

RC-032-GTC-15-107402-2-A

"This report cancels and replaces the test report N° RC-032-GTC-15-107402-2-A Edition 0"

E.M.C Test Report

According to the standards:

FCC 47 CFR PART 15 : 2015 (§15.247)

RSS-247 issue 1 : 2015

RSS-Gen Issue 4 : 2014

Equipment under test:

Location Tag : Voilà!

With BLE link WISTIKI

FCC ID: 2AEBR-WISTIKI-V2

Company:

WISTIKI S.A.S.

FCC accredited: FR0004

IC accredited: 4379A

DISTRIBUTION: Mr. LUSSATO

(Company: WISTIKI S.A.S.)

Number of pages: 58 with 6 annexes

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TEST CERTIFICATION FOR: FCC Certification and CANADA certification

NAME OF THE EQUIPMENT UNDER TEST: Location Tag : Voilà! with BLE link WISTIKI

Serial number: -

Reference / model (P/N): -

Software version: -

NAME OF THE MANUFACTURER: WISTIKI S.A.S.

ADDRESS OF THE APPLICANT:

Company: WISTIKI S.A.S.

Address: 8 rue du Faubourg Poissonnière
75010 PARIS
FRANCE

Person in charge: Mr. LUSSATO

Person present during the tests Mr LEROUX (BMS CIRCUITS Company)

DATES OF TESTS: 01/03/2016 and 31/03/2016

TESTS LOCATION: EMITECH Montigny le Bretonneux
(FCC registered test site number: 969 174)
Z.A. de l'Observatoire
3 rue des Coudriers
78180 MONTIGNY LE BRETONNEUX
France

TESTS OPERATORS: F. LHEUREUX / A. BERNARD

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1. INTRODUCTION

This document presents the results of Electromagnetic Compatibility tests performed on the equipment «Location Tag : Voilà! with BLE link WISTIKI» according to reference documents listed below.

2. REFERENCE DOCUMENTS

FCC 47 CFR Part 15: 2015

Code of Federal Regulations. Title 47- Telecommunication
Chapter 1- Federal Communication Commission
Part 15- Radio frequency devices

RSS-247 issue 1: 2015

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-Gen Issue 4 : November 2014

General Requirements and Information for the Certification of Radio Apparatus

ANSI C63.4: 2014

Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronics Equipment in the range of 9 kHz to 40 GHz.

KDB 558074 D01 DTS Meas Guidance V03r04

Guidance for performing compliance measurement on Digital Transmission Systems (DTS) operating under § 15.247

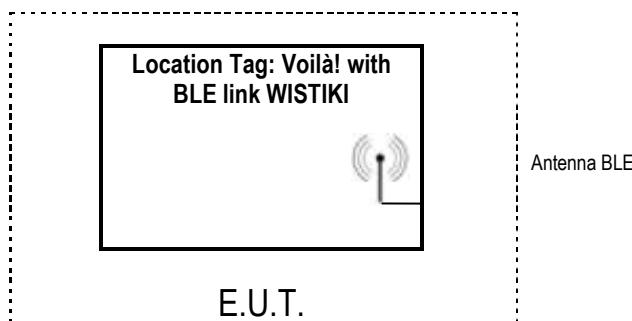
ANSI C63.10 : 2013

American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

3. PRODUCT DESCRIPTION

Class: B (residential environment)
Antenna type and gain: Integral antenna: Not communicated
Operating frequency range: from 2402 MHz to 2480 MHz
Number of channels: 40
Channel spacing: 2 MHz
Modulation: -
Power source: 3 Vdc (battery)
Software power setting: -

Modification of the equipment during the tests: No.



E.U.T.



Auxiliary board for testing purposes.
(Do not part of the E.U.T.)

4. TESTS AND CONCLUSION

The following table summarizes test results of the EUT.

Subpart B of the standard FCC part 15 – Unintentional radiators

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
15.107	Measurement of conducted emission on AC mains ports			X		
15.109	Radiated emission limits	X				

Subpart C of the standard FCC part 15 – Intentional radiators

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
15.205	Restricted bands of operation	X				
15.207	Measurement of conducted emission on AC mains ports			X		
15.209	Radiated emission limits; general requirements	X				
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				
	(c) 20 dB bandwidth and band-edge compliance	X				
15.247	Intentional radiated emissions					
	a) frequency hopping and digitally modulated					
	a) (1) hopping mode			X		
	a) (1) (i) frequency hopping in the band 902–928 MHz			X		
	a) (1) (ii) frequency hopping in the band 5725–5850 MHz			X		
	a) (1) (iii) frequency hopping in the band 2400–2483.5 MHz			X		
	a) (2) systems using digital modulation in the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz (6 dB bandwidth)	X				
	b) maximum peak conducted					
	b) (1) frequency hopping in the bands 2400–2483.5 MHz or 5725–5850 MHz			X		
	b) (2) frequency hopping in the band 902–928 MHz			X		

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
15.247	b) (3) systems using digital modulation in the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz	X				
	b) (4) maximum peak conducted > 6 dBi					
	b) (4) (i) frequency hopping in the band 2400–2483.5 MHz			X		
	b) (4) (ii) frequency hopping in the band 5725–5850 MHz			X		
	b) (4) (iii) fixed, point-to-point			X		
	c) directional antenna > 6 dBi					
	c) (1) fixed, point-to-point operation			X		
	c) (1) (i) in the band 2400–2483.5 MHz			X		
	c) (1) (ii) in the band 5725–5850 MHz			X		
	c) (1) (iii) fixed, point-to-point			X		
	c) (2) multiple directional beams in the band 2400–2483.5 MHz			X		
	c) (2) (i) information			X		
	c) (2) (ii) sum of the power supplied to all antennas			X		
	c) (2) (iii) one antenna for multiple directional beams			X		
	c) (2) (iv) single directional beam			X		
	d) intentional radiator	X				
	e) peak power spectral density	X				
	f) hybrid system			X		
	g) continuous data stream during the test			X		
	h) to avoid hopping on occupied channels			X		
	i) RF exposure compliance			X		P < 500 mW

N.A.: Not Applicable

N.P.: Not Performed

Standard RSS-247 Issue 1 : 2015

Designation of test	Test results				Comments
	Pass	Fail	N.A.	N.P.	
1. Scope					
3. Certification Requirements					
3.1 RSS-gen compliance			X		See RSS-Gen Issue 4
			X		See RSS-Gen Issue 4
			X		See RSS-Gen Issue 4
			X		See CS-03
			X		See RSS-Gen Issue 4
5.2 Digital Modulation Systems					
(1) -6 dB bandwidth			X		
(2) transmitter power spectral density			X		
5.4 Transmitter Output Power and e.i.r.p. Requirements					
1) 902-928 MHz frequency hopping systems output power / e.i.r.p.			X		
2) 2400-2483.5 MHz frequency hopping systems output power / e.i.r.p.			X		
3) 5725-5850 MHz frequency hopping systems output power / e.i.r.p.			X		
4) Digital modulation systems output power / e.i.r.p.	X				
5) point-to-point systems (2400-2483.5 and 5725-5850 MHz)			X		
6) Multiple directional beams antenna systems (2400-2483.5 MHz)			X		
5.5 Unwanted emission	X				

Standard RSS-Gen Issue 4 : November 2014

Designation of test	Test results				Comments
	Pass	Fail	N.A.	N.P.	
1. Scope					
2. Purpose and application					
2.1 Certification of Radio Apparatus			X		
2.2 Categories of radio Equipment					Category 1
2.3 Exclusions			X		
2.4 Determination of Interference			X		
3. Normative Reference Publications					
4. application for an Exemption					
5. Receivers					
5.1 Scanner Receivers			X		
5.2 Stand-Alone Receivers Operating in the Band 30-960 MHz (Category II)			X		
5.3 Receivers Exempted From Industry Canada Requirement (Category II)			X		
6. Technical Requirements					
6.1 Test Site Facilities					See ANSI C63.4-2014
6.2 Test report					
6.3 External control			X		
6.4 Near Field Measurement Method Below 30 MHz			X		
6.5 Measurement Distance Above 30 MHz					
6.6 Occupied Bandwidth	X				See RSS 247
6.7 Transmitter Antenna for Licensed Radio Apparatus			X		
6.8 Operating Bands and Selection of Test Frequencies			X		
6.9 CISPR Quasi-peak Detector	X				
6.10 Pulsed Operation			X		
6.11 Transmitter Frequency Stability			X		
6.12 Transmitter Output Power	X				See RSS 247
6.13 Transmitter unwanted Emissions	X				
7. Receiver limit					
8. Licence-Exempt radio Apparatus					
8.1 Measurement Bandwidths and Detector Functions	X				
8.2 Amplifiers			X		
8.3 Transmitter Antenna for Licence-Exempt Radio Apparatus			X		
8.4 User Manual notice for Licence-Exempt Radio Apparatus			X		
8.5 Measurement of Licence-Exempt Devices On-Site (in-situ)			X		
8.6 Operating frequency Range of Device in Master/Slave networks			X		
8.7 Radio Frequency identification (RFID) Devices			X		
8.8 AC Power Line Conducted Emission Limits for licence-Exempt Radio Apparatus	X				
8.9 Transmitter Emission limits for Licence-Exempt Radio Apparatus			X		
8.10 Restricted Frequency bands			X		
8.11 Frequency Stability for Licence-Exempt transmitters			X		

Designation of test	Test results				Comments
	Pass	Fail	N.A.	N.P.	
7. Licence-exempt Radio Apparatus					
7.1 General Informations					
7.1.1 External Amplifiers			X		
7.1.2 Transmitter Antenna			X		
7.1.3 User manual Notice			X		<i>User manual shall include the required statements</i>
7.1.4 Radio Apparatus Containing Digital Circuits			X		<i>See ICES-003</i>
7.1.5 Measurement After Installation			X		
7.1.6 operating Frequency range of Devices in Master/Slave Networks			X		
7.1.7 Home-built Devices			X		
7.1.8 RFID Devices			X		
7.2 Measurement Methods and Standard Specifications					
7.2.1 Measurement Bandwidths and Detector Functions	X				
7.2.2 Emissions Falling Within Restricted Frequency Bands			X		
7.2.3 Devices Employing Pulsed Operation			X		
7.2.4 AC Power Line Conducted Emissions Limits			X		
7.2.5 Transmitter Spurious Emission Limits	X				
7.2.6 Transmitter Frequency Stability			X		
7.2.7 Measurement Distance			X		

Note 1: *Single / Split / limited modular transmitter.*

The host devices of the certified module(s) shall be properly labeled to identify the module(s) within.

