

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

Matériel testé :
Equipment under test:

i-Q350L RTSL A
(DTS measurement, 2400–2483.5 MHz)

Constructeur:
Manufacturer: **IDENEC SOLUTIONS AG**
Millennium Park 2
A-6890 Lustenau - Austria

Rapport délivré à :
Issued to: **IDENEC SOLUTIONS AG**
Millennium Park 2
A-6890 Lustenau - Austria

Référence de la proposition : 082016-22122
Proposal number:

Date de l'essai : Du 2 décembre 2016 au 23 février 2017
Date of test: December 2nd, 2016 to February 23rd, 2017

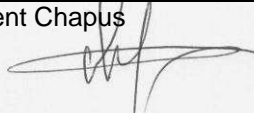
Objectif des essais : EMC qualification accordingly to following standards:
Test purpose: - CFR 47, FCC Part 15, Subpart C
(Chapter 15.247 - Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz)
- Industry Canada RSS-Gen Issue 4 & RSS-247, Issue 1
(Digital Transmission Systems)

FCC ID: OO4-ILR-IQ350LS
IC ID : 3538A-IQ350LS
Model : i-Q350L RTLS A

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	February 28 th , 2017	Initial Edition	Jeremy Blancher	
2	March 24 th , 2017	TCB review		
3	April 7 th , 2017	Model change		

La copie de ce document n'est permise que sous sa forme intégrale. Ce document est le résultat d'essais effectués sur un échantillon. Il ne préjuge pas de la conformité de l'ensemble des produits fabriqués à l'objet essayé.

This document shall not be reproduced, except in full. This document contains results related only to the item tested. It does not imply the conformity of the whole production to the item tested.

COORDONNEES

SMEE
Rue de Taille – ZI Des Blanchisseries
38500 VOIRON - France

TEL : 04 76 65 76 50
FAX : 04 76 66 18 30

SAS au capital de 50 000 € / RC Grenoble B534 796 453 / SIRET 534 796 453 00015 / code APE 7490B / n° TVA : FR 59 534 796 453

Sommaire / Contents

1. NORMATIVES REFERENCES	3
2. TEST SYNTHESIS.....	4
3. EQUIPMENT UNDER TEST (EUT).....	5
4. TEST CONDITIONS.....	7
5. MODIFICATIONS OF THE EUT.....	7
6. DTS BANDWIDTH	8
7. MAXIMUM CONDUCTED OUTPUT POWER	10
8. MAXIMUM POWER SPECTRAL DENSITY LEVEL IN THE FUNDAMENTAL EMISSION	13
9. UNWANTED EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS	15
10. UNWANTED EMISSIONS IN RESTRICTED FREQUENCY BANDS.....	19
11. OCCUPIED BANDWIDTH (99%).....	38

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 15.207 / 15.209 / 15.247

Industry Canada qualification following:		
Standards	Applied	Title
RSS-Gen (Issue 4/2014)	X	General Requirements and Information for the Certification of Radio Apparatus
RSS-247 (Issue1/2015)	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	Spec. FCC Part 15 / IC RSS-247	RESULTS (comments)
Conducted emissions test	15.207 (a) RSS-Gen: Issue 4, §8.8	15.207 (a) Table 3, §8.8	N/A (1)
Radiated emission test	15.209 (a) RSS-Gen: Issue 4, §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
Fundamental emission 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 / 15.247 (d) / 15.205 RSS-Gen: Issue 4, §8.9 & §8.10 / 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
Occupied Bandwidth	RSS-Gen: Issue 4, §6.6	BW at 99%	PASS

N/A: Not Applicable

(1): No cable

(2): Functioning only with RF function activated (Transmit or receive)

- General conclusion:**

Measures and tests performed on the sample of the product *i-Q350L RTLS A*, in configuration and description presented in this test report, show compliance with standards FCC CFR 47, PART 15, Subpart C and Industry Canada RSS-Gen & RSS-247.

3. Equipment Under Test (EUT)

**Nom /
Identification**

i-Q350L RTLS A

Sn: 0.000.450.201

**Alimentation /
Power supply**

3.6V DC from internal battery pack

**Auxiliaires /
Auxiliaries**

- i-PORT M350-RTLS, IDENTEC SOLUTIONS product
(RF configuration and communication only)
(FCC ID: OO4-ILR-IPM350RT / IC ID: 3538A-IPM350RT)

Sn: 09255M0092

**Entrées-Sorties /
Input / Output**

	Câbles pour essai / Cables for test	Blindé / Shielded	Prévu pour >3m / Intended for >3m
None	-	-	-

**Version programme /
Firmware version**

N.C

**Mode de fonctionnement /
Running mode**

The tested sample is able to:

- Transmit a carrier frequency with normal modulation (2441.75MHz with 80MHz Bandwidth, data rate: 250kb/s and 1Mb/s)
- Transmit a continuous carrier frequency without modulation
- Be in Receiver mode (no transmission)
- Be in standby mode (no transmission)

**Programme de test /
Test program /**

Gen3 Tag Certification v1.0.0.26569

• **Equipment information:**

UHF Carrier frequency:

- Frequency band: 902 to 928 MHz (Frequencies from 903MHz to 927MHz, Tx & Rx)
- Frequency used in Tx/Rx mode: - 903MHz
 - 920MHz
 - 927MHz
- Modulation: FSK (± 20 kHz)
- Antenna Type: Integral antenna (SMD chip antenna)
- Antenna Gain: -0.7dBi

RTLS Carrier frequency:

- 2441.75MHz
- Emission band: 2400-2483.5 MHz
- Modulation: 80MHz Broadband bandwidth
- Data rate: 250kb/s and 1Mb/s available
- Antenna Type: Integral antenna (SMD chip antenna)
- Antenna Gain: 2.0dBi (Max. gain)

LF Carrier frequency (Receiver only):

- 125kHz
- Antenna type: Transponder coil antenna
- Powered by 3.6V DC via internal battery pack (2x XLP-060F batteries)
- Equipment intended for use as a mobile station
- Equipment designed for continuous operation
- Extreme temperature range: -25°C and +60°C

Note: Equipment is configured with 2dBm output power by software for UHF 915MHz RF.

Equipment is configured with 17dBm output power by software for RTLS 2,4GHz RF.

Note: i-Q350L with type RTLS-AS & RTLS-AH are in the same range of product. Difference is the type of mounting on housing (by a screw or by hook).No electronic or RF difference.

All tests are performed with i-Q350L RTLS-AS.



Equipment's identification label (20x30mm)

RTLS-AS (Screw hole) and RTLS-AH (Plastic Hook) type:

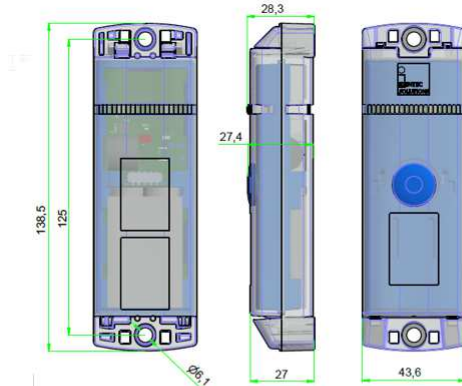


Figure 3 Housing Concept – screw mounting (not to scale)

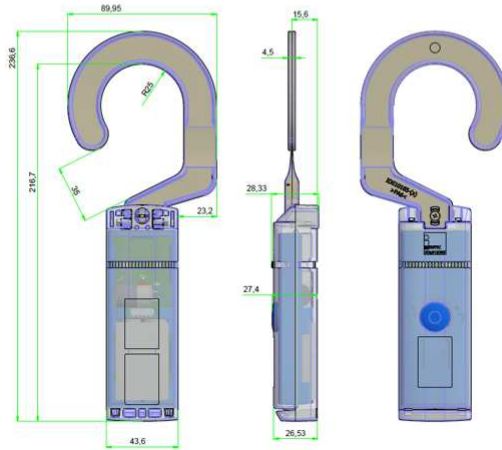


Figure 4 Housing Concept – hook mounting (not to scale)

4. Test conditions

Relative Humidity : 50% ($\pm 10\%$)
 Temperature : 20°C ($\pm 5^\circ\text{C}$)

Power supply voltage:
 Equipment under test : 3.6V DC from internal battery

5. Modifications of the EUT

None

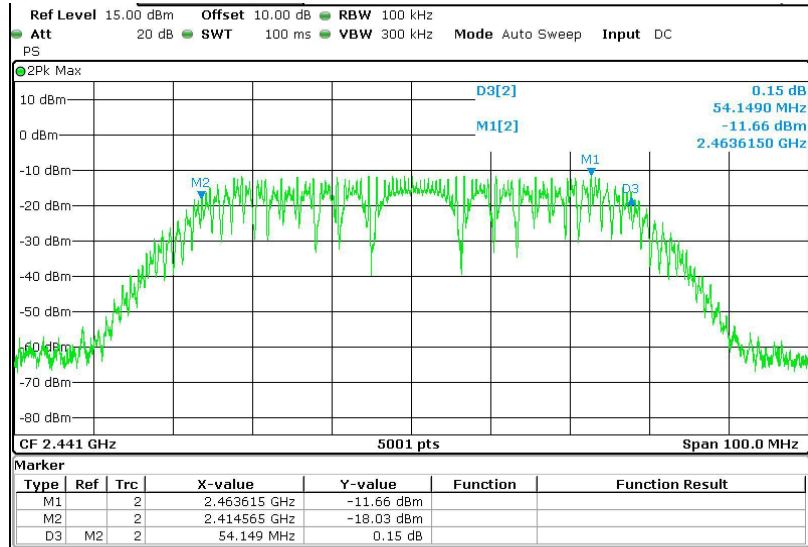
6. DTS Bandwidth

TEST: 6dB Bandwidth		Verdict
<p>Method: RF Output of EUT is connected directly to a spectrum analyser. A temporary antenna connector is added on EUT. A conducted measurement is performed. The RBW is 100kHz, with VBW $\geq 3 \times$ 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.</p>		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
2441.75	6dB below the maximum output power	At least 500kHz
Supplementary information: Test location: SMEE Test date: December 2 nd , 2016 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
RF cable	Pasternack	PE354-150	CAB-131-025	2016/3	2017/3

Tabulated Results for Occupied Bandwidth		
Frequency (MHz)	6dB Bandwidth (kHz)	Result
2441.75	54 149 kHz	Pass

Graphical representation of 6dB Bandwidth



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

7. Maximum conducted output power

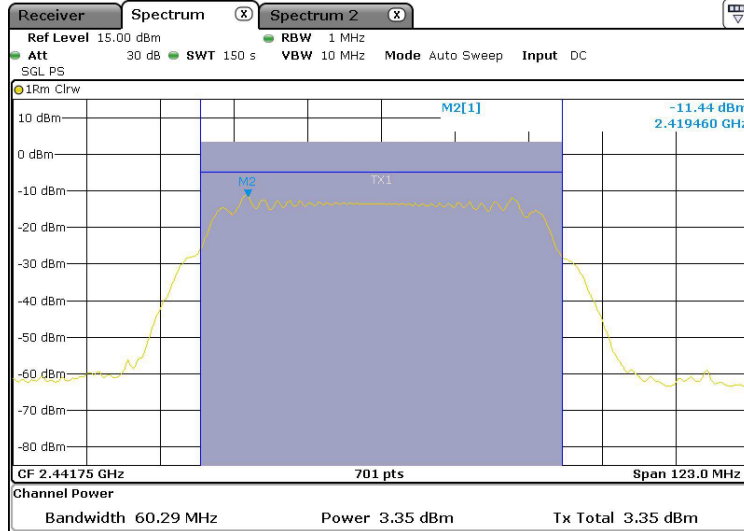
TEST: Maximum conducted output power		Verdict
<u>Method:</u> A conducted measurement is performed with a temporary RF connector. The tested equipment is set to transmit operation with modulation at data rate 1Ms/s and 125ks/s		Pass
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	10 to 40 °C	22°C
Relative Humidity	10 to 90 %	50%
Limits – FCC Part 15.247 (b) / RSS-247 §5.4 (d)		
Frequency (MHz)	Limits (dBµV/m)	
	Level / Detector / Distance	Results
2402 to 2483.5MHz	36 dBm / Pk / 3m (Radiated)	Pass
2402 to 2483.5MHz	30 dBm / Pk (Conducted)	Pass
Supplementary information: Test location: SMEE Test date: February 22 nd , 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

