RR051-15-102324-7-A Ed. 0

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
DRONE EXOM

FCC ID:
2AC2VEXOM

Company:
SENSEFLY

DISTRIBUTION: Mr GILLE **(Company: SENSEFLY)**

Number of pages: 54 with 9 appendixes

Ed.	Date	Modified pages	Written by Name	Written by Visa	Technical Verification and Quality Approval Name	Technical Verification and Quality Approval Visa
0	21/08/2015	Creation	S. LOUIS	SL	M. DUMESNIL	

Duplication of this test report is only permitted for an integral photographic facsimile. It includes the number of pages referenced here above.
This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole manufactured products of the tested sample.

DESIGNATION OF PRODUCT:	**DRONE EXOM**
Serial number (S/N):	AD04 EX-99-12880
Reference / model (P/N):	SENSEFLY EXOM
Software version:	—
MANUFACTURER:	SENSEFLY

COMPANY SUBMITTING THE PRODUCT:

Company:	SENSEFLY
Address:	Route de Genève 38 1033 Cheseaux-Lausanne SWITZERLAND
Responsible:	Mr GILLE
DATES OF TEST:	Between 11-JUNE-2015 to 21-AUG-2015
TESTING LOCATION:	EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE 21 rue de la Fuye 49610 Juigne sur Loire France FCC 2.948 Listed Site Registration Number: 90469 FCC Accredited under US-EU MRA Designation Number: FR0009 Test Firm Registration Number: 873677
TESTED BY:	S. LOUIS and T. LEDRESSEUR

CONTENTS

1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment: **DRONE EXOM** in accordance with normative reference.

The device under test integrates a multifrequency transceiver (FHSS 2.4GHz).
The host device of certified modules shall be properly labeled to identify the modules within.

2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Drone
Antenna type and gain:	Internal wiring antenna 1dBi
Operating frequency range:	from 2403 MHz to 2478 MHz
Frequency tested:	2403 MHz (low channel), 2439 MHz (central channel), 2479MHz (high channel)
Number of channels:	15
Channel spacing:	2 MHz
Modulation:	FHSS
Power source:	Battery LiPo, 11.1Vdc

Power level, frequency range and channels characteristics are not user adjustable.
The details pictures of the product and the circuit boards are joined with this file.

3. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below.
They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 FCC Part 15 (2014)	Radio Frequency Devices
ANSI C63.4	2009 Methods of measurement of Radio-Noise Emissions from low-voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C63.10	2009 Testing Unlicensed Wireless Devices.
558074 D01 DTS v03r02	Guidance for Performing Compliance on Digital Transmission Systems Operating under §15.247
Public Notice DA 00-705	Filing and Measurement Guideline for Frequency Hopping Spread Spectrum Systems.

4. TEST METHODOLOGY

Radio performance tests procedures given in CFR 47 part 15:

Subpart A –General
- Paragraph 19: labelling requirements
- Paragraph 21: information to user

Subpart B –Unintentional Radiators
- Paragraph 105: information to the user
- Paragraph 107: Conducted limits
- Paragraph 109: Radiated emission limits
- Paragraph 111: Antenna power conduction limits for receivers

Subpart C – Intentional Radiators
- Paragraph 203: Antenna requirement
- Paragraph 205: Restricted bands of operation
- Paragraph 207: Conducted limits
- Paragraph 209: Radiated emission limits; general requirements
- Paragraph 212: Modular transmitter
- Paragraph 215: Additional provisions to the general radiated emission limitations
- Paragraph 247: Operation within the bands 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz

5. TEST EQUIPMENT CALIBRATION DATES

Equipment	Model	Type	Last verification	Next verification	Validity
0000	BAT-EMC	Software	/	/	/
1406	EMCO 6502	Loop antenna	27/01/2015	27/01/2017	27/03/2017
1922	Microwave DB C020180F-4B1	Low-noise amplifier	20/08/2014	20/08/2015	20/10/2015
1939	IMC WR42	Antenna	20/04/2012	20/04/2016	20/06/2016
1940	IMC WR42	Antenna	20/04/2012	20/04/2016	20/06/2016
3036	ALC Microwave ALN02-0102	Low-noise amplifier	14/05/2014	14/05/2015	14/07/2015
4087	Filtek LP03/1000-7GH	Low Pass Filter	24/02/2014	24/02/2016	24/04/2016
4088	R&S FSP40	Spectrum Analyzer	22/08/2013	22/08/2015	22/10/2015
5625	BL Microwave BP2442-84-7CS	Band pass filter	24/01/2012	24/01/2014	24/03/2014
7299	Microtronics BRM50702	Reject band filter	25/10/2013	25/10/2015	25/12/2015
8511	HP 8447D	Low noise preamplifier	20/08/2014	20/08/2015	20/10/2015
8523	R&S FSEM30	Spectrum analyzer	20/05/2014	20/05/2016	20/07/2016
8526	Schwarzbeck VHBB 9124	Biconical antenna	12/06/2012	12/06/2016	12/08/2016
8528	Schwarzbeck VHA 9103	Biconical antenna	24/09/2013	24/09/2017	24/11/2017
8534	EMCO 3115	Antenna	30/10/2012	30/10/2016	30/12/2016
8535	EMCO 3115	Antenna	29/10/2012	29/10/2016	29/12/2016
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	12/06/2012	12/06/2016	12/08/2016
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8675	AOIP MN5102B	Multimeter	23/02/2015	23/02/2017	23/04/2017
8707	R&S ESI7	Test receiver	11/12/2014	11/12/2016	11/02/2017
8732	Emitech	OATS	23/08/2013	23/08/2016	23/10/2016
8749	La Crosse Technology WS-9232	Meteo station	03/09/2014	03/09/2016	03/11/2016
8750	La Crosse Technology WS-9232	Meteo station	03/09/2014	03/09/2016	03/11/2016
8783	EMCO 3147	Log periodic antenna	24/09/2013	24/09/2017	24/11/2017
8864	Champ libre Juigné. V3.4	Software	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
/	GPIB SHOT	Software	/	/	/

6. TESTS AND CONCLUSIONS

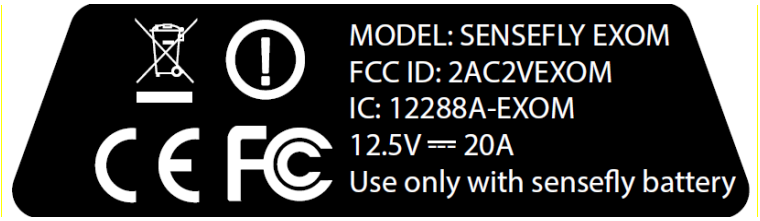
6.1 general (subpart A)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.19	LABELLING REQUIREMENTS				X	*See certification documents*
FCC Part 15.21	INFORMATION TO USER				X	*See certification documents*

NAp: Not Applicable NAs: Not Asked

LABEL SHALL CONTAIN

The label shall be located in a conspicuous location on the device
The label shall not be a stick-on, paper label. The label on these products shall be permanently affixed to the product and shall be readily visible to the purchaser at the time of purchase



§15.19: (can be placed in the user manual if the product is too small)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

USER NOTICE SHALL CONTAIN

The user notice, not provided during tests, shall include the following informations:

§15.21:
Any changes or modifications to this equipment not expressly approved by SENSEFLY may cause, harmful interference and void the FCC authorization to operate this equipment

6.2 unintentional radiator (subpart B)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.105	INFORMATION TO THE USER				X	*See certification documents*
FCC Part 15.107	CONDUCTED LIMITS			X		
FCC Part 15.109	RADIATED EMISSION LIMITS	X				*Class B*
FCC Part 15.111	ANTENNA POWER CONDUCTED LIMITS FOR RECEIVER			X		

NAp: Not Applicable NAs: Not Asked

USER NOTICE SHALL CONTAIN

The user notice, not provided during tests, shall include the following informations:

§ 15.105:

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference's by one or more of the following measures:
-Reorient or relocate the receiving antenna.
-Increase the separation between the equipment and the receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help.

6.3 intentional radiator (subpart C)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				*Note 1*
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS			X		
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				*Note 2*
FCC Part 15.212	MODULAR TRANSMITTERS			X		
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) Alternative to general radiated emission limits					
	(b) Unwanted emissions outside of §15.247 frequency bands	X				*Note 3*
	(c) 20 dB bandwidth and band-edge compliance	X				
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz					
	(a) (1) Hopping systems	X				*Note 4*
	(a) (2) Digital modulation techniques			X		
	(b) Maximum peak output power	X				*Note 5*
	(c) Operation with directional antenna gains > 6 dBi			X		
	(d) Intentional radiator	X				
	(e) Peak power spectral density			X		
	(f) Hybrid system			X		
	(g) Frequency hopping requirements			X		
	(h) Frequency hopping intelligence			X		
	(i) RF exposure compliance	X				

NAp: Not Applicable NAs: Not Asked

Note 1: Integral / dedicated antenna. Professionally installed equipment.

Note 2: See FCC part 15.247 (d).

Note 3: See FCC part 15.209. Unwanted emissions levels are all below the fundamental emission field strength level.

Note 4: The system hops to channel frequencies from a pseudo randomly ordered list of hopping frequencies. Each frequency is used equally on the average by the transmitter, and separated by a minimum of 25 kHz or 2/3 of 20 dB bandwidth of the hopping channel (see appendix 7).

The frequency hopping system uses 15 channels (see appendix 9).

The timing by channel is 4000 µs (see appendix 8).

During (15 channels × 0.4 s =) 6 s, any channel is used 8 times (see appendix 8),
then 8x4000 µs = 136 ms,
thus the average time of occupancy on any channel is less than 400 ms within a period of 0.4 seconds multiplied by the number of hopping channels employed, in normal operating mode.

Number of channels	Observation period in second (0.4s * Number of channel)	Maximal duration of each burst (ms)	Number of burst repetition during observation period	average time of occupancy on any channel (s)	Limits (s)
15	6	4.168	8	0.033344	0.4

Note 5: Conducted measurement is not possible (integral antenna), so we used the radiated method in open field.

RF EXPOSURE:

Maximum measured power = 89.8 dBµV/m = 0.228 mW

$P = (E \times d)^2 / (30 \times Gp)$ with d = 3 m and Gp = 2.51

Antenna gain: 4 dBi

$PSD = EIRP/4*\pi*R^2 = 114 / 4*\pi*(20\ cm)^2 = 45.38 \times 10^{-6}$ mW/cm² (limit= 1 mW/cm²).

The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310.

« To declare, or not, the compliance with the specifications, it was not explicitly taken into account of uncertainty associated with the result(s) »

7. RADIATED EMISSION LIMITS

Standard: FCC Part 15

Test procedure: paragraph 109

Limit class: Class B

Test set up:

First an exploratory radiated measurement was performed. During this phase the product is oriented in three orthogonal planes.

Then the final measurement is realized with the product on the most critical orientation.

The measure is realized on open area test site under 1 GHz and in anechoic chamber above 1 GHz.

When the system is tested in an open area test site (OATS), the EUT is placed on a rotating table, 0.8m from a ground plane.

When the system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5m from a ground plane.

Zero degree azimuths correspond to the front of the device under test.

See photos in appendix 2.

Frequency range: From 30 MHz to 12.4GHz (5th harmonic of the highest frequency used).

Detection mode: Quasi-peak (F < 1 GHz) Average (F > 1 GHz)

Bandwidth: 120 kHz (F < 1 GHz) 1 MHz (F > 1 GHz)

Distance of antenna: 10 meters (in open area test site) / 3 meters (in anechoic room)

Antenna height: 1 to 4 meters (in open area test site) / 1.5 meter (in anechoic room)

Antenna polarization: vertical and horizontal (only the highest level is recorded)

Equipment under test operating condition:

The equipment is blocked in discovery mode. The motors were activated.

Results:

Ambient temperature (°C): 25.6
Relative humidity (%): 55

Power source: we used for power source the internal battery fully charged

Sample N° 1

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak	Antenna height (cm)	Azimuth (degree)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
182	QP	100	312	V	17.06	43.5	26.44
208	QP	100	179	V	24.52	43.5	18.98
260	QP	100	88	V	26.79	46.4	19.61
286	QP	100	364	V	23.75	46.4	22.65
338	QP	276	349	V	26.33	46.4	20.07
679.22	QP	317	172	V	27.70	46.4	18.70
787.62	QP	385	363	V	22.00	46.4	24.40
900	QP	400	229	V	23.77	46.4	22.63

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Test conclusion:

RESPECTED STANDARD

8. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS

Standard: FCC Part 15

Test procedure: Paragraph 15.215

Test set up:

Test realized in near field. All field strength measurements are correlated with the radiated maximum peak output power

Test operating condition of the equipment:

The equipment under test is blocked in continuous hopping transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate.

Results:

Ambient temperature (°C): 21.6
Relative humidity (%): 54

Power source: we used for power source the internal battery fully charged

Lower Band Edge: from 2398 MHz to 2400 MHz
Upper Band Edge: from 2483.5 MHz to 2485.5 MHz

Sample N° 1: Hopping mode OFF

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out-of-Band Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2403	89.6	PEAK	2399.608	-40.02	49.58	69.6	20.02
2479	67.8	PEAK	2483.824	-38.29	29.51	74	44.49
2479	67.8	AVERAGE	2483.615	-54.79	13.01	54	40.99

* *Marker-Delta method*

** *The peak level is lower than the average limit (54dBµV/m).*

Sample N° 1: Hopping mode ON

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out-of-Band Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2403	89.6	PEAK	2399.520	>20dB under the carrier		69.6	>20dB
2479	67.8	PEAK	2483.596	-25.26	42.54	74	31.46
2479	67.8	AVERAGE	2483.354	-49.05	18.75	54	35.25

* *Marker-Delta method*

** *The peak level is lower than the average limit (54dBµV/m).*

20 dB bandwidth curves are given in appendix 5; band-edge curves are given in appendix 6.

Test conclusion:

RESPECTED STANDARD

9. MAXIMUM PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247 (b)

Test set up:

First an exploratory radiated measurement was performed. During this phase the product is oriented in three orthogonal planes.

Then the final measurement is realized with the product on the most critical orientation.

The measure is realized on open area test site under 1 GHz and in anechoic chamber above 1 GHz.

When the system is tested in an open area test site (OATS), the EUT is placed on a rotating table, 0.8m from a ground plane.

When the system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5m from a ground plane.

Zero degree azimuths correspond to the front of the device under test.

See photos in appendix 2.

The measure is realized in conducted mode with a calibrated peak power responding power meter.

The measurement of the electro-magnetic field is realized, with a resolution bandwidth adjusted at 1MHz and video bandwidth at 3MHz.

The measurement of the electro-magnetic field is realized, with a calibrated peak power responding power meter.

