

Test Firm Registration Number: 171131
IC Company Number: 9545A (Test site)

Matériel testé : <i>Equipment under test:</i>	MUZIK Smart On Ear (Wireless headphones) / MZHP1 v1.1
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Constructeur:
Manufacturer: **Muzik LLC**
404 Washington Ave. #700
Miami Beach, FL 33139 – USA

Rapport délivré à :
Issued to: **Muzik LLC**
404 Washington Ave. #700
Miami Beach, FL 33139 – USA

Référence de la proposition : 082015-21567
Proposal number:

Date de l'essai : Du 23 au 25 novembre 2015
Date of test: November 23rd to 25th, 2015

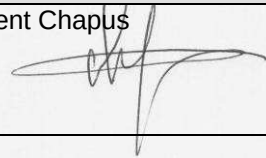
Objectif des essais : EMC qualification accordingly to following standards:
Test purpose: - CFR 47, FCC Part 15, Subpart B & C
(Chapter 15.247 - Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz)
- Industry Canada ICES-003 Issue 5, RSS-Gen Issue 4 & RSS-247, Issue 1
(Frequency Hopping Systems (FHSs))

FCC ID: 2AASD-MZHP1
IC: 11314A-MZHP1

Lieu du test: SMEE CE-Mesures
Test location: 38 VOIRON - France

Test réalisé par : Jérémy BLANCHER
Test realized by:

Conclusion : L'équipement satisfait aux prescriptions des normes citées en référence.
Conclusion: The appliance complies with requirements of above mentioned standards.

Ed.	Date	Modifications / Pages	Written by:	Approved by: Visa
1	December 9 th , 2015	Initial Edition	Jeremy Blancher	Laurent Chapus 

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COORDONNEES

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1. Références Normatives / Normative references

Standard : FCC CFR 47, PART 15, Subpart B & Subpart C

ANSI C63.4 (2014): 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): American National Standard for Testing Unlicensed Wireless Devices

Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems DA 00-705

Determining ERP and EIRP Guidance 412172 D01

Industry Canada ICES-003 (Issue 5/2014) - Information Technology Equipment (ITE) – Limits and methods of measurement

Industry Canada RSS-GEN (Issue 4/2014) - General Requirements and Information for the Certification of Radio Apparatus

Industry Canada RSS-247 (Issue 1/2015) - Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

2. Synthèse des essais / Test synthesis

TEST	Paragraph number FCC Part 15 / IC RSS-247	Spec. FCC Part 15 / IC RSS-247	RESULTS (comments)
Conducted emissions test	15.107 (a) ICES-003 § 6.1	Table 15.107 (a)	(1)
Radiated emission test	15.109 (a) ICES-003 § 6.2	Table 15.109 (a)	PASS
20dB Bandwidth	15.247 (a) (1) RSS-247 § 5.1 (1)	No restriction	(1)
Hopping channel separation	15.247 (a) (1) RSS-247 § 5.1 (2)	<u>Minimum separation</u> 25kHz or the two-third 20dB bandwidth whichever is greater	(1)
Number of hopping frequencies	15.247 (a) (1) (iii) RSS-247 § 5.1 (4)	Minimum 15 channels used	(1)
Time of occupancy	15.247 (a) (1) (iii) RSS-247 § 5.1 (4)	Maximum 400ms per channel within 31.6s	(1)
Maximum Peak Output Power	15.247 (b) (1) (4) RSS-247 § 5.4 (2)	0.125W max / 21dBm (Conducted) 0.5W max / 27dBm (EIRP)	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 / 15.247 (d) / 15.205 RSS-Gen 6.13 / RSS-247 § 5.5	<u>Measure at 300m</u> 9-490kHz: 2400µV/m/F(kHz) <u>Measure at 30m</u> 0.490-1.705: 24000µV/m/F(kHz) 1.705-30MHz: 30µV/m <u>Measure at 3m</u> 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m	PASS
Receiver Emission Limits	RSS-Gen 7.1	<u>Radiated, Measure at 3m</u> 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m <u>Conducted (for detachable antenna)</u> 30MHz-1GHz : -57dBm Above 1GHz : -53dBm	(1)
Occupied Bandwidth	RSS-Gen: 2010 § 6.6	BW at 99%	(1)

N/A: Not Applicable

(1): See test report 20721-FCC-1

- **General conclusion:**

Measures and tests performed on the sample of the product MZHP1 v1.1, 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. Equipement Sous Test (EST) / Equipment Under Test (EUT)

Nom /
Identification

**MUZIK Smart On Ear
(Wireless headphones) / MZHP1 v1.1**

Sn: Sample #1
Sn: Sample #2
Sn: Sample #3

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

- Smart Cable (4 wires, 1.5m)
- Motorola XT890 (Android smartphone)
- USB charger PHIHONG PSM03A-050Q (100-240V 50-60Hz // 5V dc / 500mA)

Entrées-Sorties /
Input / Output

	Câbles pour essai / Cables for test	Blindé / Shielded	Prévu pour >3m / Intended for >3m
DC input (5V/0.5A) Micro USB connector	USB2.0 / 0.5m	Yes	No
3.5mm INPUT JACK	Smart cable	No	No

Version programme /
Firmware version

N.C

Mode de fonctionnement /
Running mode

- The tested samples can be set in following modes:
- Bluetooth transmit mode to a smartphone (Normal operation, sample #1)
 - Audio file listening on headphones with smart cable (Direct audio, sample #1)
 - Battery charging with 5VDC power adapter (Normal operation, sample #1)
- A special connection to sample #2 (radiated measurement) and sample #3 (conducted measurement) permits to set the EUT in following modes:
- Transmit on selectable channel (low, mid, high)
 - Choice of modulation type, packet type, packet size
 - Output Tx power set at its maximum nominal value

Programme de test /
Test program /

BlueTest3 (to configure wanted mode on samples #2 and #3)

Information sur l'équipement /
Equipment information

- Frequency hopping from 2402 MHz to 2480 MHz
- Antenna type: PIFA on PCB (Peak gain < 2.5dBi), single antenna
- Modulations: GFSK (DH5)
π/4DQPSK (2-DH5)
8DPSK (3-DH5)
- Battery type Lithium-ion 3.7V-700mH
- Bluetooth module BTM720 with CSR BlueCore5
- Low channel: 2402MHz / Mid channel: 2441MHz / High channel: 2480MHz
- Equipment intended for use as a mobile station
- Equipment designed for continuous operation

4. Conditions pendant les essais / Test conditions

Humidité relative / *Relative Humidity* : 40 - 55%
Température / *Temperature* : 10 - 20°C

Tension d'alimentation / Power supply voltage:

Equipment sous test / *Equipment under test* : 3.7V DC from Li-battery
5V DC from AC/DC power adapter (for charging mode)

Tension secteur / AC mains : 110V/60Hz

5. Modifications de l'EST / Modifications of the EUT

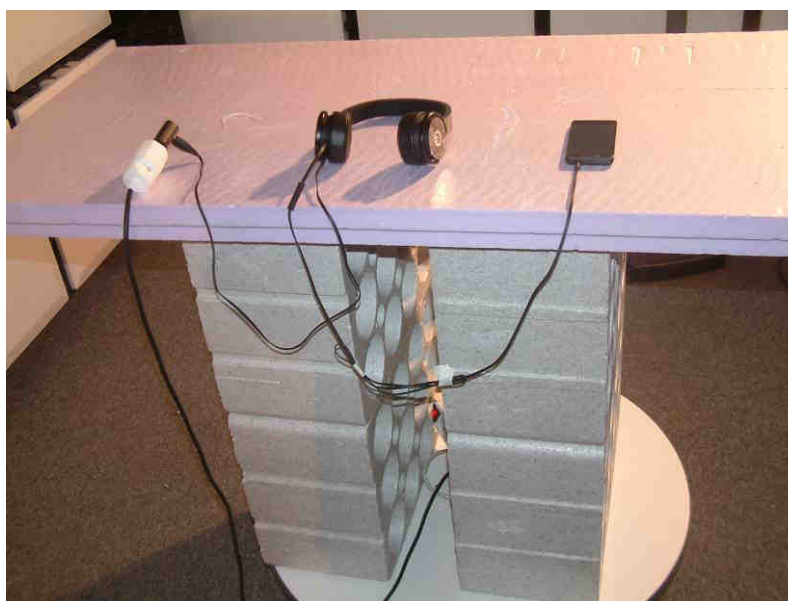
None

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

TEST: Limits for radiated disturbance 30 MHz – 1 GHz			Verdict
<u>Method:</u> Measurements were made in a 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 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, with audio cable (1kHz sound file)		
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: November 24 th , 2015 Power supply voltage: 5V DC from AC/DC power adapter			

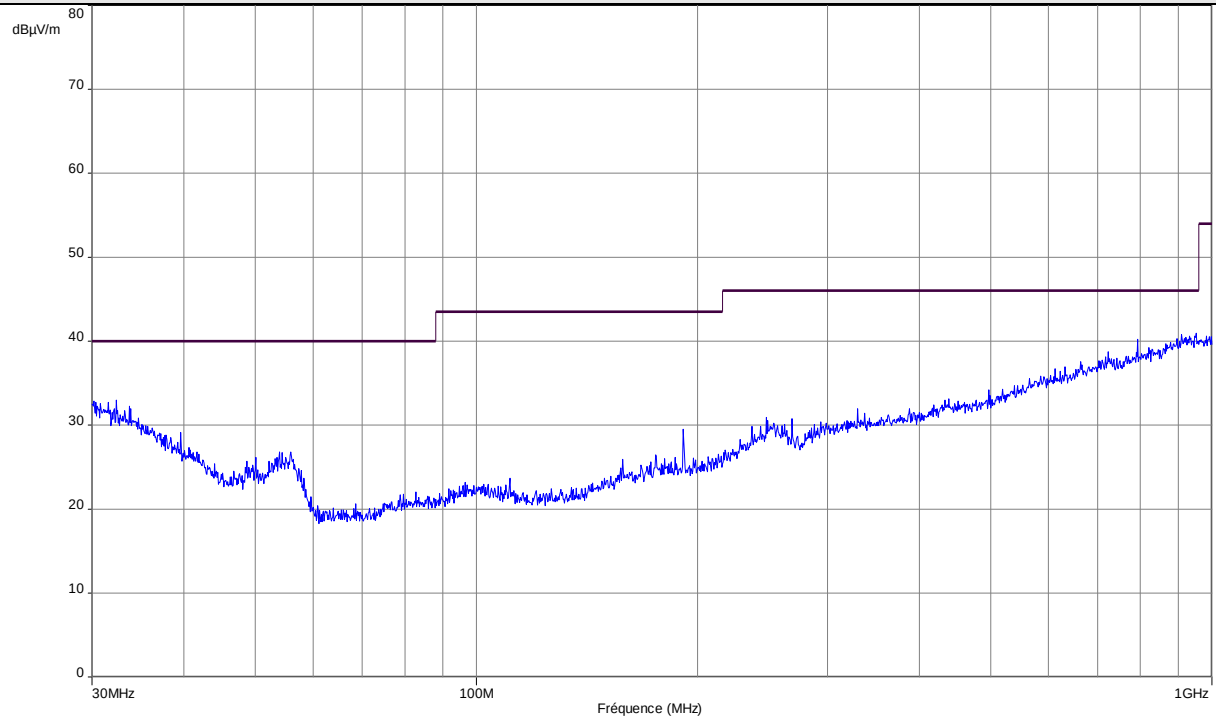
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2015/8	2016/8
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2015/8	2016/8
BiConiLog antenna	EMCO	3142B	ANT-101-010	2014/8	2015/8
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
RF cable	Div	2m	CAB-101-011	2015/3	2016/3
RF cable	Div	OATS/25m	CAB-101-019	2015/3	2016/3
RF cable	Div	OATS/10m	CAB-101-020	2015/3	2016/3
RF cable	Pasternack	PE302-120	CAB-141-024	2015/3	2016/3
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2015/3	2016/3
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2015/3	2016/3
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2015/3	2016/3
Anechoic chamber	COMTEST	214263	CAG-141-001	-	-
OATS	Div	10m	SIT-101-001	2015/5	2016/5
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	-	-

