

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

Matériel testé :
Equipment under test:

i-MARK S350 / i-MARK S350-ER

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

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

Référence de la proposition : 062016-22037
Proposal number:

Date de l'essai : Du 8 au 19 août 2016
Date of test: August 8th to 19th, 2016

Objectif des essais : EMC qualification accordingly to following standards:
Test purpose: - CFR 47, FCC Part 15, Subpart C
(Chapter 15.249 - Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz)
- Industry Canada, RSS-Gen Issue 4 & RSS-210 Issue 9, section B.10
(Bands 902–928, 2400–2483.5 and 5725–5875 MHz)

FCC ID: OO4-ILR-IMS350
IC ID : 3538A-IMS350
Model : i-MARK S350 / i-MARK S350-ER

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	October 3 rd , 2016	Initial Edition	Jeremy Blancher	Laurent Chapus
2	November 21 st , 2016	TCB comments		

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.....	6
5. MODIFICATIONS OF THE EUT.....	6
6. CONDUCTED EMISSION MEASUREMENT (150KHZ-30MHZ).....	7
7. FIELD STRENGTH OF FUNDAMENTAL	11
8. FIELD STRENGTH OF HARMONICS.....	13
9. UNWANTED EMISSIONS.....	16
10. 99% OCCUPIED BANDWIDTH	37

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 / 15.249

Industry Canada qualification following:		
Standards	Applied	Title
RSS-Gen (Issue 4/2014)	X	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 (Issue 9/2016)	X	Licence-exempt Radio Apparatus: Category I Equipment, Section A2.9: Devices Operating in Frequency Bands for Any Application, Band 902-928

2. Test synthesis

TEST	Paragraph number FCC Part 15 IC RSS-210	Spec. FCC Part 15 IC RSS-210	RESULTS (comments)
Conducted emissions test	15.107 (a) / 15.207 (a) RSS-Gen: Issue 4, §8.8	Table 15.107 (a) / 15.207 (a) Table 3, §8.8	PASS
Radiated emission test	15.109 (a) ICES-003: Issue 6, §6.2	Table 15.109 (a) Table §6.2	N/A (1)
Field Strength of fundamental	15.249 (a) (c) RSS-210: Issue 9, §B.10 (a)	94dBµV/m @3m (50mV/m @ 3m)	PASS
Field Strength of harmonics	15.249 (a) (c) (e) RSS-210: Issue 9, §B.10 (a)	54dBµV/m @3m (0.5mV/m @ 3m)	PASS
Unwanted emissions outside the specified frequency band and harmonics	15.209 / 15.249 (d) (e) RSS-210: Issue 9, §B.10 (b) / RSS-Gen: Issue 4, §8.9	Whichever is less stringent, either: - 50dB below level of fundamental, or; - General field strength limits, as follow: <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): Equipment functioning only with RF function

• General conclusion:

Measures and tests performed on the sample of the products *i-MARK S350* / *i-MARK S350-ER*, 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-210.

3. Equipment Under Test (EUT)

Nom /
Identification

i-MARK S350 / i-MARK S350-ER

Sn: 0.445.000.113

Alimentation /
Power supply

24V dc from external power source

Auxiliaires /
Auxiliaries

- i-PORT M350-2, IDENTEC SOLUTIONS product
(RF configuration and communication only)
(FCC ID: OO4-ILR-IPM350N / IC ID: 3538A-IPM350N)
- Programmable linear power supply GOODWILL, model PPT-3615

Sn: 14288M3401

Sn: A160095

Entrées-Sorties /
Input / Output

	Câbles pour essai / Cables for test	Blindé / Shielded	Prévu pour >3m / Intended for >3m
DC cable (24V)	2wires, 1m	No	Yes

Version programme /
Firmware version

S350 / S350-ER

Mode de fonctionnement /
Running mode

The tested sample is able to:

- Transmit a carrier frequency on low, middle and high channels (903MHz / 915MHz / 927MHz)
- Be in Receiver mode (no transmission)
- Be in standby mode (no transmission)

Programme de test /
Test program /

Gen3 Tag Certification v1.0.0.24394

• Equipment information:

- Frequency band: 902 to 928 MHz (Frequencies from 903MHz to 927MHz, Tx & Rx)
- Frequency used in Tx/Rx mode:
 - 903MHz
 - 920MHz
 - 927MHz
- Equipment is configured with **0dBm** nominal output power by internal firmware
- Modulation: FSK (± 20 kHz)
- Antenna type: Integral (PCB antenna, max antenna gain -6dBi)
- Powered by 24V DC
- Equipment intended for use as a fixed station
- Equipment designed for continuous operation

Note: Tests are performed with the equipment i-MARK S350-ER. (Extended range for the 125kHz RF band)
The i-MARK S350-ER is identical than i-MARK S350 for the frequency band 902 to 928MHz.

4. Test conditions

Relative Humidity : 55%
Temperature : 20°C

Power supply voltage:

Equipment under test : 24V DC from external power source

5. Modifications of the EUT

None

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

TEST: Limits for conducted disturbance 150kHz – 30MHz / FCC part 15.107, 15.207 - ICES-003, RSS-Gen				Verdict
<u>Method:</u> 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 linear power supply)
Running mode		- No RF transmission (Standby mode) - RF Transmit at 915MHz		
Limits – FCC Part 15.107 (a), 15.207 (a) / RSS-Gen §8.8				
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: August 19 th , 2016 Power supply voltage: 110V / 60Hz for 24V DC power supply				

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

Standby mode

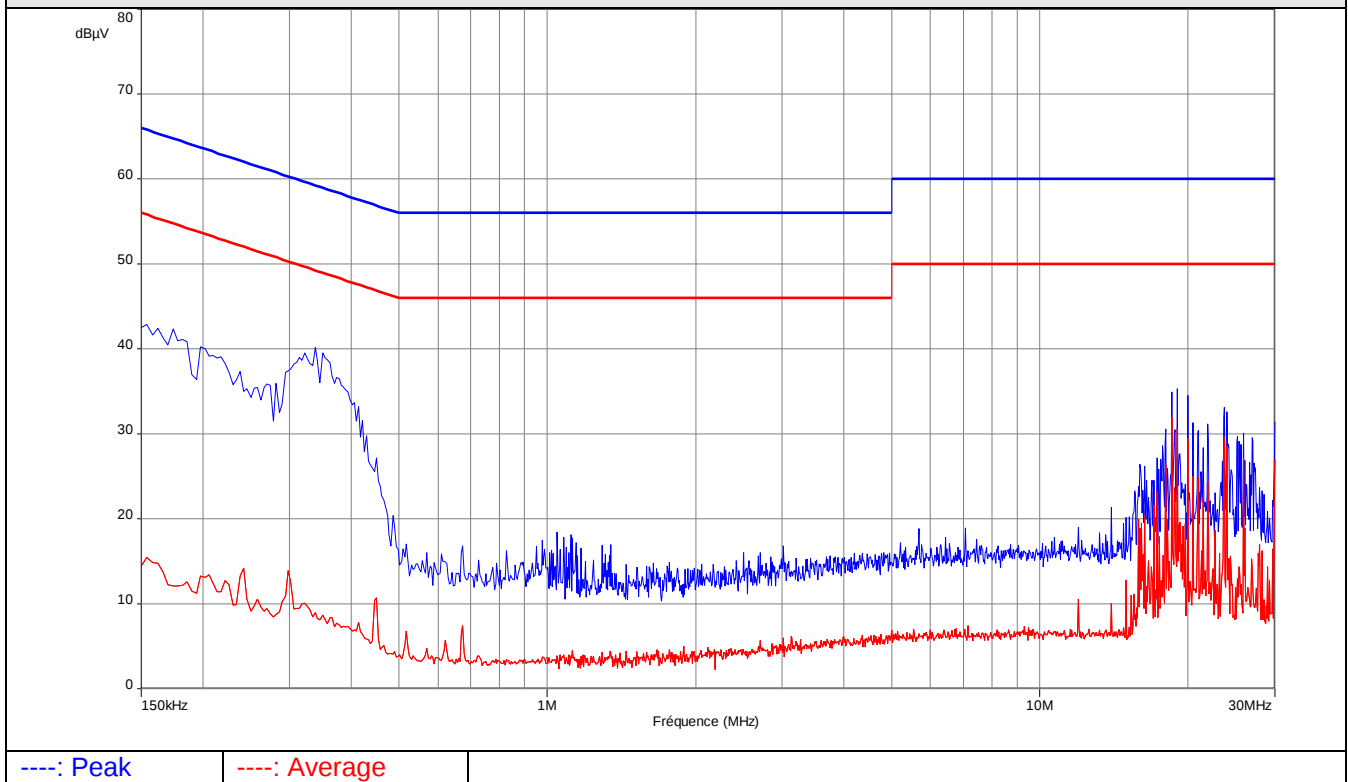
FREQ	Meas. PK	Mes. QP	LIMIT QP	Margin QP	Mes. AV	LIMIT AV	Margin AV	Line
(MHz)	(dBμV)	(dBμV)	(dBμV)	(dB)	(dBμV)	(dBμV)	(dB)	
Margin > 20dB								

Transmit mode

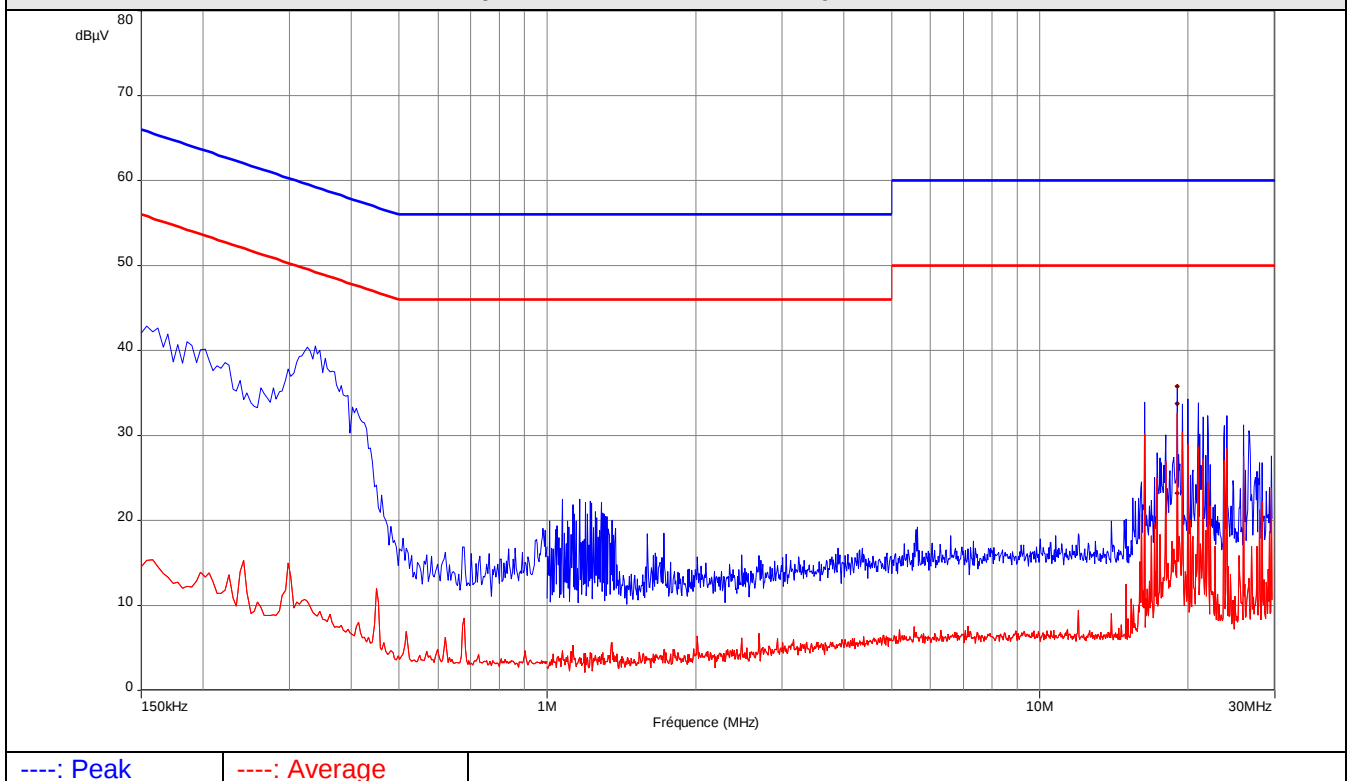
FREQ	Meas. PK	Mes. QP	LIMIT QP	Margin QP	Mes. AV	LIMIT AV	Margin AV	Line
(MHz)	(dBμV)	(dBμV)	(dBμV)	(dB)	(dBμV)	(dBμV)	(dB)	
Margin > 20dB								

