



RR051-13-104633-2-A Ed. 0

RADIO test report

According to the standard:
CFR 47 FCC Part 15

Equipment under test:
Batteryless, wireless button
Model: ZBRT2 (Solo Up/Down)

FCC ID:
Y7HZBRT2

Company:
SCHNEIDER ELECTRIC INDUSTRIE

Distribution: Mr POUYOLLON

(Company: SCHNEIDER ELECTRIC INDUSTRIE)

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DESIGNATION OF PRODUCT: Batteryless, wireless button

Serial number (S/N): 3000266

Reference / model (P/N): ZBRT2 (Solo Up/Down)

Software version: not communicated

MANUFACTURER: SCHNEIDER ELECTRIC INDUSTRIE

COMPANY SUBMITTING THE PRODUCT:

Company: SCHNEIDER ELECTRIC INDUSTRIE

Address: Boulevard Salvador Allende
ZI d'Espagnac BP 660
16340 l'Isle d'Espagnac
France

Responsible: Mr POUYOLLON

DATES OF TEST: 09 and 10 October 2013

TESTING LOCATION: EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE
EMITECH ANGERS open area test site in JUIGNE SUR LOIRE (49)
FRANCE
21 rue de la Fuye 49610 Juigne sur Loire France

FCC 2.948 Listed Site Registration Number: 90469

TESTED BY: M. DUMESNIL

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1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: Batteryless,wireless button – Model: ZBRT2 (Solo Up/Down), in accordance with normative reference.

2. PRODUCT DESCRIPTION

ITU Emission code:	2M29GXW
Class:	B (residential environment)
Utilization:	Wireless batteryless complete transmitter
Antenna type and gain:	integrated PCB antenna, unknown gain
Operating frequency range:	2405 MHz
Number of channels:	1
Channel spacing:	not concerned
Frequency generation:	crystal
Modulation:	QPSK
Power source:	3 Vd.c for purpose of the tests but self-powered when user press the button in normal use

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 (2013)	Radio Frequency Devices
ANSI C63.4 (2003)	Methods of Measurement of Radio-Noise Emissions from Low-voltage Electrical and Electronics Equipment in the range of 9 kHz to 40 GHz.
558074 D01 DTS v03r01	Guidance for Performing Compliance on Digital Transmission Systems Operating under §15.247

4. TEST METHODOLOGY

Radio performance tests procedures given in CFR 47 part 15:

Subpart B –Unintentional Radiators

- Paragraph 107: Conducted limits
- Paragraph 109: Radiated emission limits

Subpart C – Intentional Radiators

- Paragraph 205: Restricted bands of operation
- Paragraph 207: Conducted limits
- Paragraph 209: Radiated emission limits; general requirements
- 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	Software	BAT-EMC	/	/	/
1922	Microwave DB C020180F-4B1	Low-noise amplifier 1 to 18 GHz	12/09/2013	12/09/2014	12/11/2014
1939	IMC WR42	Horn antenna	20/04/2012	20/04/2016	20/06/2016
1940	IMC WR42	Horn antenna	20/04/2012	20/04/2016	20/06/2016
2469	ODZ0004A-N	Detector	02/08/2013	02/08/2015	02/10/2015
2593	B25250	Climatic chamber	07/08/2012	07/08/2014	07/10/2014
3036	ALC Microwave ALN02-0102	Low-noise amplifier	04/04/2013	04/04/2014	04/06/2014
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
6384	Metrix OX7102-C	Oscilloscop	28/05/2013	28/05/2015	28/07/2015
7299	Microtronics BRM50702	reject band filter	04/10/2013	04/10/2013	04/12/2013
8511	Préamplificateur 8447D	Hewlett Packard	28/08/2013	28/08/2014	28/10/2014
8526	Schwarzbeck VHBB 9124	Biconical antenna	12/06/2012	12/06/2016	12/08/2016
8533	HFH2-Z2	Loop antenna	01/05/2013	01/05/2014	01/07/2014
8534	Emco 3115	Horn antenna	30/10/2012	30/10/2016	30/12/2016
8535	Emco 3115	Horn antenna	30/10/2012	30/10/2016	30/12/2016
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	12/06/2012	12/06/2016	12/08/2016
8593	SIDT Cage 2	Full anechoic room	/	/	/
8675	AOIP MN5102B	Multimeter	15/01/2013	15/01/2015	15/03/2015
8702	R&S NRVS	Power meter	05/09/2013	05/09/2015	05/11/2015
8707	R&S ESI7	Test receiver	03/10/2012	03/10/2014	03/12/2014
8730	Radiofrequency generator SMR20	Rohde & Schwarz	17/04/2013	17/04/2015	17/06/2015
8732	Emitech	OATS	23/08/2013	23/08/2016	23/10/2016
8742	R&S NRV-Z52	Sensor	05/09/2013	05/09/2015	05/11/2015
8750	La Crosse Technology WS-9232	Meteo station	20/07/2012	20/07/2014	20/09/2014
8896	ACQUISYS GPS8	GPS receiver	/	/	/