Photo of test setup for Radiated Disturbance pre-scan



Tabulated Results for Radiated Disturbance (3m measurement on Open Area Test Site, 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 15.109 / 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 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						

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

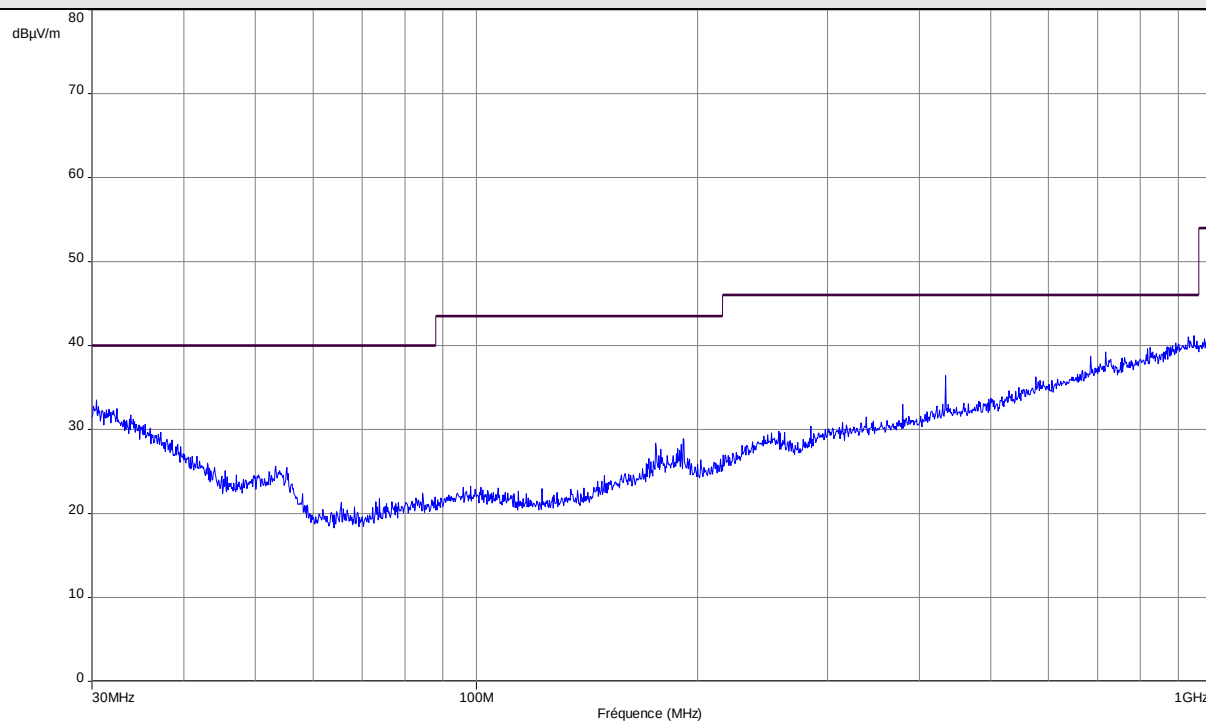


Note: Pre-scan graph only for identification purpose.

----- : Peak measure

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

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



Note: Pre-scan graph only for identification purpose.

----- : Peak measure

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

7. Maximum Peak Output power

TEST: Maximum peak conducted output power / FCC part 15.247 – RSS-247			Verdict
Method: Measurements were performed with peak detector using a 1MHz RBW. The VBW is set to 3MHz. The spectrum analyzer is connected via suitable means to the RF output of the tested equipment. (Conducted measurement). For field strength, the measure is performed on a 3m Open Area Test Site. The tested equipment is set to transmit operation with modulations on lowest, middle and highest channel.			Pass
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	10 to 40 °C	12°C	
Relative Humidity	10 to 90 %	45%	
Limits – FCC Part 15.247 (b) / RSS-247: 2015 (§ 5.4)			
Frequency (MHz)	Limits (dBµV/m)		
	Level	Results	
2400 to 2483.5	27 dBm (EIRP)	Pass	
2400 to 2483.5	21 dBm (Conducted)	Pass	
Supplementary information: Test location: SMEE – CE Mesures / Test date: November 24 th , 2015 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	Div	OATS/25m	CAB-101-017	2015/3	2016/3
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 (Conducted measurement)

Modulation DH5 / GFSK

FREQ (MHz)	Peak Power conducted (dBm)	Limit (dBm)	Result
2402	5,1	21.0	PASS
2441	4,3	21.0	PASS
2480	3,1	21.0	PASS

Modulation 2-DH5 / $\pi/4$ DQPSK

FREQ (MHz)	Peak Power conducted (dBm)	Limit (dBm)	Result
2402	3,3	21.0	PASS
2441	2,2	21.0	PASS
2480	0,4	21.0	PASS

Modulation 3-DH5 / 8DPSK

FREQ (MHz)	Peak Power conducted (dBm)	Limit (dBm)	Result
2402	3,4	21.0	PASS
2441	2,2	21.0	PASS
2480	0,5	21.0	PASS

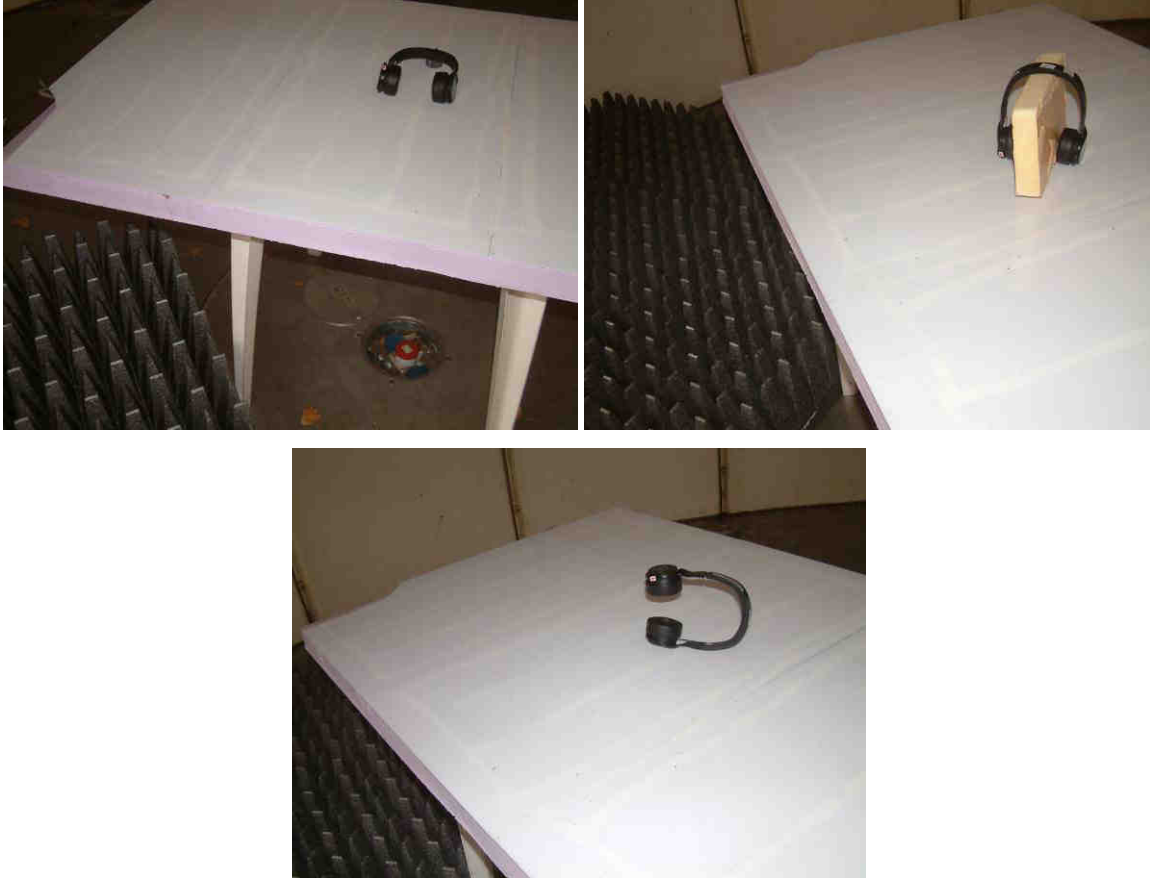
RBW:	1MHz
Limit:	FCC Part 15.247 (b) / RSS-247: 2015 (§ 5.4)
Final measurement detector:	Peak
Wide Measurement Uncertainty:	$\pm 5.2\text{dB}$ (k=2)
RESULT:	PASS
Note:	Worst case is with 1-DH5 / GFSK modulation

Tabulated Results for Maximum peak output power (Radiated measurement)

FREQ (MHz)	Field Strength 3m (dB μ V/m)	Calculated EIRP (dBm)	Limit (dBm)	Result
2402	101,6	6.4	27.0	PASS
2440	101,9	6.7	27.0	PASS
2480	100,8	5.6	27.0	PASS

RBW:	1MHz
Measurement distance:	3m
Limit:	FCC Part 15.247 (b) / RSS-247: 2015 (§ 5.4)
Final measurement detector:	Peak
Wide Measurement Uncertainty:	$\pm 5.2\text{dB}$ (k=2)
RESULT:	PASS
Note:	Field strength is measured on the Open Area Test Site at a distance of 3m. Three orthogonal axis measurements are performed for both horizontal and vertical antenna (measure) polarization in order to obtain the maximum peak field strength. Test is performed with and without audio or DC cable in order to maximize radiated field. The power (EIRP) was calculated using the following equation: $EIRP = (E \times d)^2/30$ Where D is the distance in meters from which the field strength was measured E is the maximum field strength in V/m Test performed with 1-DH5 / GFSK modulation (worst case)

