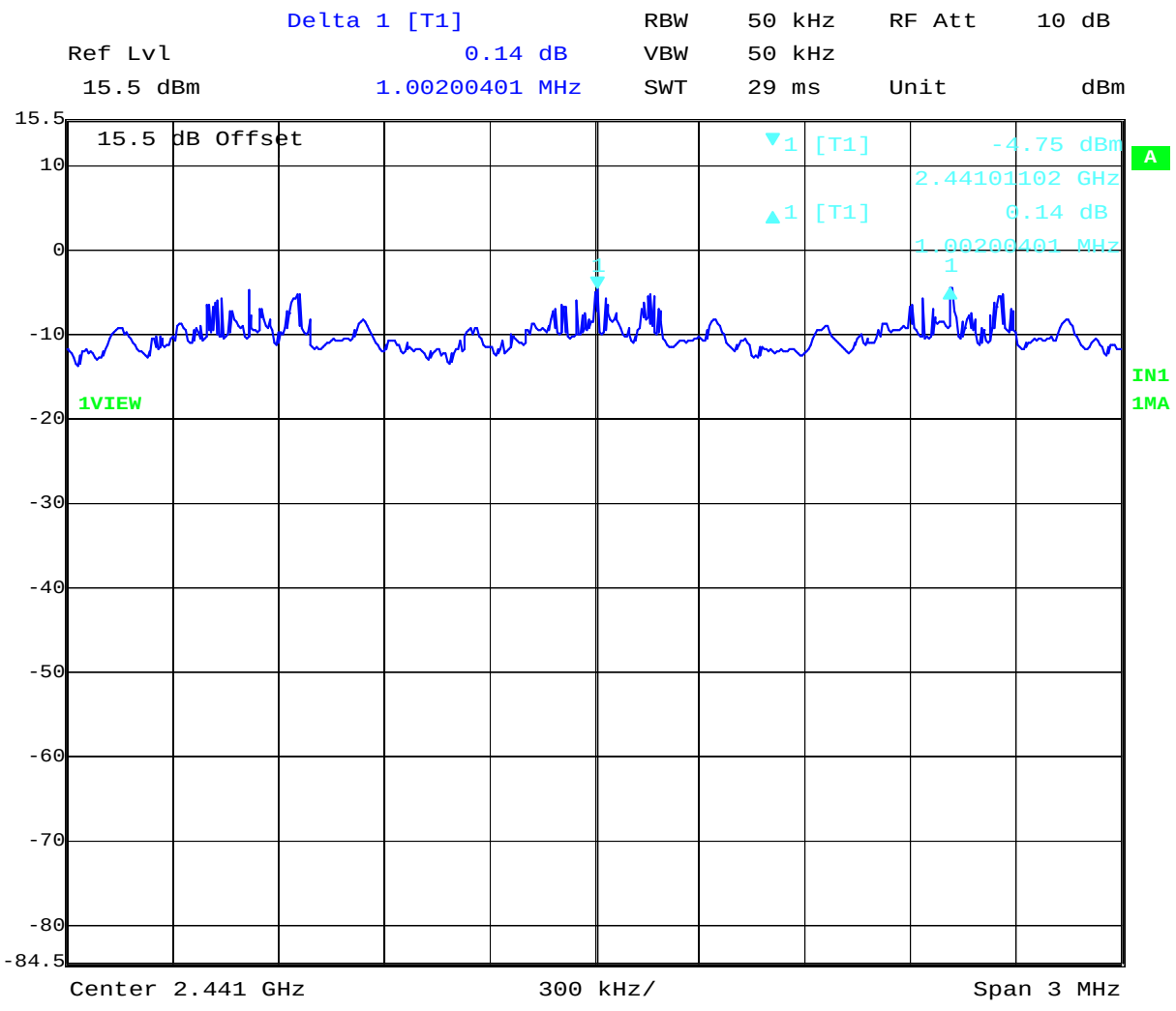


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -6.23 dBm	Channel Separation: 1.020 MHz Limit: > 1 MHz Margin: 0.020 MHz

Back to the Matrix

Channel Separation 2 DH5

Variant: 802.15 2 DH5, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

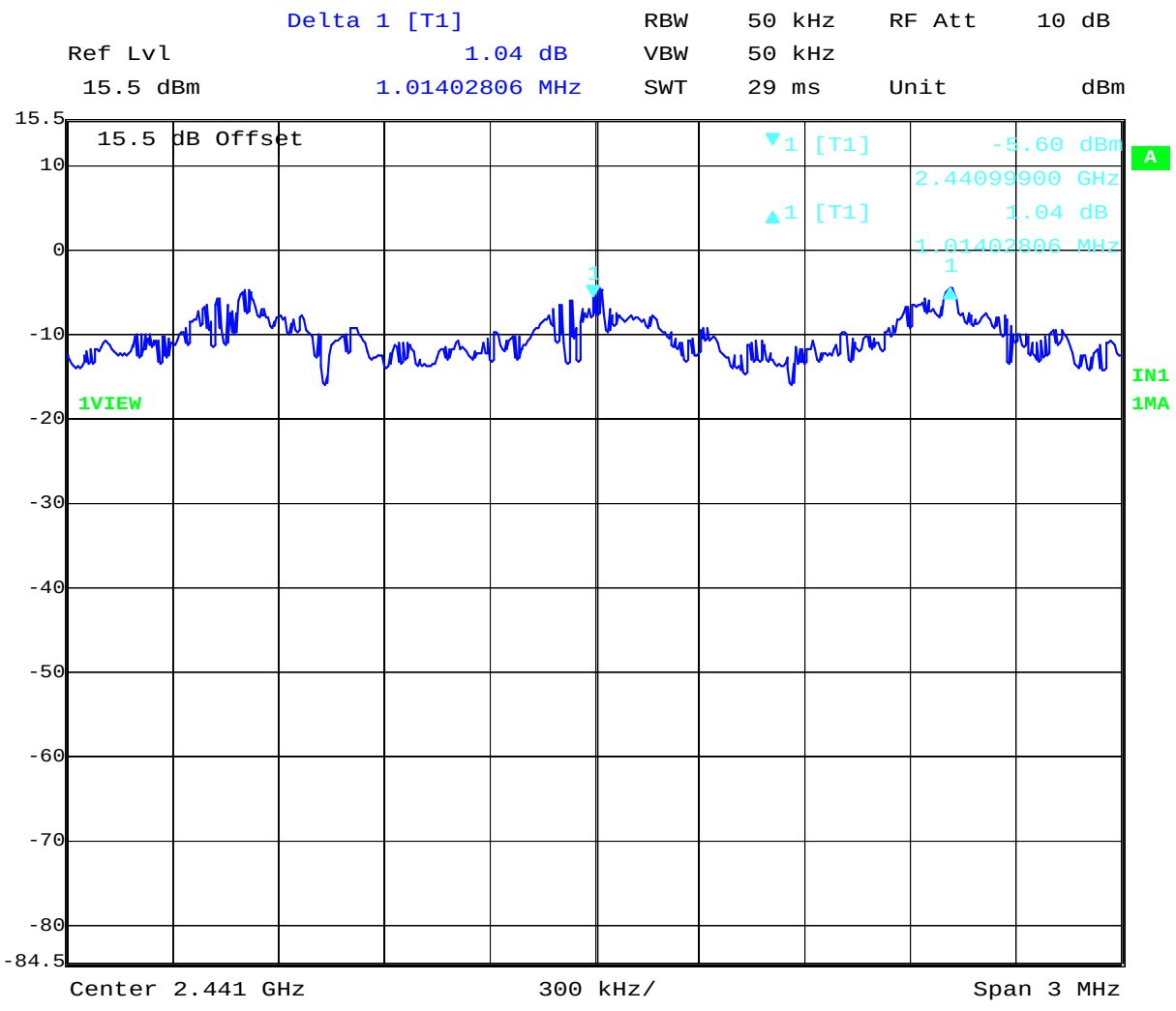


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -4.75 dBm	Channel Separation: 1.002 MHz Limit: > 1 MHz Margin: 0.002 MHz

Back to the Matrix

Channel Separation 3 DH1

Variant: 802.15 3 DH1, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

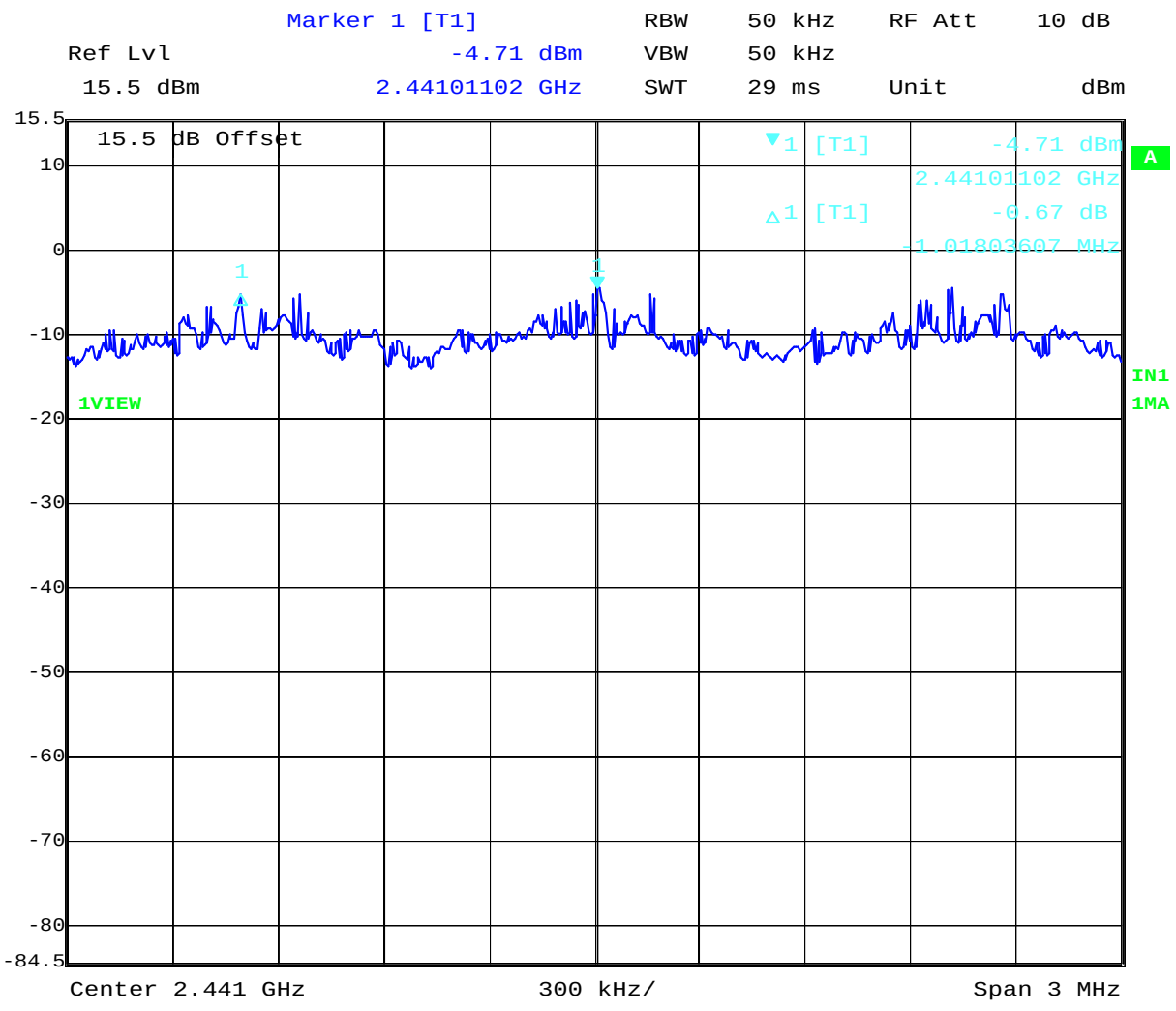


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -5.60 dBm	Channel Separation: 1.014 MHz Limit: > 1 MHz Margin: 0.014 MHz

Back to the Matrix

Channel Separation 3 DH3

Variant: 802.15 3 DH3, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

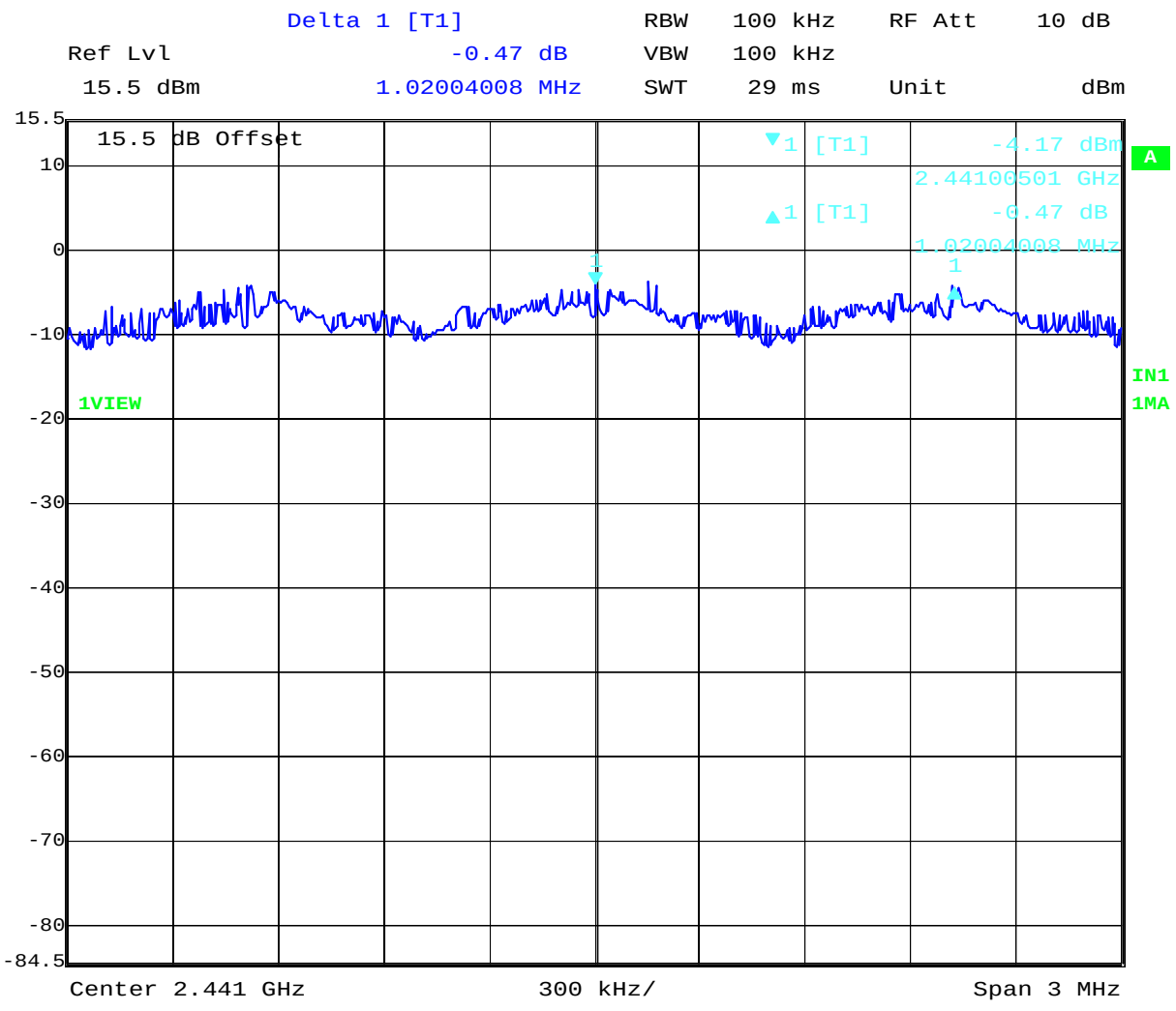


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -4.71 dBm	Channel Separation: 1.018 MHz Limit: > 1 MHz Margin: 0.018 MHz

Back to the Matrix

Channel Separation 3 DH5

Variant: 802.15 3 DH5, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



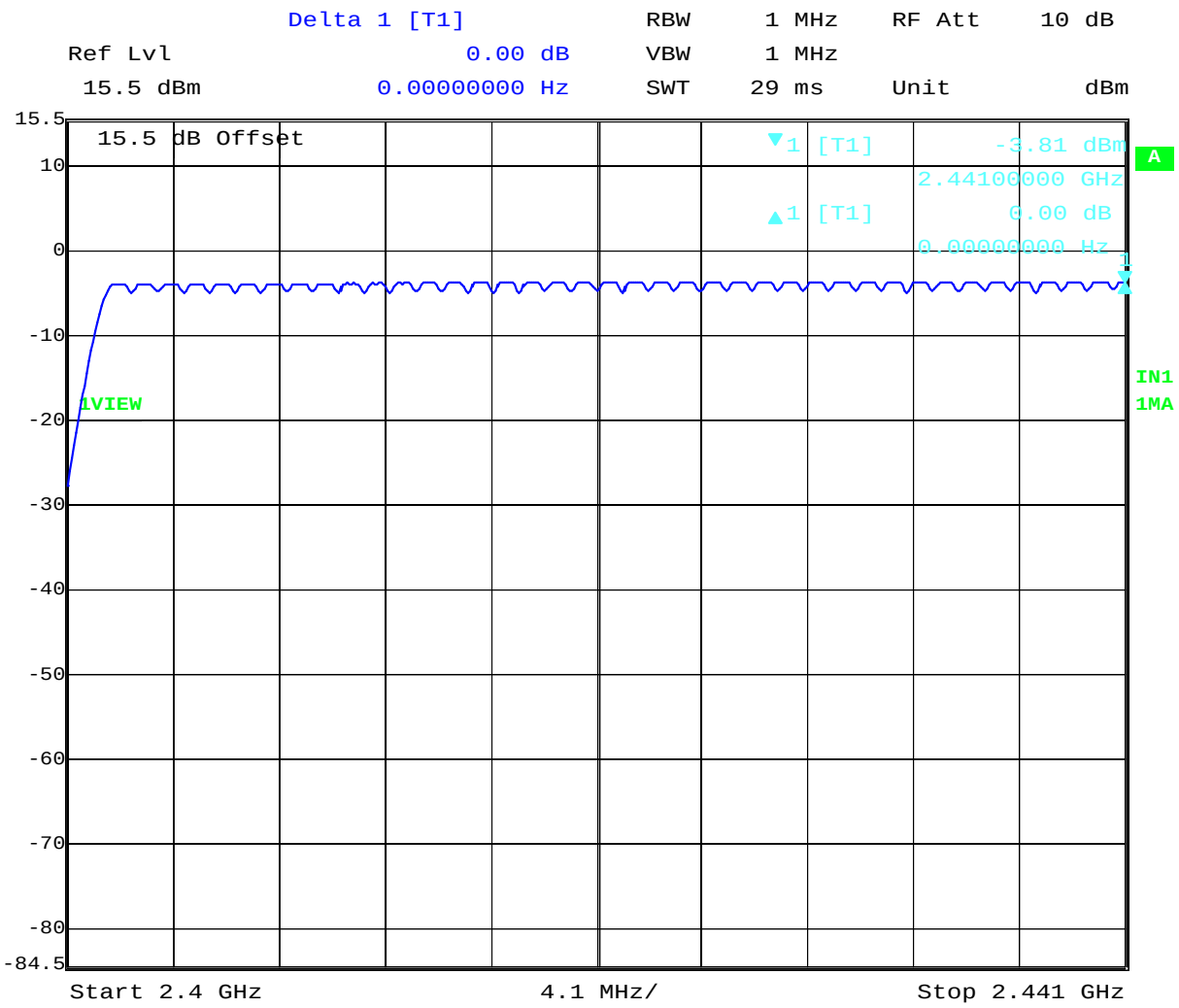
Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -2.32 dBm	Channel Separation: 1.016 MHz Limit: > 1 MHz Margin: 0.016 MHz