6. TESTS AND CONCLUSIONS

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	X				
	(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		
	(a) (2) Digital modulation techniques	X				Note 4
	(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				Note 6

NAP: Not Applicable

NAs: Not Asked

Note 1: Integral PCB antenna.

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 minimum 6 dB bandwidth of the equipment is 1509 kHz (see appendix 4).

Note 5: Conducted measurement is not possible (integral antenna), so we used the radiated method in open field. No variation of radiated power is observed at +/- 15% of the power source.

Note 6: $PSD = EIRP / 4 * \pi * R^2 = 0.369 / 4 * \pi * (20 \text{ cm})^2 = 0.00007 \text{ mW/cm}^2$ (limit = 1 mW/cm²).
The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of CFR 47 §1.1310.

7. 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 transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate.

Results:

Ambient temperature (°C): 23.4
Relative humidity (%): 37

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

Sample N° 1:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dB μ V/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out-of-Band Emission Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2405	86.8 (100 kHz)	Peak	2399.987	-39.33	47.47	66.8	19.33
2405	90.5 (1 MHz)	Peak	2484.663	-40.05	50.45 **	74	23.55

* Marker-Delta method

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

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

Test conclusion:

RESPECTED STANDARD

8. MAXIMUM PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247 (b)

Test set up:

The system is tested in anechoic room. The EUT is placed on a rotating table, 1.5 m from a ground plane. Zero degree azimuth corresponds to the front of the device under test.

The measurement of the electro-magnetic field is realized, with a resolution bandwidth adjusted at 10 MHz and video bandwidth at 10 MHz (measurement procedure paragraph 9.1.1 of 558074).

Distance of antenna: 3 meters

Antenna height: 1.5 meters

Antenna polarization: vertical and horizontal

Equipment under test operating condition:

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

Results:

Ambient temperature (°C): 22.7
Relative humidity (%): 50

Sample N° 1:

We used for power source two LR06 batteries and we noted:

Voltage at the beginning of test (Vdc): 3.19
Voltage at the end of test (Vdc): 3.11
Percentage of voltage drop during the test (%): 2.51

	Electro-magnetic field (dB μ V/m):	Conducted power * (mW)	Limit (mW)
Nominal supply voltage:	90.9	0.225	1000

Polarization of test antenna: horizontal (height: 150 cm)

Position of equipment: see photos in appendix 2 (azimuth: 250 degrees)

* $P = (E \times d)^2 / (30 \times G_p)$ with $d = 3 \text{ m}$ and $G_p = 1.64$ (2.15 dBi)

Test conclusion:

RESPECTED STANDARD

9. INTENTIONAL RADIATOR

Standard: FCC Part 15

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

Test set up:

The measure applies to open area test site from the range 9 kHz to 1 GHz and to indoor full anechoic room above 1 GHz

The EUT is placed on a rotating table, 0.8m from a ground plane (open area test site) and 1,5m from a ground plane (anechoic room). Zero degree azimuths correspond to the front of the device under test.

