Rapport d'essais / *Test Report*

N° : **22281-FCC-IC-1**

FCC Test Firm Registration Number: 171131
Industry Canada Test Firm Number: Site# 9545A-1

Matériel testé : *Equipment under test*:	**OCTOPUS**

Constructeur: *Manufacturer:*	**JOY** 5 avenue du Belveder 54000 Nancy – France
Rapport délivré à : *Issued to*:	**JOY** 5 avenue du Belveder 54000 Nancy – France
Référence de la proposition : *Proposal number:*	22281
Date de l'essai : *Date of test:*	Du 3 au 7 mars 2017 *March 3rd to 7th, 2017*
Objectif des essais : *Test purpose*:	EMC qualification accordingly to following standards: - CFR 47, FCC Part 15, Subpart B & C *(Chapter 15.247 - Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz)* - Industry Canada ICES-003 Issue 6 & RSS-247, Issue 1 *(Digital Transmission Systems Operating in the Bands 2400-2483.5 MHz)*
FCC ID: IC ID : Model :	2AKSXO1R7 22301-O1R7 O1R7
Lieu du test: *Test location:*	SMEE CE-Mesures 38 VOIRON - France
Test réalisé par : *Test realized by:*	Jérémy BLANCHER
Conclusion : *Conclusion:*	L'équipement satisfait aux prescriptions des normes citées en référence. *The appliance complies with requirements of above mentioned standards.*

Ed.	Date	Modifications / Pages	Written by:	Approved by: Visa
1 2	March 10th, 2017 March 14th, 2017	Initial Edition TCB review	Jeremy Blancher	Laurent Chapus

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1. Normatives References

FCC qualification following:		
Standards	**Applied**	**Title**
ANSI C63.4 (2014)	X	American National Standard for 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 (2013)	X	American National Standard for Testing Unlicensed Wireless Devices
CFR47, Part 15	X	Telecommunication – Federal Communication Commission – Radio frequency devices, Sections 15.107 / 15.109 / 15.207 / 15.209 / 15.247

Industry Canada qualification following:		
Standards	**Applied**	**Title**
ICES-003 (Issue 6/2016)	X	Information Technology Equipment (ITE) – Limits and methods of measurement
RSS-Gen (Issue 4/2014)	X	General Requirements and Information for the Certification of Radio Apparatus
RSS-247 (Issue2/2017)	X	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Note: Following guidance are used

- DTS Measurement Guidance 558074 D01 v03r05
- Determining ERP and EIRP Guidance 412172 D01 v01r01

2. Test synthesis

TEST	Paragraph number FCC Part 15 / IC RSS-247 / RSS-GEN	Spec. FCC Part 15 / IC RSS-247 / RSS-GEN	RESULTS (comments)
Conducted emissions test	15.207 (a) RSS-Gen § 8.8	Table 15.107 (a) Table 15.207 (a)	**PASS** [1]
Radiated emission test	15.209 (a) RSS-Gen § 7.1	Table 15.209 (a) Table §7.1.2	**PASS**
6dB Bandwidth	15.247 (a) (2) RSS-247 § 5.2 (a)	At least 500kHz	**PASS**
Maximum Peak Output Power	15.247 (b) (3) RSS-247 § 5.4 (d)	1W max / 30dBm (Conducted) 4W max / 36dBm (EIRP)	**PASS**
Maximum Power Spectral Density	15.247 (e) RSS-247 § 5.2 (b)	8dBm in a 3kHz band segment	**PASS**
Unwanted emissions into Non Restricted Frequency Bands	15.247 (d) / RSS-247 § 5.5	-20dBc in any 100kHz outside frequency band.	**PASS**
Unwanted emissions into Restricted Frequency Bands	15.209 (a) / 15.247 (d) / 15.205 (a) RSS-GEN § 7.1, §8.9, § 8.10 / RSS-247 § 5.5	Measure at 300m 9-490kHz: 2400µV/m/F(kHz) Measure at 30m 0.490-1.705: 24000µV/m/F(kHz) 1.705-30MHz: 30µV/m Measure at 3m 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m	**PASS**
Occupied Bandwidwth	RSS-GEN § 6.6	BW at 99%	**PASS**

N/A: Not Applicable
[1]: For battery charging mode only

- **General conclusion:**

Measures and tests performed on the sample of the product *OCTOPUS*, in configuration and description presented in this test report, show compliance with standards FCC CFR 47, PART 15, Subpart B & C and Industry Canada ICES-003, RSS-Gen & RSS-247.

3. Equipment Under Test (EUT)

Nom /
Identification

OCTOPUS

Sn: N.C

Alimentation /
Power supply

- 3.7V dc from a Lithium battery (normal used mode)
- 5V DC from standard AC/DC power adapter (charge mode)

Auxiliaires /
Auxiliaries

For charge mode:
- Companion device (JOY equipment), USB to 3 points cable converter
- POGO cable (Joy equipment), USB to 3points cable converter
- Standard power adapter Dong Guan AoHai Power Technology Co. Ldt, model A18A-050100U-US2 (AC Mains to USB output)

Entrées-Sorties /
Input / Output

	Câbles pour essai / *Cables for test*	Blindé / *Shielded*	Prévu pour >3m / *Intended for >3m*
USB to Pogo connector *	2wires, 1m	Yes	No
USB cable (Companion) *	USB2.0, 1.8m		

* Note: Cable for battery charging only (no data transfer possible)

Version programme /
Firmware version

N.C

Mode de fonctionnement /
Running mode

The tested sample is able to:
- Transmit a carrier frequency on low, middle and high channels (Bluetooth Low Energy) without battery charging mode
- Transmit a carrier frequency on low, middle and high channels (Bluetooth Low Energy) with battery charging mode on the Companion nightlight station or with the USB to Pogo 1m cable
- Be in Receiver mode (no transmission)
- Be in standby mode (no transmission)

Programme de test /
Test program /

N.C

- **<u>Equipment information:</u>**

- ISM Frequency band: 2400 to 2483.5 MHz (Tx & Rx, Wideband Data Transmission systems)
- Bluetooth chip: nRF51822, Nordic product (Multiprotocole Bluetooth Low Energy System)
- Power Setting: Power is set at is maximum (+4dBm)
- Modulation: Bluetooth Low Energy
- Data rate: 250kb/s, 1Mb/s & 2Mb/s available
- Antenna type: Integral (SMD ceramic, 0dBi peak gain)
- Powered by 3.7V DC from internal battery
- Equipment intended for use as a portable station
- Equipment designed for continuous operation

4. Test conditions

Relative Humidity : 50-65%
Temperature : 10-20°C

Power supply voltage:
Equipment under test: 3.7V DC from Li-battery (Fully charged)
5V DC from standard power adapter

5. Modifications of the EUT

None

6. Special accessory

None

7. Conducted Emission Measurement (150kHz-30MHz)

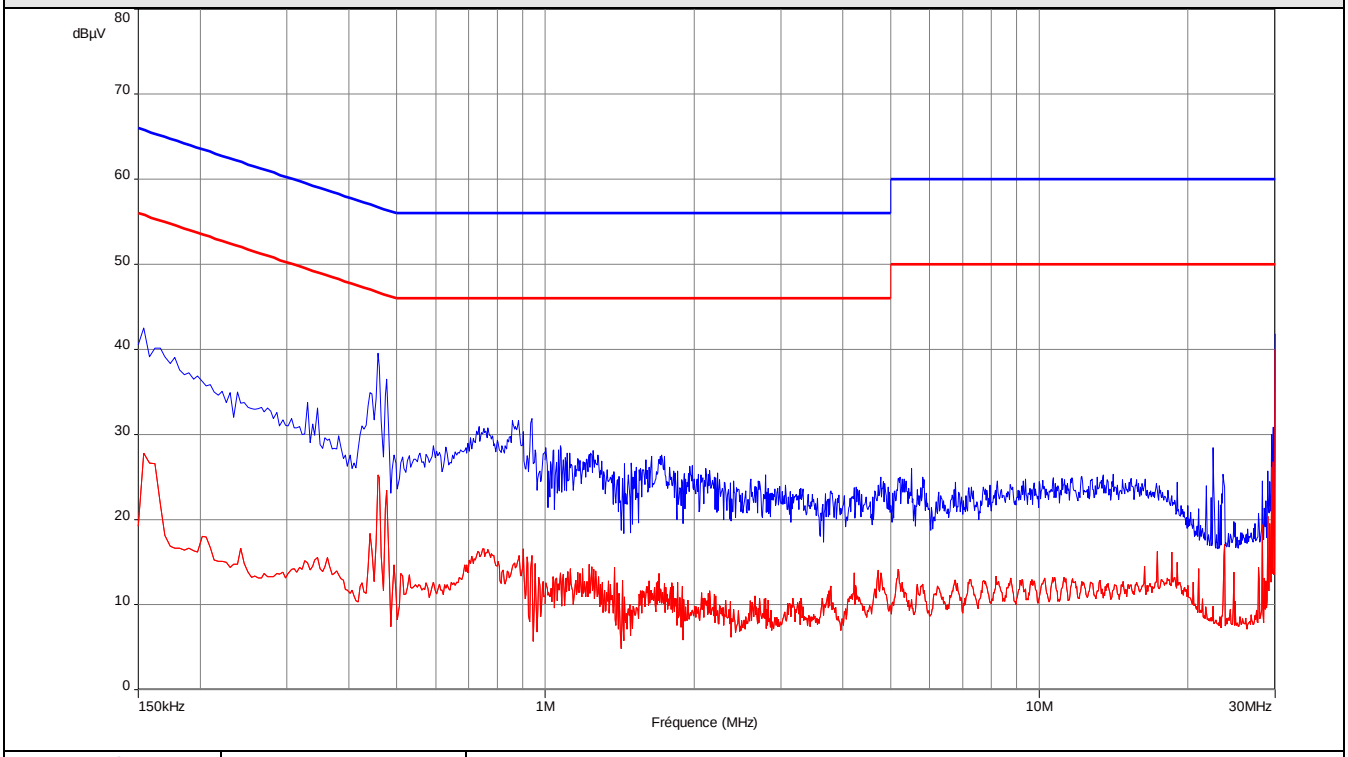
TEST: Limits for conducted disturbance 150kHz – 30MHz				**Verdict**
Method: The LISN is placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment were at least 0,8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on lines were made at the output of the LISN. The EUT is 80cm above the ground reference plane and 40cm from the vertical ground plane. The AC power cable is 1m length.				**Pass**
Laboratory Parameters:	Required prior to the test		During the test	
Ambient Temperature	10 to 40 °C		20°C	
Relative Humidity	10 to 90 %		55%	
Fully configured sample scanned over the following frequency range	Frequency range on each side of line		Measurement Point	
	150kHz to 30MHz		AC input ports (110V on standard power adapter)	
Running mode	Battery charging			
Limits				
Frequency (MHz)	Limit dB (µV)			
	Quasi-Peak	Result	Average	Result
0.15 – 0.50	66 \ 56	**Pass**	56 \ 46	**Pass**
0.50 – 5	56	**Pass**	46	**Pass**
5 – 30	60	**Pass**	50	**Pass**
Supplementary information: Test location: SMEE – CE Mesures Test date: March 6th, 2017 Power supply voltage: 110V / 60Hz for 5V DC power adapter				

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Attenuator / limiter	SMEE	ATT#1	ATT-101-004	2016/3	2017/3
Cable RF	Div	2m	CAB-101-007	2016/3	2017/3
LISN (50Ω / 50µH)	AFJ	LS16C	RSI-101-001	2016/3	2017/3
LISN (50Ω / 50µH)	AFJ	LS16C	RSI-101-002	2016/3	2017/3
Measuring Rec	Rohde&Schwarz	ESRP	REC-151-021	2015/7	2018/7
Ref. Comb generator	SMEE	EMC-250K	REF-111-001	-	-

Tabulated Results for Mains Terminal Disturbance Voltage on AC port								
Companion device								
FREQ (MHz)	**Meas. PK** (dBµV)	**Mes. QP** (dBµV)	**LIMIT QP** (dBµV)	**Margin QP** (dB)	**Mes. AV** (dBµV)	**LIMIT AV** (dBµV)	**Margin AV** (dB)	Line
Margin < -20dB								Line L1
0,474	44,2	42,9	56,4	**-13,5**	37,0	46,4	**-9,4**	Neutral
POGO cable								
FREQ (MHz)	**Meas. PK** (dBµV)	**Mes. QP** (dBµV)	**LIMIT QP** (dBµV)	**Margin QP** (dB)	**Mes. AV** (dBµV)	**LIMIT AV** (dBµV)	**Margin AV** (dB)	Line
Margin < -20dB								Line L1
0,474	42,5	41,4	56,4	**-15,1**	35,9	46,4	**-10,6**	Neutral

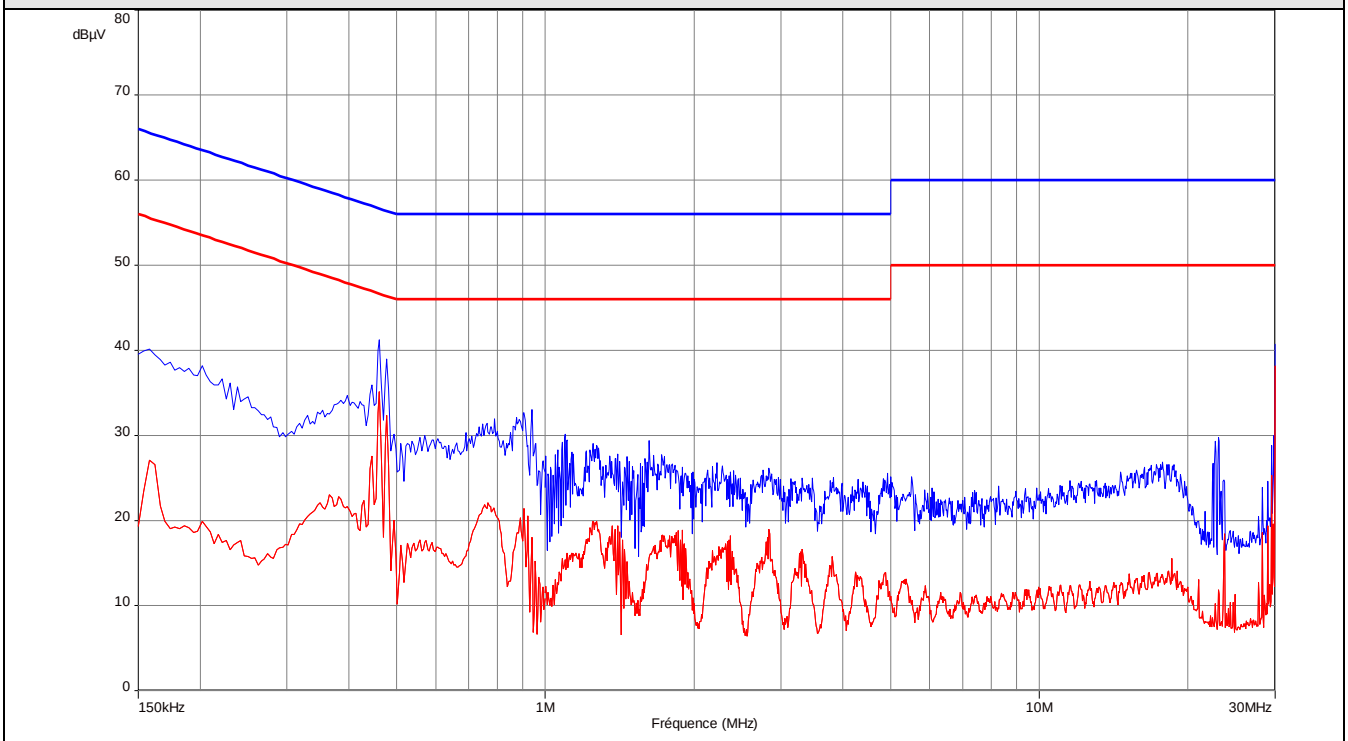
Frequency band investigated:	150kHz-30MHz
RBW:	9kHz
Voltage:	110V / 60Hz
Limit:	FCC Part 15.107 / 15.207 / ICES-003
Final measurement detector:	Quasi-Peak and Average
Wide Measurement Uncertainty:	± 3.6dB (k=2)
RESULT:	PASS
Measured value calculation:	The measured value (level) is calculated by adding the Cable Factor, the Transient suppressor attenuation and LISN attenuation from the receiver amplitude reading. The basic equation is as follow: Meas. = RA + CF + ATT_{TRAN} + ATT_{LISN} Where Meas. = Level (dBµV) RA = Receiver Amplitude CF = Cable Factor ATT_{TRAN} = Transient suppressor attenuation ATT_{LISN} = LISN attenuation Margin value = Emission level – Limit value

Graphical representation of Conducted Disturbance Measurement (Peak and Average detection)
AC port, Line L1 – Companion device



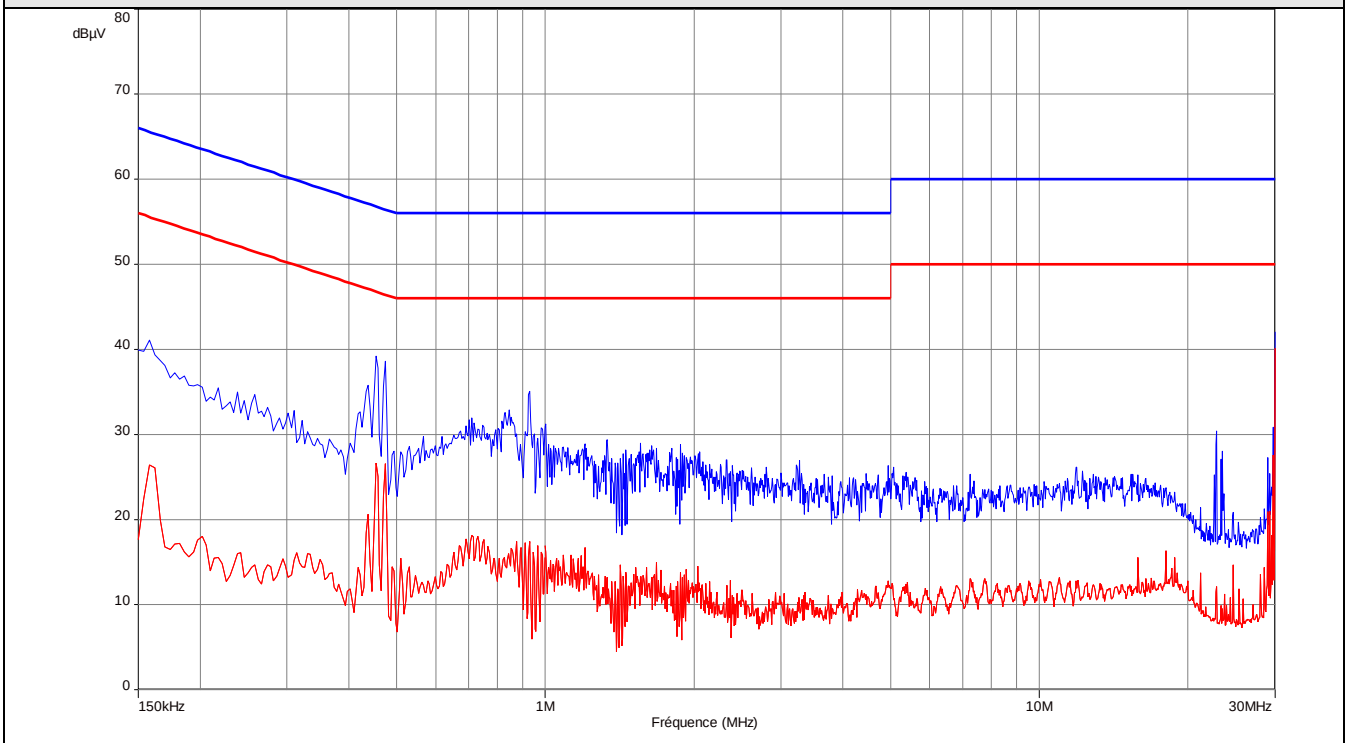
----: Peak	----: Average	

Graphical representation of Conducted Disturbance Measurement (Peak and Average detection)
AC port, Line Neutral – Companion device



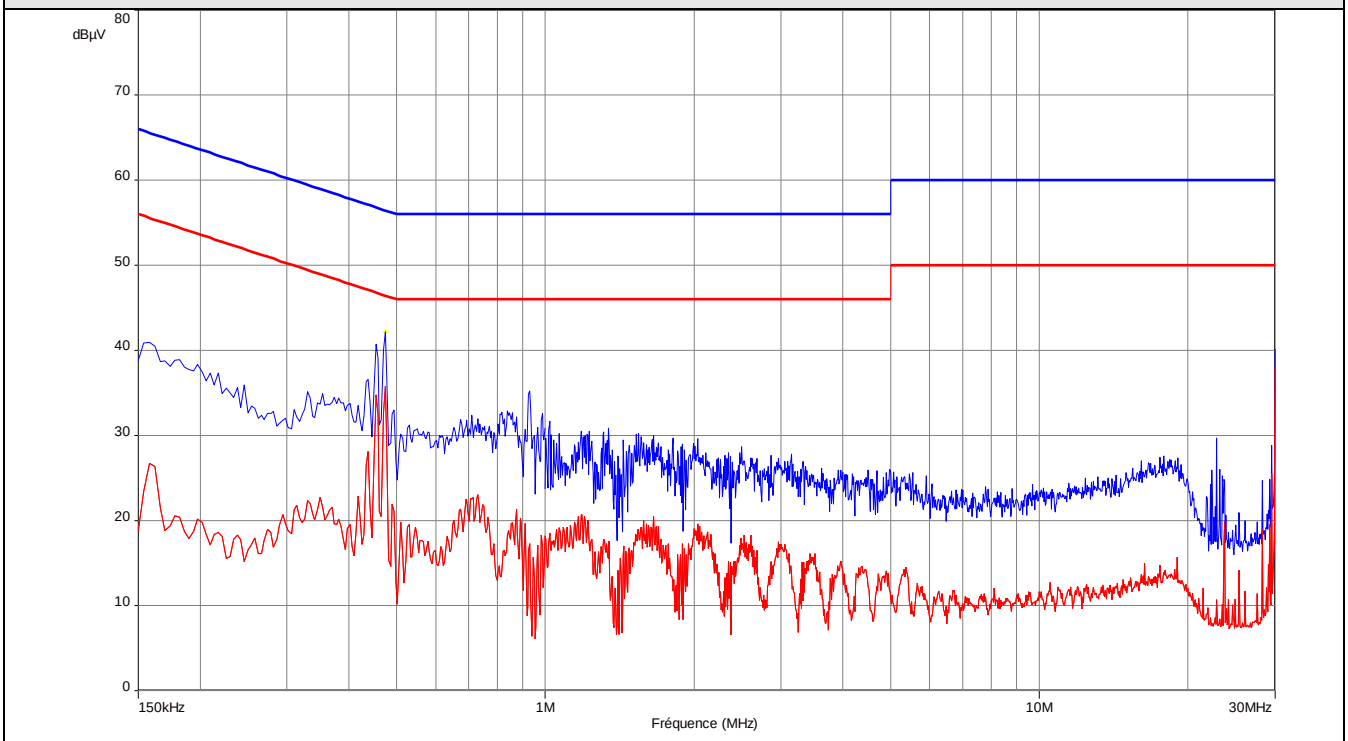
----: Peak	----: Average	

Graphical representation of Conducted Disturbance Measurement (Peak and Average detection)
AC port, Line L1 – POGO cable



----: Peak	----: Average	

Graphical representation of Conducted Disturbance Measurement (Peak and Average detection)
AC port, Line Neutral – POGO cable



----: Peak	----: Average	

8. Radiated Emission Measurement (30MHz-1GHz)

TEST: Limits for radiated disturbance 30 MHz – 1 GHz		**Verdict**
Method: Measurements were made in a 3-meter Open Area Test Site (OATS). Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meters. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (Peak, Quasi-peak) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. A pre-scan frequency identification of the EUT has been performed in full anechoic chamber. The measured radiated field of the EUT is realised at 3-meters of distance. Antenna is 1.25-meters high. The pre-characterization graphs are obtained in PEAK detection.		**Pass**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	10 to 40 °C	20°C
Relative Humidity	10 to 90 %	55%
Fully configured sample scanned over the following frequency range	Frequency range on each side of line	Measurement Point
	30MHz – 1GHz	3 m measurement distance
Running mode	Battery Charging mode	
Limits		
Frequency (MHz)	Limit at 3m (dBµV/m)	
	Level / Detector	Results
30 to 88	40.0 (QP)	**Pass**
88 to 216	43.5 (QP)	**Pass**
216 to 960	46.0 (QP)	**Pass**
960 to 1000	54.0 (QP)	**Pass**
Above 1GHz	54.0 (AV) 74.0 (PK)	**Pass**
Supplementary information: Test location: SMEE Test date: March 7th, 2017 by J. Blancher Power supply voltage: 5V DC via external power adapter		