Photo of test setup for Radiated Disturbance

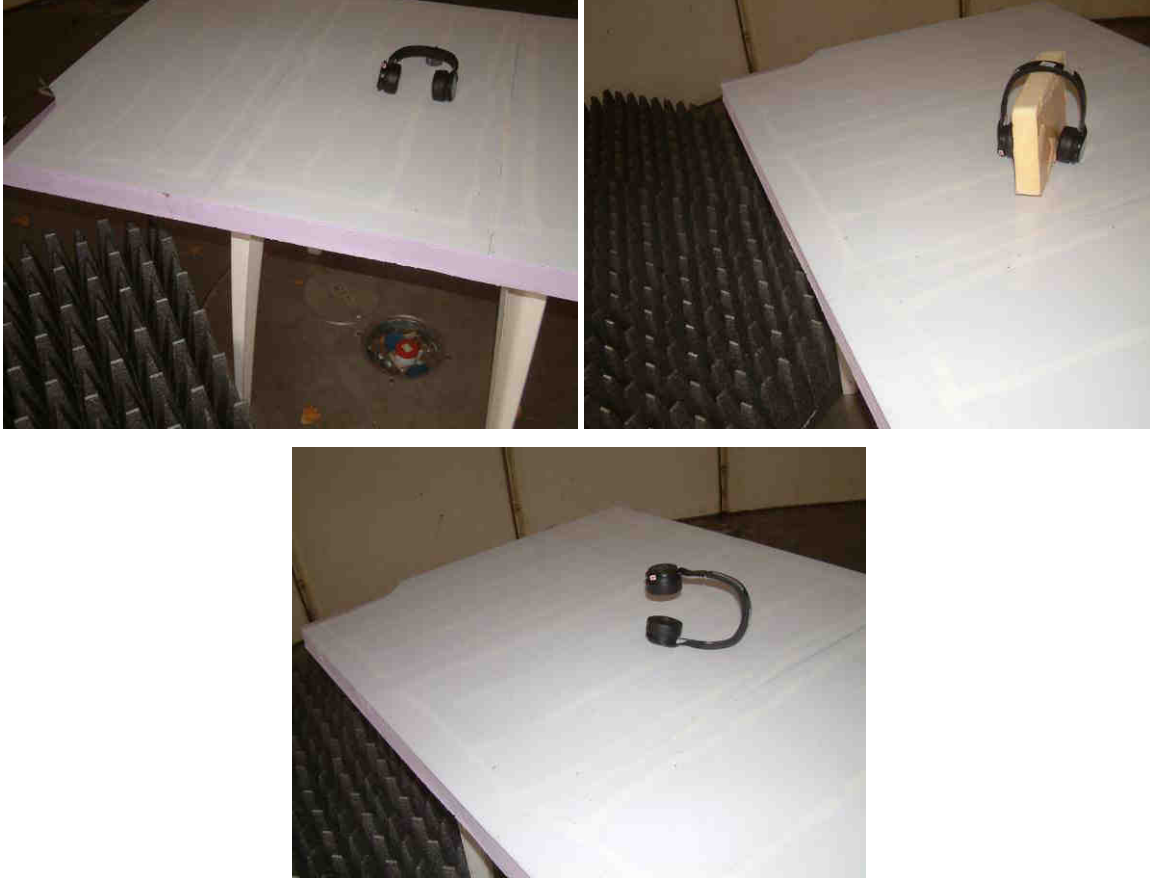


8. Unwanted emissions in Non-Restricted Frequency bands (Radiated / Conducted)

TEST: Unwanted emissions in Non-Restricted Frequency Bands / FCC part 15.247 – RSS-247			Verdict
<u>Method:</u> For radiated test, measurements were made in a 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 meters. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements 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. For conducted test, measurements were performed with peak detector using a 100kHz RBW. The VBW is set to 300kHz. The spectrum analyzer is connected via suitable means to the RF output of the tested equipment.			Pass
Laboratory Parameters:	Required prior to the test		During the test
Ambient Temperature	10 to 40 °C	12°C	
Relative Humidity	10 to 90 %	45%	
Fully configured sample scanned over the following frequency range	Frequency range on each side of line	Measurement Point	
	30MHz – 25GHz	3 m measurement distance (Radiated) RF coaxial connector (Added on antenna trace for conducted measurement)	
Limits – FCC Part 15.247 (d) / RSS-247: 2015 (§ 5.5)			
Frequency (MHz)	Limits		
	Detector / Analyser RBW	Limit	Results
30 to 25000	Pk / 100kHz	20dB below the maximum Peak level	Pass
Supplementary information: Test location: SMEE – CE Mesures / Test date: November 24 th , 2015 Power supply voltage: 3.7V from battery (fully charged)			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2015/8	2016/8
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2015/8	2016/8
BiConiLog antenna	EMCO	3142B	ANT-101-010	2015/8	2016/8
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
RF cable	Div	OATS/25m	CAB-101-019	2015/3	2016/3
RF cable	Pasternack	PE302-120	CAB-131-024	2015/3	2016/3
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2015/3	2016/3
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2015/3	2016/3
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2015/3	2016/3
High-pass filter	Mini-Circuit	VHF-3100+	FIL-151-006	2015/3	2016/3
Pre-amplifier	PE	PE1524	PRE-101-002	2015/3	2016/3
Anechoic chamber	COMTEST	214263	CAG-141-001	-	-
OATS	Div	10m	SIT-101-001	2015/8	2016/8
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	2013/9	2016/9

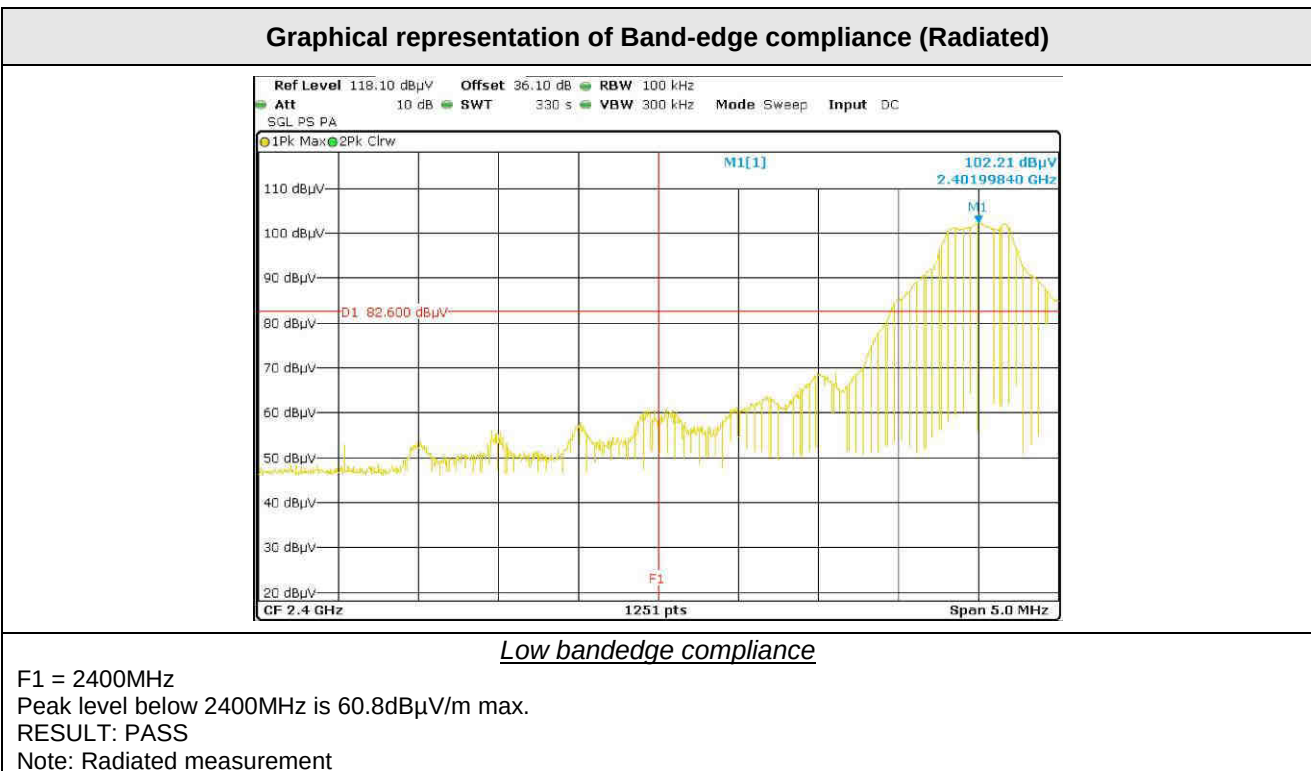
Photo of test setup for Radiated Disturbance



Tabulated Results for Peak Output Power Reference level (Radiated)	
FREQ	Field Strength 3m
(MHz)	(dBμV/m)
2402.0	101,5
2440.0	101,8
2480.0	100,7
RBW:	100kHz
Measurement distance:	3m
Limit:	Ref. level only – For 15.247 (d) / RSS-247: 2016 (§ 5.5)
Final measurement detector:	Peak
Wide Measurement Uncertainty:	± 5.2dB (k=2)
Note:	Only for identification of limit in non-restricted band (1): Limit is 80.7 dBμV/m Peak for radiated out-of-band frequencies in Non-Restricted bands (2): Test performed with 1-DH5 / GFSK modulation (Worst case) (3): Test is performed with and without audio or DC cables in order to maximize radiated field on three orthogonal axis.

Tabulated Results for Peak Output Power Reference level (Conducted)	
FREQ	Peak Power
(MHz)	(dBm)
2402.0	4.9
2440.0	4.2
2480.0	2.8
RBW:	100kHz
Limit:	Ref. level only – For 15.247 (d) / RSS-247: 2016 (§ 5.5)
Final measurement detector:	Peak
Wide Measurement Uncertainty:	± 3.2dB (k=2)
Note:	Only for identification of limit in non-restricted band (1): Limit is -17.2dBm Peak for conducted out-of-band frequencies (2): Test performed with 1-DH5 / GFSK modulation (Worst case)

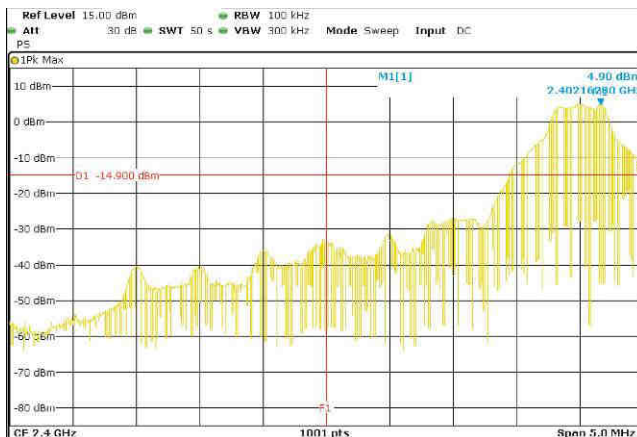
Tabulated Results for Unwanted emissions in Non-Restricted bands (Radiated) 30MHz-25GHz			
FREQ (MHz)	Field Strength 3m (dBμV/m)	Limit (dBμV/m)	Result
Margin > 20dB			
RBW:	100kHz		
Measurement distance:	3m		
Limit:	15.247 (d) / RSS-247: 2015 (§ 5.5)		
Final measurement detector:	Peak		
Wide Measurement Uncertainty:	± 5.2dB (k=2)		
RESULT:	PASS		
Note:	See low band-edge compliance graph below		