Note 2: Spectrum investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz to the 10th harmonic of the highest fundamental frequency or 40 GHz, whichever is lower ($F < 10$ GHz) or to the 5th harmonic of the highest fundamental frequency or 100 GHz, whichever is lower ($F \geq 10$ GHz).

Note 3: Spectrum investigated from the lowest frequency internally generated or used in the receiver or 30 MHz, whichever is higher to at least 3 times the highest tuneable or local oscillator frequency, whichever is higher without exceeding 40 GHz.

Note 4: *The certificate holder shall be able to demonstrate a quality control process used for production.*
Inspection and testing in accordance with good engineering practices.

Note 5: *The device must be properly identified and labeled.*

Note 6: *Suppliers of radio apparatus shall provide notices and user information in both English and French.*

Note 7: *The device shall not have any external controls accessible to the user.*

Note 8: *When transitioning between bands, the equipment shall not actively transmit*

Conclusion:

The tested sample «**Location Tag : Voilà! with BLE link WISTIKI**» submitted to the tests complies with the requirements of the standards:

- FCC 47 CFR PART 15 : 2015
- RSS-247 issue 1: 2015
- RSS-Gen Issue 4 : November 2014

According to the limits specified in this report.

5. DIGITAL MODULATION SYSTEMS

Standards: FCC 47 CFR PART 15 : 2015

RSS-247 Issue 1 : 2015

Section: §15.247 a) (2)
 §6.6 of RSS-247 issue 1 : 2015
 §4.6 of CNR-Gen issue3 : 2010

Test configuration:

The system is tested in normalized test site.

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

The level was maximised in antenna height, azimuth and polarization. The maximum level measured on the spectrum analyser was recorded.

Distance of antenna: 3 meters

Instrumentation test list:

CATEGORY	BRAND	TYPE	Nr EMITECH
Antenna	Emco	Emco	3374
Antenna mast	Maturo	Maturo	8410
Antenna mast	Maturo	Maturo	8411
Cable	C&C	C&C	11136
Cable	C&C	C&C	11172
Cable	C&C	N-2m	11181
Receiver	Rohde & Schwarz	ESRP7	10517
Shielded enclosure	SIDT	SIDT	0549

Equipment under test operating condition:

EUT is in continuous transmission mode.

Measure conditions:

Ambient temperature (°C): 22

Relative humidity (%): 40

Resolution bandwidth: 100 kHz

Results:

Power source: 3 Vdc.

6 dB bandwidth

Frequency	Mode	Results	Comments
2402 MHz	advertising	0.740 MHz	See annex n°4
2442 MHz		0.610 MHz	See annex n°4
2480 MHz		0.750 MHz	See annex n°4

20 dB bandwidth

Frequency	Mode	Results	Comments
2402 MHz	advertising	1.280 MHz	See annex n°4
2442 MHz		1.290 MHz	See annex n°4
2480 MHz		1.300 MHz	See annex n°4

99 % bandwidth

Frequency	Mode	Results	Comments
2402 MHz	advertising	1.104 MHz	See annex n°4
2442 MHz		1.102 MHz	See annex n°4
2480 MHz		1.107 MHz	See annex n°4

26 dBc bandwidth

Frequency	Mode	Results	Comments
2402 MHz	advertising	1.410 MHz	See annex n°4
2442 MHz		1.430 MHz	See annex n°4
2480 MHz		1.450 MHz	See annex n°4

Test conclusion: Complies with the requirements of the standard.

6. TRANSMITTER OUTPUT POWER

Standards: FCC 47 CFR PART 15 : 2015
 RSS-247 Issue 1 : 2015

Section: §15.247 b) (3)
 §5.4

Test configuration:

The system is tested in normalized test site.

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

The level was maximised in antenna height, azimuth and polarization. The maximum level measured on the spectrum analyser was recorded.

Distance of antenna: 3 meters.

Instrumentation test list:

CATEGORY	BRAND	TYPE	Nr EMITECH
Antenna	Emco	Cornet 3115	3374
Antenna mast	Maturo	MCU	8410
Cable	C&C	N-10m	8411
Cable	C&C	N-6m	11136
Cable	C&C	N-2m	11172
Shielded enclosure	SIDT	C.4	0549
Cable	C&C	N-2m	11181
Receiver	Rohde & Schwarz	ESRP7	10517

Equipment under test operating condition: EUT is in continuous transmission mode.

Measure conditions:

Ambient temperature (°C): 22
 Relative humidity (%): 40

Resolution bandwidth: 1 MHz

Results:

Power source: 3 Vdc

Frequency	Mode	Electro-magnetic field (dB μ V/m)	TP* (dBm)	Limit (dBm)
2402 MHz	advertising	95.37	-2.01	+ 30
2442 MHz		93.56	-3.82	+ 30
2480 MHz		93.16	-4.22	+ 30

* TP = $(E \times d)^2 / (30 \times 1.64)$ for d = 3 m

Test conclusion: Complies with the requirements of the standard.

7. PEAK POWER SPECTRAL DENSITY

Standards: FCC 47 CFR PART 15 : 2015

RSS-247 Issue 1 : 2015

Section: §15.247 e)
§5.2

Test configuration:

The system is tested in normalized test site.

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

The level was maximised in antenna height, azimuth and polarization. The maximum level measured on the spectrum analyser was recorded.

Distance of antenna: 3 meters

Instrumentation test list:

CATEGORY	BRAND	TYPE	Nr EMITECH
Antenna	Emco	Cornet 3115	3374
Antenna mast	Maturo	MCU	8410
Cable	C&C	N-10m	8411
Cable	C&C	N-6m	11136
Cable	C&C	N-2m	11172
Cable	C&C	N-2m	11181
Receiver	Rohde & Schwarz	ESRP7	10517
Shielded enclosure	SIDT	C.4	0549

Equipment under test operating condition:

EUT is in continuous transmission mode.

Measure conditions:

Ambient temperature (°C): 22

Relative humidity (%): 40

Resolution bandwidth: 30 kHz

Video bandwidth: 300 kHz

Results:

Power source: 3 Vdc

Frequency	Mode	Electro-magnetic field (dB μ V/m)	PPSD*	Limit (dBm)
2402 MHz	Advertising	88.82	-8.58	+ 8.0
2442 MHz		87.67	-9.73	
2480 MHz		86.76	-10.64	

* PPSD = $(E \times d)^2 / (30 \times 1.64)$ for d = 3 m





Test conclusion: Complies with the requirements of the standard.

8. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSIONS LIMITATION

Standard: FCC 47 CFR PART 15 : 2015

Sections: §15.215 (b) and §15.247 (d)

Instrumentation test list:

CATEGORY	BRAND	TYPE	Nr EMITECH
Antenna	Emco	Cornet 3115	3374
Antenna mast	Maturo	MCU	8410
Cable	C&C	N-10m	8411
Cable	C&C	N-6m	11136
Cable	C&C	N-2m	11172
Cable	C&C	N-2m	11181
Receiver	Rohde & Schwarz	ESRP7	10517
Shielded enclosure	SIDT	C.4	0549

Equipment under test arrangement:

The system is tested in normalized test site.

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

The level was maximised in antenna height, azimuth and polarization. The maximum level measured on the spectrum analyser was recorded.

Results:

Ambient temperature (°C): 22

Relative humidity (%): 40

Lower Band Edge: from 2310 MHz to 2390 MHz

Upper Band Edge: from 2483.5 MHz to 2500 MHz

Polarization of test antenna: Vertical (height = 124 cm)

Position of equipment: azimuth = 343°

} For 2402 MHz

Polarization of test antenna: Vertical (height = 120 cm)

Position of equipment: azimuth = 145°

} For 2480 MHz

- advertising Mode

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)	Limits (dB μ V/m)	Margin (dB)
2402.04	86.09	Average	2387.90	36.6	49.5	54.0	4.5
2479.4	85.04	Average	2484.78	38.1	46.9	54.0	7.1

The band edge readings were performed with a peak detector and with the E.U.T. set in a constant 100 % transmit state.

* According to step 2 of Marker-Delta Method DA 00-705.

Band-edge curves are given in annex 5.

9. UNINTENTIONAL RADIATED EMISSIONS AND TRANSMITTER UNWANTED EMISSION IN THE BAND 9 KHz – 25 GHz

Standards: FCC 47 CFR PART 15 : 2015
RSS-Gen Issue 4 : November 2014

Sections: §15.205; 15.209 and §5.247
§6.13 of RSS-Gen

Equipment under test arrangement:

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal metal ground plane.

For maximum meter reading at each frequency, the antenna height is adjusted between 1 m and 4 m above the ground plane. A 360 degrees rotation of the EUT is performed in vertical and horizontal polarization. The frequency azimuth and antenna height are presented in the table on the next pages.

The E.U.T. is blocked in continuous transmission.

Frequencies range: 9 kHz – 30 MHz
30 MHz - 1 GHz
1 GHz – 25 GHz

Detection mode: Quasi-peak for 9 kHz – 30 MHz
Quasi-peak for 30 MHz - 1 GHz
Average for 1 GHz – 25 GHz

Resolution bandwidth: 200 Hz for 9 kHz – 150 kHz
9 kHz for 150 kHz – 30 MHz
120 kHz for 30 MHz - 1 GHz
1 MHz for 1 GHz – 25 GHz

Measurement distance: 3 meters from 9 kHz to 30 MHz
3 meters from 30 MHz to 25 GHz

- Limit for emission radiated outside the frequency band, except the harmonics, shall be attenuated by at least 20 dB below the level of fundamental or the general radiated emission limits.

From 9 kHz to 30 MHz

Frequencies range	Limit (μ V/m)
9 – 490 kHz	2400/F (F in kHz) *
490 – 1705 kHz	24000/F (F in kHz) **
1.705 – 30 MHz	30 **

* Limits in μ V/m can be extrapolated to 3 m using 40 dB / decade.