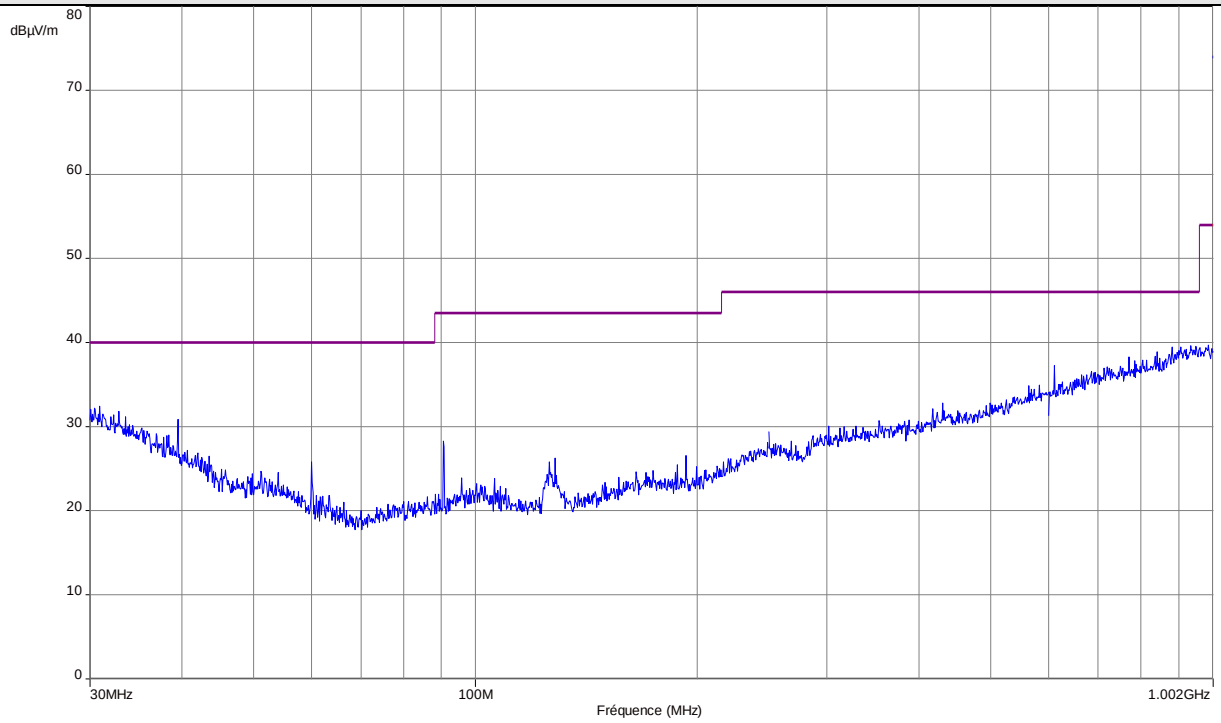
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2016/8	2017/8
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2016/8	2017/8
BiConiLog antenna	EMCO	3142B	ANT-101-010	2016/8	2017/8
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
RF cable	Div	2m	CAB-101-011	2016/3	2017/3
RF cable	Div	OATS/25m	CAB-101-019	2016/3	2017/3
RF cable	Div	OATS/10m	CAB-101-020	2016/3	2017/3
Anechoic chamber	COMTEST	214263	CAG-141-001	-	-
OATS	Div	10m	SIT-101-001	2016/8	2017/8
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-
Measuring Rec	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7
Ref. Comb generator	SMEE	EMR-10M	REF-111-002	-	-

Tabulated Results for Radiated Disturbance (3m measurement on Open Area Test Site, 30MHz-1GHz)										
With Companion device										
FREQ	**Meter reading**	**Meter reading**	**Total Factor**	**Field level**	**Field level**	**Pol**	**Antenna height**	**Table angle**	**Limit**	**Margin**
MHz	(QP) dBµV	(Pk) dBµV	dB	(QP) dBµV/m	(Pk) dBµV/m		cm	Degré	(QP) dBµV/m	dB
Margin < -10dB										
With POGO Cable										
FREQ	**Meter reading**	**Meter reading**	**Total Factor**	**Field level**	**Field level**	**Pol**	**Antenna height**	**Table angle**	**Limit**	**Margin**
MHz	(QP) dBµV	(Pk) dBµV	dB	(QP) dBµV/m	(Pk) dBµV/m		cm	Degré	(QP) dBµV/m	dB
Margin < -10dB										

Supplementary information:
Frequency list measured on the Open Area Test Site has been created with pre-scan results.
3-axis measurement performed for device under test.

Frequency band investigated:	30MHz-1GHz
RBW:	120kHz
Measurement distance:	3m
Limit:	FCC Part 15.109 / 15.209 / ICES-003
Final measurement detector:	Quasi-Peak
Wide Measurement Uncertainty:	± 5.2dB (k=2)
RESULT:	PASS
Field Strength Calculation:	The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follow: FS = RA + AF + CF – AG Where FS = Field Strength (Level) RA = Receiver Amplitude (Meter reading) AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain Total factor (dB) is AF + CF – AG Margin value = Emission level – Limit value

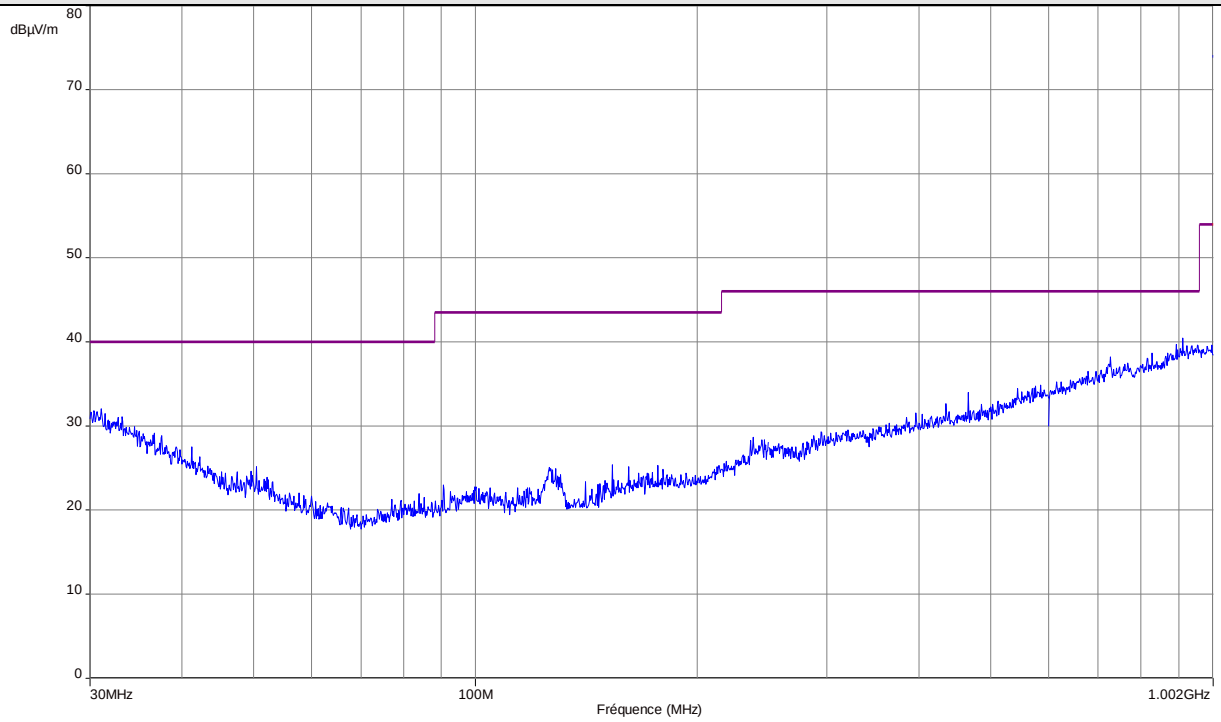
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal) – With Companion



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Class B limit (3m)	

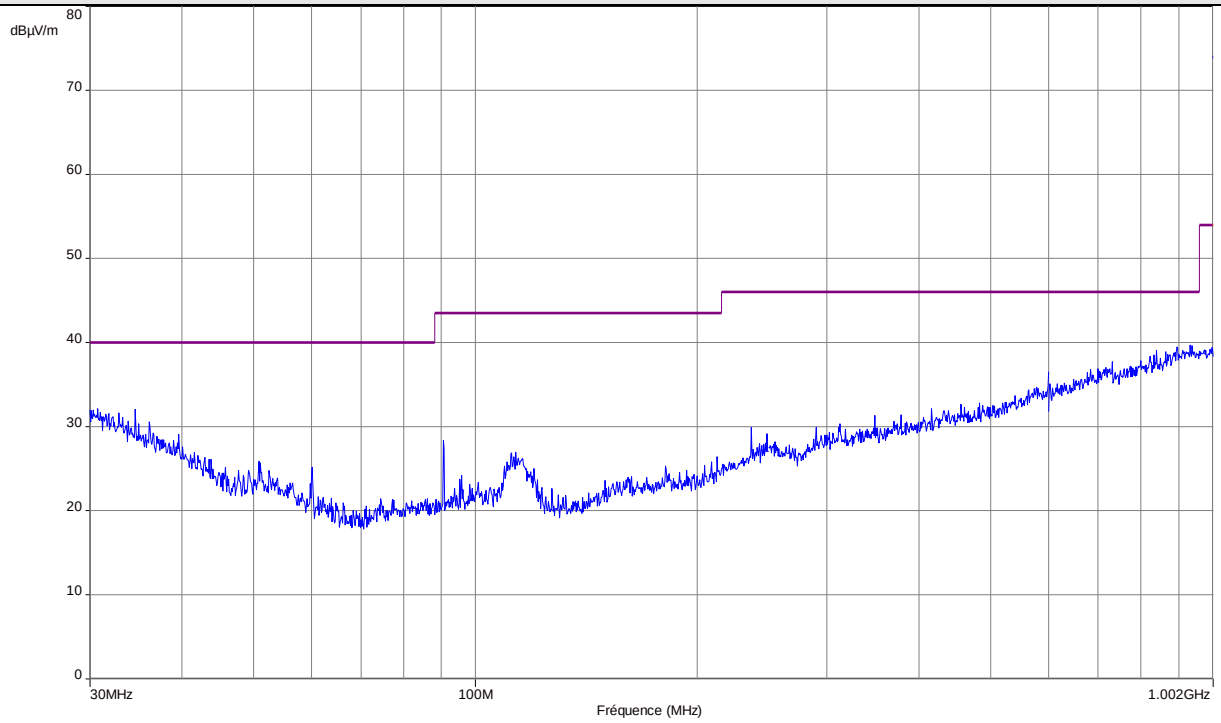
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical) – With Companion



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Class B limit (3m)	

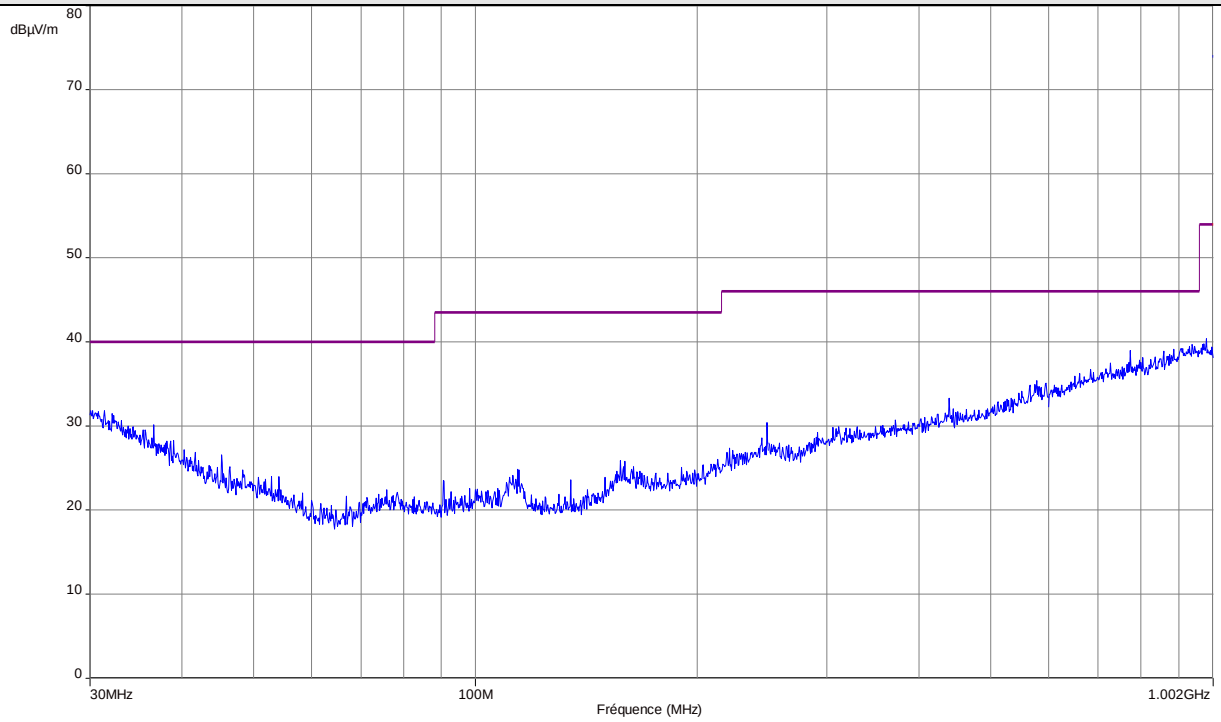
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal) – With POGO Cable



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Class B limit (3m)	

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical) – With POGO Cable



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Class B limit (3m)	

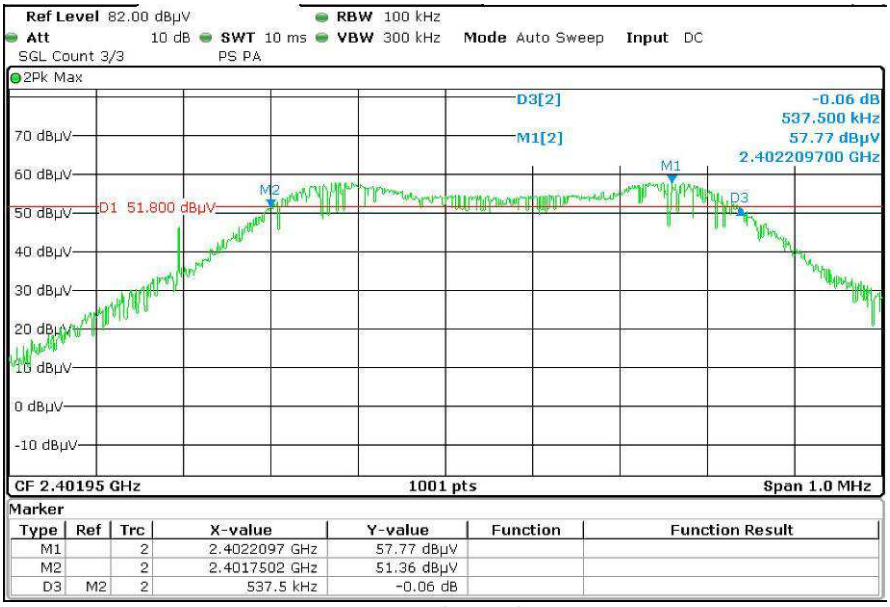
9. 6dB Bandwidth

TEST: 6dB Bandwidth		**Verdict**
Method: The setup is in an anechoic chamber. The spectrum analyzer is connected to the measuring antenna. A radiated measurement is performed. The RBW is 100kHz, with VBW ≥ 3 x RBW. The SPAN is wide enough to capture all products of the modulation process. A MaxHold Peak detector is used. The tested equipment is set to transmit operation with modulation on low, mid and high channels.		**Pass**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	10 to 40 °C	20°C
Relative Humidity	10 to 90 %	55%
Limits – FCC Part 15.247 (a) / RSS-247 §5.2 (a)		
Frequency (MHz)	**Level for Bandwidth**	**Limit**
2402.0	6dB below the maximum output power	At least 500kHz
2440.0		
2480.0		
Supplementary information: Test location: SMEE Test date: March 7th, 2017 by J. Blancher Power supply voltage: 3.7V from battery (fully charged)		

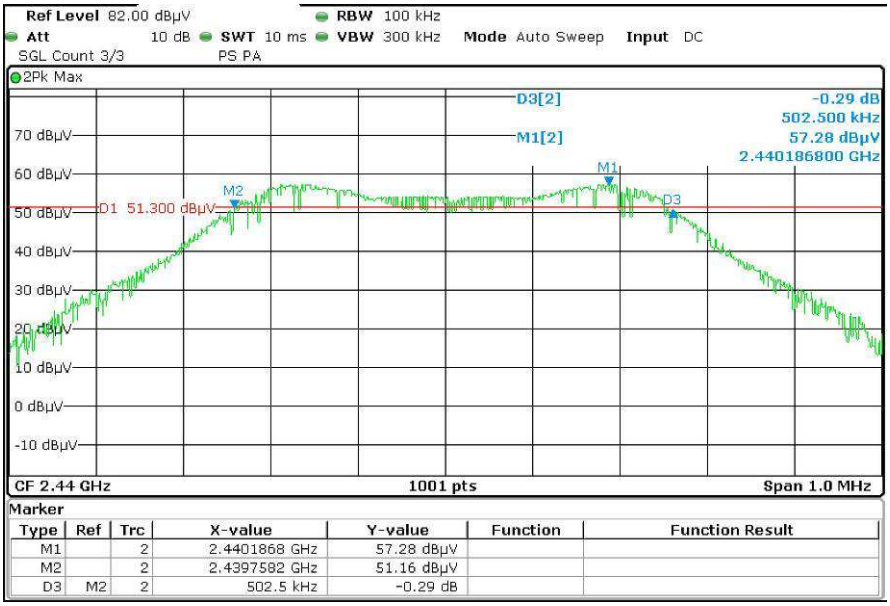
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2016/3	2017/3
RF cable	Pasternack	PE302-120	CAB-131-024	2016/3	2017/3
Anechoic chamber	COMTEST	214263	CAG-141-001	-	-
Turntable	Innco- Systems	CT0800	PLA-141-001	-	-

Tabulated Results for Occupied Bandwidth		
Frequency (MHz)	**6dB Bandwidth** (kHz)	**Result**
2402.0	537.5 kHz	**Pass**
2440.0	502.5 kHz	**Pass**
2480.0	503.5 kHz	**Pass**

Graphical representation of 6dB Bandwidth

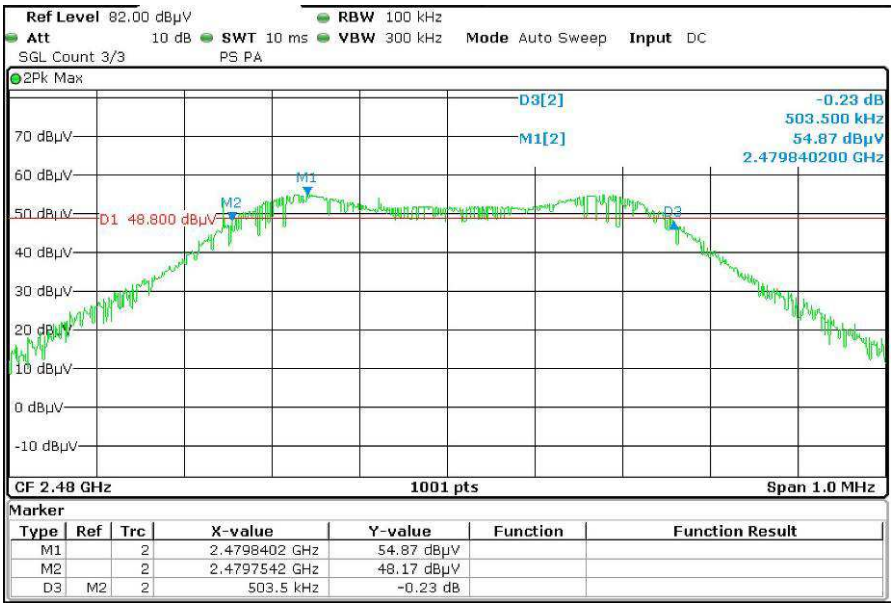


Low channel



Mid channel

Frequency band investigated:	2400MHz to 2483.5MHz
RBW :	100kHz
Measurement detector :	Peak

Graphical representation of 6dB Bandwidth	
 *High channel*	
Frequency band investigated:	2400MHz to 2483.5MHz
RBW :	100kHz
Measurement detector :	Peak
Note :	Worst case measurement between Charge mode and Normal used mode

10. Maximum Peak Output power

TEST: Maximum peak conducted output power			**Verdict**
Method: A radiated and conducted measurement is performed. The RBW is wide enough to capture the maximum amplitude level (1MHz). The SPAN is wide enough to capture all products of the modulation process. A MaxHold Peak detector is used. Radiated field strength of RF Output Power is measured at 3m on Open Area Test Site. Maximum field strength (Peak) is performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity. Measurement is performed for three axis positions of EUT (X, Y, Z). The tested equipment is set to transmit operation with modulation on low, mid and high channels.			**Pass**
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	10 to 40 °C	13°C	
Relative Humidity	10 to 90 %	65%	

Limits – FCC Part 15.247 (b) / RSS-247 §5.4 (d)		
Frequency (MHz)	Limits (dBµV/m)	
	Level / Detector	Results
2400 to 2483.5	36 dBm / Pk / 3m (Radiated)	**Pass**
2400 to 2483.5	30 dBm / Pk (Conducted)	**Pass**

Supplementary information:
Test location: SMEE
Test date: March 3rd, 2017 by J. Blancher
Power supply voltage: 3.7V from battery (fully charged) / 5V DC from power adapter (with charger)

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
RF cable	Div	OATS/25m	CAB-101-017	2016/3	2017/3
OATS	Div	3 / 10m	SIT-101-001	2015/8	2016/8
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-

Tabulated Results for Maximum peak output power (Radiated measurement)				
On battery running (normal used mode)				
FREQ	**Field Strength 3m**	**Calculed EIRP**	**Limit**	**Result**
(MHz)	(dBµV/m)	(dBm)	(dBm)	
2402	92.3	**-3.0**	36.0	**Pass**
2440	93.4	**-1.9**	36.0	**Pass**
2480	90.0	**-5.3**	36.0	**Pass**
With charger (battery charging mode)				
FREQ	**Field Strength 3m**	**Calculed EIRP**	**Limit**	**Result**
(MHz)	(dBµV/m)	(dBm)	(dBm)	
2402	91.5	**-3.8**	36.0	**Pass**
2440	93.7	**-1.6**	36.0	**Pass**
2480	90.8	**-4.5**	36.0	**Pass**

RBW:	1MHz
Measurement distance:	3m
Limit:	FCC Part 15.247 / RSS-247
Final measurement detector:	Peak
Wide Measurement Uncertainty:	± 5.2dB (k=2)
RESULT:	PASS
Note:	(1): The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follow: FS = RA + AF + CF – AG Where FS = Field Strength RA = Receiver Amplitude AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain Total factor (dB) is AF + CF – AG Margin value = Emission level – Limit value (2): EIRP is calculated using the following equation: EIRP = E + 20xlog (D) – 104.8 – GR Where EIRP = Equivalent Isotropic Radiated Power in dBm E = Electric field strength in dBµV/m D = Measuring distance in meter GR = Ground reflection in dB (0dB above 1GHz) (3): Test performed on OATS at 3m distance

Tabulated Results for Maximum peak output power (Conducted)			
FREQ	**Conducted power**	**Limit**	**Result**
(MHz)	(dBm)	(dBm)	
2402	**-0.9**	30.0	**Pass**
2440	**-0.9**	30.0	**Pass**
2480	**-1.0**	30.0	**Pass**

RBW:	1MHz
Limit:	FCC Part 15.247 / IC RSS-247
Final measurement detector:	Peak
RESULT:	PASS
Note:	Conducted power measured on the antenna port of the device.