Back to the Matrix

A.1.3. Number of Hopping Frequencies

Hopping Sequence Channel 0-39

Variant: 802.15 3 DH5, Channel: Hopping, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

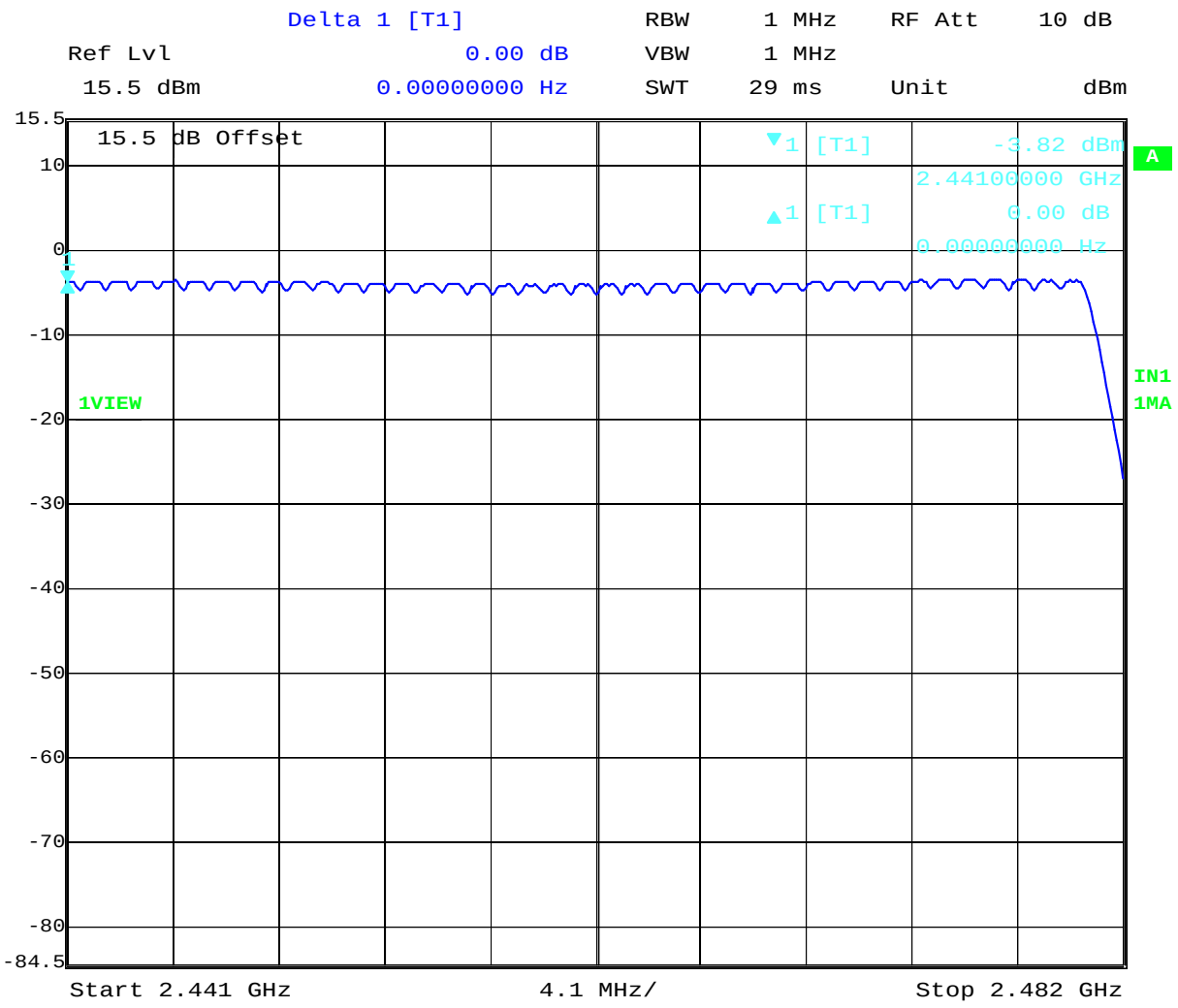


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -3.81 dBm	

Back to the Matrix

Hopping Sequence Channel 40-78

Variant: 802.15 3 DH5, Channel: Hopping, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



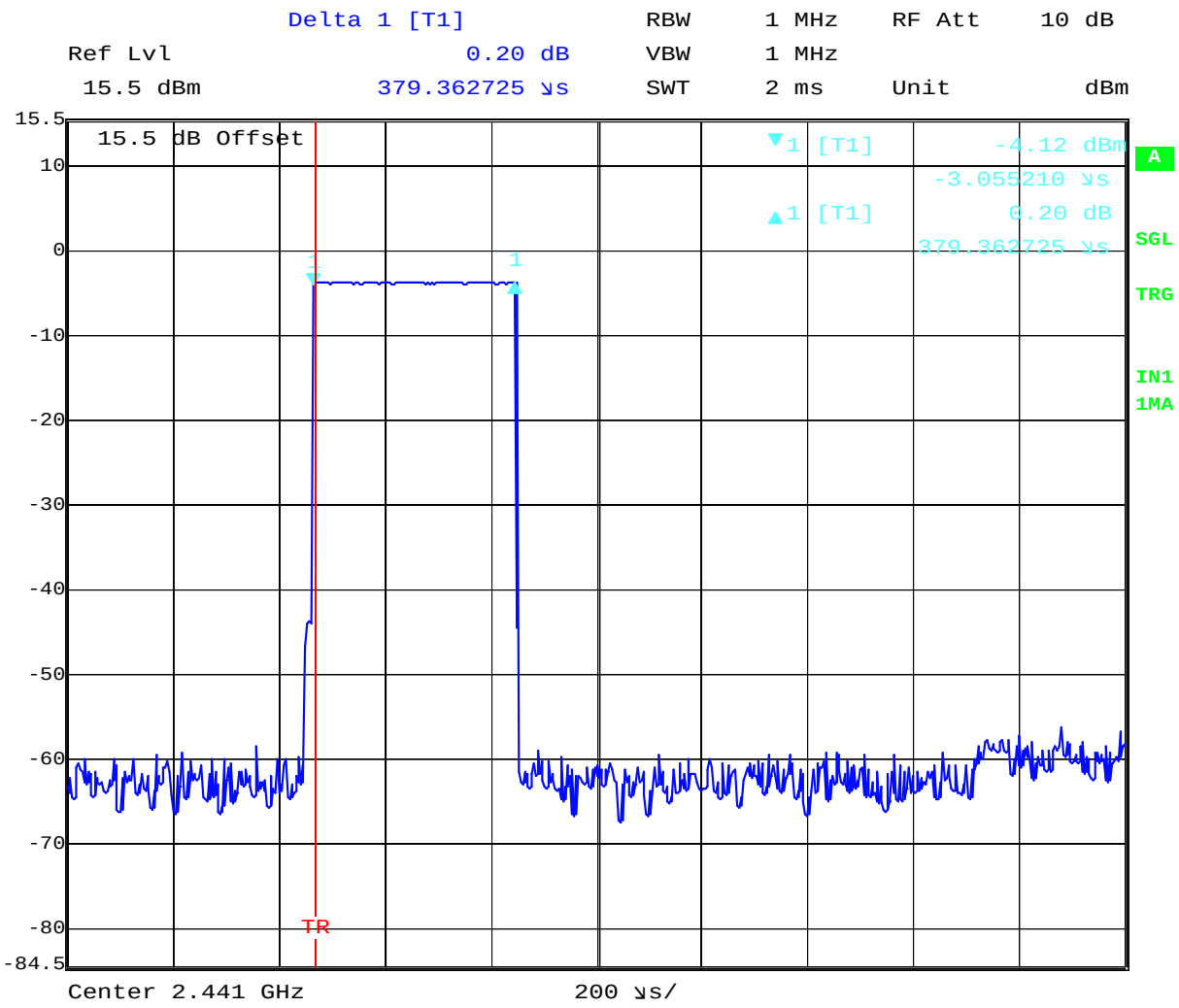
Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW		

Back to the Matrix

A.1.4. Dwell Time

Dwell Time DH1

Variant: 802.15 DH1, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

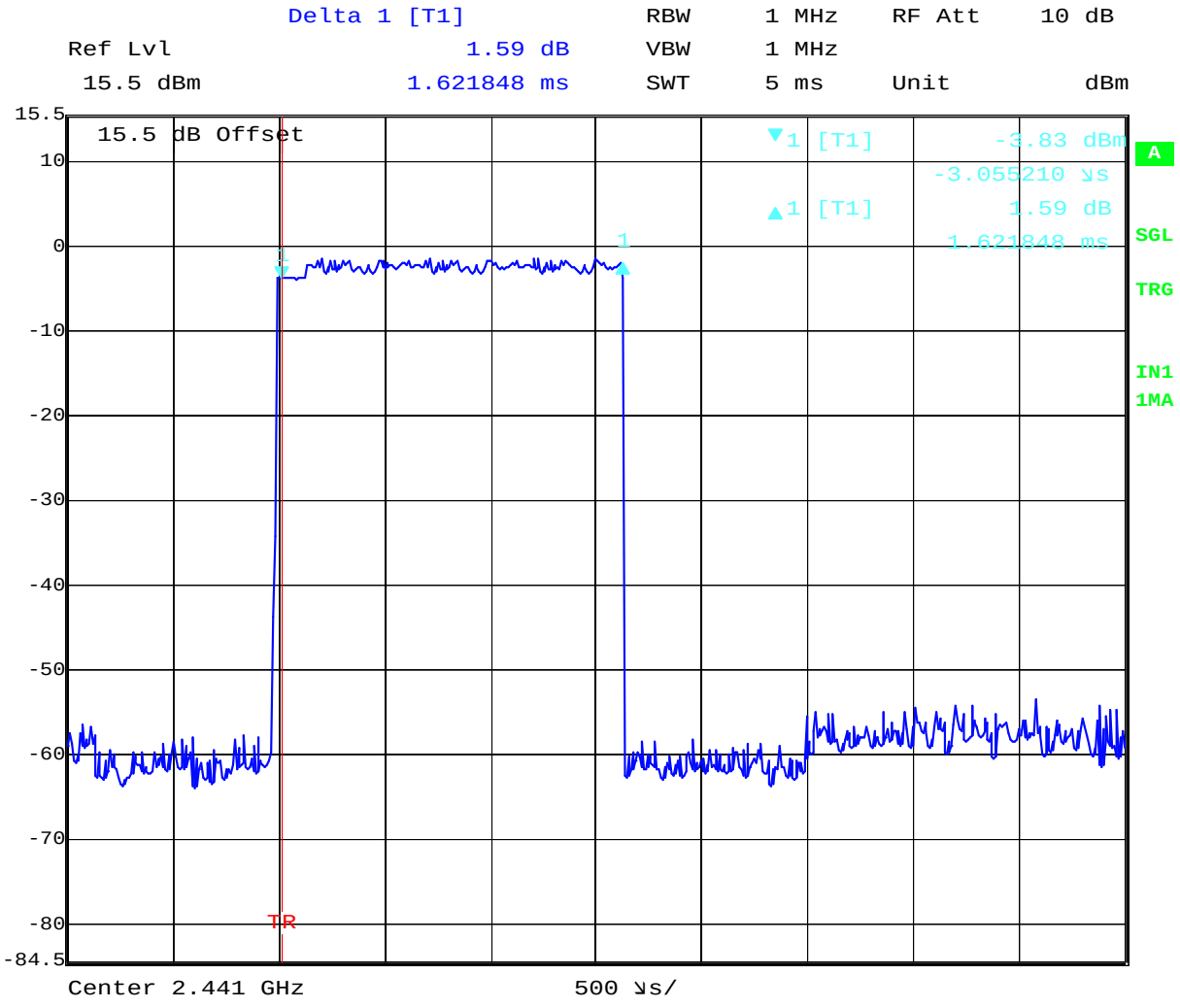


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -4.12 dBm	Dwell Time: 0.3794 mS Limit: 400 mS Margin: 399.62 mS

Back to the Matrix

Dwell Time DH3

Variant: 802.15 DH3, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



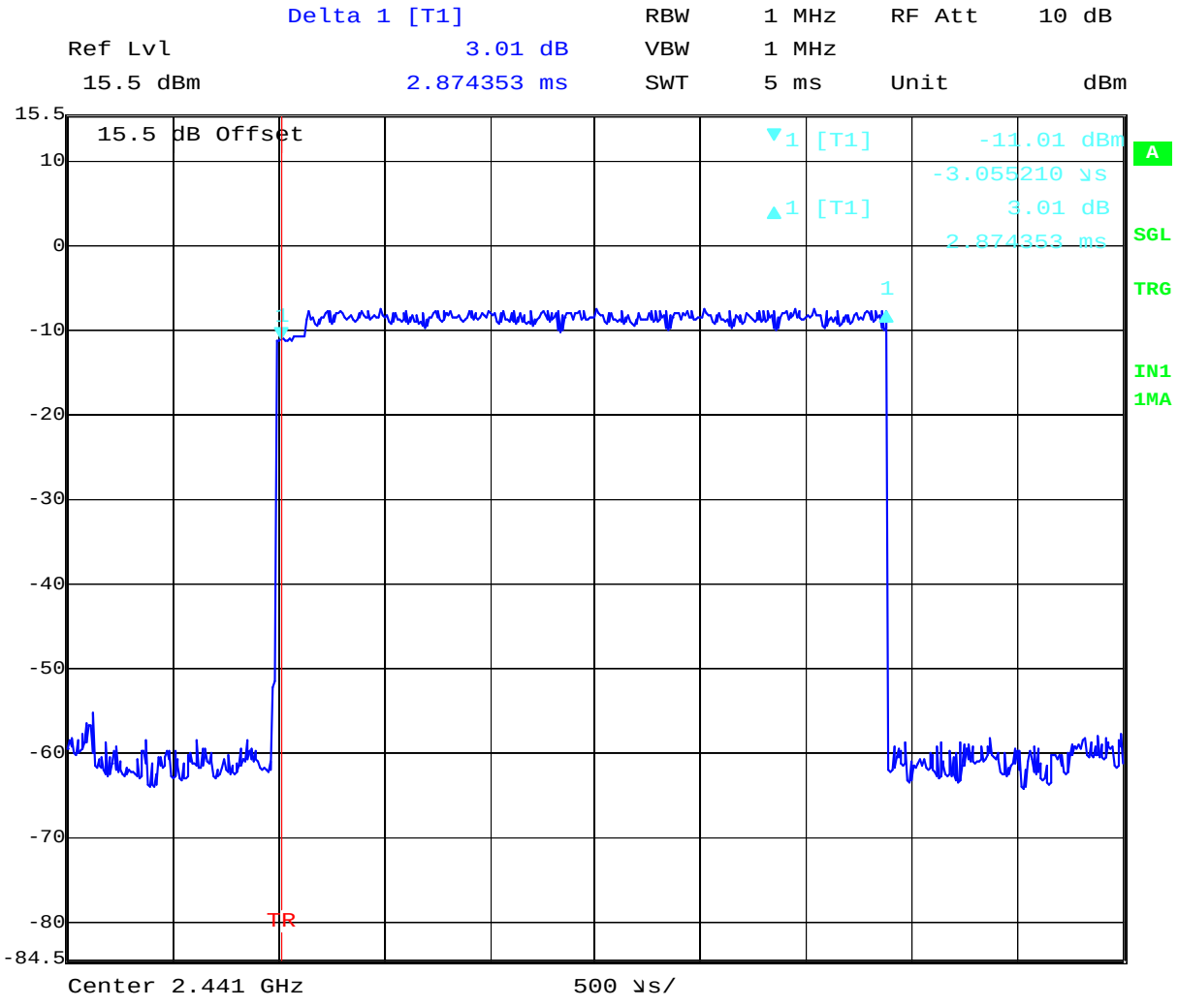
Date: 6.NOV.2013 16:49:16

Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -3.83 dBm	Dwell Time: 1.622 mS Limit: 400 mS Margin: 398.38 mS