** Limits in μ V/m can be extrapolated to 3 m using 20 dB / decade.

From 30 MHz to 25 GHz

Frequencies range (MHz)	Limit (dB μ V/m)	Limit (μ V/m)
30 to 88	40.0	100
88 to 216	43.5	150
216 to 960	46.0	200
Above 960	54.0	500

Instrumentation test list:

CATEGORY	BRAND	TYPE	Nr EMITECH
Amplifier	Mini-circuit	ZFL-1000LN	6367
Amplifier	MITEQ	AFS42-00102650-42-10P-42	3229
Antenna	Schwarzbeck	VHA 9103	0317
Antenna	Schwarzbeck	UHALP 9108	3106
Antenna	Emco	3115	3374
Antenna	Oritel	CM 42/25	1045
Antenna	Emco	6502	9579
Antenna mast	Maturo	MCU	8410
Antenna mast	Maturo	AM 4.0	8411
Cable	C&C	N-2m	11181
Cable	C&C	N-10m	11136
Cable	C&C	N-2m	11176
Cable	C&C	N-6m	11172
Cable	C&C	K-2m	11132
Cable	C&C	K-2m	11133
Filter	Micro-Tronics	HPM 14758	4691
Receiver	Rohde & Schwarz	ESRP7	10517
Shielded enclosure	SIDT	C.4	0549

Results:

Ambient temperature (°C): 22
 Relative humidity (%): 40
 Power source: 3 Vdc

Frequency 2402 MHz

FREQUENCY (MHz)	Detector	Antenna height (cm)	Azimuth (degree)	Resolution bandwidth	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
63.790	Quasi-peak	100	0	120 kHz	H	11.5	40.0	28.5
90.983	Quasi-peak	100	170	120 kHz	V	20.1	40.0	19.9
4804.46	Average	150	0	1 MHz	V	50.0	54.0	4.0
7206.74	Average	150	270	1 MHz	V	52.9	54.0	1.1

Frequency 2442 MHz

FREQUENCY (MHz)	Detector	Antenna height (cm)	Azimuth (degree)	Resolution bandwidth	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
80.627	Quasi-peak	100	150	120 kHz	V	13.6	40.0	26.4
87.758	Quasi-peak	100	150	120 kHz	V	17.3	40.0	22.7
4883.50	Average	150	0	1 MHz	V	49.7	54.0	4.3
7325.20	Average	100	310	1 MHz	V	48.5	54.0	5.5

Frequency 2480 MHz

FREQUENCY (MHz)	Detector	Antenna height (cm)	Azimuth (degree)	Resolution bandwidth	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
83.225	Quasi-peak	100	290	120 kHz	V	17.3	40.0	22.7
86.821	Quasi-peak	100	140	120 kHz	V	17.4	40.0	22.6
4959.48	Average	130	0	1 MHz	V	49.2	54.0	4.8
7440.76	Average	150	270	1 MHz	V	53.2	54.0	0.8

No significant frequency has been found other than those given above between 9 kHz to 30 MHz and 8 GHz to 25 GHz.

Test conclusion:

The equipment complies with the requirements of the standard.

« □□□ End of report, 6 annexes to be forwarded □□□ »

ANNEX 1

ANTENNA FACTORS, INSERTION LOSSES AND AMPLIFIER VALUES

BILL OF MATERIAL

The test antenna used for the radiated emission between 9 kHz and 30 MHz is the active loop antenna n°9579. Antenna factors are given in table 1.

The test antennas used for the radiated emission between 30 MHz and 1 GHz is the biconical n°0317 and logperiodic antenna n°3106. Antenna factors are given in table 2a and 2b.

The measuring receiver n°10517 used in the frequency range 9 kHz to 1 GHz has an integrated preamplifier.

The spectrum analyzer n°5175 is used in the frequency range 1 GHz to 25 GHz.

The test cable used between 9 kHz and 30 MHz to connect the antennas to the receiver for measurements at a distance of 3 meters has losses given in table 3.

The test cable used between 30 MHz and 1 GHz to connect the antennas to the receiver for measurements at a distance of 3 meters has losses given in table 4a, 4b and 4c.

The test antenna used for the radiated emission between 1 GHz and 18 GHz is the horn antenna n°3374. Factors are given in table 5.

The test antenna used for the radiated emission between 18 GHz and 25 GHz is the horn antenna n°1045. Factors are given in table 6.

The amplifier n°3229 used to connect the spectrum analyzer to the test cable has gain values given in the table 7.

The test cable used between 1 GHz and 18 GHz to connect the horn antenna to the amplifier for measurements at distance of 3 meters has losses given in table 8.

The test cable used between 18 GHz and 26 GHz to connect the horn antenna to the amplifier for measurements at distance of 3 meters has losses given in table 9a and 9b.

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
0.009	20.9	0.8	11.2
0.01	20.2	1	11.2
0.015	16.6	1.5	11.1
0.02	15.1	2	11.0
0.03	13.8	3	10.9
0.05	12.4	5	10.7
0.08	11.9	8	10.3
0.1	11.8	10	10.0
0.15	11.7	15	9.3
0.2	11.6	20	8.4
0.3	11.5	25	6.3
0.5	11.4	30	5.7

TABLE 1 : ACTIVE LOOP ANTENNA

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
30	19.5	100	10.8
35	17.2	120	12.0
40	15.2	140	14.2
45	13.2	160	15.9
50	11.4	180	16.0
60	8.1	200	16.4
70	6.6	250	17.8
80	6.9	300	20.7
90	8.6	-	-

TABLE 2a : BILCONICAL ANTENNA

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
200	24.3	600	19.6
250	17.6	700	20.4
300	14.6	800	21.3
400	17.0	900	21.9
500	18.5	1000	22.5

TABLE 2b : LOGPERIODIC ANTENNA

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
0.009	0.0	6.000	0.5
0.020	0.0	7.000	0.5
0.050	0.0	8.000	0.5
0.100	0.1	9.000	0.6
0.500	0.1	10.00	0.6
1.000	0.2	15.00	0.8
2.000	0.3	20.00	0.9
3.000	0.3	25.00	1.0
4.000	0.4	30.00	1.1
5.000	0.4	-	-

TABLE 3 : TEST CABLE FOR 3M MEASUREMENT INTO 9 kHz AND 30 MHz

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
30	0.1	250	0.2
40	0.1	300	0.3
50	0.1	400	0.3
60	0.1	500	0.4
70	0.1	600	0.4
80	0.1	700	0.5
90	0.1	800	0.5
100	0.1	900	0.6
150	0.2	1000	0.6
200	0.2	-	-

TABLE 4a : TEST CABLE FOR 3M MEASUREMENT INTO 30 MHz AND 1 GHz

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
30	0.3	250	0.8
40	0.3	300	0.8
50	0.4	400	1.0
60	0.4	500	1.1
70	0.4	600	1.2
80	0.4	700	1.3
90	0.5	800	1.4
100	0.5	900	1.5
150	0.6	1000	1.5
200	0.7	-	-

TABLE 4b : TEST CABLE FOR 3M MEASUREMENT INTO 30 MHz AND 1 GHz

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
30	0.3	250	1.1
40	0.4	300	1.2
50	0.5	400	1.4
60	0.5	500	1.7
70	0.5	600	1.8
80	0.6	700	2.0
90	0.6	800	2.1
100	0.7	900	2.3
150	0.8	1000	2.4
200	1.0	-	-

TABLE 4c : TEST CABLE FOR 3M MEASUREMENT INTO 30 MHz AND 1 GHz

Frequency (GHz)	Antenna factor (dB/m)	Frequency (GHz)	Antenna factor (dB/m)
1.0	23.7	10.0	37.6
1.5	25.0	10.5	37.8
2.0	27.5	11.0	38.1
2.5	28.8	11.5	38.3
3.0	29.8	12.0	38.8
3.5	31.2	12.5	38.8
4.0	32.5	13.0	39.4
4.5	32.5	13.5	40.0
5.0	33.5	14.0	40.1
5.5	34.1	14.5	40.6
6.0	34.1	15.0	40.6
6.5	34.4	15.5	39.7
7.0	35.4	16.0	39.3
7.5	36.6	16.5	39.9
8.0	36.6	17.0	41.4
8.5	37.0	17.5	45.1
9.0	37.1	18.0	46.3
9.5	37.2	-	-

TABLE 5 : HORN ANTENNA

Frequency (GHz)	Antenna factor (dB/m)	Frequency (GHz)	Antenna factor (dB/m)
18.0	30.7	22.5	30.9
18.5	30.7	23.0	31.2
19.0	30.5	23.5	31.1
19.5	30.7	24.0	31.3
20.0	30.7	24.5	31.5
20.5	30.8	25.0	31.0
21.0	30.9	25.5	31.0
21.5	30.5	26.0	31.4
22.0	30.6	-	-

TABLE 6 : HORN ANTENNA

Frequency (GHz)	Gain value (dB)	Frequency (GHz)	Gain value (dB)
1.0	33.4	12.0	32.4
1.5	33.7	13.0	32.5
2.0	33.9	14.0	31.6
2.5	34.0	15.0	33.0
3.0	33.9	16.0	33.5
4.0	34.3	17.0	33.9
5.0	35.2	18.0	34.3
6.0	34.7	19.0	34.4
7.0	34.0	20.0	32.9
8.0	33.7	21.0	33.2
9.0	31.8	22.0	34.3
9.5	31.1	23.0	34.6
10.0	30.5	24.0	34.4
10.5	30.7	25.0	34.5
11.0	31.1	26.0	32.5

TABLE 7 : AMPLIFIER GAIN VALUE

Frequency (GHz)	Gain value (dB)	Frequency (GHz)	Gain value (dB)
1.0	1.6	9.5	5.6
1.5	2.0	10.0	5.7
2.0	2.4	10.5	5.8
2.5	2.7	11.0	5.9
3.0	3.0	12.0	6.2
4.0	3.4	13.0	6.4
5.0	3.8	14.0	6.6
6.0	4.1	15.0	7.1
7.0	4.6	16.0	7.3
8.0	5.1	17.0	7.6
9.0	5.5	18.0	7.8