11. Maximum Power Spectral Density Level in the fundamental emission

TEST: Maximum Peak Power Spectral Density		**Verdict**
Method: Conducted measurement		**Pass**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	10 to 40 °C	NA
Relative Humidity	10 to 90 %	NA
Limits – FCC Part 15.247 (e) / RSS-247 §5.2 (b)		
Frequency (MHz)	**Level / Detector**	**Limit**
2441.75	8 dBm/3kHz / Pk	**Pass**
Supplementary information: Test location: SMEE Test date: March 3rd, 2017 by J. Blancher Power supply voltage: 3.7 from battery (fully charged)		

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7
RF cable	Pasternack	PE302-120	CAB-131-024	2016/3	2017/3

Tabulated Results for Maximum Power Spectral Density			
Frequency (MHz)	**PSD (dBm/3kHz)**	**Limit**	**Result**
2402	**-0.9** [1]	8dBm/3kHz	**Pass**
2440	**-0.9** [1]	8dBm/3kHz	**Pass**
2480	**-1.0** [1]	8dBm/3kHz	**Pass**
RBW:	100kHz		
Limit:	FCC Part 15.247 / RSS-247		
Final measurement detector:	Peak		
RESULT:	PASS		
Note:			

[1]: Measured output power reported. Maximum Peak Output power complies with the PSD limit.
See Clause 11.10.1 of ANSI C63.10 (2013).

12. Unwanted emissions in Non-Restricted Frequency bands

TEST: Unwanted emissions in Non-Restricted Frequency Bands			**Verdict**
Method: Measurements were made in a 3-meter Open Area Test Site (OATS). Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (Peak) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. A pre-scan frequency identification of the EUT has been performed in full anechoic chamber. The measured radiated field of the EUT is performed (or corrected) at 3-meters of distance. Antenna is 1.25-meters high.			**Pass**
Laboratory Parameters:	Required prior to the test		During the test
Ambient Temperature	10 to 40 °C		13°C
Relative Humidity	10 to 90 %		65%
Fully configured sample scanned over the following frequency range	Frequency range on each side of line		Measurement Point
	30MHz – 25GHz		3 m measurement distance
Limits – FCC Part 15.247 (d) / RSS-247 § 5.5			
Frequency (MHz)	Limits (dBµV/m)		
	Detector / Analyser RBW	Limit	Results
30 to 25000	Pk / 100kHz	20dB below the maximum Peak level	**Pass**
Supplementary information: Test location: SMEE Test date: March 3rd to 7th, 2017 by J. Blancher Power supply voltage: 3.7V from battery (fully charged) / 5V DC from power adapter (with charger)			

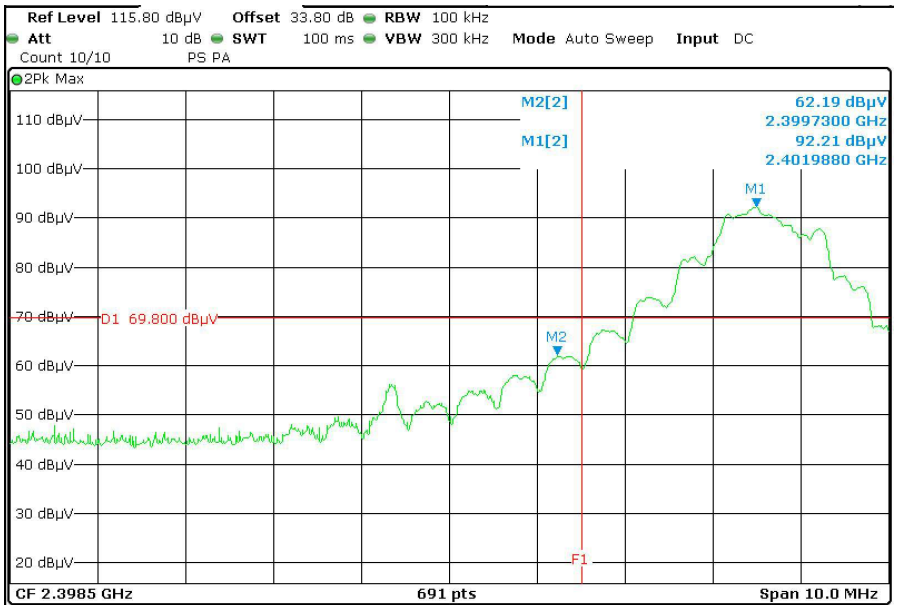
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2016/8	2017/8
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2016/8	2017/8
Loop antenna	EMCO	6502	ANT-101-009	2016/8	2017/8
BiConiLog antenna	EMCO	3142B	ANT-101-010	2016/8	2017/8
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
Horn antenna	ETS-LINDGREN	3116	ANT-161-014	2012/4	2019/4
RF cable	Div	OATS/25m	CAB-101-019	2016/3	2017/3
RF cable	Pasternack	PE302-120	CAB-131-024	2016/3	2017/3
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2016/3	2017/3
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2016/3	2017/3
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2016/3	2017/3
High-pass filter	Mini-Circuit	VHF-3100+	FIL-151-006	2016/3	2017/3
Pre-amplifier	PE	PE1524	PRE-101-002	2016/3	2017/3
Anechoic chamber	COMTEST	214263	CAG-141-001	-	-
OATS	Div	10m	SIT-101-001	2016/8	2017/8
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-
Turntable	Innco- Systems	CT0800	PLA-141-001	-	-
Measuring Rec	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7
Spectrum analyzer	AGILENT HP	8563E	ASP-111-003	2014/9	2017/9

Tabulated Results for Peak Output Power Reference level	
On battery running (normal used mode)	
FREQ	**Field Strength 3m**
(MHz)	(dBµV/m)
2402.0	92.1
2440.0	93.2
2480.0	89.8
With charger (charge mode)	
FREQ	**Field Strength 3m**
(MHz)	(dBµV/m)
2402.0	91.3
2440.0	93.5
2480.0	90.6
RBW:	100kHz
Measurement distance:	3m
Limit:	Ref. level only – For 15.247 (d) / RSS-247 § 5.5
Final measurement detector:	Peak
Wide Measurement Uncertainty:	± 5.2dB (k=2)
Note:	(1): Only for identification of limit in non-restricted band Limit is **69.8 dBµV/m** Peak for out-of-band frequencies in Non-Restricted bands (with a 100kHz RBW on the spectrum analyser)

Tabulated Results for Unwanted emissions in Non-Restricted bands				
FREQ (MHz)	**Field Strength 3m** (dBµV/m)	**Limit** (dBµV/m)	**Margin** (dBµV/m)	**Result** (dBµV/m)
2400.0	62.6	69.8	**-7.2**	**Pass**
9608.0	53.4	69.8	**-16.4**	**Pass**
9760.0	52.7	69.8	**-17.1**	**Pass**
9920.0	53.1	69.8	**-16.7**	**Pass**
12010.0	54.5	69.8	**-15.3**	**Pass**
12200.0	53.2	69.8	**-16.6**	**Pass**
12400.0	53.9	69.8	**-15.8**	**Pass**

RBW:	100kHz
Measurement distance:	3m
Limit:	15.247 / RSS-247
Final measurement detector:	Peak
Wide Measurement Uncertainty:	± 5.2dB (k=2)
RESULT:	PASS
Note:	(1): The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follow: FS = RA + AF + CF – AG Where FS = Field Strength RA = Receiver Amplitude AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain Total factor (dB) is AF + CF – AG Margin value = Emission level – Limit value (2): Peak pre-scans not performed at 3-meters distance are corrected as follow: $M@3m = M@D_m + 20 \times \log (D_m / 3_m)$ Where D is the measurement distance in meter (3): All frequencies not specified have margin < -10dB (4): Worst case between charge mode and normal used mode (5): 3-axis measurement performed for device under test.

Graphical representation of Band-edge compliance



Low bandedge compliance

F1 = 2400MHz
Peak level at 2400MHz is 62.6dBµV/m (limit is 69.8dBµV/m)
RESULT: PASS
Note: Radiated measurement / Worst case between charge mode and normal used mode

13. Unwanted emissions in Restricted Frequency bands

TEST: Unwanted emissions into Restricted Frequency Bands		**Verdict**
Method: Measurements were made in a 10 or 3-meter Open Area Test Site (OATS) that complies to ANSI C63.4. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (Peak, Quasi-peak, Average) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. A pre-scan frequency identification of the EUT has been performed in full anechoic chamber. The measured radiated field of the EUT is performed (or corrected) at 3-meters of distance. Antenna is 1.25-meters high.		**Pass**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	10 to 40 °C	13°C
Relative Humidity	10 to 90 %	65%
Fully configured sample scanned over the following frequency range	Frequency range on each side of line	Measurement Point
	9kHz – 30MHz	10 m measurement distance
	30MHz – 25GHz	3 m measurement distance

Limits – FCC Part 15.205, 15.209 (a), 15.247 (d) / RSS-GEN §8.9, §8.10, RSS-247 §5.5		
Frequency (MHz)	Limits (dBµV/m)	
	Level / Detector / Distance	Results
0.009 to 0.490	107.6 to 72.9 / QP / 10m	**Pass**
0.490 to 1.705	52.9 to 42.1 / QP / 10m	**Pass**
1.705 to 30	48.6 / QP / 10m	**Pass**
30 to 88	40.0 / QP / 3m	**Pass**
88 to 216	43.5 / QP / 3m	**Pass**
216 to 960	46.0 / QP / 3m	**Pass**
960-1000	54.0 / QP / 3m	**Pass**
Above 1GHz	54.0 / AV / 3m 74.0 / PK / 3m	**Pass**

Supplementary information:
Test location: SMEE
Test date: March 3rd to 7th, 2017 by J. Blancher
Power supply voltage: 3.7V from battery (fully charged) / 5V DC from power adapter (with charger)

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2016/8	2017/8
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2016/8	2017/8
Loop antenna	EMCO	6502	ANT-101-009	2016/8	2017/8
BiConiLog antenna	EMCO	3142B	ANT-101-010	2016/8	2017/8
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
Horn antenna	ETS-LINDGREN	3116	ANT-161-014	2012/4	2019/4
RF cable	Div	OATS/25m	CAB-101-019	2016/3	2017/3
RF cable	Pasternack	PE302-120	CAB-131-024	2016/3	2017/3
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2016/3	2017/3
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2016/3	2017/3
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2016/3	2017/3
High-pass filter	Mini-Circuit	VHF-3100+	FIL-151-006	2016/3	2017/3
Pre-amplifier	PE	PE1524	PRE-101-002	2016/3	2017/3
Anechoic chamber	COMTEST	214263	CAG-141-001	-	-
OATS	Div	10m	SIT-101-001	2016/8	2017/8
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-
Turntable	Innco- Systems	CT0800	PLA-141-001	-	-
Measuring Rec	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7
Spectrum analyzer	AGILENT HP	8563E	ASP-111-003	2014/9	2017/9

Tabulated Results for Unwanted emissions (9kHz-30MHz)						
FREQ	**RF field @ 30m**	**Limit @ 30m**	**Margin**	**Antenna angle**	**Table angle**	**Correc. Fact. (CF)**
MHz	(QP) dBµV/m	(QP) dBµV/m	dB	Degree	Degree	dB
Margin < -10dB						
Supplementary information: Frequency list measured on the Open Area Test Site has been created with pre-scan results.						

Frequency band investigated:	9kHz-30MHz
RBW:	200Hz (9kHz-150kHz)
	9kHz (150kHz-30MHz)
Measurement distance:	10m
Limit:	FCC Part 15.205 - 15.209 / RSS-GEN
Final measurement detector:	Quasi-Peak
Wide Measurement Uncertainty:	± 5 dB (k=2)
Note:	CF: Correction factor = Antenna factor + Cable loss *[1]: Measure have been done at 10m distance and corrected according to requirements of 15.209.e) (M@30m = M@10m-19.1dB)

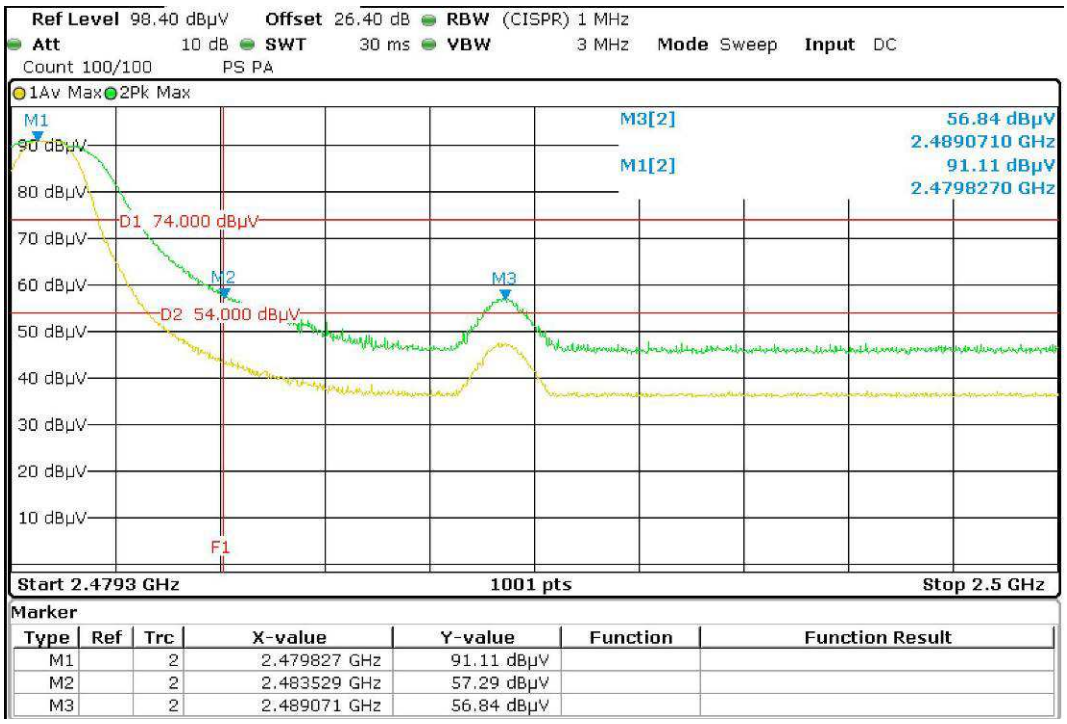
Tabulated Results for Unwanted emissions (30MHz-1GHz)										
FREQ	**Meter reading**	**Meter reading**	**Total factor**	**Field level**	**Field level**	**Pol**	**Antenna height**	**Table angle**	**Limit**	**Margin**
MHz	(QP) dBµV	(Pk) dBµV	dB	(QP) dBµV/m	(Pk) dBµV/m		cm	Degré	(QP) dBµV/m	dB
Margin < -10dB										
Supplementary information: Frequency list measured on the Open Area Test Site has been created with pre-scan results.										

Frequency band investigated:	30MHz-1GHz
RBW:	120kHz
Measurement distance:	3m
Limit:	FCC Part 15.205 - 15.209 / RSS-GEN
Final measurement detector:	Quasi-Peak
Wide Measurement Uncertainty:	± 5.2dB (k=2)
RESULT:	PASS
Field Strength Calculation:	The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follow: FS = RA + AF + CF – AG Where FS = Field Strength RA = Receiver Amplitude AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain Total factor (dB) is AF + CF – AG Margin value = Emission level – Limit value

Tabulated Results for Unwanted emissions (1GHz-25GHz)					
FREQ (MHz)	**Field Strength 3m** (dBµV/m)	**Detector**	**Limit** (dBµV/m)	**Margin** (dBµV/m)	**Result**
2483.5	58.0	Pk	74	**-16.0**	**Pass**
2483.5	39.3	Avg	54	**-14.7**	**Pass**
2489.0	57.3	Pk	74	**-16.7**	**Pass**
2489.0	39.3	Avg	54	**-14.7**	**Pass**
4804.0	53.7	Pk	74	**-10.3**	**Pass**
4804.0	43.0	Avg	54	**-11.0**	**Pass**
4880.0	52.8	Pk	74	**-21.8**	**Pass**
4880.0	42.1	Avg	54	**-11.9**	**Pass**
4960.0	54.1	Pk	74	**-19.9**	**Pass**
4960.0	43.5	Avg	54	**-10.5**	**Pass**
7206.0	54.1	Pk	74	**-19.9**	**Pass**
7206.0	46.3	Avg	54	**-7.7**	**Pass**
7320.0	54.3	Pk	74	**-19.7**	**Pass**
7320.0	46.4	Avg	54	**-7.6**	**Pass**
7440.0	54.0	Pk	74	**-20.0**	**Pass**
7440.0	46.6	Avg	54	**-7.4**	**Pass**

RBW / VBW	1MHz / 3MHz (Peak) 1MHz / 10Hz (AV)
Measurement distance:	3m
Limit:	FCC Part 15.205, 15.209, 15.247 / RSS-Gen, RSS-247
Final measurement detector:	Peak / Average
Wide Measurement Uncertainty:	± 5.2dB (k=2)
RESULT:	PASS
Notes:	(1): The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follow: FS = RA + AF + CF – AG Where FS = Field Strength RA = Receiver Amplitude AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain Total factor (dB) is AF + CF – AG Margin value = Emission level – Limit value (2): Peak pre-scans not performed at 3-meters distance are corrected as follow: M@3m = M@Dm + 20 x log (Dm / 3m) Where D is the measurement distance in meter (3): All frequencies not specified have margin < -10dB (for peak and average detector) (4): Worst case between charge mode and normal used mode (5): 3-axis measurement performed for device under test.

Graphical representation of Band-edge compliance



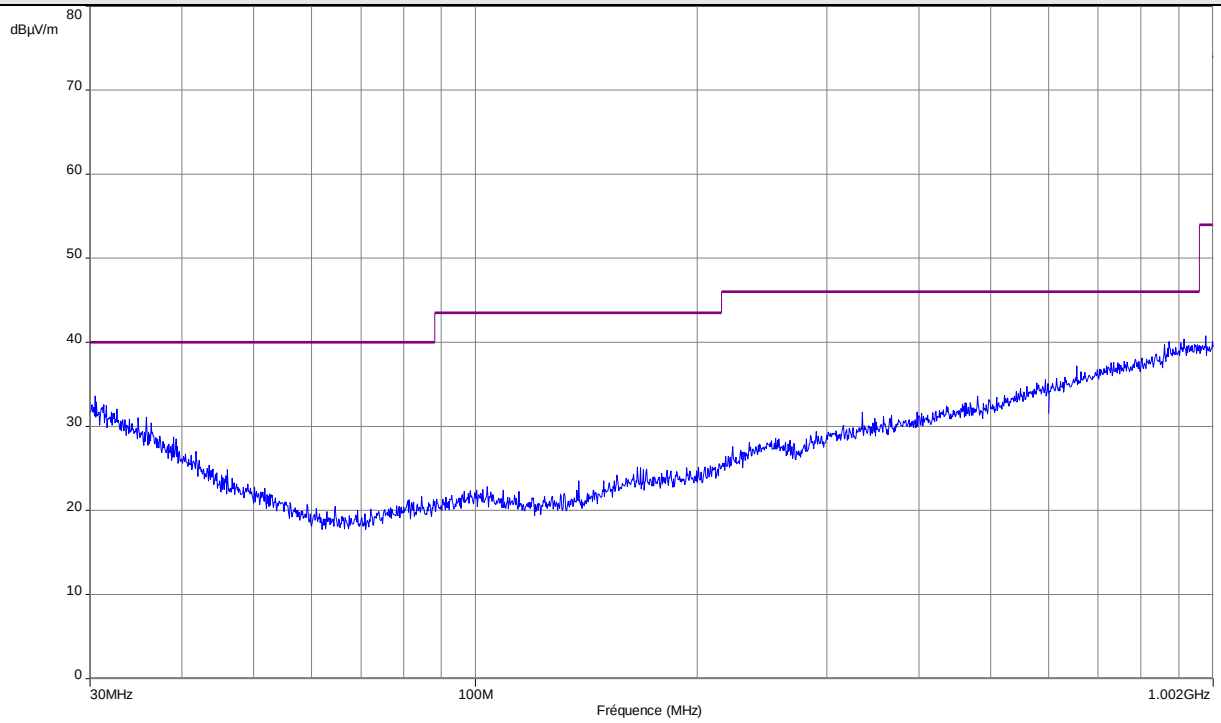
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		2	2.479827 GHz	91.11 dBµV		
M2		2	2.483529 GHz	57.29 dBµV		
M3		2	2.489071 GHz	56.84 dBµV		

High bandedge compliance

Radiated Peak level is 58.0dBµV/m (limit 74dBµV/m)
Radiated Average level is 39.3dBµV/m (limit 54dBµV/m, CISPR Average detector measurement)
RESULT: PASS
Note: radiated measurement (3m on OATS)

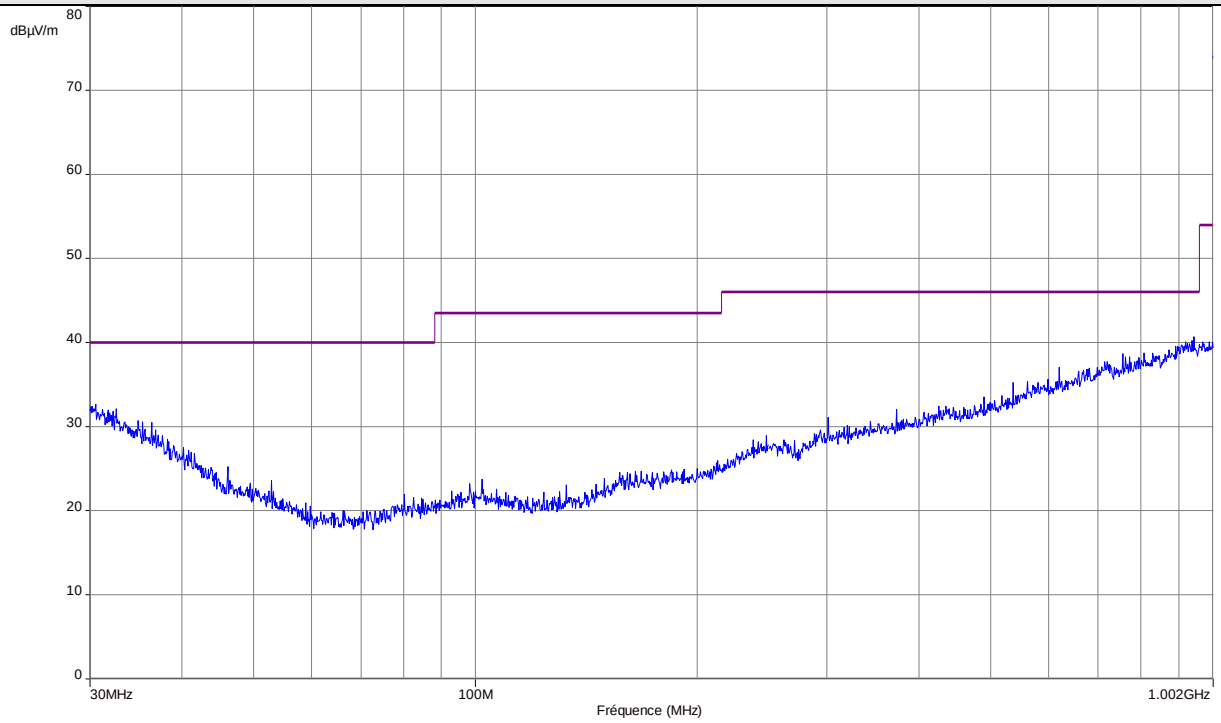
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Transmit mode) – Normal mode



Note: Pre-scan graph only for identification purpose. Worst case between low, mid and high channels.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

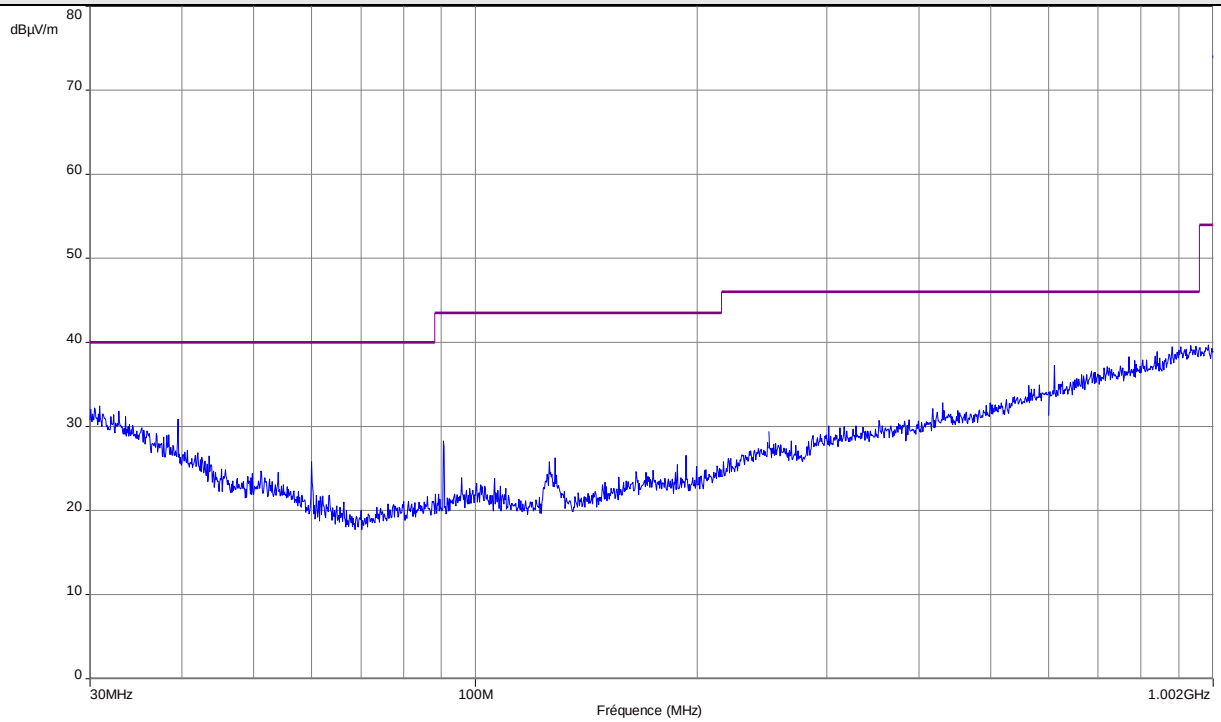
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Transmit mode) – Normal mode