Frequency band investigated:	150kHz-30MHz
RBW:	9kHz
Voltage:	110V / 60Hz
Limit:	FCC Part 15.207 / RSS-Gen
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: $\text{Meas.} = \text{RA} + \text{CF} + \text{ATT}_{\text{TRAN}} + \text{ATT}_{\text{LISN}}$ 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

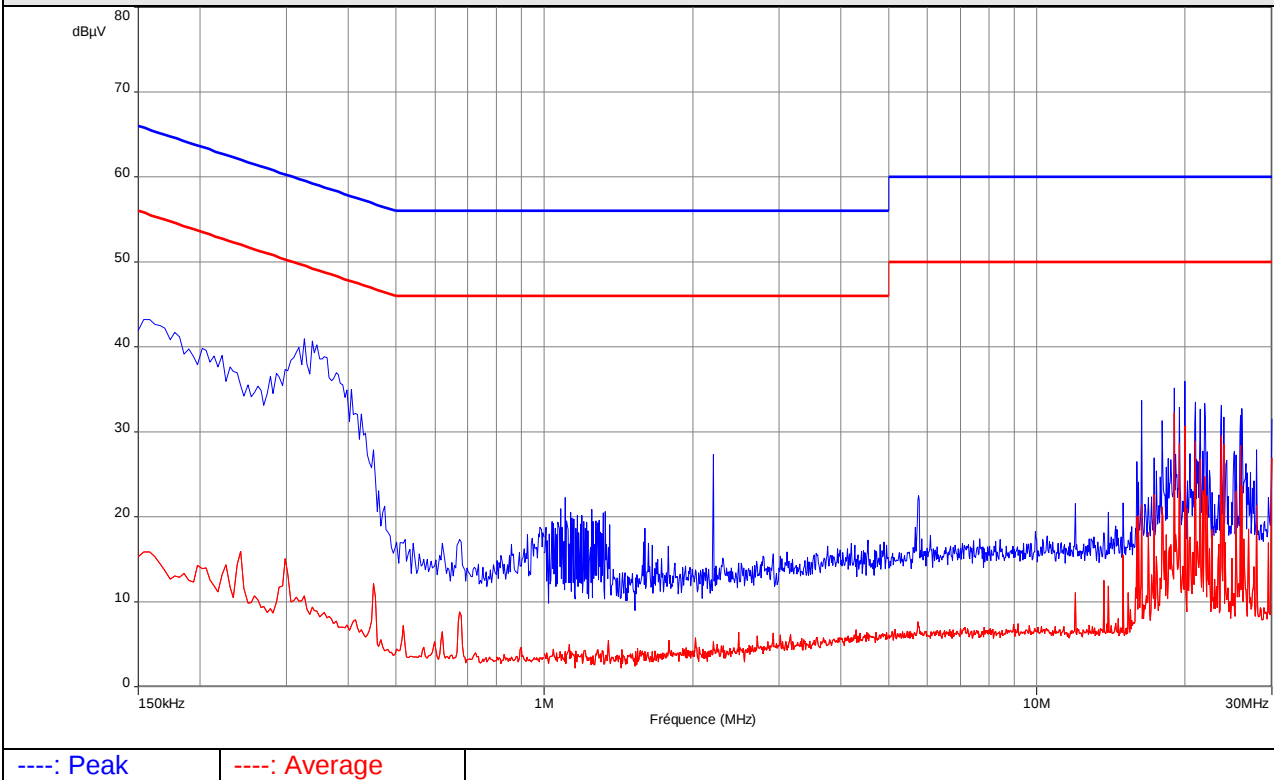
Graphical representation of Conducted Disturbance Measurement (Peak and Average detection) AC port, Line L1 – Standby mode



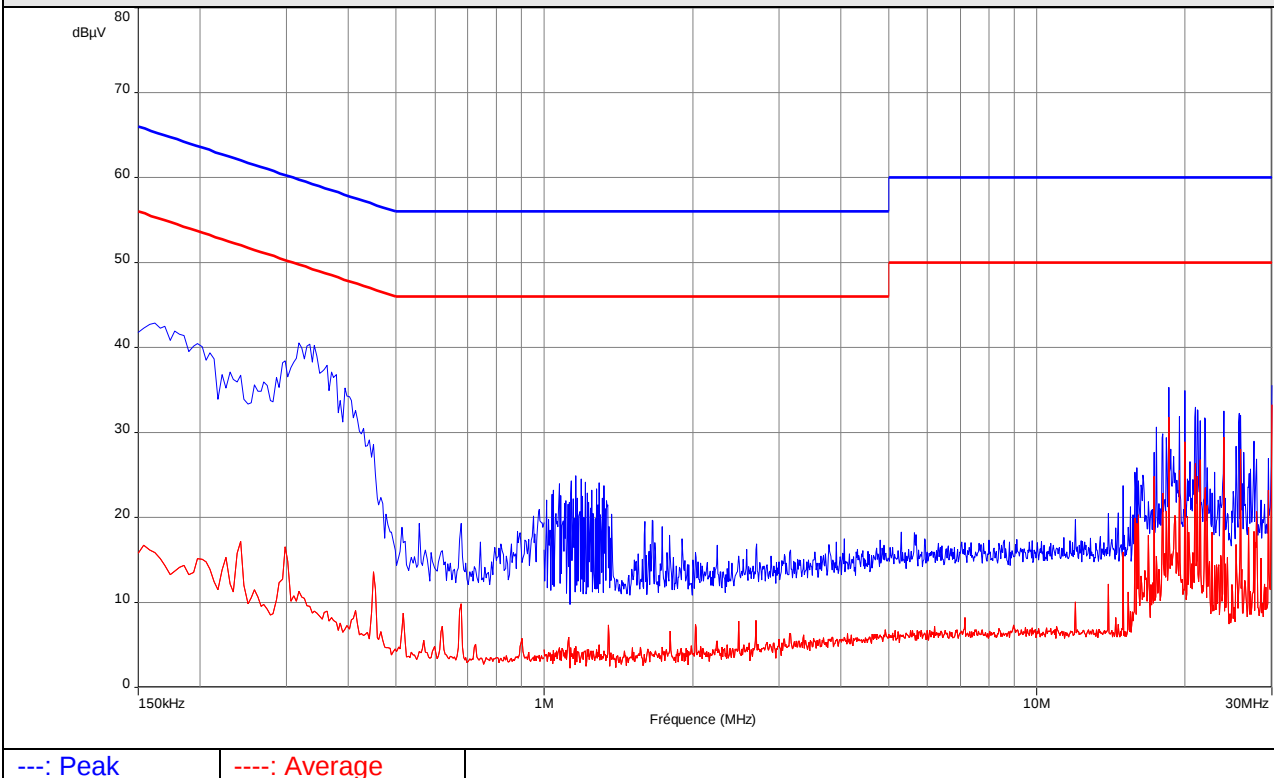
Graphical representation of Conducted Disturbance Measurement (Peak and Average detection) AC port, Line Neutral – Standby mode



Graphical representation of Conducted Disturbance Measurement (Peak and Average detection) AC port, Line L1 – 915MHz transmit mode



Graphical representation of Conducted Disturbance Measurement (Peak and Average detection) AC port, Line Neutral – 915MHz transmit mode



7. Field Strength of fundamental

TEST: Field strength of fundamental / FCC part 15.249 – RSS 210 §B.10			Verdict
<u>Method:</u> Measurements were made in a 3-meter Open Area Test Site (OATS) that complies to ANSI C63.4 and RSS-Gen. Measurements were performed with peak detector using a 100kHz RBW. The VBW is set to 300kHz. 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. The tested equipment is set to transmit operation with modulations on lowest, middle and highest channel. Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength.			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 15.249 (a) (c) / RSS-210 §B.10 (a)			
Frequency (MHz)	Limits (dBµV/m)		
	Level / Detector / Distance	Results	
902 to 928 MHz	94dBµV/m / Pk / 3m	Pass	
Supplementary information: Test location: SMEE – CE Mesures / Test date: August 8 th , 2016 Power supply voltage: 24V DC via external power source			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2015/8	2016/8
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 Field Strength of fundamental			
FREQ	Field Strength 3m	Limit	Result
(MHz)	(dBμV/m)	(dBμV/m)	
903,0	93,8	94,0	Pass
915,0	93,8	94,0	Pass
927,0	91,7	94,0	Pass
RBW:		100kHz	
Measurement distance:		3m	
Limit:		FCC Part 15.249 (a) (c) / RSS-210 §B.10	
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): Three axis measurement performed for equipment under test	

8. Field Strength of harmonics

TEST: Field Strength of harmonics / FCC part 15.249 – RSS-210 §B.10		Verdict
<u>Method:</u> Measurements were made in a 3-meter Open Area Test Site (OATS) that complies to ANSI C63.4 and RSS-Gen. 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. The tested equipment is set to transmit operation with modulations on lowest, middle and highest channel. Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength. 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.		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 – 9.3GHz	3 m measurement distance
Limits – FCC Part 15.249 (a) (c) (e) / RSS-210 §B.10 (a)		
Frequency bands for harmonics (MHz)	Limits (dBµV/m)	
	Level / Detector / Distance	Results
1804 to 1856	54.0 / AV / 3m 74.0 / PK / 3m	Pass
2706 to 2784	54.0 / AV / 3m 74.0 / PK / 3m	Pass
3608 to 3712	54.0 / AV / 3m 74.0 / PK / 3m	Pass
4510 to 4640	54.0 / AV / 3m 74.0 / PK / 3m	Pass
5412 to 5568	54.0 / AV / 3m 74.0 / PK / 3m	Pass
6314 to 6496	54.0 / AV / 3m 74.0 / PK / 3m	Pass
7216 to 7424	54.0 / AV / 3m 74.0 / PK / 3m	Pass
8118 to 8352	54.0 / AV / 3m 74.0 / PK / 3m	Pass
9020 to 9280	54.0 / AV / 3m 74.0 / PK / 3m	Pass
Supplementary information: Test location: SMEE – CE Mesures / Test date: August 9th, 2016 Power supply voltage: 24V DC via external power source		

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
Loop antenna	EMCO	6502	ANT-101-009	2015/3	2017/3
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	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	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