TABLE 8 : TEST CABLE FOR 3M MEASUREMENT INTO 1 TO 18 GHz

Frequency (GHz)	Loss (dB)
18.0	3.8
19.0	3.8
20.0	3.9
21.0	4.0
22.0	4.1
23.0	4.2
24.0	4.3
25.0	4.4
26.0	4.5

TABLE 9a: TEST CABLE FOR 3M
MEASUREMENT INTO 18 TO 26 GHz

Frequency (GHz)	Loss (dB)
18.0	3.8
19.0	3.8
20.0	3.9
21.0	4.0
22.0	4.1
23.0	4.2
24.0	4.3
25.0	4.4
26.0	4.5

TABLE 9b: TEST CABLE FOR 3M
MEASUREMENT INTO 18 TO 26 GHz

ANNEX 2

EXTERNAL PHOTOGRAPH

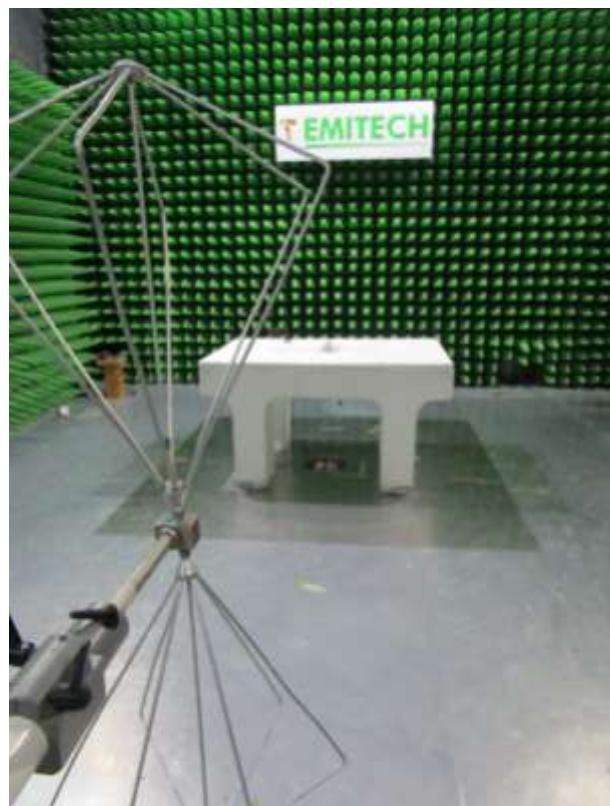


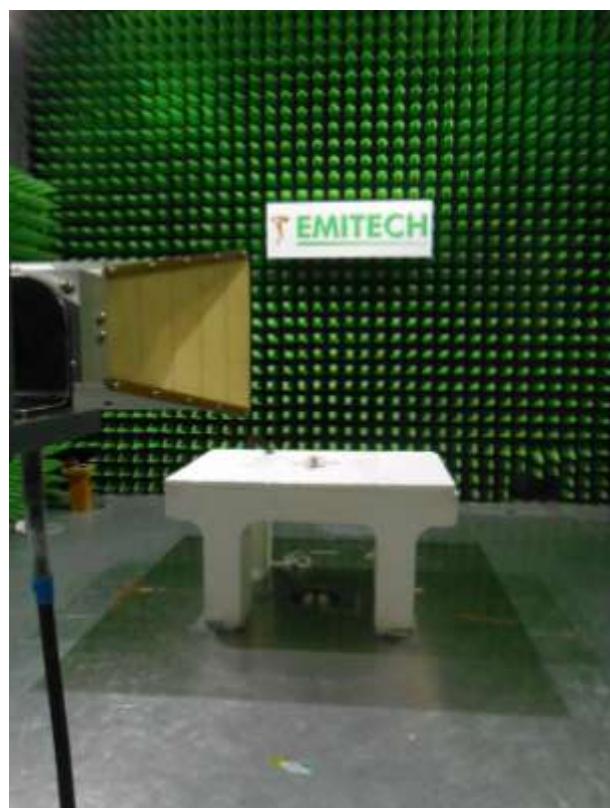


ANNEX 3

TEST SETUP PHOTOGRAPHS







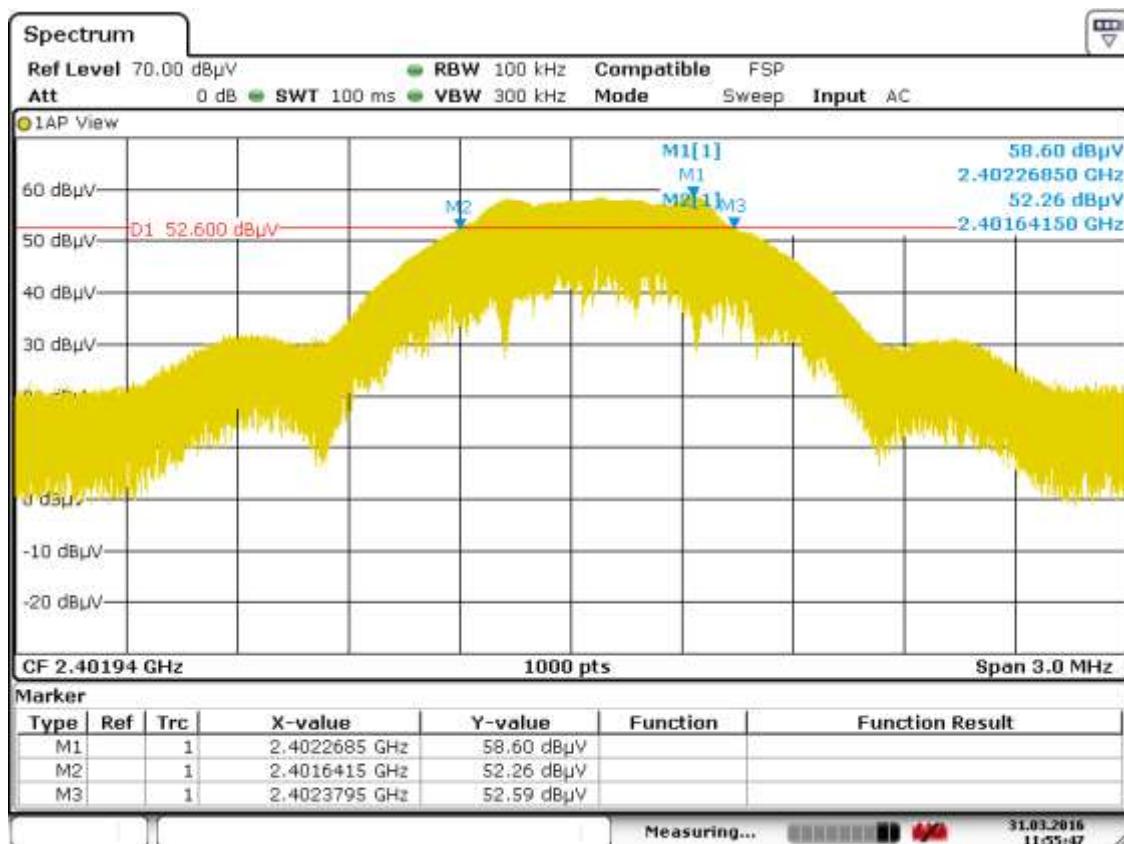


ANNEX 4

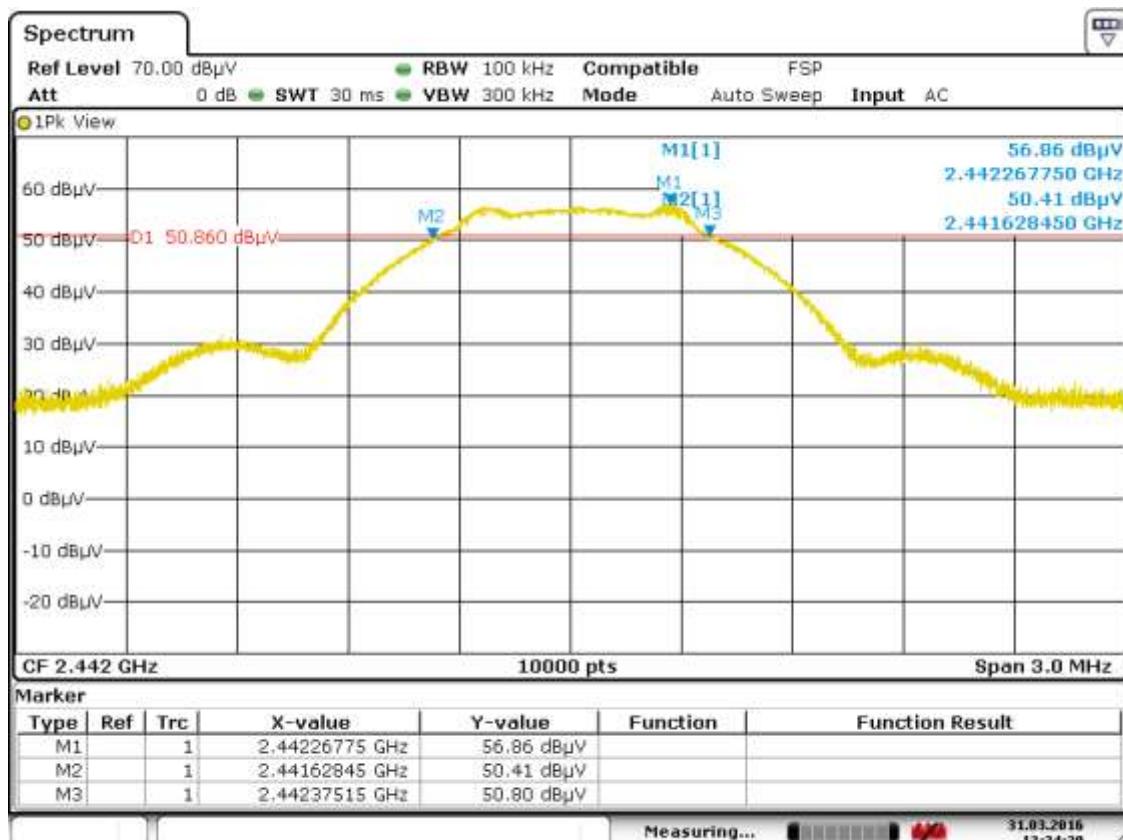
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20 dB BANDWIDTH