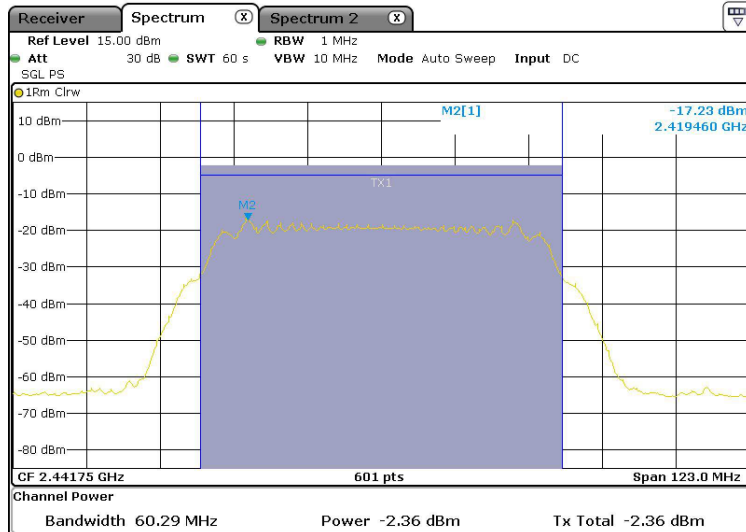
Tabulated Results for Maximum output power (Conducted)					
FREQ (MHz)	Measured conducted power (dBm)	Duty cycle factor (dB)	Maximum output power (dBm)	Limit (dBm)	Result
2441.75 (Data rate 1Mb/s)	3.4	15.0	18.4	30.0	Pass
2441.75 (Data rate 0.25Mb/s)	-2.4	20.7	18.3	30.0	Pass
Limit:		FCC Part 15.247 / RSS-247			
RESULT:		PASS			
Note:		- Method used as per KDB 558074 D01 DTS Meas Guidance v03r05 : AVGSA-2 Alternative (RMS detection with slow sweep with spectrum bin averaging across on and off times of the EUT transmissions, followed by duty cycle correction) - Duty cycle factor is $10 \cdot \log(1/x)$ where x is the duty cycle			

Tabulated Results for Maximum output power (Radiated)					
FREQ (MHz)	Maximum output power (dBm)	Antenna Gain (dBi)	Maximum output power (dBm)	Limit (dBm)	Result
2441.75 (Data rate 1Mb/s)	18.4	2.0	20.4	36.0	Pass
2441.75 (Data rate 0.25Mb/s)	18.3	2.0	20.3	36.0	Pass
Limit:		FCC Part 15.247 / RSS-247			
RESULT:		PASS			

Graphical representation of output power (Conducted without DC correction)



Data rate 1Ms/s



Data rate 250ks/s

RBW / VBW	1MHz / 10MHz
Sweep points	601
Sweep time	150s (Data rate 1Ms/s) and 60s (Data rate 250ks/s)
Note:	Channel power function of the spectrum analyser used

Tabulated Results for Duty Cycle measurement

FREQ (MHz)	Tx ON	Tx OFF	Duty Cycle (x)	10*log(1/x) (dB)
2441.75 (Data rate 1Mb/s)	212µs	6460µs	0.032	15.0
2441.75 (Data rate 0.25Mb/s)	212µs	24900µs	0.00844	20.7
Note:	Method used as per KDB 558074 D01 DTS Meas Guidance v03r05: Zero-span mode on a spectrum analyzer			

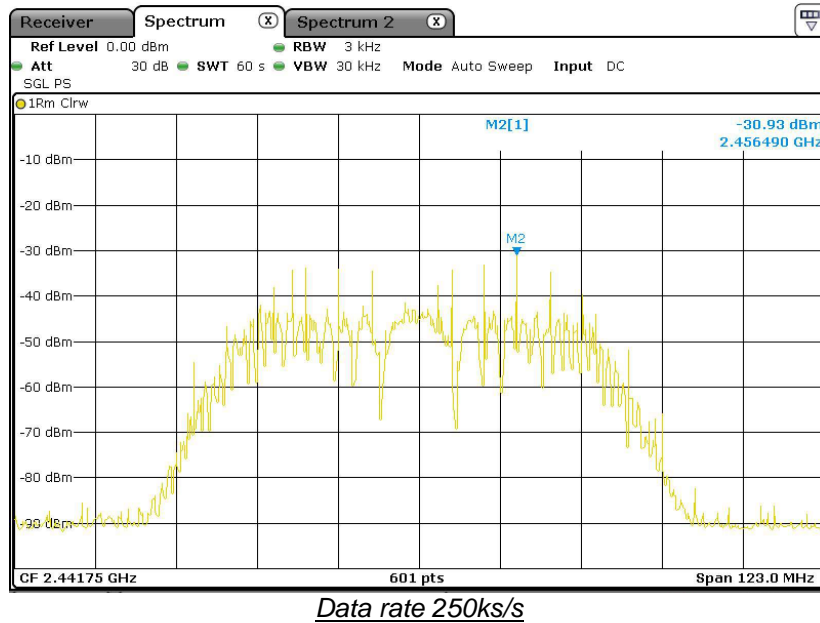
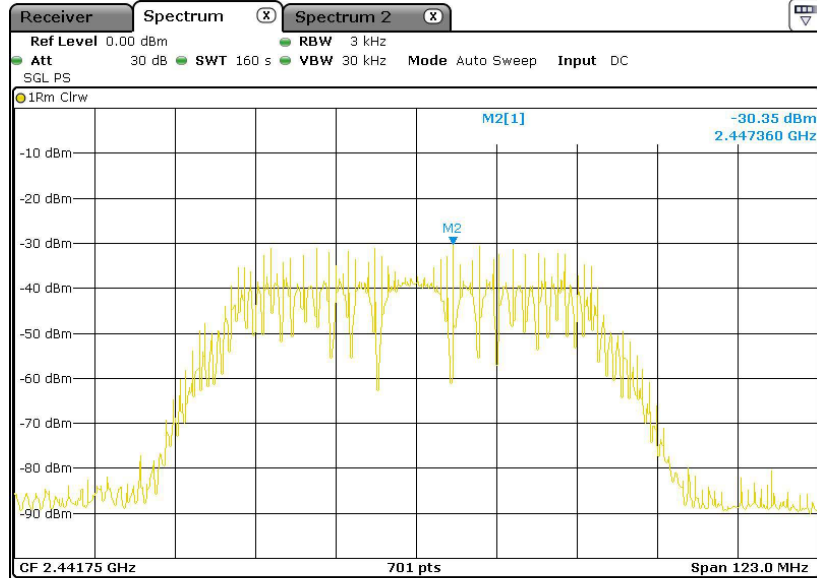
8. Maximum Power Spectral Density Level in the fundamental emission

TEST: Maximum Peak Power Spectral Density		Verdict
Method: A conducted measurement is performed with a temporary RF connector. The tested equipment is set to transmit operation with modulation at data rate 1Ms/s and 125ks/s		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 (e) / RSS-247 §5.2 (b)		
Frequency (MHz)	Level	Limit
2441.75	8 dBm/3kHz	Pass
Supplementary information: Test location: SMEE Test date: February 22 nd , 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

Tabulated Results for Maximum Power Spectral Density					
Frequency (MHz)	PSD measured	Duty cycle factor (dB)	PSDc	Limit	Result
2441.75 (Data rate 1Mb/s)	-30.3 dBm/3kHz	15.0	-15.3	8 dBm/3kHz	Pass
2441.75 (Data rate 0.25Mb/s)	-30.9 dBm/3kHz	20.7	-10.2	8 dBm/3kHz	Pass
RBW:	3kHz				
Limit:	FCC Part 15.247 / RSS-247				
Final measurement detector:	Peak				
RESULT:	PASS				
Note:	PSDc (Corrected) = PSD measured + Duty Cycle Factor				

Graphical representation of Power Spectral Density



Frequency:	2441.75MHz
SPAN:	123MHz
Sweep time:	150s (Data rate 1Ms/s) and 60s (Data rate 250ks/s)
RBW / VBW:	3kHz / 30kHz
Measurement detector:	RMS

9. Unwanted emissions in Non-Restricted Frequency bands

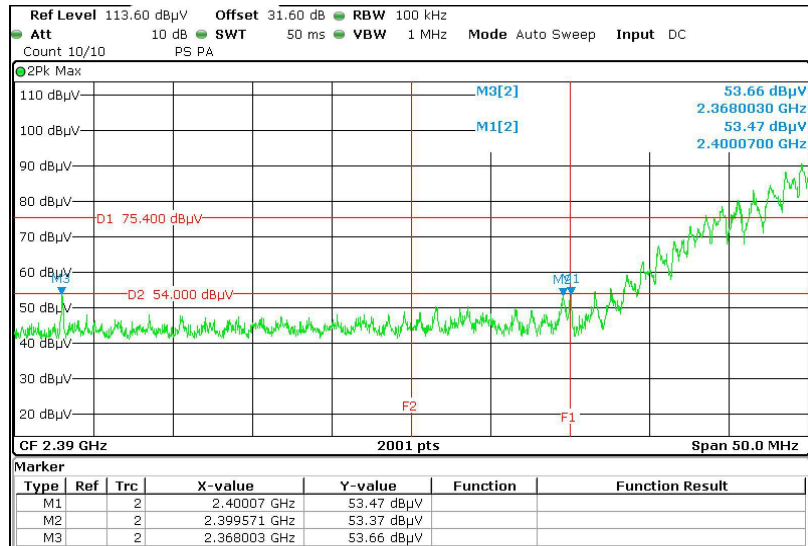
TEST: Unwanted emissions in Non-Restricted Frequency Bands			Verdict
<p><u>Method:</u> Measurements were made in a 3-meter Open Area Test Site (OATS). Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the 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.</p> <p>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.</p>			Pass
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	10 to 40 °C	18°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 – 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: February 22 nd and 23 rd , 2017 by J. Blancher Power supply voltage: 3.7 from battery (fully charged)			

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	
FREQ (MHz)	Field Strength 3m (dBµV/m)
2441.75	95.4
RBW:	100kHz
Measurement distance:	3m
Limit:	Ref. level only – For 15.247 / RSS-247
Final measurement detector:	Peak
Wide Measurement Uncertainty:	± 5.2dB (k=2)
Note:	Only for identification of limit in non-restricted band Limit is 75.4 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)
1953.4	42.3	75.4	-33.1	Pass
1983.9	50.7	75.4	-24.7	Pass
2079.9	52.8	75.4	-22.6	Pass
2197.0	45.6	75.4	-29.8	Pass
2304.0	57.5	75.4	-17.9	Pass
2399.6	53.4	75.4	-22.0	Pass
2400.0	53.7	75.4	-21.7	Pass
2500.9	55.4	75.4	-20.0	Pass
RBW:	100kHz			
Measurement distance:	3m			
Limit:	For 15.247 / RSS-247			
Final measurement detector:	Peak			
Wide Measurement Uncertainty:	± 5.2dB (k=2)			
RESULT:	PASS			
Notes:	<p>(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</p> <p>(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</p> <p>(3): All frequencies not specified have margin < -20dB</p> <p>(4): 3-axis measurement performed for device under test.</p>			