Tabulated Results for Field strength of harmonics (1GHz-9.3GHz)				
FREQ (MHz)	Field level dBμV/m	Detector	Limit (dBμV/m)	Result
1806,0	43,2	Pk	54 Av / 74 Pk	Pass
1830,0	43,2	Pk	54 Av / 74 Pk	Pass
1854,0	43,9	Pk	54 Av / 74 Pk	Pass
2709,0	47,3	Pk	54 Av / 74 Pk	Pass
2745,0	48,4	Pk	54 Av / 74 Pk	Pass
2780,0	47,6	Pk	54 Av / 74 Pk	Pass
3612,0	37,1	Pk	54 Av / 74 Pk	Pass
3660,0	37,3	Pk	54 Av / 74 Pk	Pass
3708,0	40,7	Pk	54 Av / 74 Pk	Pass
4515,0	45,7	Pk	54 Av / 74 Pk	Pass
4575,0	46,6	Pk	54 Av / 74 Pk	Pass
4635,0	46,2	Pk	54 Av / 74 Pk	Pass
5418,0	40,8	Pk	54 Av / 74 Pk	Pass
5490,0	41,4	Pk	54 Av / 74 Pk	Pass
5562,0	41,1	Pk	54 Av / 74 Pk	Pass
6321,0	43,5	Pk	54 Av / 74 Pk	Pass
6405,0	43,6	Pk	54 Av / 74 Pk	Pass
6489,0	45,8	Pk	54 Av / 74 Pk	Pass
7224,0	48,9	Pk	54 Av / 74 Pk	Pass
7320,0	49,2	Pk	54 Av / 74 Pk	Pass
7416,0	49,4	Pk	54 Av / 74 Pk	Pass
8127,0	48,7	Pk	54 Av / 74 Pk	Pass
8235,0	48,8	Pk	54 Av / 74 Pk	Pass
8343,0	49,0	Pk	54 Av / 74 Pk	Pass
9030,0	47,7	Pk	54 Av / 74 Pk	Pass
9150,0	48,2	Pk	54 Av / 74 Pk	Pass
9270,0	48,3	Pk	54 Av / 74 Pk	Pass
RBW / VBW		1MHz / 3MHz (Peak) 1MHz / 10Hz (AV)		
Measurement distance:		3m		
Limit:		FCC Part 15.249 (a) (c) (e) / RSS-210 §B.10 (a)		
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): Test performed on OATS at 3m distance (3): For peak measurement below average limit, no test performed with average detector. (4): Three axis measurement performed for equipment under test		

9. Unwanted emissions

TEST: Unwanted emissions outside fundamental and harmonics bands / FCC part 15.209, 15.249 - RSS-210 §B.10 / RSS-Gen §8.9		Verdict
<u>Method:</u> 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.		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
	9kHz – 30MHz	10 m measurement distance
	30MHz – 9.3GHz	3 m measurement distance
Limits – FCC Part 15.209, 15.249 (d) (e) / RSS-Gen §8.9, RSS-210 §B.10 (b)		
Whichever is less stringent, either:		
Frequency (MHz)	Limits (dBµV/m)	
	Level / Detector / Distance	Results
30 to 1000	50dB below the fundamental / QP / 3m	Not used
Above 1GHz	50dB below the fundamental / Av / 3m 30dB below the fundamental / Pk / 3m	Not used
Or		
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 – CE Mesures / Test date: August 9th, 2016 Power supply voltage: 24V DC via external power source		

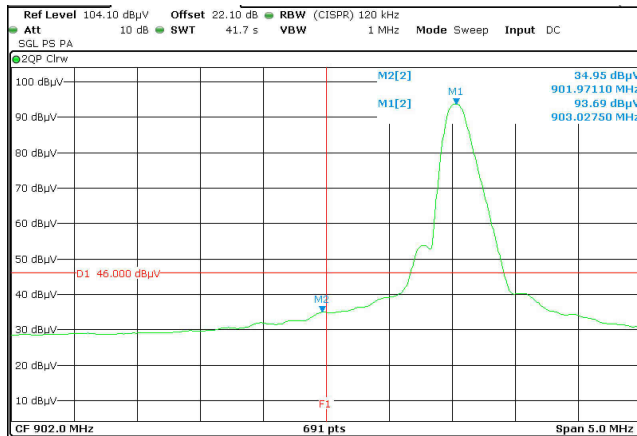
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2015/8	2016/8
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2015/8	2016/8
Loop antenna	EMCO	6502	ANT-101-009	2015/3	2017/3
BiConiLog antenna	EMCO	3142B	ANT-101-010	2015/8	2016/8
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
RF cable	Div	OATS/25m	CAB-101-019	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	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

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 15.209 – 15.249 / RSS-Gen §8.9 – RSS-210 §B.10 (b)				
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	Total factor	Field level	Limit	Margin
MHz	(QP) dBμV	dB	(QP) dBμV/m	(QP) dBμV/m	dB
902.0	12,9	22,1	35,0	46,0	-11,0
928.0	12,0	21,0	33,0	46,0	-13,0
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 15.209 – 15.249 / RSS-Gen §8.9 – RSS-210 §B.10 (b)			
Final measurement detector:		Quasi-Peak			
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): Limits used are FCC part 15.209 / RSS-Gen: Less stringent than fundamental field strength minus 50dB 15.249 limits → 43.8dBμV/m Pk @ 3m (= 93.8dBμV/m - 50dB) (3): Three axis measurement performed for equipment under test			

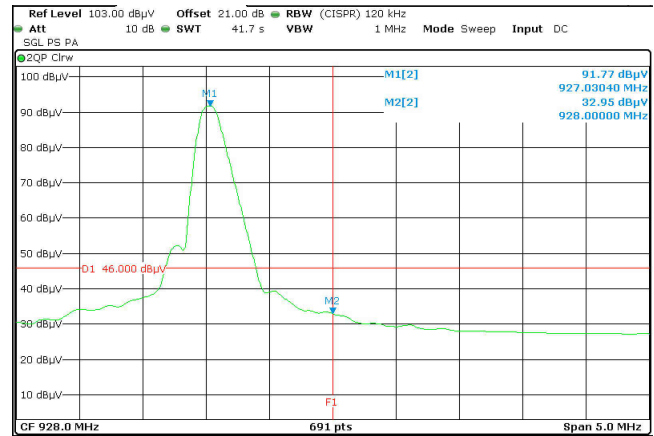
Tabulated Results for Unwanted emissions (1GHz-9.3GHz)				
FREQ (MHz)	Field level dBμV/m	Detector	Limit (dBμV/m)	Result
Margin > 10dB				
RBW / VBW	1MHz / 3MHz (Peak) 1MHz / 10Hz (AV)			
Measurement distance:	3m			
Limit:	FCC Part 15.209 – 15.249 / RSS-Gen §8.9 – RSS-210 §B.10 (b)			
Final measurement 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): Limits used are FCC part 15.209 / RSS-Gen: Less stringent than fundamental field strength minus 50dB 15.249 limits → 43.8dBμV/m Pk @ 3m (= 93.8dBμV/m - 50dB) (3): Three axis measurement performed for equipment under test			

Graphical representation of Band-edge compliance (Radiated)



Low band-edge compliance

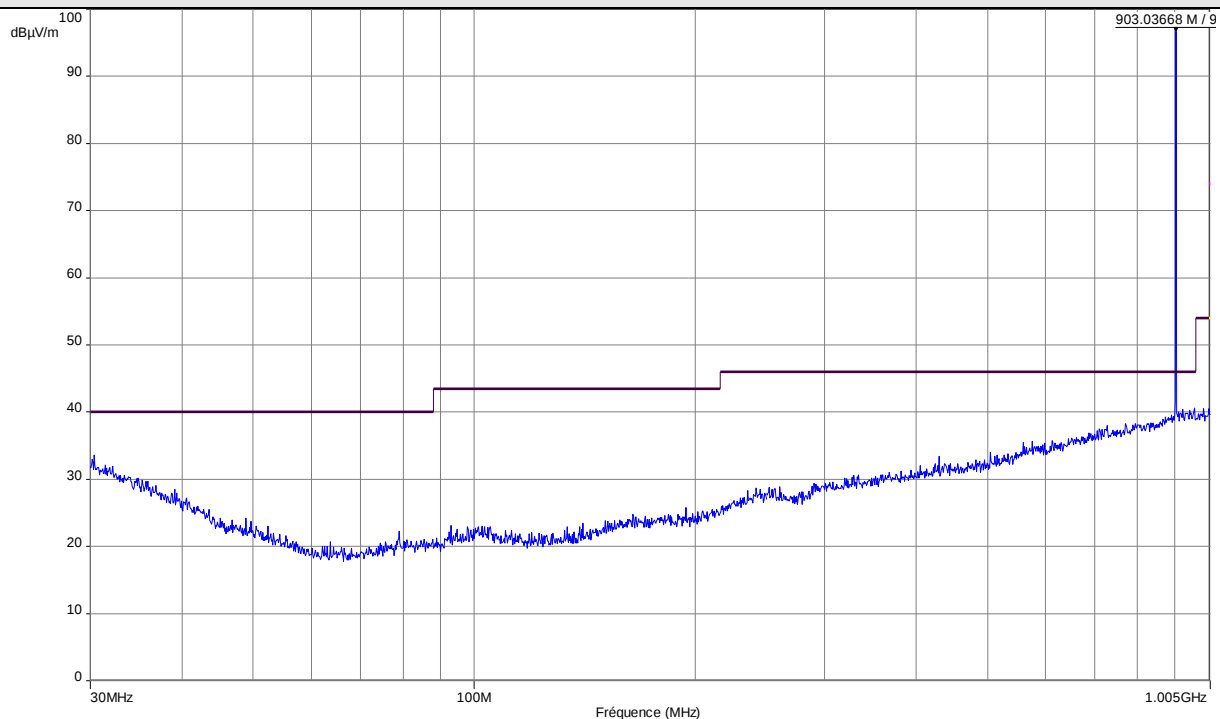
F1 = 902MHz
 Quasi-Peak level below 902MHz is 35,0dBμV/m max at 3m
 (limit is 46dBμV/m @ 3m)
 RESULT: PASS
 Note: Radiated measurement



High band-edge compliance

F1 = 928MHz
 Quasi-Peak level below 928MHz is 33,0dBμV/m max at 3m
 (limit is 46dBμV/m @ 3m)
 RESULT: PASS
 Note: Radiated measurement

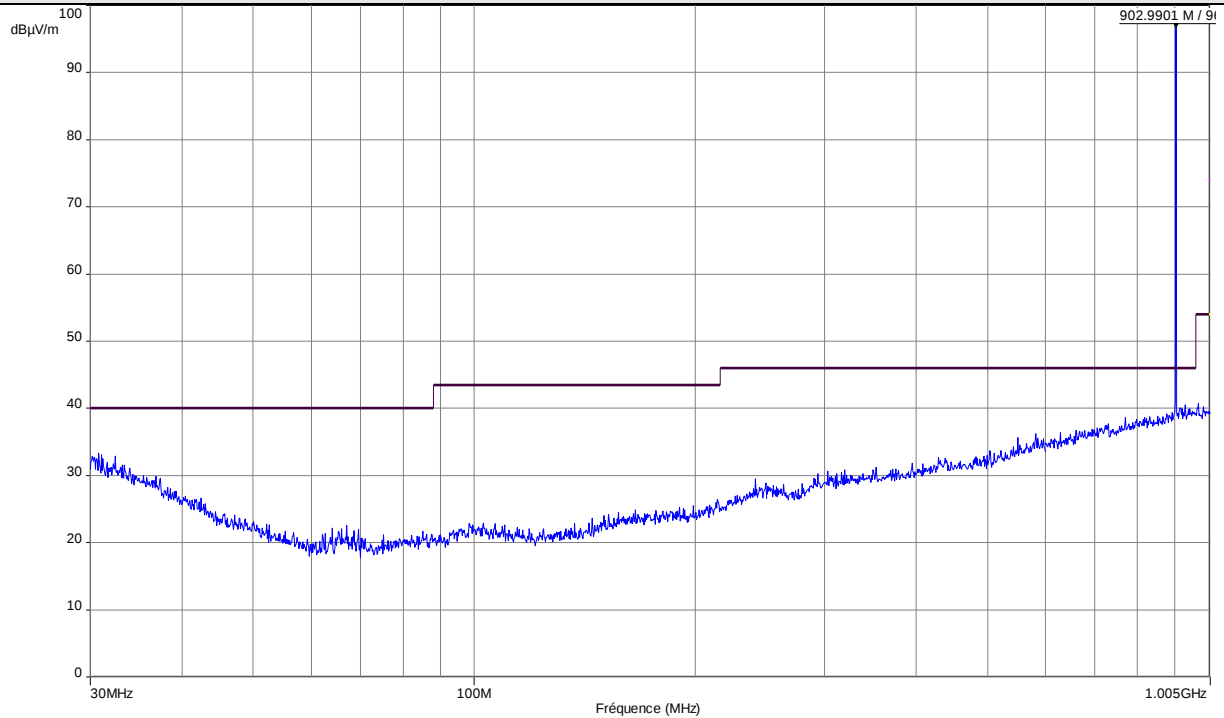
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Transmit mode at 903MHz)



Note: Pre-scan graph only for identification purpose.