6 dB BANDWIDTH

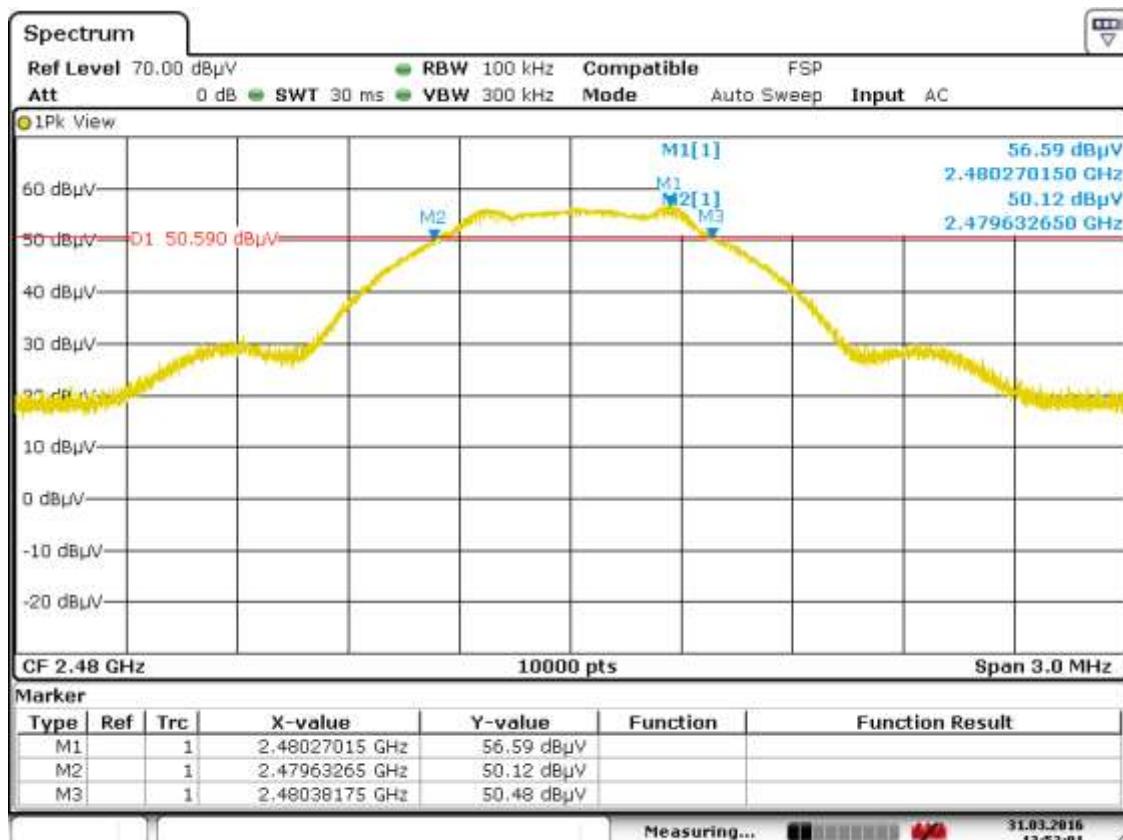
Frequency 2402 MHz



Frequency 2442 MHz

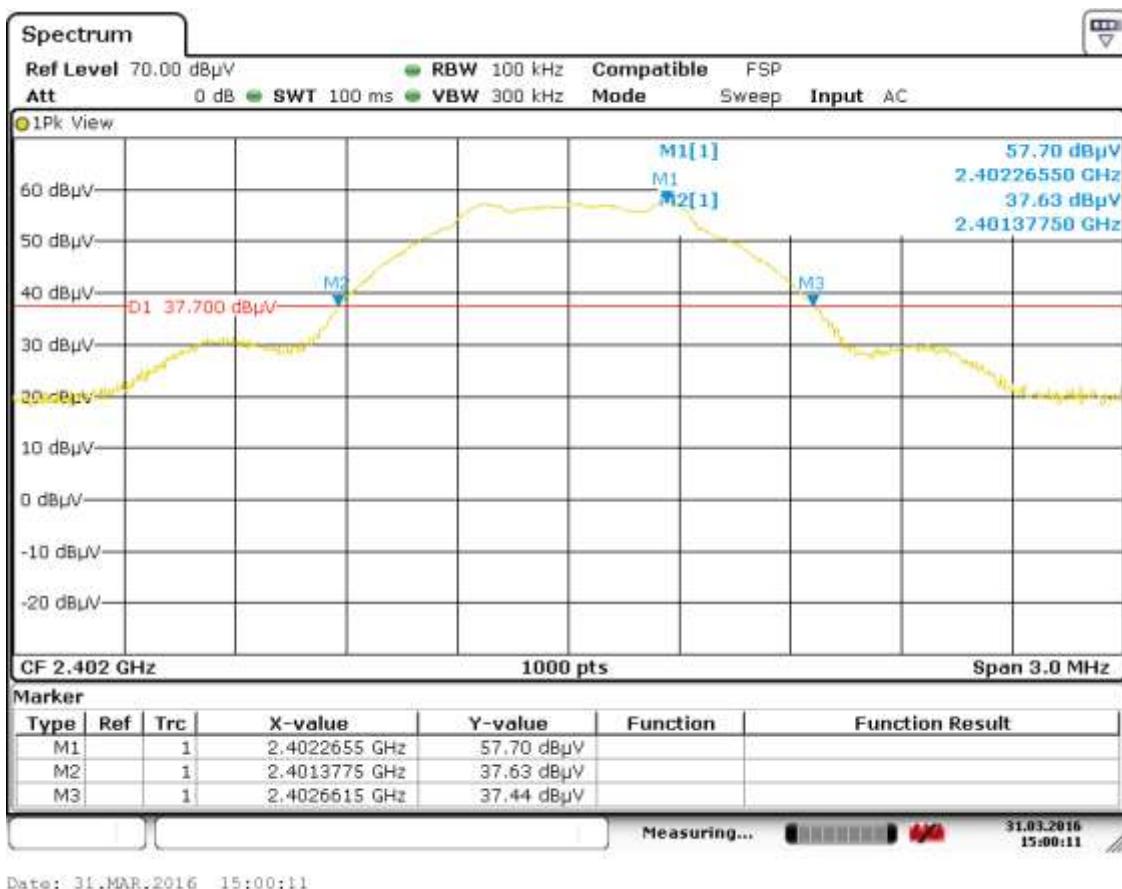


Frequency 2480 MHz

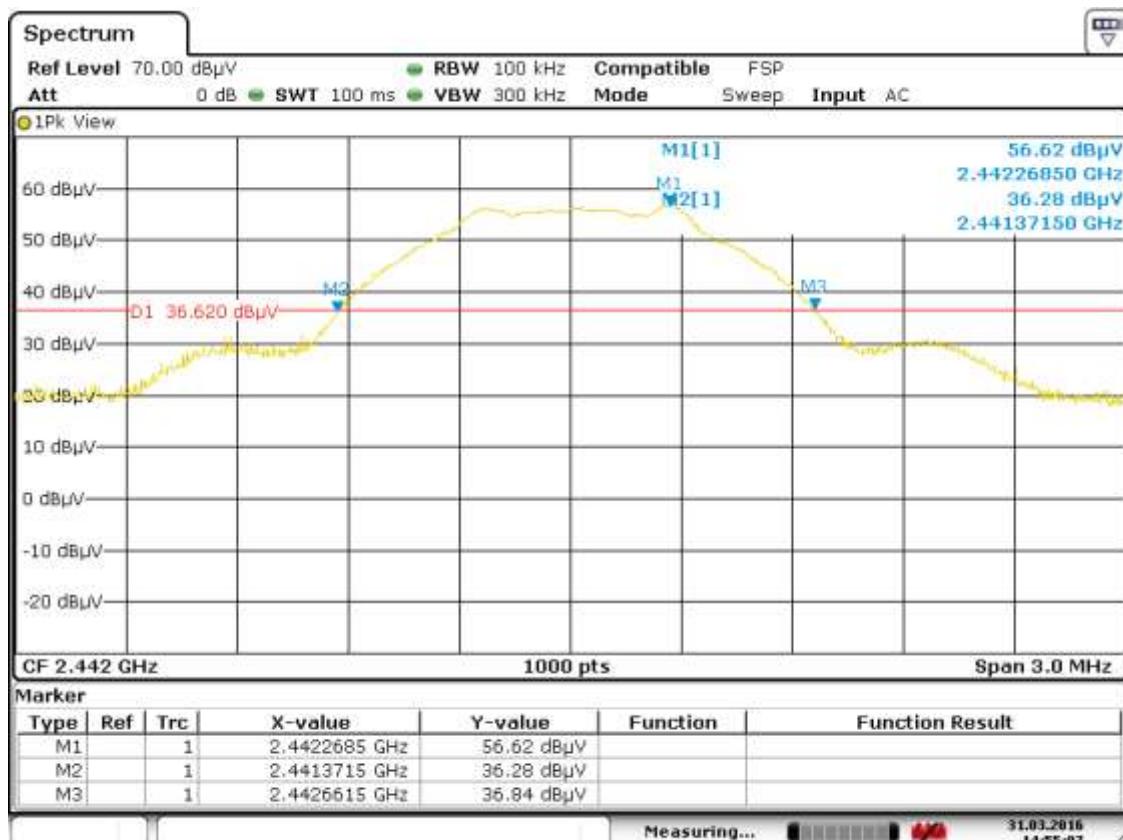


20 dB BANDWIDTH

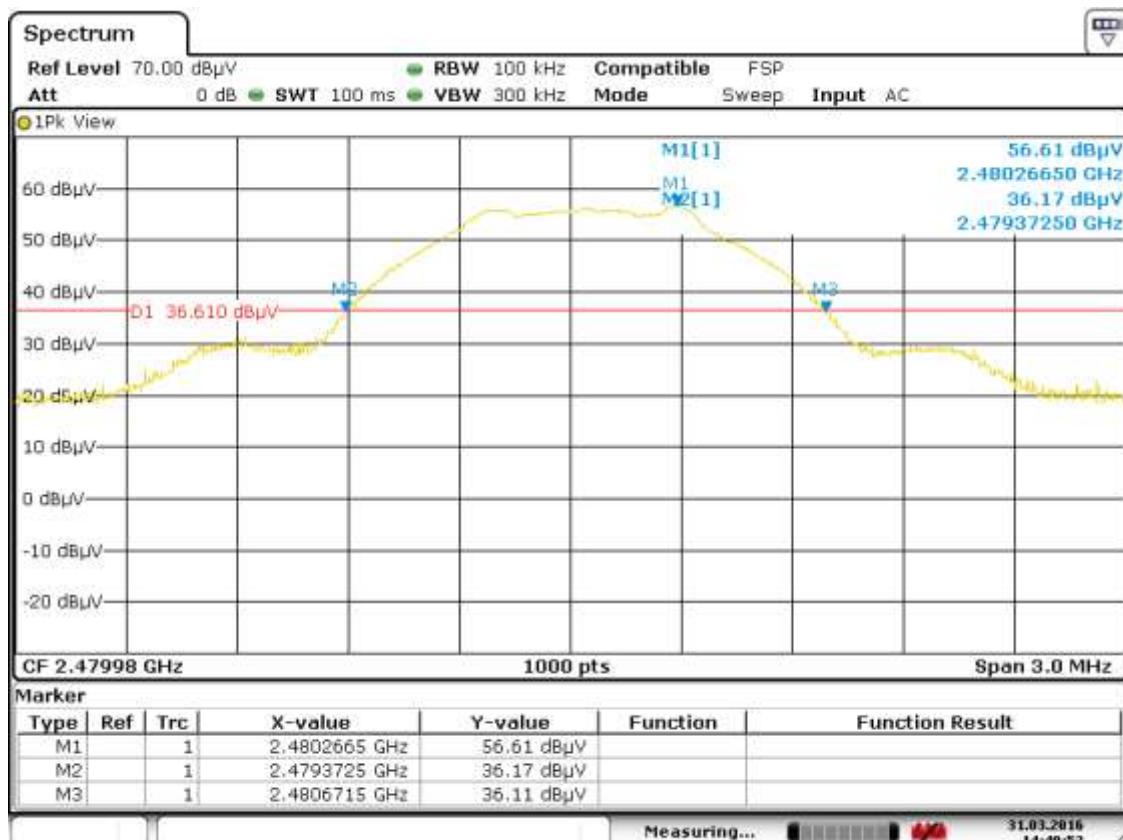