Graphical representation of Band-edge compliance



Low bandedge compliance

F1 = 2400MHz

F2 = 2390MHz

Total factor directly added on graphical representation (Total factor = 31.6dB)

RESULT: PASS

Note: Radiated measurement

10. Unwanted emissions in Restricted Frequency bands

TEST: Unwanted emissions into Restricted Frequency Bands		Verdict
<p>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.</p> <p>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.</p>		Pass
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	10 to 40 °C	25°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
	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: February 22 nd and 23 rd , 2017 by J. Blancher Power supply voltage: 3.7 from battery (fully charged)		

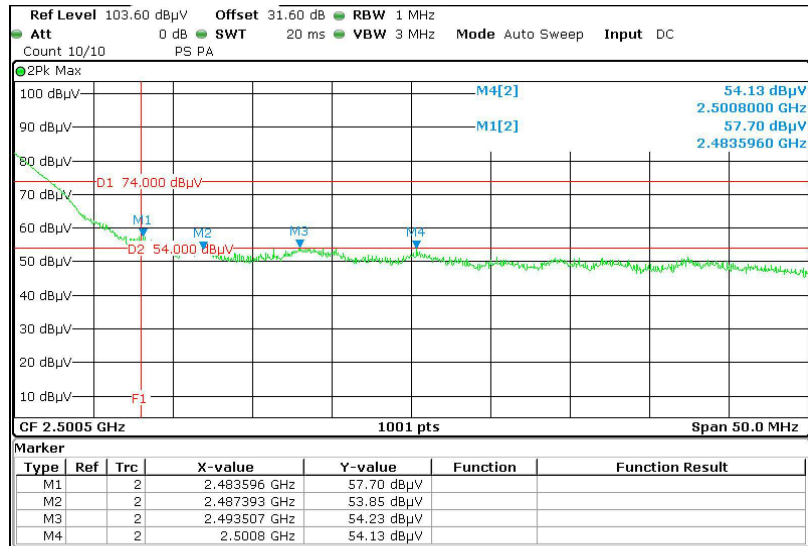
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2016/8	2017/8
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2016/8	2017/8
Loop antenna	EMCO	6502	ANT-101-009	2016/8	2017/8
BiConiLog antenna	EMCO	3142B	ANT-101-010	2016/8	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, 15.247 / RSS-Gen, RSS-247				
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 < -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, 15.247 / RSS-Gen, RSS-247								
Final measurement detector:		Quasi-Peak								
Wide Measurement Uncertainty:		± 5.2dB (k=2)								
RESULT:		PASS								
Field Strength Calculation:		<p>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:</p> $FS = RA + AF + CF - AG$ <p>Where FS = Field Strength RA = Receiver Amplitude AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain</p> <p>Total factor (dB) is AF + CF – AG Margin value = Emission level – Limit value</p>								

Tabulated Results for Unwanted emissions (1GHz-25GHz)					
FREQ (MHz)	Field Strength 3m (dBµV/m)	Detector	Limit (dBµV/m)	Margin (dBµV/m)	Result
2240.2	57.0	Pk	74	-17.0	Pass
2240.2	37.3	Avg	54	-16.7	Pass
2368.0	59.4	Pk	74	-14.6	Pass
2368.0	41.7	Avg	54	-12.3	Pass
4884.0	53.1	Pk	74	-20.9	Pass
4884.0	36.6	Avg	54	-17.4	Pass
2483.5	57.9	Pk	74	-16.1	Pass
2483.5	40.6	Avg	54	-13.4	Pass
2487.4	55.8	Pk	74	-18.2	Pass
2487.4	40.0	Avg	54	-14.0	Pass
2493.8	56.1	Pk	74	-17.9	Pass
2493.8	40.0	Avg	54	-14.0	Pass
2500.9	55.4	Pk	74	-18.6	Pass
2500.9	39.8	Avg	54	-14.2	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:		<p>(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</p> <p>(2): Peak pre-scans not performed at 3-meters distance are corrected as follow: $M@3m = M@D_m + 20 \times \log(D_m / 3m)$ Where D is the measurement distance in meter</p> <p>(3): All frequencies not specified have margin < -10dB (for peak and average detector)</p> <p>(4): 3-axis measurement performed for device under test.</p>			

Graphical representation of Band-edge compliance



High bandedge compliance

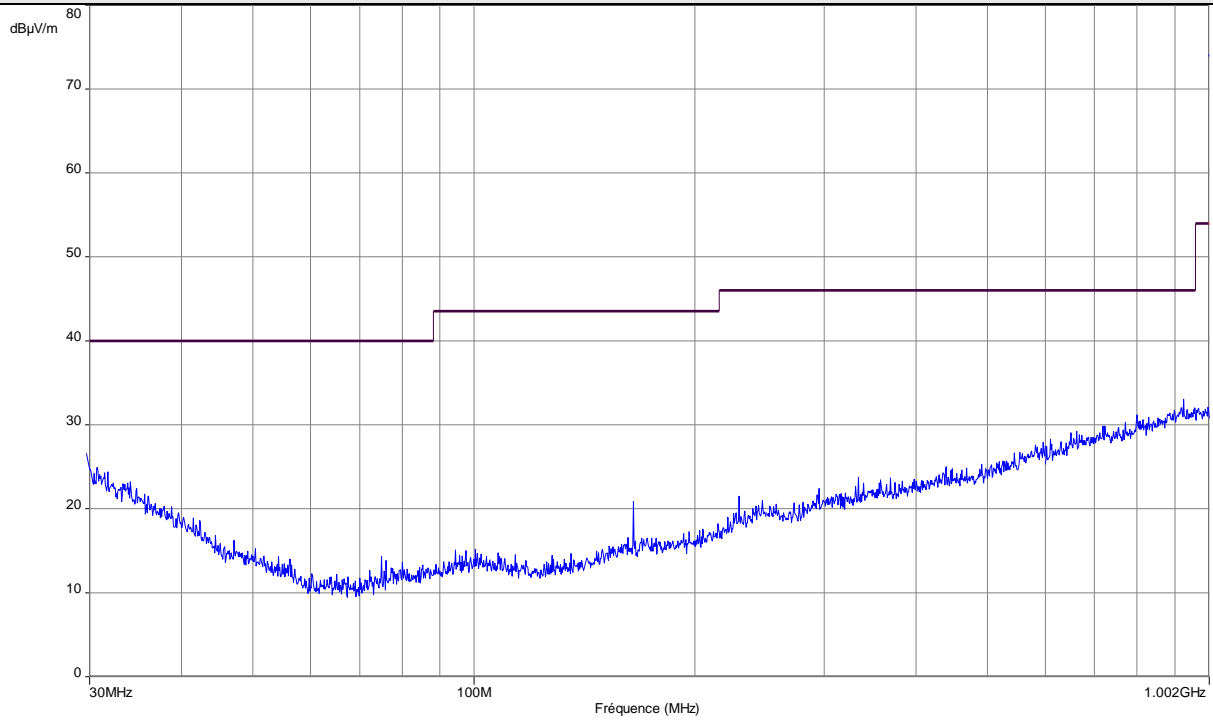
F1 = 2483.5MHz

Total factor directly added on graphical representation (Total factor = 31.6dB)

RESULT: PASS

Note: Radiated measurement

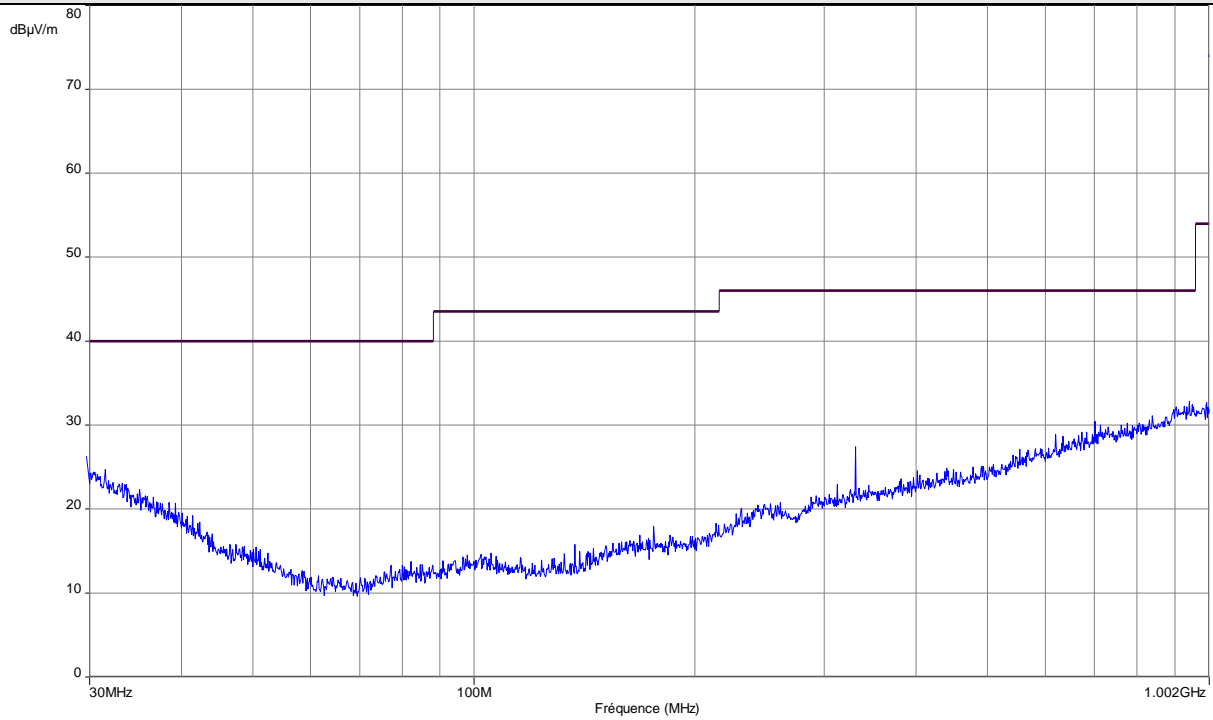
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Transmit mode)



Note: Pre-scan graph only for identification purpose.