See photos in appendix 2.

Frequency range: From 9 kHz to 24.05 GHz (10th harmonic of the highest fundamental frequency: 2405 MHz).

Detection mode: Quasi-peak (F < 1 GHz) Peak / RMS (F > 1 GHz)
(measurement procedure paragraph 11 and 12 of 558074)

Bandwidth: 120 kHz (F < 1 GHz) 100 kHz / 1 MHz (F > 1 GHz)

Distance of antenna: between 30 m and 3 m according the frequencies and the limits

Antenna height: 1 to 4 meters (open area test site)
1,5 meters (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 modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Results:

Ambient temperature (°C): 24
 Relative humidity (%): 47

Sample N° 1

We used for power source two LR06 batteries and we noted:

Voltage at the beginning of test (Vdc): 3.11
 Voltage at the end of test (Vdc): 3.02
 Percentage of voltage drop during the test (%): 2.89

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak R: RMS	Antenna height (cm)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
4810	P	150	1000	H	54.1	74	19.9
4810	R	150	1000	H	51.85*	54	2.15

* restricted bands of operation in 15.205

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 86.8 dBμV/m

So the applicable limit is 66.8 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)).

Test conclusion:

RESPECTED STANDARD

10. PEAK POWER DENSITY

Standard: FCC Part 15

Test procedure: paragraph 15.247 (e)

Test set up:

The system is tested in anechoic room. The EUT is placed on a rotating table, 1.5 m from a ground plane. Zero degree azimuth corresponds to the front of the device under test.

We used the same method of the peak output power measurement, but the equipment under test power level is recorded with the spectrum analyzer (measurement procedure paragraph 10.2 of 558074).

Resolution bandwidth: 3 kHz
Video bandwidth: 10 kHz

Distance of antenna: 3 meters

Antenna height: 1.5 meters

Antenna polarization: vertical and horizontal

Equipment under test operating condition:

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

Results:

Ambient temperature (°C): 22.7
Relative humidity (%): 50

Sample N° 1:

We used for power source two LR06 batteries and we noted:

Voltage at the beginning of test (Vdc): 3.19
Voltage at the end of test (Vdc): 3.11
Percentage of voltage drop during the test (%): 2.51

	Peak power density at frequency: 2405 MHz
Normal test conditions	-18.13
Limits	+8 dBm

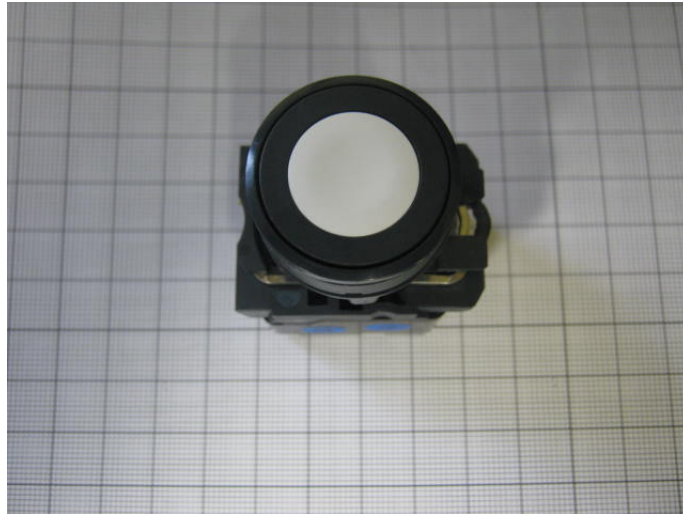
Test conclusion:

RESPECTED STANDARD

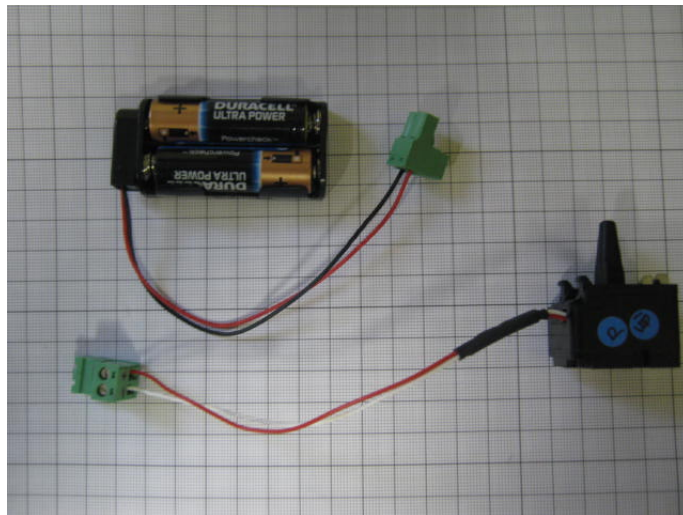
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APPENDIX 1: Photos of the equipment under test

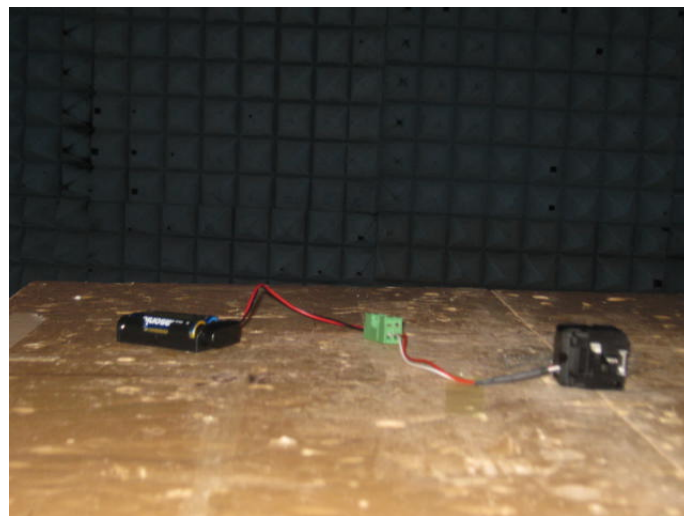




Ancillary equipment for radio test



APPENDIX 2: Test set up



APPENDIX 3: Test equipment list

Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	N° EMITECH
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	Electrometrics	8535
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8750

Maximum peak output power

TYPE	MANUFACTURER	N° EMITECH
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Climatic chamber	MPC	2593
Diode detector ODZ0004A	Omniyig	2469
Oscilloscop OX 7102-C	Scopix	6384
2.4 GHz band pass filter	ALC	5625
Antenna 3115	Electrometrics	8535
Antenna 3115	Electrometrics	8534
Radiofrequency generator SMR20	Rohde & Schwarz	8730
Powermeter NRVS	Rohde & Schwarz	8702
Power sensor NRV-Z52	Rohde & Schwarz	8742
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC	0000

