

FCC Test Firm Designation Number: FR0014  
Industry Canada Test Firm Number: Site# 9545A-1 / 9545A-2

Matériel testé : <i>Equipment under test:</i>	<b>SEVENHUGS / Room Sensor RS1A</b> <i>(Trademark / Marketing name or product reference)</i>
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Client / Demandeur: **Sevenhugs**  
*Customer / Applicant :* Stephane Jaubertou  
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75014 Paris - France

Fabricant : **Sevenhugs**  
*Manufacturer:* 29 bd Romain Rolland  
75014 Paris - France

Numéro d'affaire : 12114  
*Work number :*

Référence de la proposition : 032017-22416  
*Proposal number:*

Date de l'essai : Du 4 au 8 juin 2018  
*Date of test:* June 4th to 8th, 2018

Objectif des essais : EMC qualification accordingly to following standards:  
*Test purpose:* - CFR 47, FCC Part 15, Subpart F (15.517, Technical requirements for indoor UWB systems)  
- RSS-220, Issue 1 (5.2, UWB Indoor Communication Devices)

Lieu du test: SMEE, Rue de Taille  
*Test location:* 38500 VOIRON - France

Test réalisé par : Laurent CHAPUS  
*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 : Visa	Approved by: Visa
1	July 11 <sup>th</sup> , 2018	Initial Edition	Laurent Chapus	Régis ANCEL
2	August 24, 2018	TCB review (ATCB022935)		

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**1. Normatives References**

FCC qualification according to:		
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. Subpart F—Ultra-Wideband Operation

ISED qualification according to:		
Standards	Applied	Title
RSS-Gen (Issue 5/2018)	X	General Requirements and Information for the Certification of Radio Apparatus
RSS-220 (Issue1/2009)	X	Devices Using Ultra-Wideband (UWB) Technology

Deviation from standards: None.

**2. Test synthesis / Requirement for Indoor UWB systems**

TEST	Paragraph numb. FCC Part 15 RSS-220	Spec. FCC Part 15 / RSS	RESULTS (comments)	
Conducted emissions test	FCC 15.207 (a) RSS-Gen § 8.8	Table 15.207 (a) Table 4 / RSS-Gen	N/A (1)	
Radiated power density	FCC 15.517 (c)	EIRP -41.3 dBm/MHz in assigned frequency band 3100-10600	<b>PASS</b> (Chan 2 / Chan 5)	
Radiated power density	RSS-220 5.2.1 (d)	EIRP -41.3 dBm/MHz in assigned frequency band 4750-10600	<b>PASS</b> (Chan 5)	
Occupied Bandwidth test	UWB technical requirements	Minimum allowed bandwidth 500MHz	<b>PASS</b>	
Radiated emissions measurements below 960MHz	FCC 15.517 (b) & 15.209 (a) RSS-220 5.2.1 (c) & clause 3.4	<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	<b>PASS</b>	
Radiated emissions measurements above 960MHz FCC part 15	FCC 15.517 (c) (d)	<b>Frequency in MHz</b>	<b>PASS</b>	
		<b>EIRP in dBm</b>		
		960-1610		-75.3
		1610-1990		-53.3
		1990-3100		-51.3
		3100-10600		-41.3
		Above 10600		-51.3
		1164-1240 (1)		-83.5
1559-1610 (1)	-83.5			
		(1) : 1kHz Measurement RBW		
Radiated emissions measurements above 960MHz RSS-220	RSS-220 5.2.1 (d) (e)	<b>Frequency in MHz</b>	<b>PASS</b>	
		<b>EIRP in dBm</b>		
		960-1610		-75.3
		1610-4750		-70.0
		4750-10600		-41.3
		Above 10600		-51.3
		1164-1240 (1)		-83.5
		1559-1610 (1)		-83.5
		(1) : 1kHz Measurement RBW		
Peak level of the emissions contained within a 50 MHz bandwidth	FCC 15.517 (e)	EIRP 0dBm within 50MHz bandwidth in the frequency band 3100-10600MHz	<b>PASS</b> (Chan 2 / Chan 5)	
Peak level of the emissions contained within a 50 MHz bandwidth	RSS-220 5.2.1 (g)	EIRP 0dBm within 50MHz bandwidth in the frequency band 4750-10600MHz	<b>PASS</b> (Chan 5)	
Occupied Bandwidth	RSS-GEN § 6.7	BW at 99%	<b>PASS</b>	

N/A: Not Applicable  
(1): Operate only with battery

- **General conclusion:**

Measures and tests performed on the sample of the product SEVENHUGS, Room Sensor RS1A, in configuration and description presented in this test report, show compliance with standards FCC CFR 47, PART 15, used with channel 2 and 5.

Measures and tests performed on the sample of the product SEVENHUGS, Room Sensor RS1A, in configuration and description presented in this test report, show compliance with standards RSS-220, used with channel 5.