Back to the Matrix

Dwell Time DH5

Variant: 802.15 DH5, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

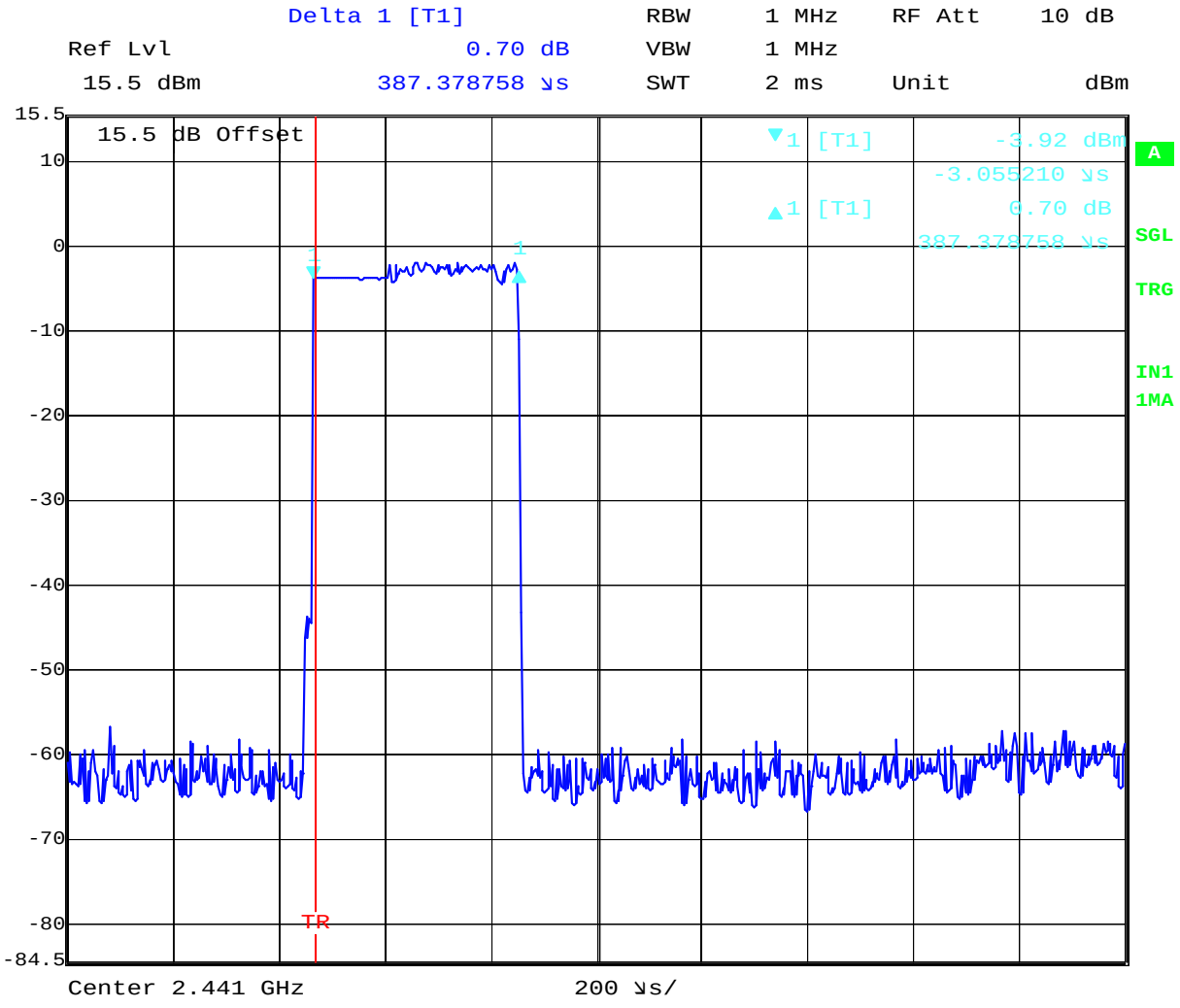


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -3.05 dBm	Dwell Time: 2.874 mS Limit: 400 mS Margin: 397.13 mS

Back to the Matrix

Dwell Time 2 DH1

Variant: 802.15 2 DH1, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



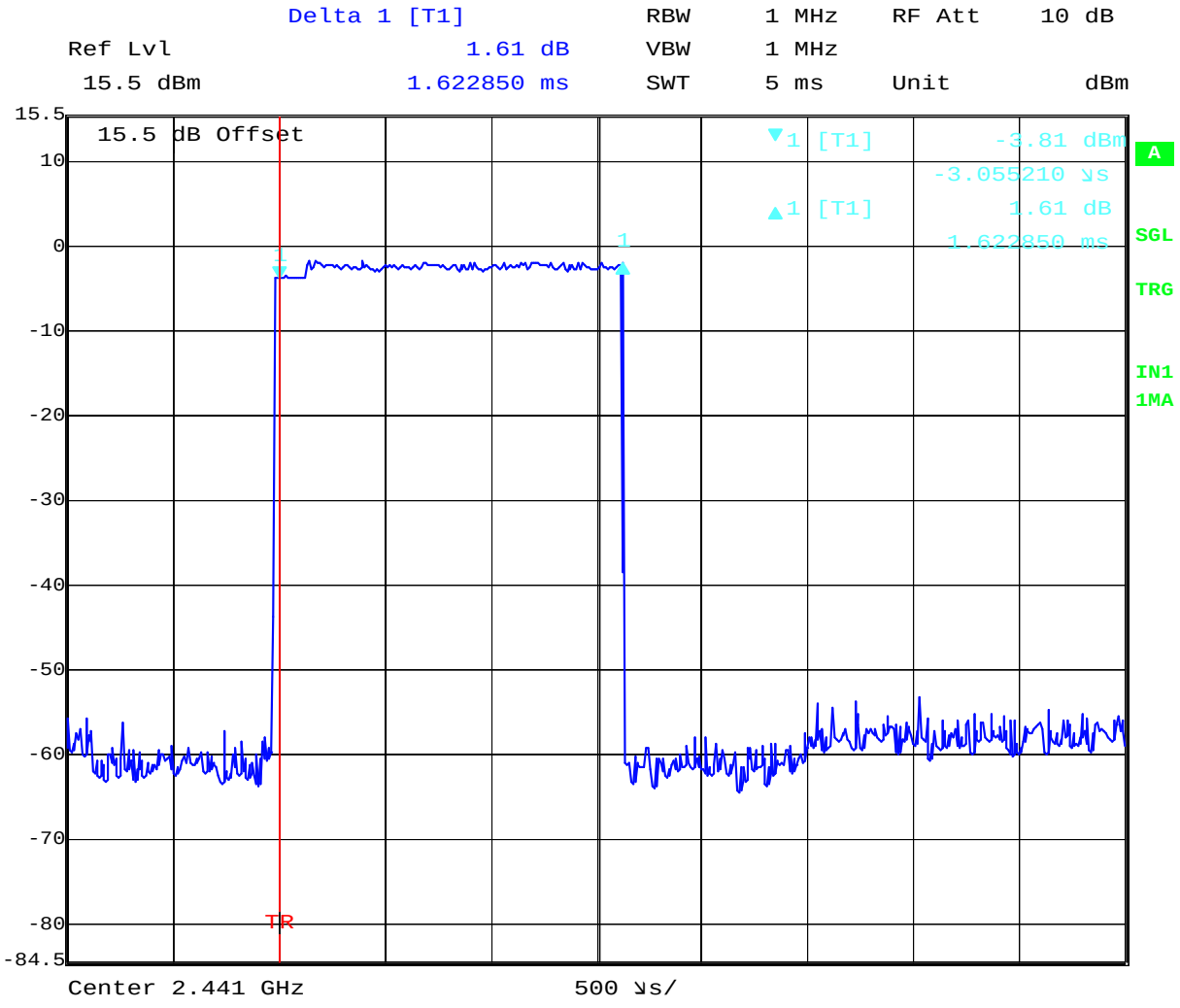
Date: 6.NOV.2013 16:45:14

Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -3.92 dBm	Dwell Time: 0.3874 mS Limit: 400 mS Margin: 399.61 mS

Back to the Matrix

Dwell Time 2 DH3

Variant: 802.15 2 DH3, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



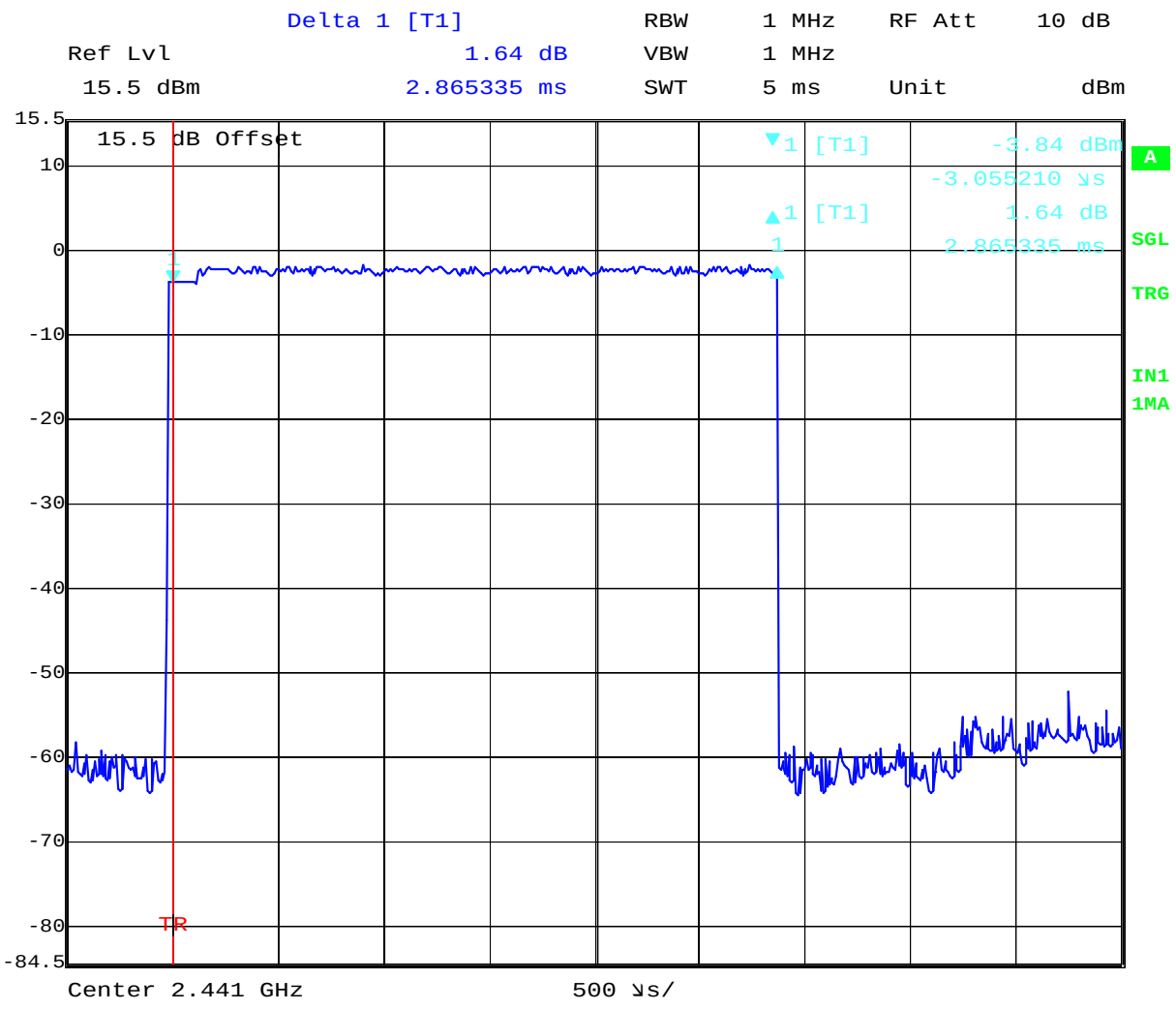
Date: 6.NOV.2013 16:43:04

Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -3.81 dBm	Dwell Time: 1.623 mS Limit: 400 mS Margin: 398.38 mS

Back to the Matrix

Dwell Time 2 DH5

Variant: 802.15 2 DH5, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

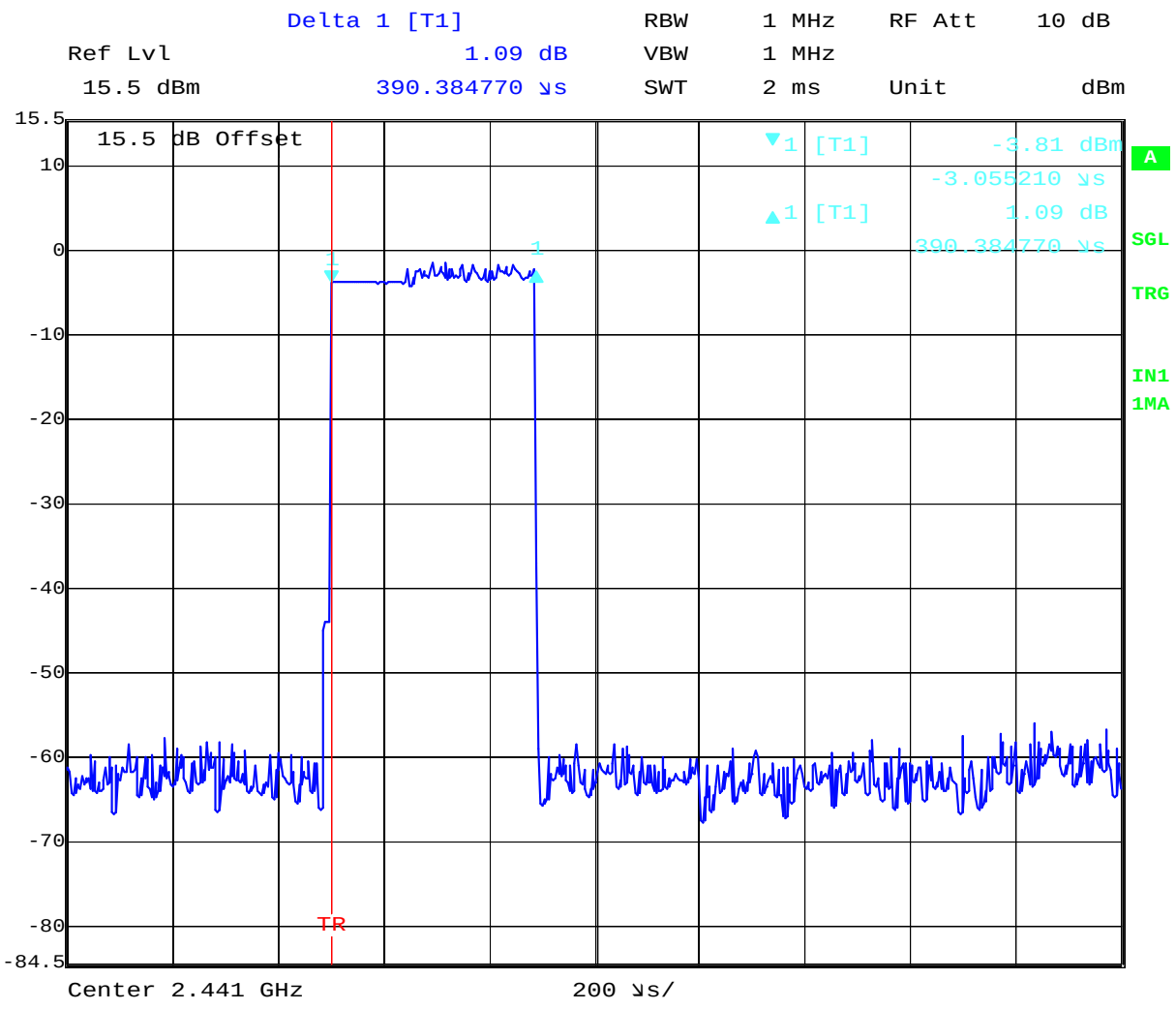


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -3.84 dBm	Dwell Time: 2.865 mS Limit: 400 mS Margin: 397.13 mS

Back to the Matrix

Dwell Time 3 DH1

Variant: 802.15 3 DH1, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



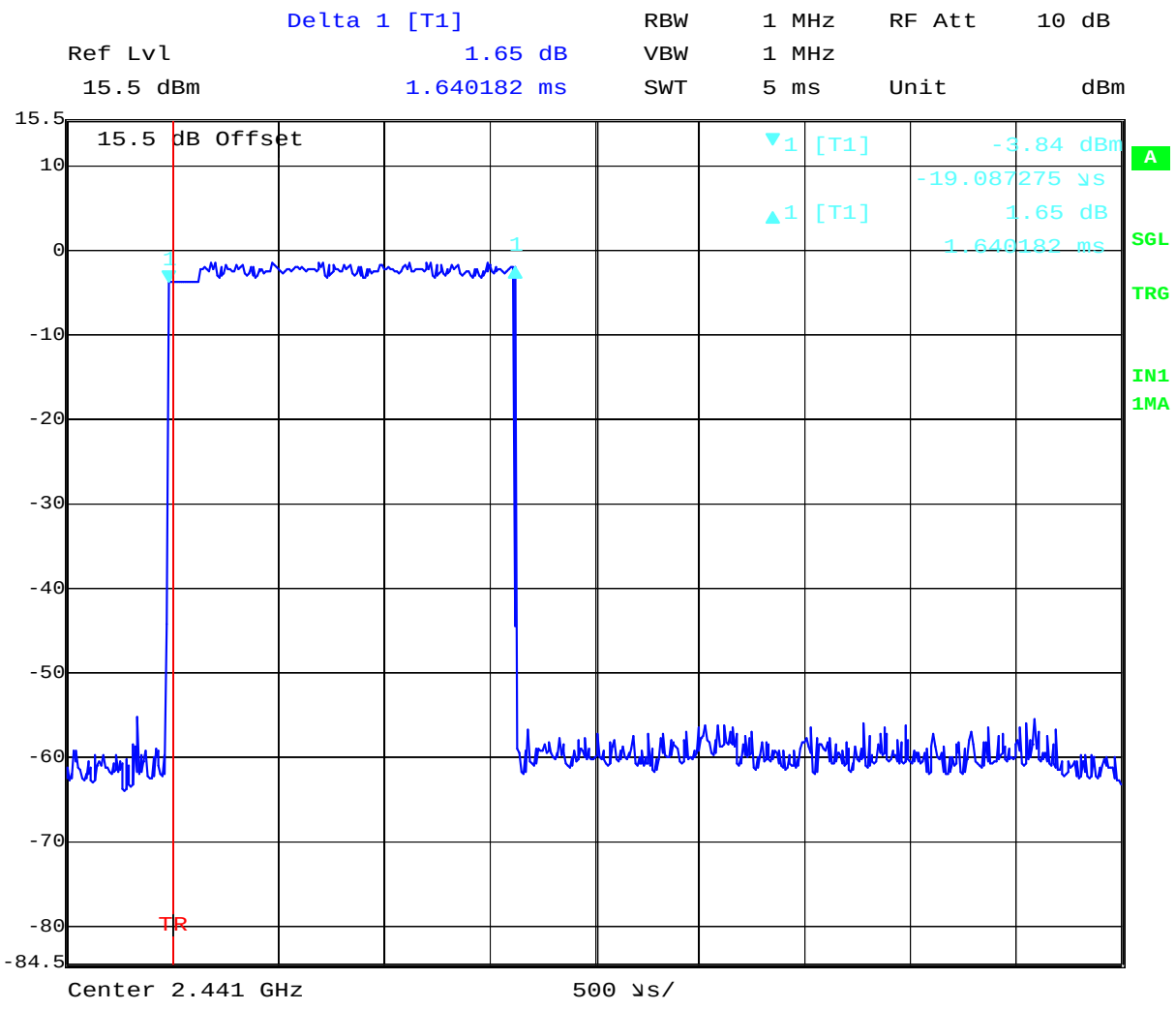
Date: 6.NOV.2013 16:38:30

Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -3.81 dBm	Dwell Time: 0.39038 mS Limit: 400 mS Margin: 399.61 mS