Tabulated Results for Unwanted emissions (Conducted) 30MHz-25GHz

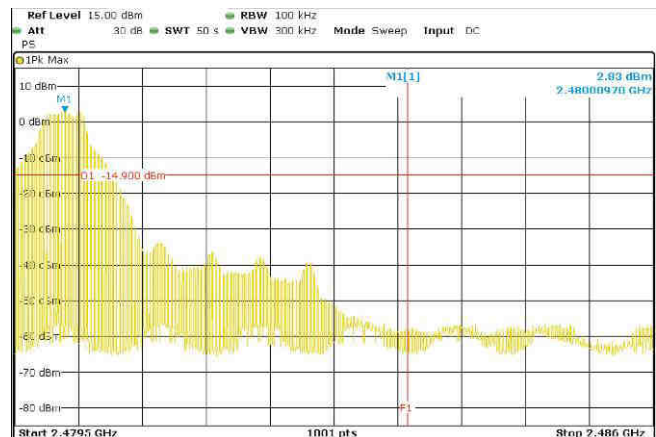
FREQ (MHz)	Peak level (dBm)	Limit (dBm)	Result
4804	-37.8	-17.2	Pass
4882	-40.8	-17.2	Pass
4960	-44.0	-17.2	Pass
RBW:		100kHz	
Limit:		15.247 (d) / RSS-247: 2015 (§ 5.5)	
Final measurement detector:		Peak	
Wide Measurement Uncertainty:		± 3.2dB (k=2)	
RESULT:		PASS	
Note:		(1): Test performed with 1-DH5 / GFSK modulation (2): See graphs page 22/23/24 (3): See Band-edge compliance on graphs below	

Graphical representation of Band-edge compliance (Conducted)



Low band-edge compliance

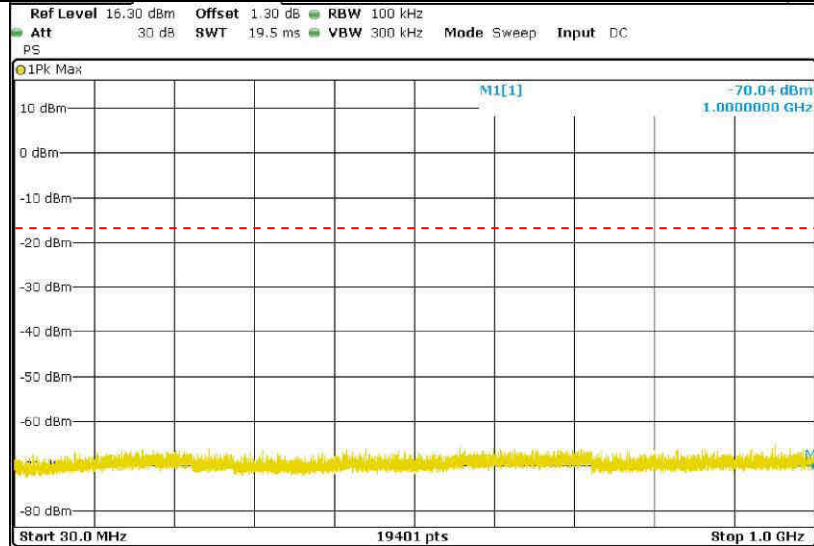
F1 = 2400MHz
Peak level below 2400MHz is -32.3dBm max.
(limit is -17.2dBm)
RESULT: PASS
Note: Conducted measurement



High band-edge compliance

F1 = 2483.5MHz
Peak level above 2483.5 MHz is -58dBm max
(limit is -17.2dBm)
RESULT: PASS
Note: Conducted measurement

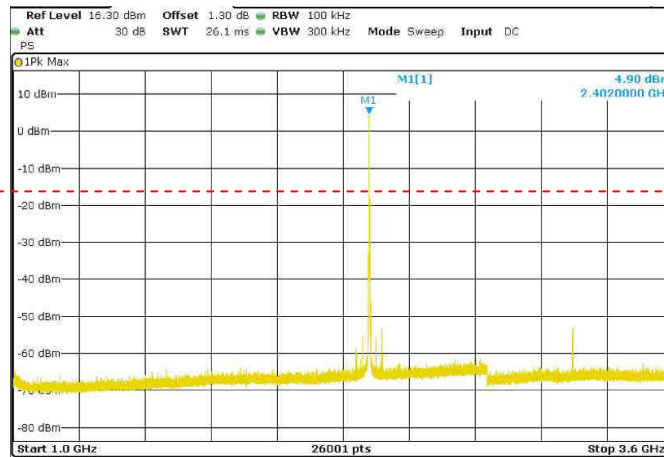
Graphical representation of Conducted unwanted emissions (30MHz-1GHz)



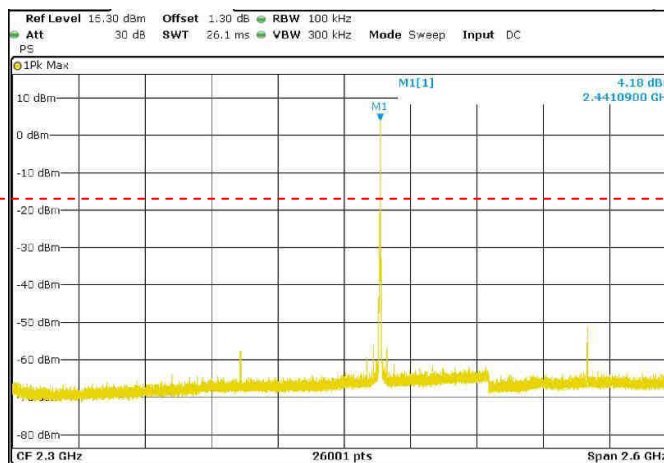
Middle Channel

Note: Worst case result for low, middle and high channels. Limit is -17.2dBm

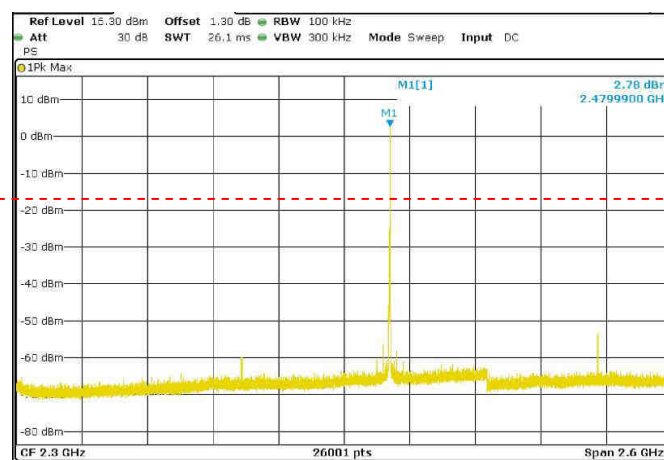
Graphical representation of Conducted unwanted emissions (1GHz-3.6GHz)



Low channel

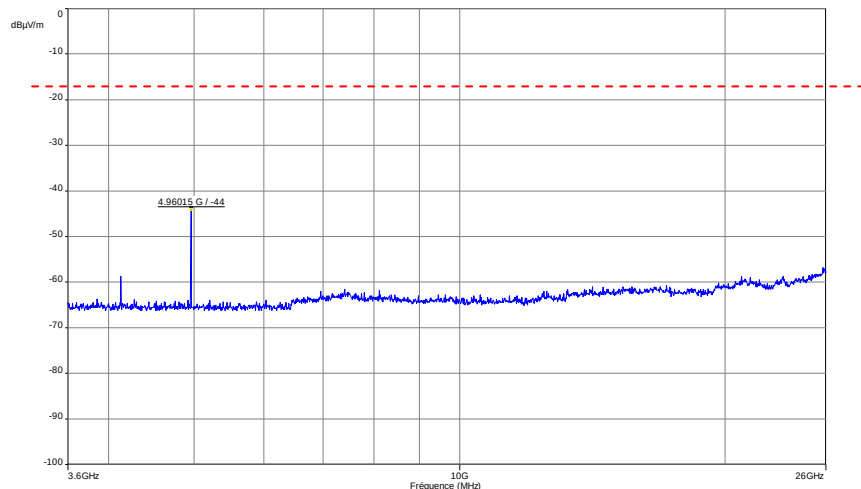
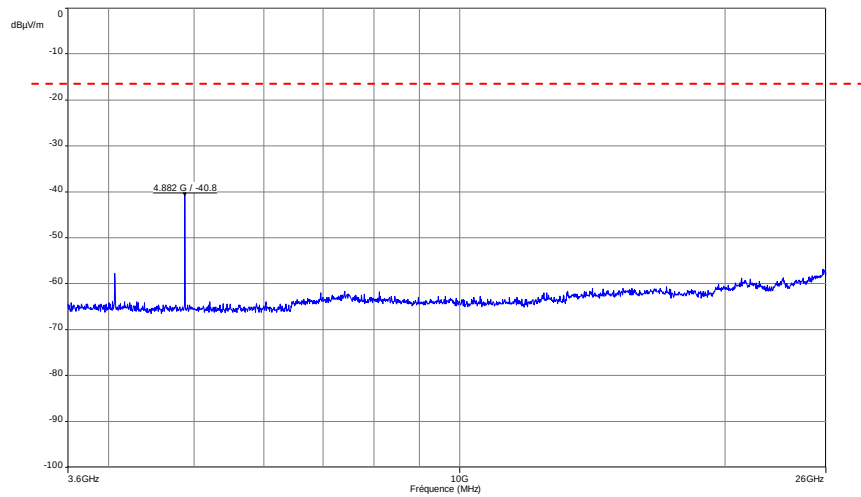
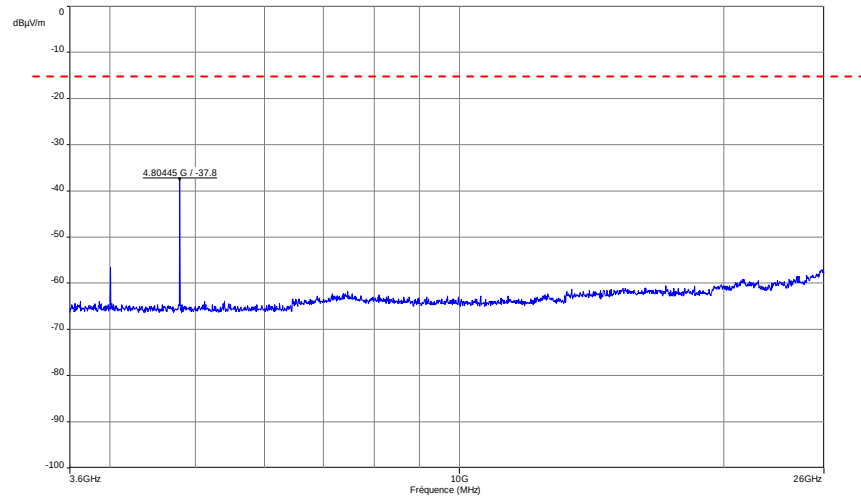


Middle channel



High channel

Graphical representation of Conducted unwanted emissions (3.6GHz-25GHz)