Distance of antenna: 10 meters (in open area test site) / 3 meters (in anechoic room)

Antenna height: 1 to 4 meters (in open area test site) / 1.5 meter (in anechoic room)

Antenna polarization: vertical and horizontal (only the highest level is recorded)

Equipment under test operating condition:

The equipment under test is blocked in continuous hopping modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Results:

Ambient temperature (°C): 23.7
Relative humidity (%): 50

Power source: we used for power source the internal battery fully charged

Sample N° 1 Low channel

	Electro-magnetic field (dBµV/m):	Conducted power * (mW)	Limit (mW)
Nominal supply voltage: 11.1V	89.8	0.228	1000

Polarization of test antenna: Vertical (height: 150 cm)
Position of equipment: see photos in annex 2 (azimuth: 37 degrees)

Sample N° 1 Central channel

	Electro-magnetic field (dBµV/m):	Conducted power * (mW)	Limit (mW)
Nominal supply voltage:11.1V	83.4	0.052	1000

Polarization of test antenna: Vertical (height: 150 cm)
Position of equipment: see photos in annex 2 (azimuth: 37 degrees)

Sample N° 1 High channel

	Electro-magnetic field (dBµV/m):	Conducted power * (mW)	Limit (mW)
Nominal supply voltage:11.1V	68	0.002	1000

Polarization of test antenna: Vertical (height: 150 cm)
Position of equipment: see photos in annex 2 (azimuth: 37 degrees)

** $P = (E \times d)^2 / (30 \times Gp)$ with d = 3 m and Gp = 1.26*
Antenna gain: 1 dBi

Test conclusion:

RESPECTED STANDARD

10. INTENTIONAL RADIATOR

Standard: FCC Part 15

Test procedure: paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)

Test set up:

First an exploratory radiated measurement was performed. During this phase the product is oriented in three orthogonal planes.

Then the final measurement is realized with the product on the most critical orientation.

The measure is realized on open area test site under 1 GHz and in anechoic chamber above 1 GHz.

When the system is tested in an open area test site (OATS), the EUT is placed on a rotating table, 0.8m from a ground plane.

When the system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5m from a ground plane.

Zero degree azimuths correspond to the front of the device under test.

See photos in appendix 2.

Frequency range: From 9 kHz to 26GHz (10^{th} harmonic of the highest fundamental frequency).

Detection mode: Quasi-peak (F < 1 GHz) Peak / Average (F > 1 GHz)

Bandwidth: 200Hz (9 kHz < F < 150kHz)
9 kHz (150 kHz < F < 30MHz)
120 kHz (30 MHz < F < 1 GHz)
100 kHz / 1 MHz (F > 1 GHz)

Distance of antenna: 10 meters (in open area test site) / 3 meters (in anechoic room)

Antenna height: 1 to 4 meters (in open area test site) / 1.5 meter (in anechoic room)

Antenna polarization: vertical and horizontal (only the highest level is recorded)

Equipment under test operating condition:

The equipment under test is blocked in continuous hopping modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Results:

Ambient temperature (°C): 24
Relative humidity (%): 48

Power source: we used for power source the internal battery fully charged

Sample N° 1 Low channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
208	QP	100	179	120	V	24.52	43.5	18.98
260	QP	100	88	120	V	26.79	46.4	19.61
679.22	QP	317	172	120	V	27.70	46.4	18.70
1602*	P	150	281	1000	H	54.4	74	19.6
4805.5*	P	150	164	1000	H	61.1	74	12.9
7207.2	P	150	219	100	H	46.7	69.6	22.9

Sample N° 1 Central channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
208	QP	100	179	120	V	24.52	43.5	18.98
260	QP	100	88	120	V	26.79	46.4	19.61
679.22	QP	317	172	120	V	27.70	46.4	18.70
1627	P	150	287	100	V	49.5	69.6	20.1
4880.5*	P	150	279	1000	V	65.4	74	8.6
7320.6*	P	150	219	1000	H	54.8	74	19.2

Sample N° 1 High channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
208	QP	100	179	120	V	24.52	43.5	18.98
260	QP	100	88	120	V	26.79	46.4	19.61
679.22	QP	317	172	120	V	27.70	46.4	18.70
1652	P	150	174	100	H	53.8	69.6	15.8
4130.5	P	150	200	1000	H	59.2	74	14.8
4956.5	P	150	164	1000	H	69.1	74	4.9
7434	P	150	219	1000	H	52.9	74	21.1

* restricted bands of operation in 15.205
***the peak level is lower than the average limit (54 dBµV/m).*

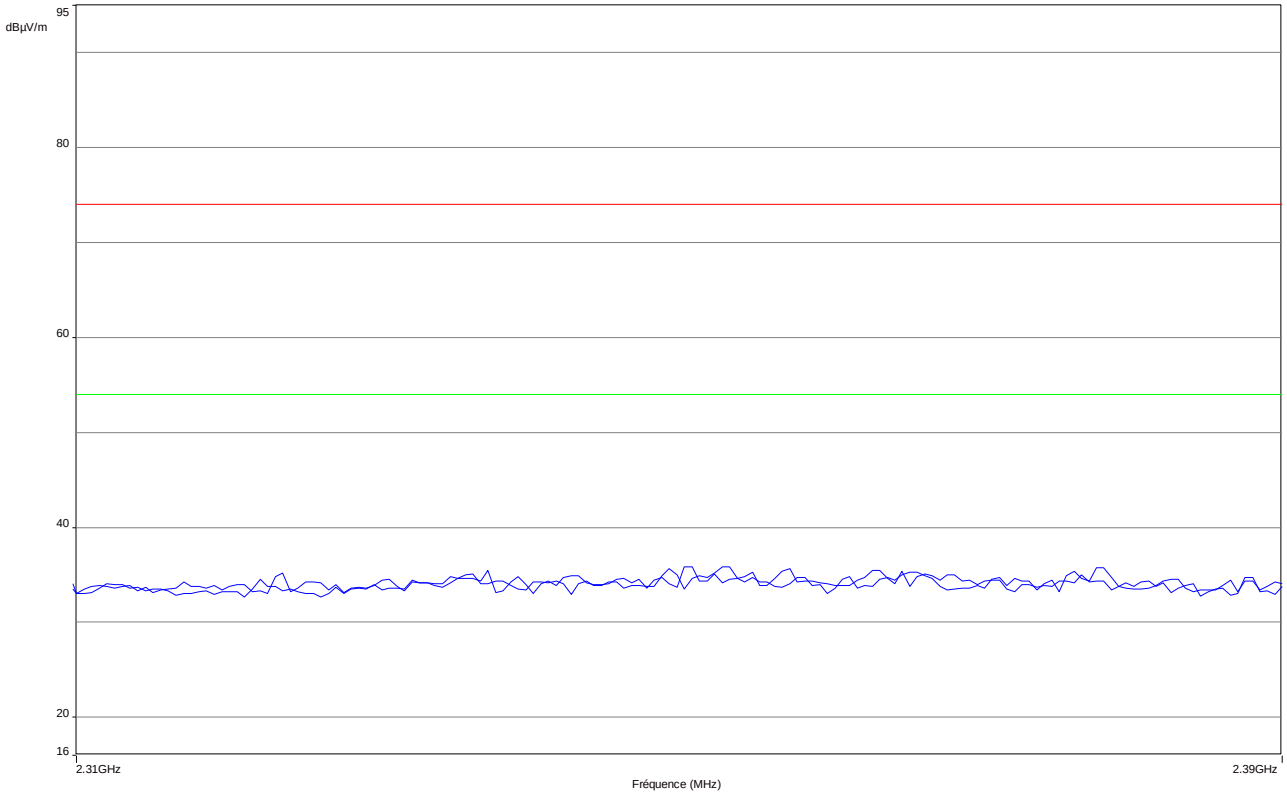
Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Applicable limits: 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.

The highest level recorded in a 100 kHz bandwidth is 89.6 dBµV/m on low channel.
So the applicable limit is 69.6 dBµV/m.
In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

Band edge worst case results

Low channel



Test conclusion:

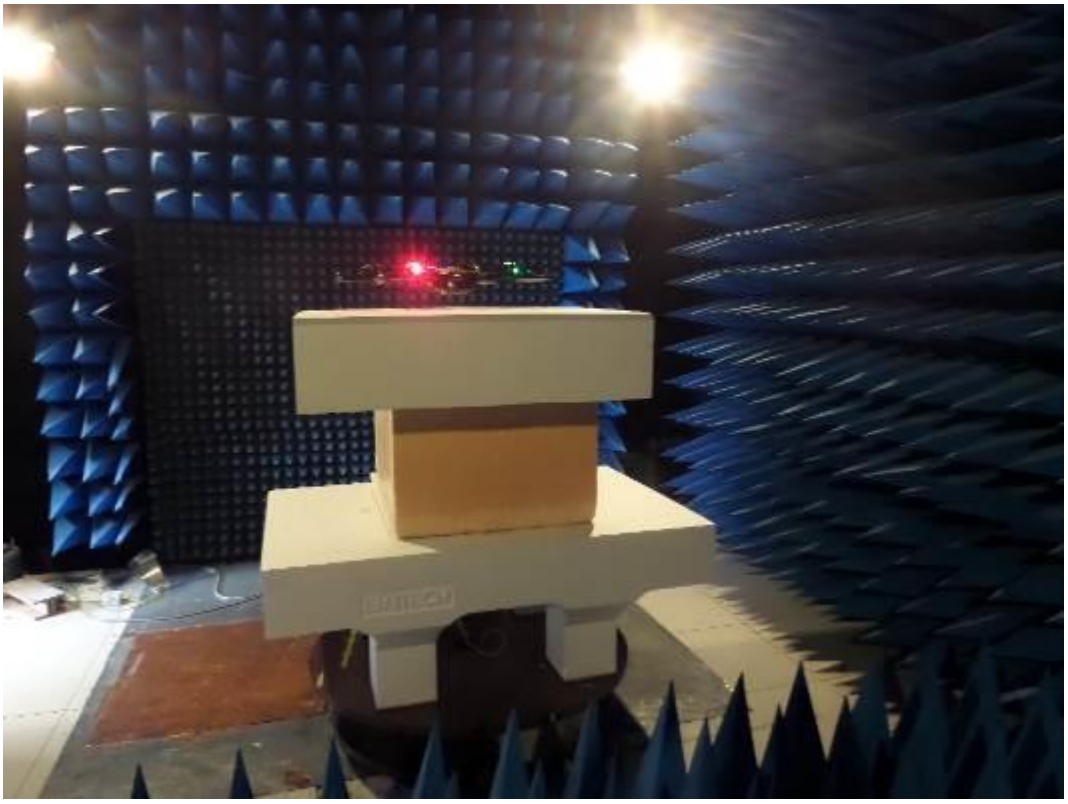
RESPECTED STANDARD

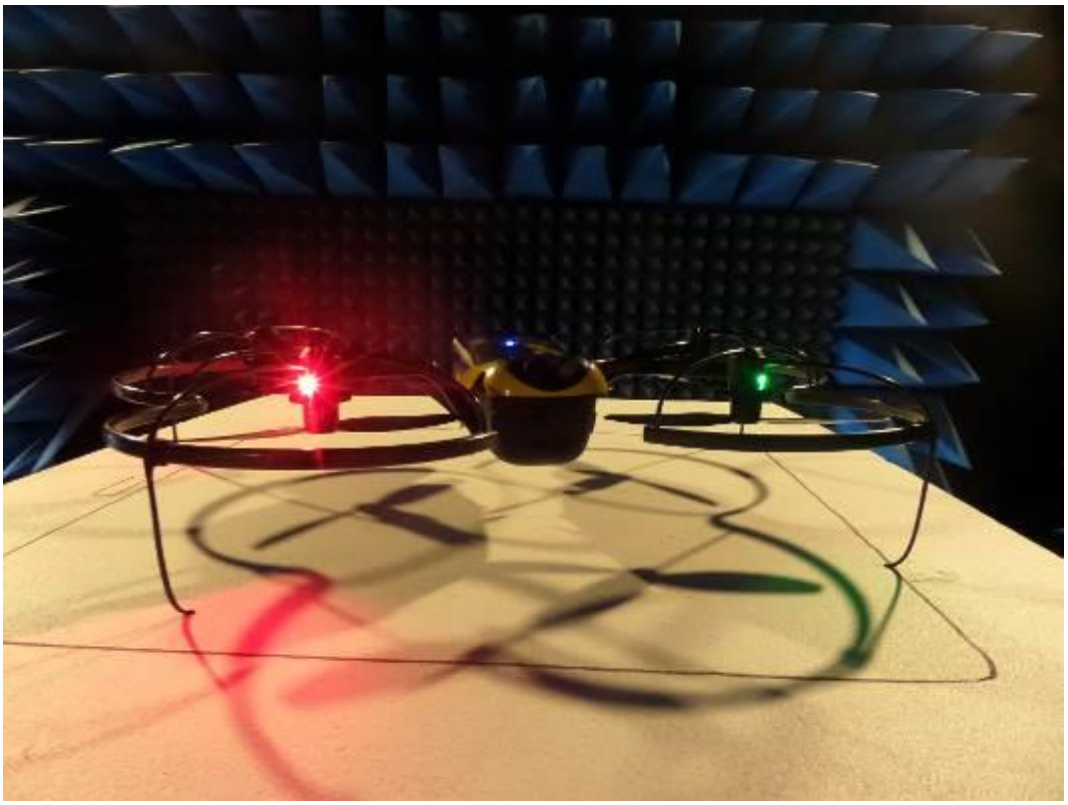
End of report, 9 appendixes to be forwarded

APPENDIX 1: Photos of the equipment under test


eXom

APPENDIX 2: Test set up





APPENDIX 3: Test equipment list

Radiated emission limits

TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Biconical antenna VHBB 9124	Schwarzbeck	8526
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Log periodic antenna 3147	EMCO	8783
Antenna 3115	EMCO	8535
Antenna WR42	IMC	1939
Antenna WR42	IMC	1940
Low-noise amplifier 8447D	Hewlett Packard	8511
Low-noise amplifier C020180F-4B1	Microwave DB	1922
Low-noise amplifier ALN02-0102	ALC Microwave	3036
Low pass filter LP03/1000-7GH	Filtek	4087
Reject band filter BRM50702	Microtronics	7299
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8749
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000
Software	Champ libre Juigné. V3.4	8864

Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	EMCO	8534
Antenna 3115	EMCO	8535
Low-noise amplifier C020180F-4B1	Microwave DB	1922
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBShot V2.4	-

Maximum peak output power

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Band pass filter BP2442-84-7CS	BL Microwave	5625
Antenna 3115	EMCO	8535
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000

Intentional radiator

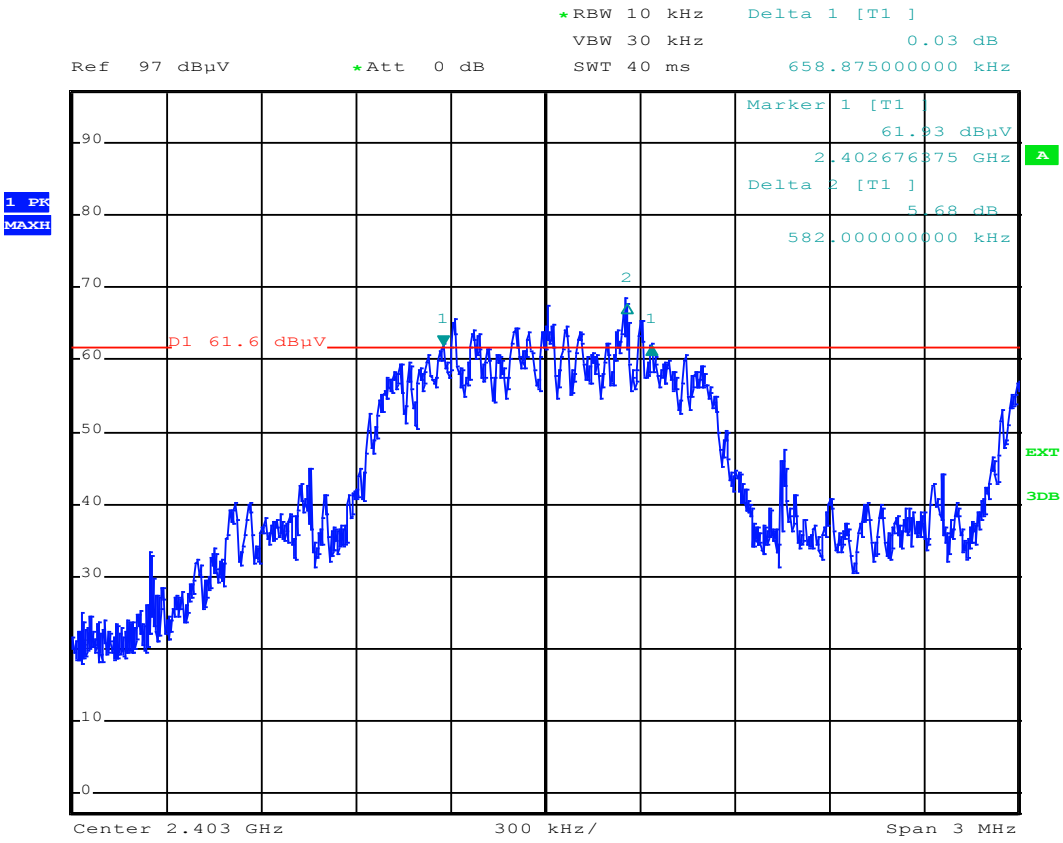
TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Biconical antenna VHBB 9124	Schwarzbeck	8526
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Log periodic antenna 3147	EMCO	8783
Bi-log antenna CBL6112A	Chase	8530
Antenna 3115	EMCO	8535
Antenna WR42	IMC	1939
Antenna WR42	IMC	1940
Low-noise amplifier 8447D	Hewlett Packard	8511
Low-noise amplifier C020180F-4B1	Microwave DB	1922
Low-noise amplifier ALN02-0102	ALC Microwave	3036
Low pass filter LP03/1000-7GH	Filtek	4087
Reject band filter BRM50702	Microtronics	7299
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8749
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000
Software	Champ libre Juigné. V3.4	8864