Back to the Matrix

Dwell Time 3 DH3

Variant: 802.15 3 DH3, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



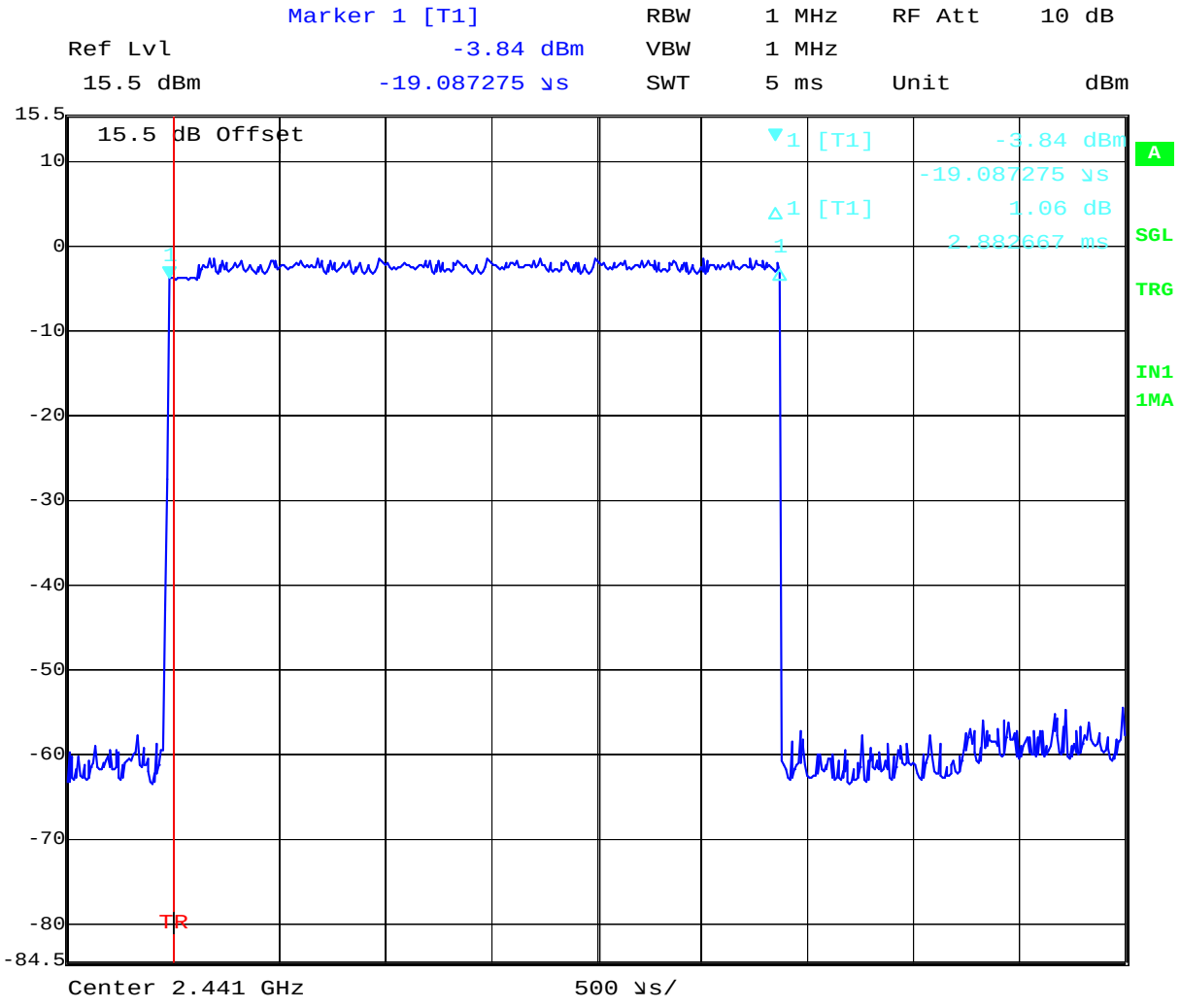
Date: 6.NOV.2013 16:32:54

Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -3.84 dBm	Dwell Time: 1.640 mS Limit: 400 mS Margin: 398.36 mS

Back to the Matrix

Dwell Time 3 DH5

Variant: 802.15 3-DH5, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



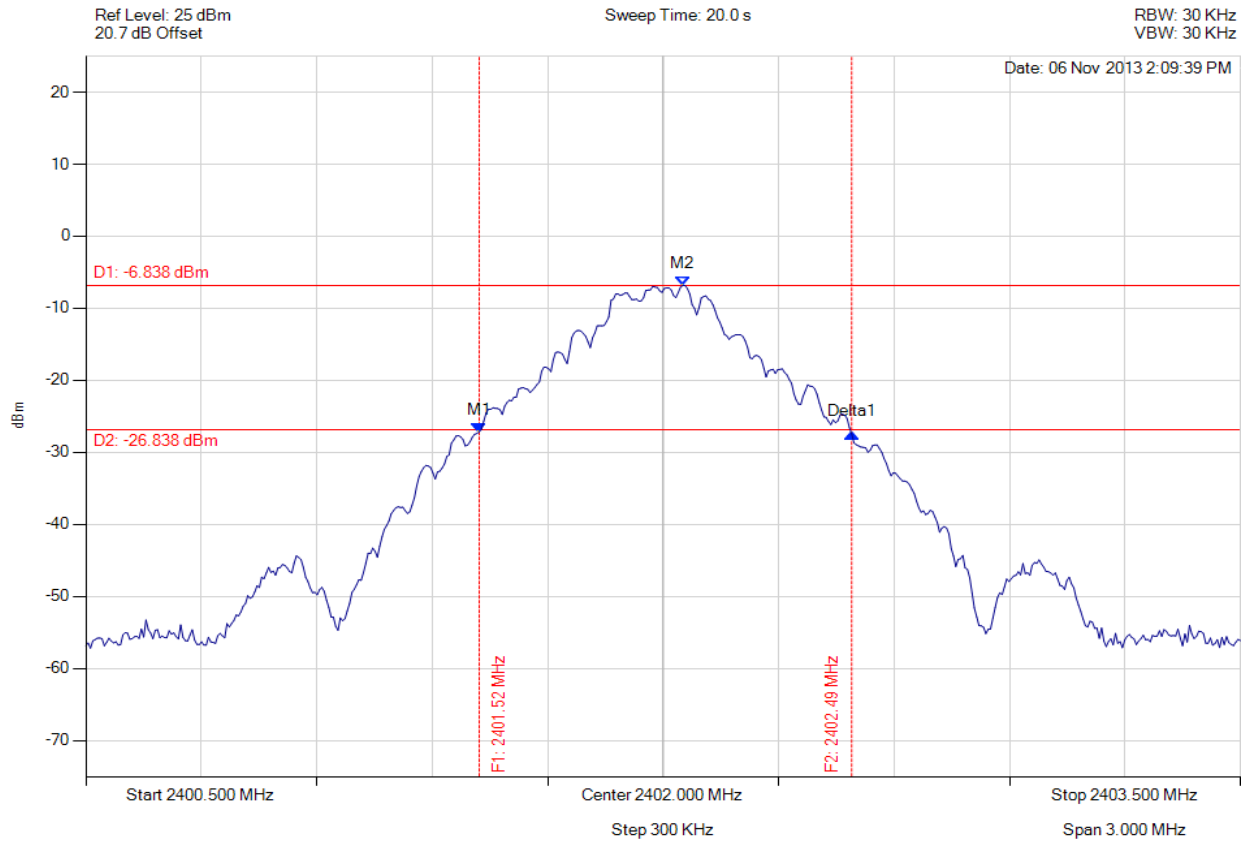
Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = Max Peak Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2441.00 MHz : -3.84 dBm	Dwell Time: 2.883 mS Limit: 400 mS Margin: 397.12 mS

Back to the Matrix

A.1.5. Peak Power Output

PEAK OUTPUT POWER

Variant: 802.15 DH1, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2401.522 MHz : -27.155 dBm M2 : 2402.051 MHz : -6.838 dBm Delta1 : 968 KHz : -0.287 dB	Channel Power: 2.17 dBm Limit: 30.00 dBm Margin: -27.83 dB

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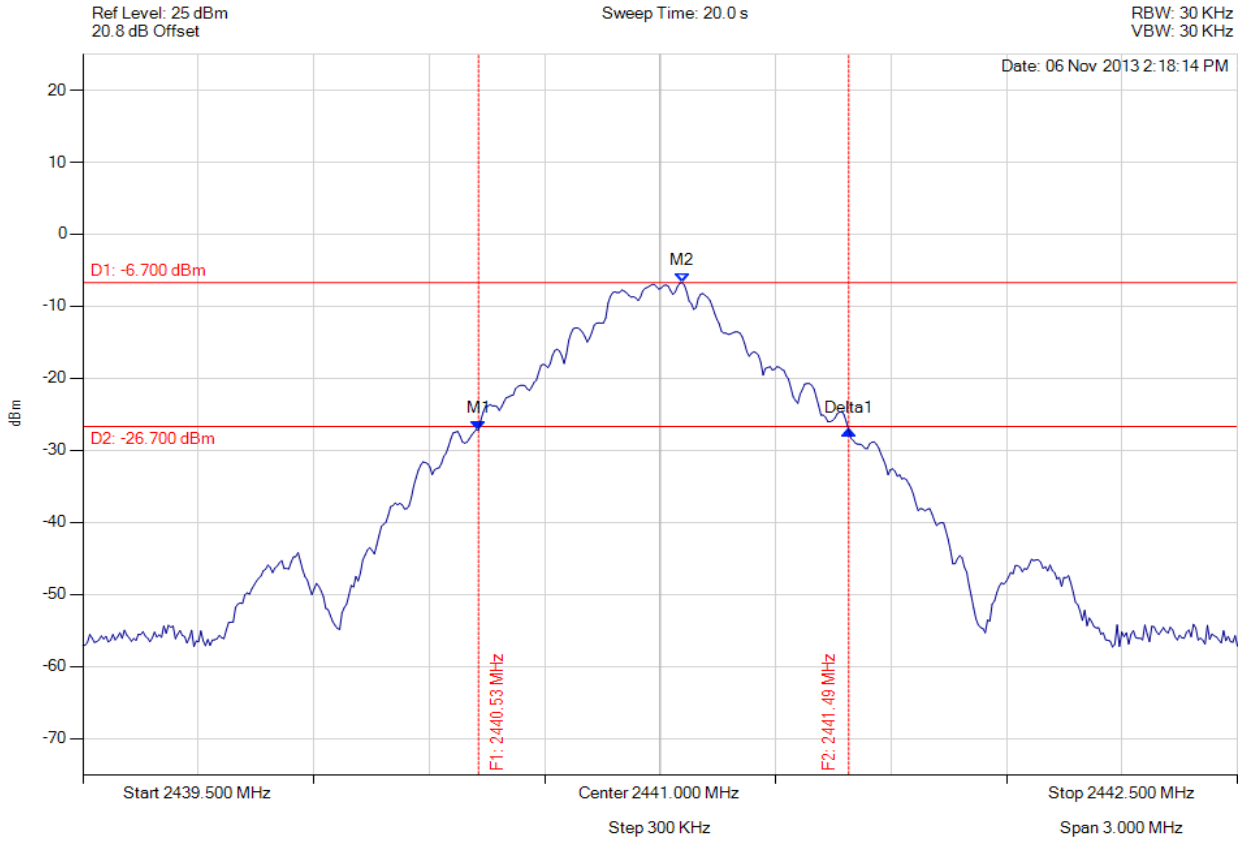
PEAK OUTPUT POWER

Variant: 802.15 DH1, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.528 MHz : -27.188 dBm M2 : 2441.057 MHz : -6.700 dBm Delta1 : 962 KHz : -0.049 dB	Channel Power: 2.22 dBm Limit: 30.00 dBm Margin: -27.78 dB

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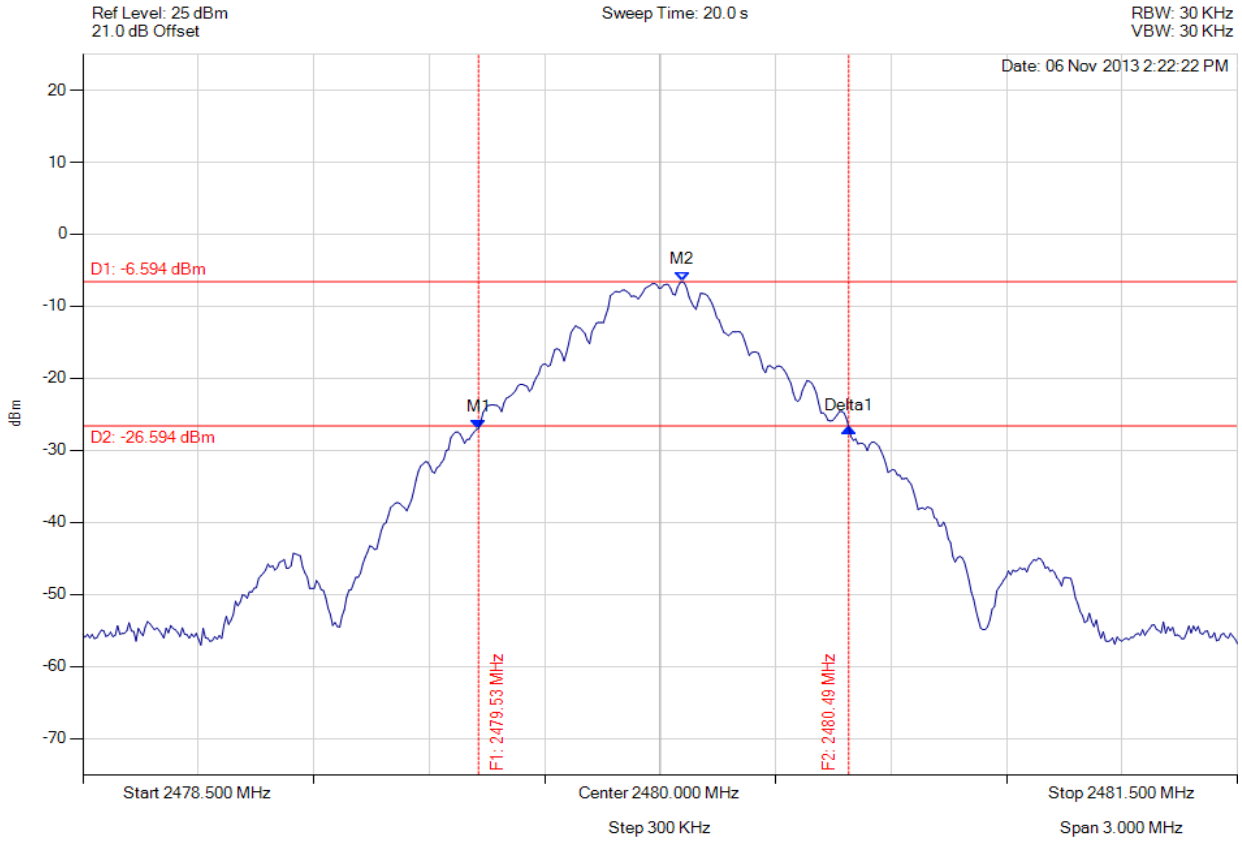
PEAK OUTPUT POWER

Variant: 802.15 DH1, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2479.528 MHz : -27.009 dBm M2 : 2480.057 MHz : -6.594 dBm Delta1 : 962 KHz : 0.183 dB	Channel Power: 2.32 dBm Limit: 30.00 dBm Margin: -27.68 dB

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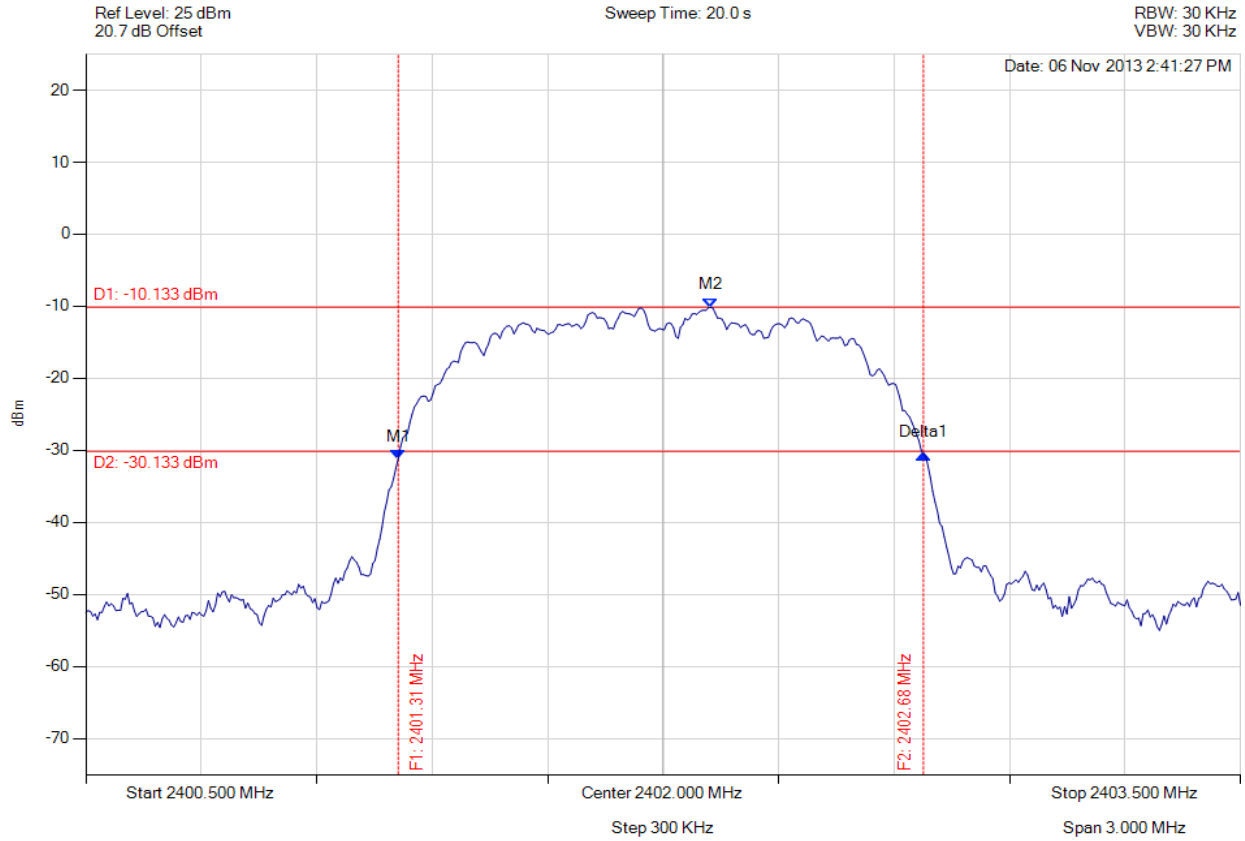
PEAK OUTPUT POWER