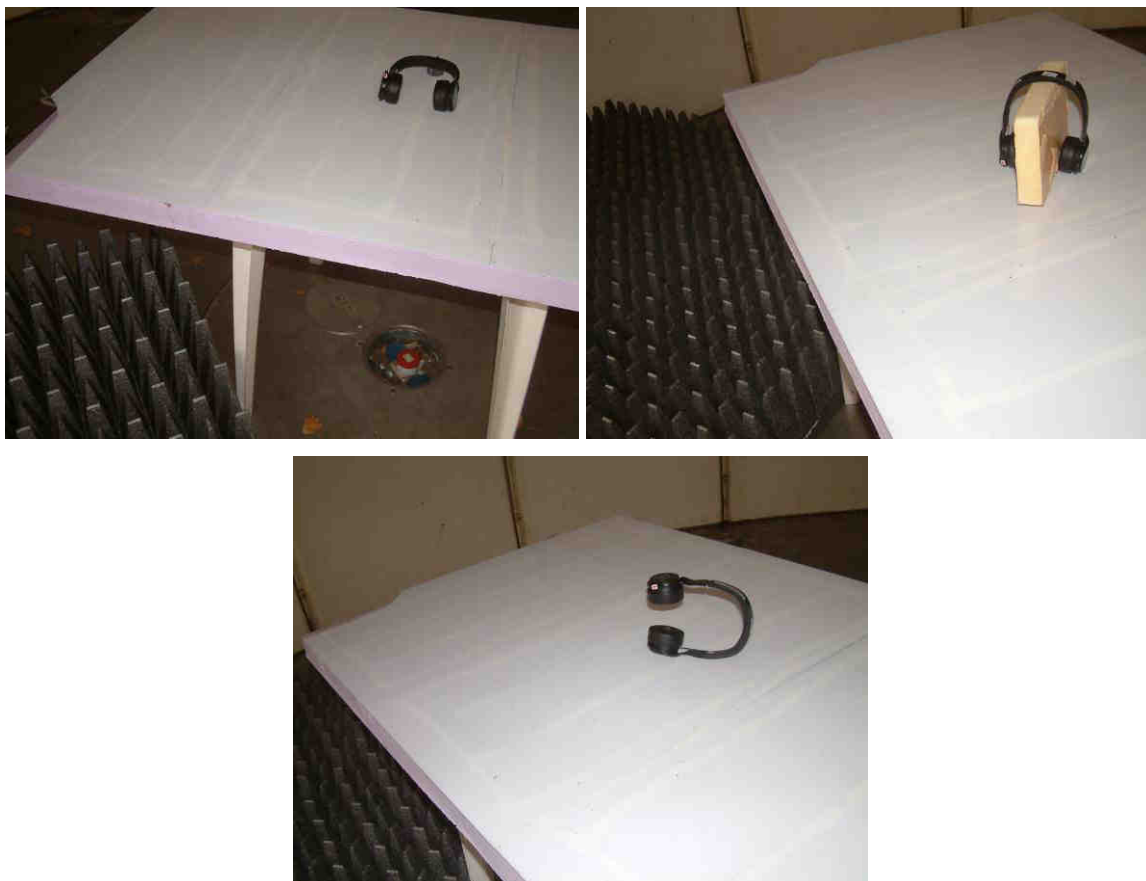
Low, Middle, High channels

9. Unwanted emissions in Restricted Frequency bands

TEST: Unwanted emissions into Restricted Frequency Bands / FCC part 15.205, 15.209, 15.247 – RSS-GEN, RSS-247			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 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	12°C	
Relative Humidity	10 to 90 %	45%	
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, 15.247 / RSS-GEN, RSS-247			
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 to 1GHz	54.0 / QP / 3m	Pass	
1GHz to 25GHz	74 / Pk / 3m 54 / Av / 3m	Pass	
Supplementary information: Test location: SMEE – CE Mesures / Test date: November 24 th , 2015 Power supply voltage: 3.7V from battery (fully charged)			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2015/8	2016/8
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2015/8	2016/8
BiConiLog antenna	EMCO	3142B	ANT-101-010	2015/8	2016/8
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
RF cable	Div	OATS/25m	CAB-101-019	2015/3	2016/3
RF cable	Pasternack	PE302-120	CAB-131-024	2015/3	2016/3
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2015/3	2016/3
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2015/3	2016/3
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2015/3	2016/3
High-pass filter	Mini-Circuit	VHF-3100+	FIL-151-006	2015/3	2016/3
Pre-amplifier	PE	PE1524	PRE-101-002	2015/3	2016/3
Anechoic chamber	COMTEST	214263	CAG-141-001	-	-
OATS	Div	10m	SIT-101-001	2015/8	2016/8
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	2013/9	2016/9

Photo of test setup for Radiated Disturbance

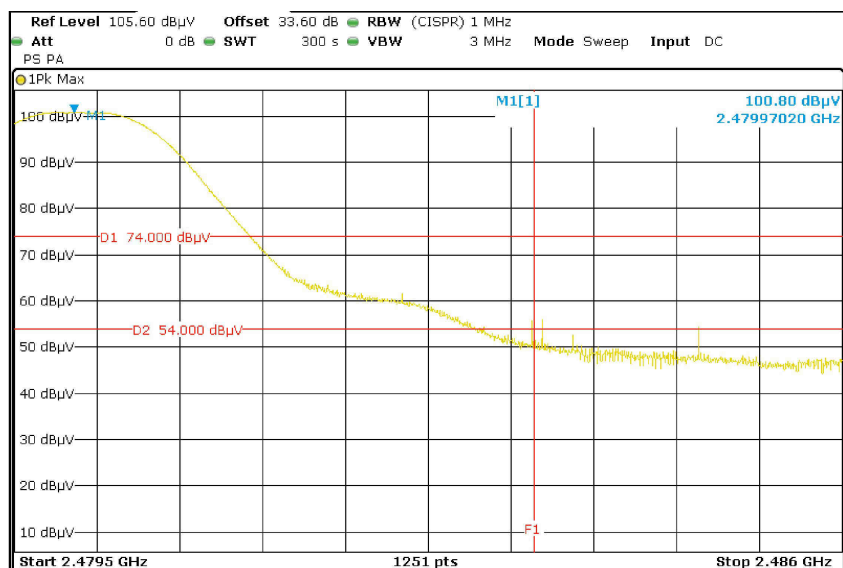


Tabulated Results for Unwanted emissions (9kHz-30MHz)						
FREQ	RF field @ 30m	Limit @ 30m	Margin	Antenna angle	Table angle	Correc. Fact. (CF)
MHz	(QP) dBμV/m	(QP) dBμV/m	dB	Degree	Degree	dB
Margin > 20dB						
Supplementary information: Frequency list measured on the Open Area Test Site has been created 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: 2014			
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	CF total	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 > 20dB										
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: 2014						
Final measurement detector:				Quasi-Peak						
Wide Measurement Uncertainty:				± 5.2dB (k=2)						
RESULT:				PASS						

Tabulated Results for Unwanted emissions (1GHz-25GHz)				
FREQ (MHz)	Field level dBμV/m	Detector	Limit (dBμV/m)	Result
2483.5	54.3	Pk	74	Pass (3)
2483.5	34.5	Av	54	Pass (3)
4804,0	63,0	Pk	74	Pass
4804,0	53,4	Av	54	Pass
4882,0	62,4	Pk	74	Pass
4882,0	52,8	Av	54	Pass
4960,0	60,4	Pk	74	Pass
4960,0	50,8	Av	54	Pass
RBW:		1MHz		
Measurement distance:		3m		
Limit:		FCC Part 15.205 - 15.209 / RSS-GEN: 2014		
Final measurement detector:		Peak / Average		
Wide Measurement Uncertainty:		± 5.2dB (k=2)		
RESULT:		PASS		
Note:		(1): Performed on OATS at 3m distance (2): Test performed with 1-DH5 / GFSK modulation (Worst case) (3): See graph for band-edge compliance below (4): Test is performed with and without audio or DC cables in order to maximize radiated field on three orthogonal axis.		

Graphical representation of Band-edge compliance



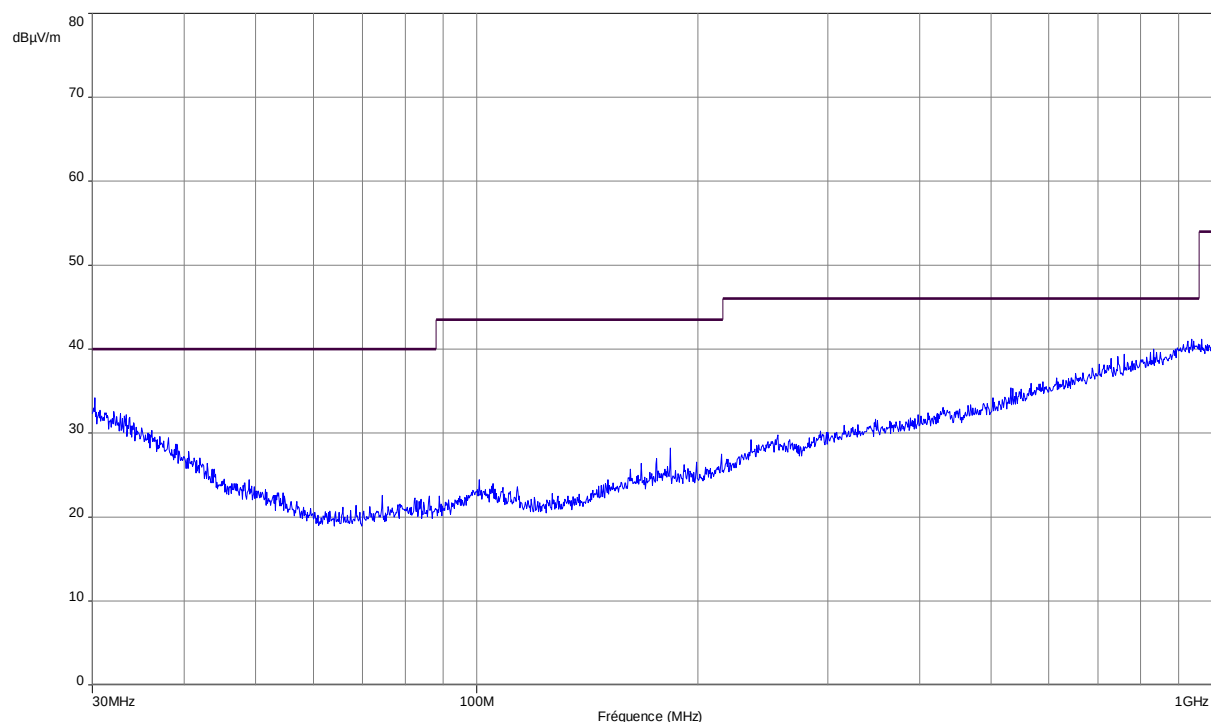
High bandedge compliance

Radiated Peak level is 54.3dBμV/m (limit 74dBμV/m)
 Radiated Average level is 34.5dBμV/m (limit 54dBμV/m)

RESULT: PASS

Note: radiated measurement (3m on OATS)