Note: Pre-scan graph only for identification purpose. Worst case between low, mid and high channels.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Vertical
Voltage:	3.7V DC
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

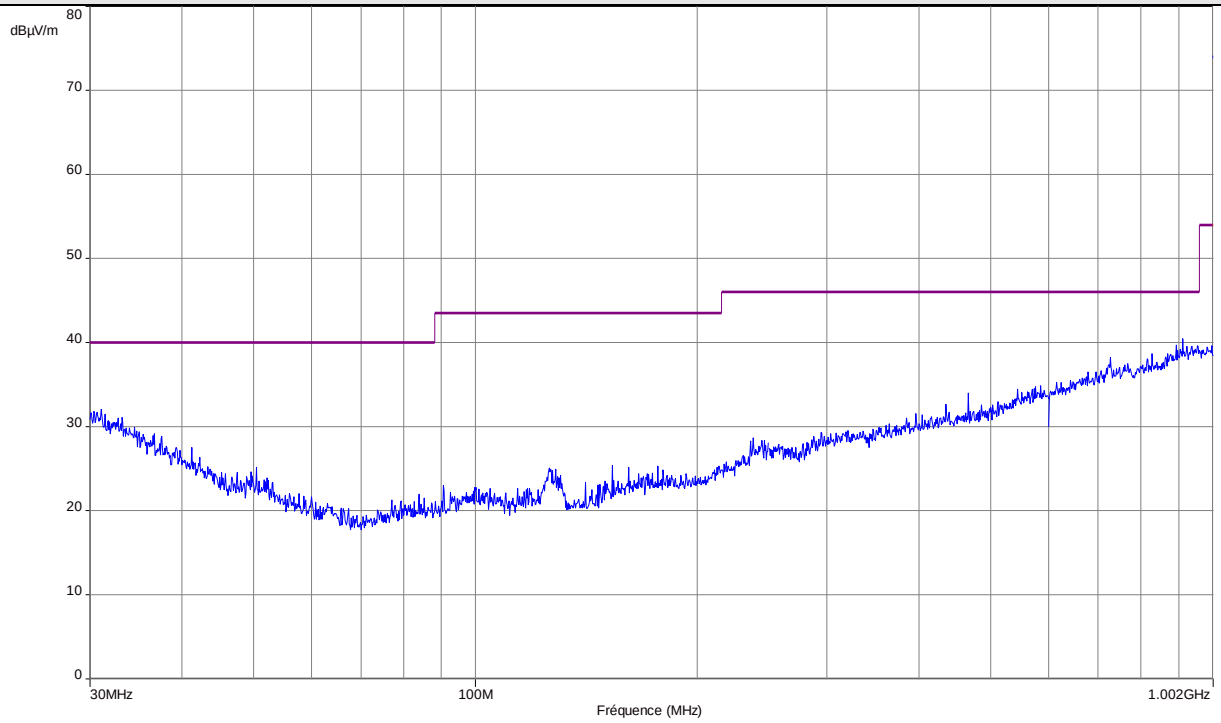
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Transmit mode) – Charge mode / With companion device



Note: Pre-scan graph only for identification purpose. Worst case between low, mid and high channels.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Horizontal
Voltage:	5V DC
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

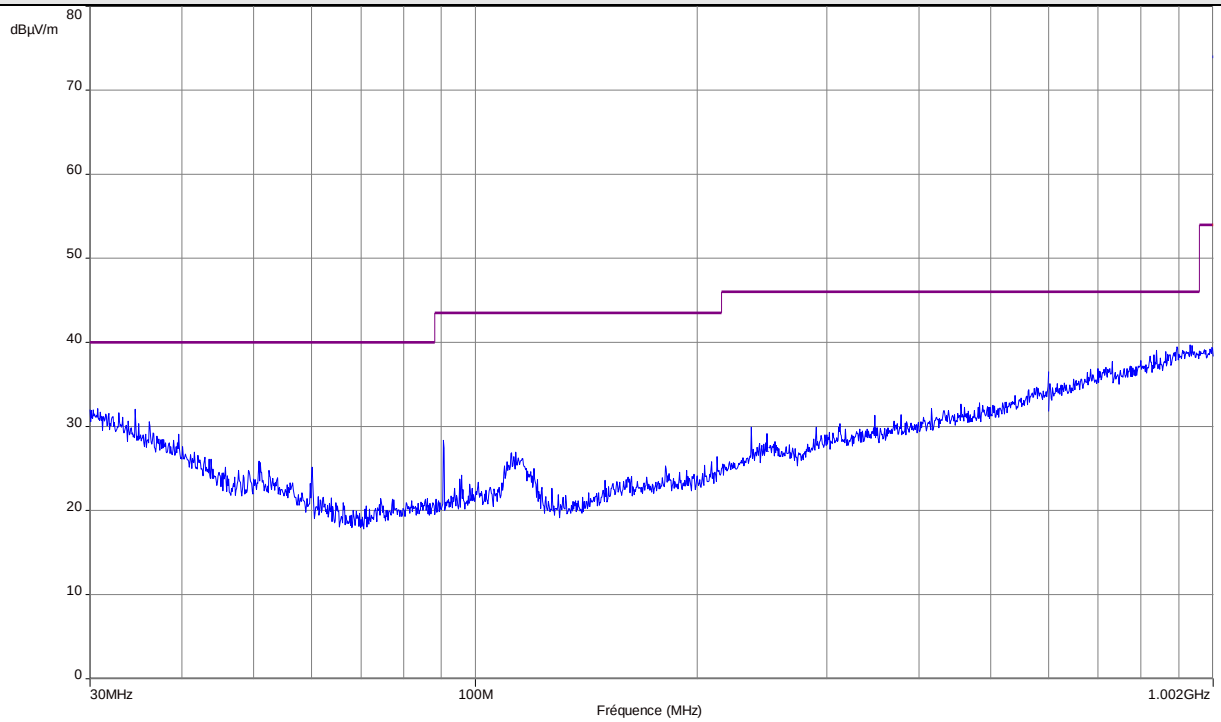
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Transmit mode) – Charge mode / With companion device



Note: Pre-scan graph only for identification purpose. Worst case between low, mid and high channels.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Vertical
Voltage:	5V DC
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

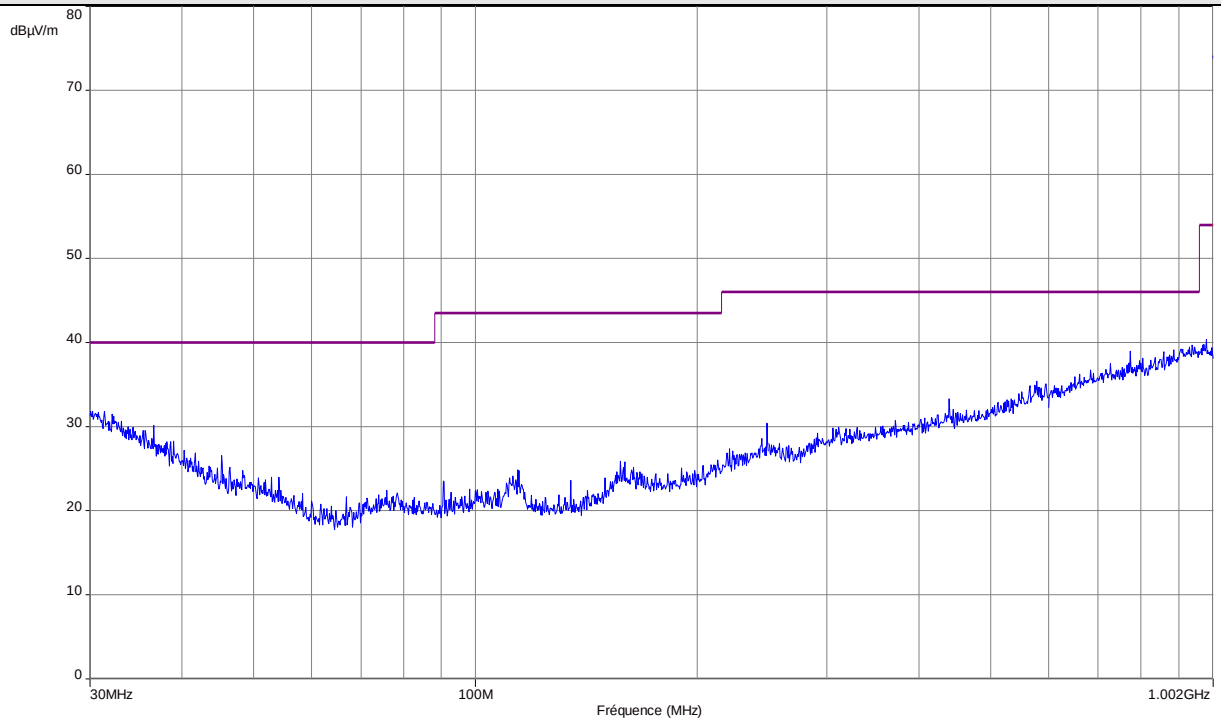
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Transmit mode) – Charge mode / With POGO cable



Note: Pre-scan graph only for identification purpose. Worst case between low, mid and high channels.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Horizontal
Voltage:	5V DC
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

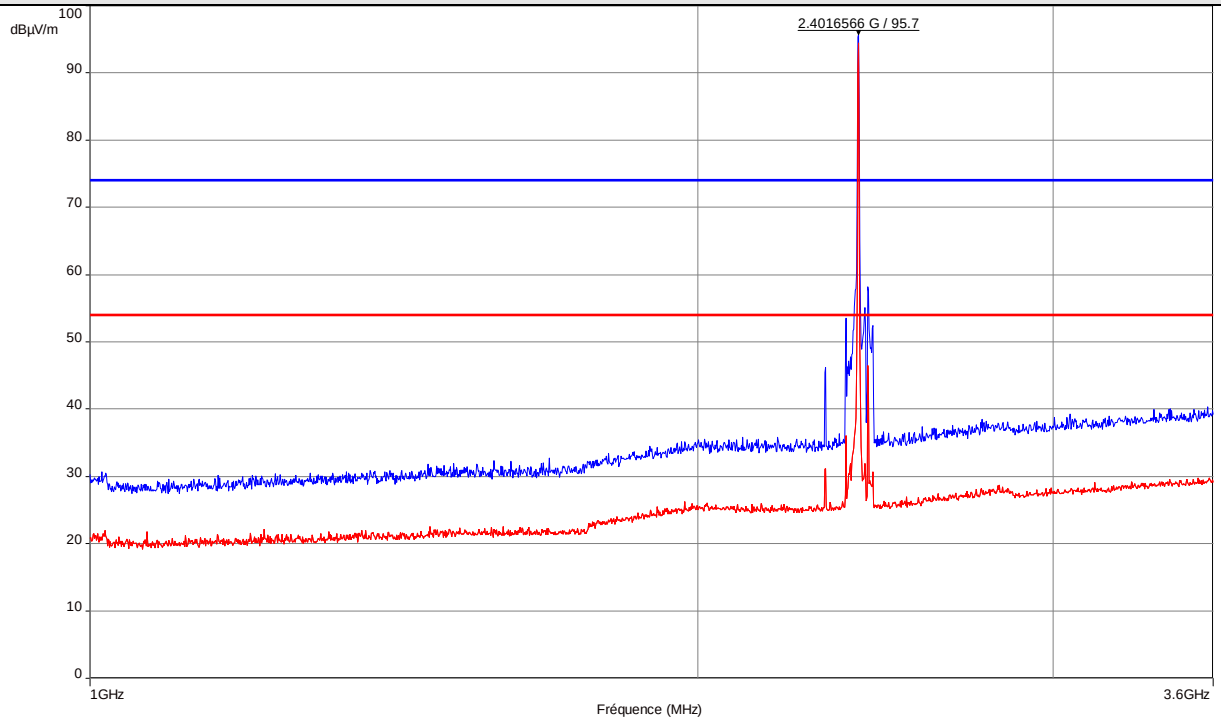
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Transmit mode) – Charge mode / With POGO cable



Note: Pre-scan graph only for identification purpose. Worst case between low, mid and high channels.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Vertical
Voltage:	5V DC
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

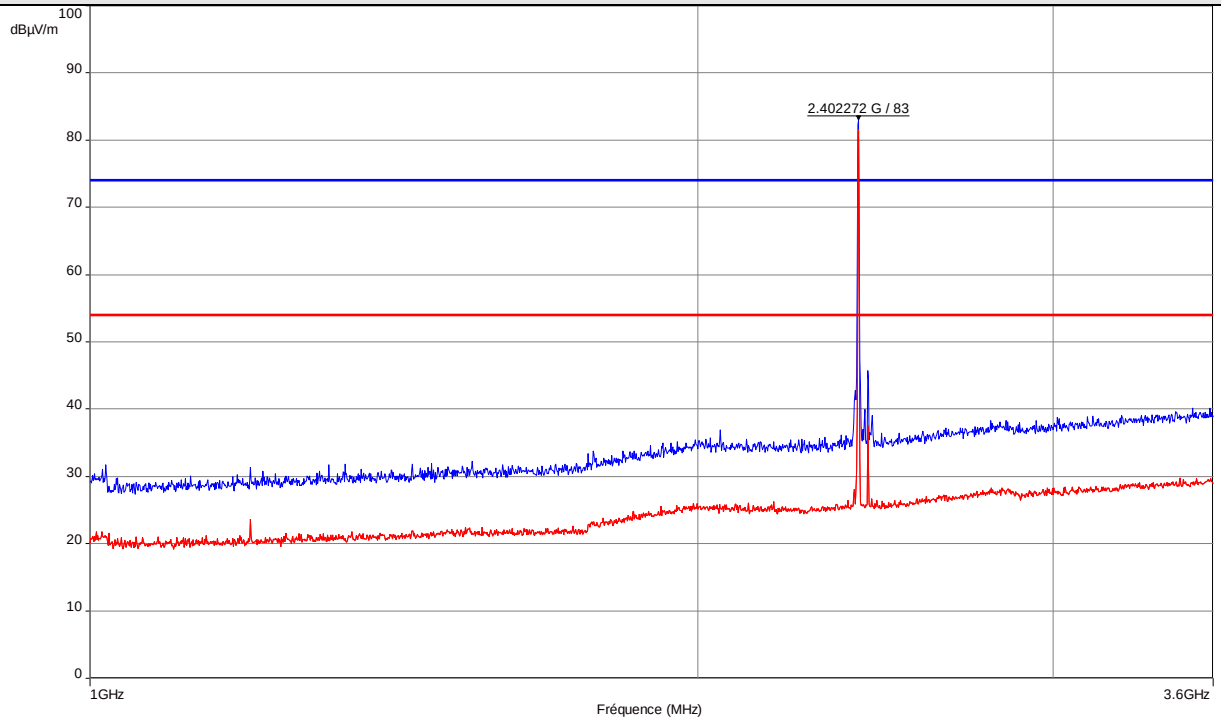
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Horizontal / Transmit mode) – Low channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

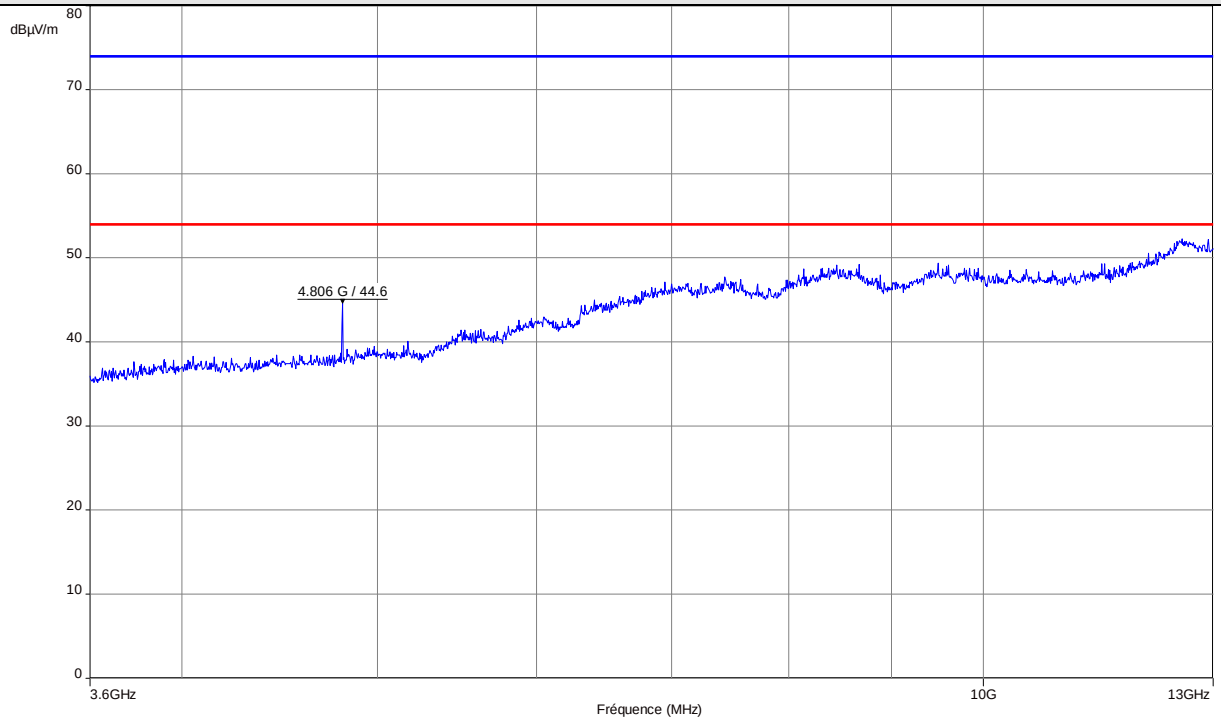
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Vertical / Transmit mode) – Low channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

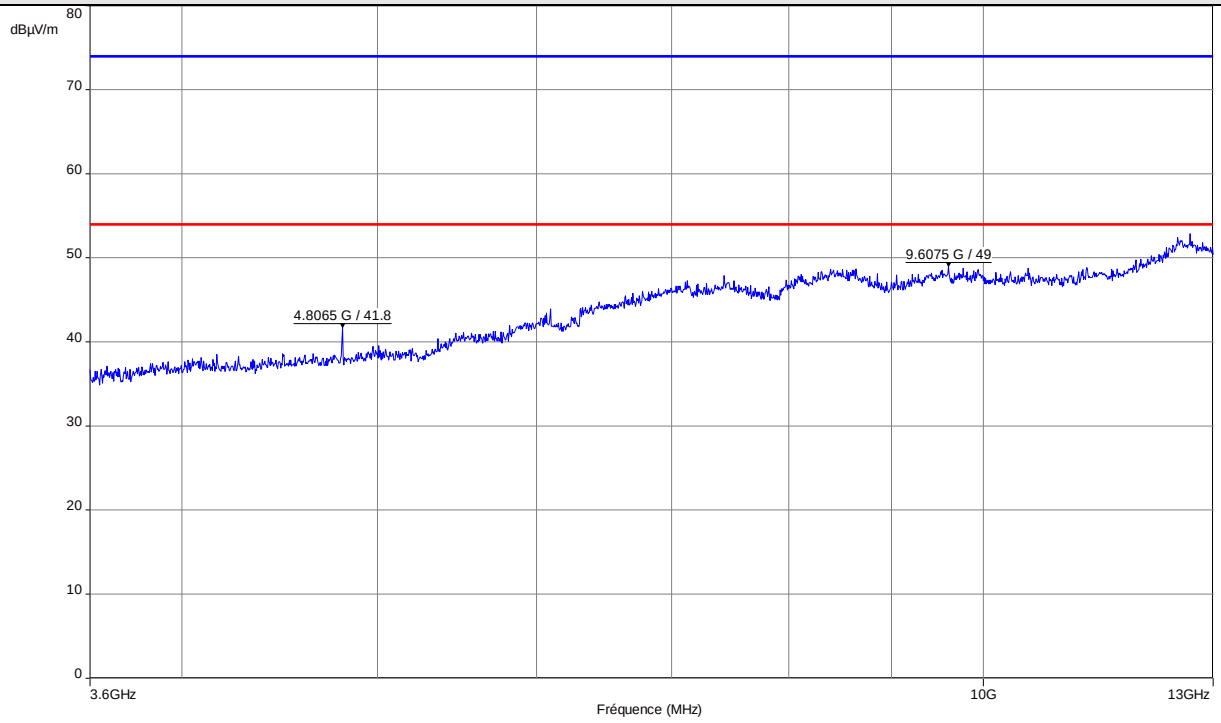
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-13GHz / 3m / Horizontal / Transmit mode) – Low channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	3.6GHz-13GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

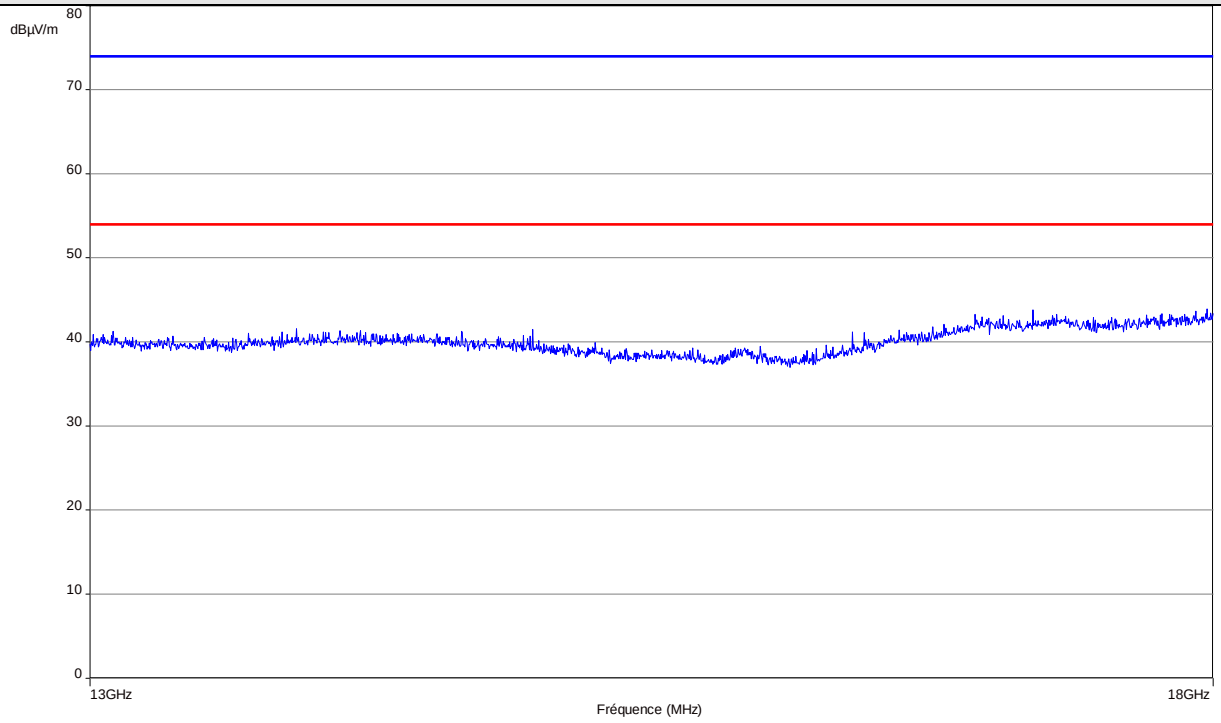
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-13GHz / 3m / Vertical / Transmit mode) – Low channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	3.6GHz-13GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