Frequency 2402 MHz



Frequency 2442 MHz



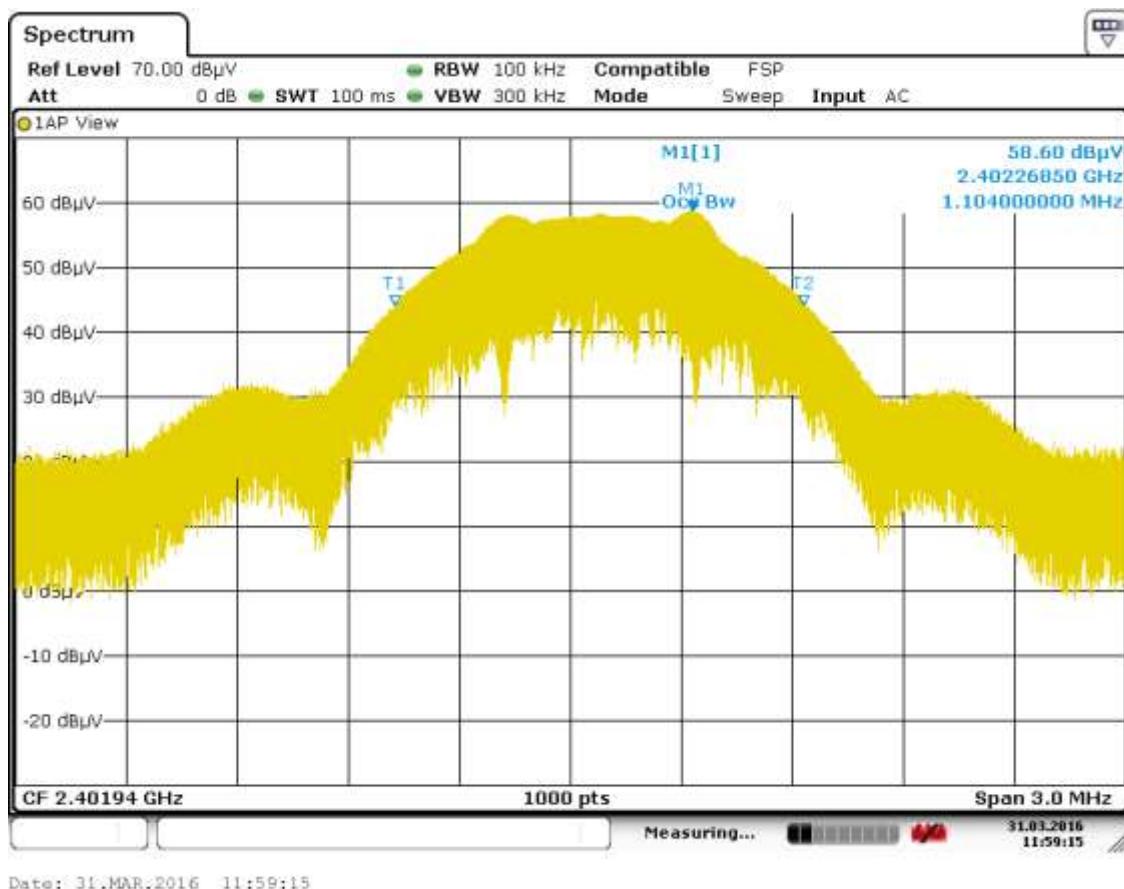
Frequency 2480 MHz



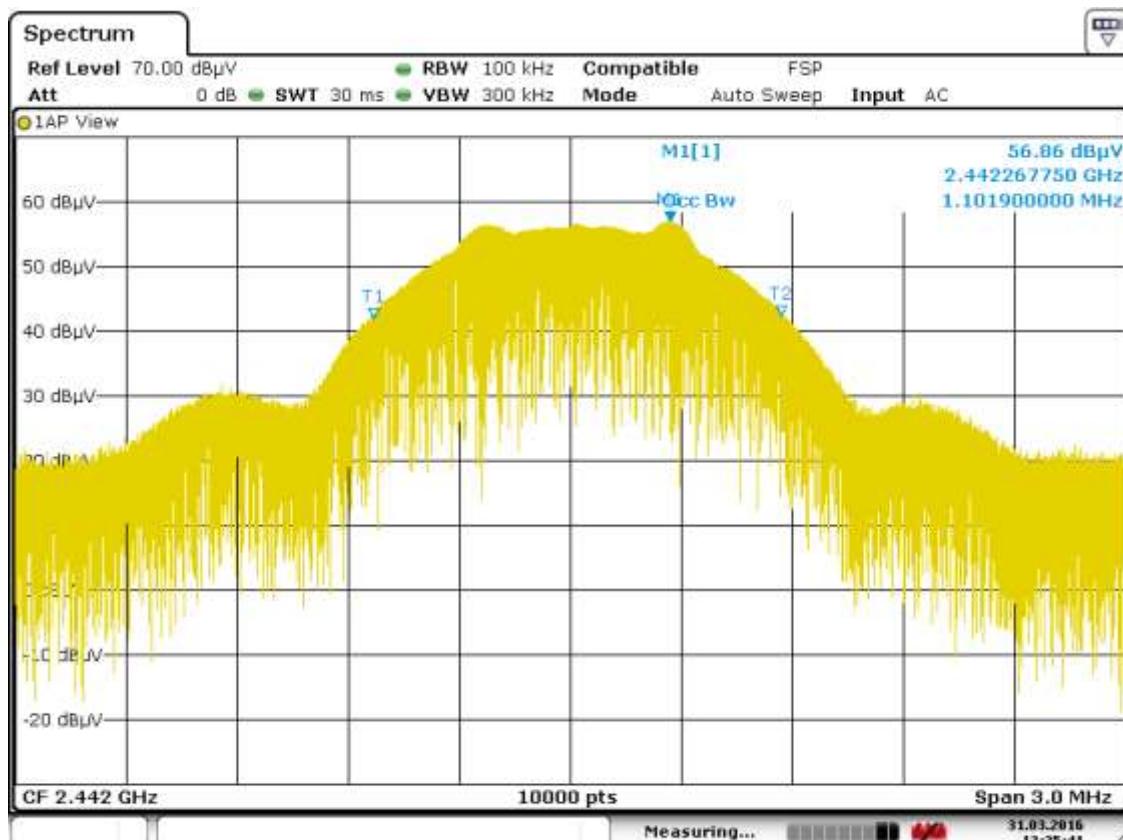
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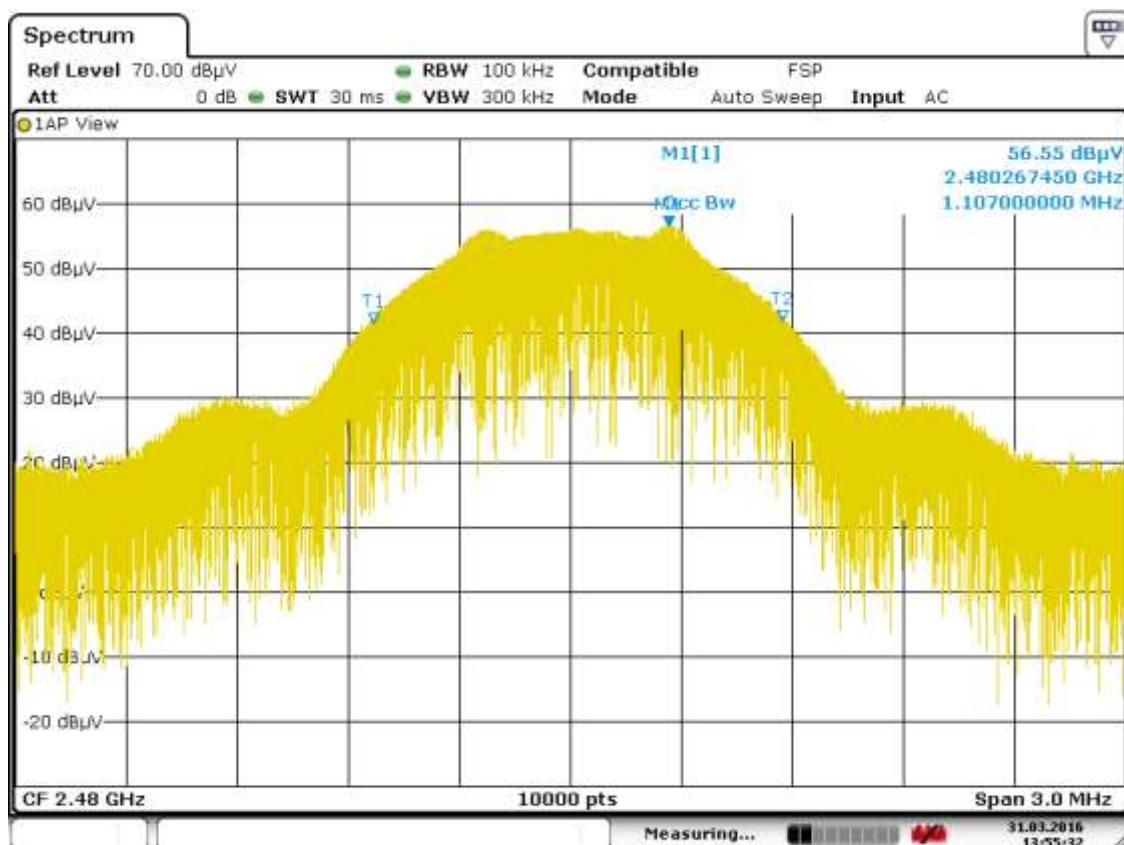
Frequency 2402 MHz