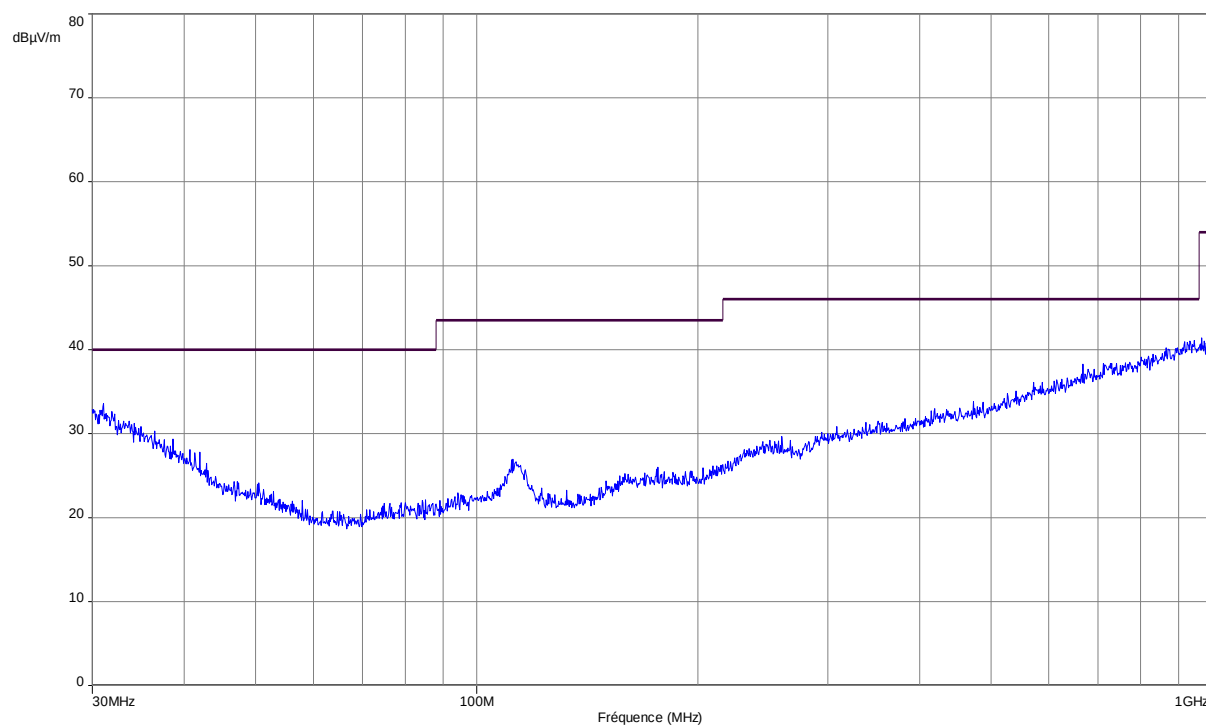
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Transmit mode)



Note: Pre-scan graph only for identification purpose. Same result for low, middle and high channels

Frequency band investigated:	30MHz-1GHz
Unit :	dBμV/m
RBW :	100kHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC
Limit:	15.205 - 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

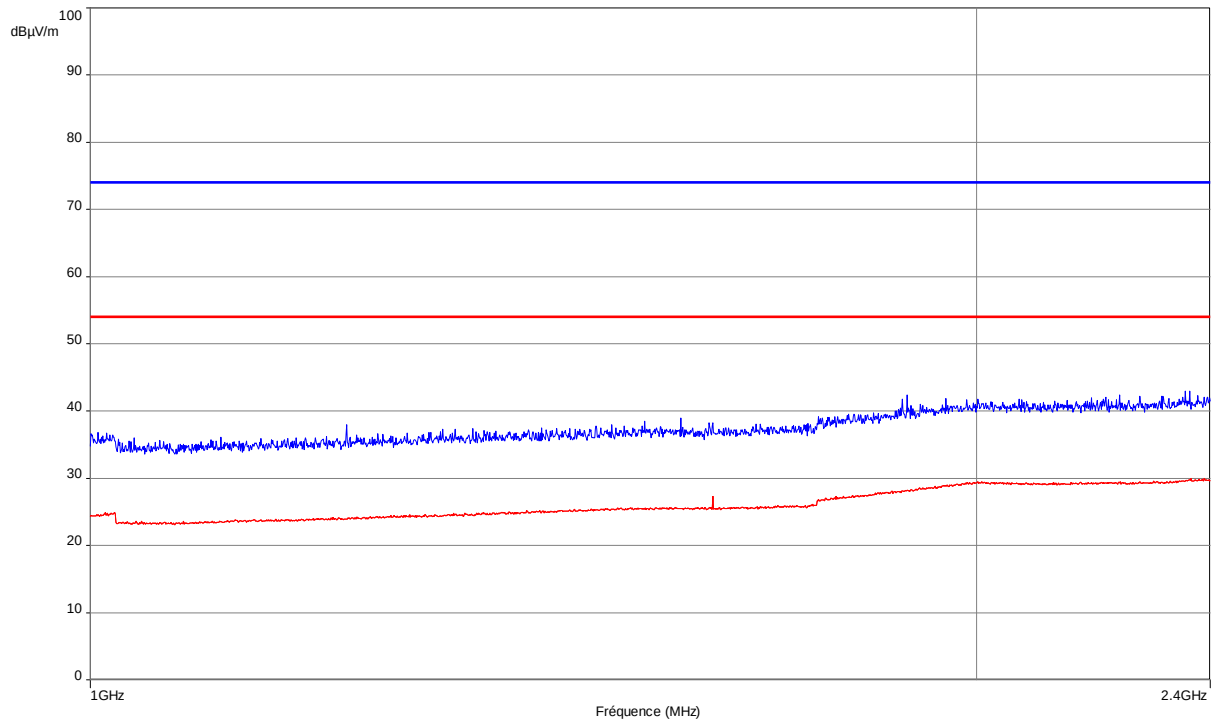
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Transmit mode)



Note: Pre-scan graph only for identification purpose. Same result for low, middle and high channels

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Vertical
Voltage:	3.7V DC
Limit:	15.205 - 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

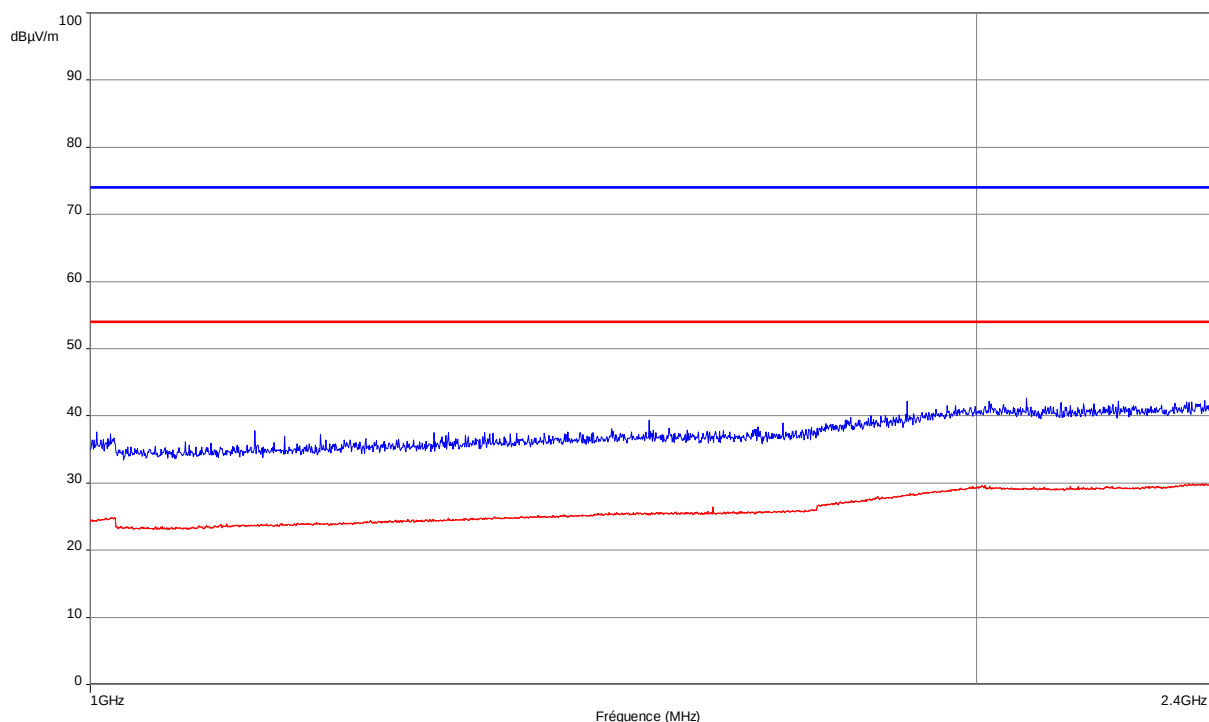
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-2.4GHz / 3m / Horizontal / Transmit mode)



Note: Pre-scan graph only for identification purpose. Same result for low, middle and high channels

----- : Peak measure	----- : Average measure
Frequency band investigated:	1GHz-2.4GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC
Limit:	15.205 - 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

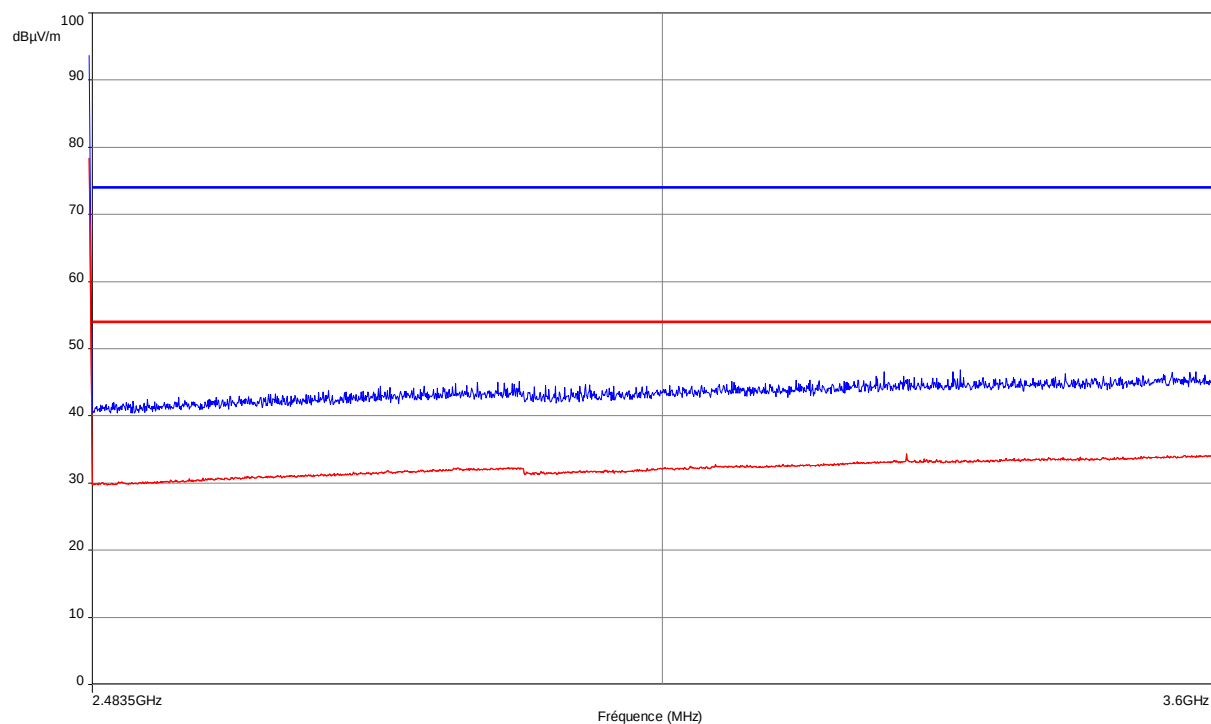
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-2.4GHz / 3m / Vertical / Transmit mode)



Note: Pre-scan graph only for identification purpose. Same result for low, middle and high channels

----- : Peak measure	----- : Average measure
Frequency band investigated:	1GHz-2.4GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC
Limit:	15.205 - 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