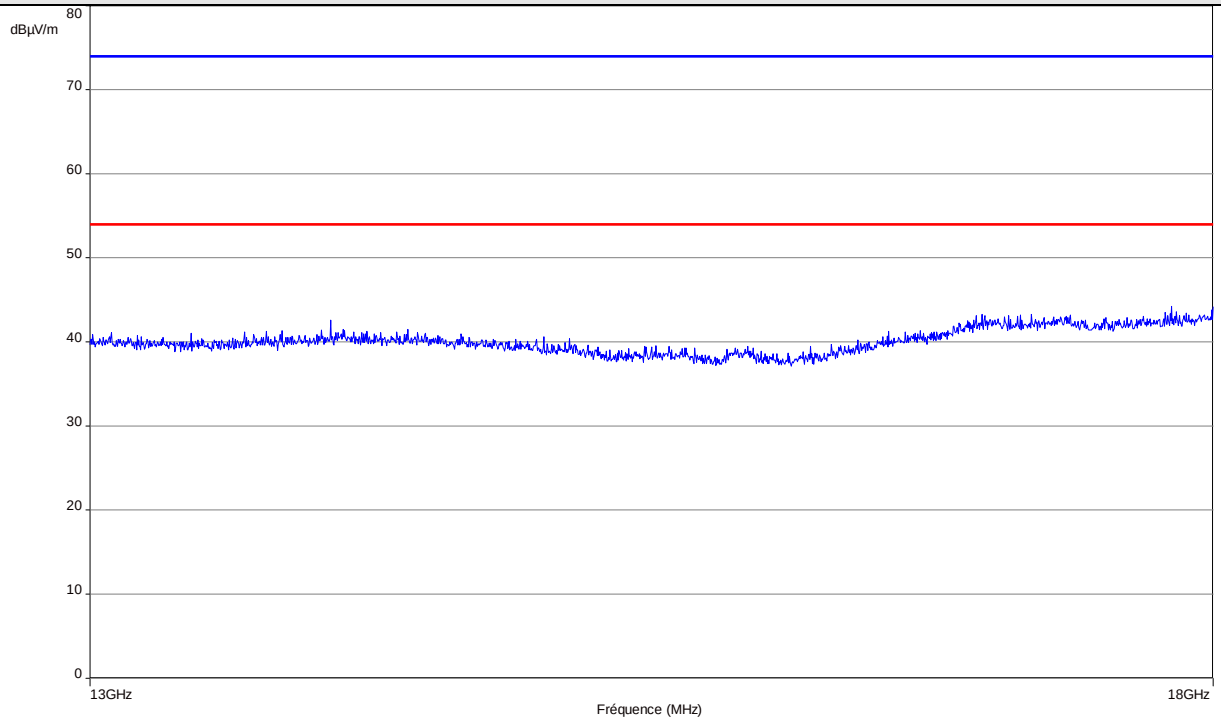
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 13GHz-18GHz / 3m / Horizontal / Transmit mode) – Low channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	13GHz-18GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

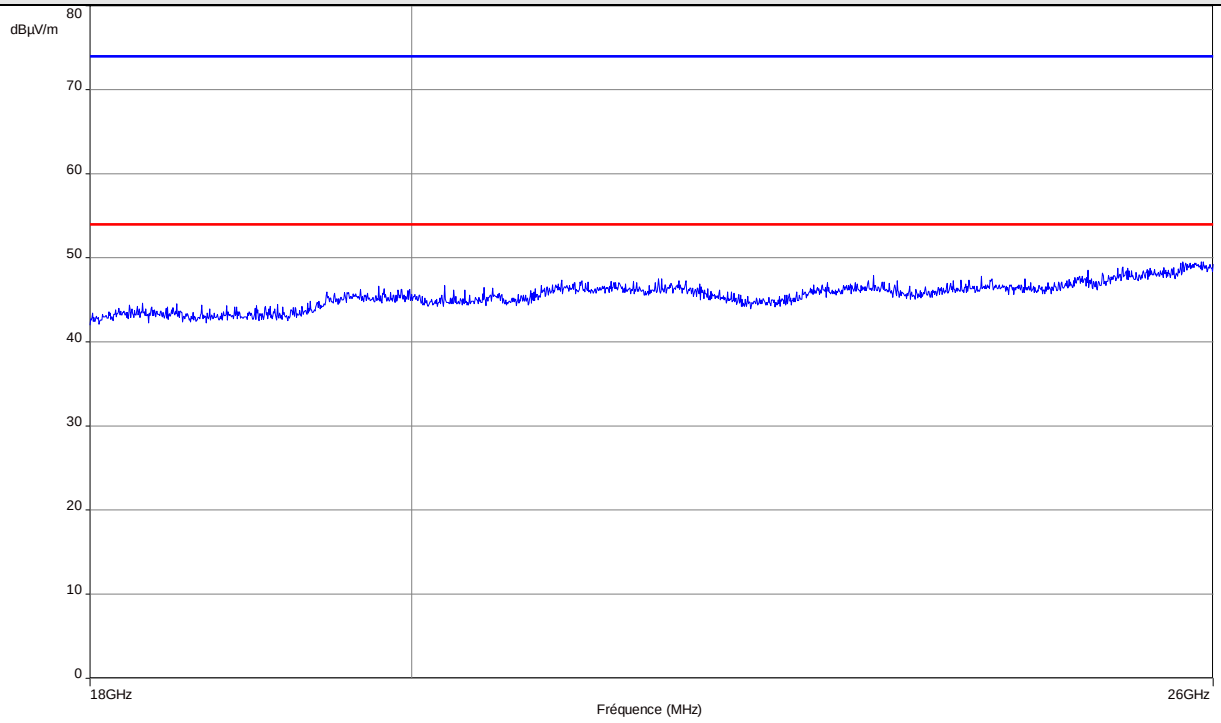
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 136GHz-18GHz / 3m / Vertical / Transmit mode) – Low channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	13GHz-18GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

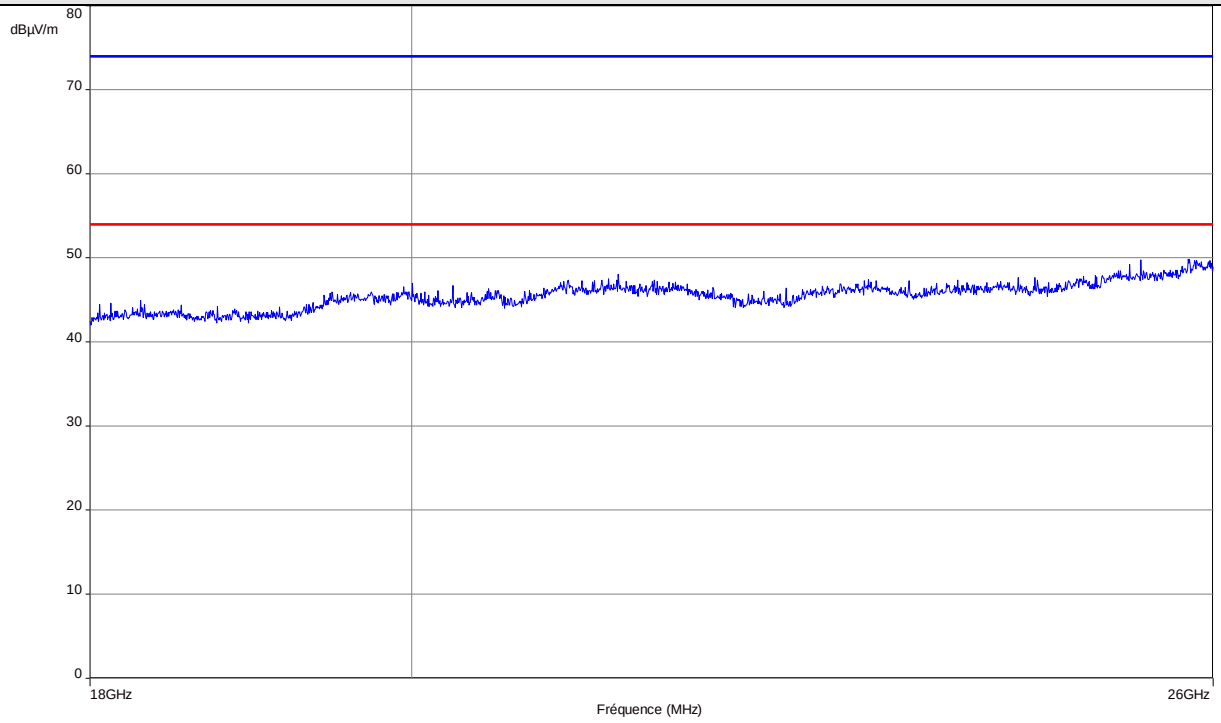
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 18GHz-26GHz / 3m / Horizontal / Transmit mode) – Low channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	18GHz-26GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

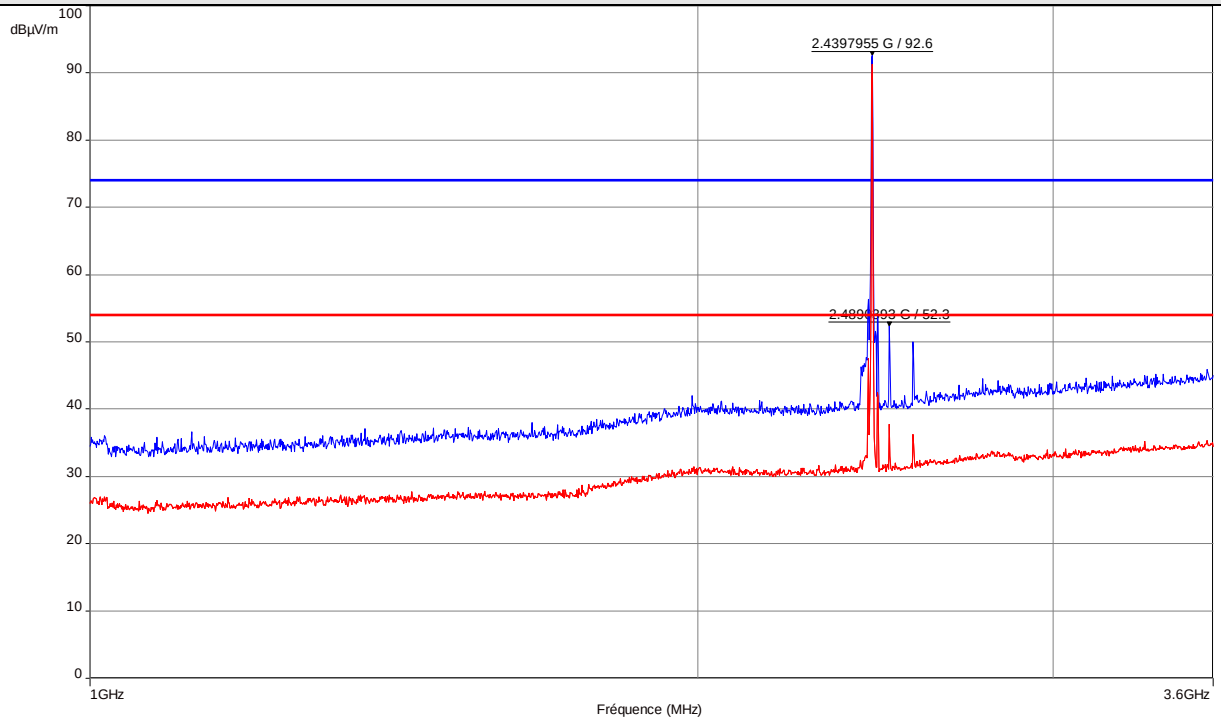
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 18GHz-26GHz / 3m / Vertical / Transmit mode) – Low channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	18GHz-26GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

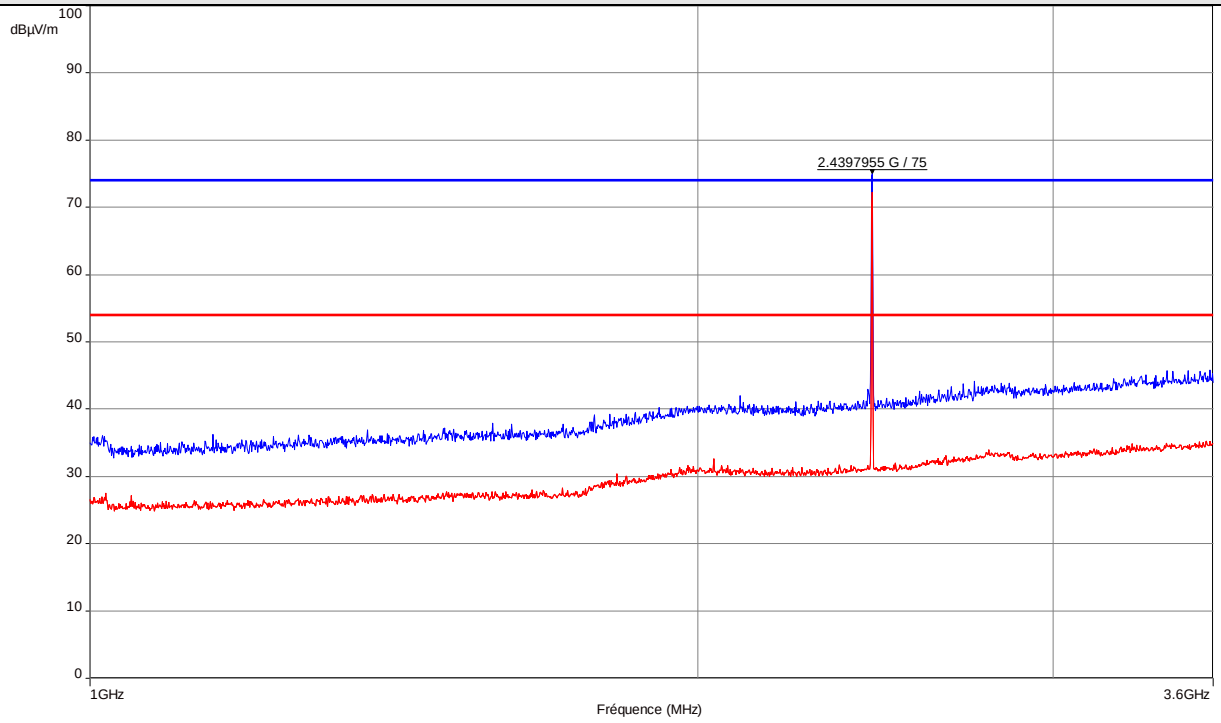
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Horizontal / Transmit mode) – Mid channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

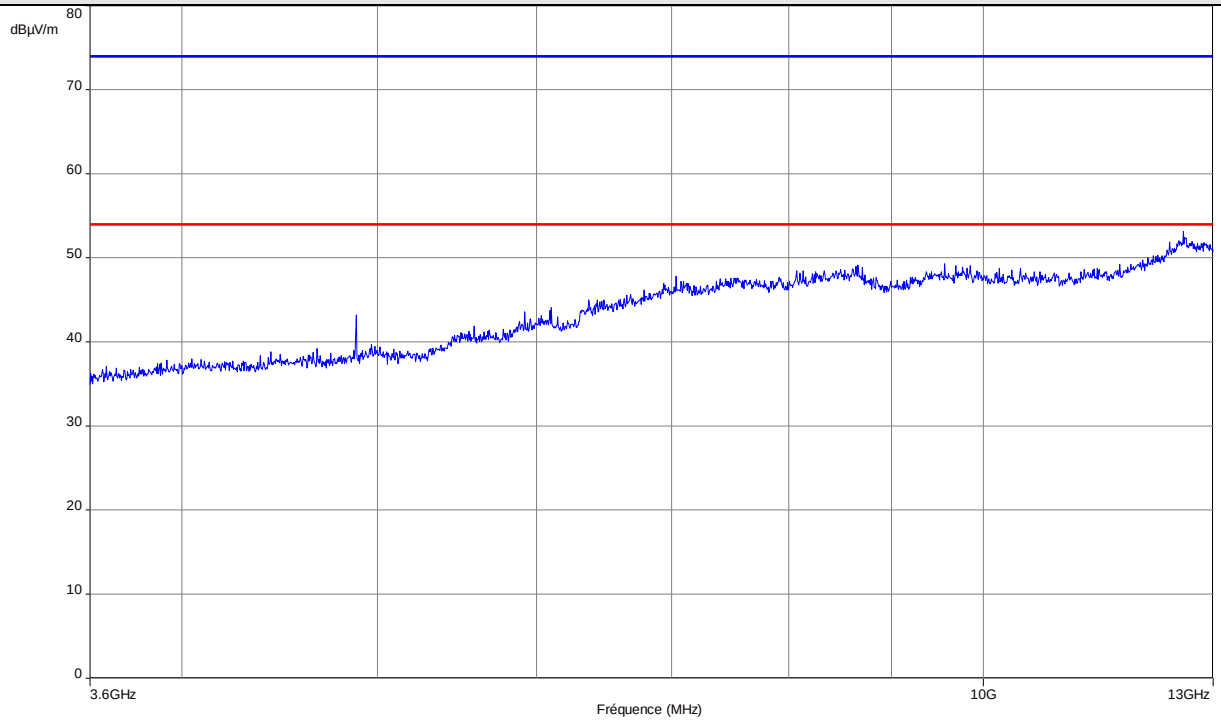
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Vertical / Transmit mode) – Mid channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

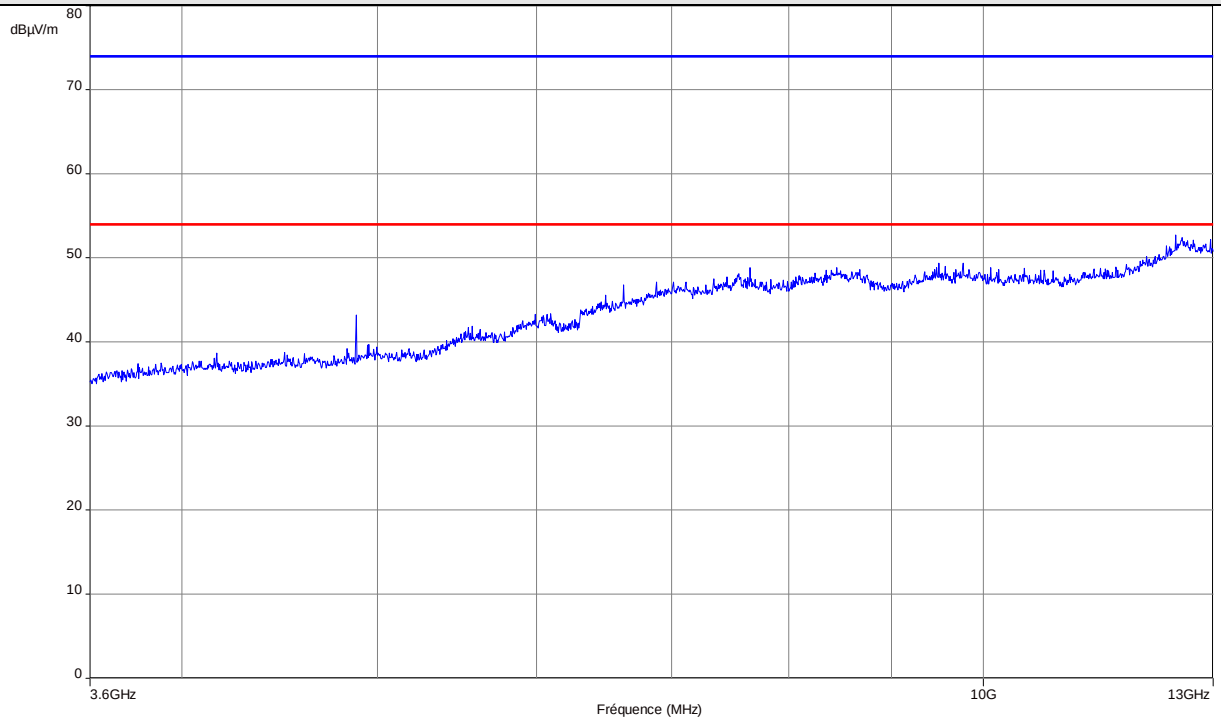
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-13GHz / 3m / Horizontal / Transmit mode) – Mid channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	3.6GHz-13GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

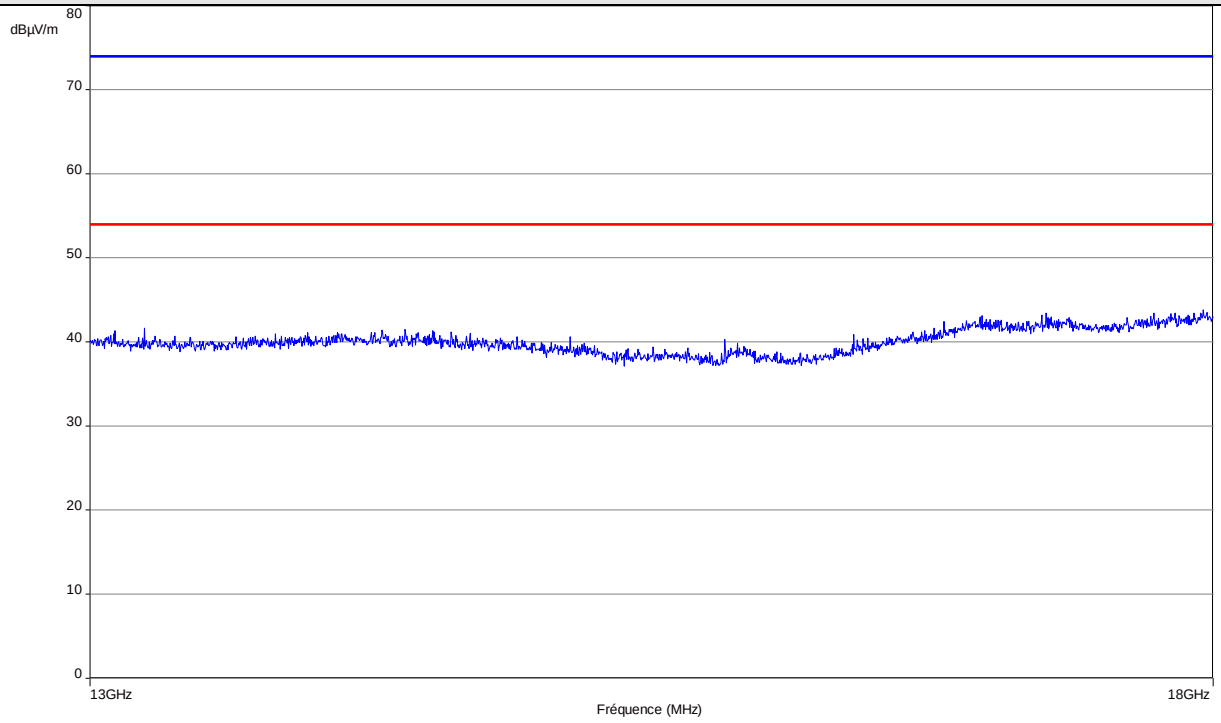
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-13GHz / 3m / Vertical / Transmit mode) – Mid channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	3.6GHz-13GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

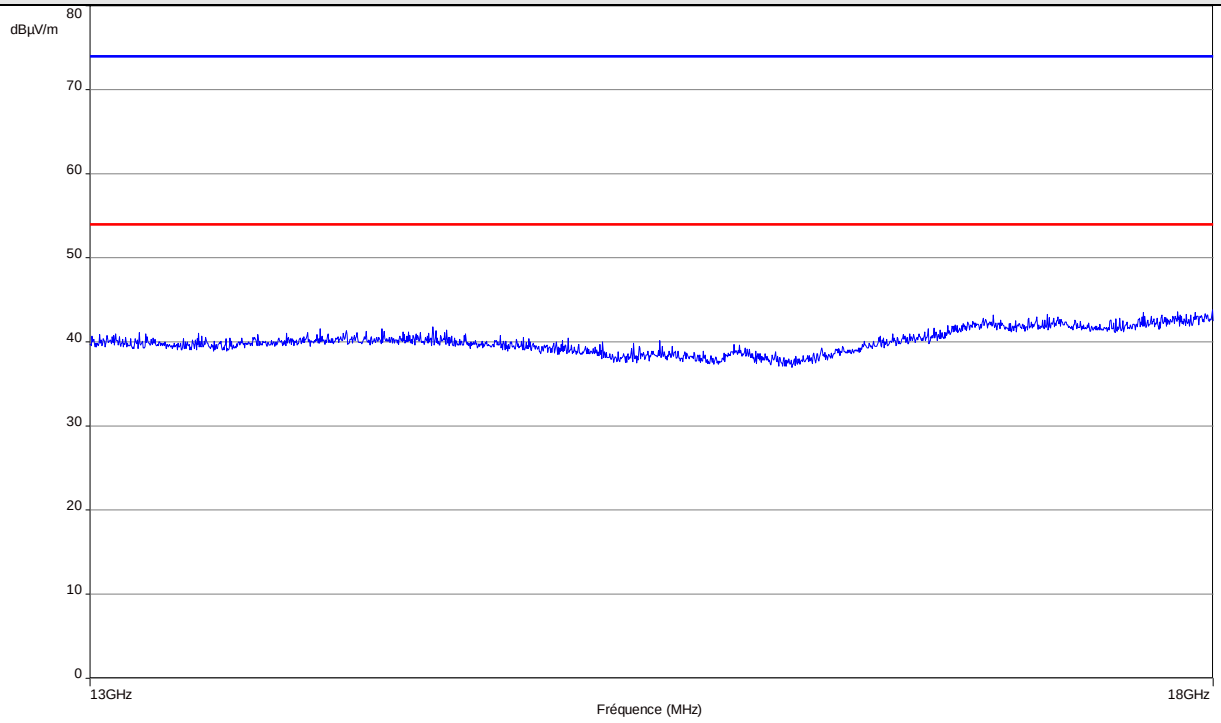
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 13GHz-18GHz / 3m / Horizontal / Transmit mode) – Mid channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	13GHz-18GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