Frequency 2442 MHz

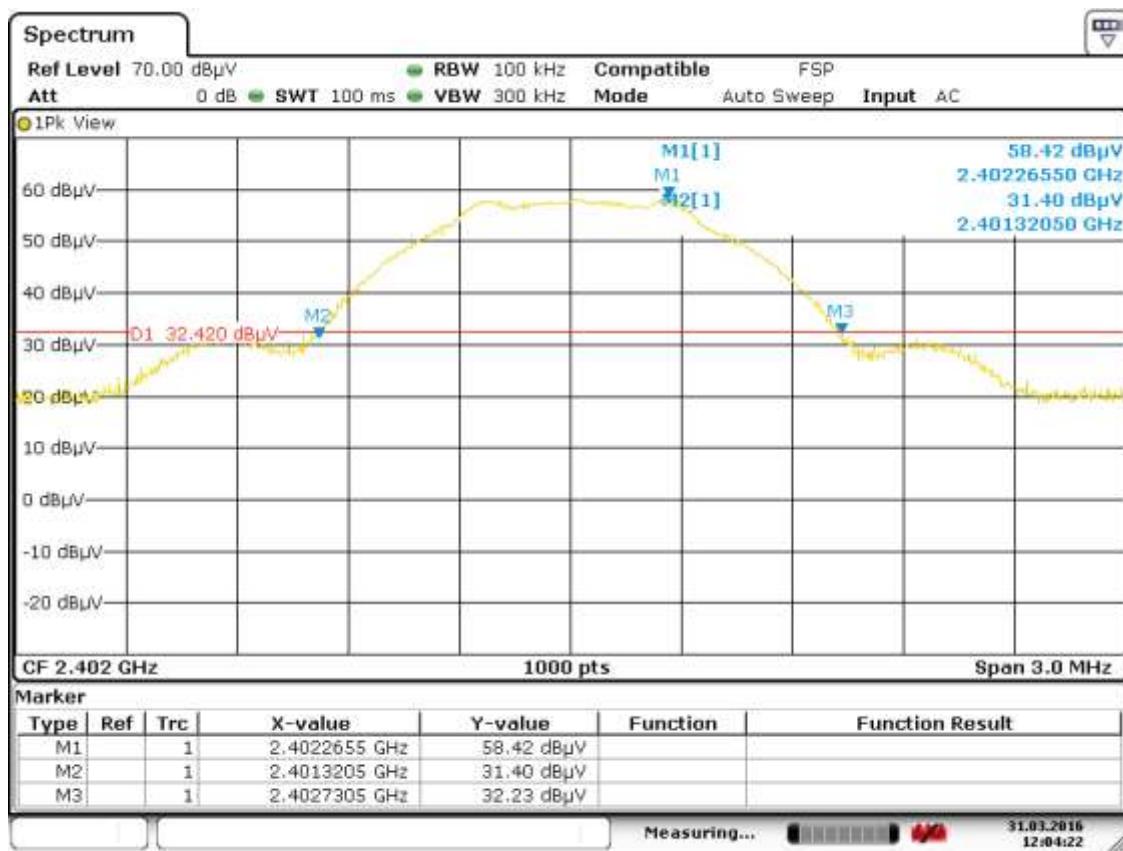


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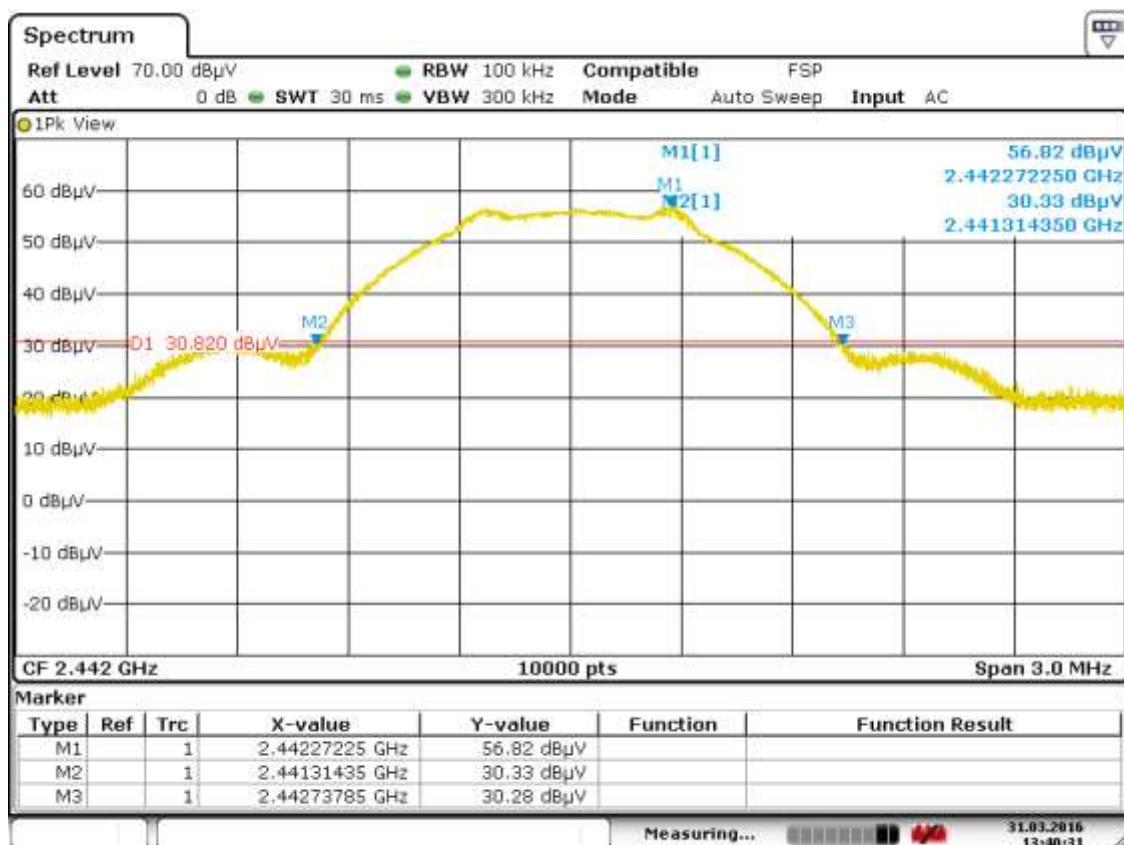