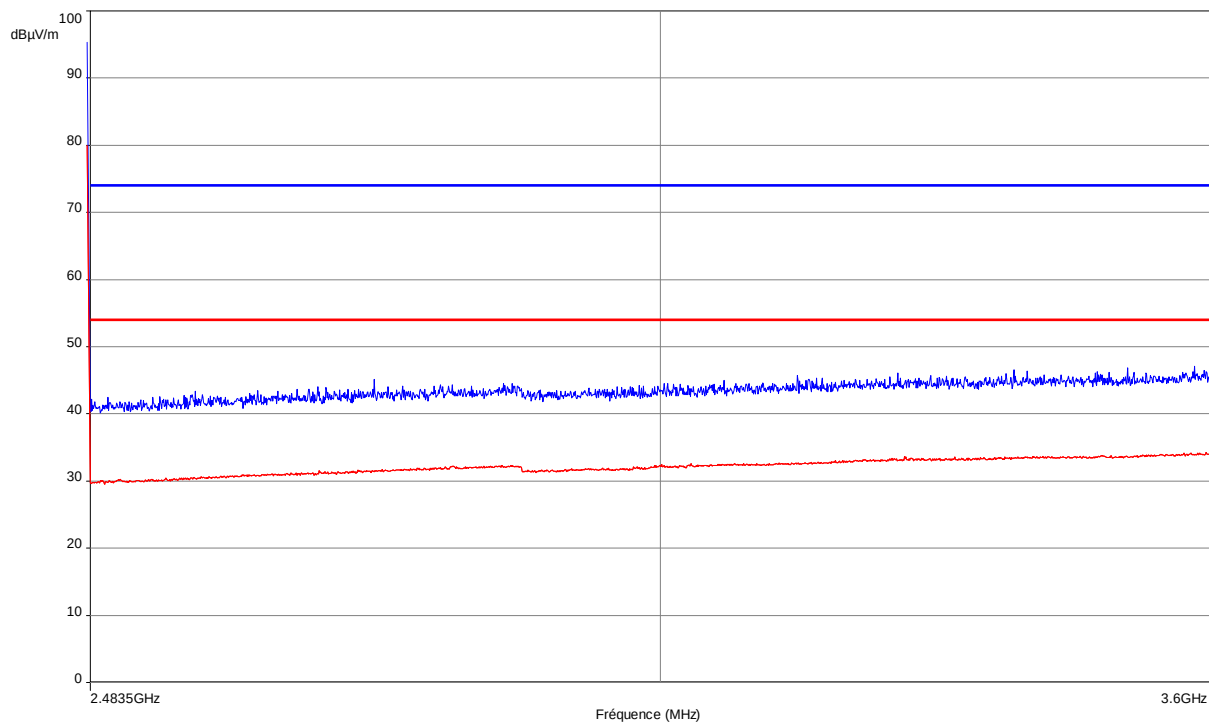
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 2.435GHz-3.6GHz / 3m / Horizontal / Transmit mode)



Note: Pre-scan graph only for identification purpose. Same result for low, middle and high channels

----- : Peak measure	----- : Average measure
Frequency band investigated:	2.435GHz-3.6GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC
Limit:	15.205 - 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

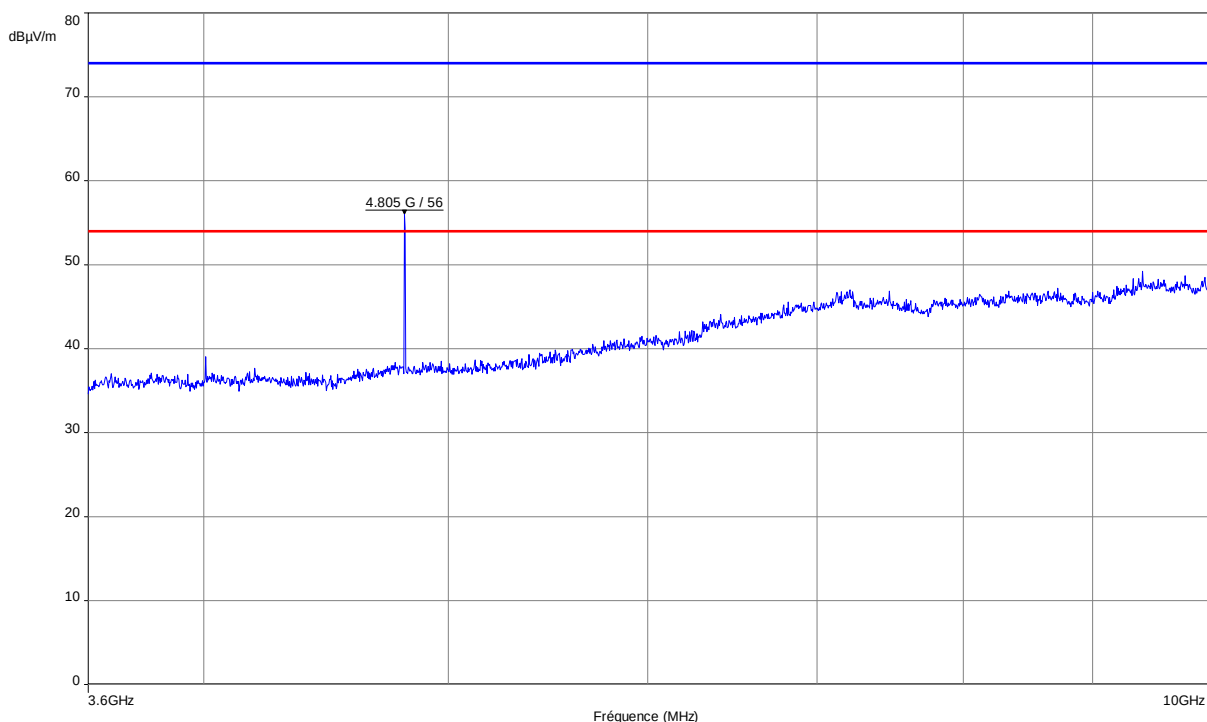
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 2.435GHz-3.6GHz / 3m / Vertical / Transmit mode)



Note: Pre-scan graph only for identification purpose. Same result for low, middle and high channels

----- : Peak measure	----- : Average measure
Frequency band investigated:	2.435GHz-3.6GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC
Limit:	15.205 - 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-10GHz / 3m / Horizontal / Transmit mode) – Low channel

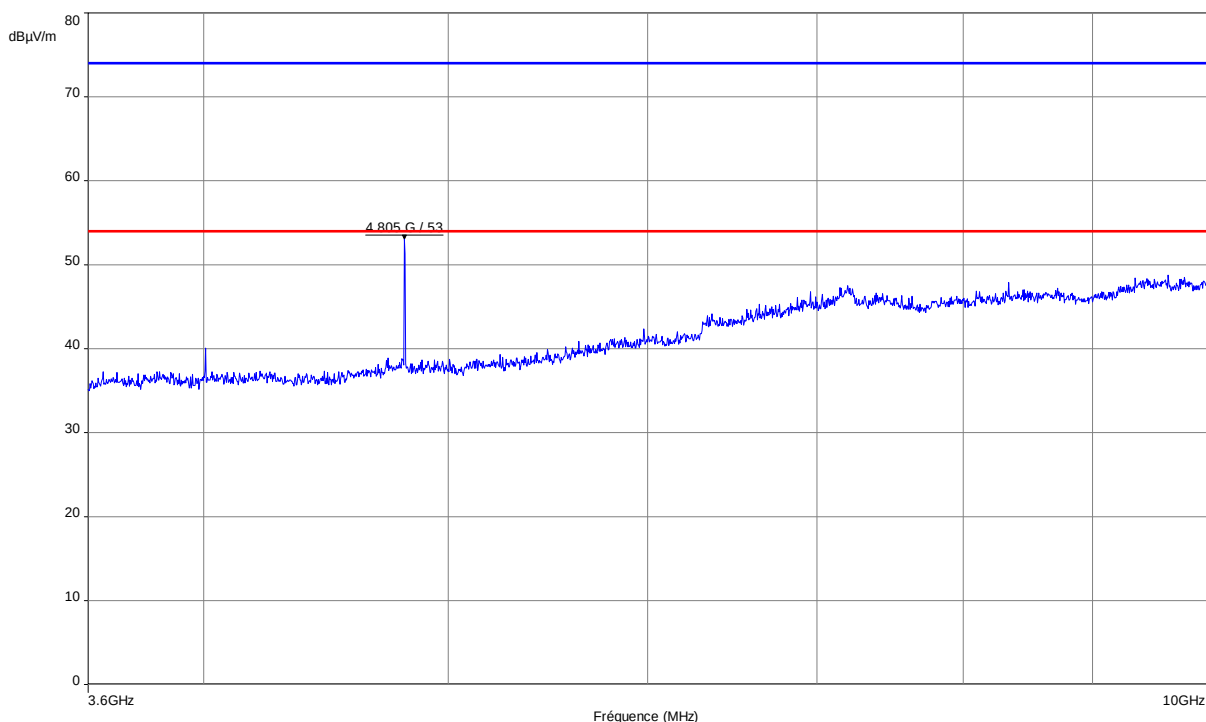


Note: Pre-scan graph only for identification purpose.

Above 10GHz, a manual search were performed at 1m distance and corrected with the Correction Factor :
 $CF = 20\log(1 \text{ meter} / 3 \text{ meters}) = -9.5\text{dB}$

----- : Peak measure	----- : Average measure
Frequency band investigated:	3.6GHz-10GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC
Limit:	15.205 - 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-10GHz / 3m / Vertical / Transmit mode) – Low channel

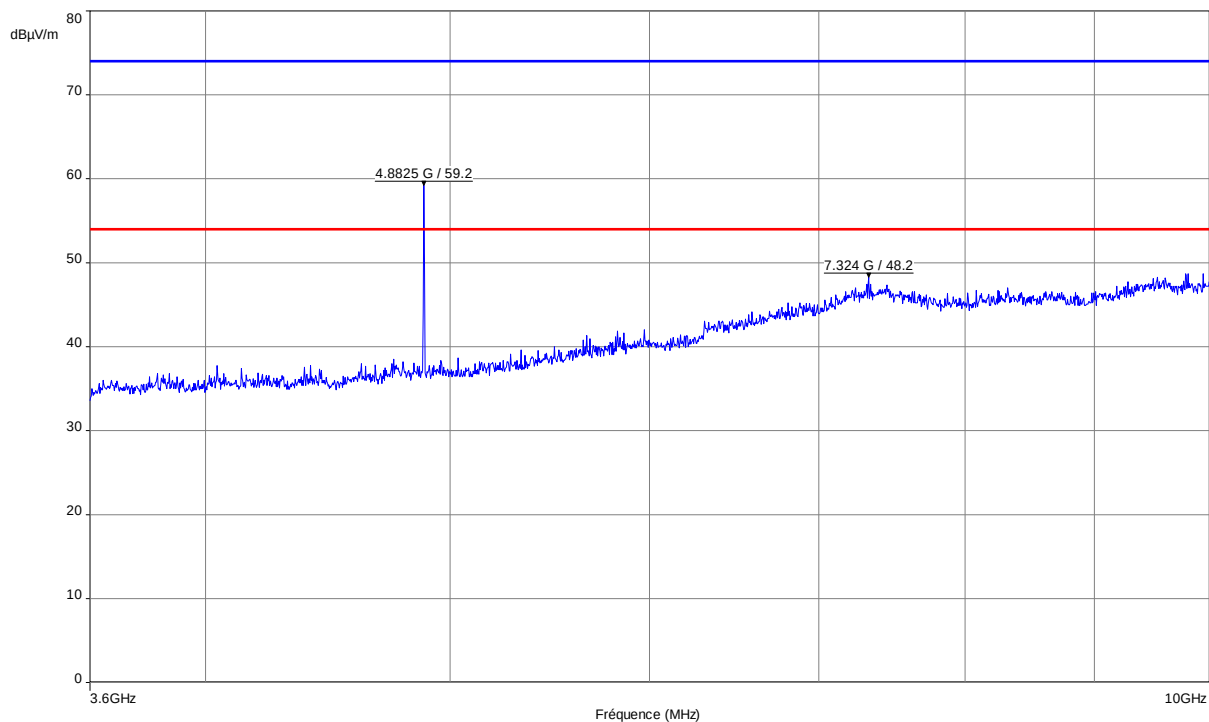


Note: Pre-scan graph only for identification purpose.