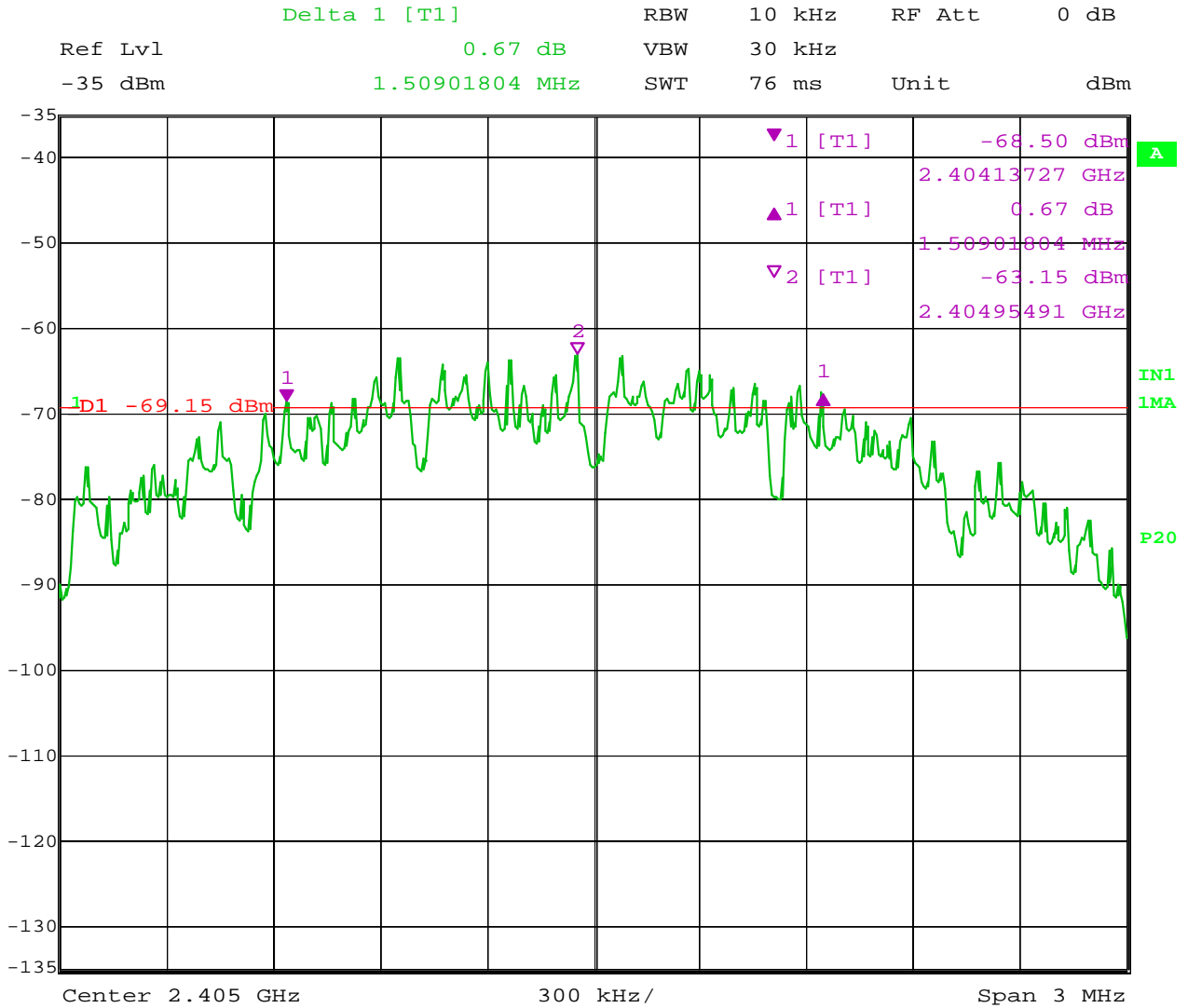
Intentional radiator

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
Biconical antenna VHBB 9124	Schwarzbeck	8526
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Antenna HFH2-Z2	Rohde & Schwarz	8533
Antenna 3115	Electrometrics	8535
Antenna WR42	IMC	1939
Antenna WR42	IMC	1940
Antenna 3115	Electrometrics	8534
Préamplificateur 8447D	Hewlett Packard	8511
Low-noise amplifier C020180F-4B1	Microwave DB	1922
Low-noise amplifier ALN02-0102	ALC Microwave	3036
Reject band filter BRM50702	Microtronics	7299
Radiofrequency generator SMR20	Rohde & Schwarz	8730
Powermeter NRVS	Rohde & Schwarz	8702
Power sensor NRV-Z52	Rohde & Schwarz	8742
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC	0000