Frequency band investigated:	30MHz-1GHz
Unit :	dBμV/m
RBW :	100kHz
Antenna polarization :	Horizontal
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

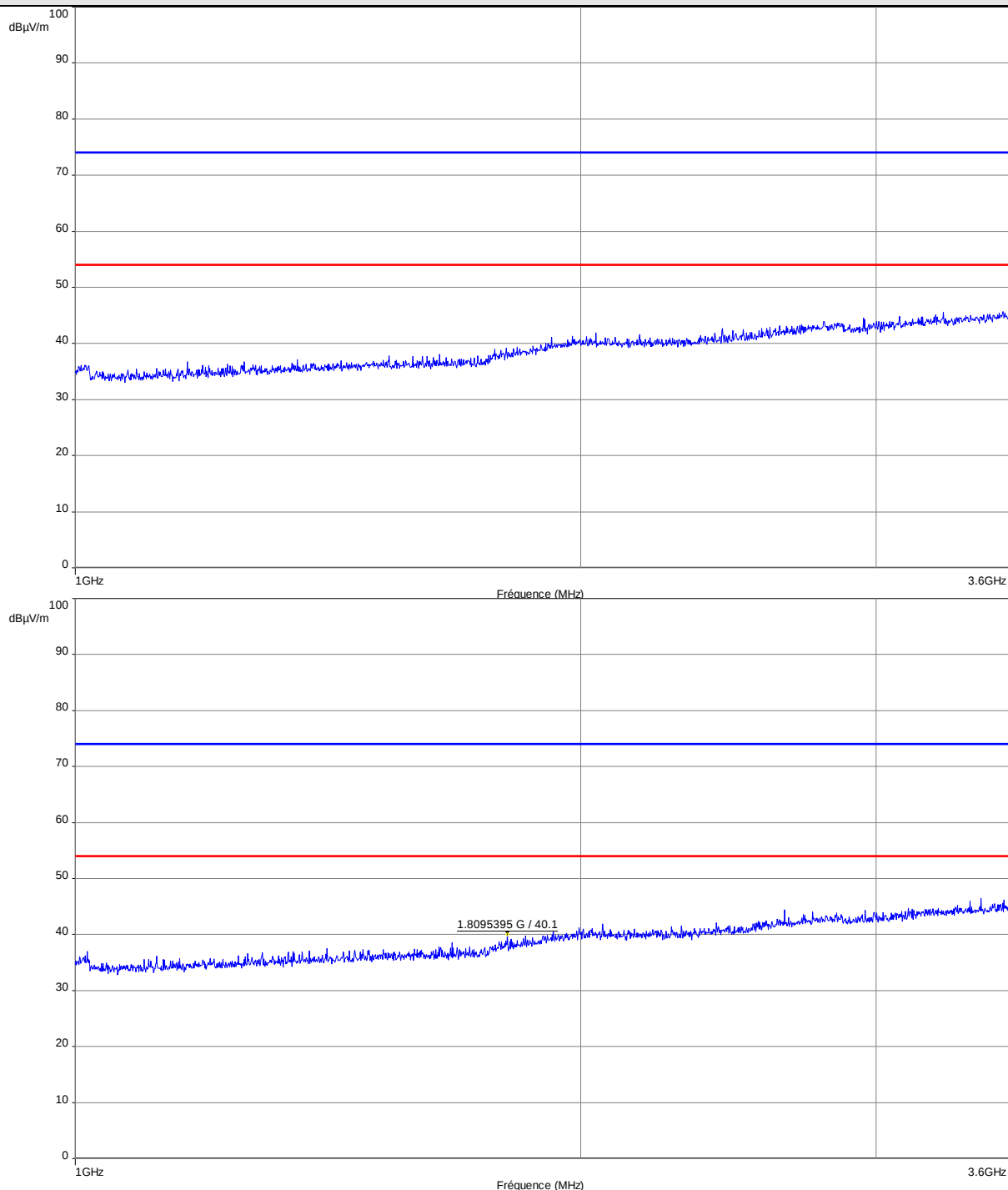
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Transmit mode at 903MHz)



Note: Pre-scan graph only for identification purpose.

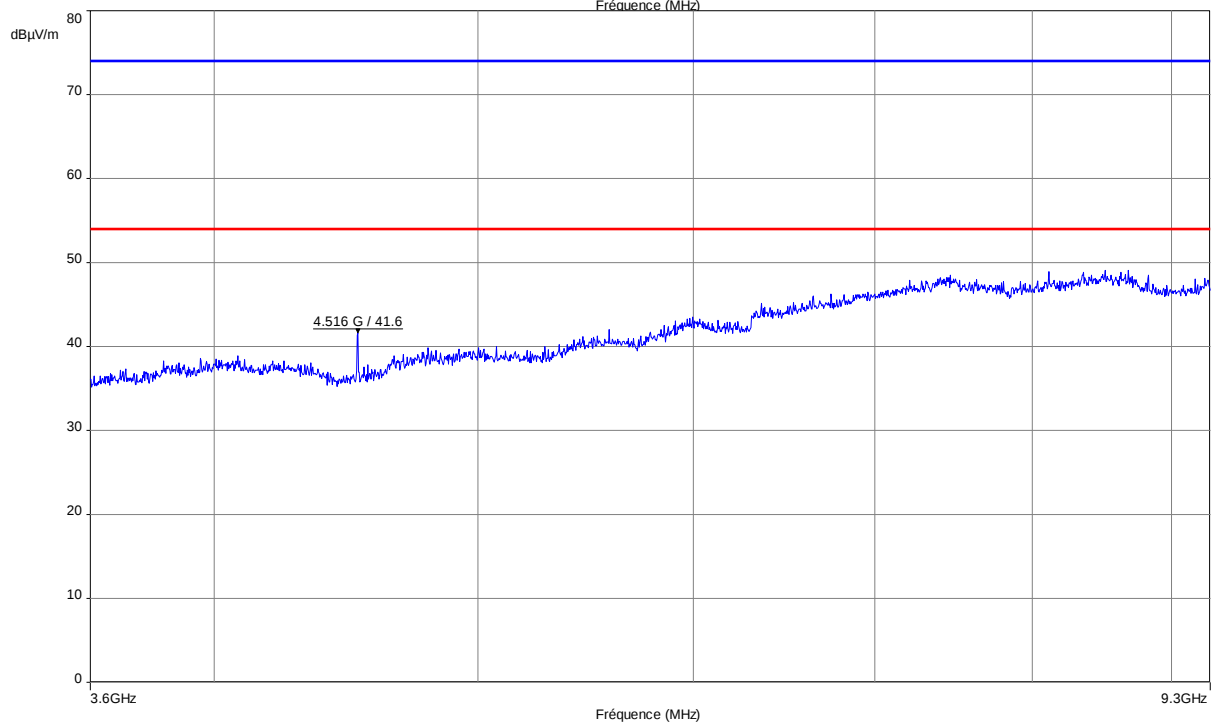
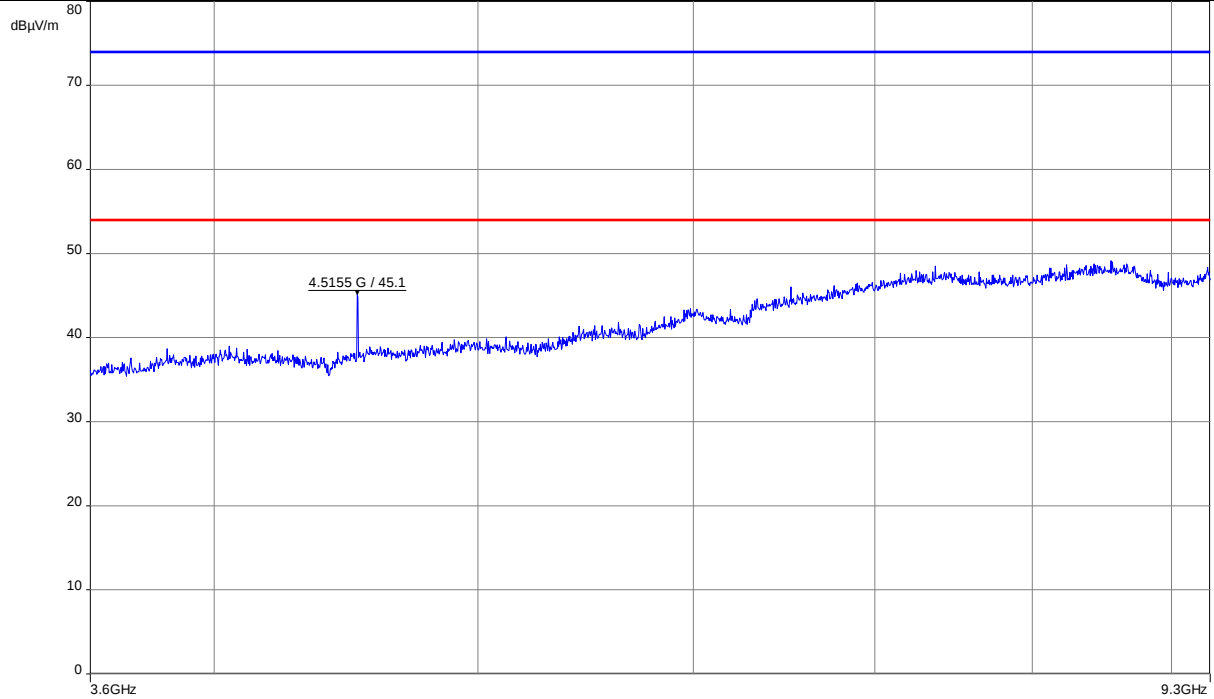
Frequency band investigated:	30MHz-1GHz
Unit :	dBμV/m
RBW :	100kHz
Antenna polarization :	Vertical
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Horizontal & Vertical / Transmit mode at 903MHz)