Variant: 802.15 DH5, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2401.312 MHz : -31.176 dBm M2 : 2402.123 MHz : -10.133 dBm Delta1 : 1.365 MHz : 0.624 dB	Channel Power: 2.35 dBm Limit: 30.00 dBm Margin: -27.65 dB

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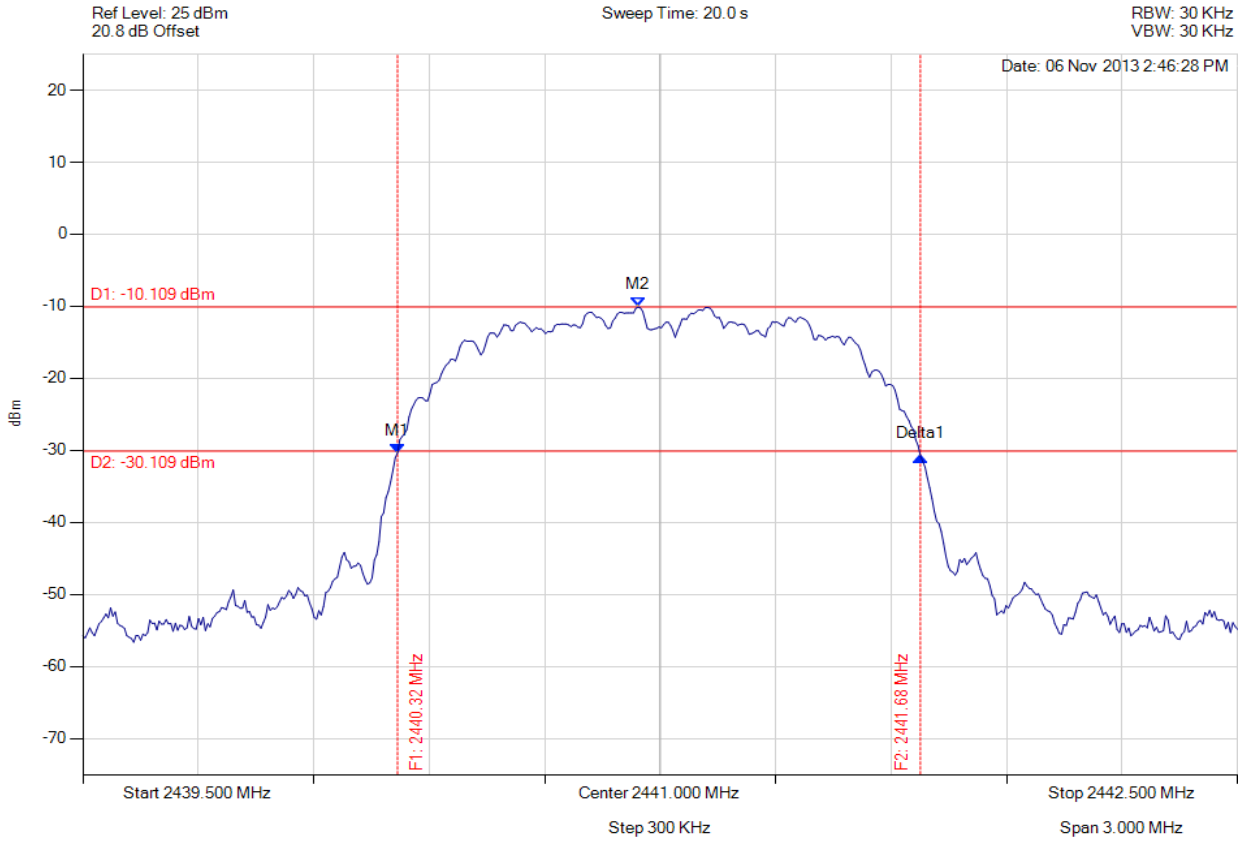
PEAK OUTPUT POWER

Variant: 802.15 DH5, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

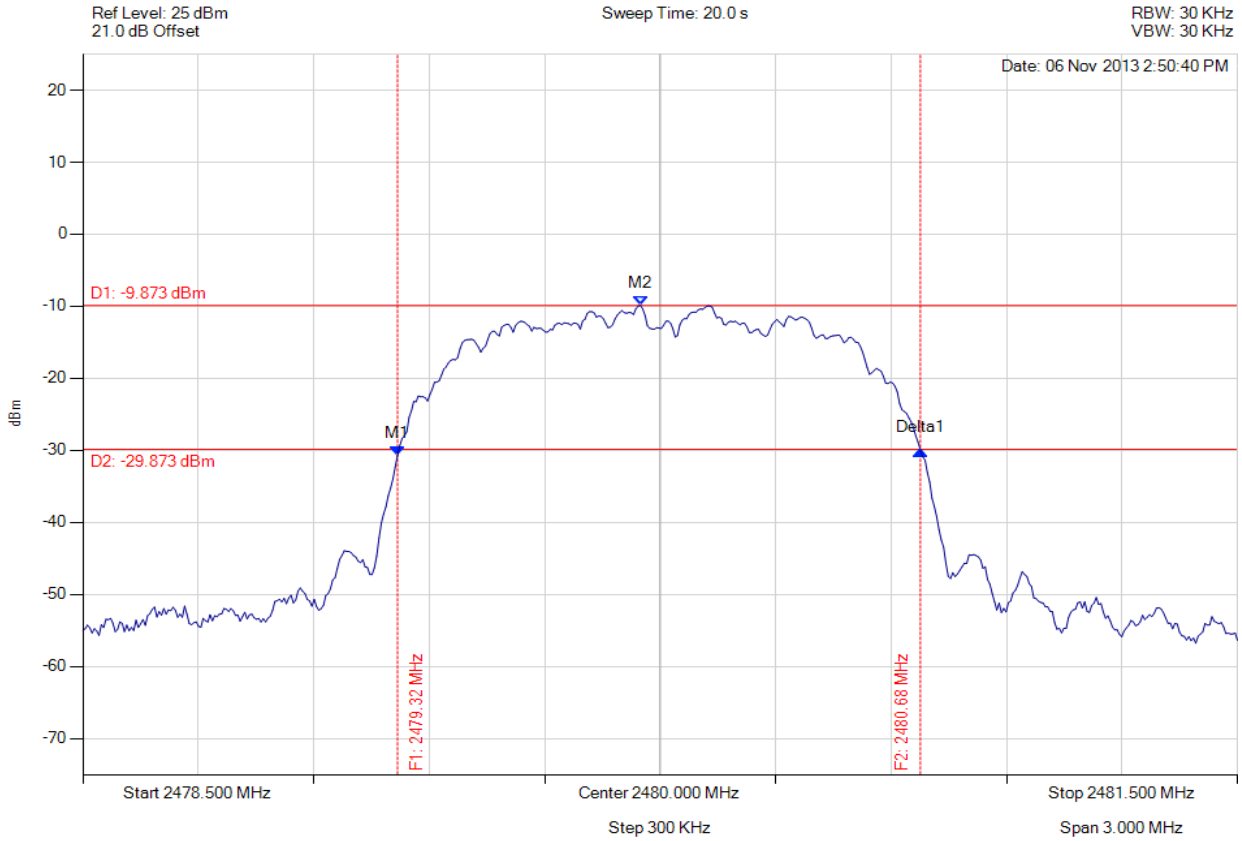


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.318 MHz : -30.350 dBm M2 : 2440.943 MHz : -10.109 dBm Delta1 : 1.359 MHz : -0.454 dB	Channel Power: 2.47 dBm Limit: 30.00 dBm Margin: -27.53 dB

Back to the Matrix

PEAK OUTPUT POWER

Variant: 802.15 DH5, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc

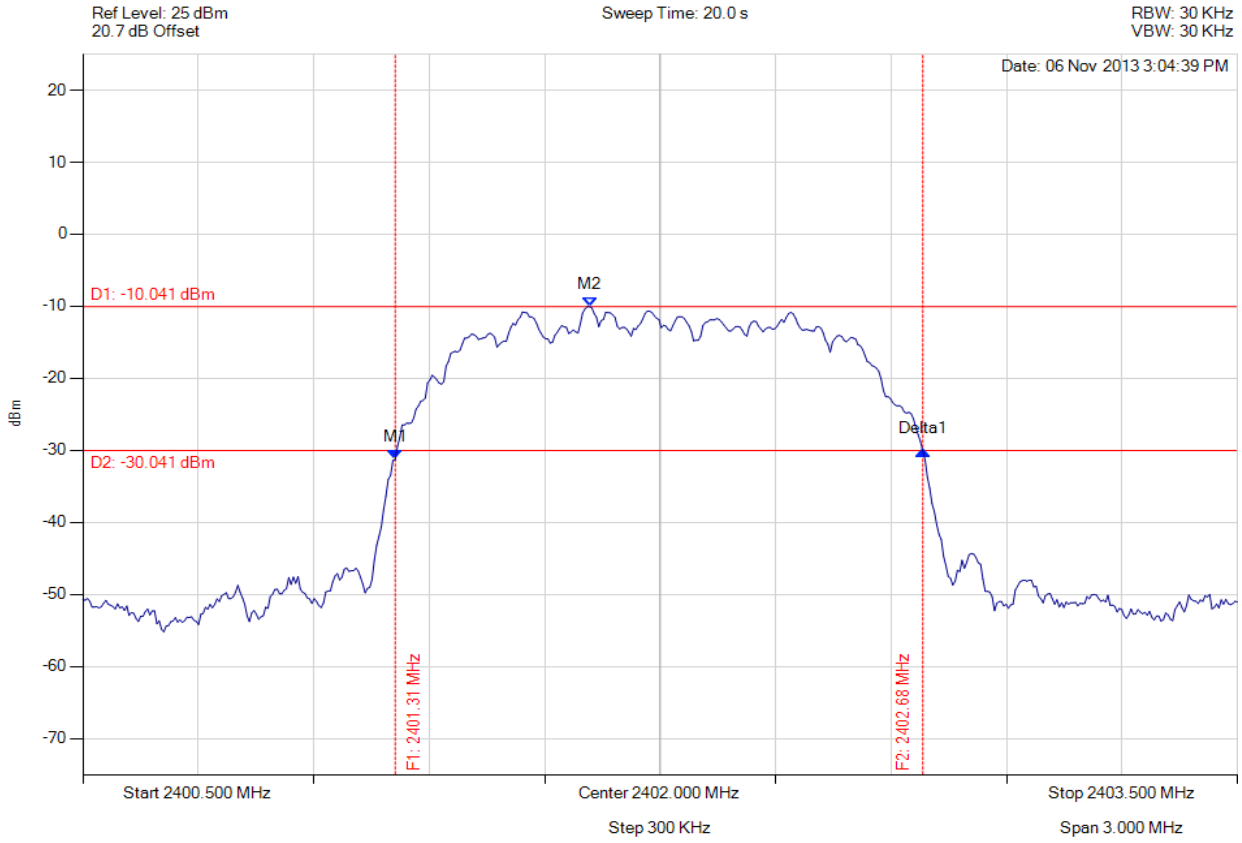


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2479.318 MHz : -30.672 dBm M2 : 2479.949 MHz : -9.873 dBm Delta1 : 1.359 MHz : 0.706 dB	Channel Power: 2.59 dBm Limit: 30.00 dBm Margin: -27.41 dB

Back to the Matrix

PEAK OUTPUT POWER

Variant: 802.15 3-DH1, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2401.312 MHz : -31.278 dBm M2 : 2401.817 MHz : -10.041 dBm Delta1 : 1.371 MHz : 1.186 dB	Channel Power: 2.30 dBm Limit: 30.00 dBm Margin: -27.70 dB

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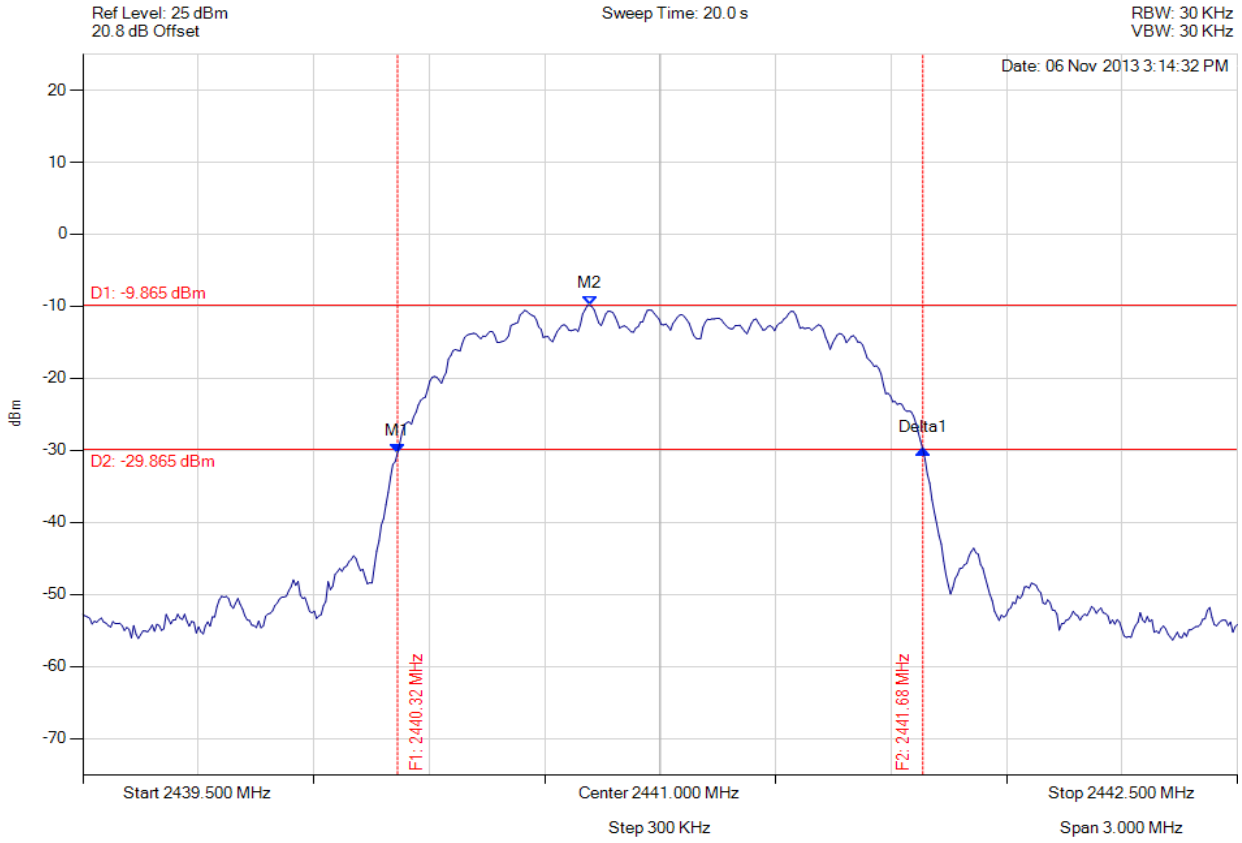
PEAK OUTPUT POWER

Variant: 802.15 3-DH1, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.318 MHz : -30.363 dBm M2 : 2440.817 MHz : -9.865 dBm Delta1 : 1.365 MHz : 0.492 dB	Channel Power: 2.47 dBm Limit: 30.00 dBm Margin: -27.53 dB

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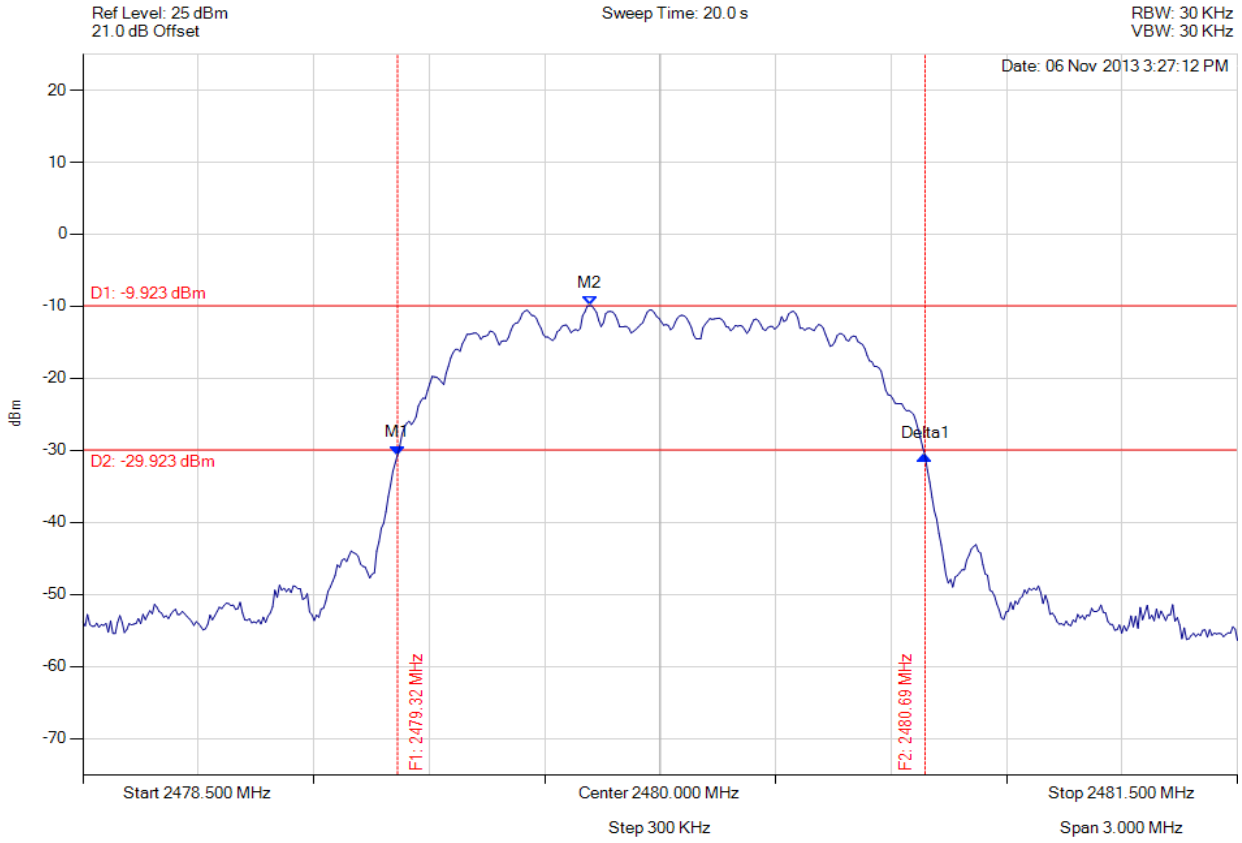
PEAK OUTPUT POWER