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

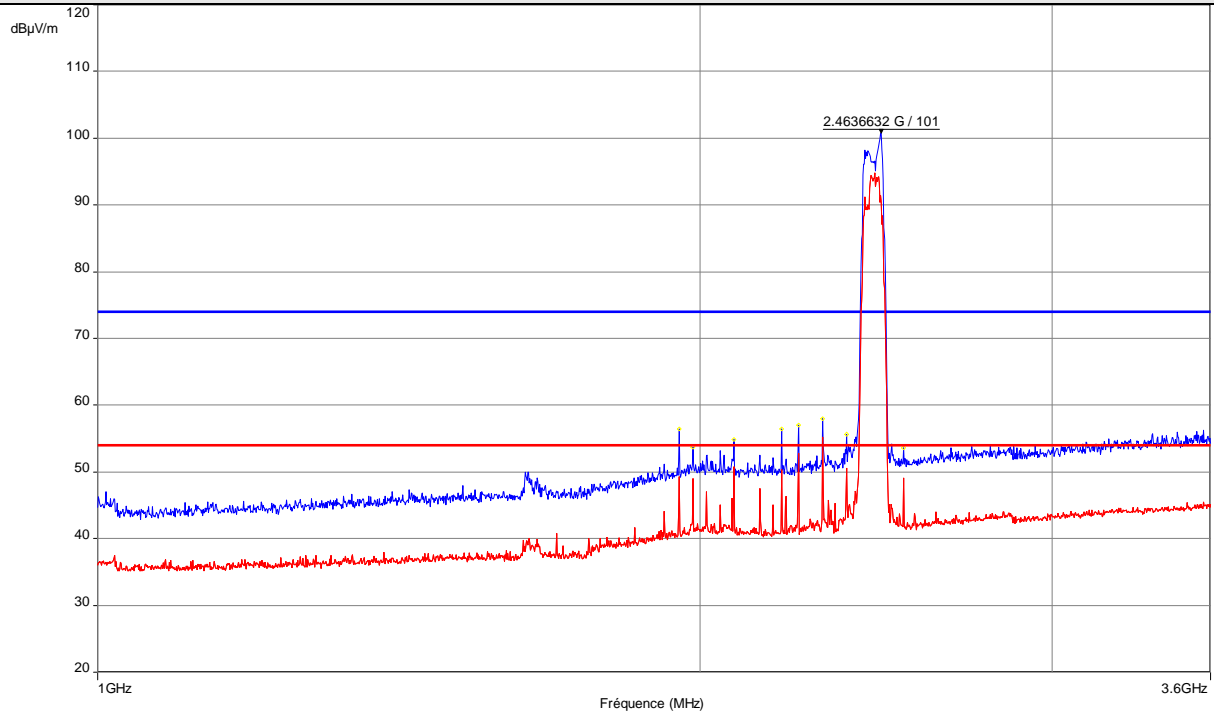
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Transmit mode)



Note: Pre-scan graph only for identification purpose.

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

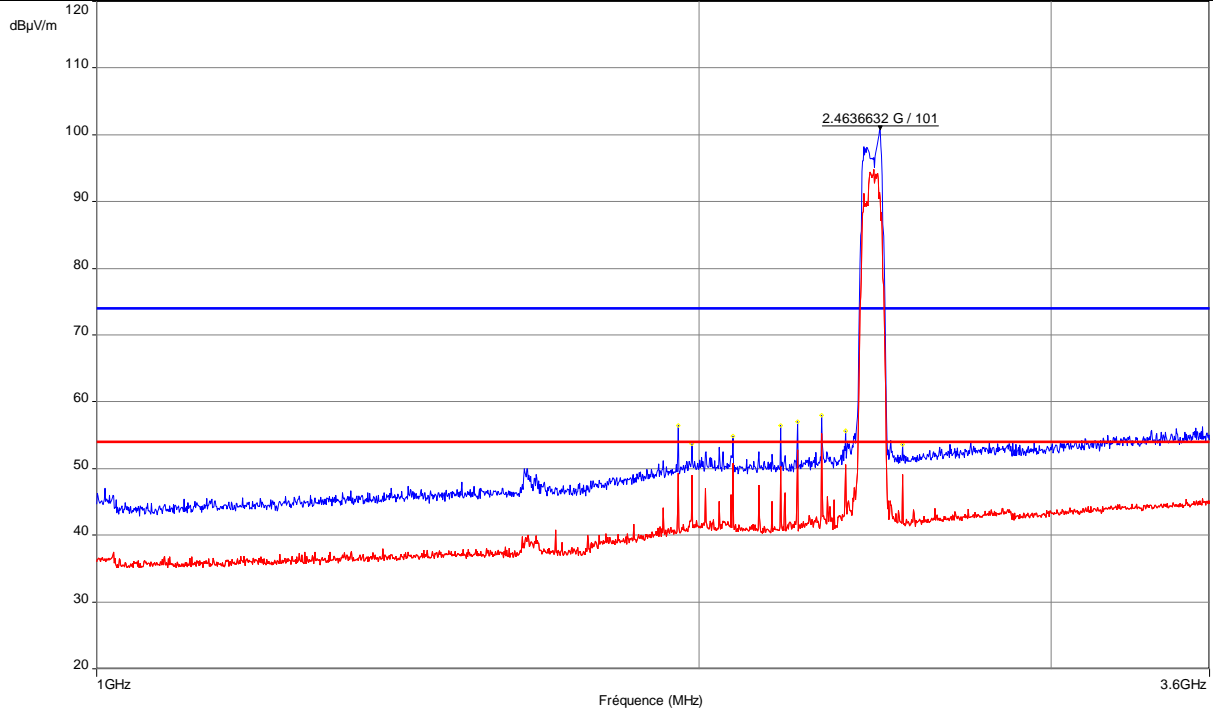
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Horizontal / Transmit mode)



Frequency (MHz)	Peak level (dBµV/m)	Comments
1953,350	56,4	Non rest. band
1983,860	53,7	Non rest. band
2079,880	54,9	Non rest. band
2197,090	56,5	Non rest. band
2240,000	57,0	Restricted band
2304,020	58,0	Non rest. band
2368,050	55,7	Restricted band
2527,920	53,6	Non rest. band

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

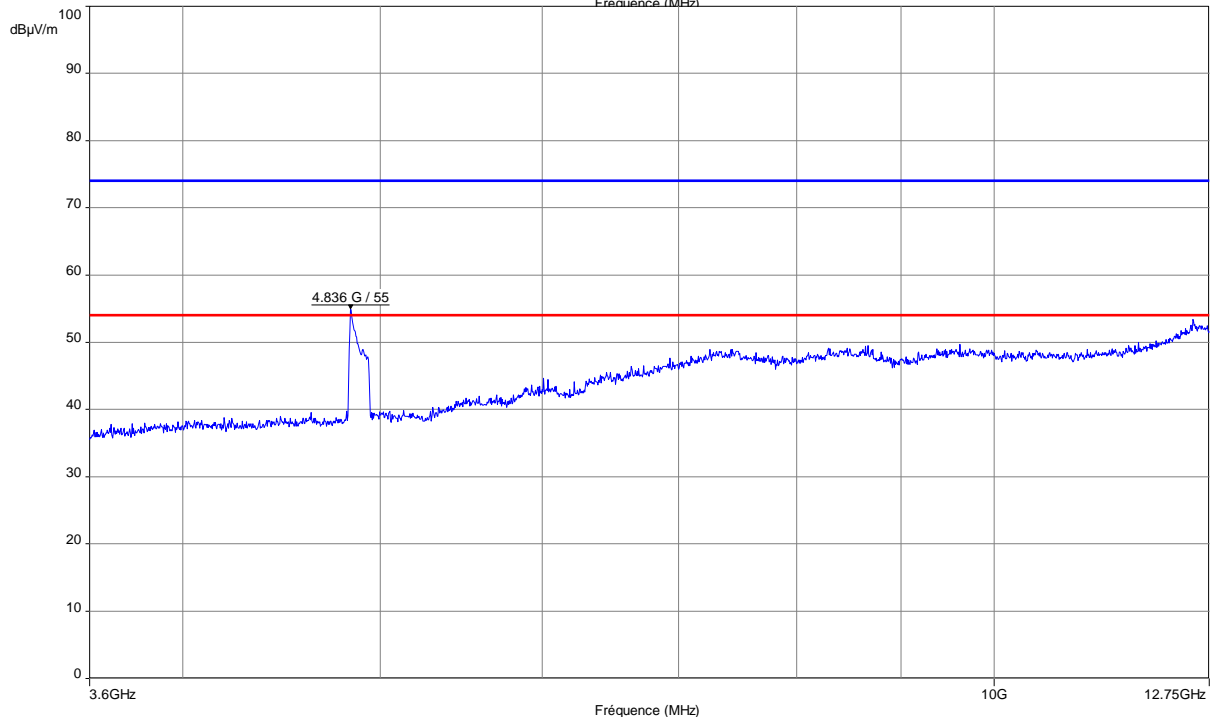
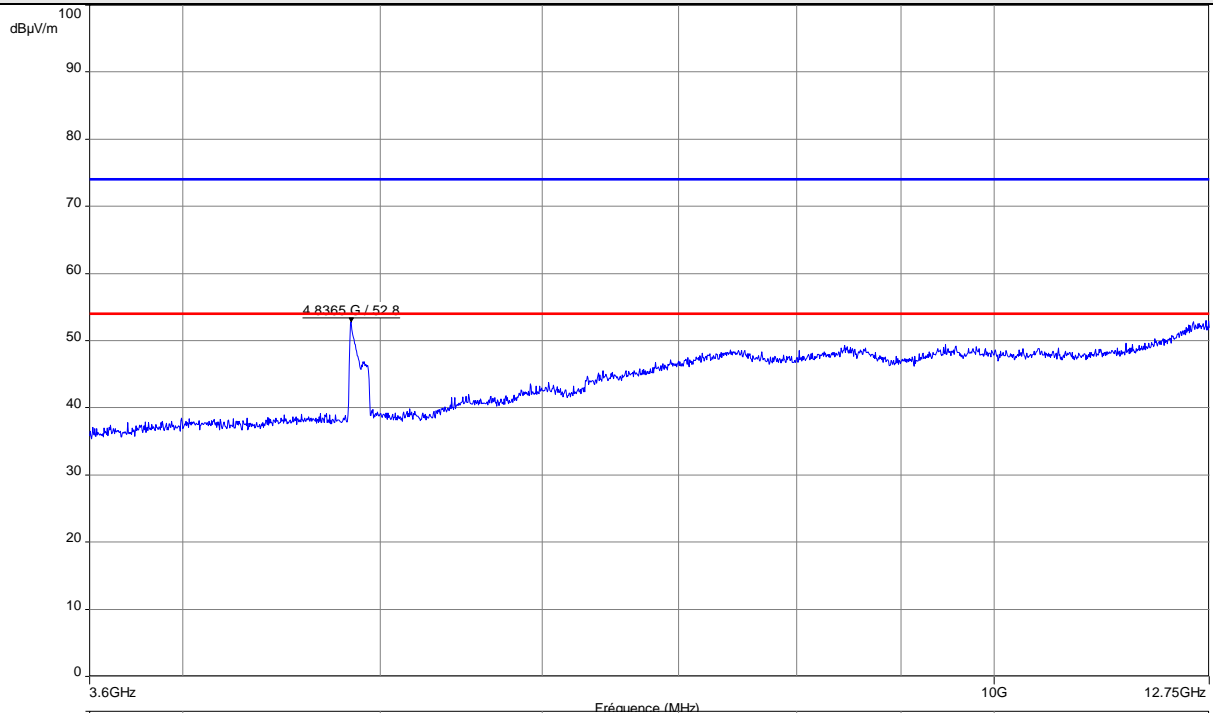
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Vertical / Transmit mode)



Frequency (MHz)	Peak level (dBµV/m)	Comments
2143,710	53,6	Non rest. band
2197,370	57,9	Non rest. band
2239,710	54,2	Restricted band
2304,020	55,3	Non rest. band
2368,050	56,5	Restricted band