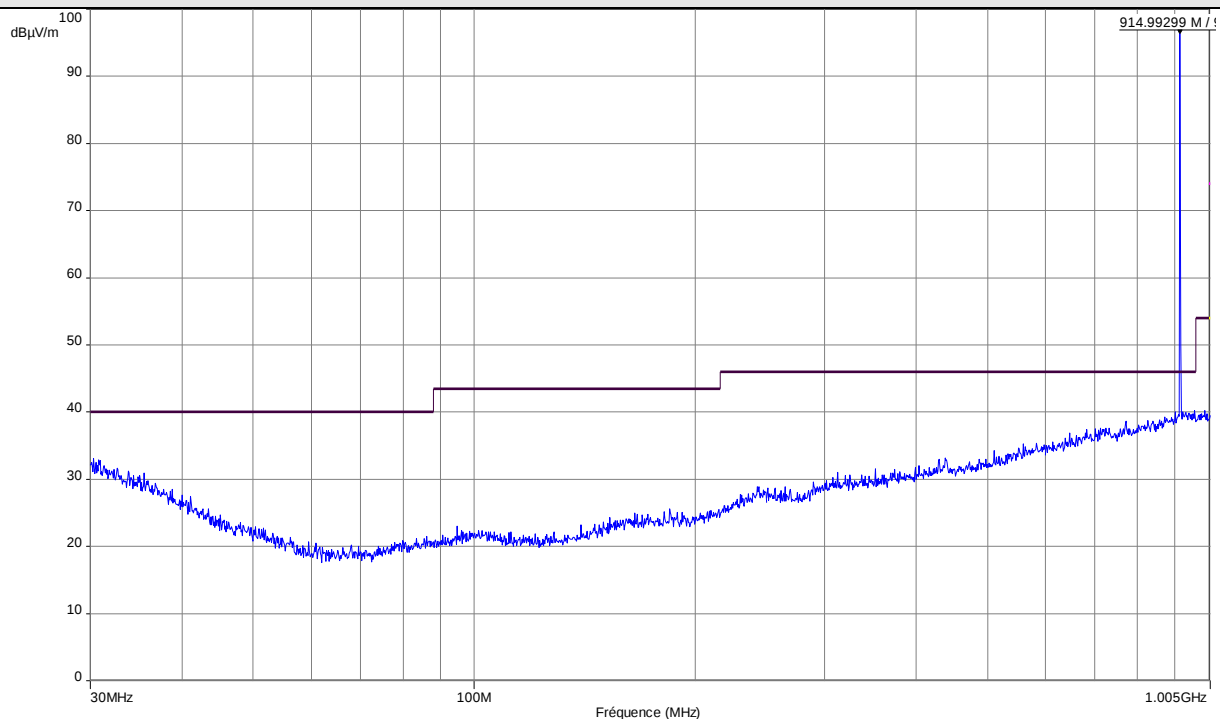
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-9.3GHz / 3m / Horizontal & Vertical / Transmit mode at 903MHz)



Frequency band investigated:	3.6GHz-9.3GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

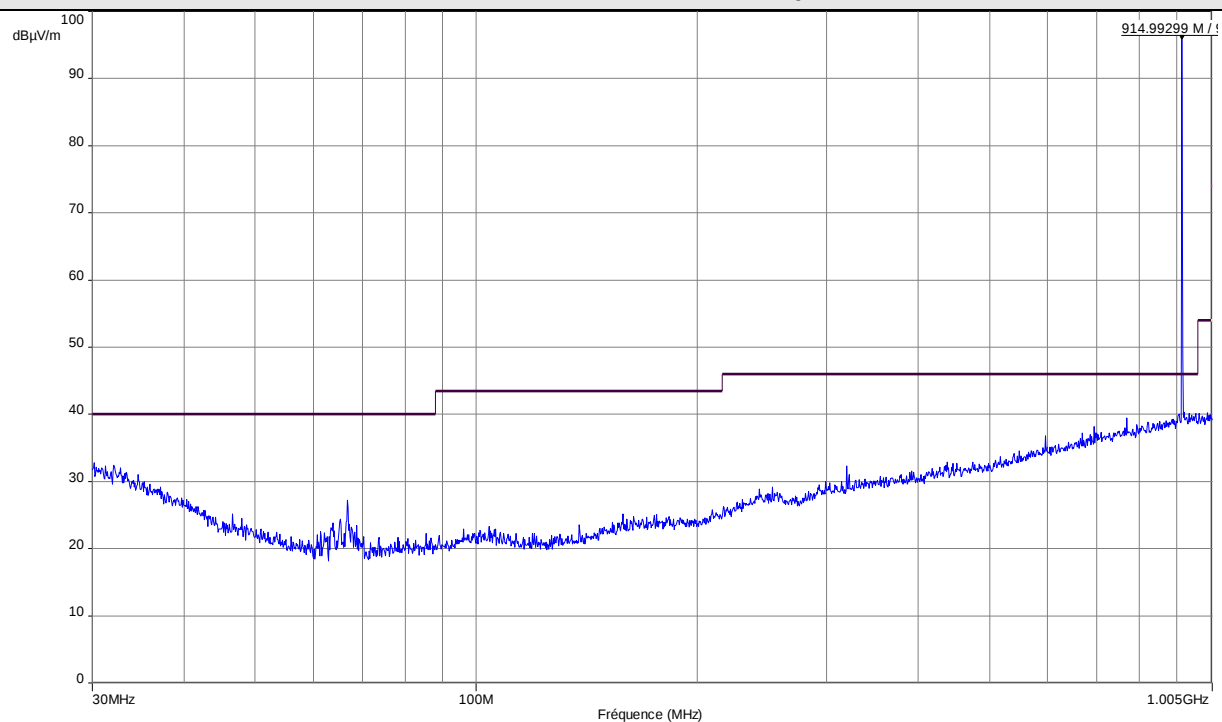
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Transmit mode at 915MHz)



Note: Pre-scan graph only for identification purpose.

Frequency band investigated:	30MHz-1GHz
Unit :	dBμV/m
RBW :	100kHz
Antenna polarization :	Horizontal
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

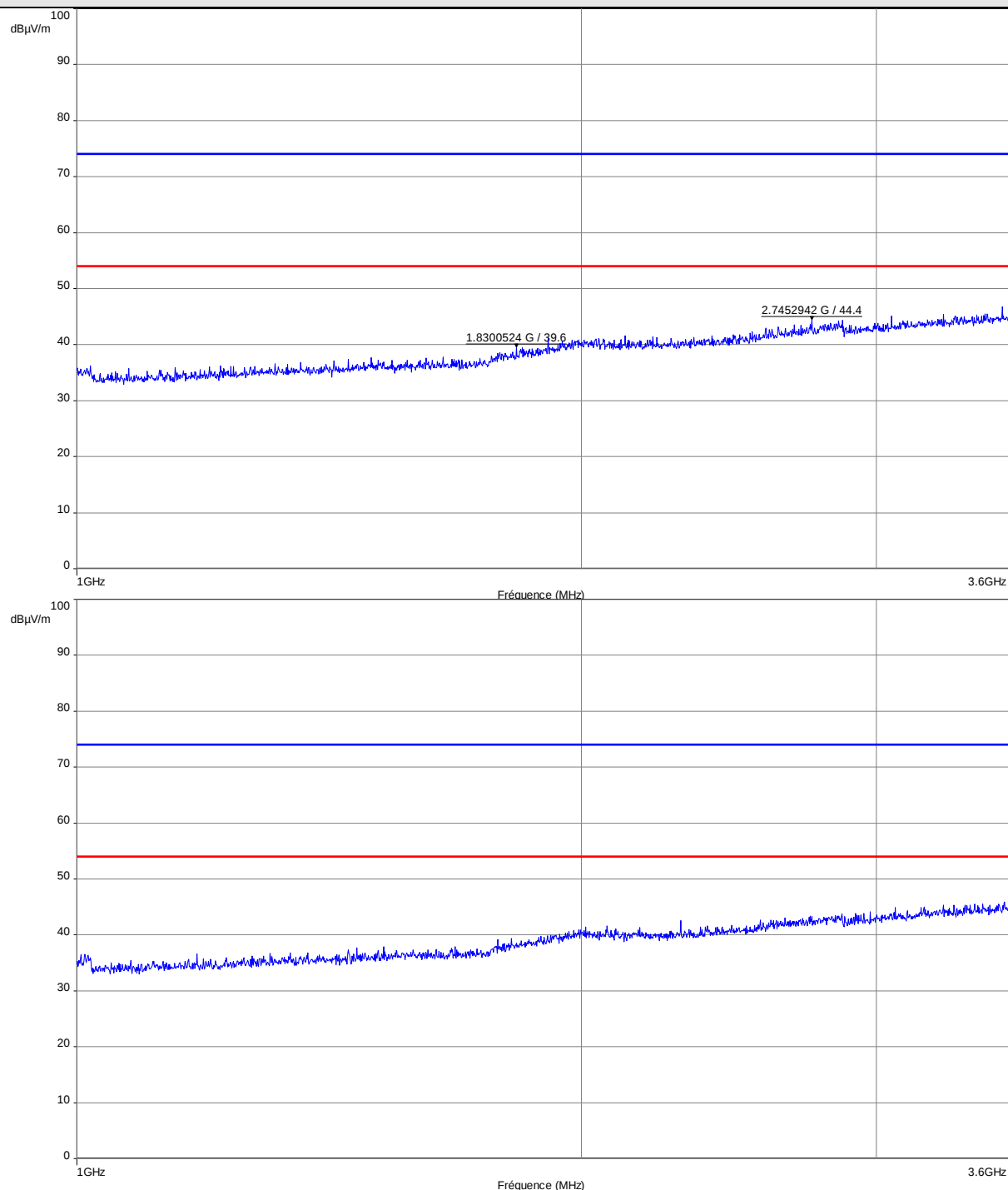
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Transmit mode at 915MHz)



Note: Pre-scan graph only for identification purpose.

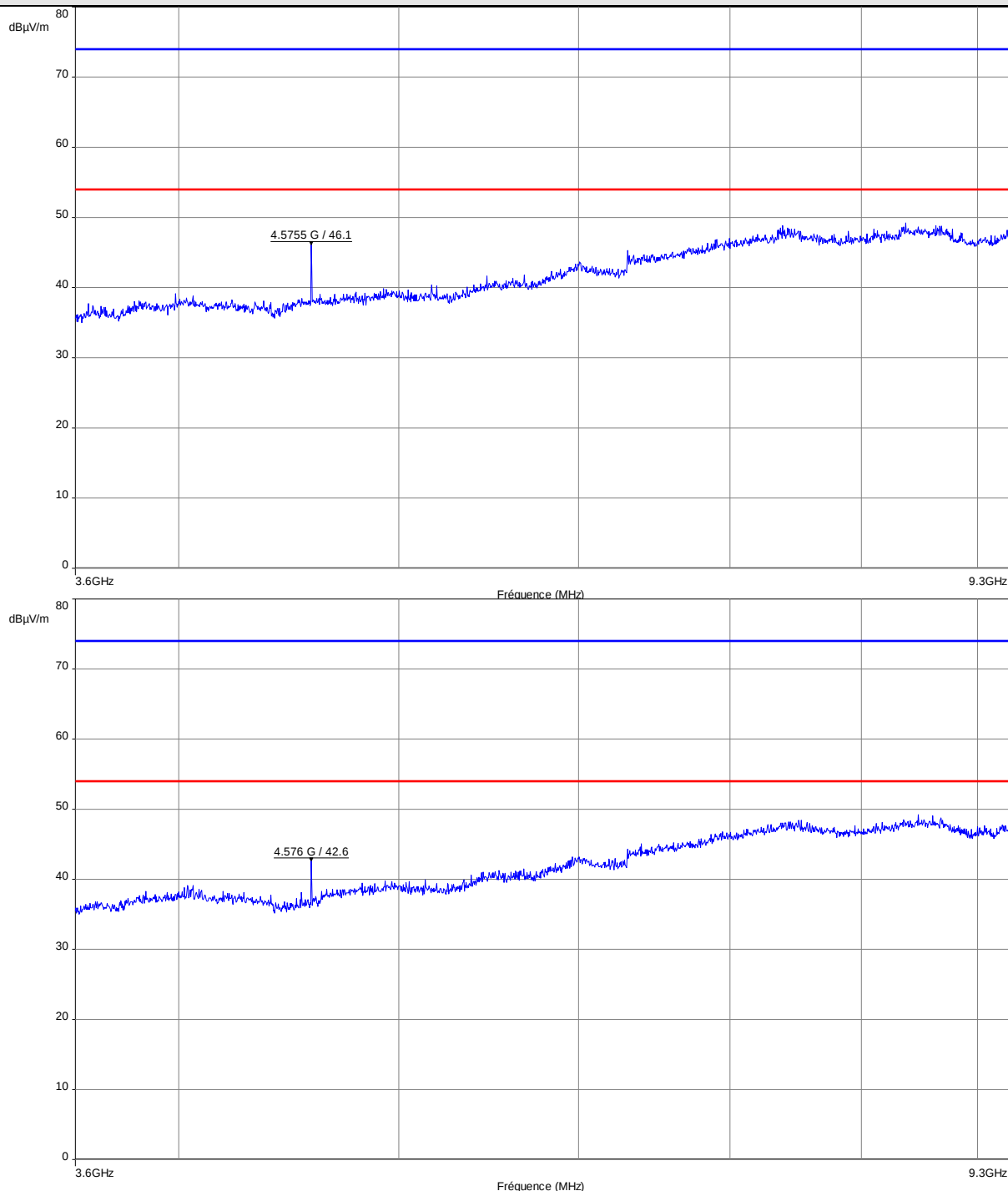
Frequency band investigated:	30MHz-1GHz
Unit :	dBμV/m
RBW :	100kHz
Antenna polarization :	Vertical
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Horizontal & Vertical / Transmit mode at 915Hz)