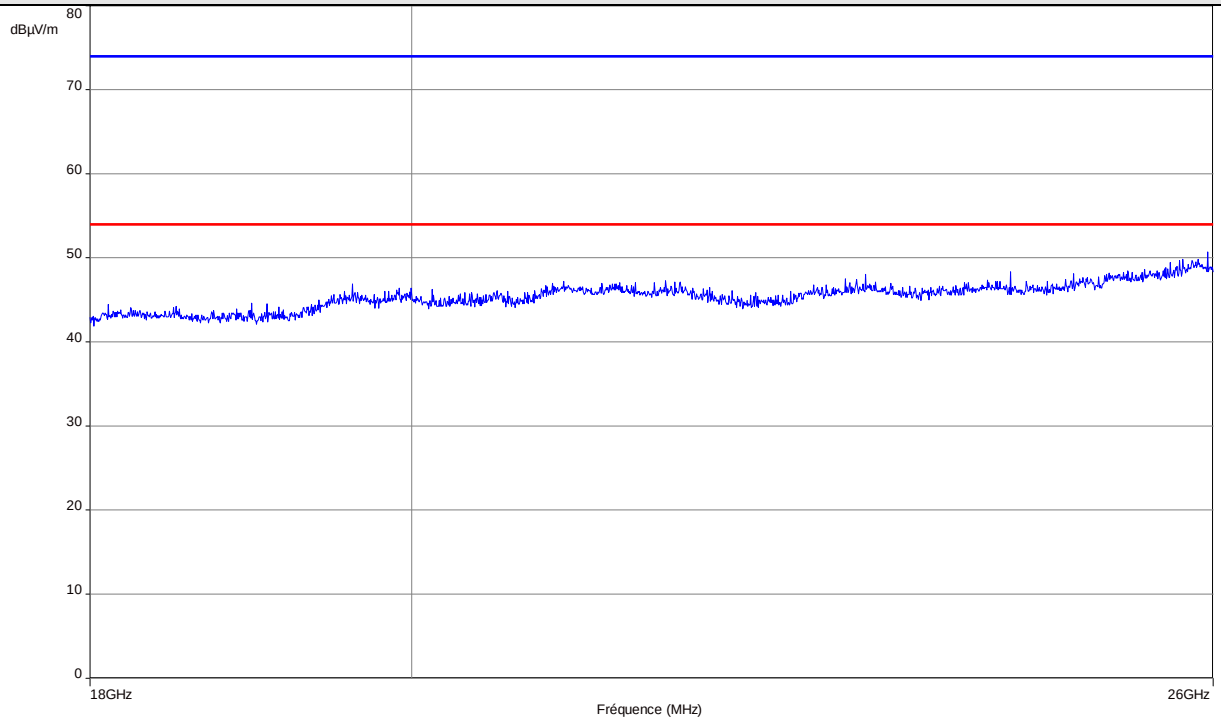
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-13GHz / 3m / Vertical / Transmit mode) – Mid channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	13GHz-18GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

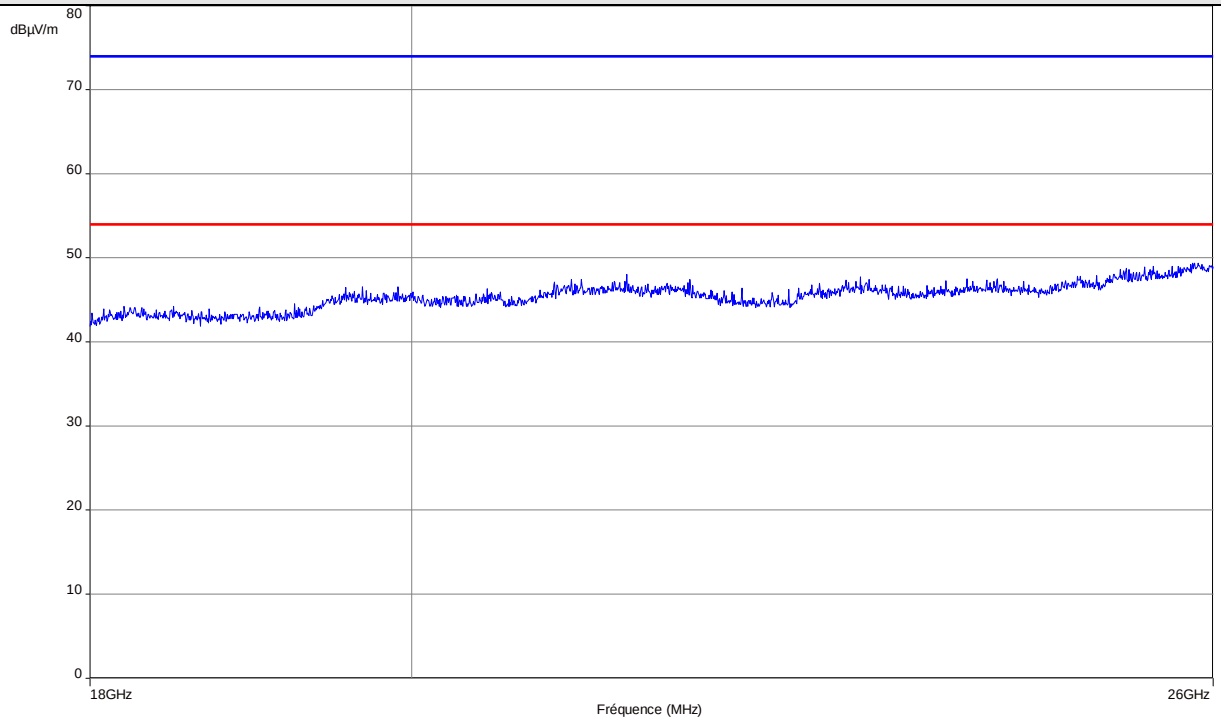
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 18GHz-26GHz / 3m / Horizontal / Transmit mode) – Mid channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	18GHz-26GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

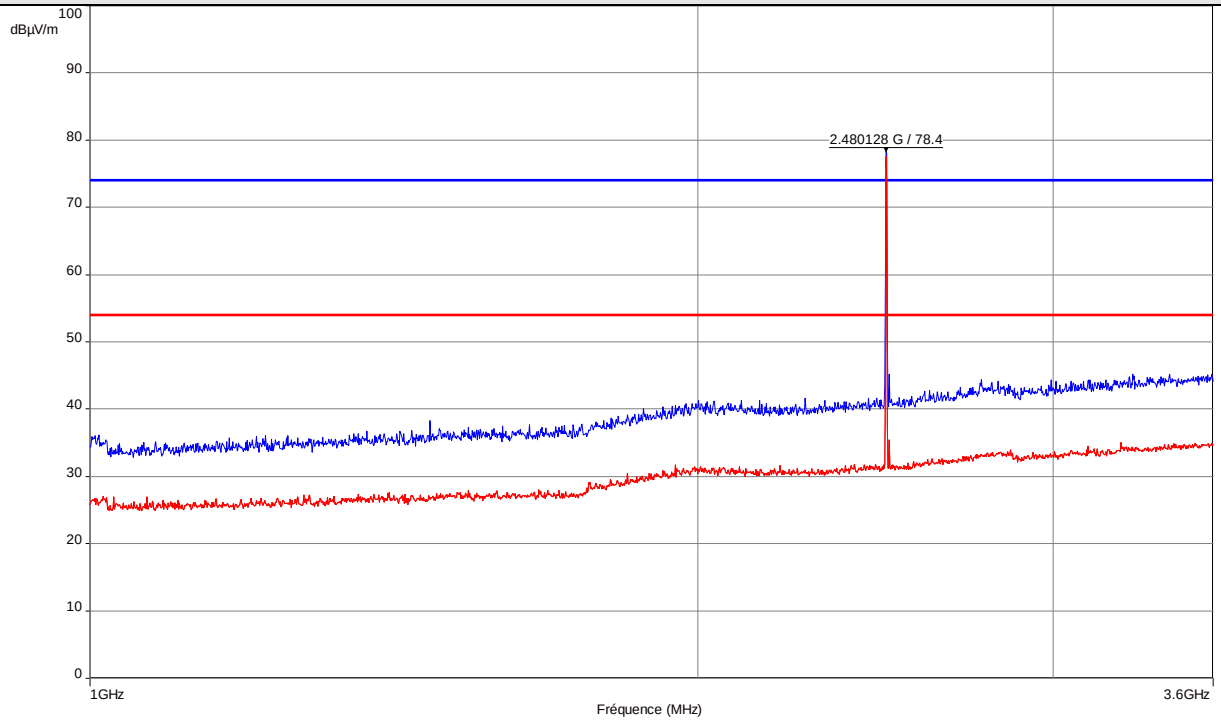
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 18GHz-26GHz / 3m / Vertical / Transmit mode) – Mid channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	18GHz-26GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

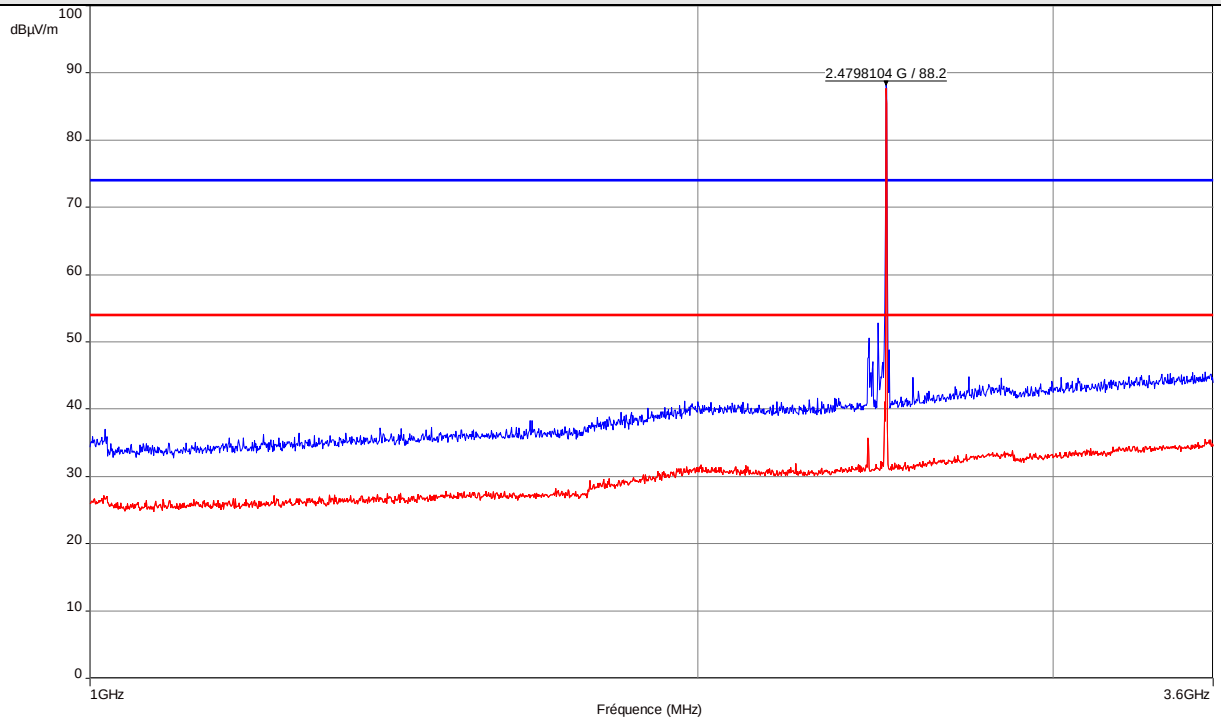
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Horizontal / Transmit mode) – High channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

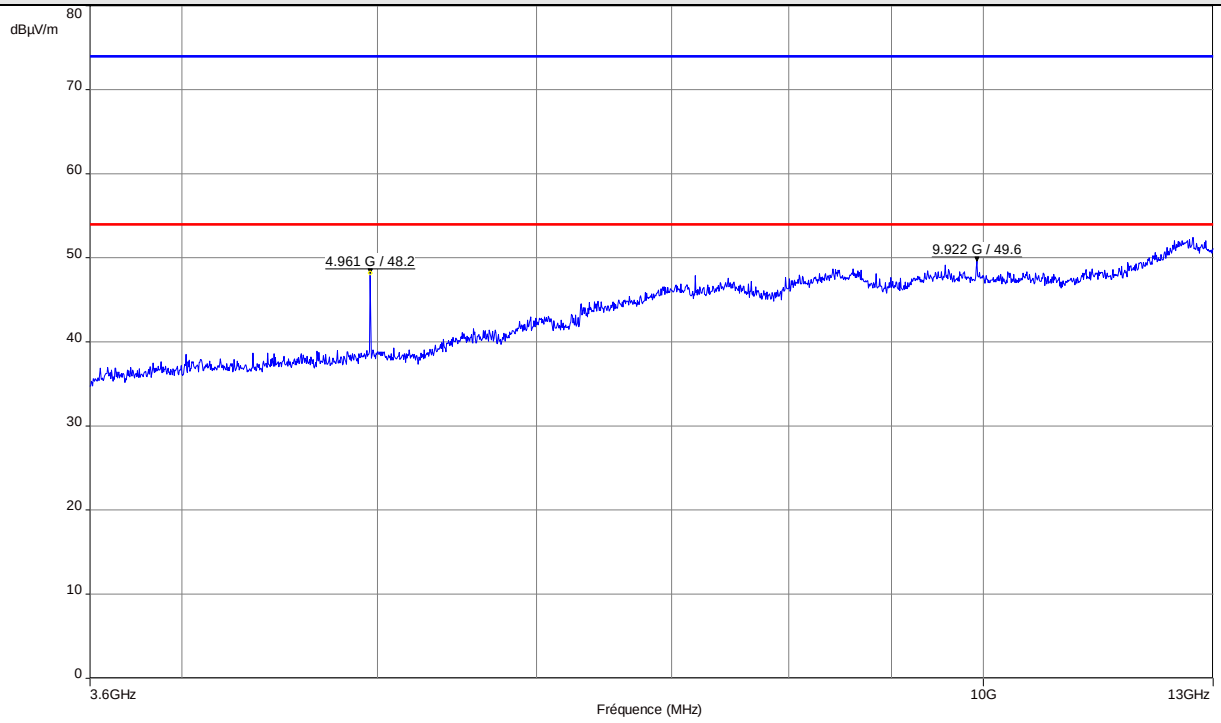
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Vertical / Transmit mode) – High channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

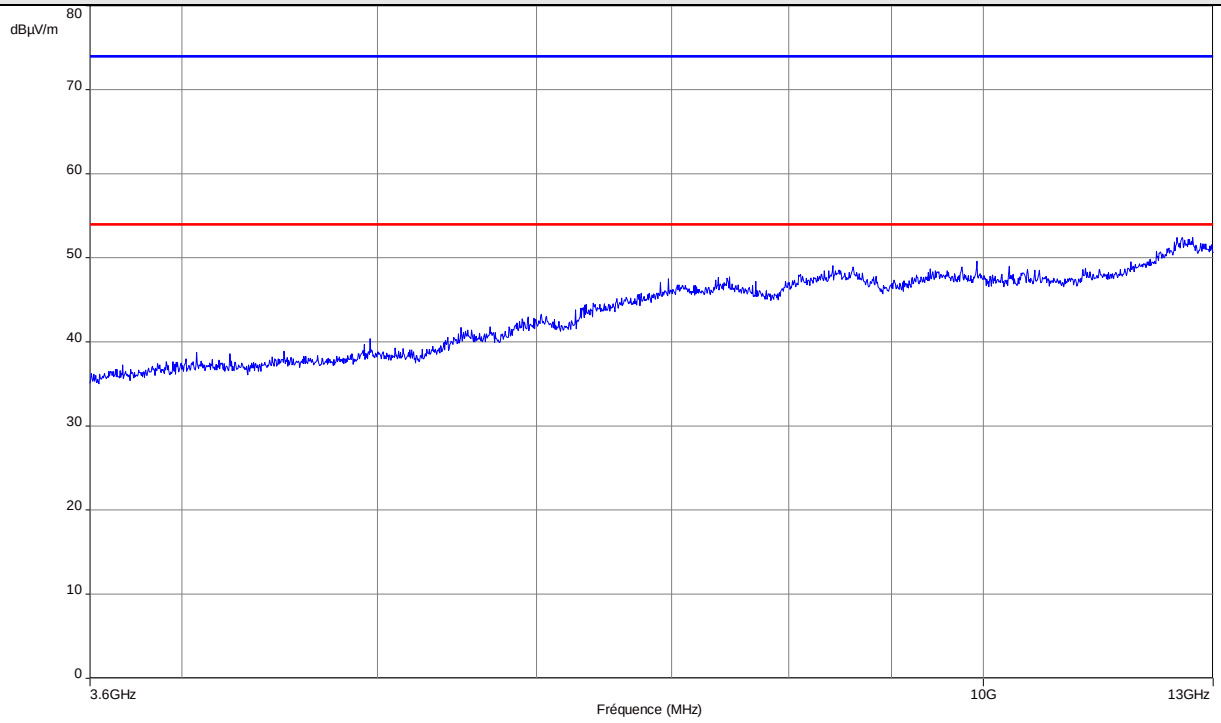
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-13GHz / 3m / Horizontal / Transmit mode) – High channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	3.6GHz-13GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

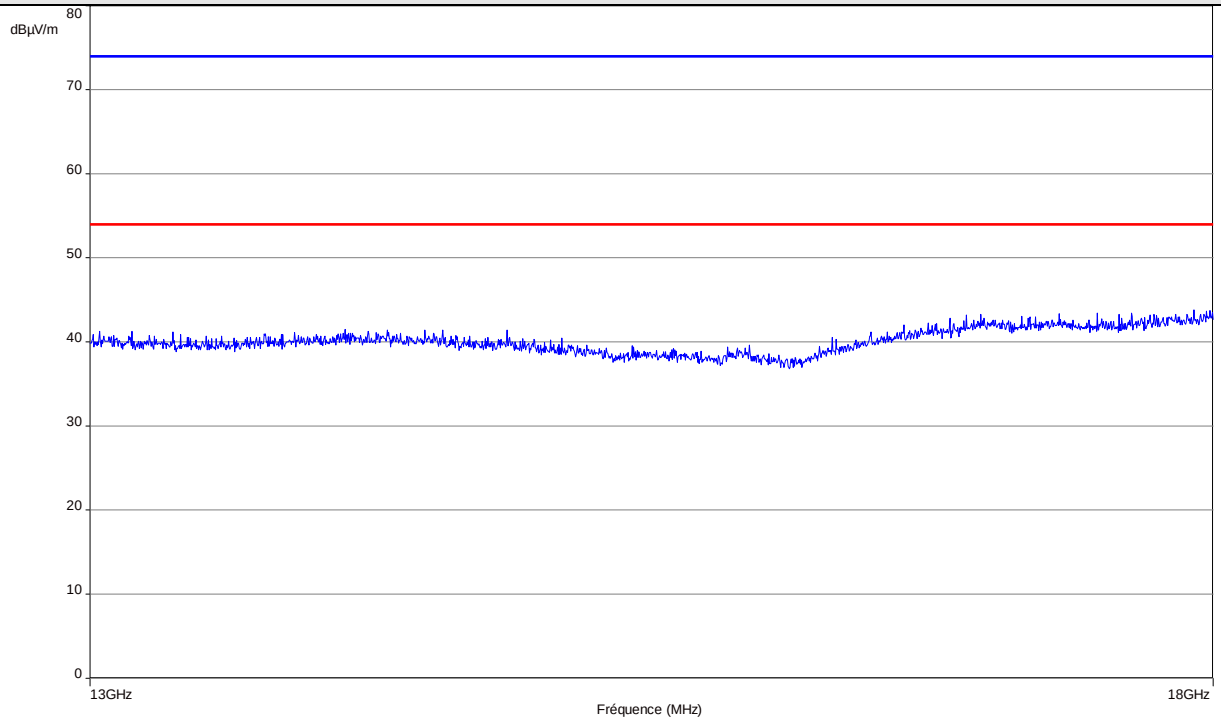
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-13GHz / 3m / Vertical / Transmit mode) – High channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	3.6GHz-13GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

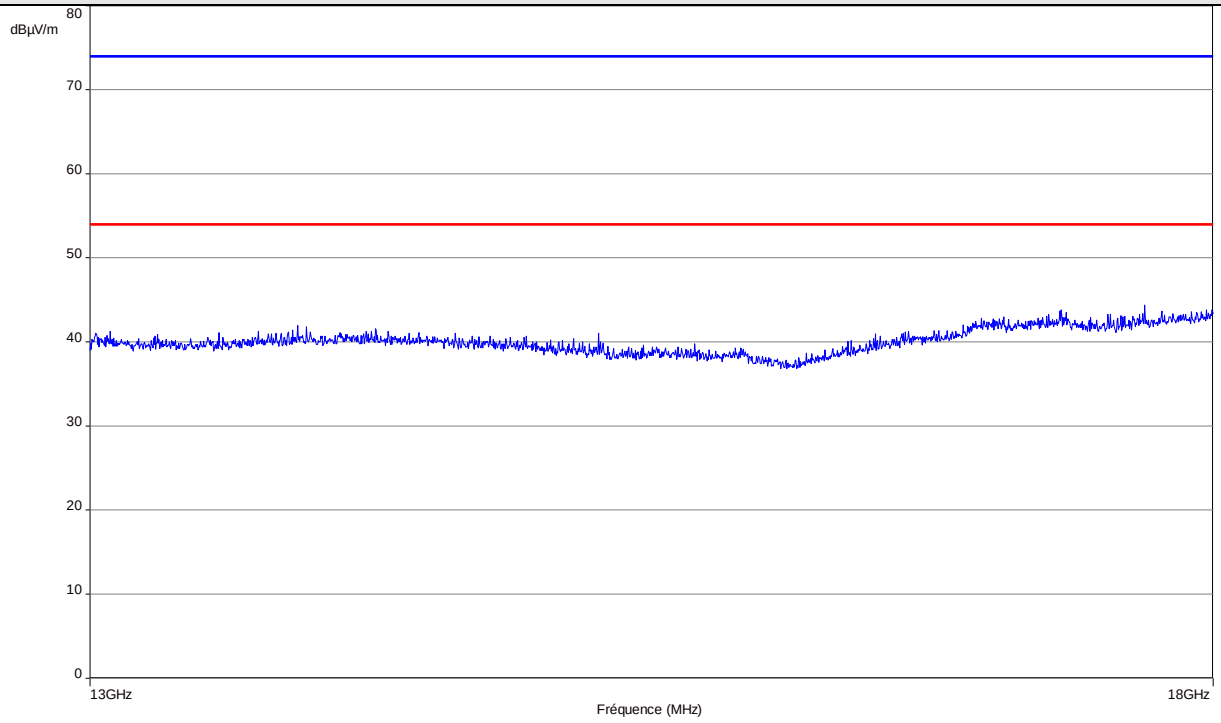
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 13GHz-18GHz / 3m / Horizontal / Transmit mode) – High channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	13GHz-18GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