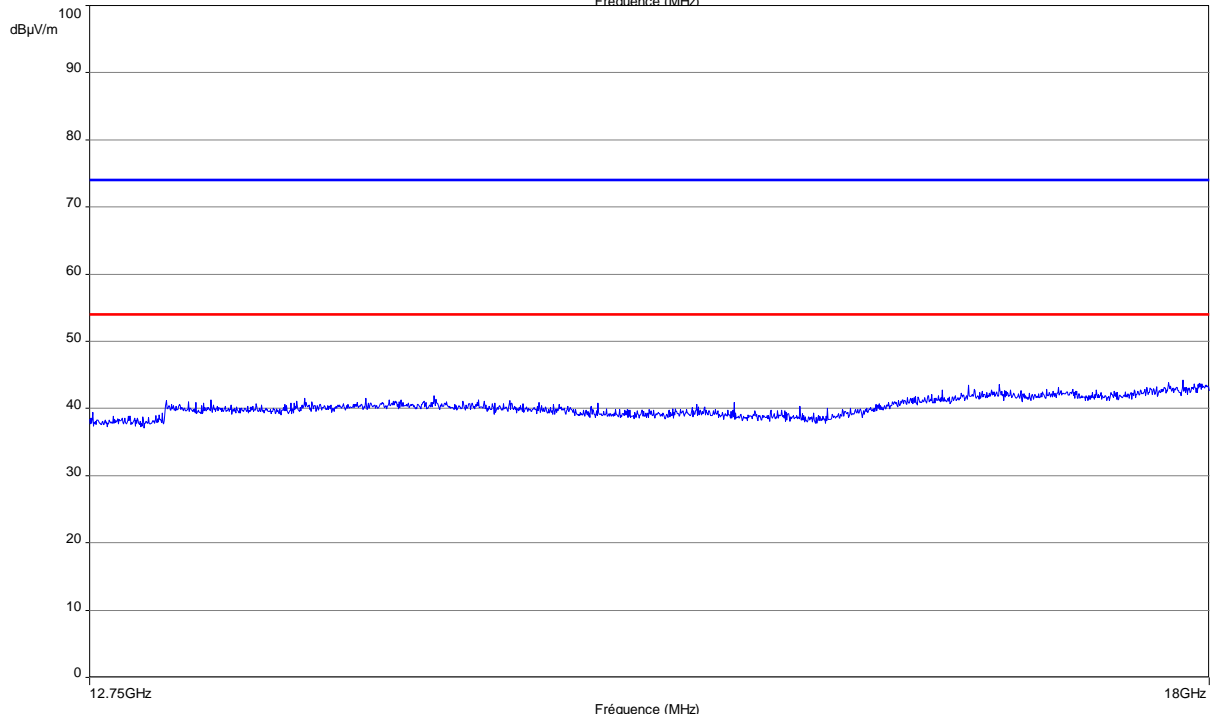
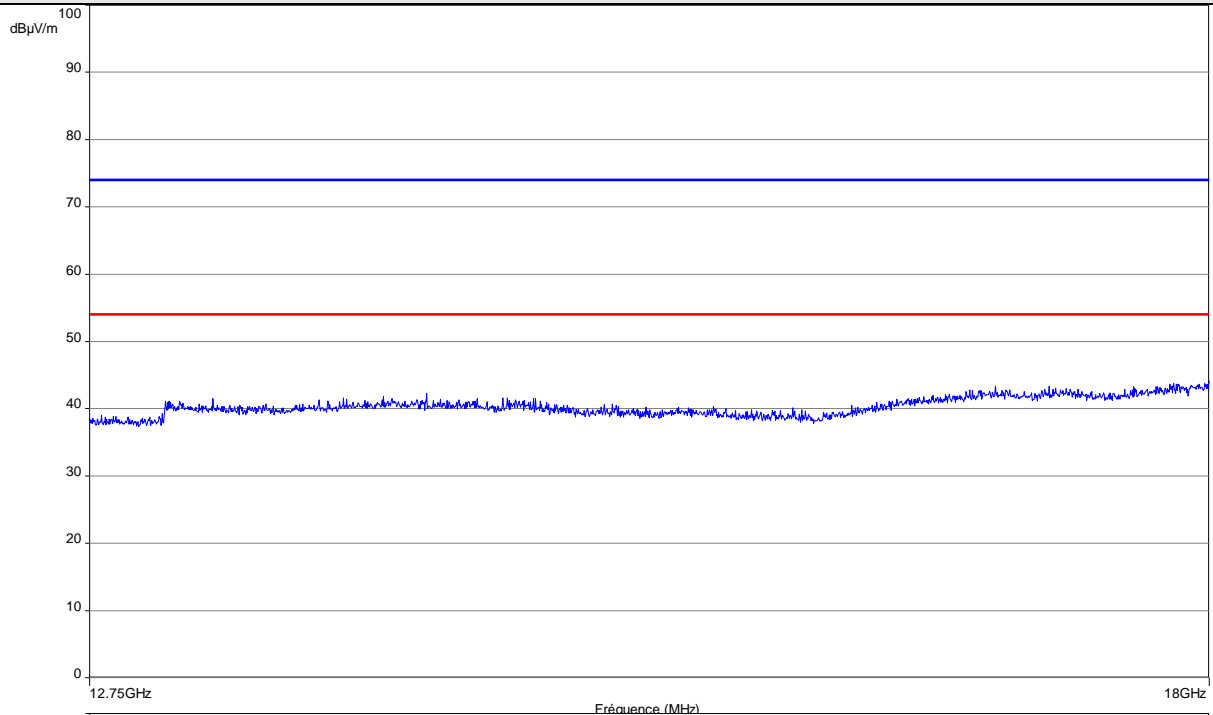
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Vertical
Voltage:	3.7V DC
Limit:	15.209 / RSS-Gen
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-12.75GHz / 3m / Horizontal & Vertical / Transmit mode)



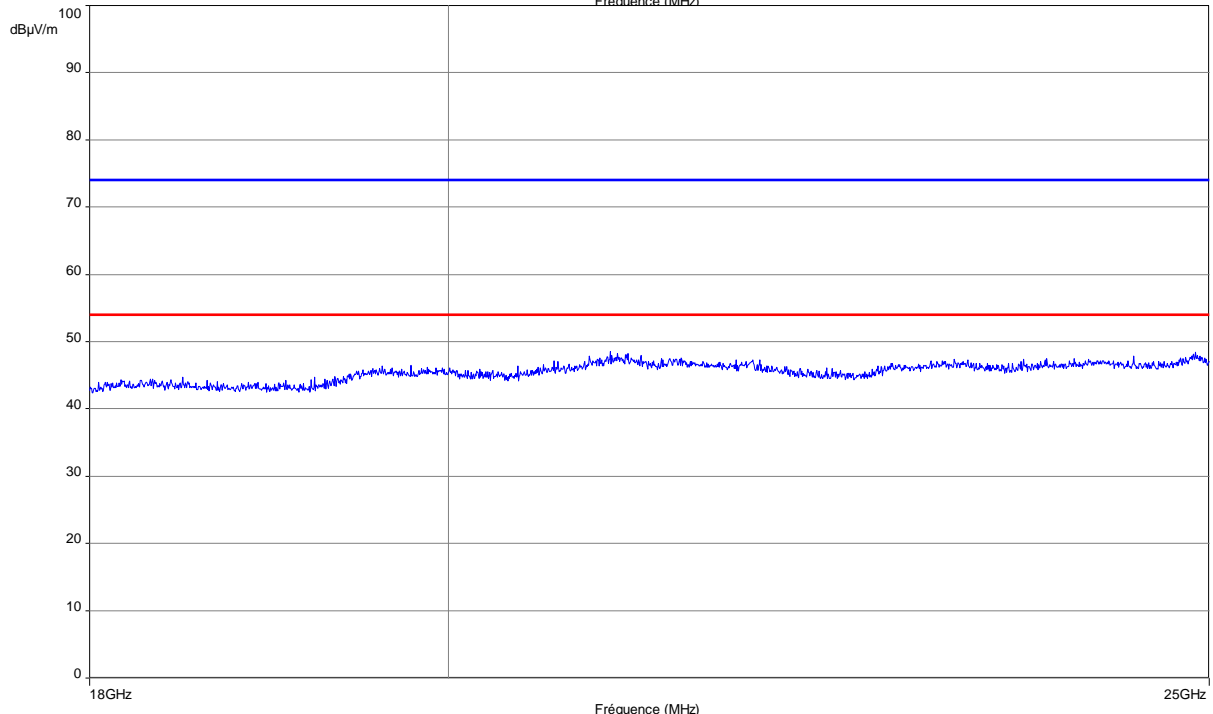
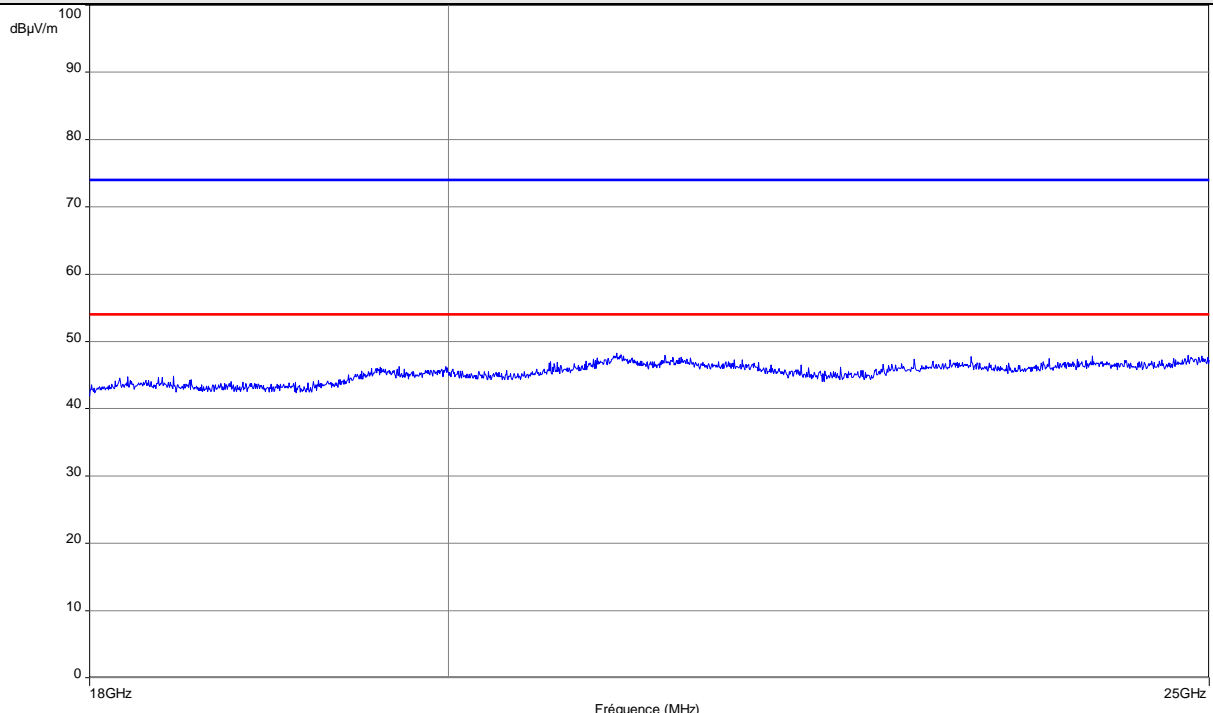
Frequency band investigated:	3.6GHz-12.75GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	3.7V DC
Limit:	15.209 / RSS-Gen
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 12.75GHz-18GHz / 3m / Horizontal & Vertical / Transmit mode)