Peak Power Density

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Band pass filter BP2442-84-7CS	BL Microwave	5625
Antenna 3115	EMCO	8535
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000

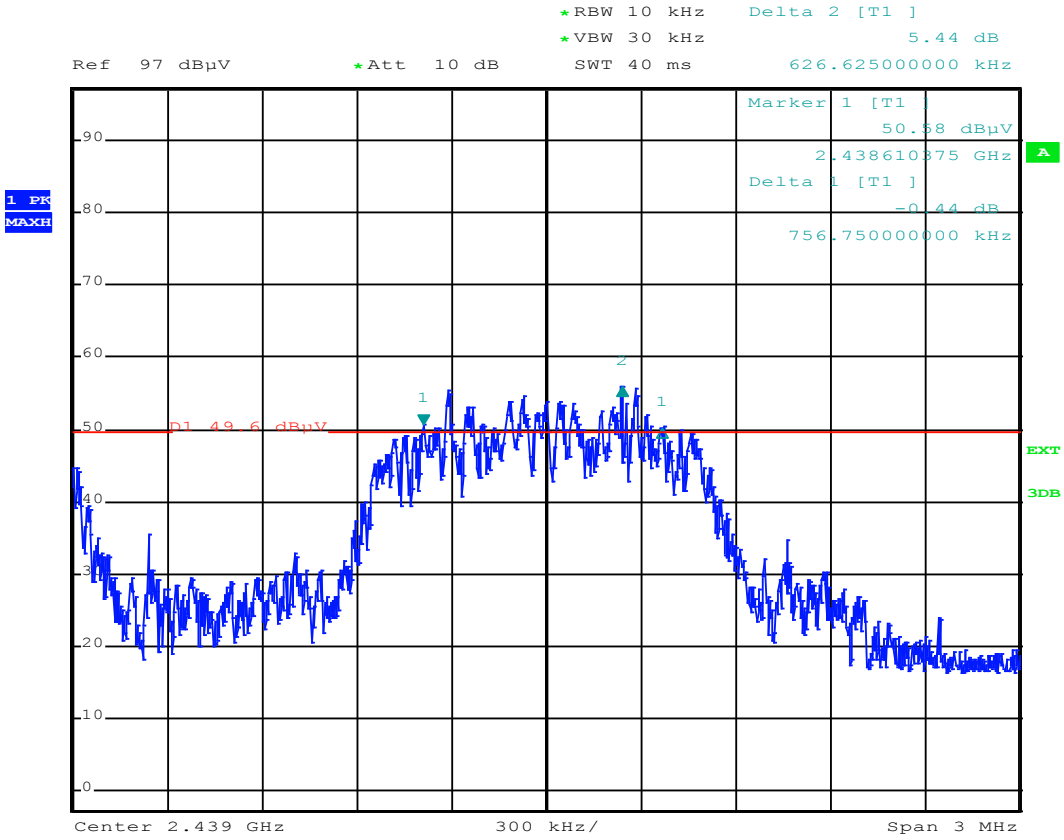
APPENDIX 4: 6 dB bandwidth

Low channel



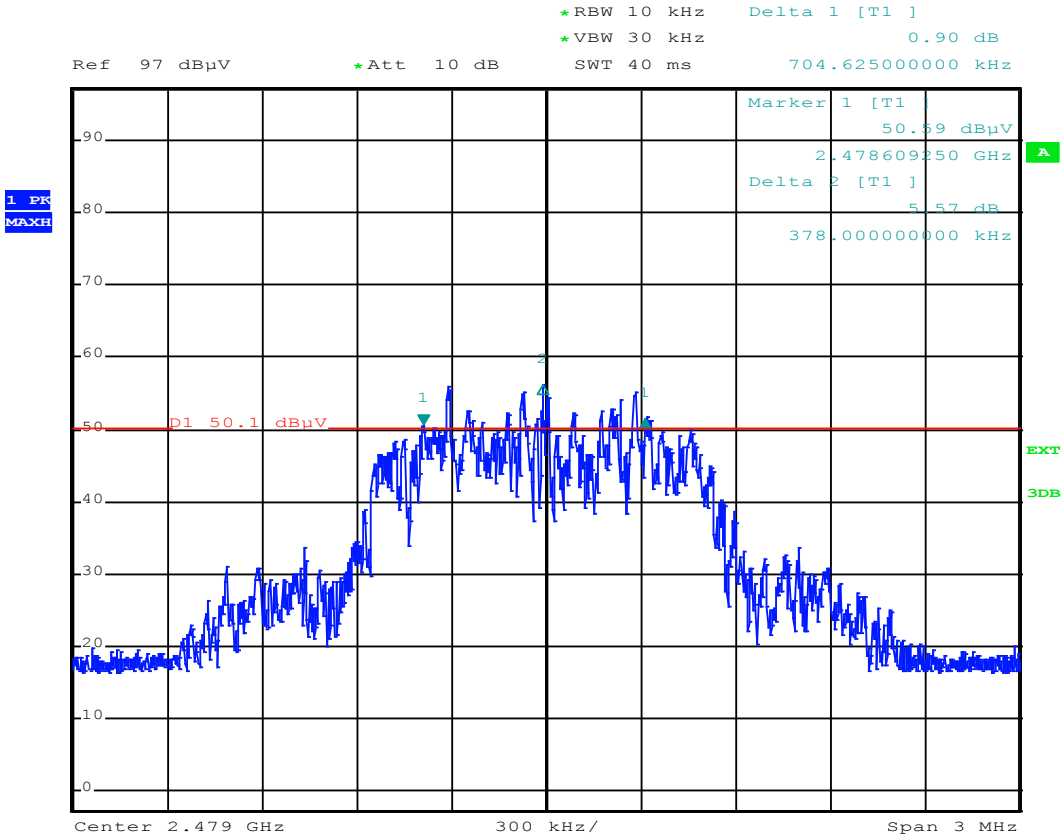
Date: 26.JUN.2015 10:28:18

Central channel



Date: 19.JUN.2015 16:36:39

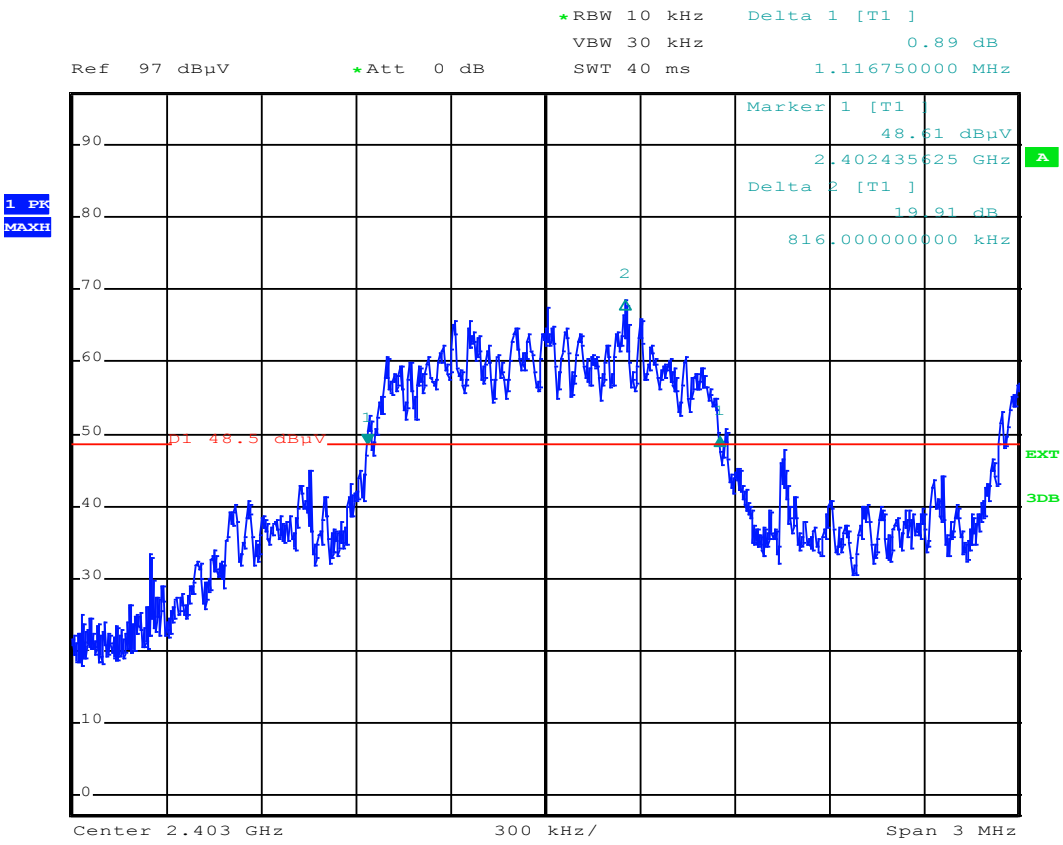
High channel



Date: 19.JUN.2015 16:27:02