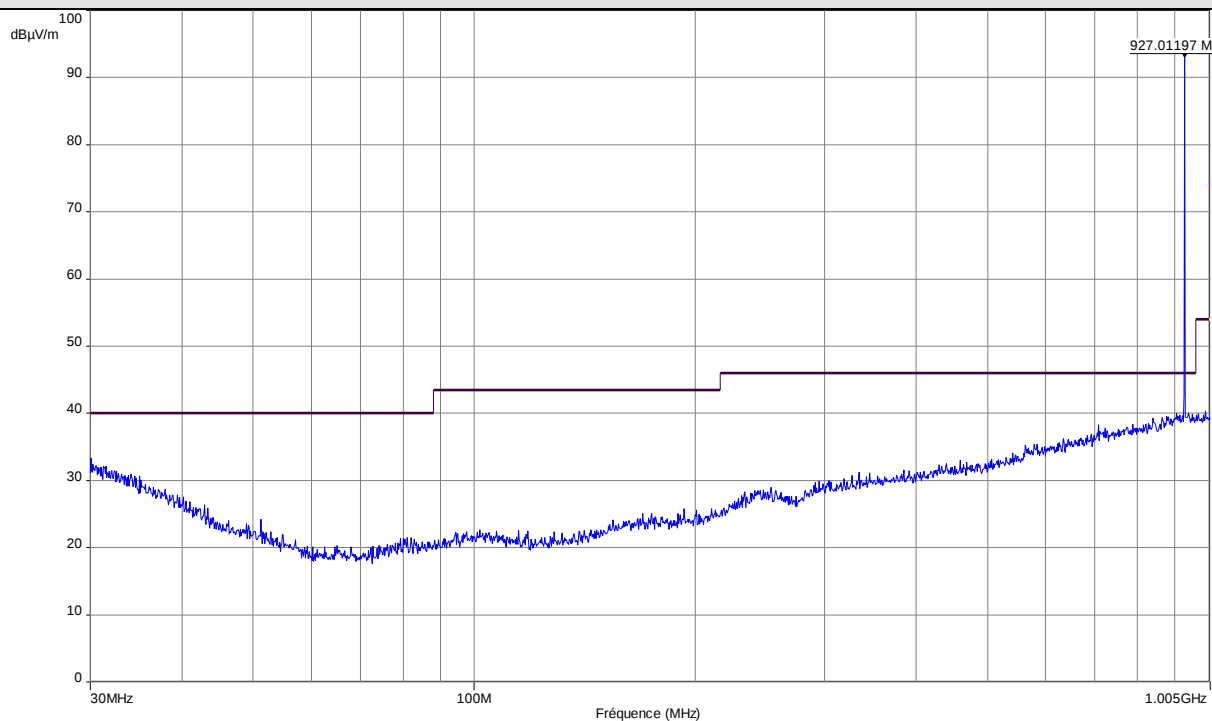
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-9.3GHz / 3m / Horizontal & Vertical / Transmit mode at 915MHz)



Frequency band investigated:	3.6GHz-9.3GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

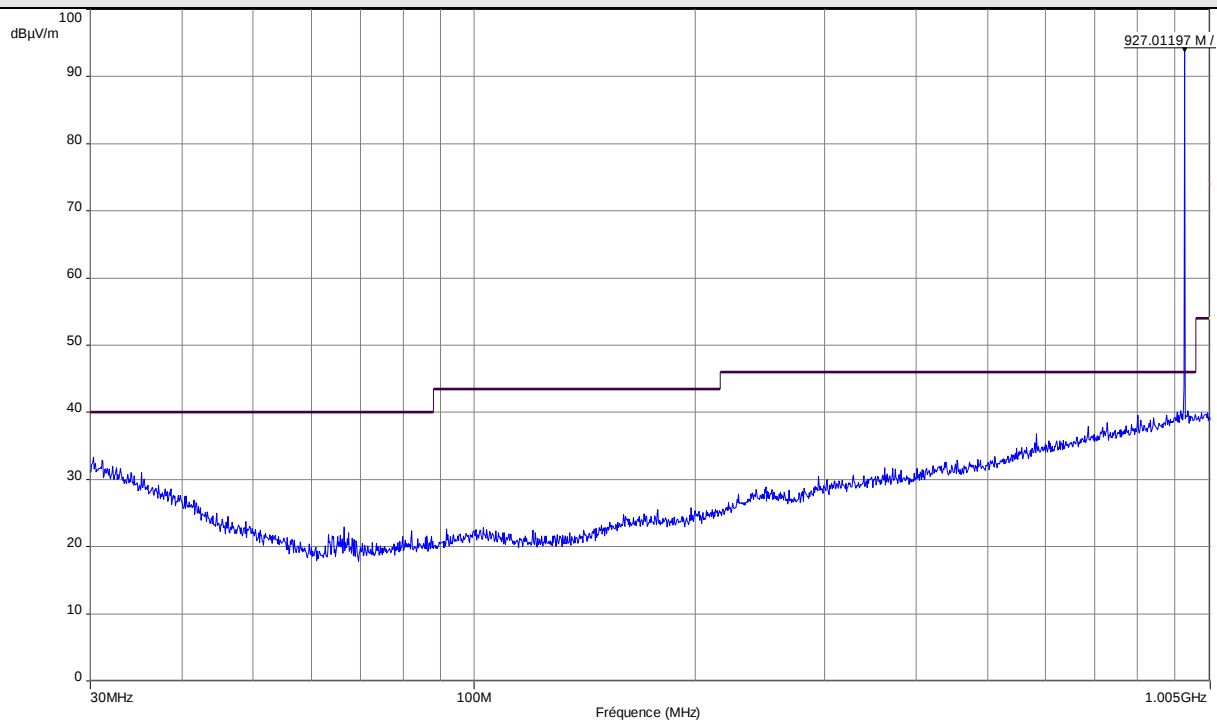
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Transmit mode at 927MHz)



Note: Pre-scan graph only for identification purpose.

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Horizontal
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

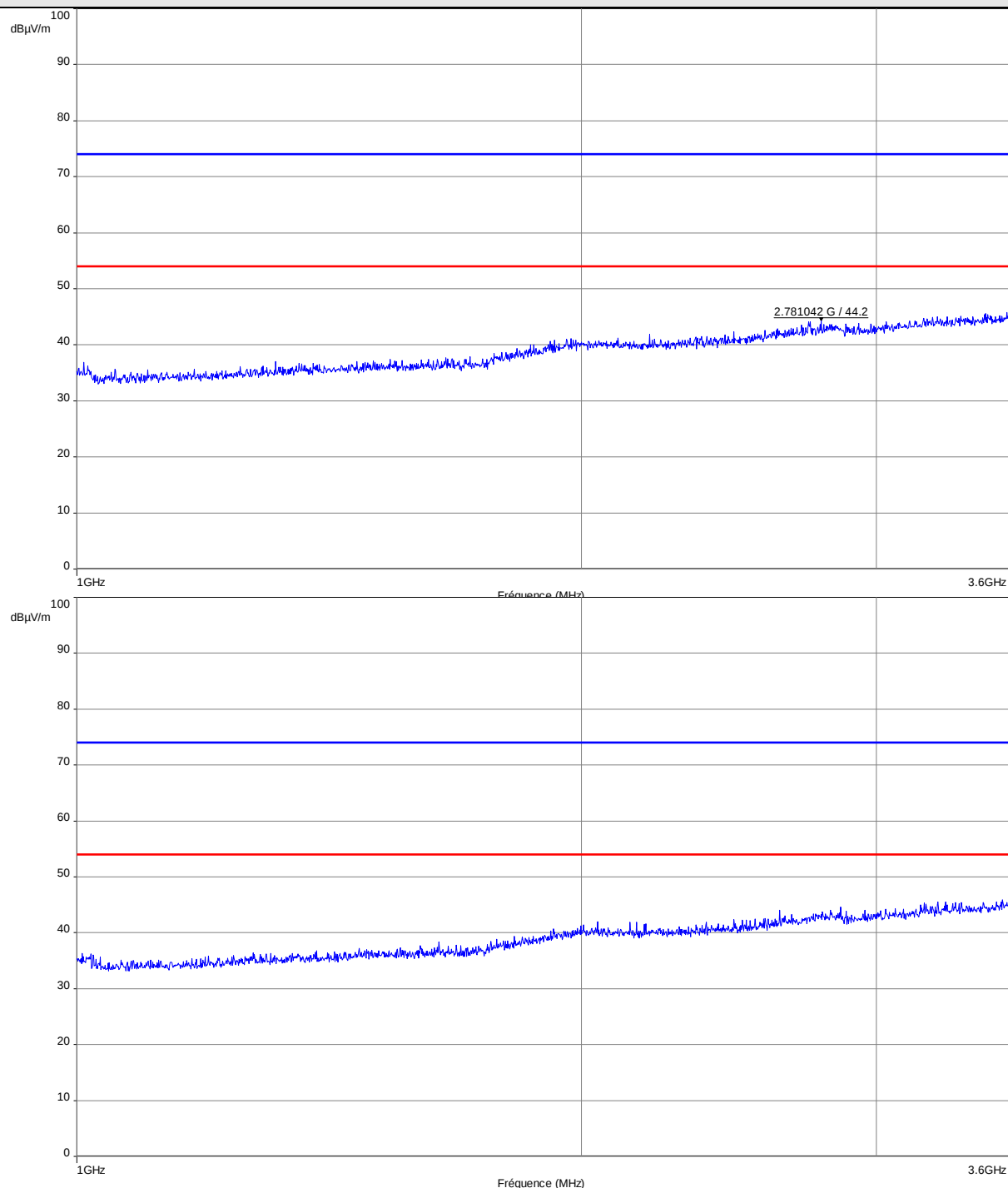
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Transmit mode at 927MHz)



Note: Pre-scan graph only for identification purpose.