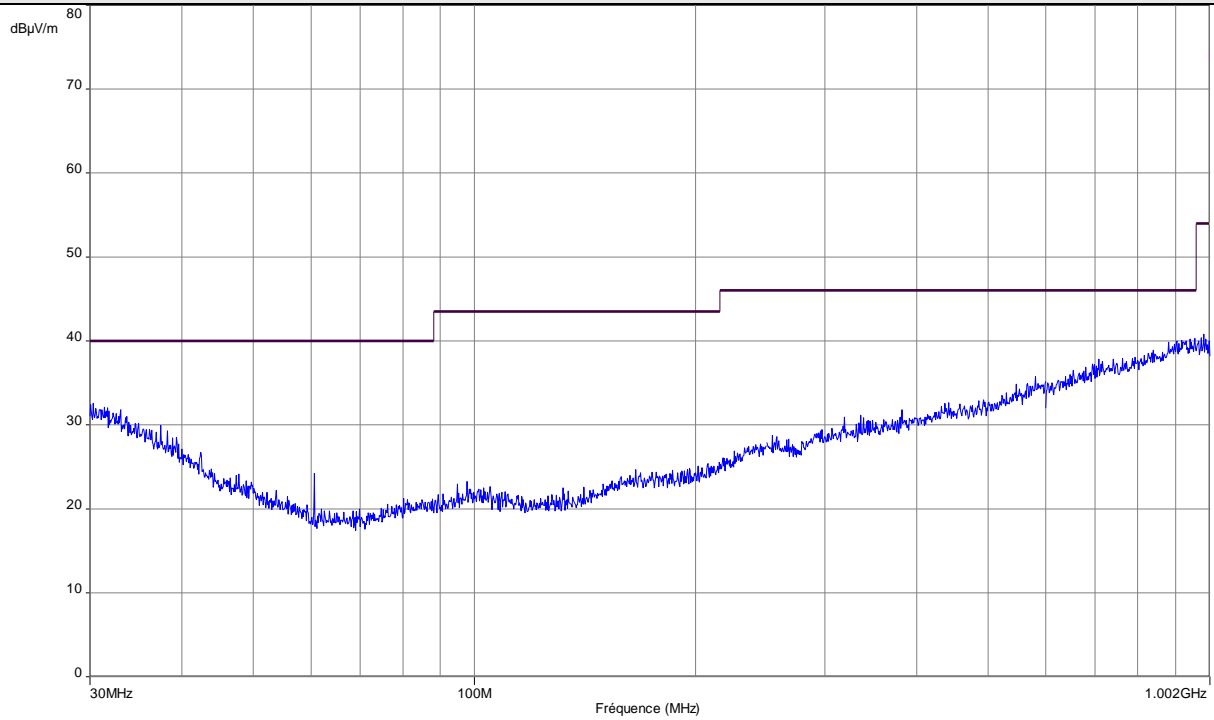
Frequency band investigated:	12.75GHz-18GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	3.7V DC
Limit:	15.209 / RSS-Gen
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 18GHz-25GHz / 3m / Horizontal & Vertical / Transmit mode)



Frequency band investigated:	18GHz-25GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	3.7V DC
Limit:	15.209 / RSS-Gen
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

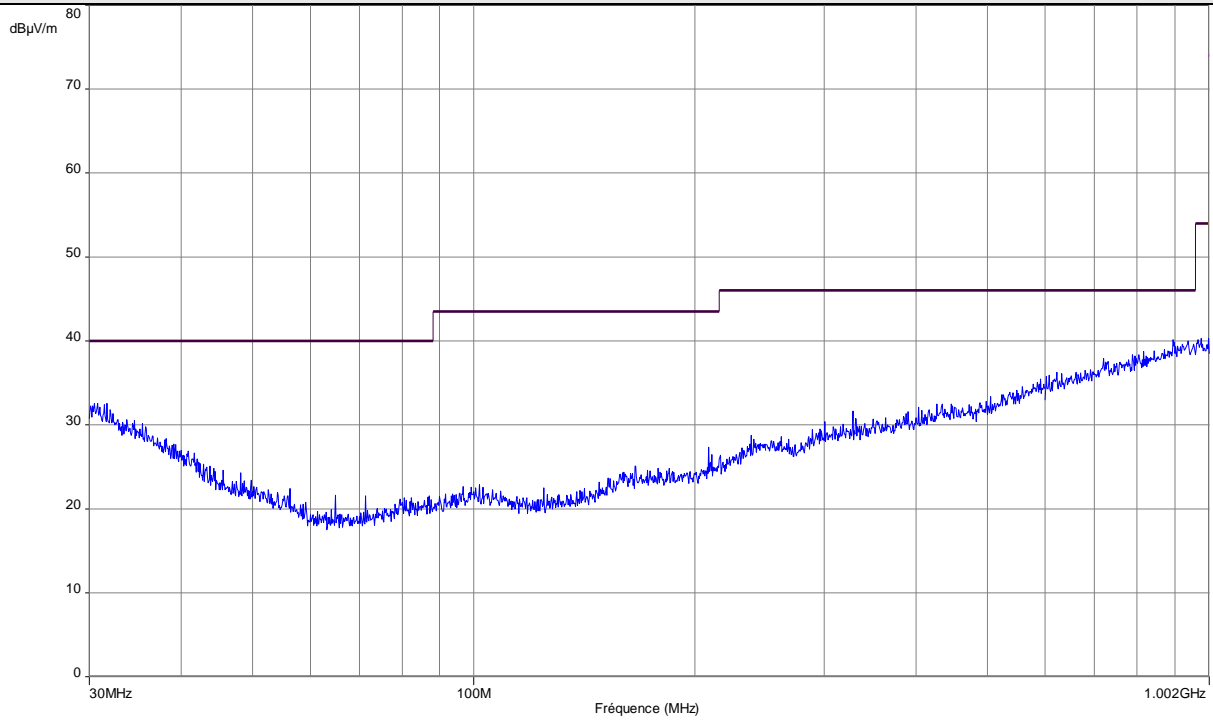
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Receive mode)



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:	15.209 / RSS-Gen
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

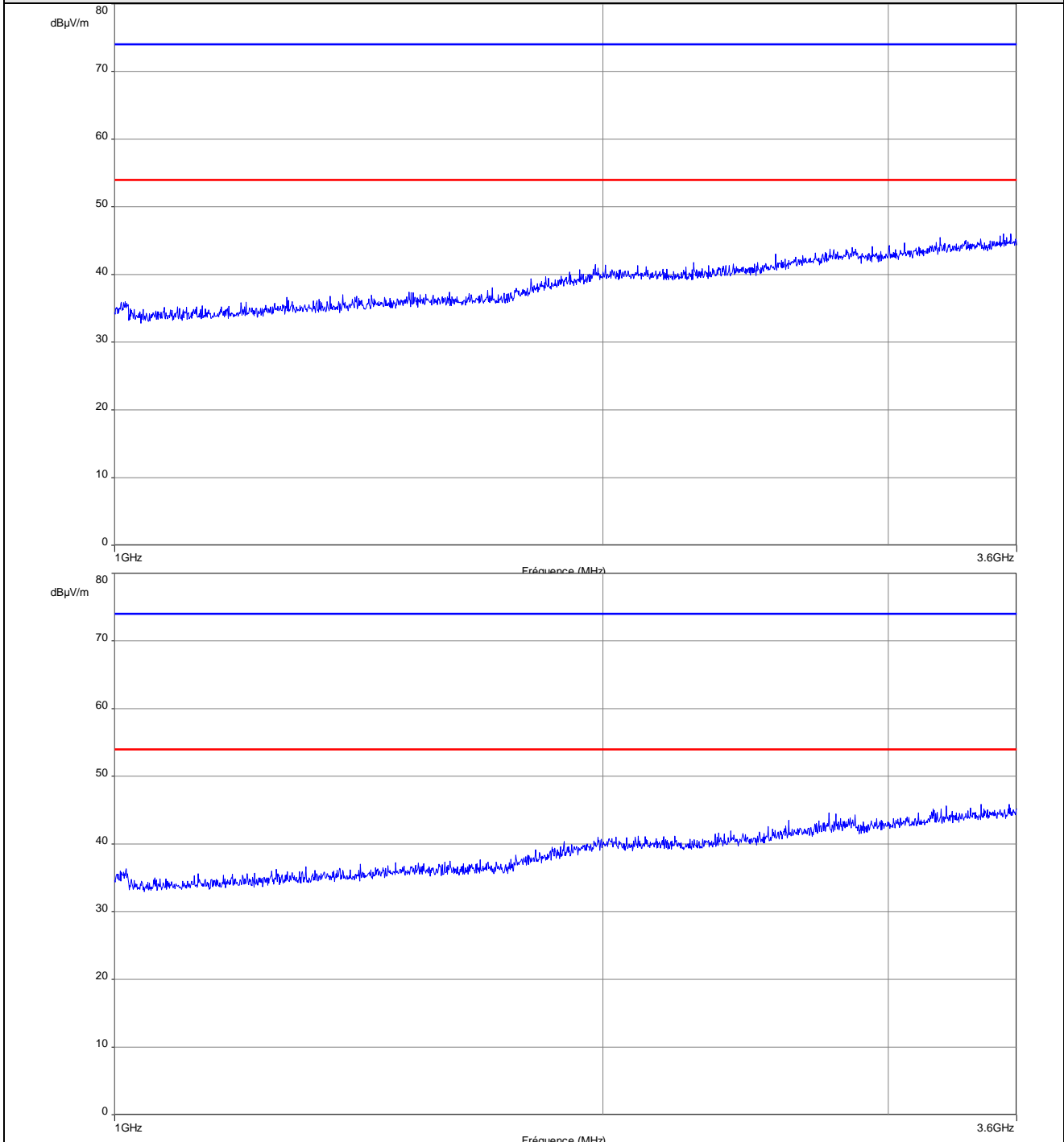
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Receive mode)



Note: Pre-scan graph only for identification purpose.