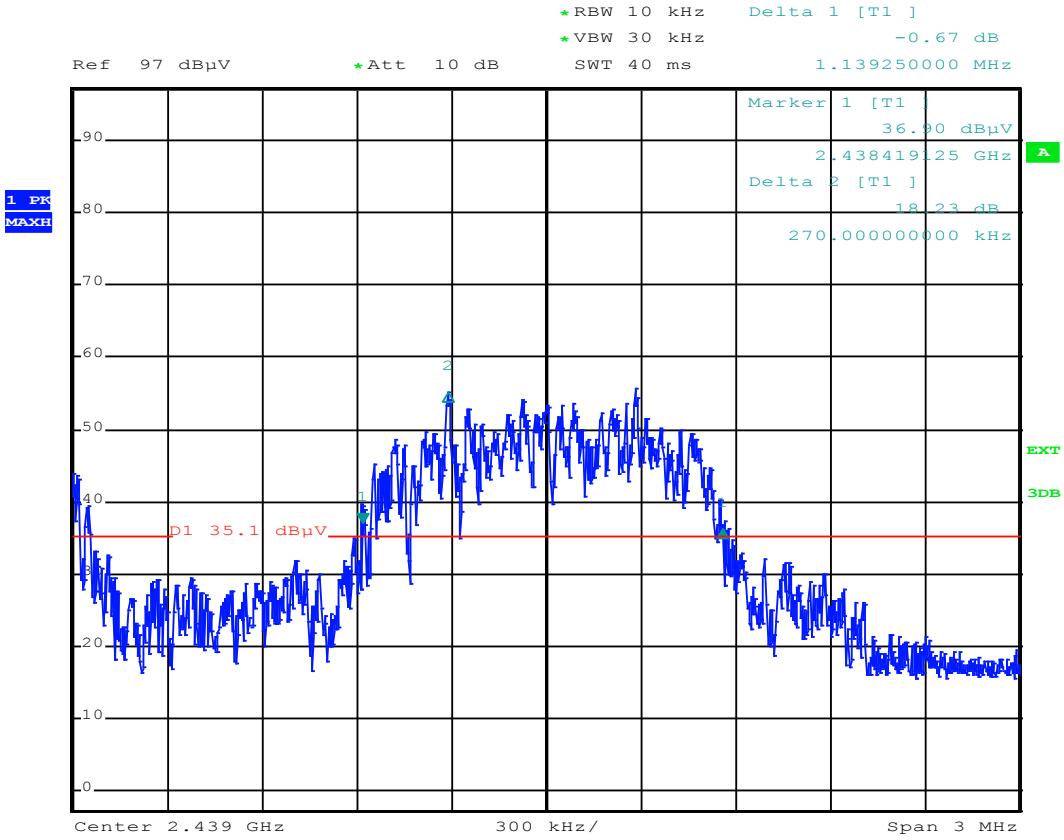
APPENDIX 5: 20 dB bandwidth

Low channel



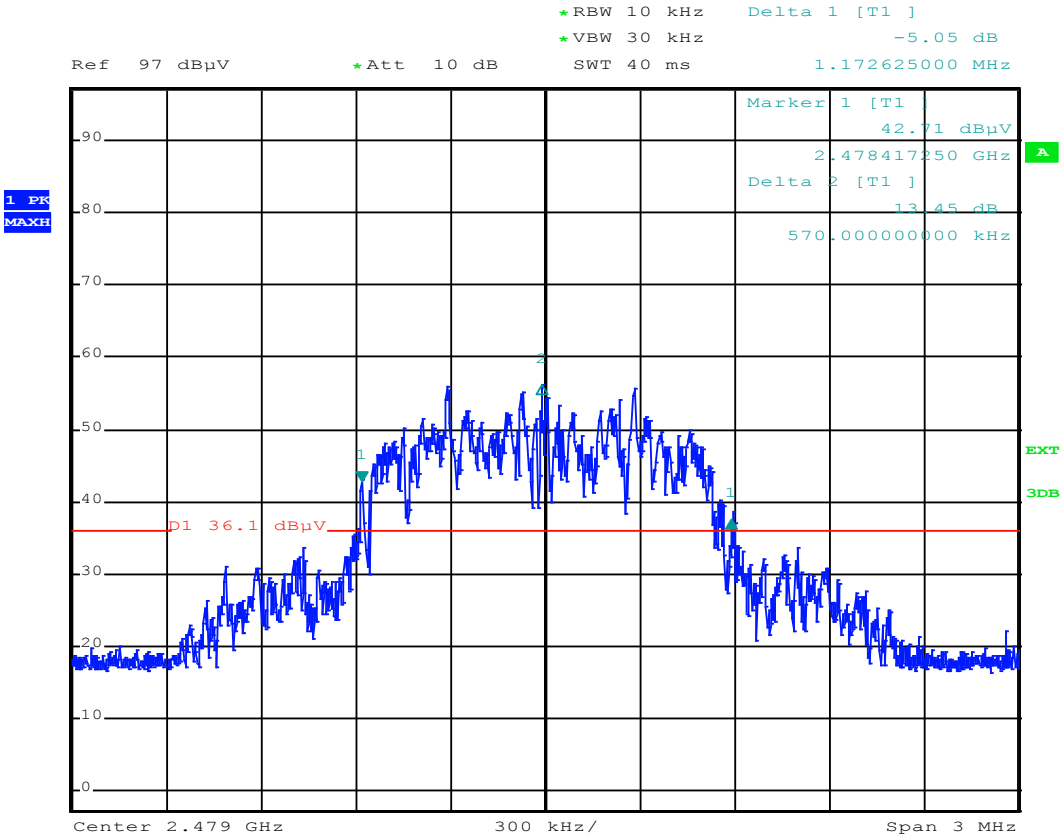
Date: 26.JUN.2015 10:30:09

Central channel



Date: 19.JUN.2015 16:32:48

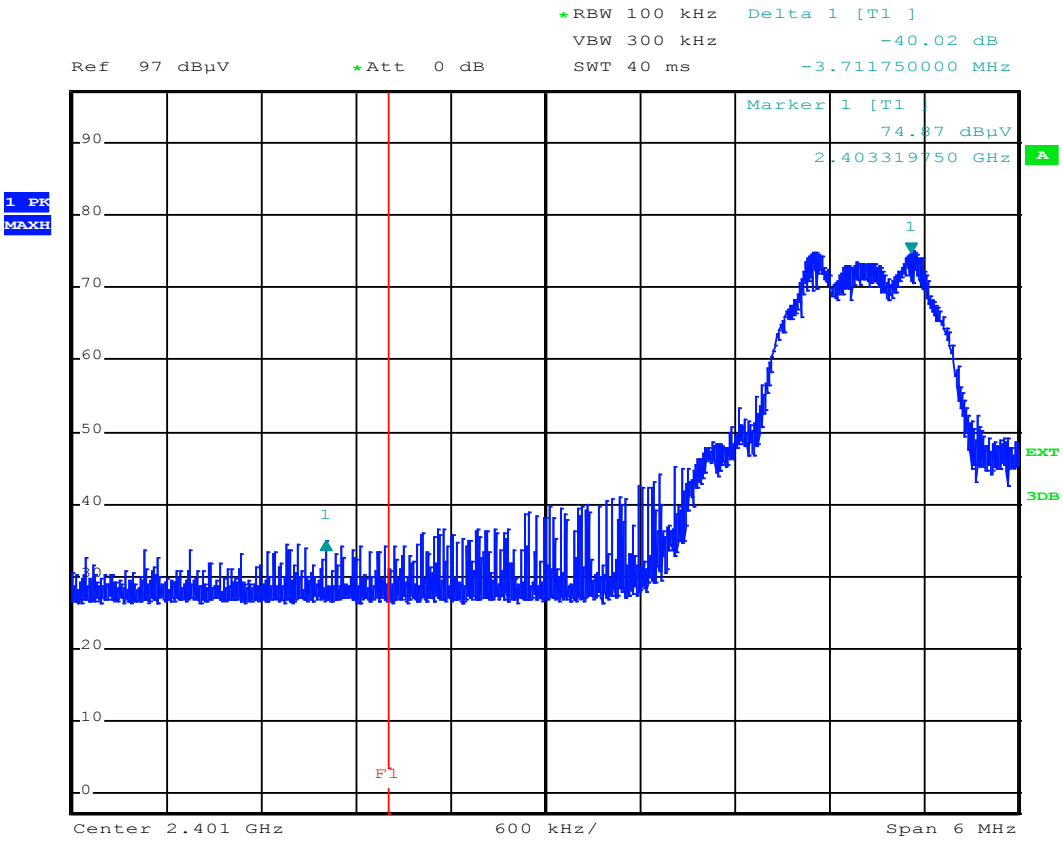
High channel



Date: 19.JUN.2015 16:30:17

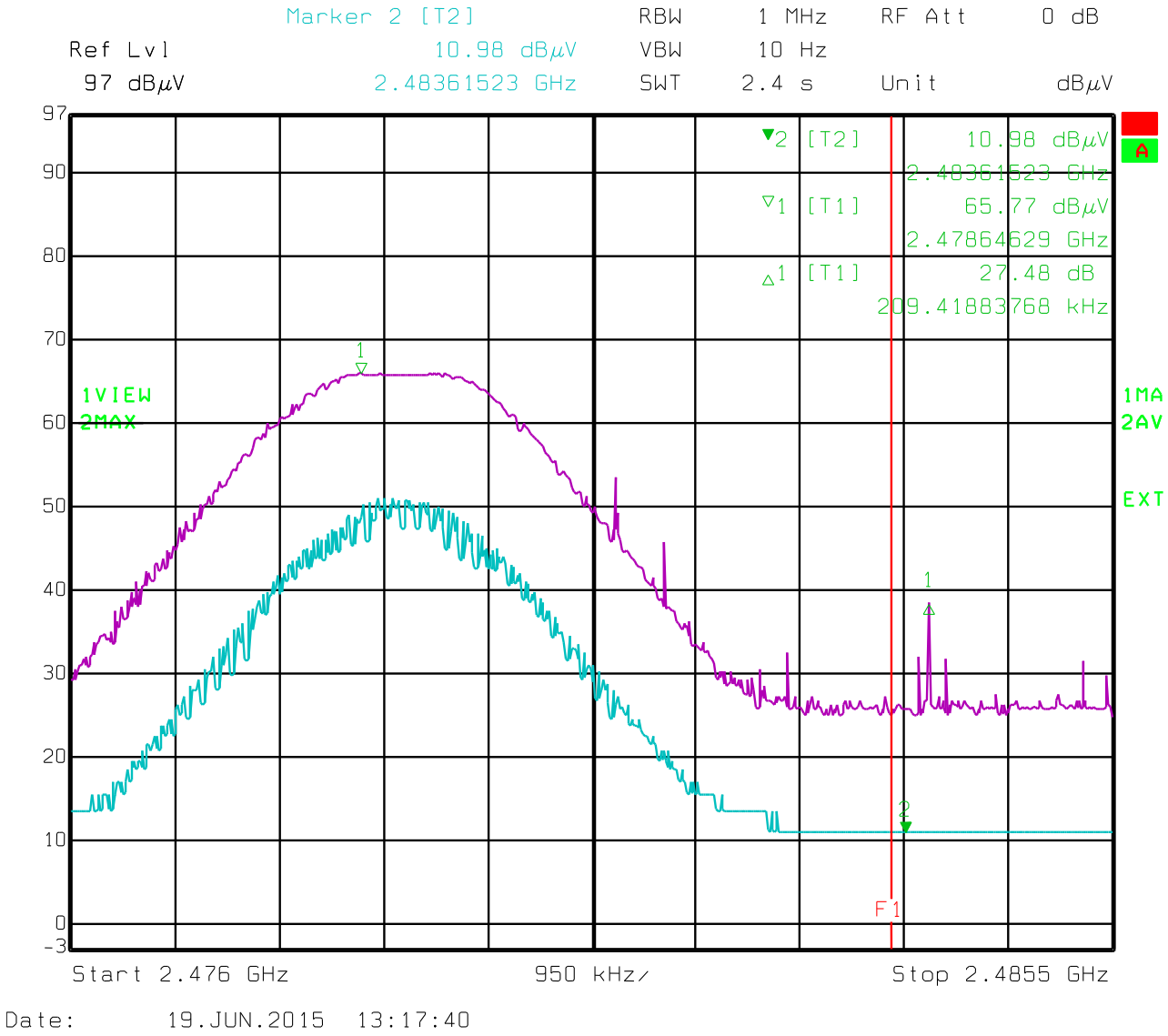
APPENDIX 6: Band edge

Low Channel with hopping off mode

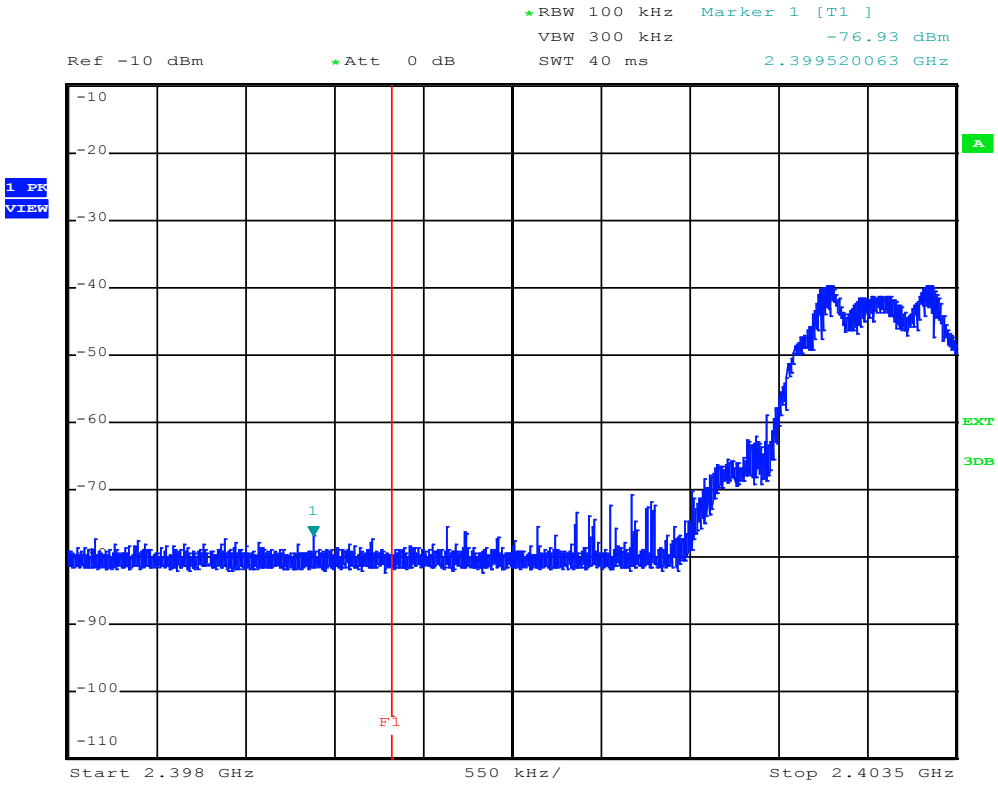


Date: 26.JUN.2015 10:22:19

High Channel with hopping off mode



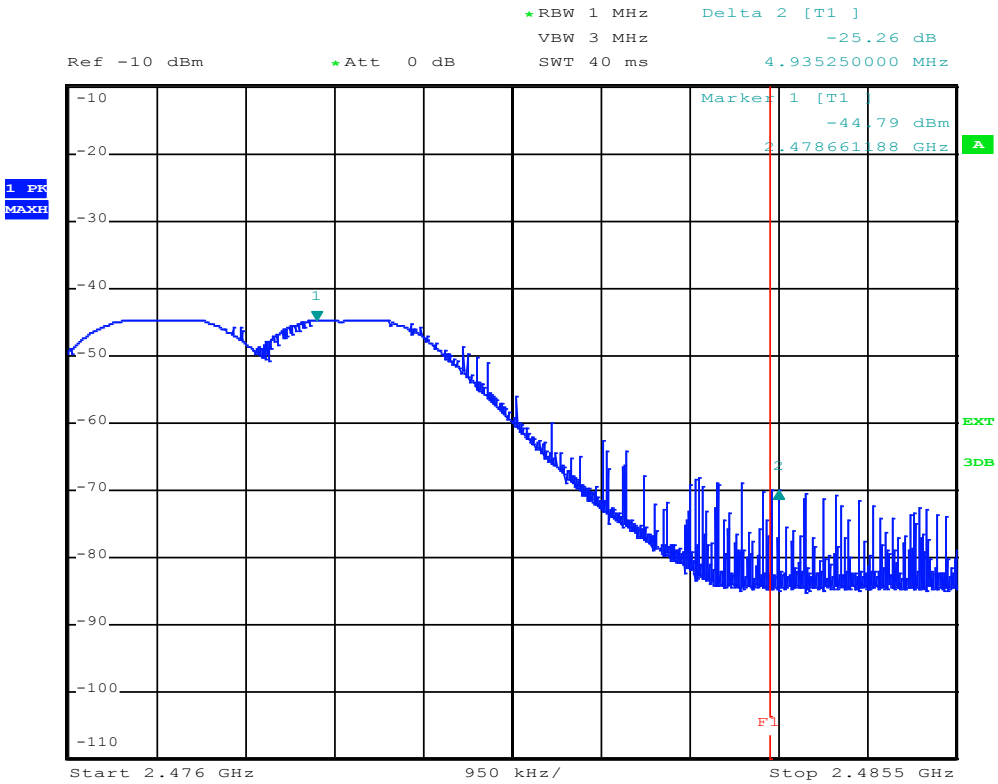