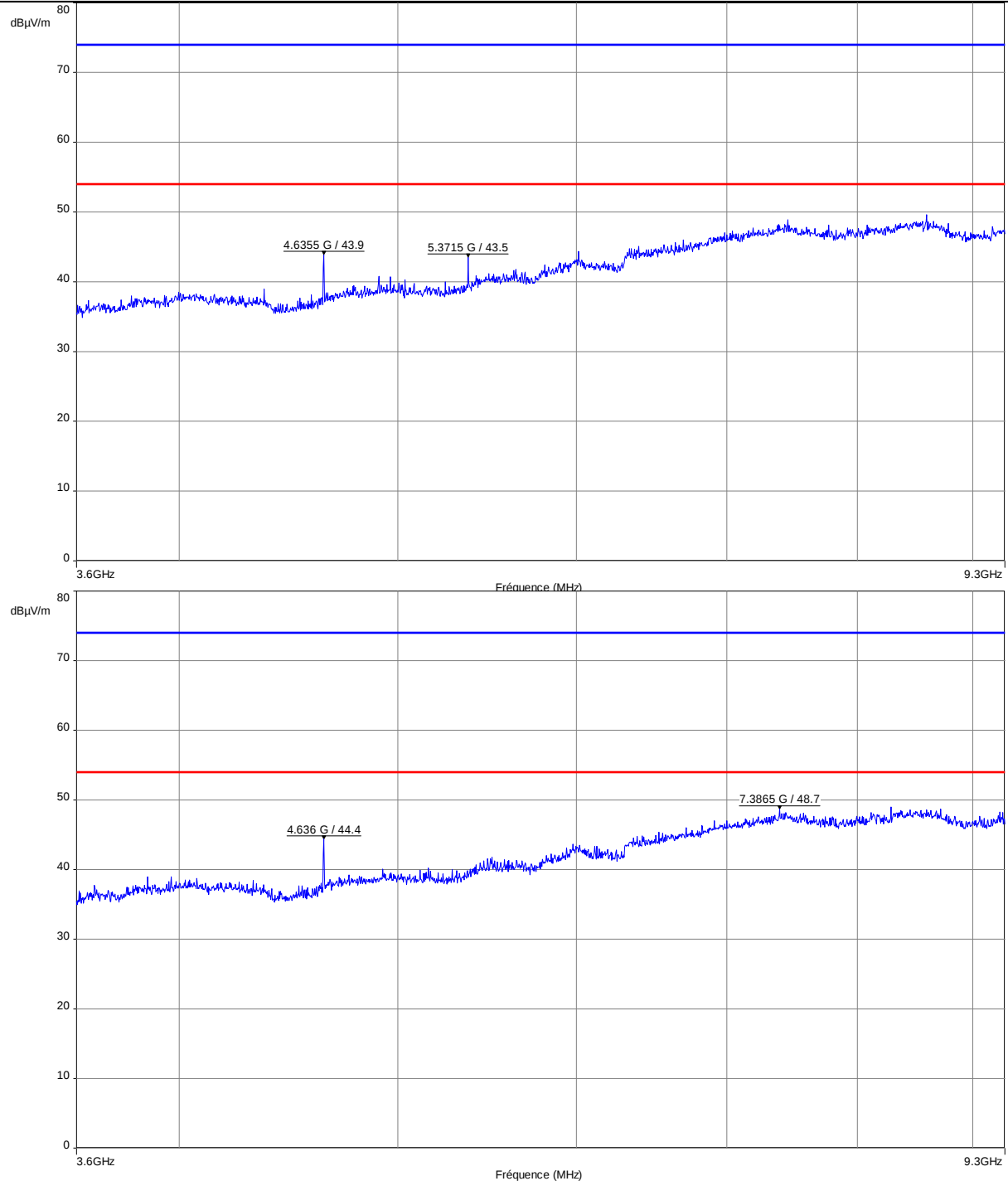
Frequency band investigated:	30MHz-1GHz
Unit :	dBμV/m
RBW :	100kHz
Antenna polarization :	Vertical
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-3.6GHz / 3m / Horizontal & Vertical / Transmit mode at 927Hz)



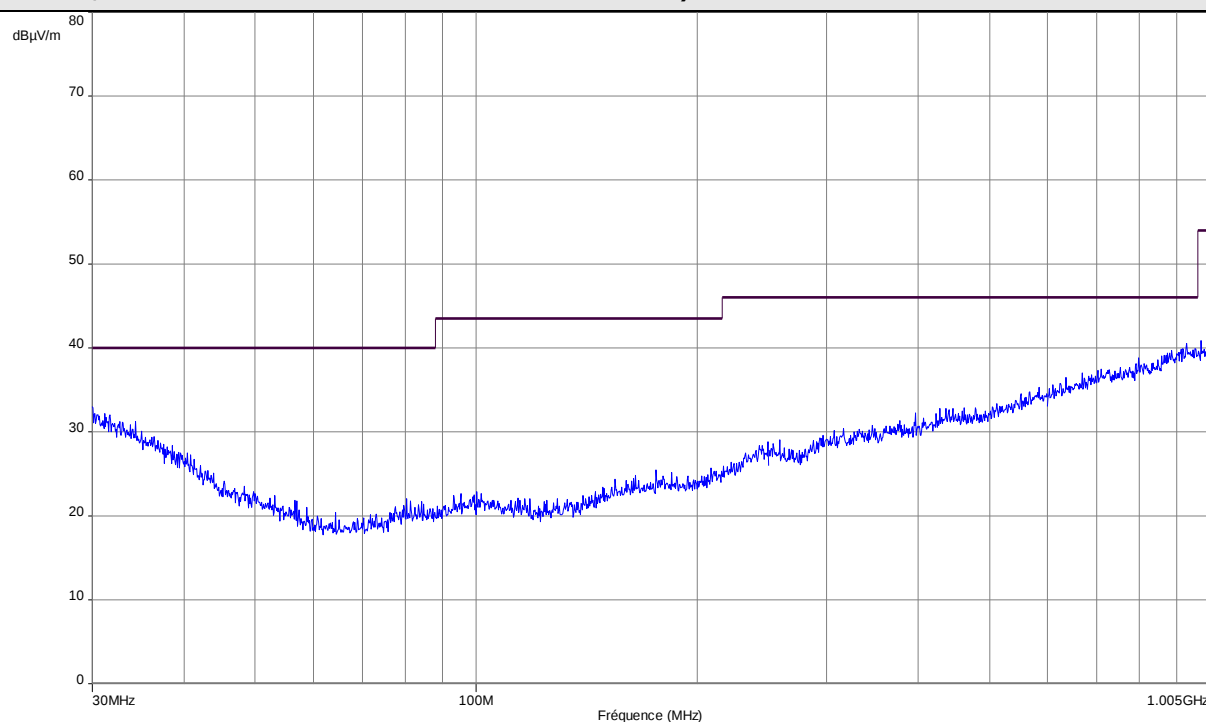
Frequency band investigated:	1GHz-3.6GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-9.3GHz / 3m / Horizontal & Vertical / Transmit mode at 927MHz)



Frequency band investigated:	3.6GHz-9.3GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

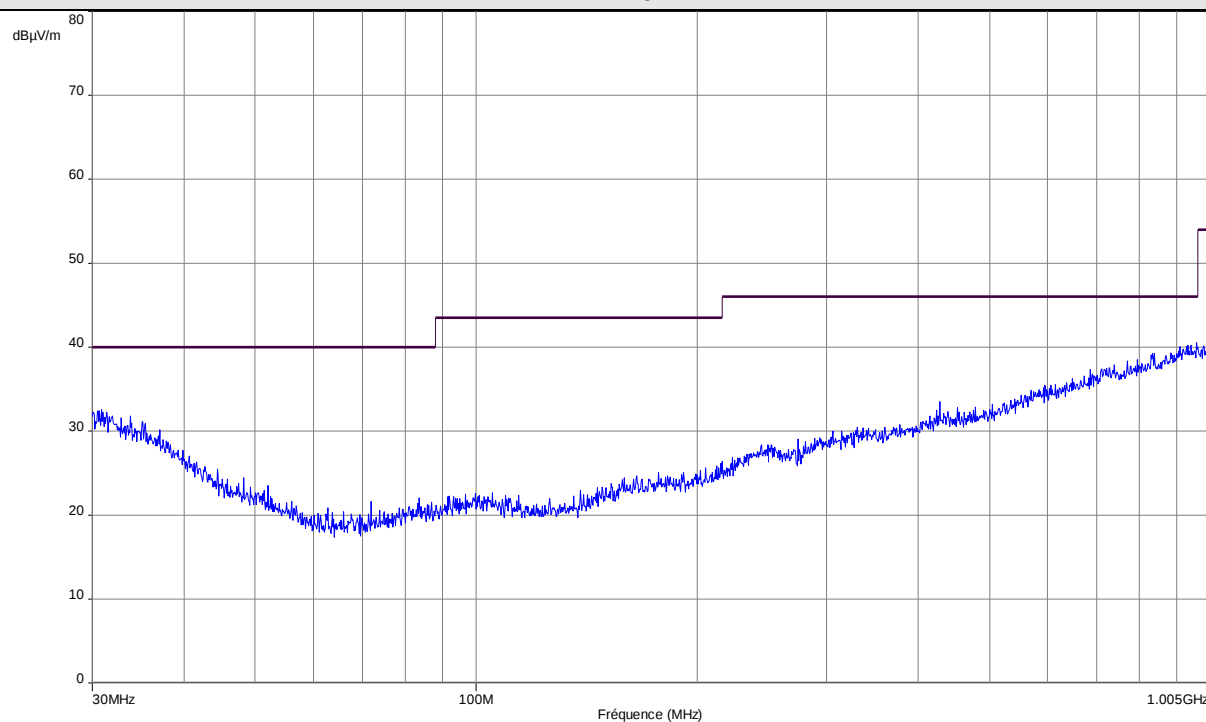
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal / Receive Mode)



Note: Pre-scan graph only for identification purpose.

Frequency band investigated:	30MHz-1GHz
Unit :	dBμV/m
RBW :	100kHz
Antenna polarization :	Horizontal
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

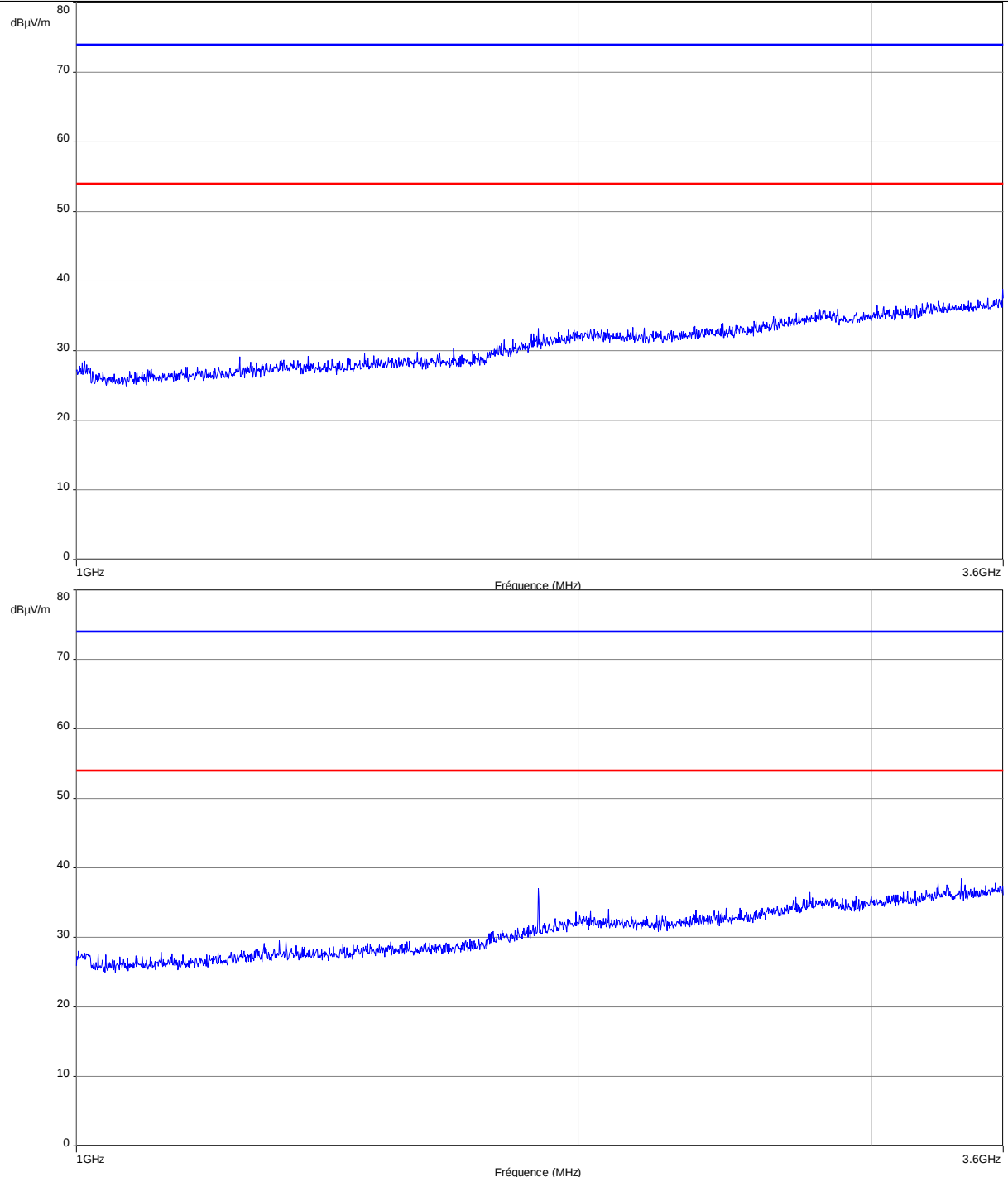
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Vertical / Receive Mode)