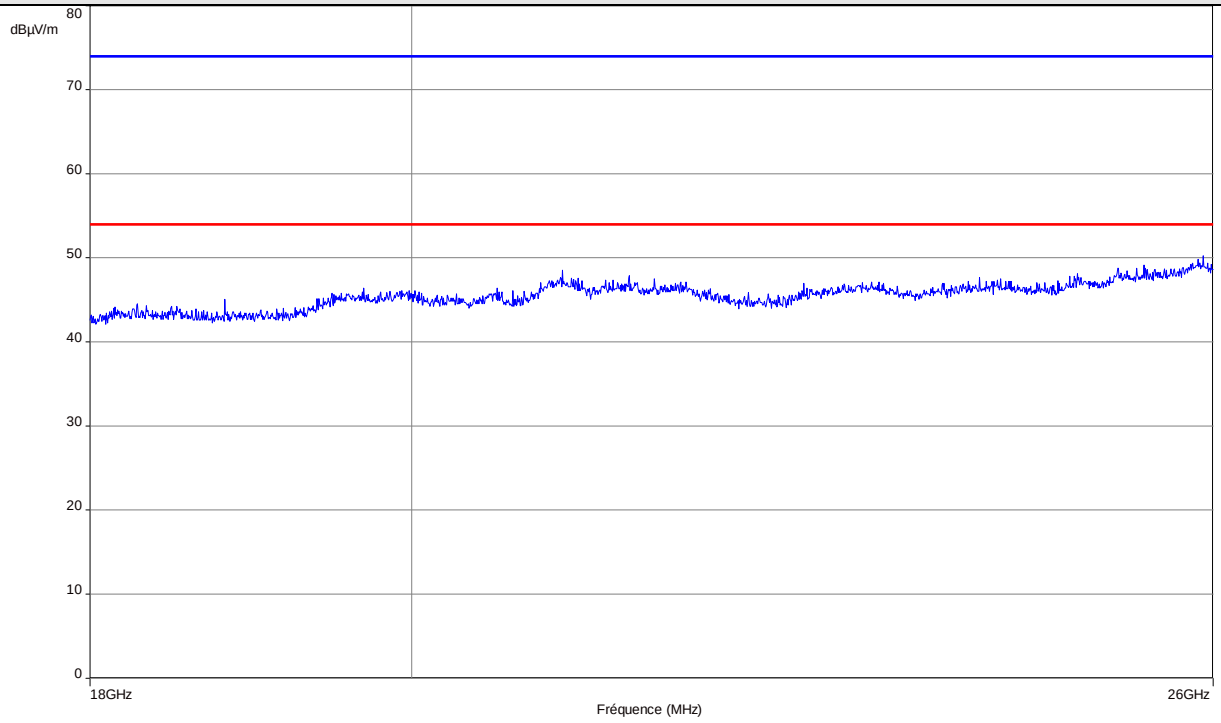
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-13GHz / 3m / Vertical / Transmit mode) – High channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	13GHz-18GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

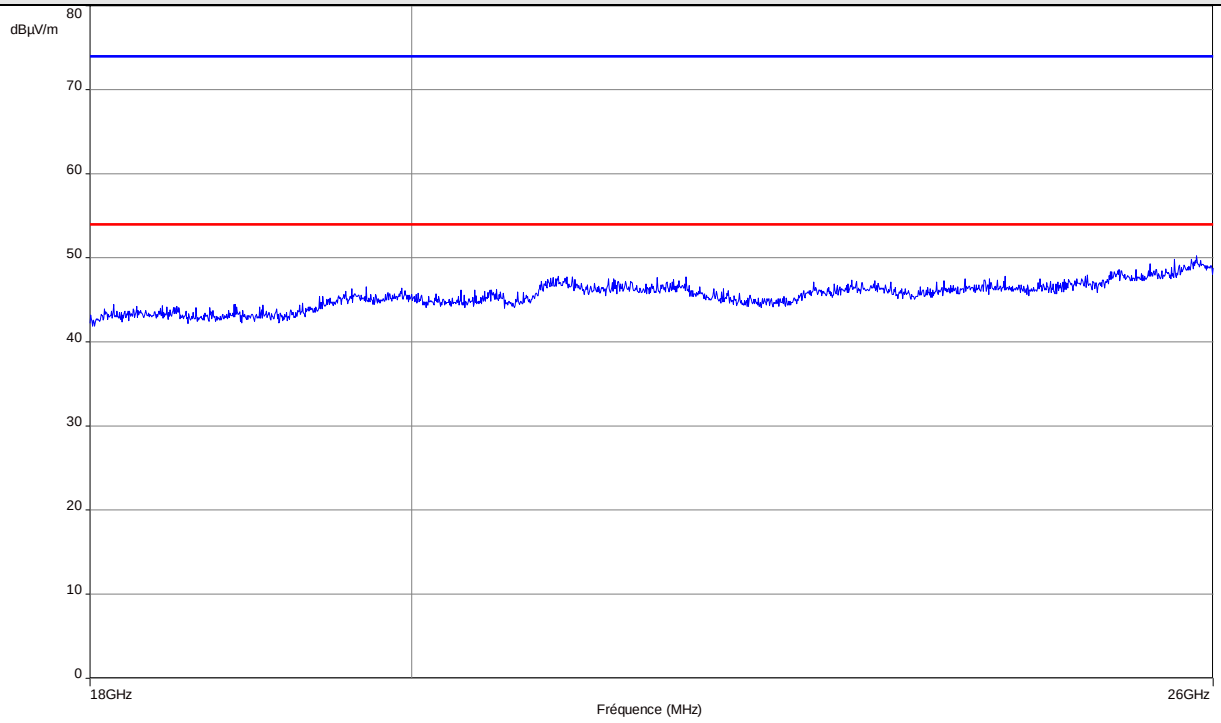
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 18GHz-26GHz / 3m / Horizontal / Transmit mode) – High channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	18GHz-26GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

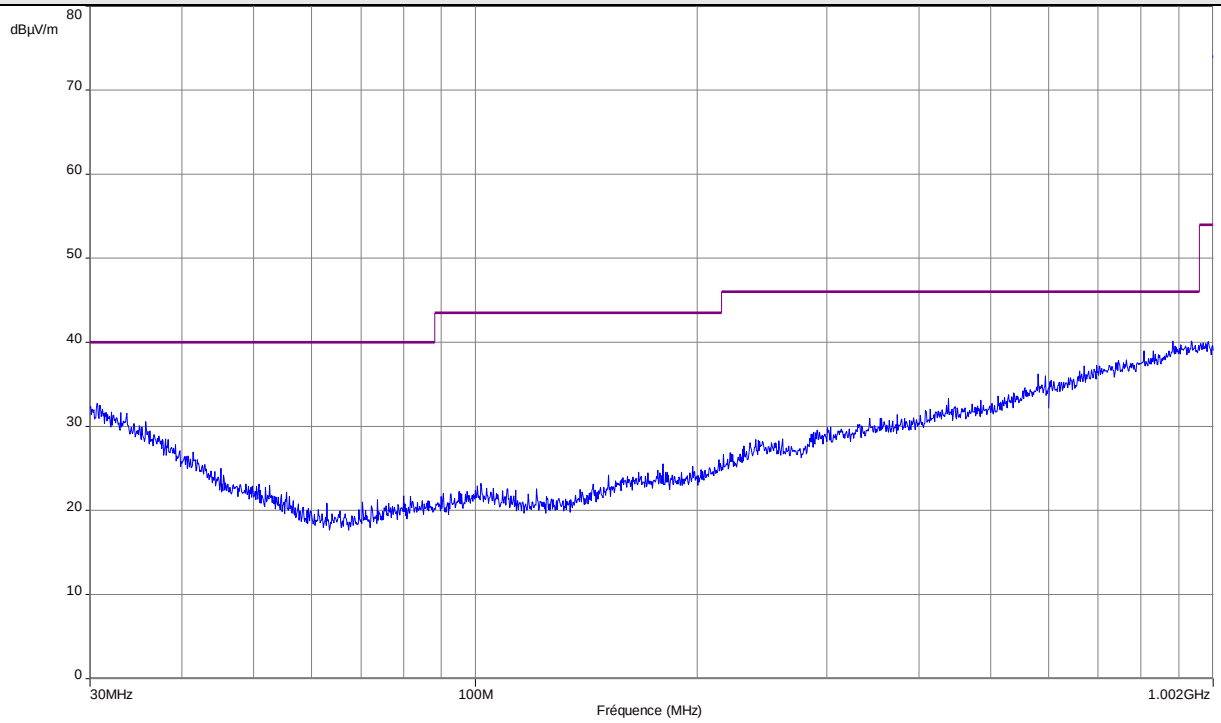
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 18GHz-26GHz / 3m / Vertical / Transmit mode) – High channel



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	18GHz-26GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

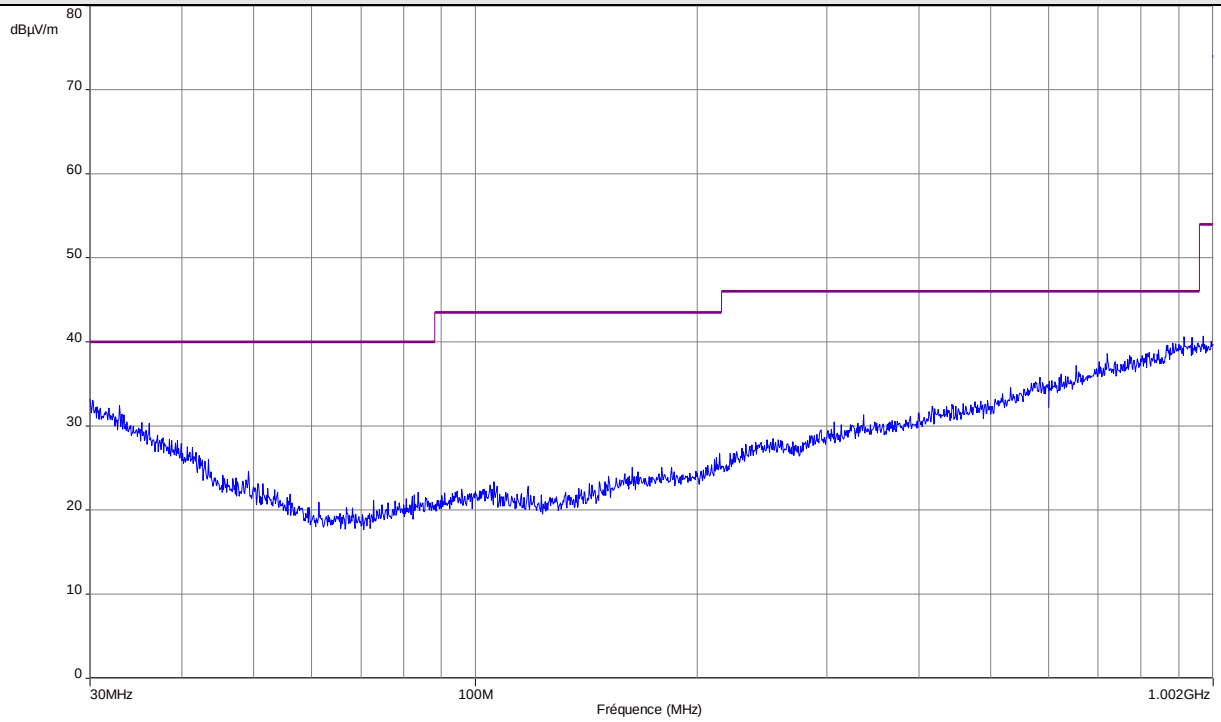
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Receive mode) – Normal mode



Note: Pre-scan graph only for identification purpose.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

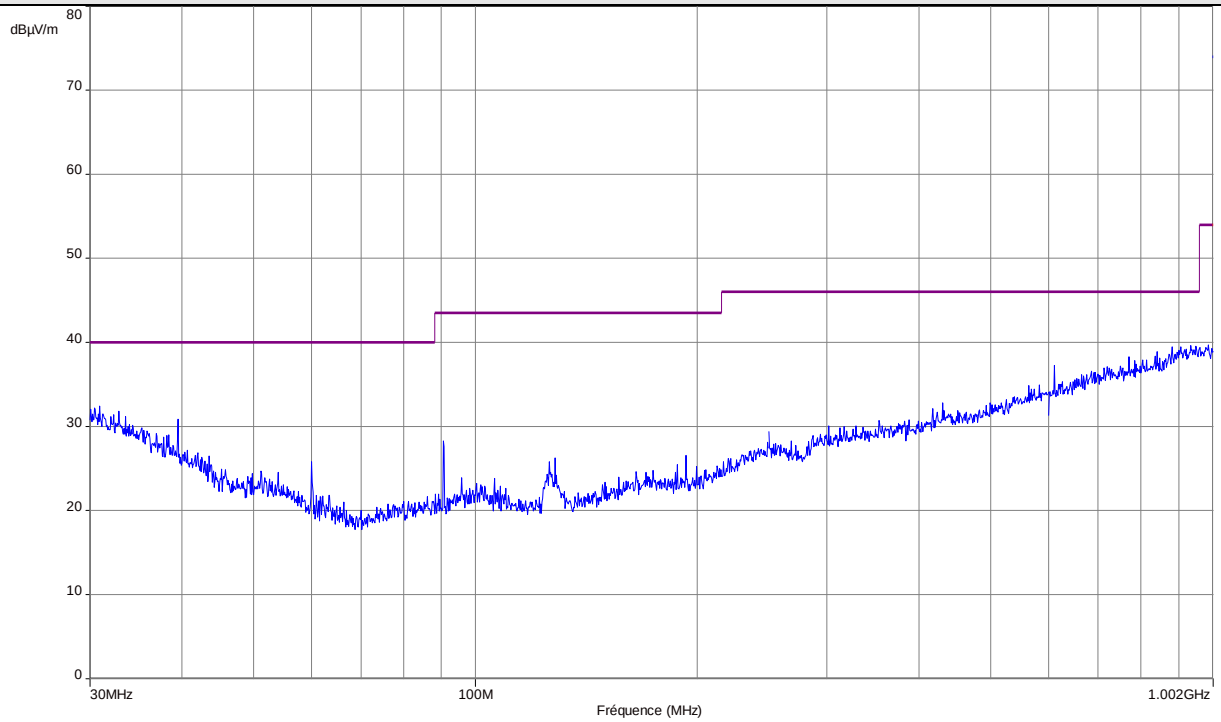
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Receive mode) – Normal mode



Note: Pre-scan graph only for identification purpose.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Vertical
Voltage:	3.7V DC
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

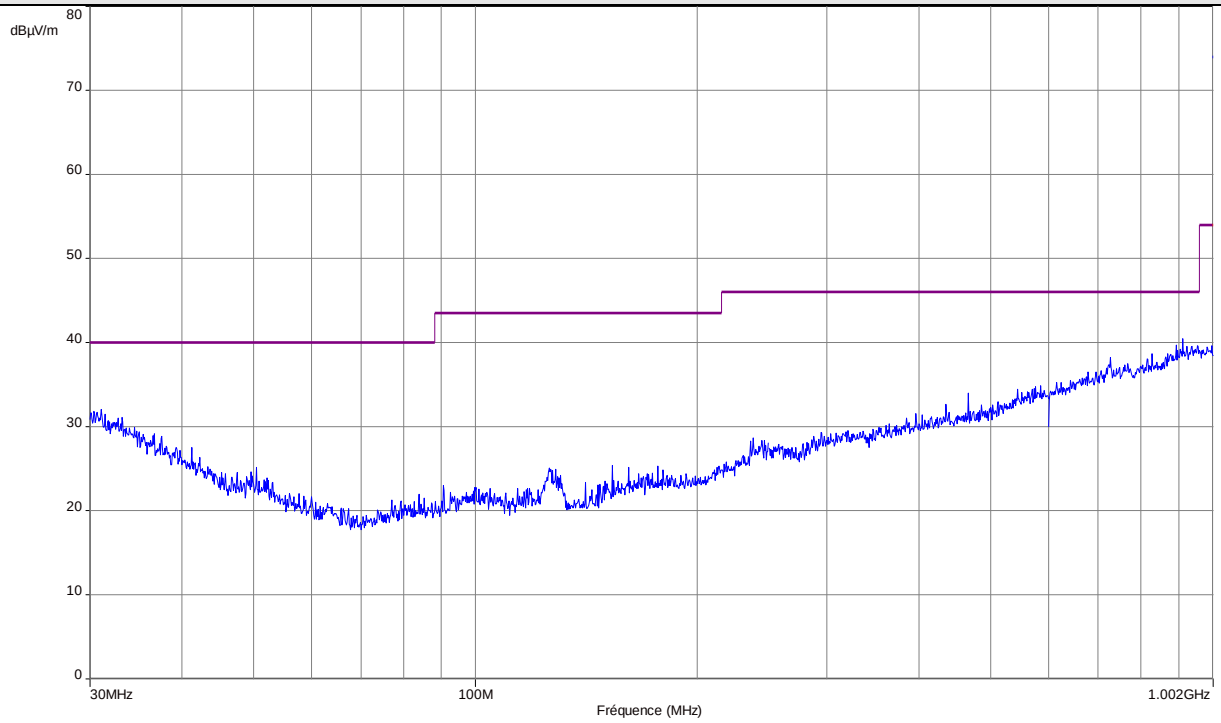
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Receive mode) – Charge mode / With companion device



Note: Pre-scan graph only for identification purpose. Worst case between low, mid and high channels.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Horizontal
Voltage:	5V DC
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

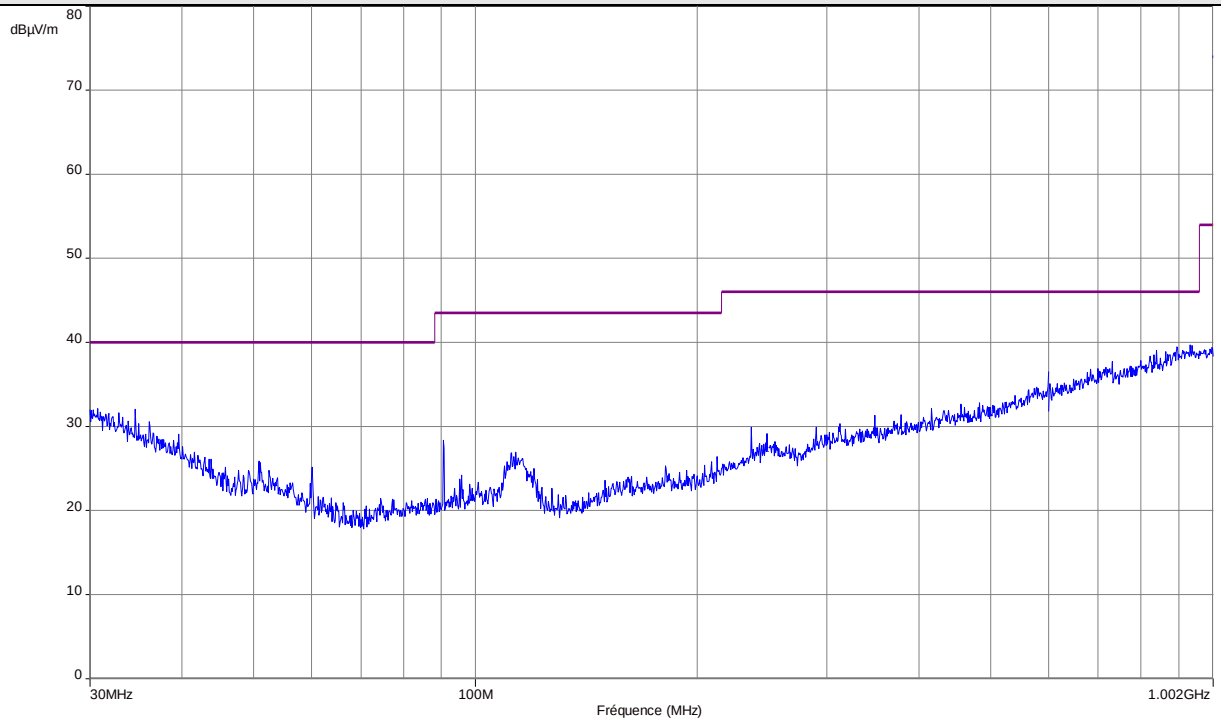
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Receive mode) – Charge mode / With companion device



Note: Pre-scan graph only for identification purpose. Worst case between low, mid and high channels.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Vertical
Voltage:	5V DC
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

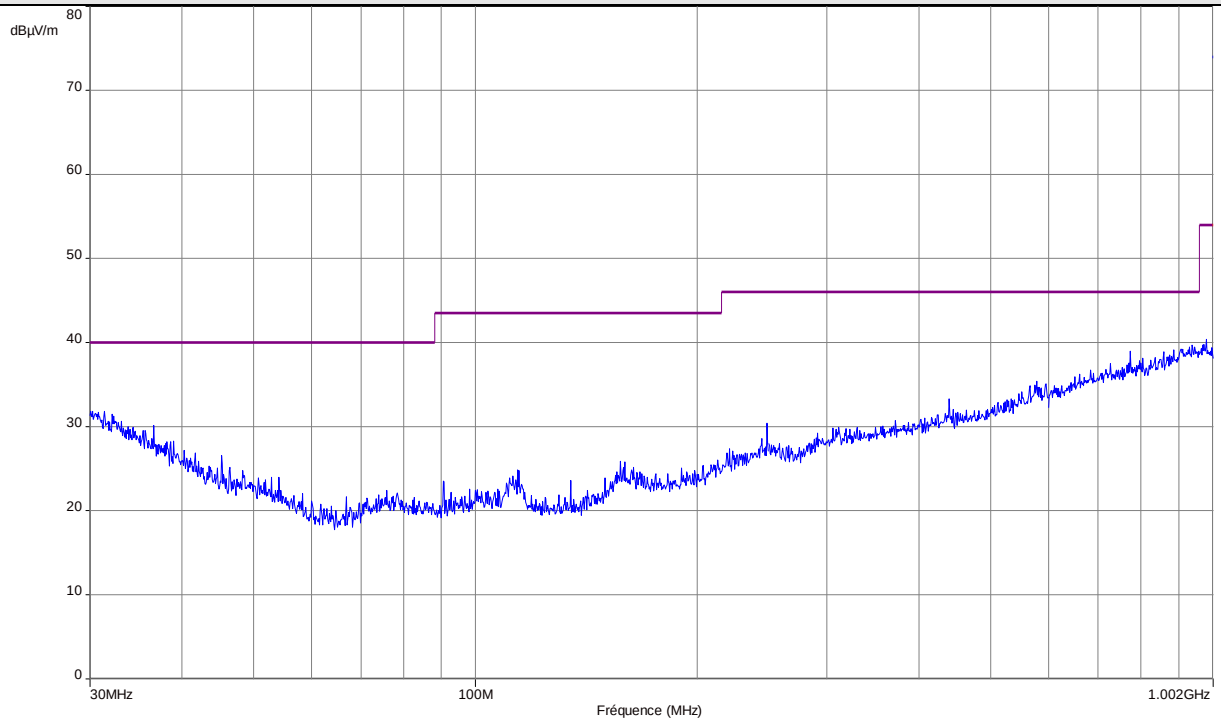
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Receive mode) – Charge mode / With POGO cable



Note: Pre-scan graph only for identification purpose. Worst case between low, mid and high channels.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Horizontal
Voltage:	5V DC
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

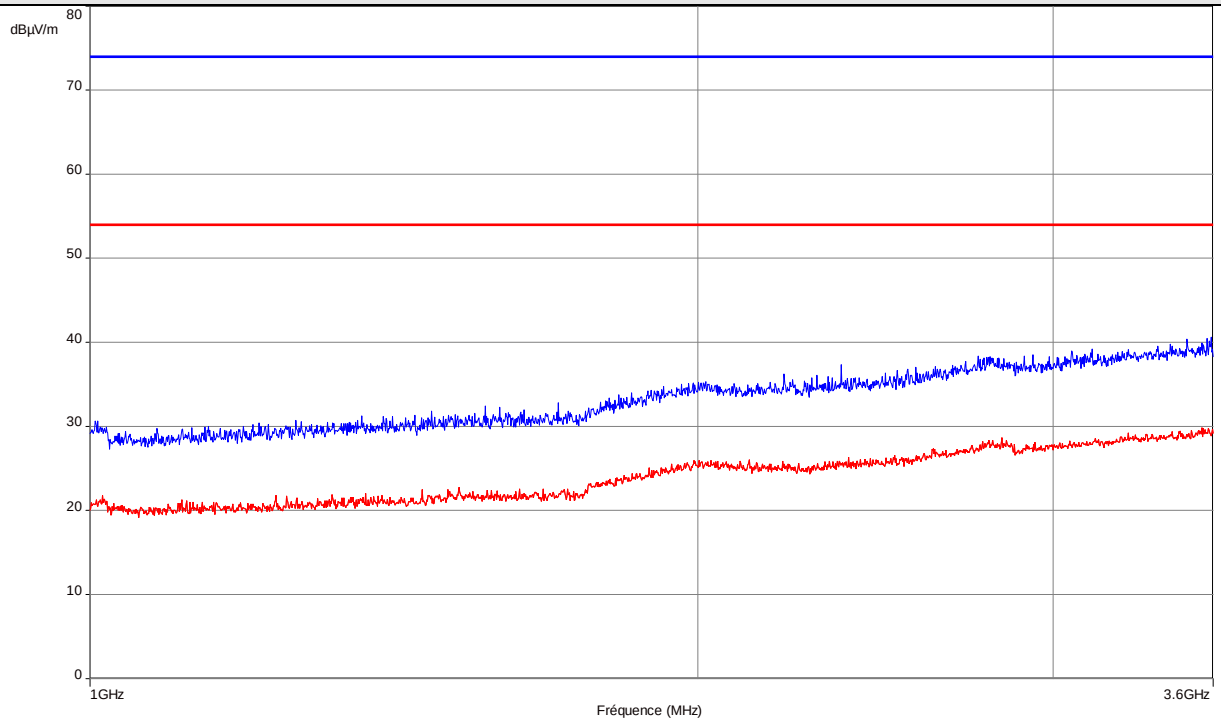
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Receive mode) – Charge mode / With POGO cable