Low Channel with hopping on mode



Date: 12.AUG.2015 16:20:38

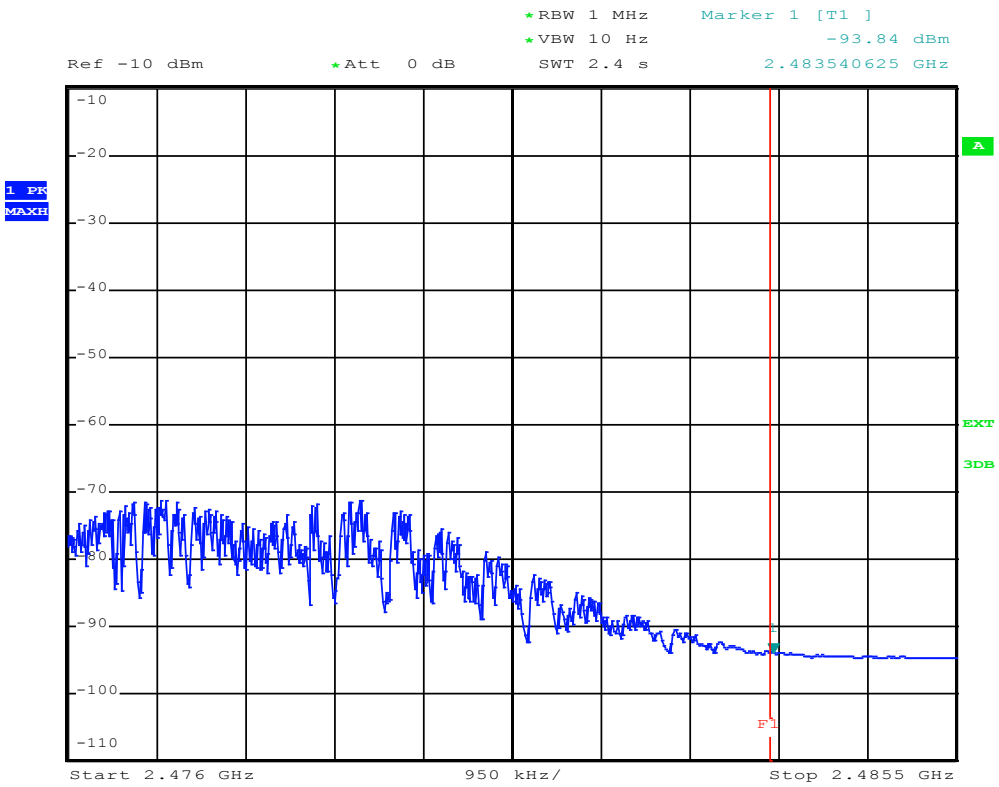
High Channel with hopping on mode

Peak detector



Date: 12.AUG.2015 16:24:02

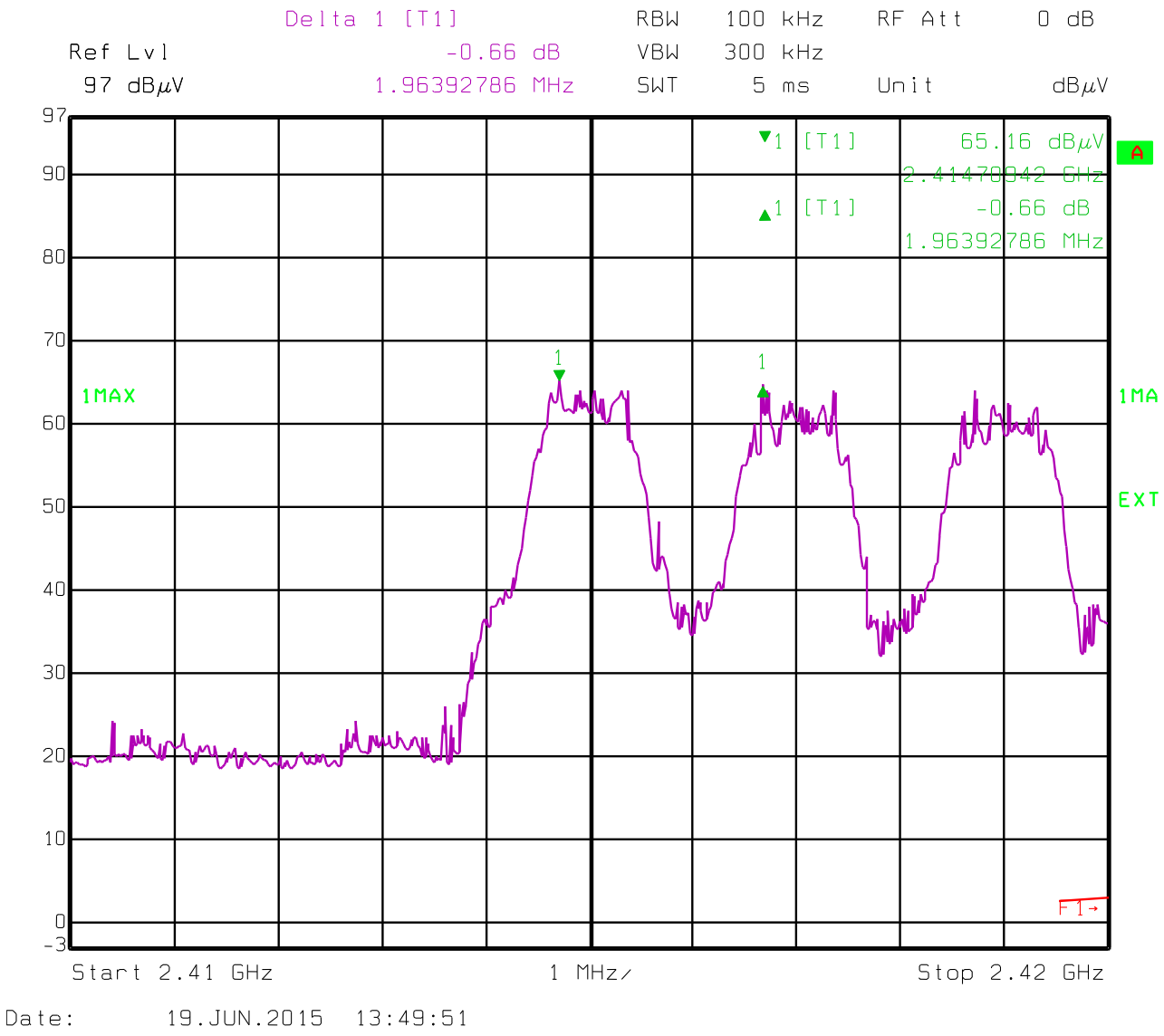
Average detector



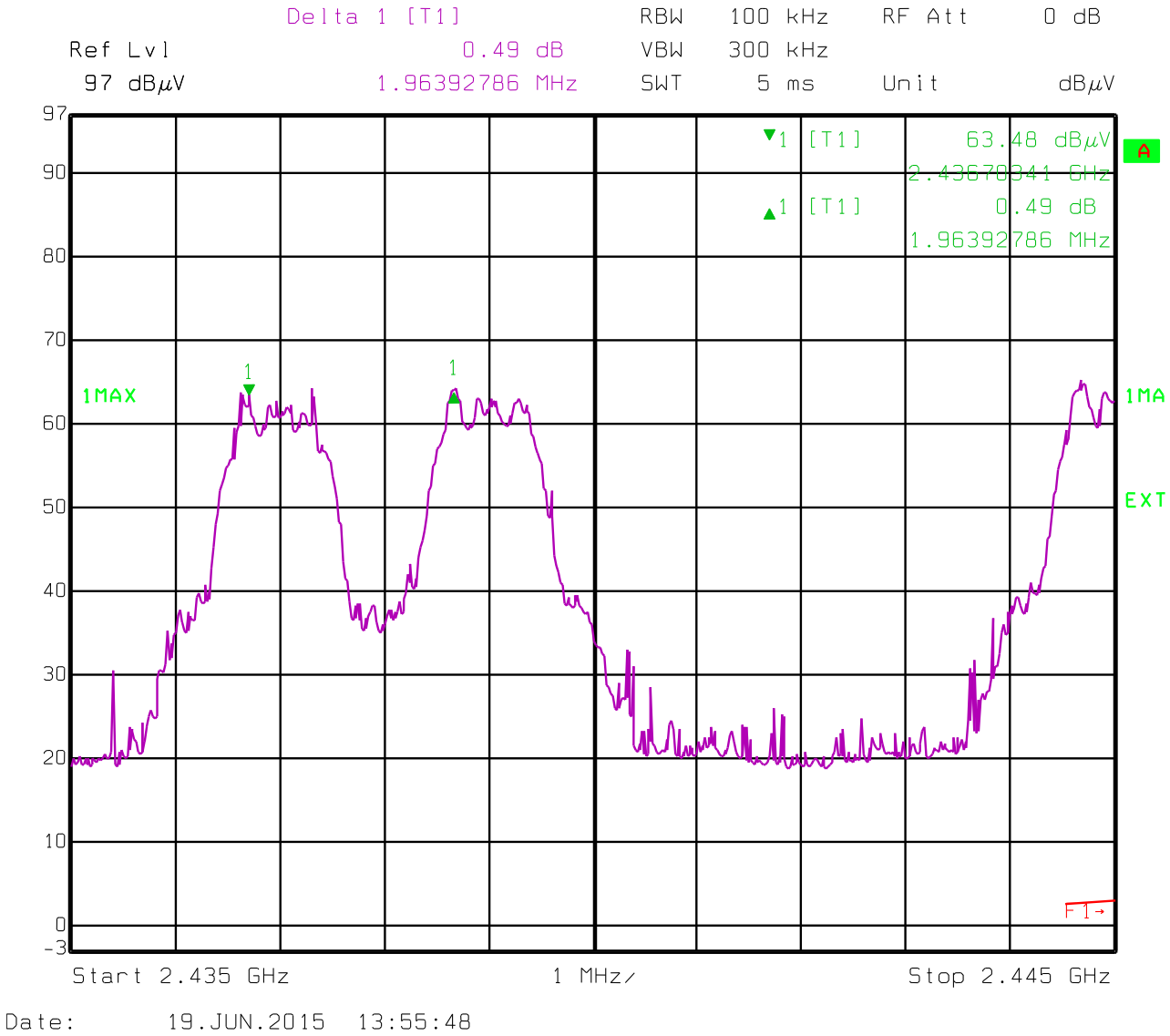
Date: 12.AUG.2015 16:28:47

APPENDIX 7: Channel spacing

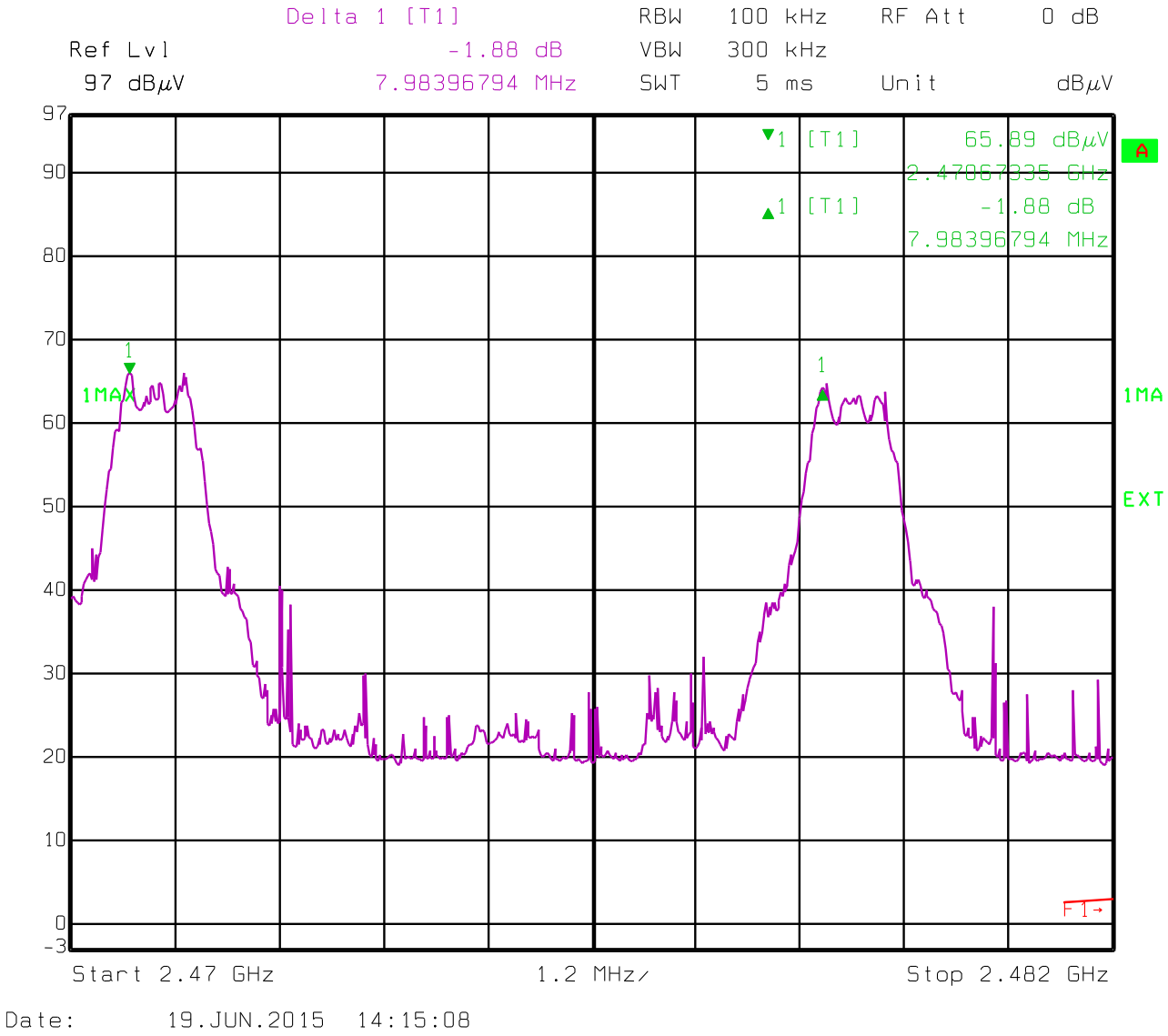
Low Channel



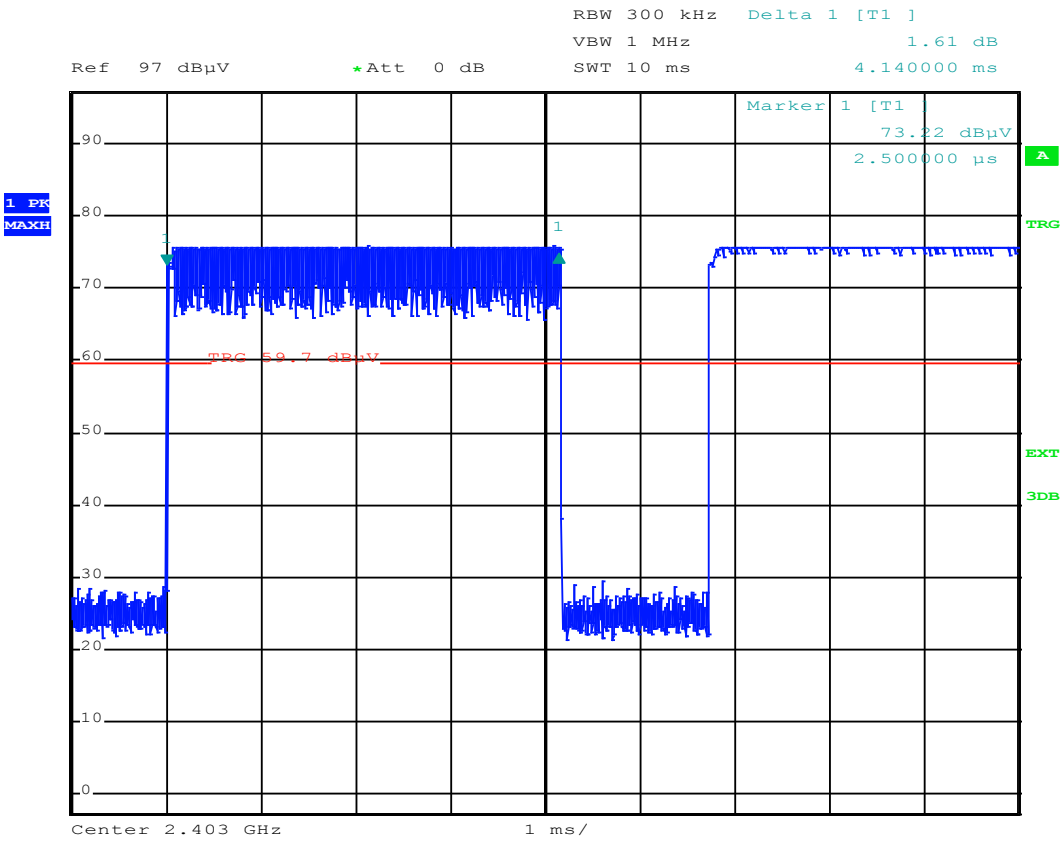
Central Channel



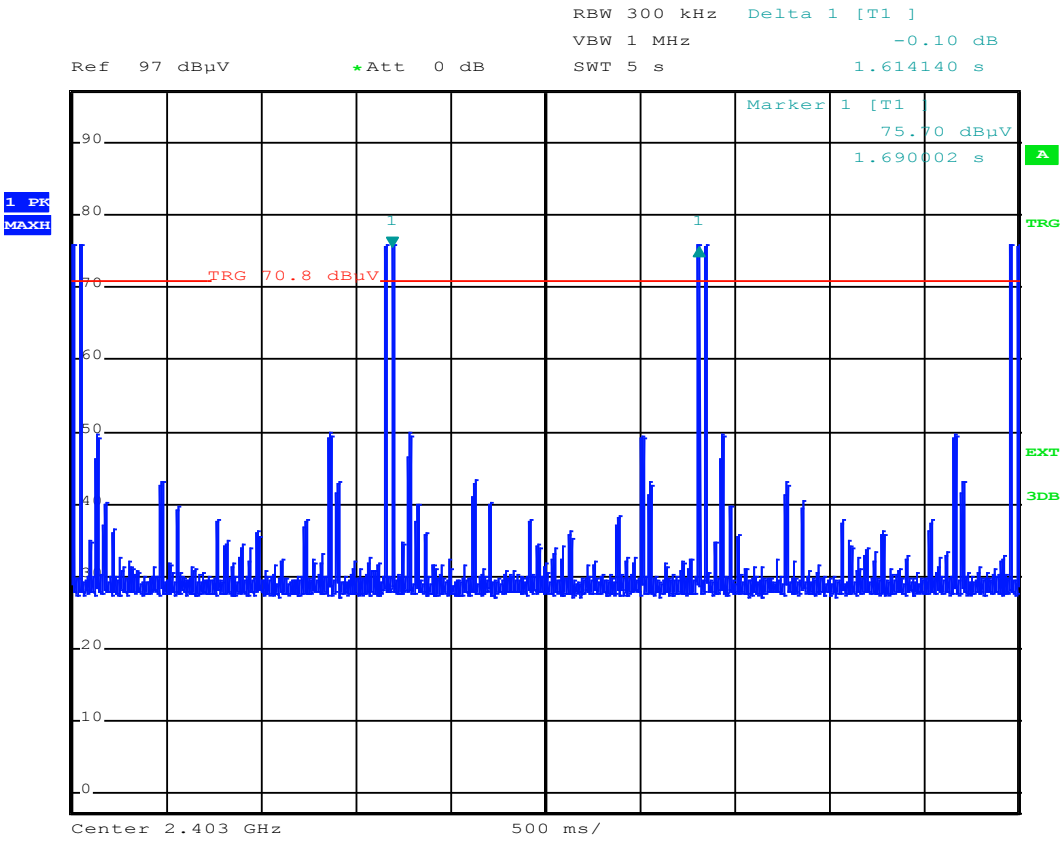