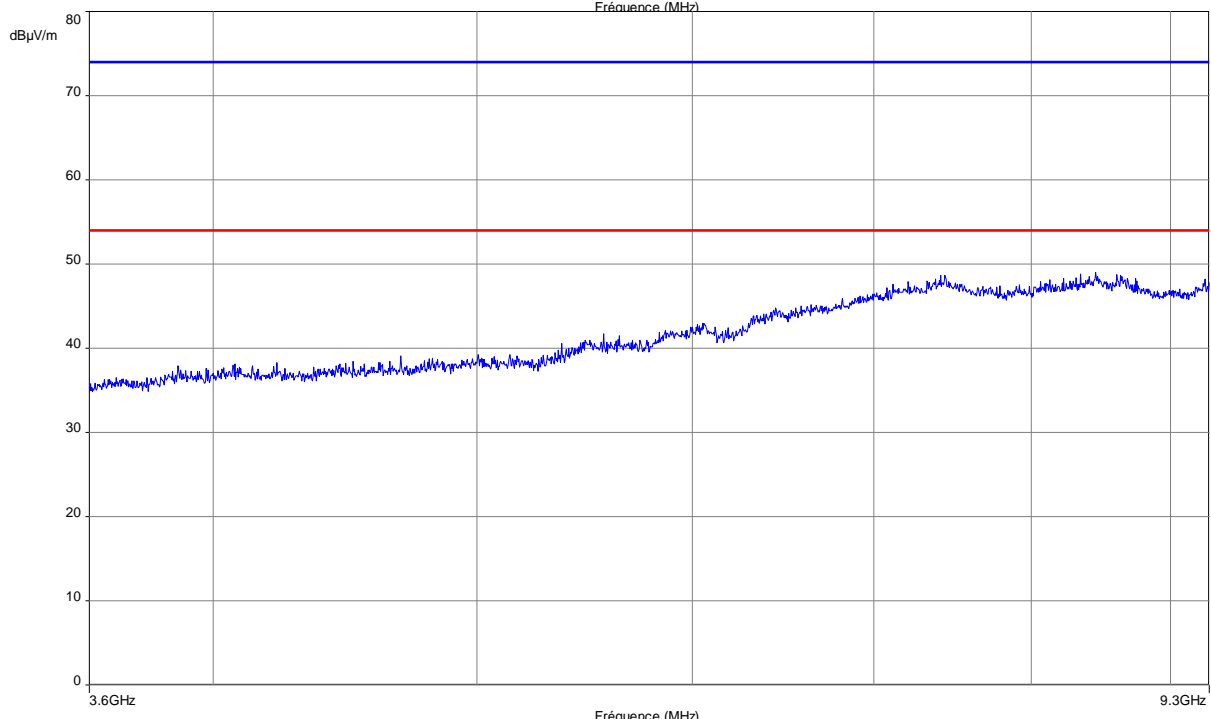
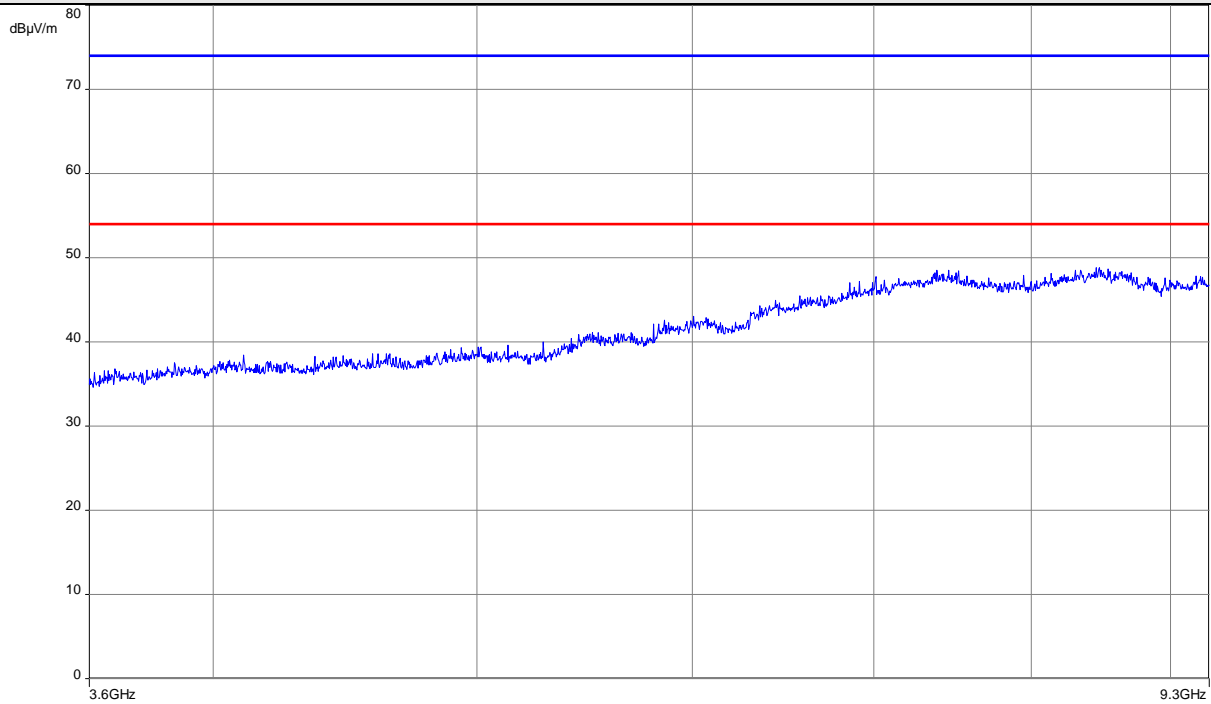
Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Vertical
Voltage:	3.7V DC
Limit:	15.209 / RSS-Gen
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

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



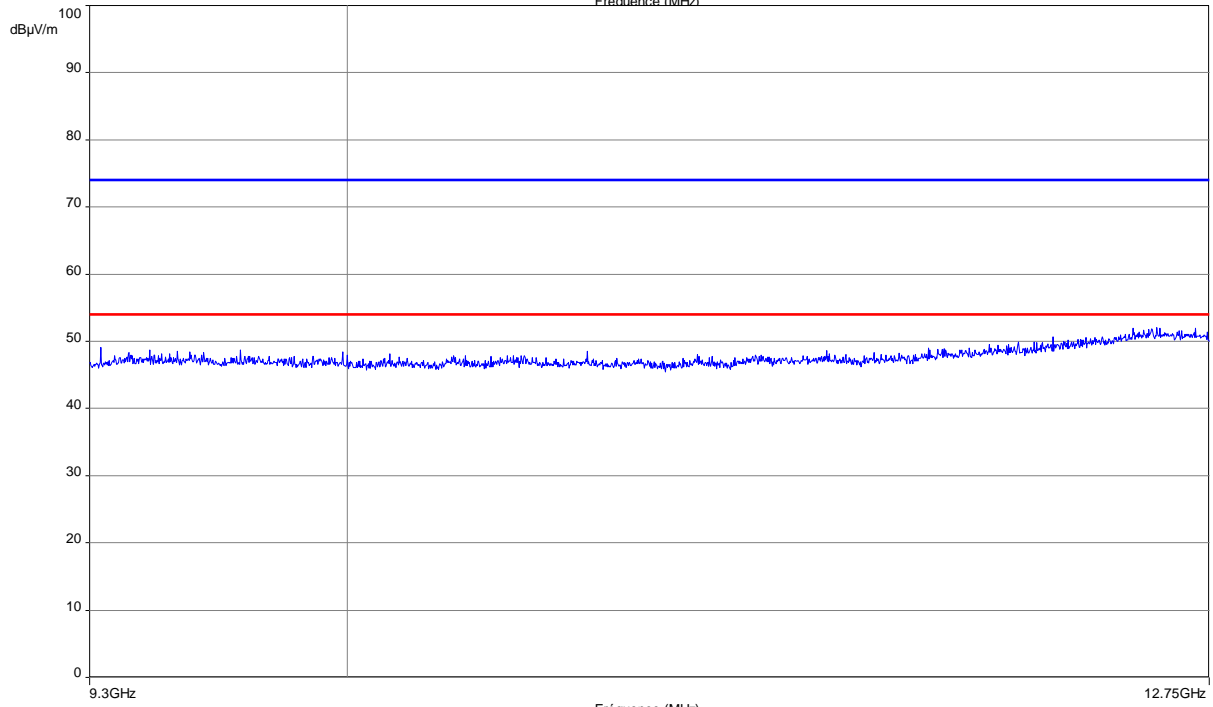
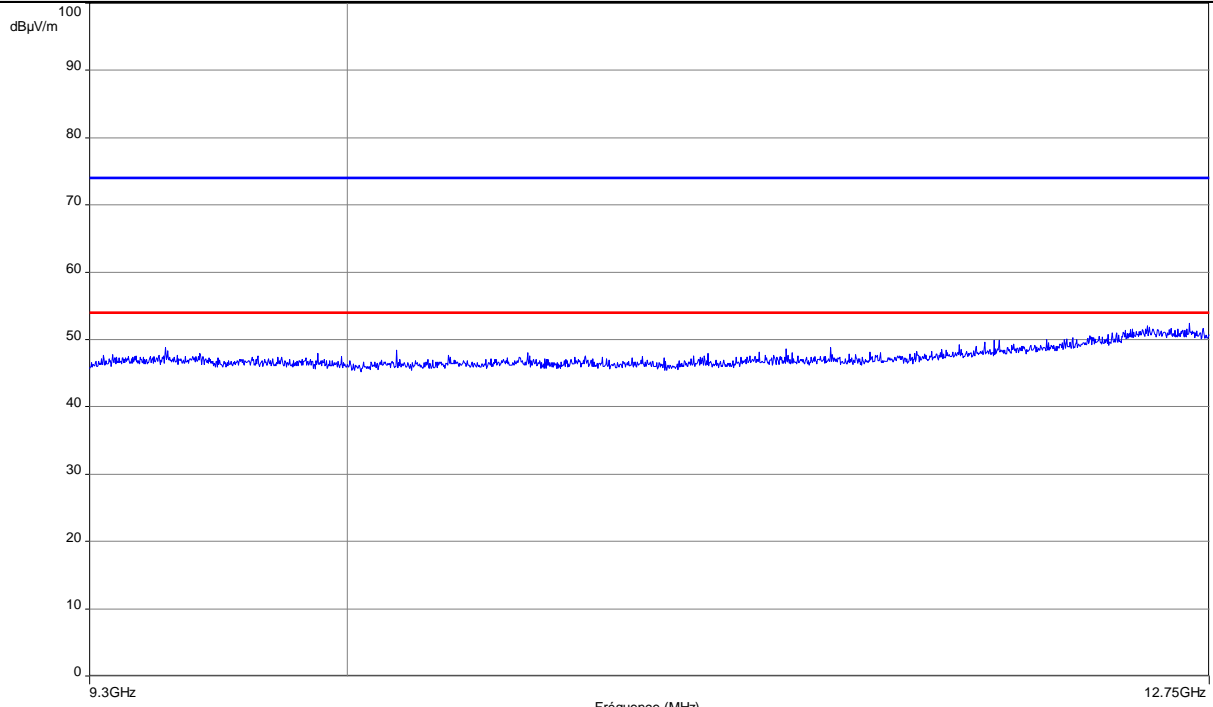
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	3.7V DC
Limit:	15.209 / RSS-Gen
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-9.3GHz / 3m / Horizontal & Vertical / Receive mode)