Peak power density

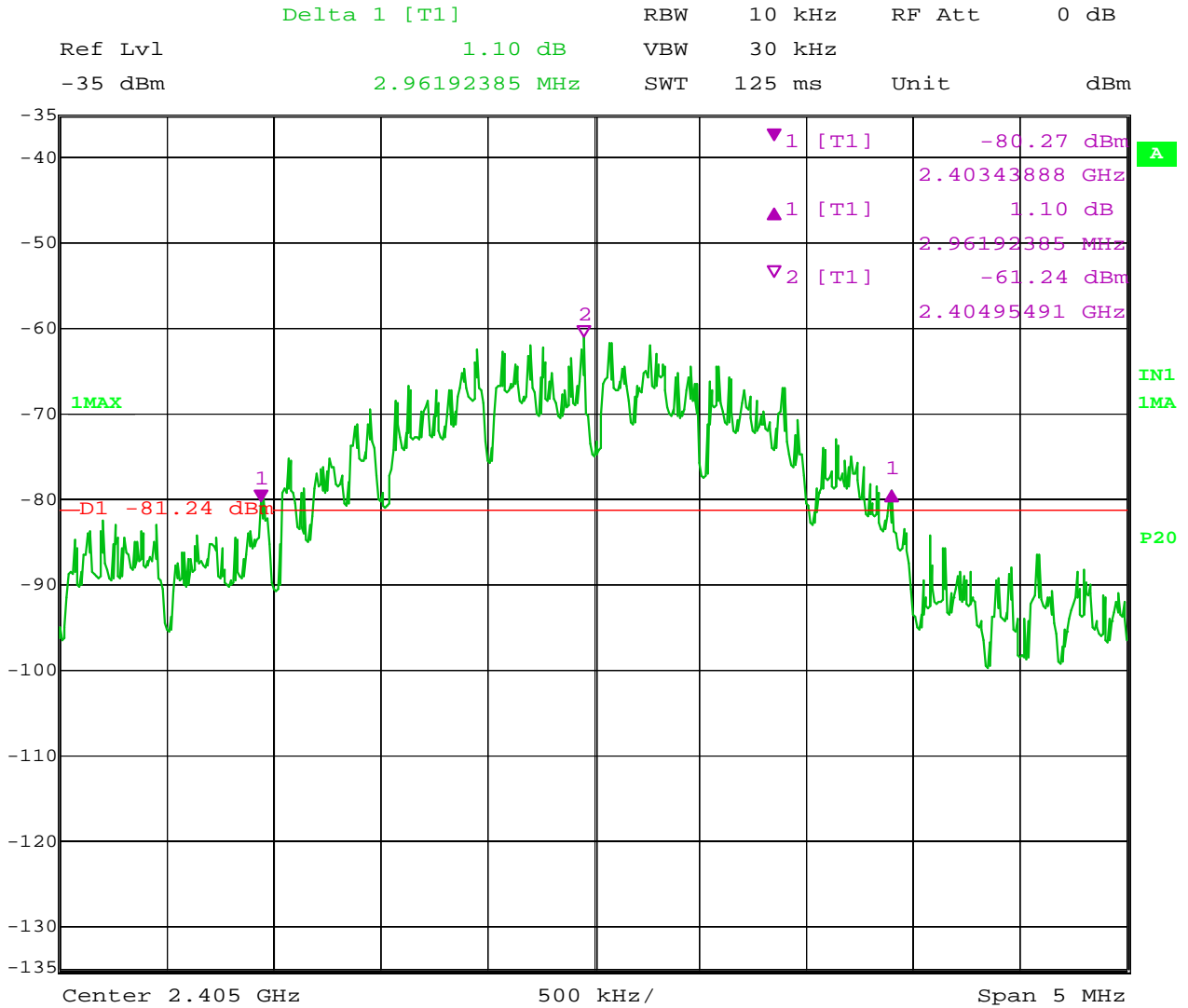
TYPE	MANUFACTURER	N° EMITECH
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Climatic chamber	MPC	2593
Diode detector ODZ0004A	Omniyig	2469
Oscilloscop OX 7102-C	Scopix	6384
2.4 GHz band pass filter	ALC	5625
Antenna 3115	Electrometrics	8535
Antenna 3115	Electrometrics	8534
Radiofrequency generator SMR20	Rohde & Schwarz	8730
Powermeter NRVS	Rohde & Schwarz	8702
Power sensor NRV-Z51	Rohde & Schwarz	8742
Multimeter MN5102B	AOIP	8675
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC	0000