High Channel



APPENDIX 8: Time of occupancy on any frequency

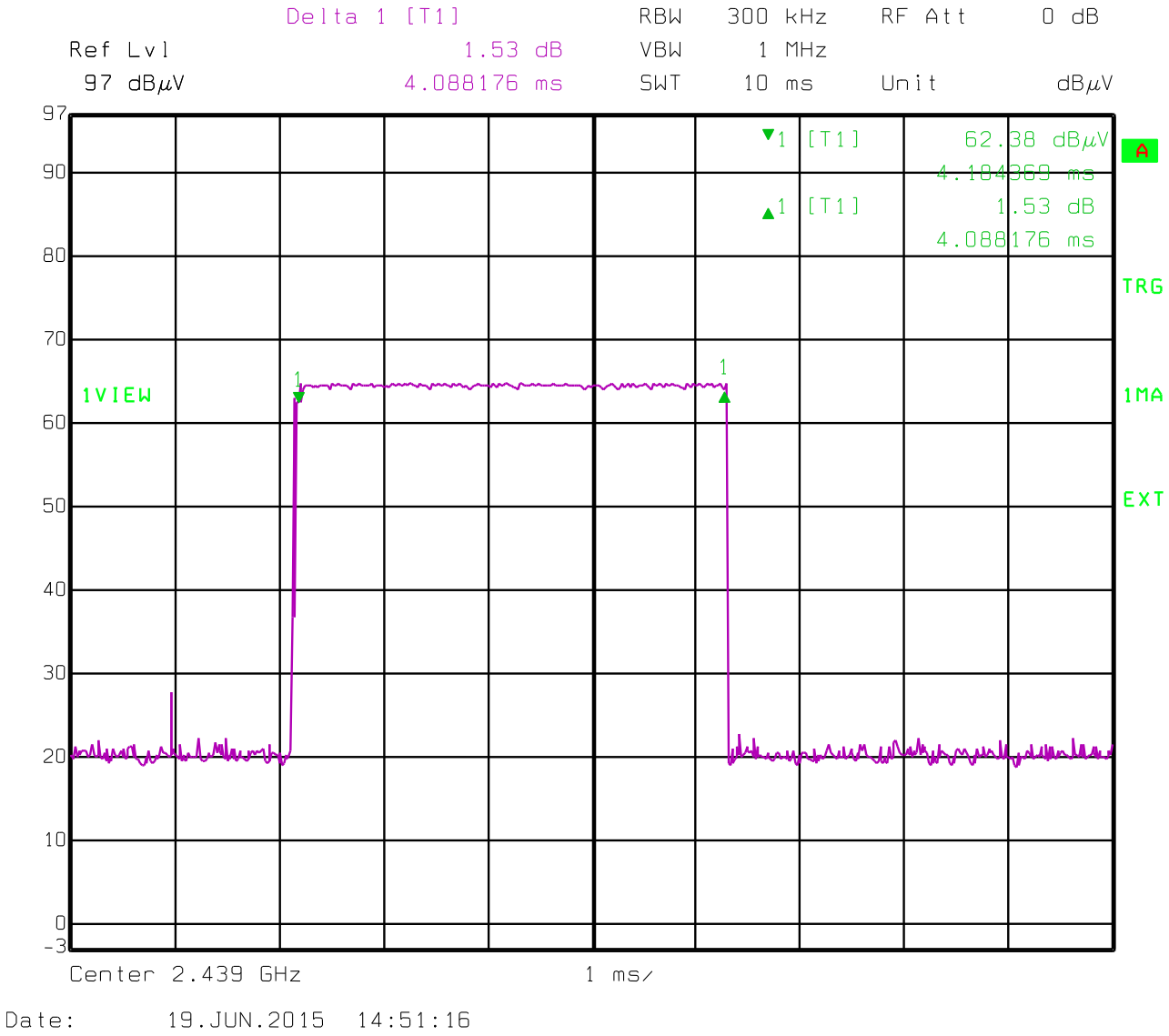


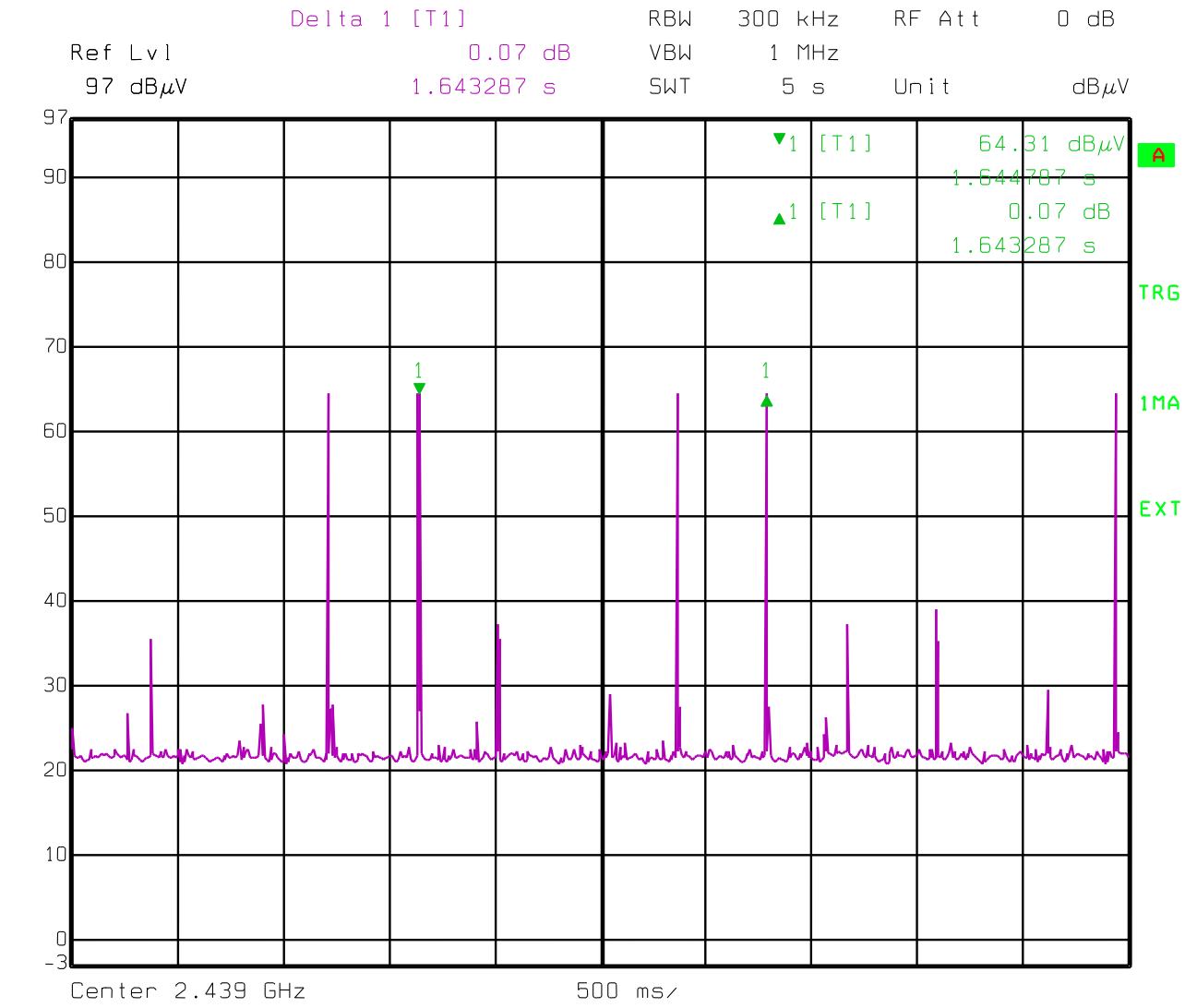
Date: 26.JUN.2015 10:32:42



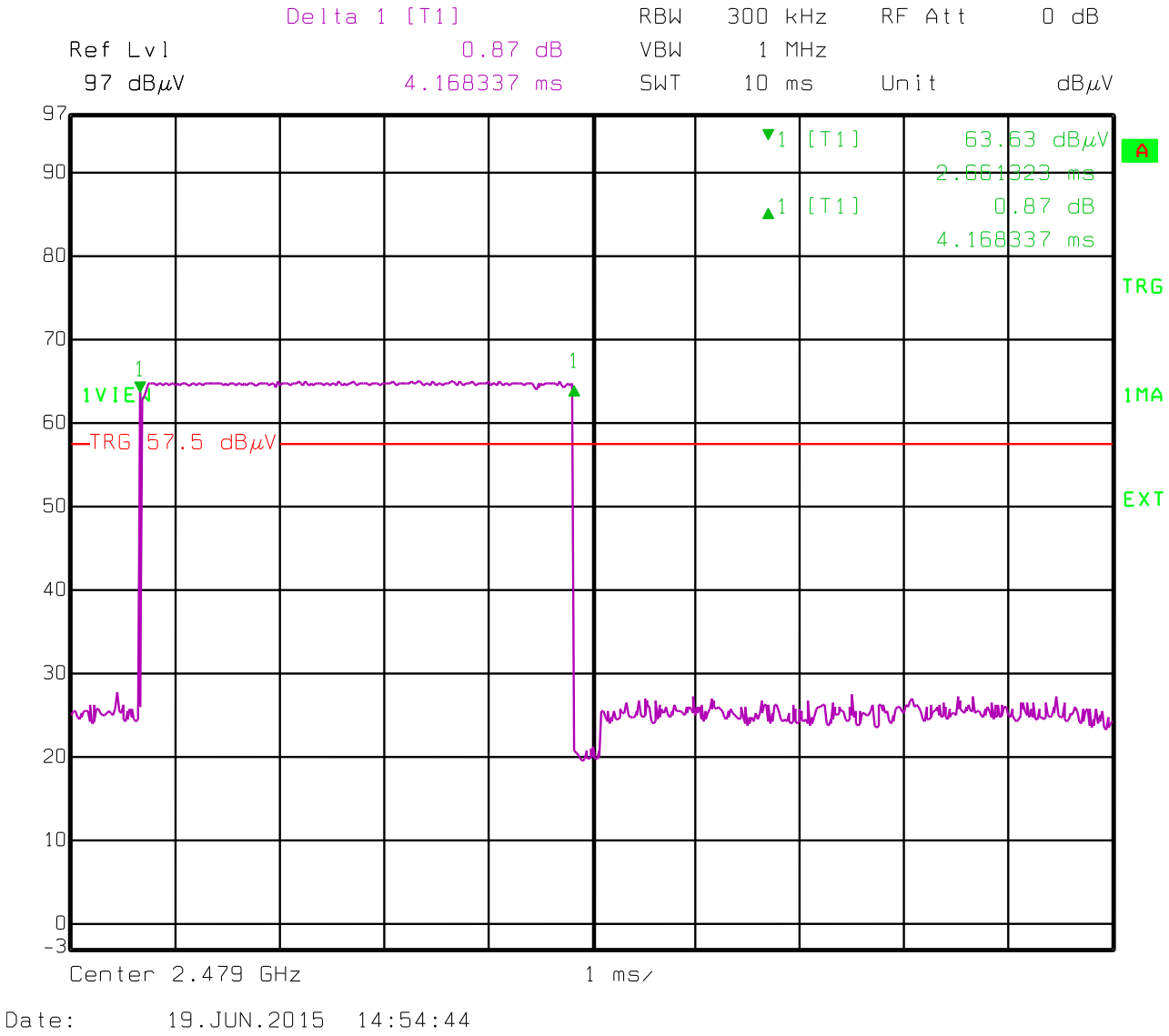
Date: 26.JUN.2015 10:35:59

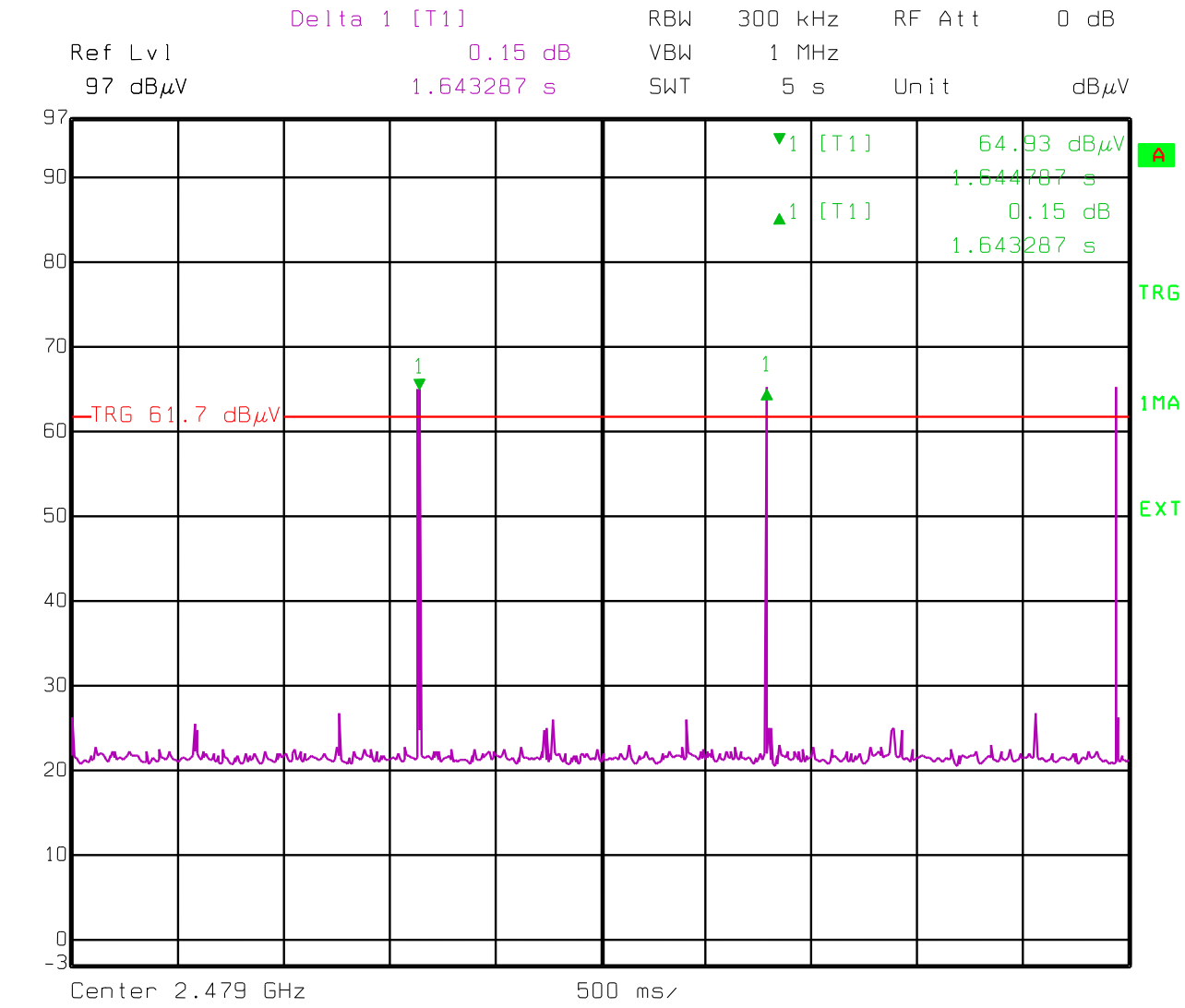
Central channel



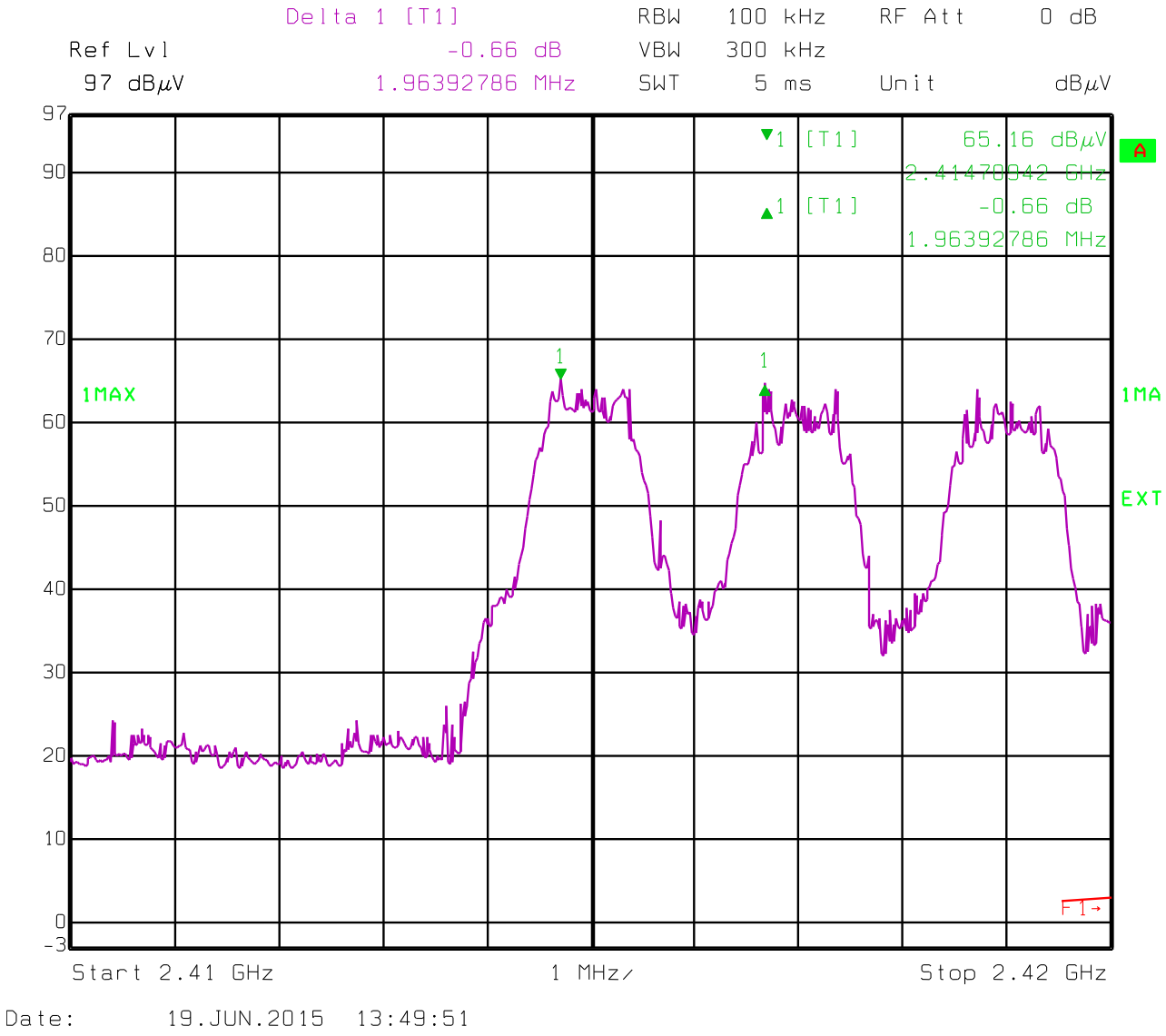

Delta 1 [T1]
RBW 300 kHz
RF Att 0 dB
Ref Lvl
0.07 dB
VBW 1 MHz
97 dBµV
1.643287 s
SWT 5 s
Unit dBµV
1 [T1] 64.31 dBµV
1.644787 s
1 [T1] 0.07 dB
1.643287 s
A
TRG