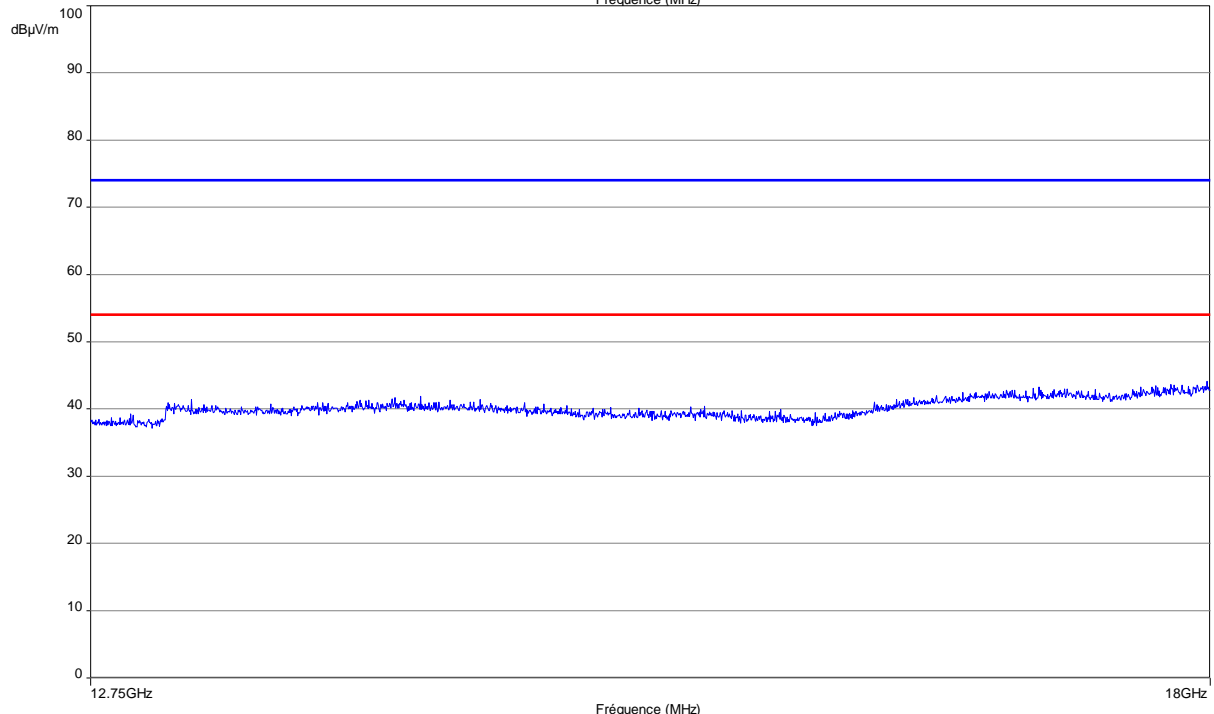
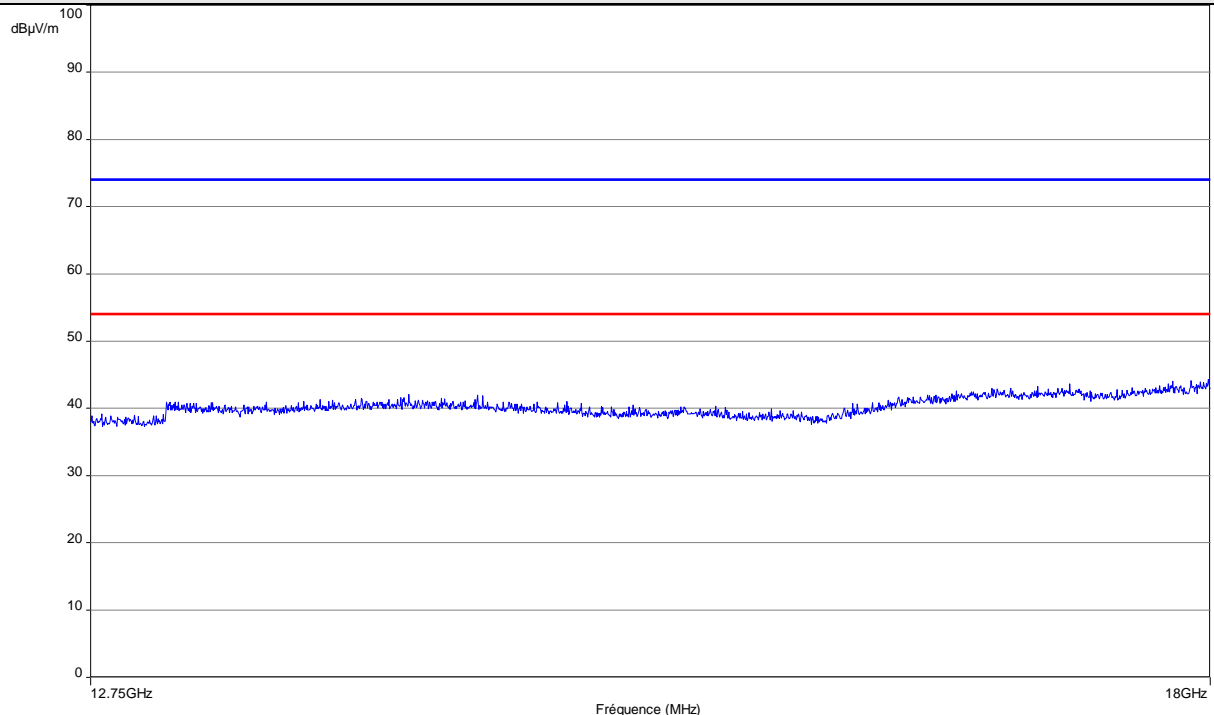
Frequency band investigated:	3.6GHz-9.3GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	3.7V DC
Limit:	15.209 / RSS-Gen
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 9.3GHz-12.75GHz / 3m / Horizontal & Vertical / Receive mode)



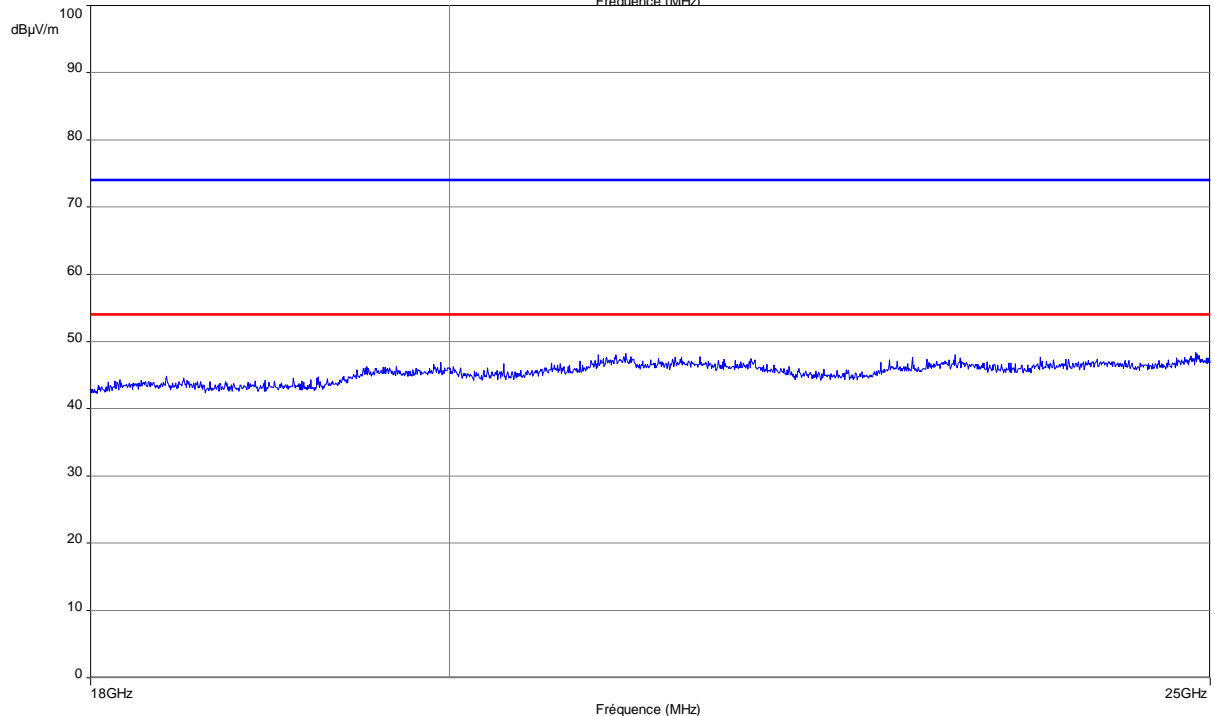
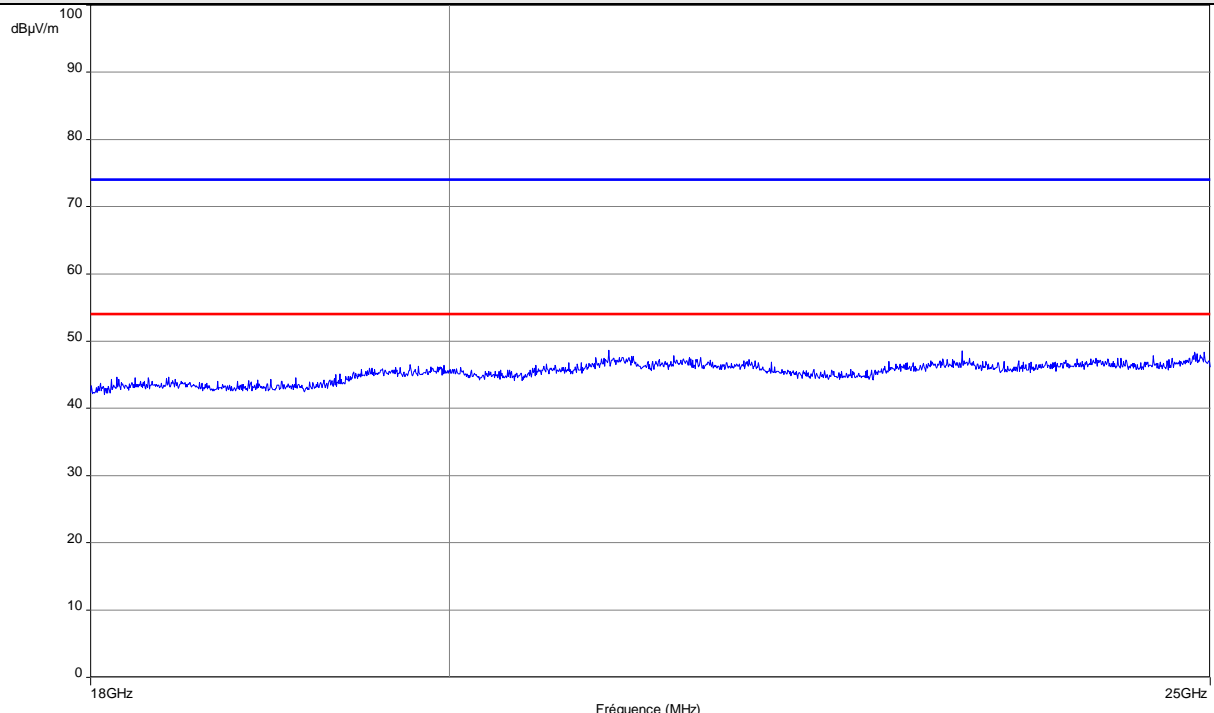
Frequency band investigated:	9.3GHz-12.75GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	3.7V DC
Limit:	15.209 / RSS-Gen
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 12.75GHz-18GHz / 3m / Horizontal & Vertical / Receive mode)



Frequency band investigated:	12.75GHz-18GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	3.7V DC
Limit:	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-25GHz / 3m / Horizontal & Vertical / Receive mode)



Frequency band investigated:	18GHz-25GHz
Unit :	dBµV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	3.7V DC
Limit:	15.209 / RSS-Gen
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

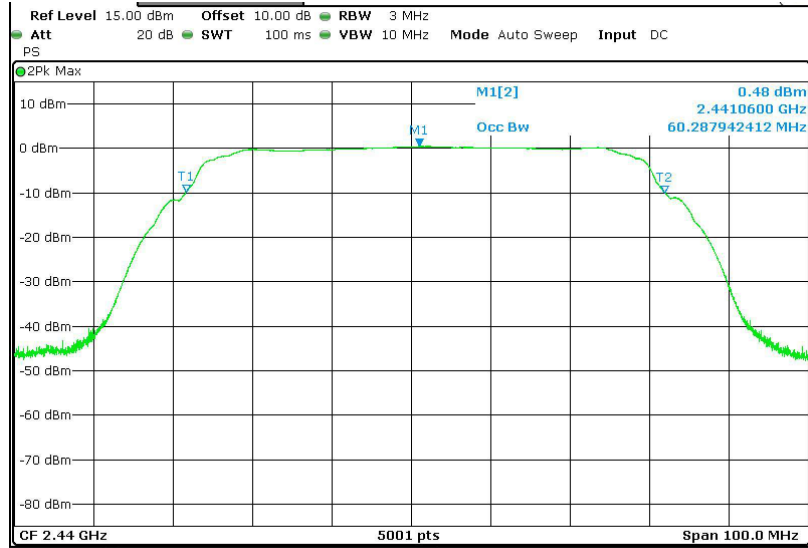
11. Occupied bandwidth (99%)

TEST: Occupied bandwidth (99%) / RSS-GEN		Verdict
<p>Method: RF Output of EUT is connected directly to a spectrum analyser. A temporary antenna connector is added on EUT. A conducted measurement is performed. The RBW is set in the range of 1% to 5% of the occupied bandwidth, with VBW $\geq 3 \times$ 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.</p>		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: December 2 nd , 2016 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

Tabulated Results for Occupied Bandwidth	
Frequency (MHz)	99% Occupied Bandwidth (MHz)
2441.75	60.288 MHz

Graphical representation of 99% Occupied Bandwidth



Frequency band investigated:	2400MHz to 2483.5MHz
RBW :	3MHz
Measurement detector:	Peak
Note :	Same results for data rate of 1Mb/s and 250kb/s