APPENDIX 4: 6 dB bandwidth



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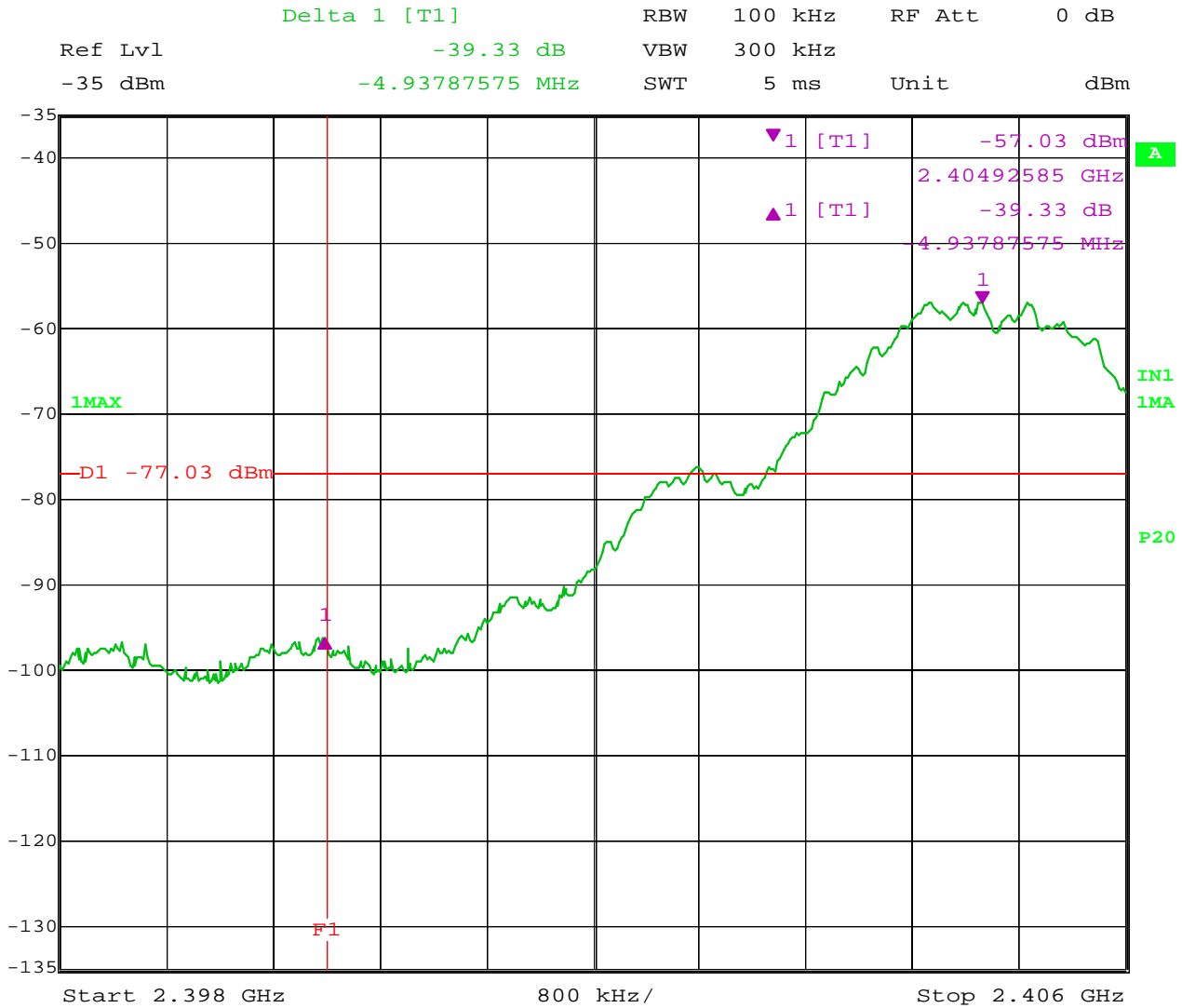
APPENDIX 5: 20 dB bandwidth