Note: Pre-scan graph only for identification purpose.

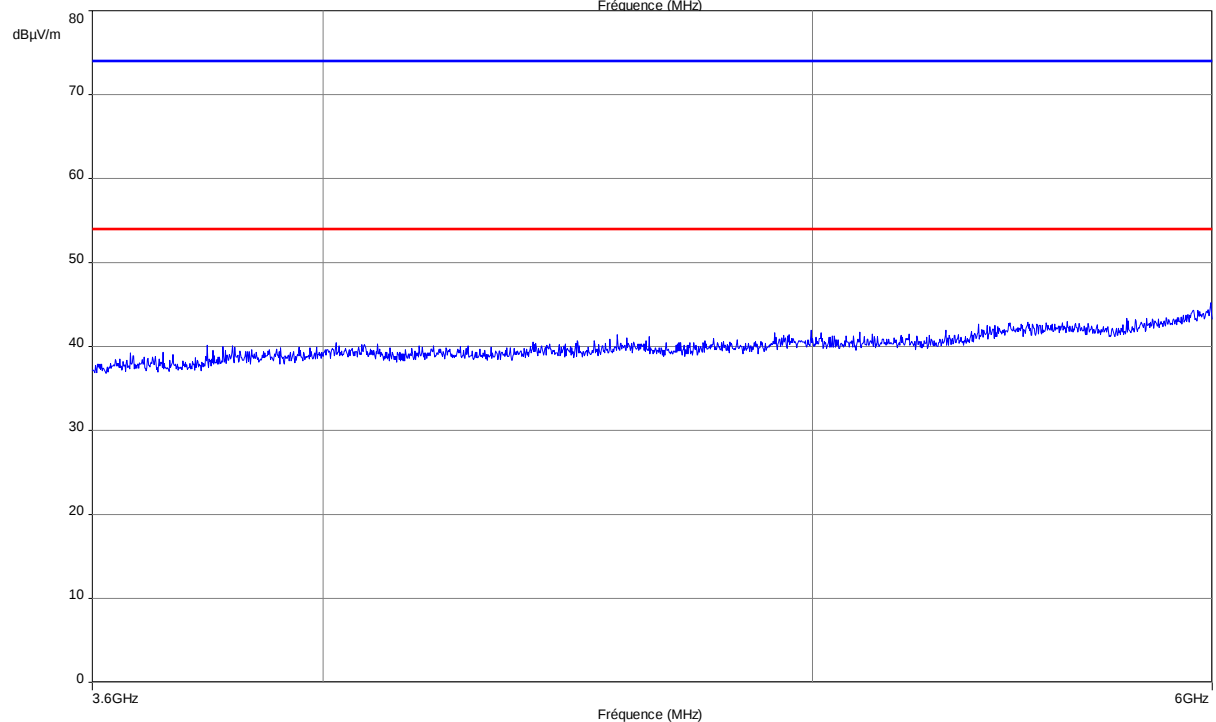
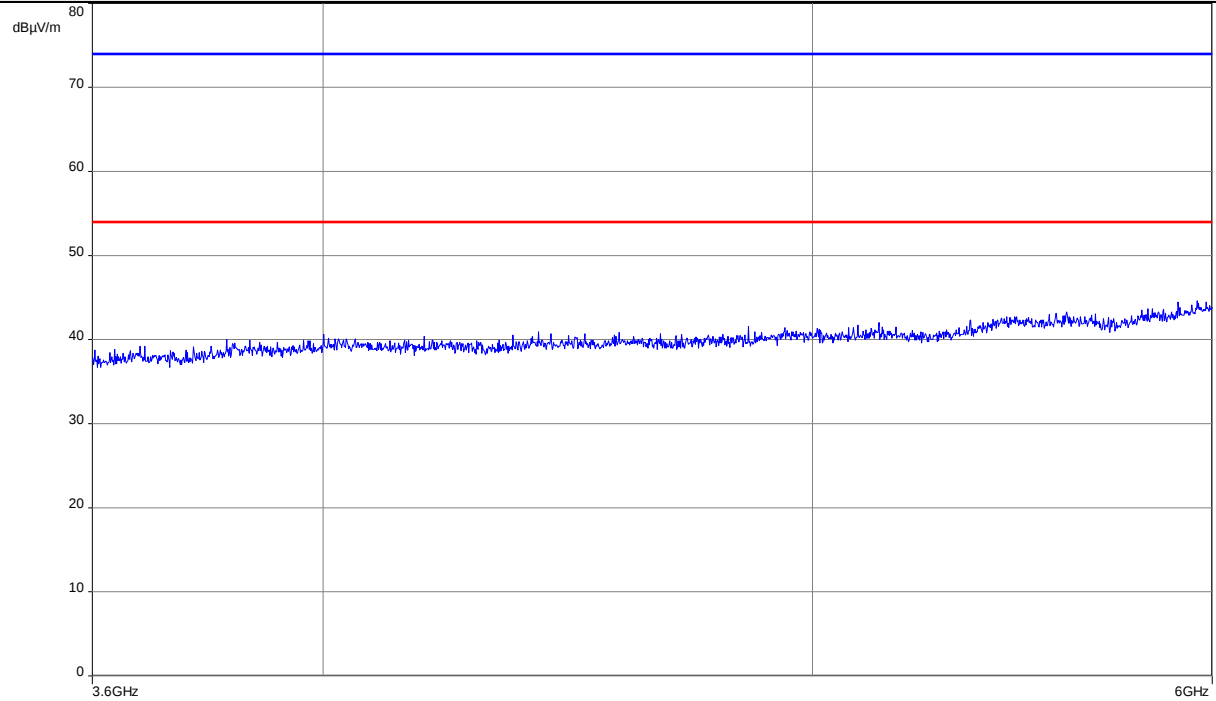
Frequency band investigated:	30MHz-1GHz
Unit :	dBμV/m
RBW :	100kHz
Antenna polarization :	Vertical
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

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:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 3.6GHz-6GHz / 3m / Horizontal & Vertical / Receive Mode)



Frequency band investigated:	3.6GHz-6GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	24V DC
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)

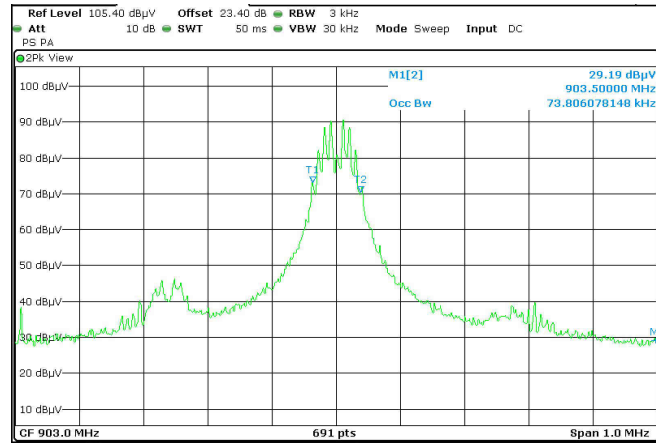
10. 99% Occupied Bandwidth

TEST: 99% Occupied Bandwidth / RSS-Gen			Verdict
<u>Method:</u> The setup is in an anechoic chamber. The spectrum analyzer is connected to the measuring antenna. 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 modulations on lowest, middle and highest channel.			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%	
RSS-Gen Issue 4 (§6.6)			
Frequency (MHz)	Level for Bandwidth	Limit	
903.0	99% occupied bandwidth	No restriction	
915.0			
927.0			
Supplementary information: Test location: SMEE – CE Mesures / Test date: August 9 th , 2016 Power supply voltage: 24V DC			

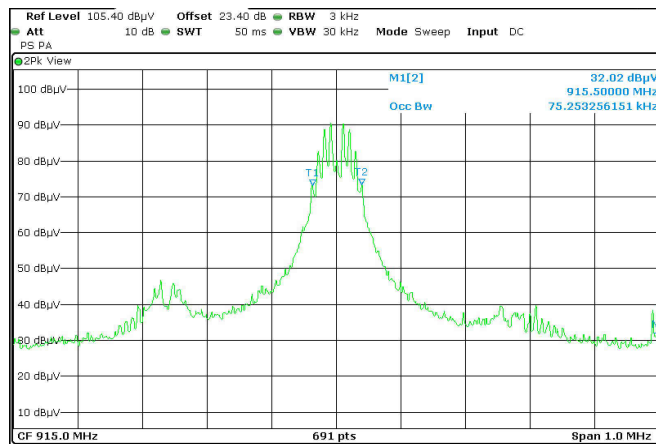
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2016/3	2017/3
RF cable	Pasternack	PE302-120	CAB-131-024	2016/3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

Tabulated Results for Occupied Bandwidth	
Frequency (MHz)	99% Bandwidth (kHz)
903.0	73.806 kHz
915.0	75.253 kHz
927.0	75.253 kHz

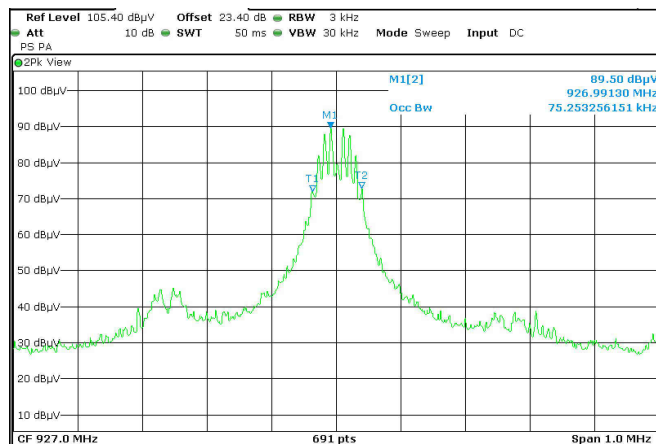
Graphical representation of 99% Occupied Bandwidth



Low channel



Mid channel



High channel

Frequency band investigated:	902MHz to 928MHz
RBW :	3kHz
Measurement detector:	Peak