Note: Pre-scan graph only for identification purpose. Worst case between low, mid and high channels.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Vertical
Voltage:	5V DC
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

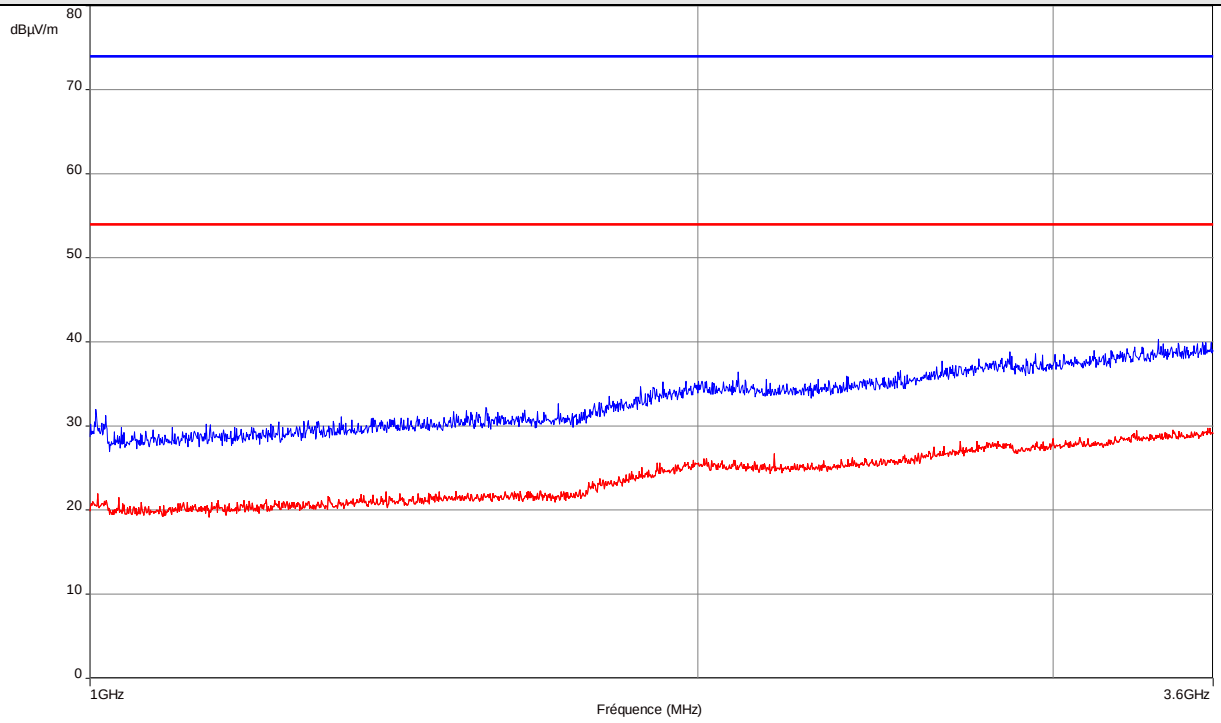
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Horizontal / Receive mode)



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

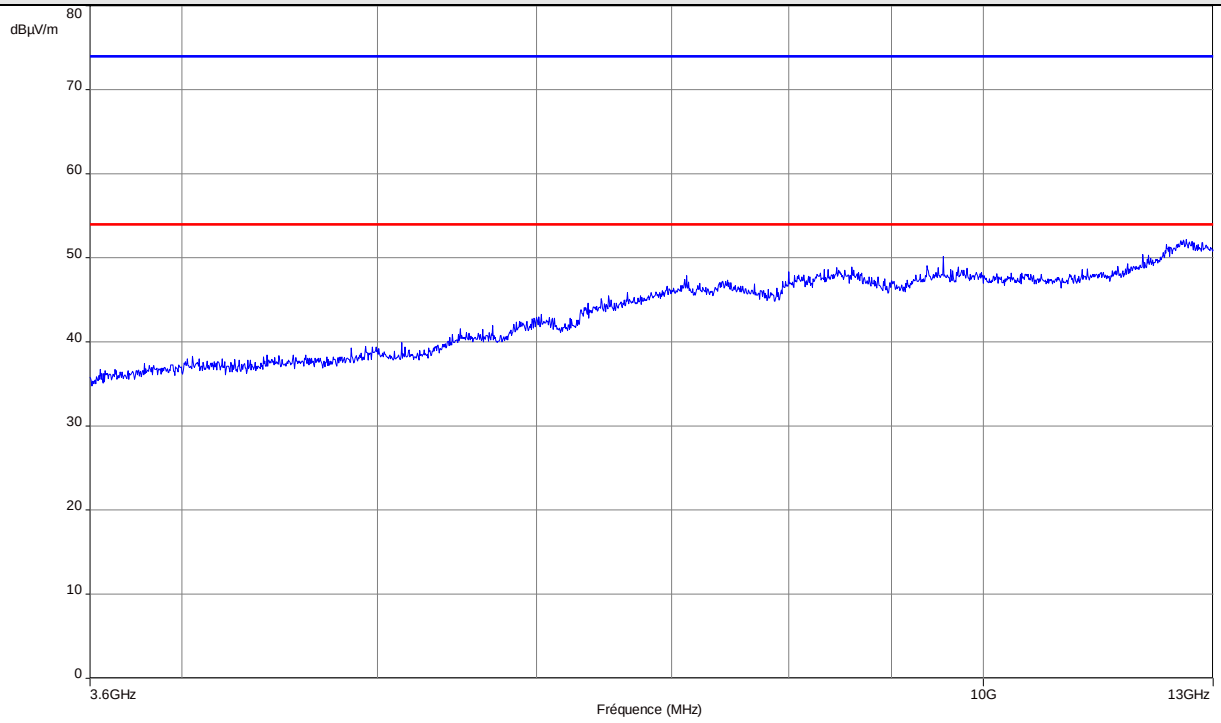
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Vertical / Receive mode)



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

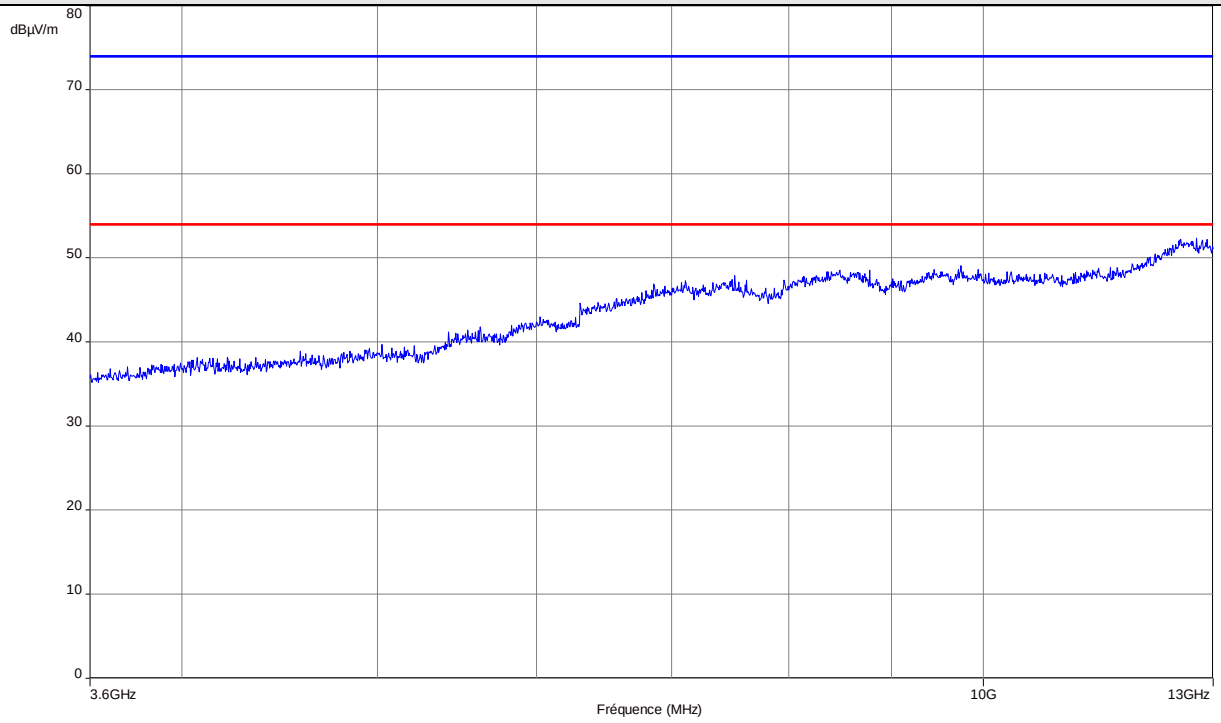
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-13GHz / 3m / Horizontal / Receive mode)



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	3.6GHz-13GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

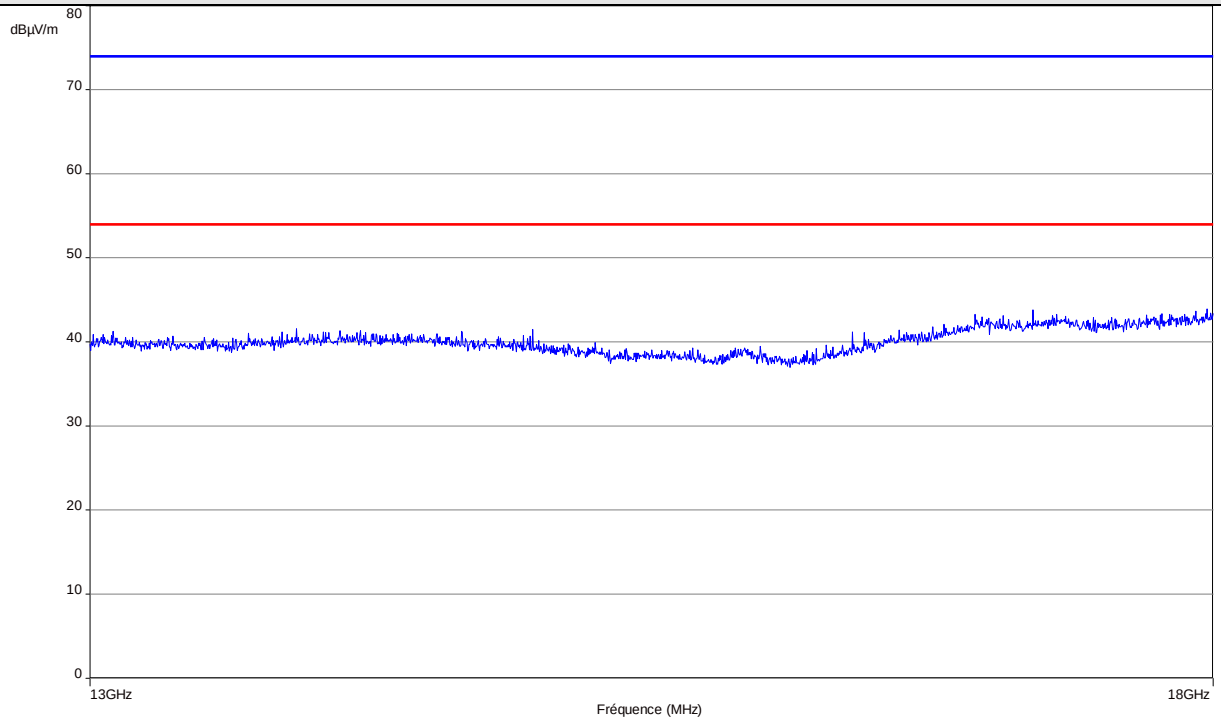
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-13GHz / 3m / Vertical / Receive mode)



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	3.6GHz-13GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

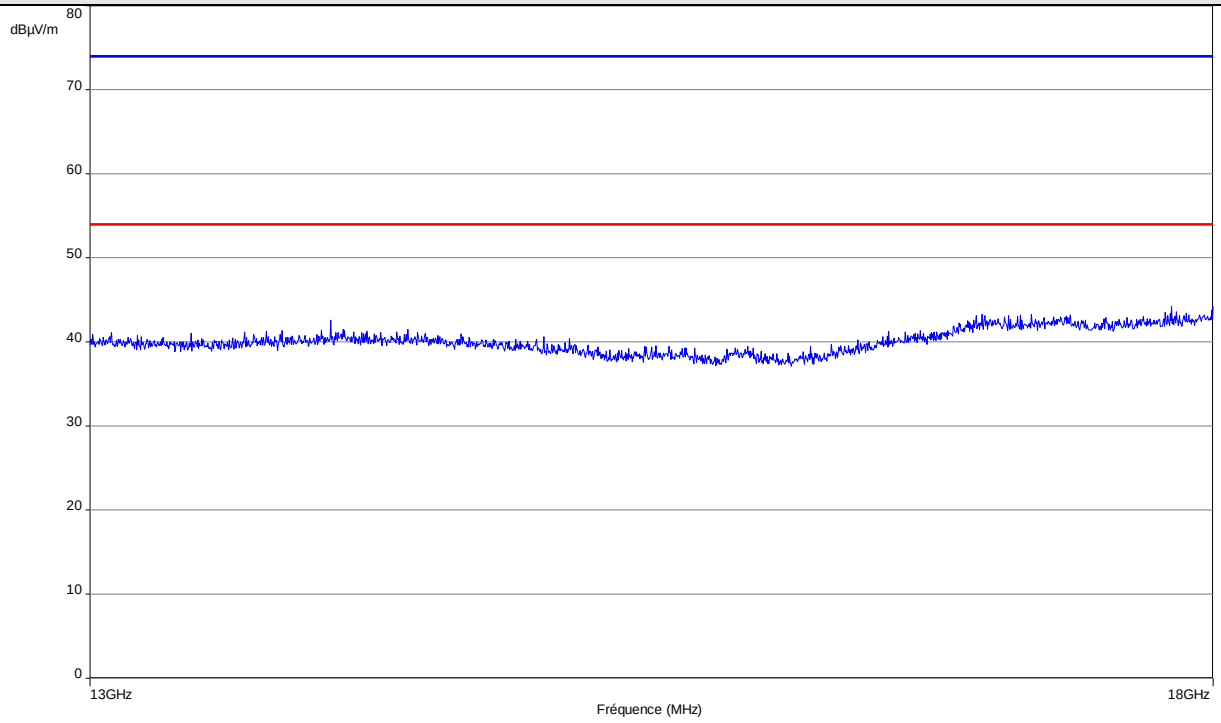
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 13GHz-18GHz / 3m / Horizontal / Receive mode)



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	13GHz-18GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

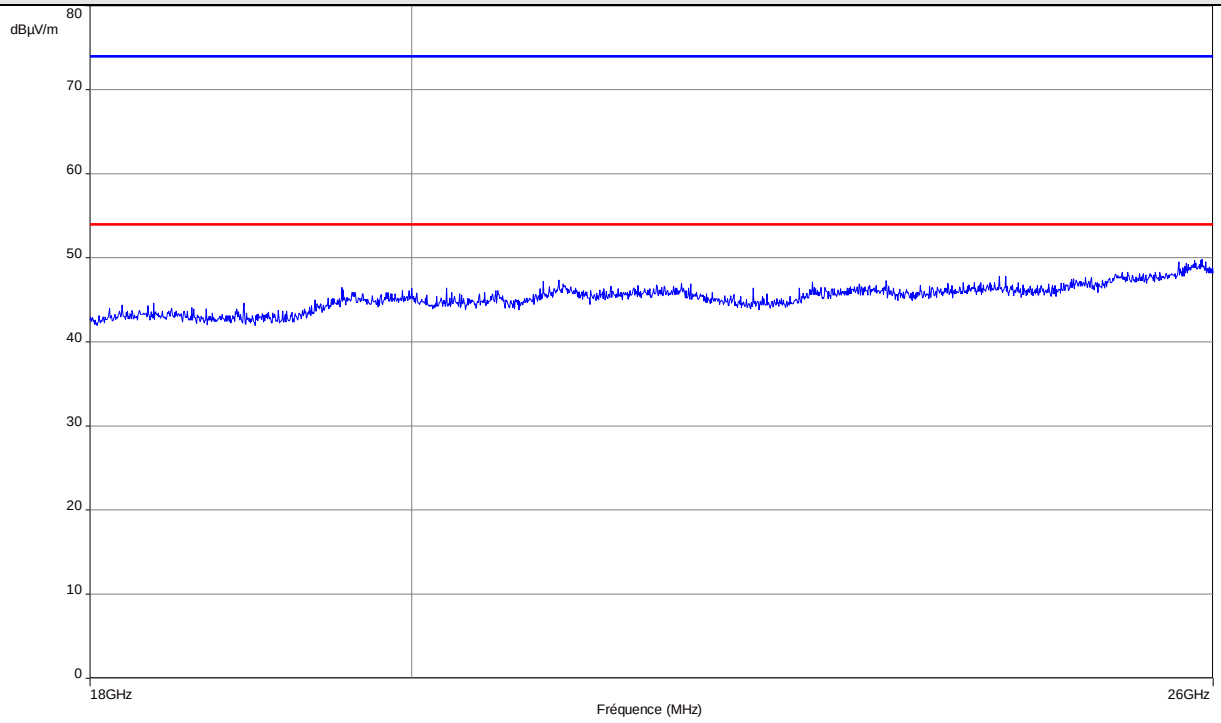
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-13GHz / 3m / Vertical / Receive mode)



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	13GHz-18GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

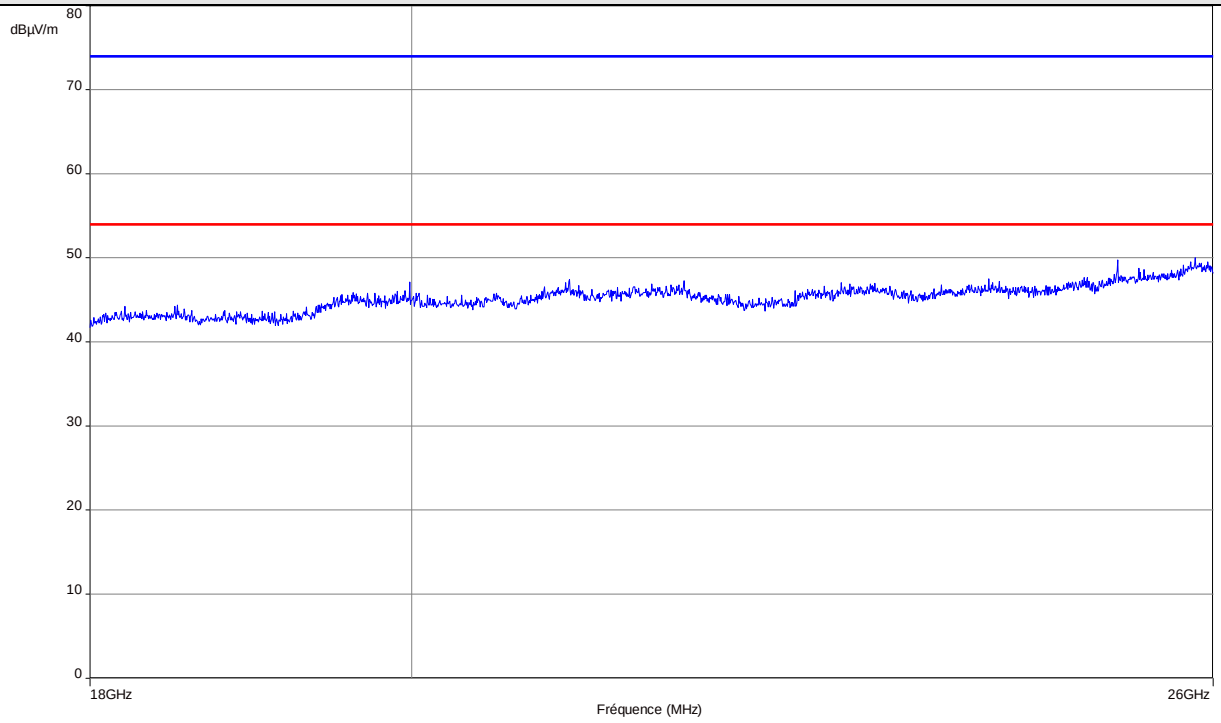
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 18GHz-26GHz / 3m / Horizontal / Receive mode)



Note: Pre-scan graph only for identification purpose.

------ : Peak measure	------ : Average measure
Frequency band investigated:	18GHz-26GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 18GHz-26GHz / 3m / Vertical / Receive mode)



Note: Pre-scan graph only for identification purpose.

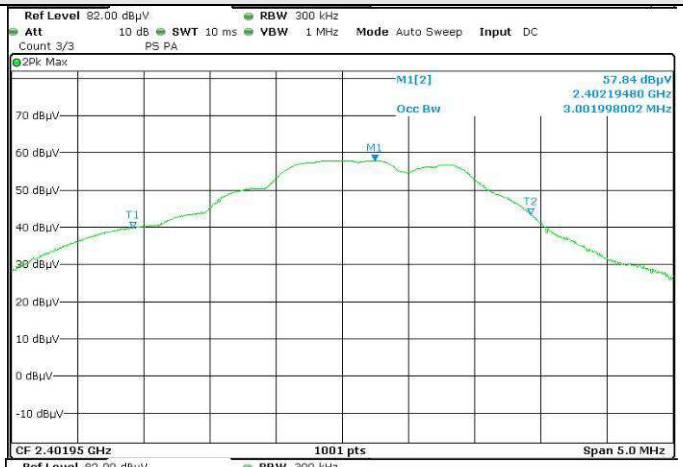
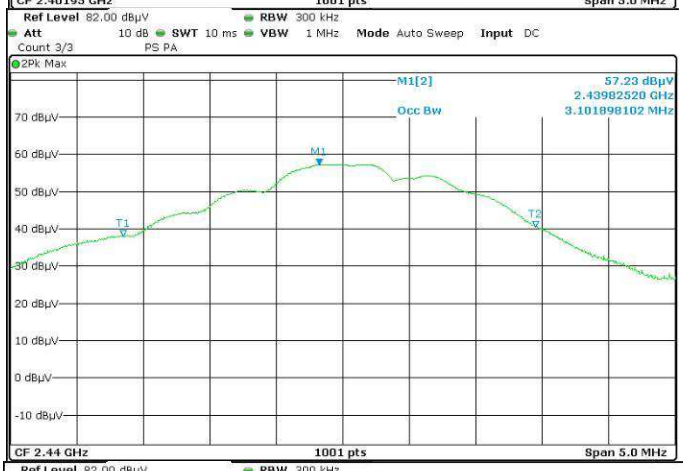
------ : Peak measure	------ : Average measure
Frequency band investigated:	18GHz-26GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC (Normal mode) / 5V DC (Charge mode) / Worst case
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

14. Occupied bandwidth (99%)

TEST: Occupied bandwidth (99%) / RSS-GEN		Verdict
Method: The setup is in an anechoic chamber. The spectrum analyzer is connected to the measuring antenna. A radiated measurement is performed. The RBW is set in the range of 1% to 5% of the occupied bandwidth, with VBW ≥ 3 x RBW. The SPAN is wide enough to capture all products of the modulation process. A MaxHold Peak detector is used. Measure is performed with OBW 99% function of the spectrum analyser. The tested equipment is set to transmit operation with modulation on low, mid and high channels.		**Pass**
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	10 to 40 °C	20°C
Relative Humidity	10 to 90 %	55%
Supplementary information: Test location: SMEE Test date: March 7th, 2017 by J. Blancher Power supply voltage: 3.7V from battery (fully charged)		

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
Anechoic chamber	COMTEST	214263	CAG-141-001	-	-
Turntable	Innco- Systems	CT0800	PLA-141-001	-	-

Tabulated Results for Occupied Bandwidth	
Frequency (MHz)	**99% Occupied Bandwidth** (MHz)
2402.0	3.002MHz
2440.0	3.102MHz
2480.0	2.557MHz

Graphical representation of Occupied Bandwidth	
	Low channel
	Mid channel
	High channel

Frequency band investigated:	2400MHz to 2483.5MHz
RBW :	300kHz
Measurement detector:	Peak