Variant: 802.15 3-DH1, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2479.318 MHz : -30.639 dBm M2 : 2479.817 MHz : -9.923 dBm Delta1 : 1.371 MHz : -0.155 dB	Channel Power: 2.47 dBm Limit: 30.00 dBm Margin: -27.53 dB

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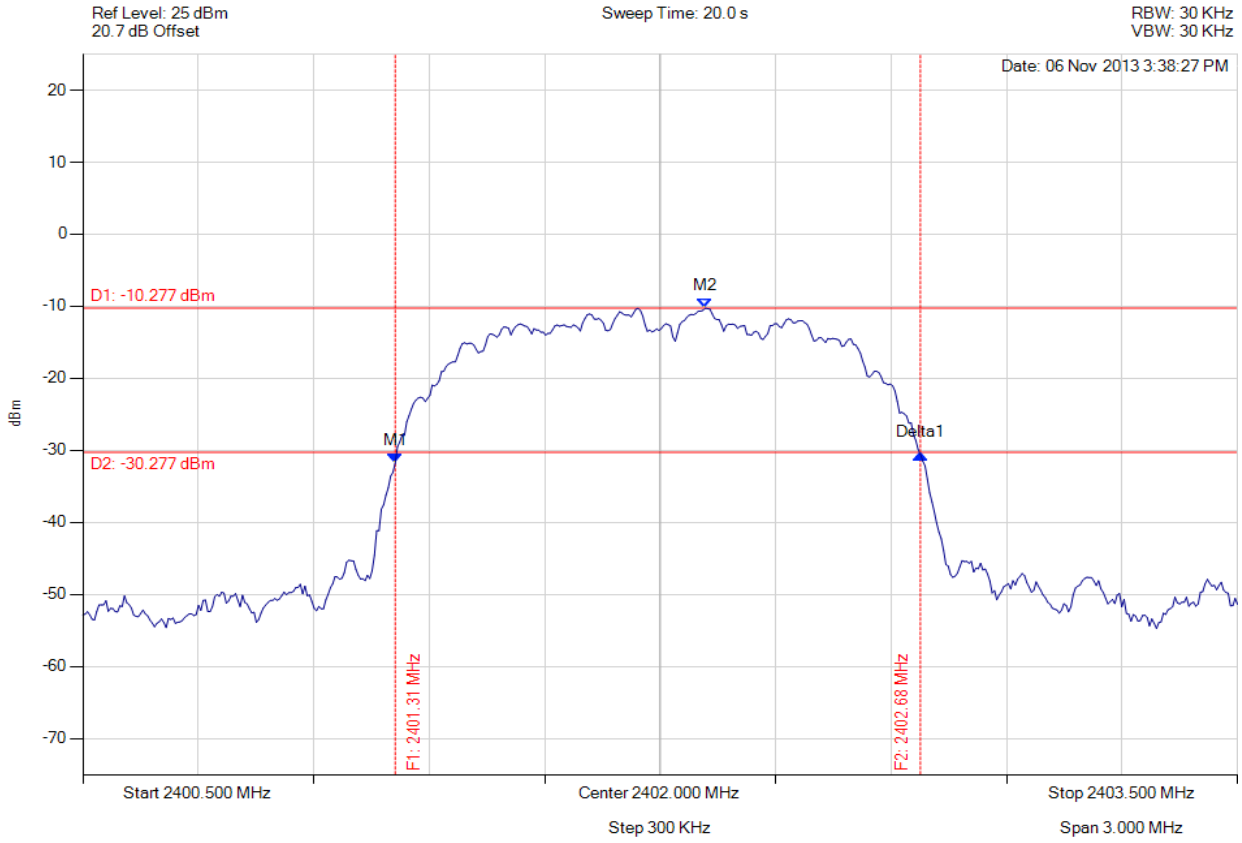
PEAK OUTPUT POWER

Variant: 802.15 3-DH5, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2401.312 MHz : -31.768 dBm M2 : 2402.117 MHz : -10.277 dBm Delta1 : 1.365 MHz : 1.247 dB	Channel Power: 2.23 dBm Limit: 30.00 dBm Margin: -27.77 dB

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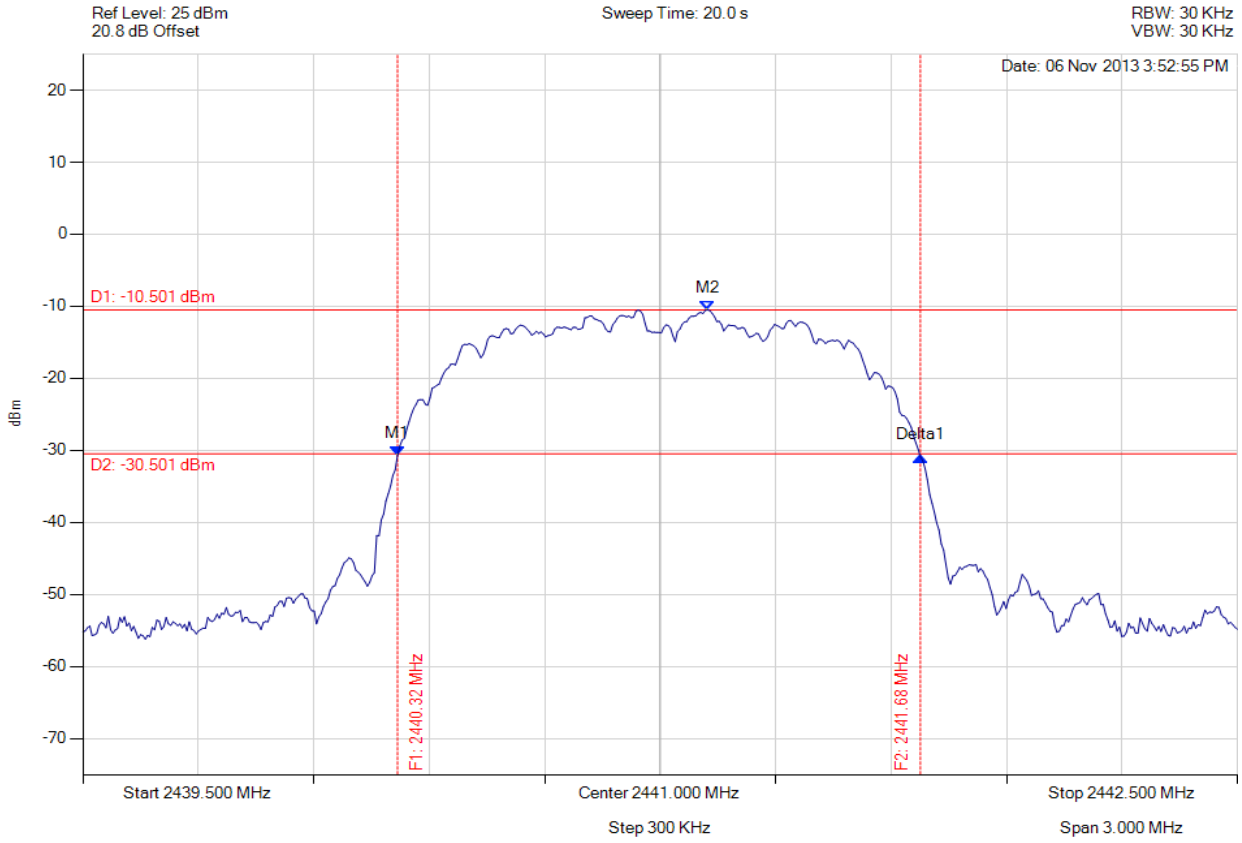
PEAK OUTPUT POWER

Variant: 802.15 3-DH5, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2440.318 MHz : -30.692 dBm M2 : 2441.123 MHz : -10.501 dBm Delta1 : 1.359 MHz : -0.224 dB	Channel Power: 2.00 dBm Limit: 30.00 dBm Margin: -28.00 dB

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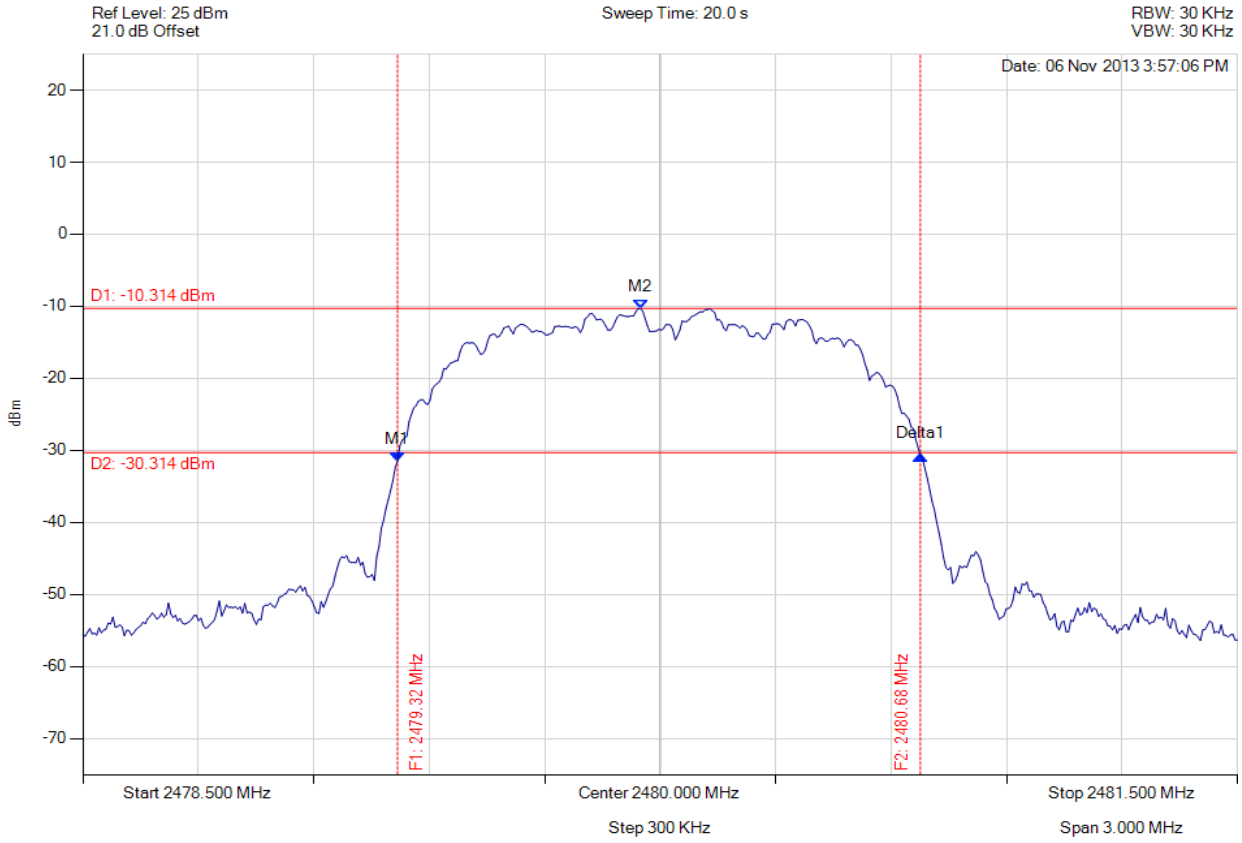
PEAK OUTPUT POWER

Variant: 802.15 3-DH5, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2479.318 MHz : -31.491 dBm M2 : 2479.949 MHz : -10.314 dBm Delta1 : 1.359 MHz : 0.793 dB	Channel Power: 2.19 dBm Limit: 30.00 dBm Margin: -27.81 dB

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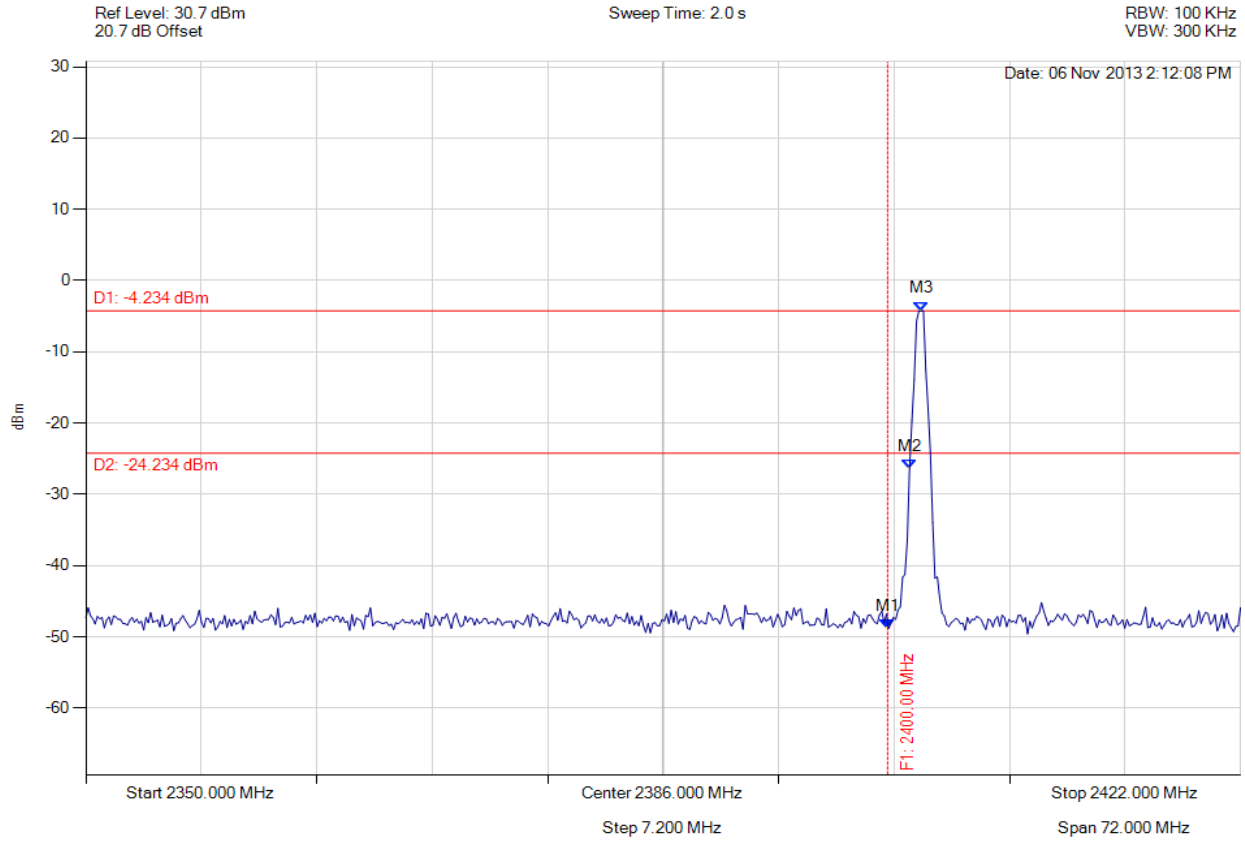
A.1.6. Conducted Spurious Emissions

CONDUCTED LOW BAND-EDGE EMISSION - PEAK

Variant: 802.15 DH1, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2400.000 MHz : -48.809 dBm M2 : 2401.367 MHz : -26.359 dBm M3 : 2402.088 MHz : -4.234 dBm	Channel Frequency: 2402.00 MHz

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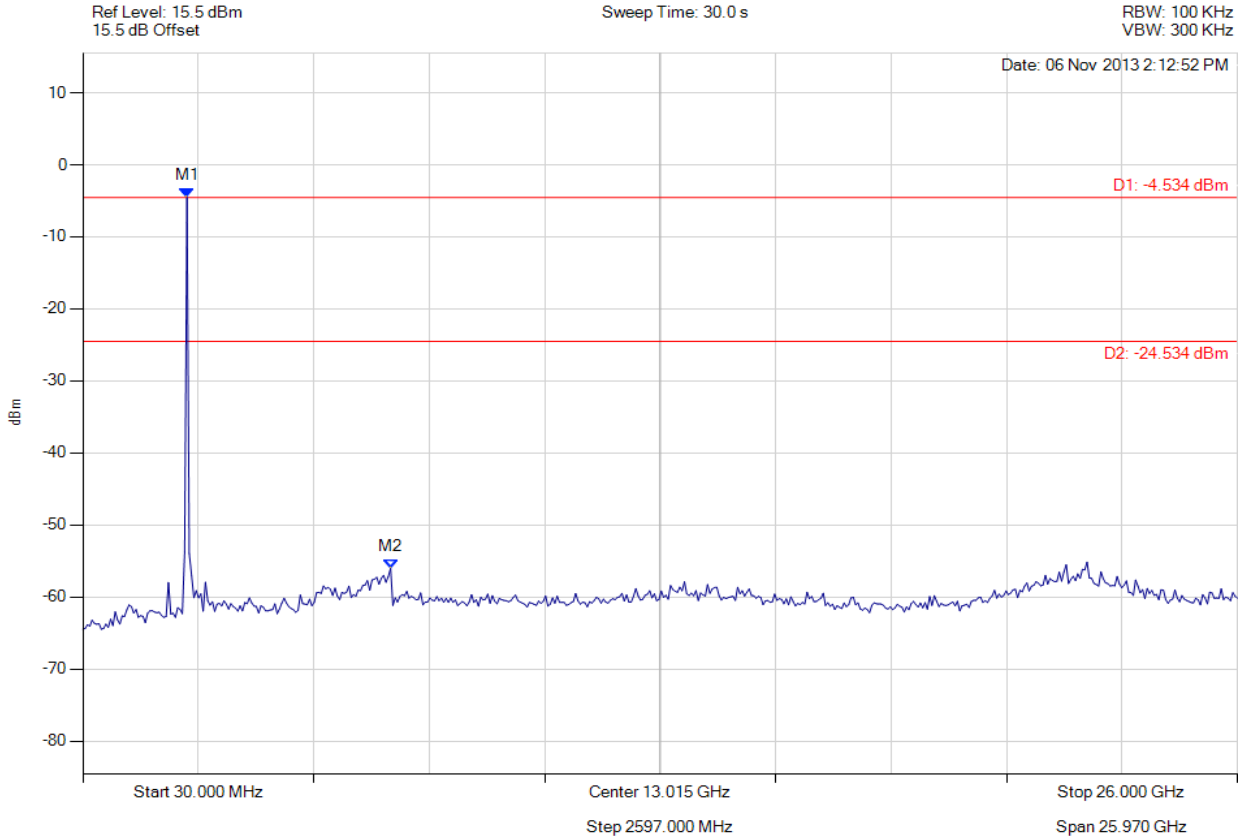
CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: 802.15 DH1, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2371.984 MHz : -4.534 dBm M2 : 6951.864 MHz : -56.027 dBm	Limit: -24.53 dBm Margin: -31.50 dB