Above 10GHz, a manual search were performed at 1m distance and corrected with the Correction Factor :
 $CF = 20\log(1 \text{ meter} / 3 \text{ meters}) = -9.5\text{dB}$

----- : Peak measure	----- : Average measure
Frequency band investigated:	3.6GHz-10GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC
Limit:	15.205 - 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-10GHz / 3m / Horizontal / Transmit mode) – Mid channel

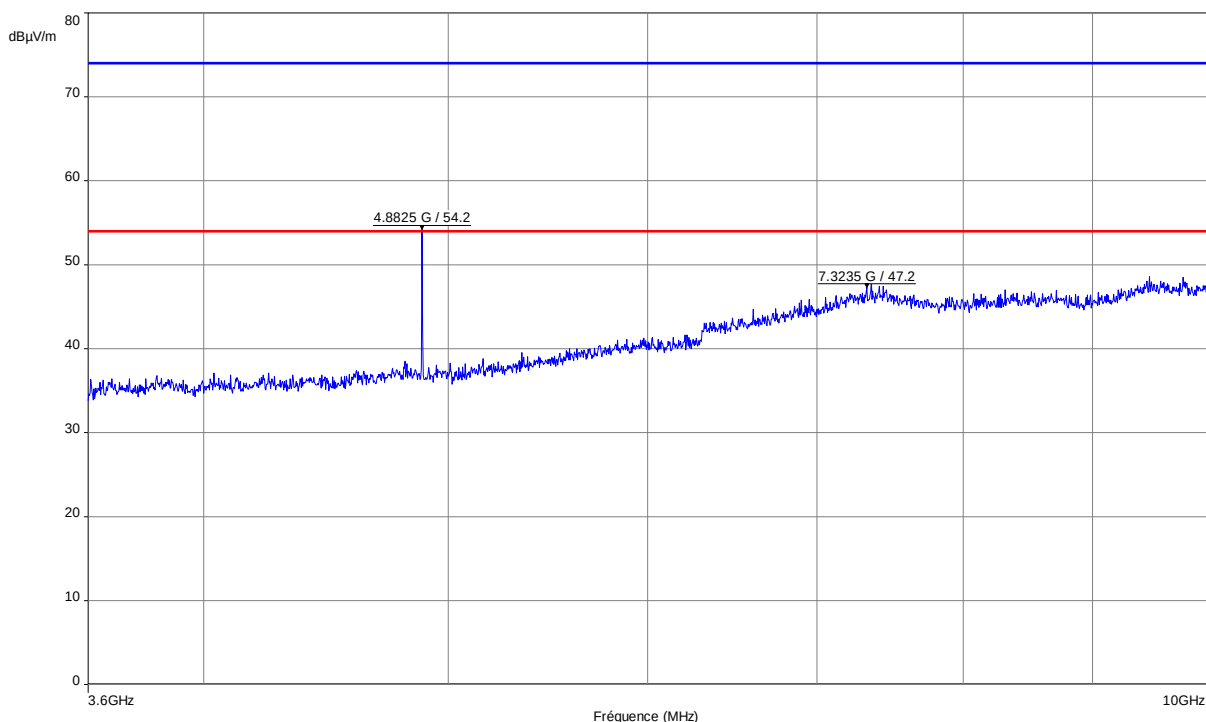


Note: Pre-scan graph only for identification purpose.

Above 10GHz, a manual search were performed at 1m distance and corrected with the Correction Factor :
 $CF = 20\log(1 \text{ meter} / 3 \text{ meters}) = -9.5\text{dB}$

----- : Peak measure	----- : Average measure
Frequency band investigated:	3.6GHz-10GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC
Limit:	15.205 - 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-10GHz / 3m / Vertical / Transmit mode) – Mid channel

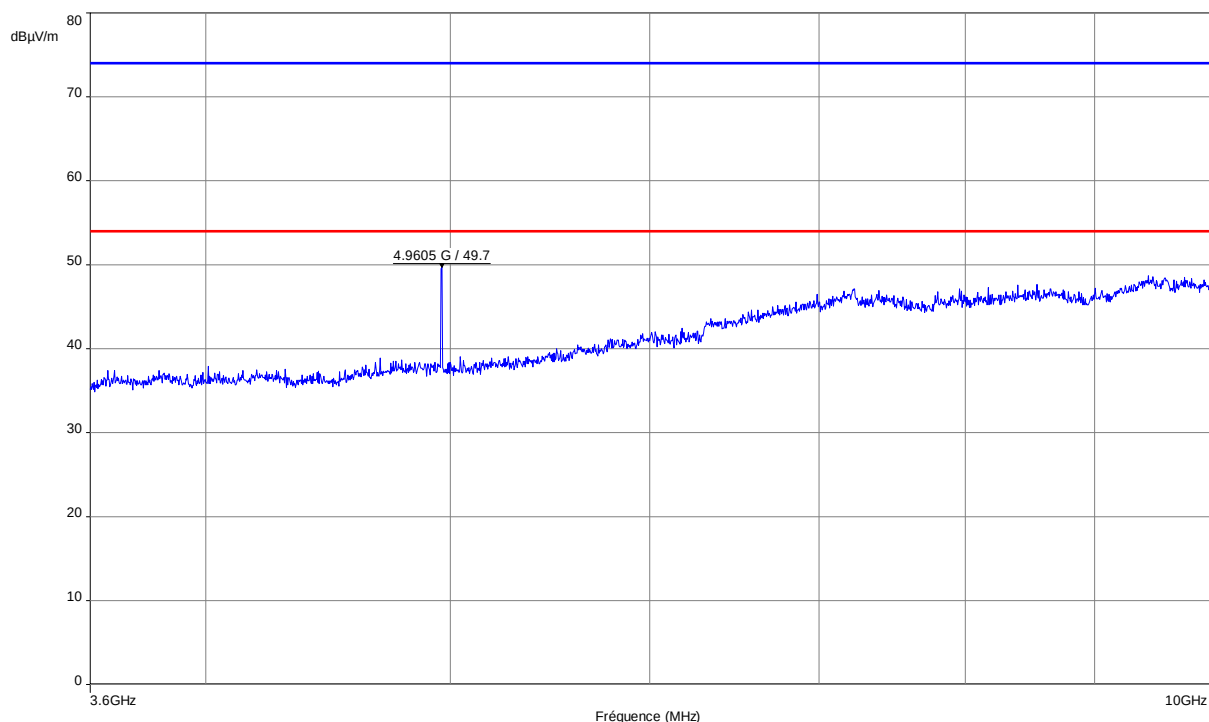


Note: Pre-scan graph only for identification purpose.

Above 10GHz, a manual search were performed at 1m distance and corrected with the Correction Factor :
 $CF = 20\log(1 \text{ meter} / 3 \text{ meters}) = -9.5\text{dB}$

----- : Peak measure	----- : Average measure
Frequency band investigated:	3.6GHz-10GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC
Limit:	15.205 - 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-10GHz / 3m / Horizontal / Transmit mode) – High channel

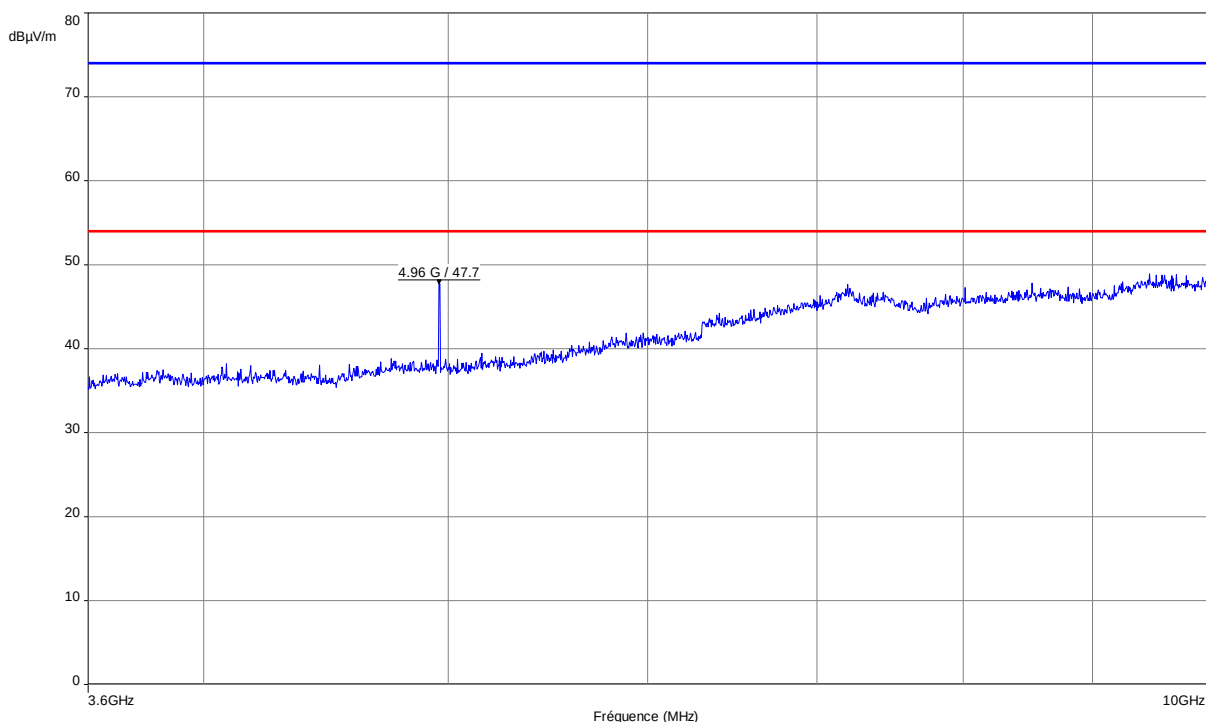


Note: Pre-scan graph only for identification purpose.

Above 10GHz, a manual search were performed at 1m distance and corrected with the Correction Factor :
 $CF = 20\log(1 \text{ meter} / 3 \text{ meters}) = -9.5\text{dB}$

----- : Peak measure	----- : Average measure
Frequency band investigated:	3.6GHz-10GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal
Voltage:	3.7V DC
Limit:	15.205 - 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-10GHz / 3m / Vertical / Transmit mode) – High channel



Note: Pre-scan graph Above 10GHz, a manual search were performed at 1m distance and corrected with the Correction Factor :

CF = $20\log(1 \text{ meter} / 3 \text{ meters}) = -9.5\text{dB}$ only for identification purpose.

----- : Peak measure	----- : Average measure
Frequency band investigated:	3.6GHz-10GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC
Limit:	15.205 - 15.209 / RSS-GEN
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)