1MA
EXT
97
90
80
70
60
50
40
30
20
10
0
-3
Center 2.439 GHz
500 ms/
Date: 19.JUN.2015 14:36:25

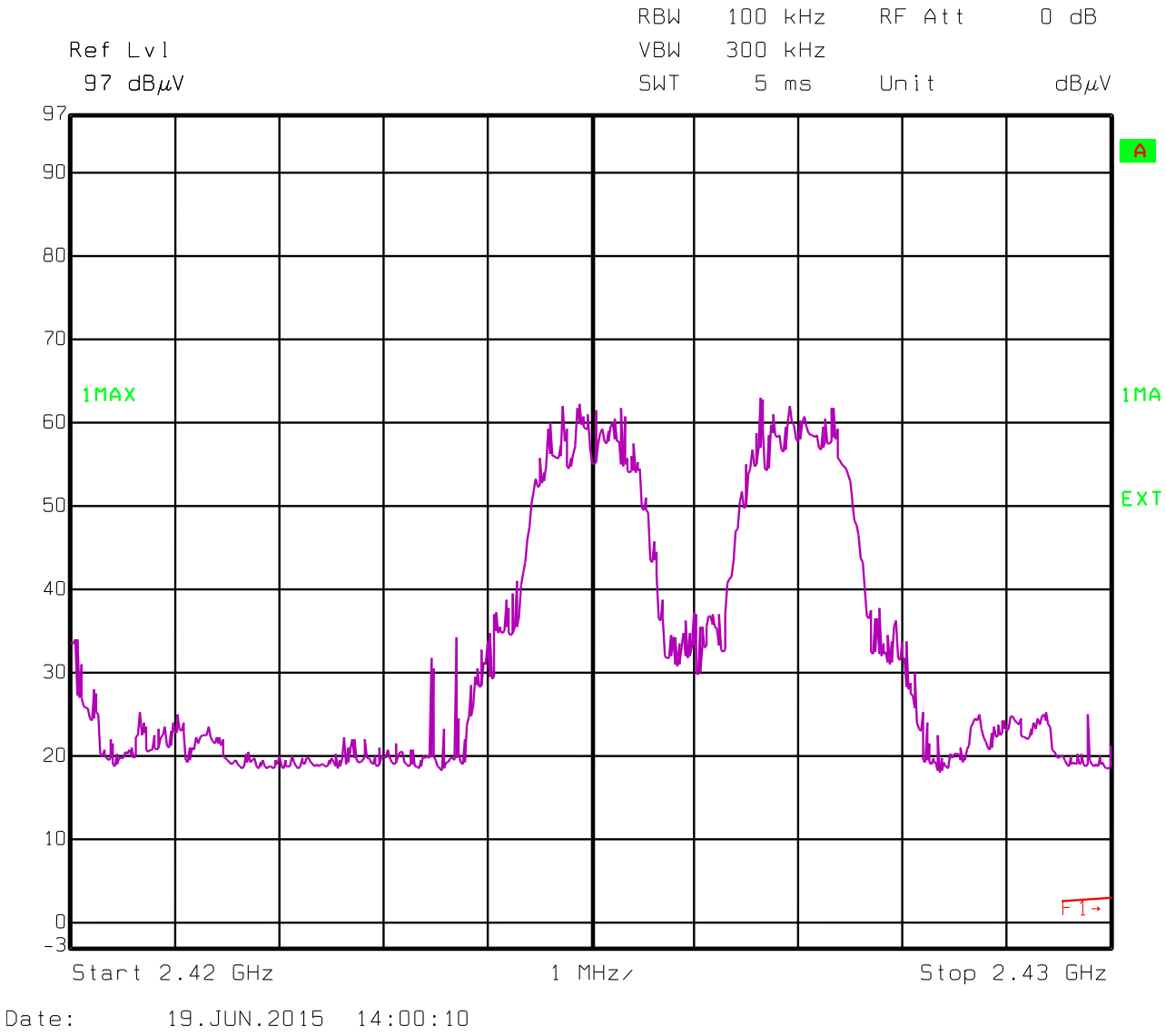
High channel

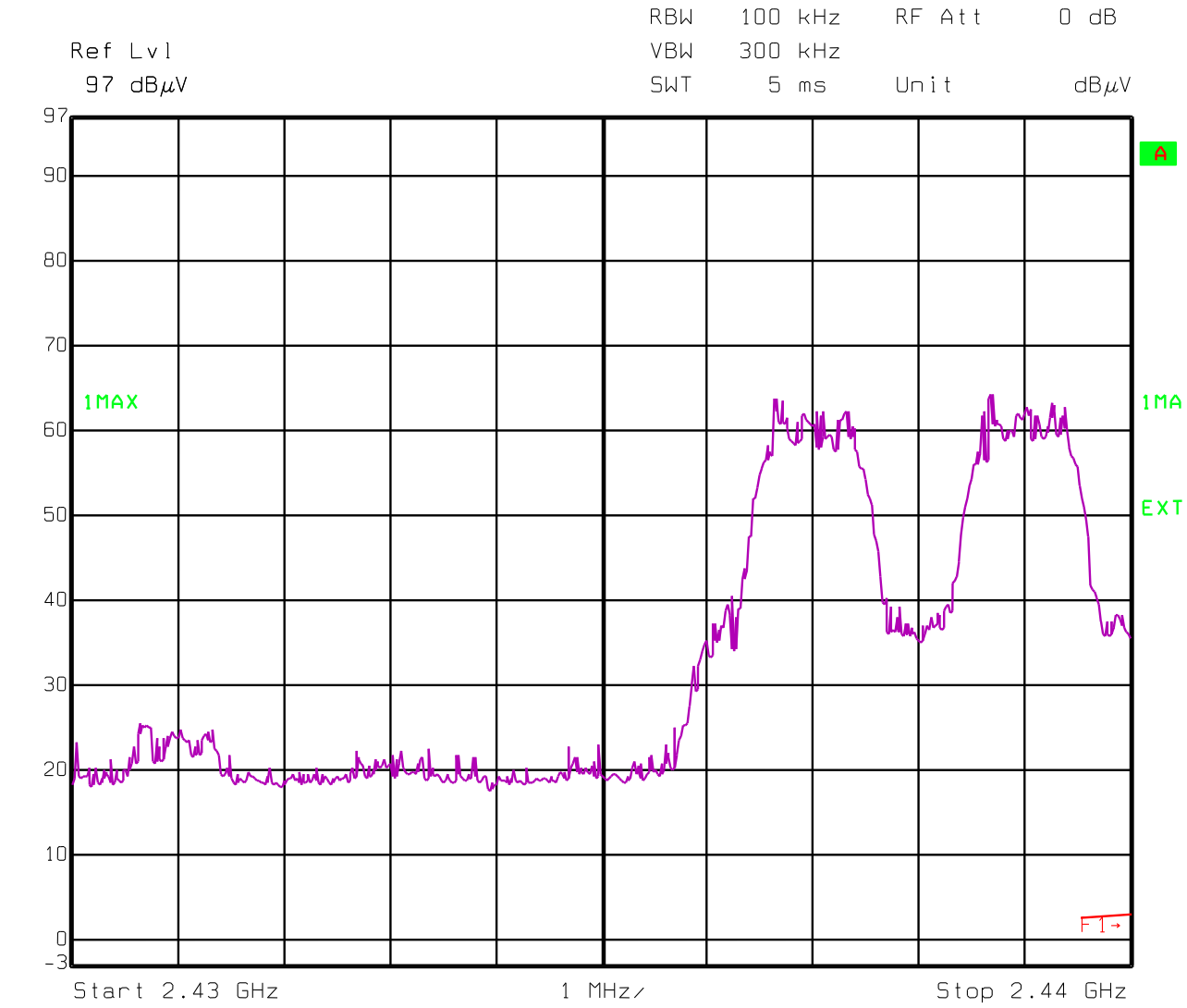


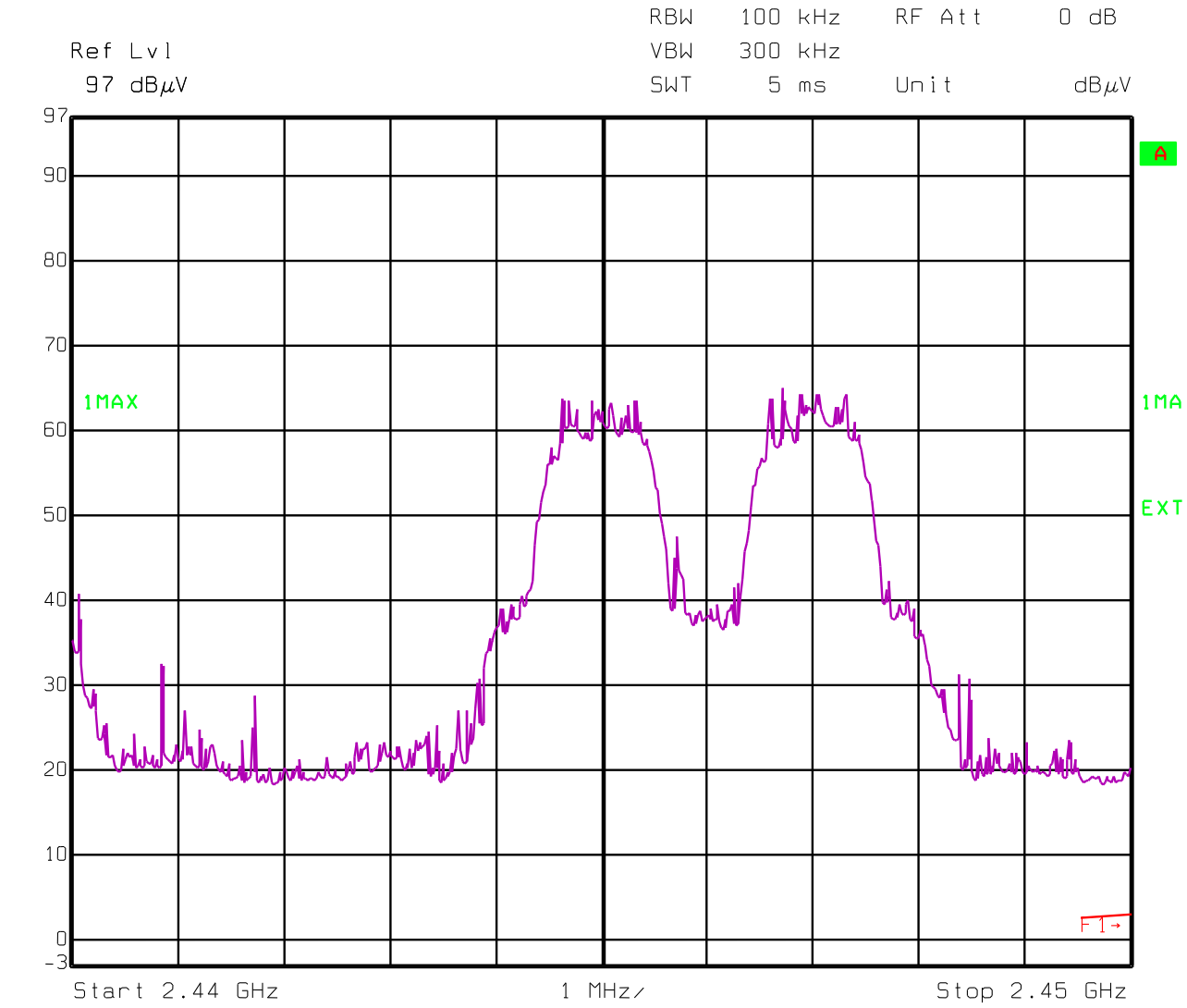

Delta 1 [T1]
RBW 300 kHz
RF Att 0 dB
Ref Lvl
0.15 dB
VBW 1 MHz
97 dBµV
1.643287 s
SWT 5 s
Unit dBµV
1 [T1] 64.93 dBµV
1.644787 s
1 [T1] 0.15 dB
1.643287 s
A
TRG
1MA
EXT
TRG 61.7 dBµV
97
90
80
70
60
50
40
30
20
10
0
-3
Center 2.479 GHz
500 ms/
Date: 19.JUN.2015 14:34:26