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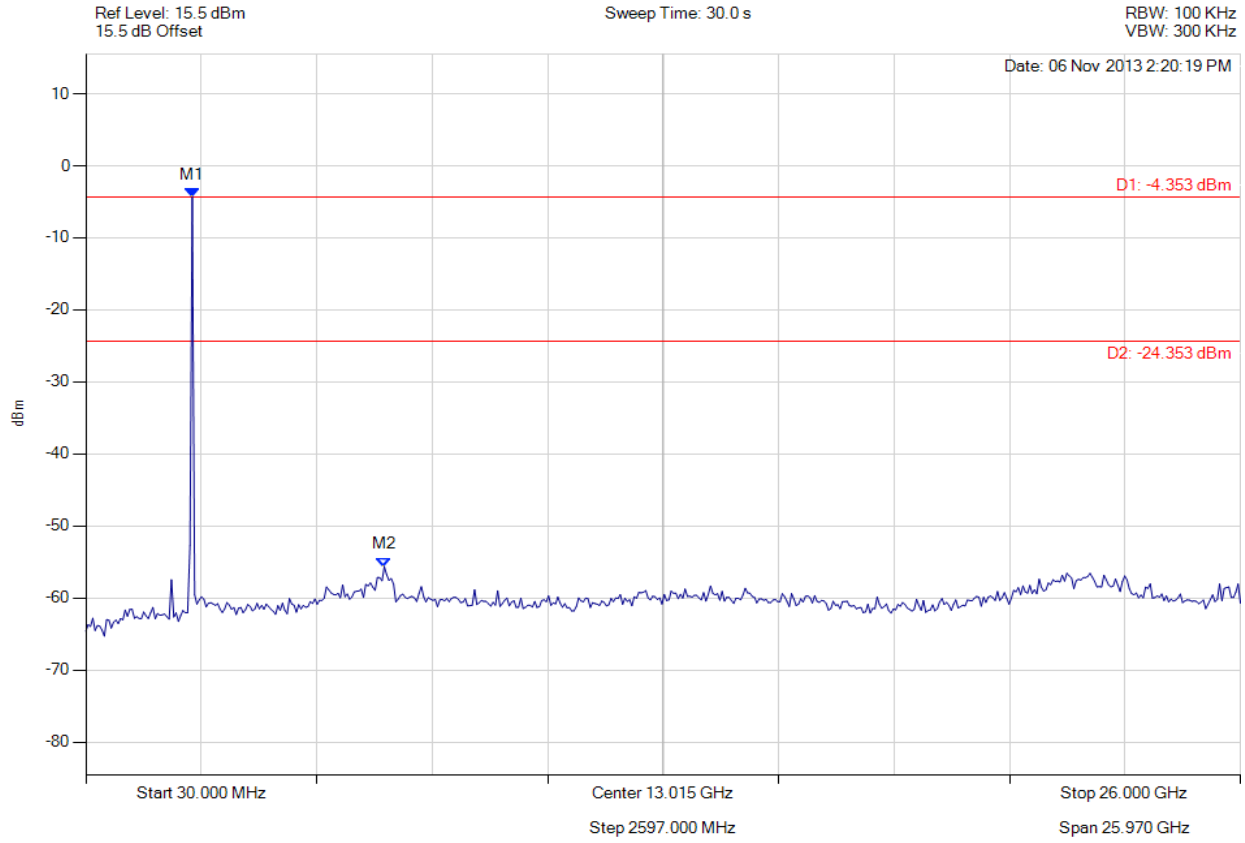
CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: 802.15 DH1, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2424.028 MHz : -4.353 dBm M2 : 6743.687 MHz : -55.647 dBm	Limit: -24.35 dBm Margin: -31.30 dB

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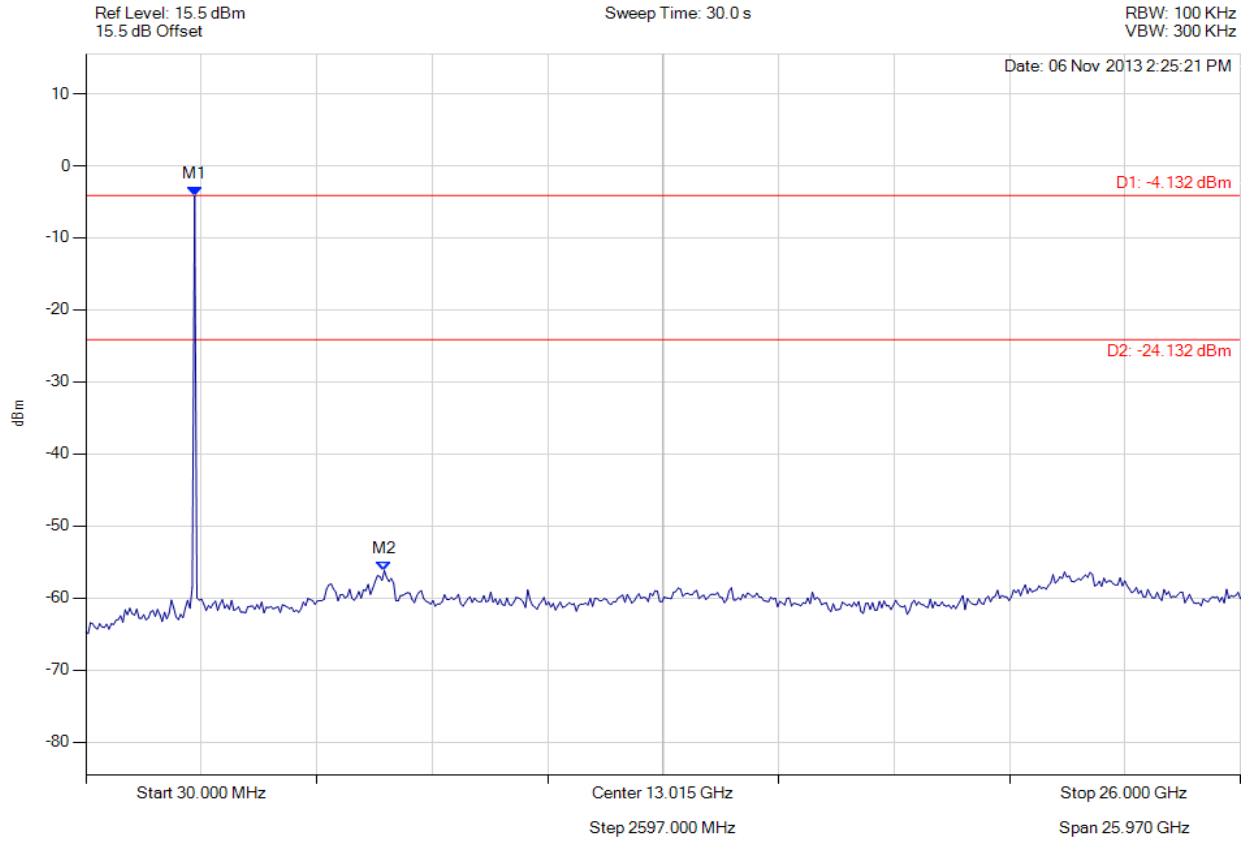
CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: 802.15 DH1, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2476.072 MHz : -4.132 dBm M2 : 6743.687 MHz : -56.179 dBm	Limit: -24.13 dBm Margin: -32.05 dB

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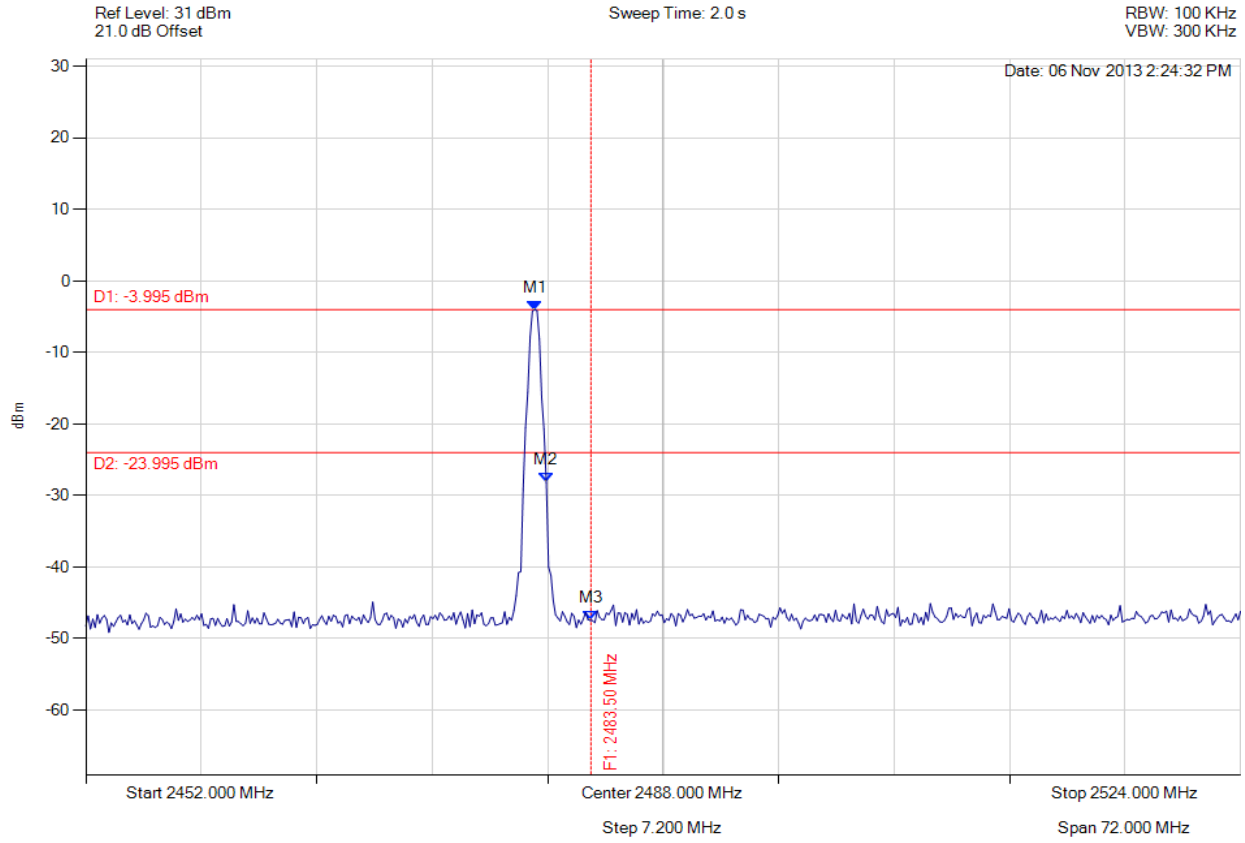
CONDUCTED HIGH BAND-EDGE EMISSION - PEAK

Variant: 802.15 DH1, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2479.992 MHz : -3.995 dBm M2 : 2480.713 MHz : -28.164 dBm M3 : 2483.500 MHz : -47.462 dBm	Channel Frequency: 2480.00 MHz

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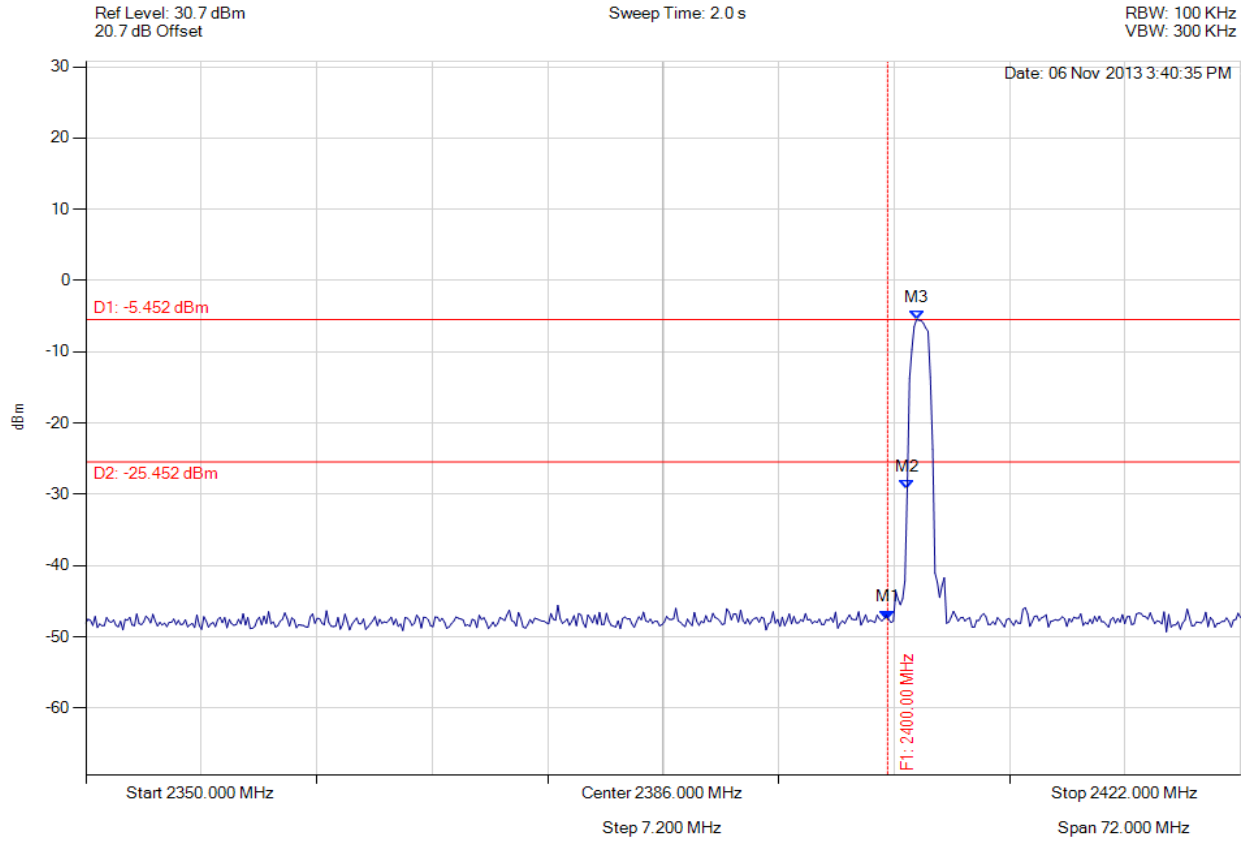
CONDUCTED LOW BAND-EDGE EMISSION - PEAK

Variant: 802.15 3-DH5, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2400.000 MHz : -47.563 dBm M2 : 2401.222 MHz : -29.202 dBm M3 : 2401.800 MHz : -5.452 dBm	Channel Frequency: 2402.00 MHz

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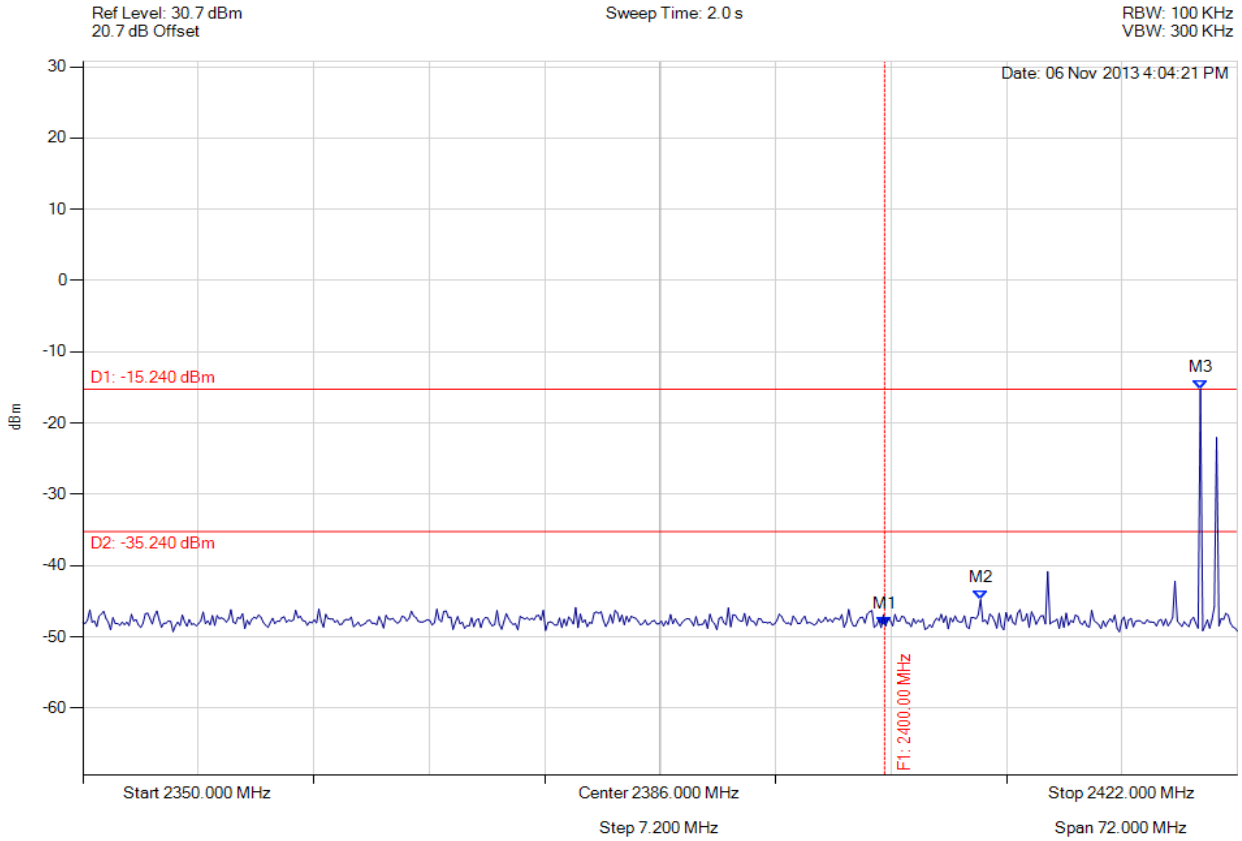
CONDUCTED LOW BAND-EDGE EMISSION - PEAK