26 dBc BANDWIDTH

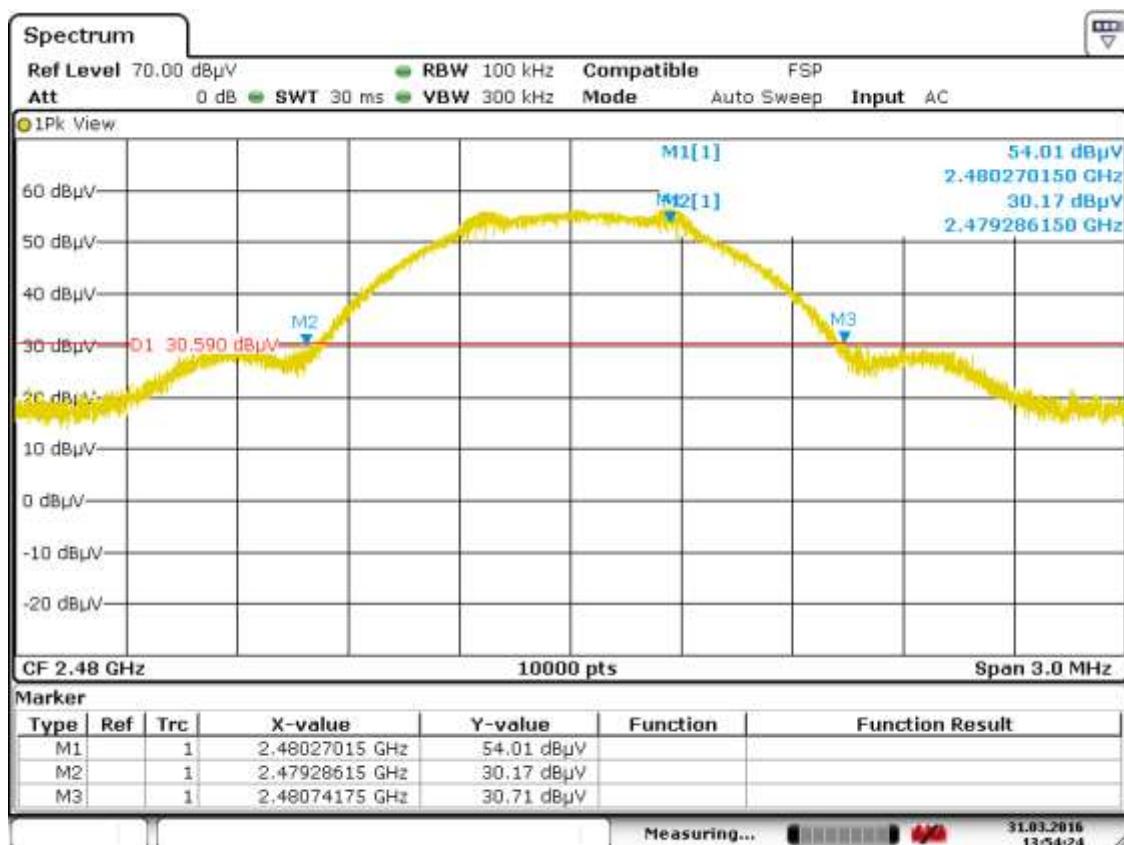
Frequency 2402 MHz



Frequency 2442 MHz

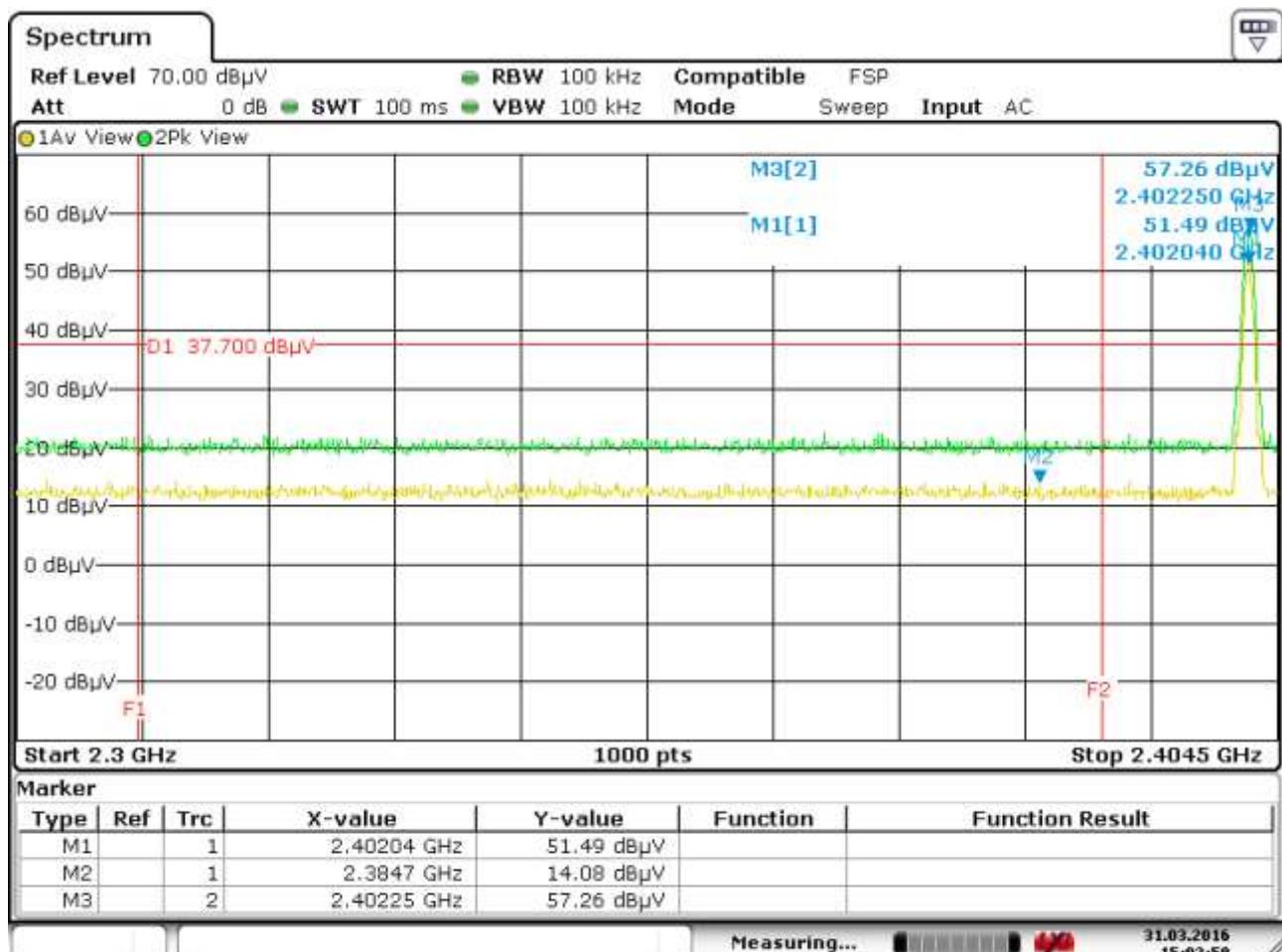


Frequency 2480 MHz

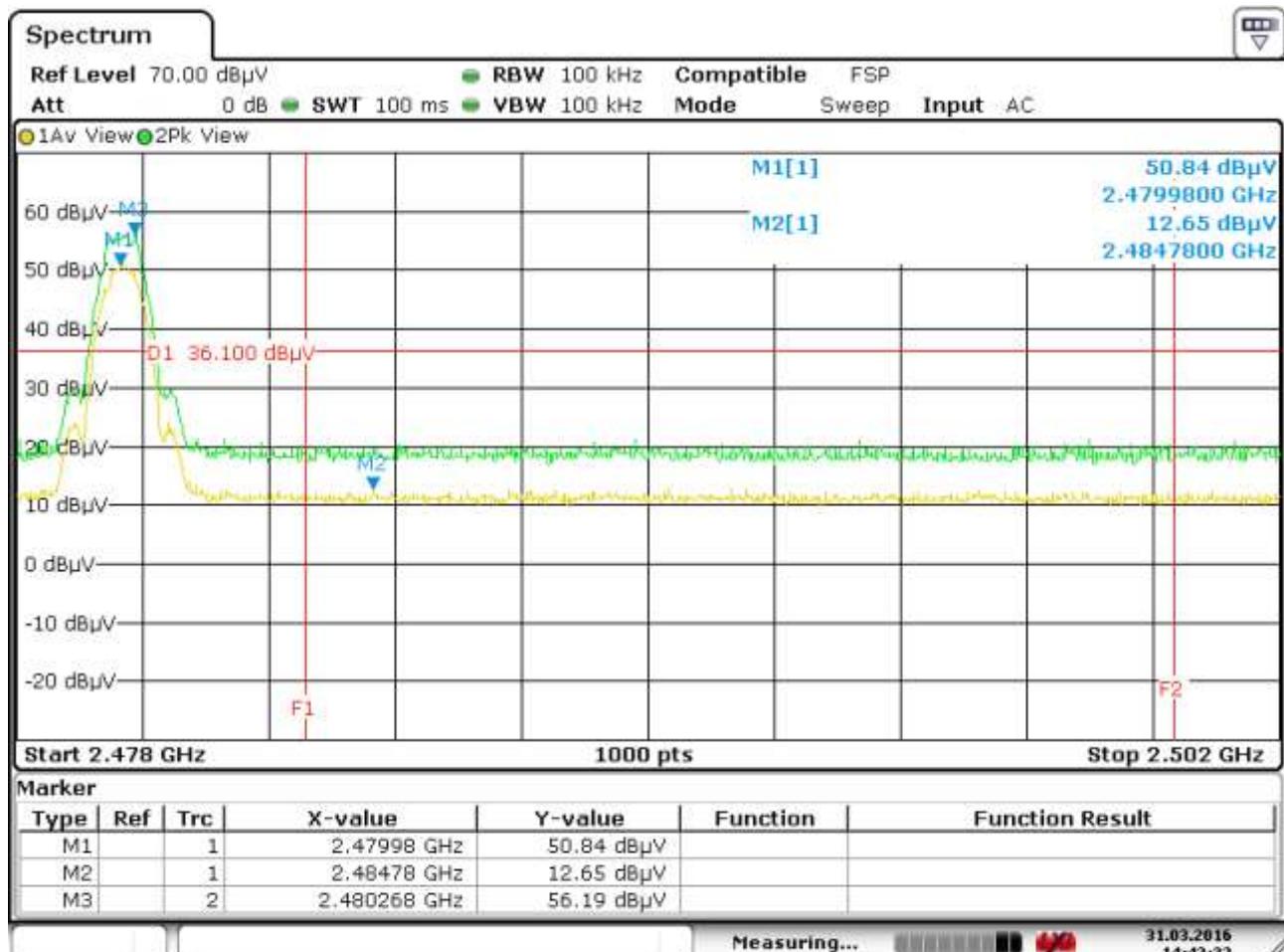


ANNEX 5

BAND EDGE



Date: 31.MAR.2016 15:03:59



Date: 31.MAR.2016 14:42:32

ANNEX 6

CALIBRATION DATES

N° EMITECH	LAST CALIBRATION	CALIBRATION DUE DATE
10517	18/09/2014	18/09/2016
0549	16/02/2015	16/02/2018
0317	18/02/2015	18/02/2019
3106	05/06/2014	05/06/2016
11136	10/03/2014	10/05/2016
11172	28/03/2014	28/05/2016
11181	28/03/2014	28/05/2016
11182	28/03/2014	28/05/2016
1045	21/03/2015	21/03/2019
11132	10/03/2014	10/05/2016
11133	10/03/2014	10/05/2016
3374	28/10/2015	28/10/2018
9579	21/08/2015	21/08/2017
3229	02/04/2015	02/06/2016
6367	16/07/2015	16/07/2016
1176	28/03/2014	18/03/2016
4691	30/04/2015	30/04/2017