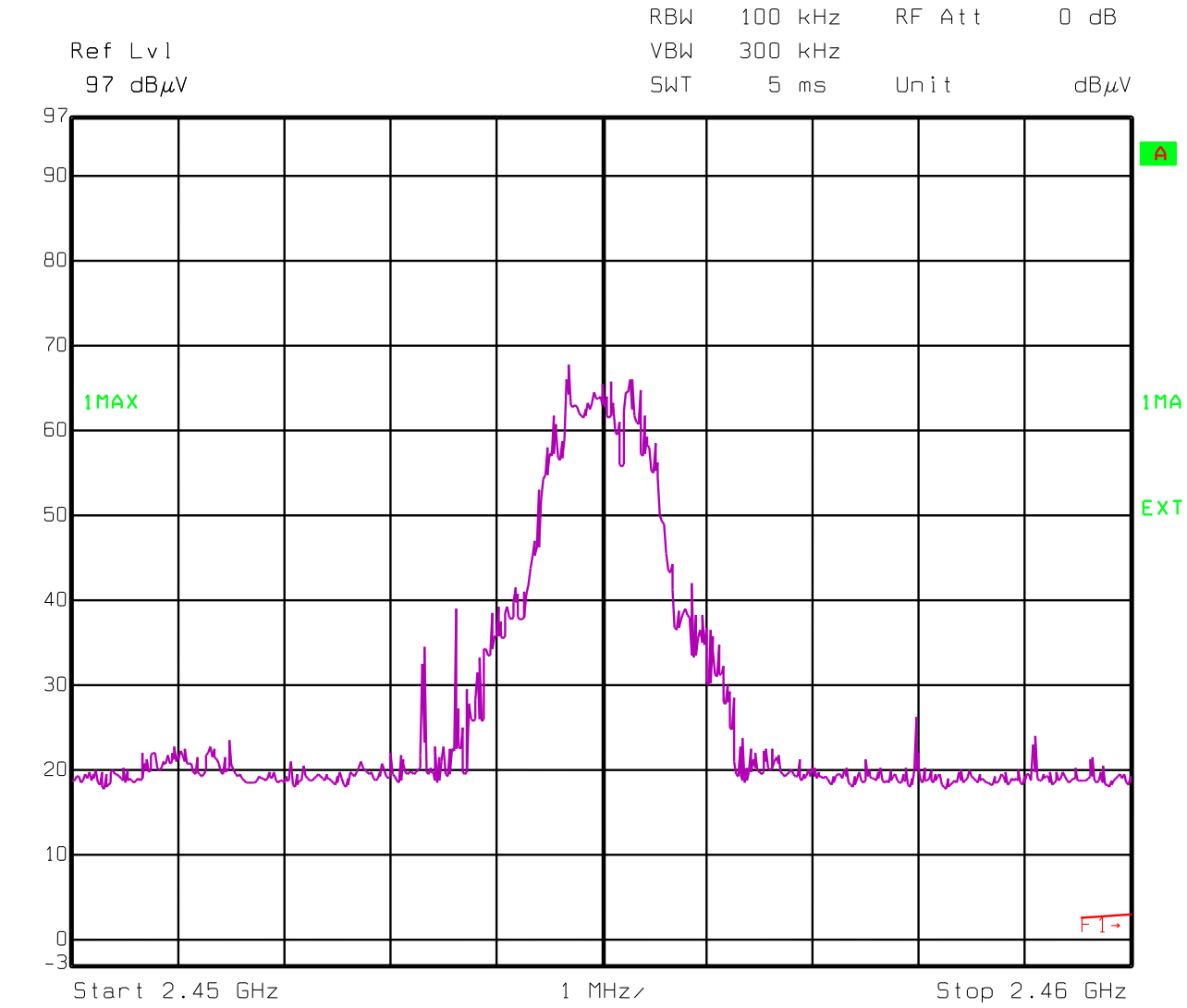
APPENDIX 9: Number of hopping channels

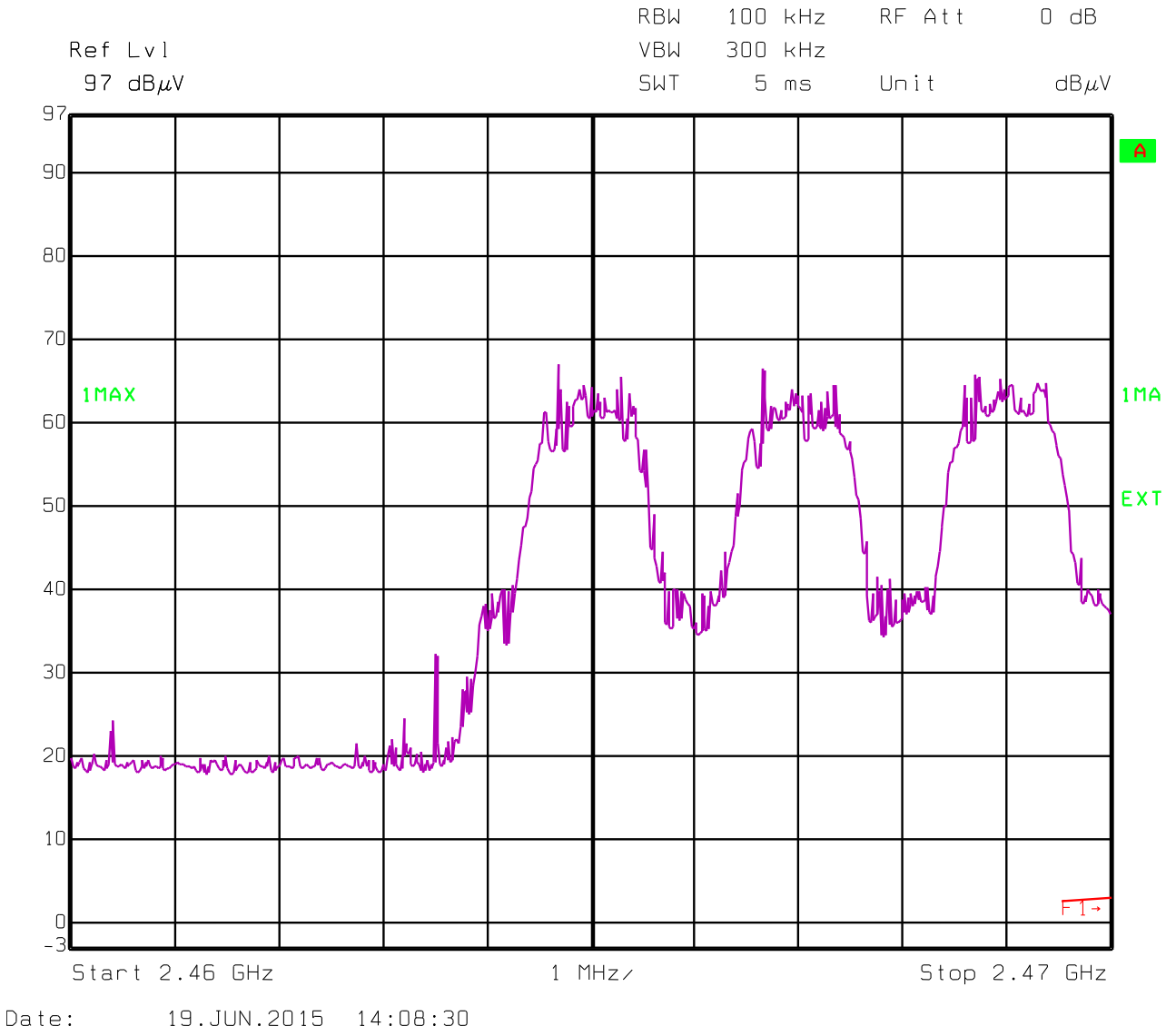


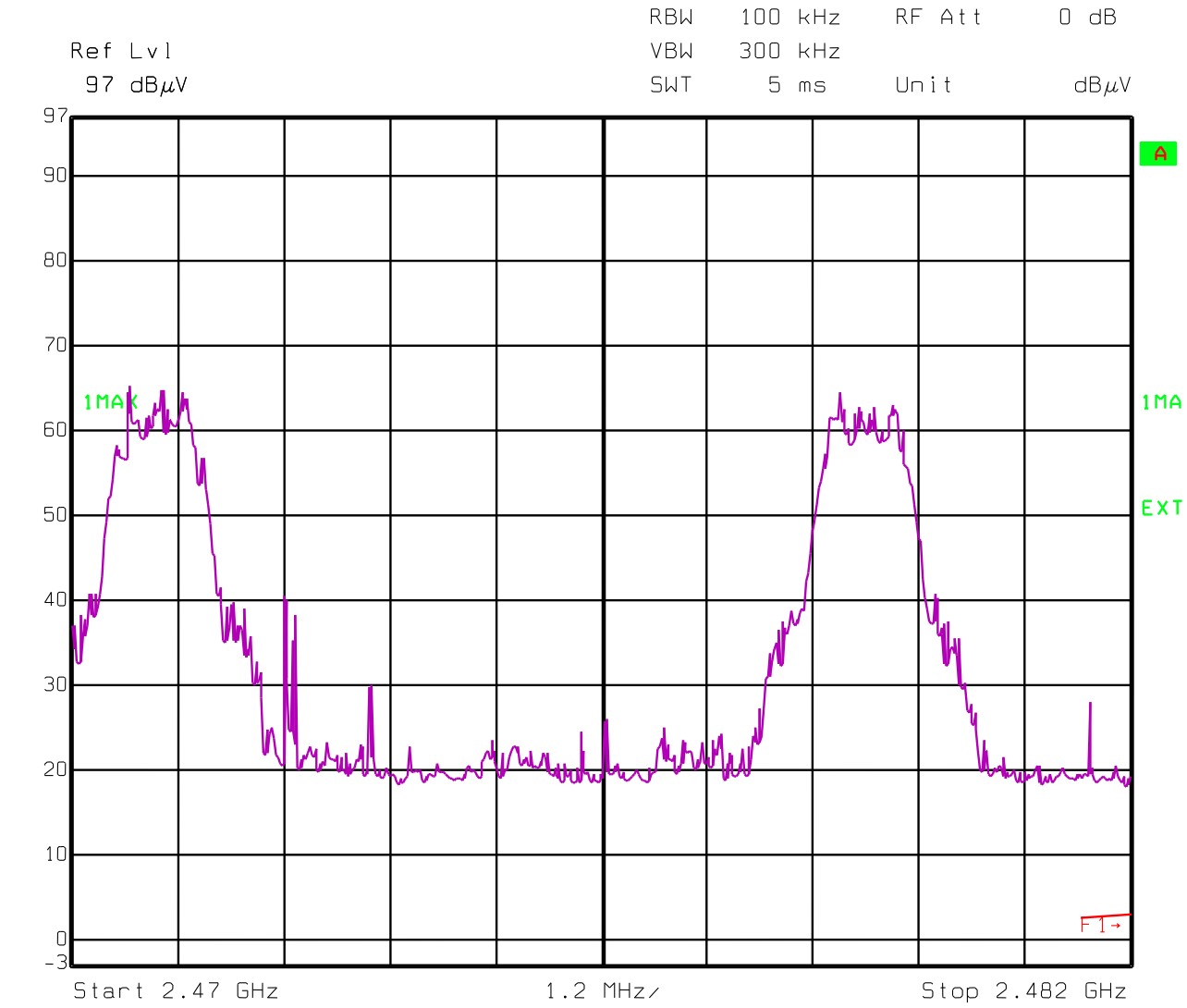

RBW 100 kHz
RF Att 0 dB
Ref Lvl
VBW 300 kHz
97 dBµV
SWT 5 ms
Unit dBµV
97
90
80
70
60
50
40
30
20
10
0
-3
A
1MAX
1MA
EXT
F1
Start 2.42 GHz
1 MHz/
Stop 2.43 GHz
Date: 19.JUN.2015 14:00:10


RBW 100 kHz
RF Att 0 dB
Ref Lvl
VBW 300 kHz
97 dBµV
SWT 5 ms
Unit dBµV
97
90
80
70
60
50
40
30
20
10
0
-3
A
1MAX
1MA
EXT
F1
Start 2.43 GHz
1 MHz/
Stop 2.44 GHz
Date: 19.JUN.2015 14:05:05


RBW 100 kHz
RF Att 0 dB
Ref Lvl
VBW 300 kHz
97 dBµV
SWT 5 ms
Unit dBµV
97
90
80
70
60
50
40
30
20
10
0
-3
A
1MAX
1MA
EXT
F1
Start 2.44 GHz
1 MHz/
Stop 2.45 GHz
Date: 19.JUN.2015 14:03:47


RBW 100 kHz
RF Att 0 dB
Ref Lvl
VBW 300 kHz
97 dBµV
SWT 5 ms
Unit dBµV
97
90
80
70
60
50
40
30
20
10
0
-3
A
1MAX
1MA
EXT
F1
Start 2.45 GHz
1 MHz/
Stop 2.46 GHz
Date: 19.JUN.2015 14:06:44


RBW 100 kHz
RF Att 0 dB
Ref Lvl
VBW 300 kHz
97 dBµV
SWT 5 ms
Unit dBµV
97
90
80
70
60
50
40
30
20
10
0
-3
A
1MAX
1MA
EXT
F1
Start 2.46 GHz
1 MHz/
Stop 2.47 GHz
Date: 19.JUN.2015 14:08:30


RBW 100 kHz
RF Att 0 dB
Ref Lvl
VBW 300 kHz
97 dBµV
SWT 5 ms
Unit dBµV
97
90
80
70
60
50
40
30
20
10
0
-3
A
1MAK
1MA
EXT
F1→
Start 2.47 GHz
1.2 MHz/
Stop 2.482 GHz
Date: 19.JUN.2015 14:10:47