Variant: 802.15 3-DH5 Hopping, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2400.000 MHz : -48.466 dBm M2 : 2405.984 MHz : -44.754 dBm M3 : 2419.691 MHz : -15.240 dBm	Channel Frequency: 2402.00 MHz

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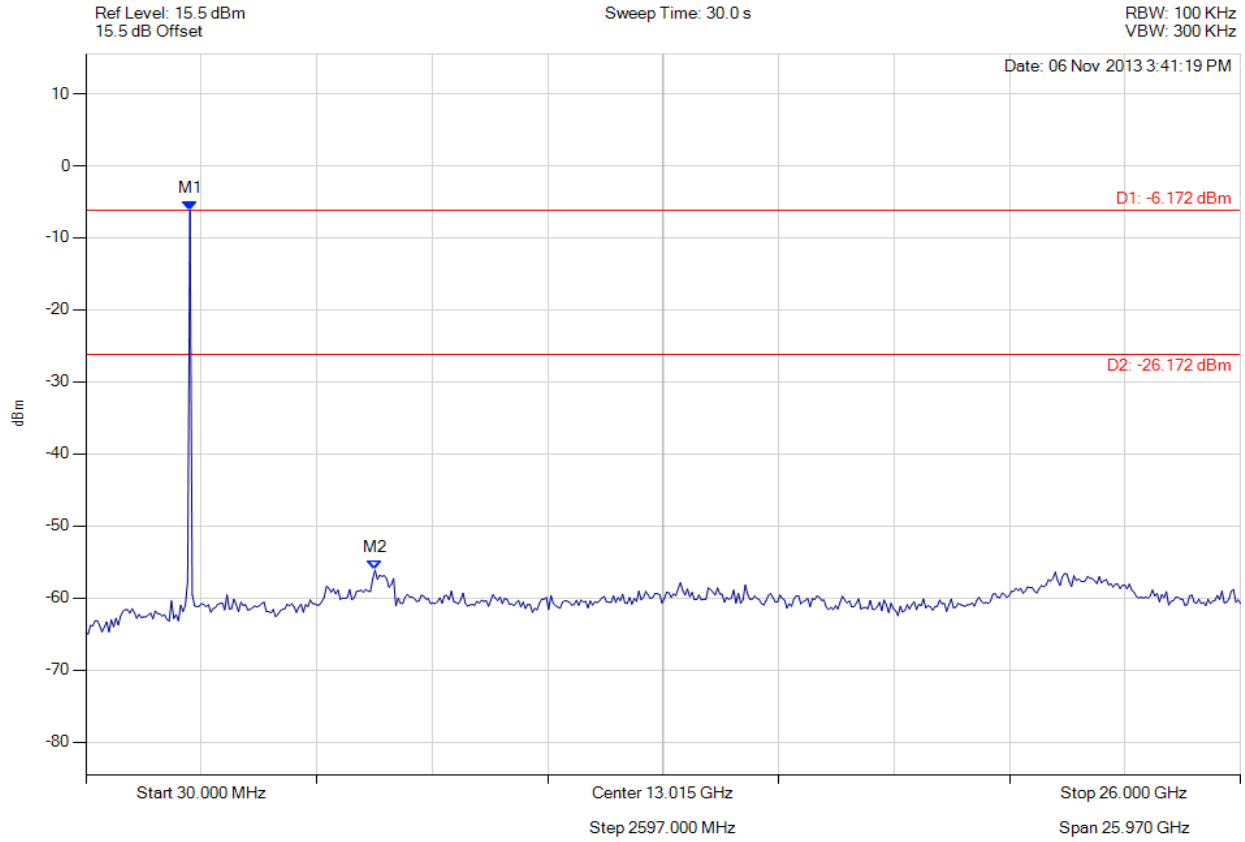
CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: 802.15 3-DH5, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2371.984 MHz : -6.172 dBm M2 : 6535.511 MHz : -56.129 dBm	Limit: -26.17 dBm Margin: -29.96 dB

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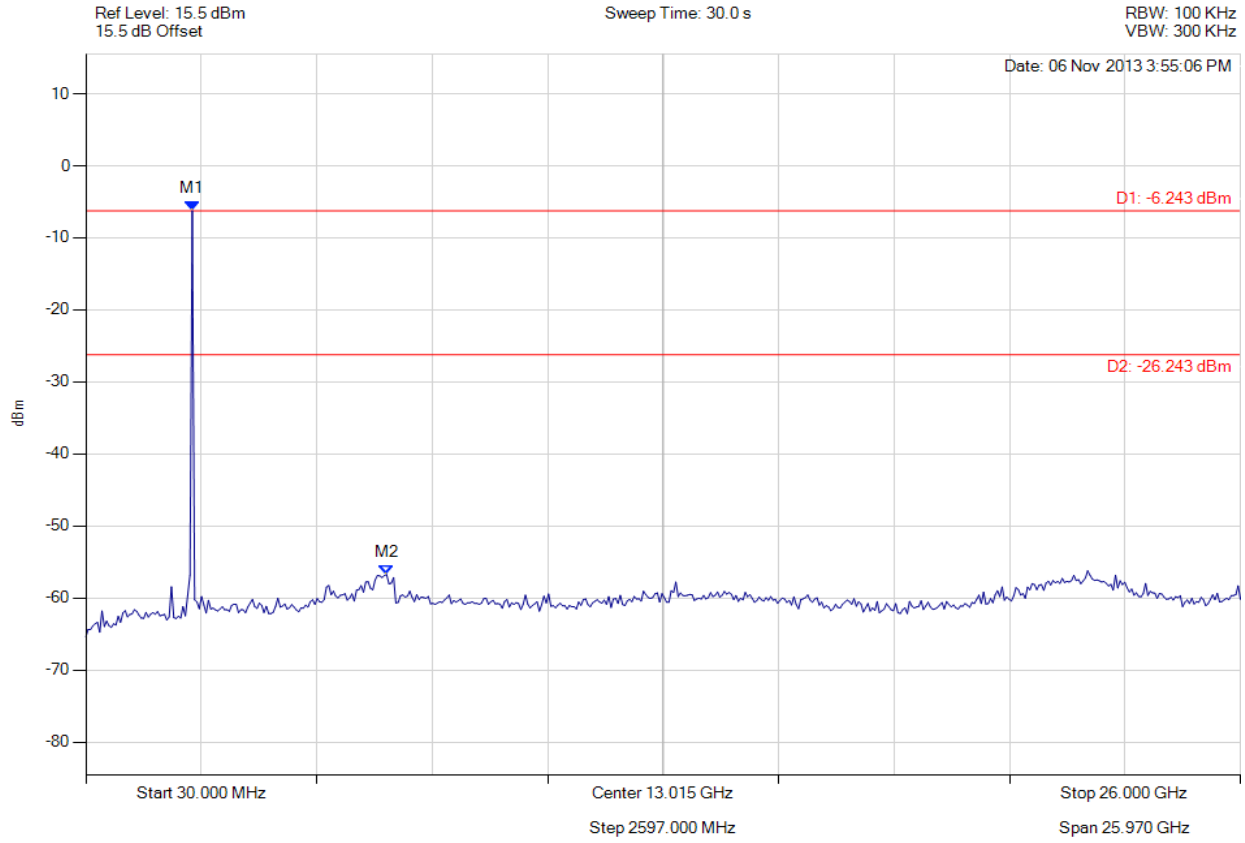
CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: 802.15 3-DH5, Channel: 2441.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2424.028 MHz : -6.243 dBm M2 : 6795.731 MHz : -56.737 dBm	Limit: -26.24 dBm Margin: -30.50 dB

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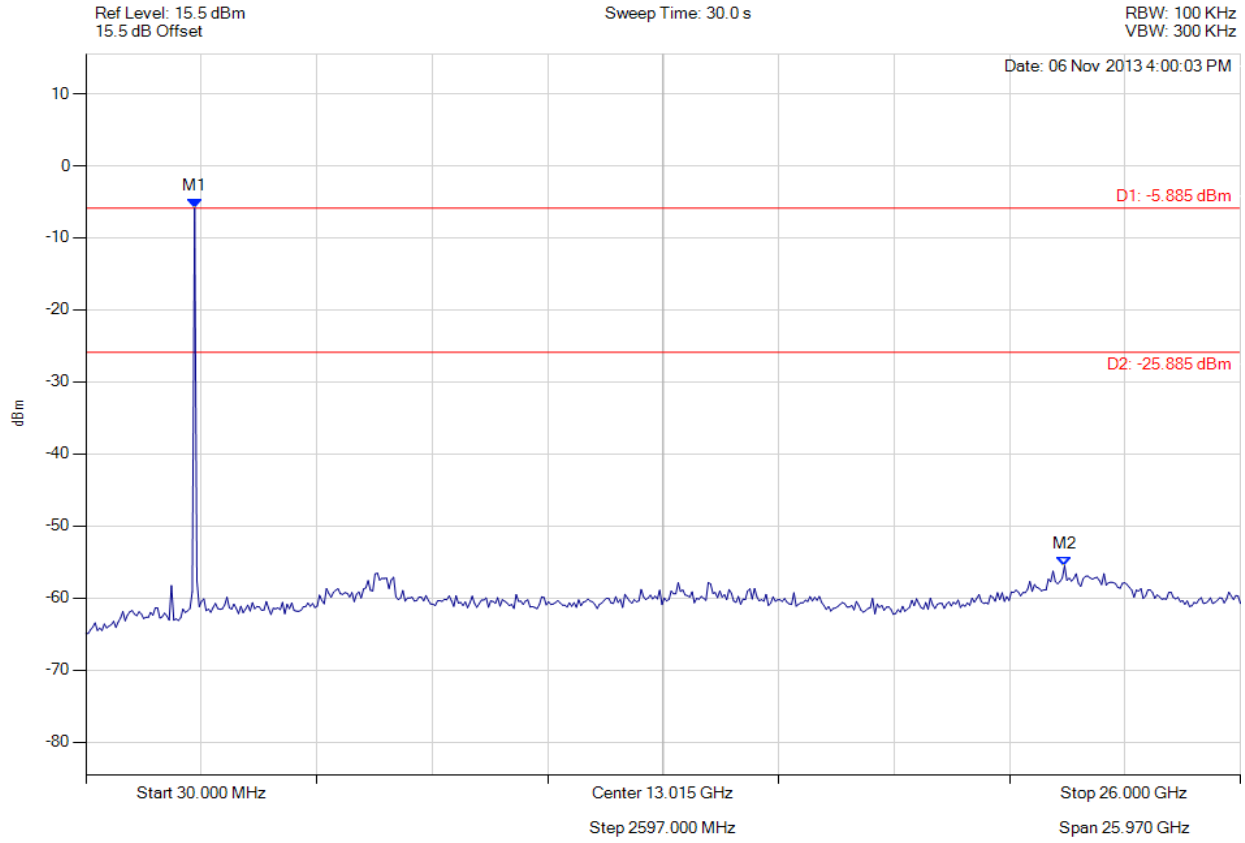
CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: 802.15 3-DH5, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 2476.072 MHz : -5.885 dBm M2 : 22.045 GHz : -55.529 dBm	Limit: -25.89 dBm Margin: -29.64 dB

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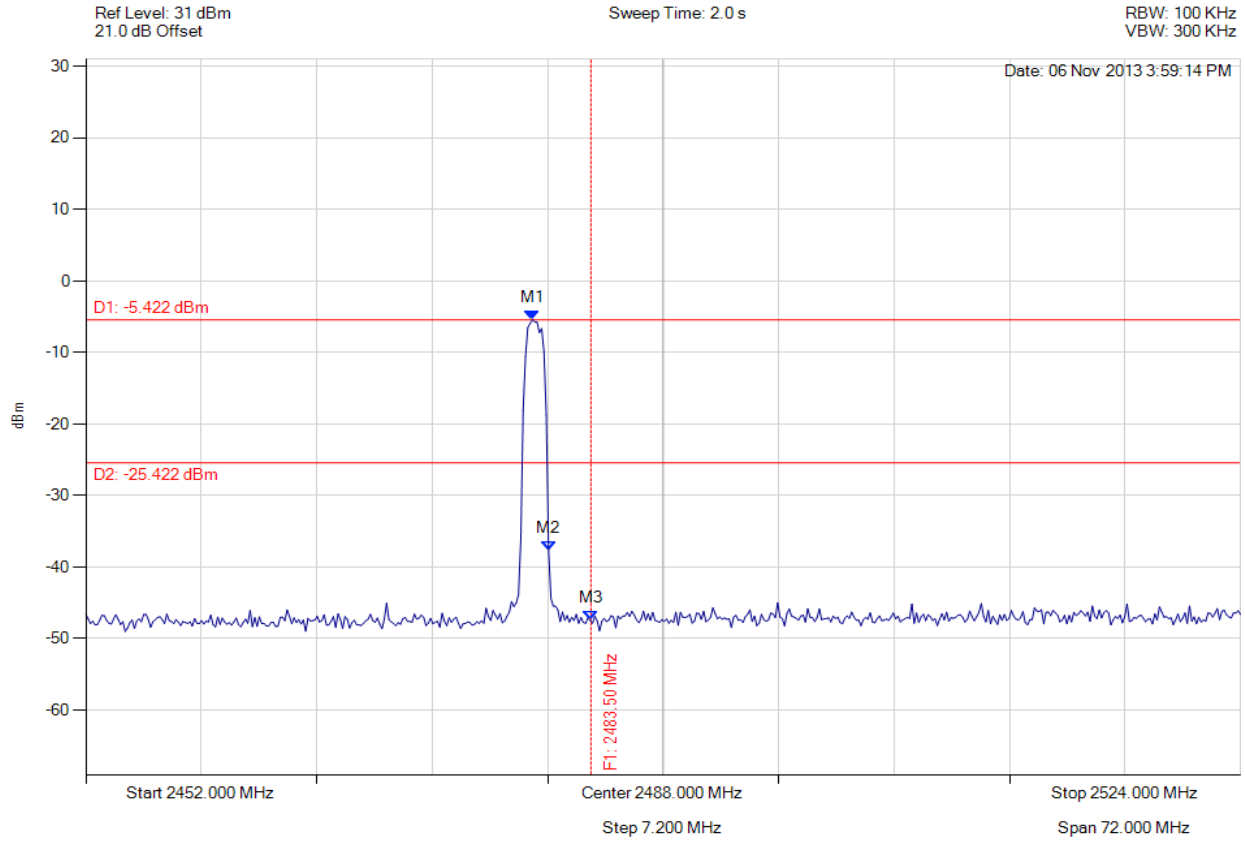
CONDUCTED HIGH BAND-EDGE EMISSION - PEAK

Variant: 802.15 3-DH5, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2479.848 MHz : -5.422 dBm M2 : 2480.858 MHz : -37.669 dBm M3 : 2483.500 MHz : -47.462 dBm	Channel Frequency: 2480.00 MHz

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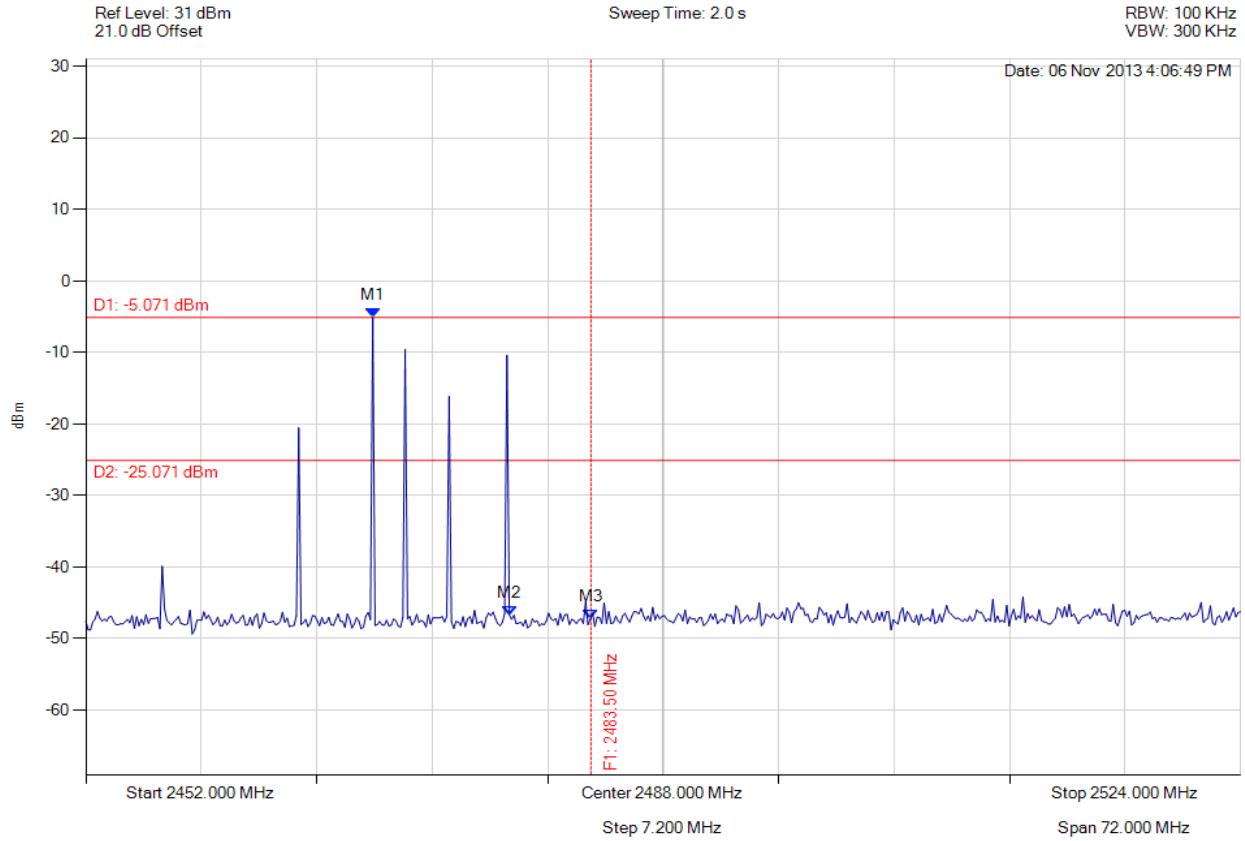
CONDUCTED HIGH BAND-EDGE EMISSION - PEAK

Variant: 802.15 3-DH5 Hopping, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 3.7 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 2469.892 MHz : -5.071 dBm M2 : 2478.405 MHz : -46.669 dBm M3 : 2483.500 MHz : -47.297 dBm	Channel Frequency: 2480.00 MHz

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