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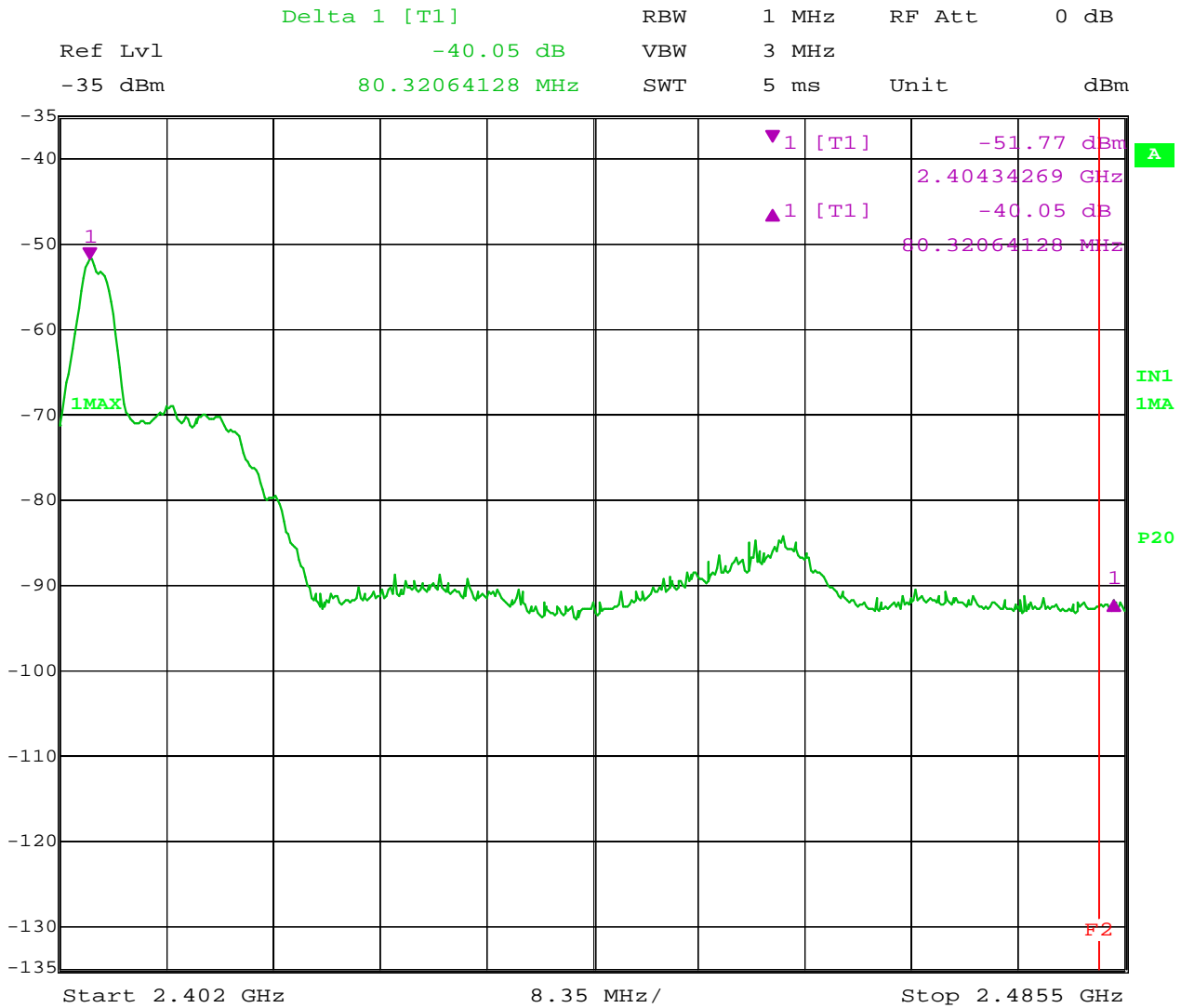
APPENDIX 6: Band edge

Lower band edge



Date: 10.OCT.2013 15:31:34

Upper band edge



Date: 10.OCT.2013 15:33:27