### 3. Equipment Under Test (EUT)

Nom /  
Identification

**SEVENHUGS Room Sensor RS1A**

Sn: 0044

**FCC ID:** FCC ID: 2AEVC-RS1A  
**IC:** IC: 20292-RS1A  
**Model:** RS1A

**Alimentation /  
Power supply** 3V from batteries (2xAA 1.5V)

**Auxiliaires /  
Auxiliaries** None

**Entrées-Sorties /  
Input / Output**

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

**Version programme /  
Firmware version** Certification\_v8.6

**Mode de fonctionnement /  
Running mode** The tested sample is able to:  
 - Transmit a modulated carrier frequency on low, and high channels  
 - Be in standby mode (no transmission)

**Programme de test /  
Test program /** None

• **Equipment information:**

- Assigned Frequency band: 3743.6-4243.6MHz (Band 2) & 6239.6-6739.6MHz (Band 5)
- Operating frequencies: 3993.6MHz (Chan 2) & 6489.6MHz (Chan 5)
- Power Setting: Nominal power without variable setting
- Others UWB settings PRF: 16  
Preamble length: 128  
Bitrate: 6.8 Mbits
- Antenna type: PCB antenna (3.6dBi peak gain at 3993.6MHz and -0.5dBi at 6489.6MHz)
- Equipment intended for use as a fixed station (Indoor)

### 4. Test conditions

Power supply voltage:  
Equipment under test: 3V DC from batteries

### 5. Modifications of the EUT

None

### 6. Special accessory

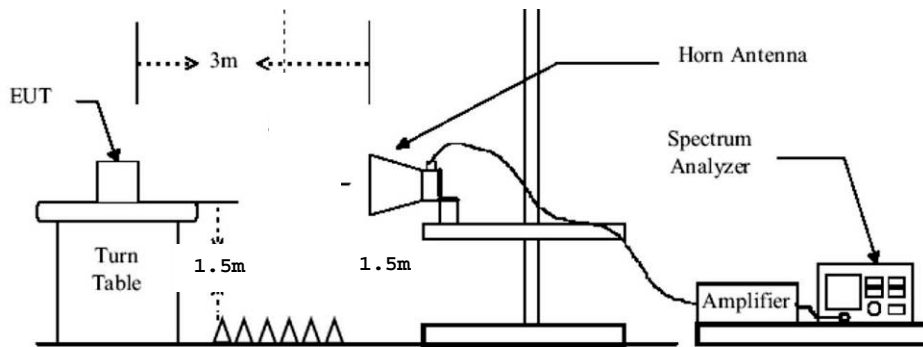
None

**7. Radiated Power density**

<b>TEST: Limits for radiated Radiated Power density</b>			<b>Verdict</b>
<p><u>Method:</u> Measurements were made in a 3-meter Full Anechoic Chamber that complies to ANSI C63.10. Final measurements were performed by rotating the EUT 360° and adjusting the receive antenna height.</p> <p>The tested equipment is set to transmit operation with modulations on lowest and highest channel. Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength, with 60° rotation on each axis. (Clause 6.6.5 of ANSI C63.10).</p>			<b>Pass</b>
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	20 to 30 °C	23°C ± 2	
Relative Humidity	25 to 70 %	63% ± 5	
<b>Limits FCC 15.517 (c)</b>			
Assigned Frequency band (MHz)	Limit		
	dBm	Results	
3100-10600	-41.3	<b>Pass (Chan 2 / Chan 5)</b>	
<b>Limits ISED RSS-220 5.2.1 (d)</b>			
Assigned Frequency band (MHz)	Limit		
	dBm	Results	
4750-10600	-41.3	<b>Pass (Chan 5)</b>	
Supplementary information:			
Test location: SMEE			
Test date: June 4 <sup>th</sup> , 2018. Tested by L. CHAPUS			
Power supply voltage: 3V DC from batteries			

<b>Test Equipment Used</b>					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2017/3	2018/3
RF cable	Pasternack	PE302-120	CAB-131-024	2017/3	2018/3
Anechoic chamber	COMTEST	214263	CAG-141-001	-	-
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/5	2019/5

## Test Setup for radiated emission



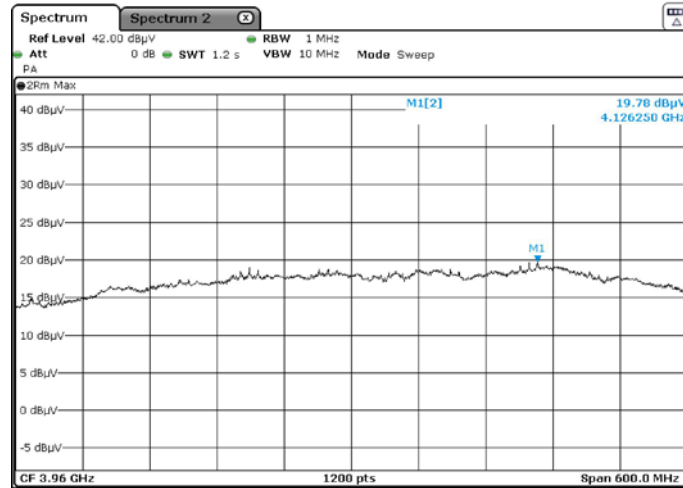
*Test setup for 1-40GHz*

## Tabulated Results for Radiated Density

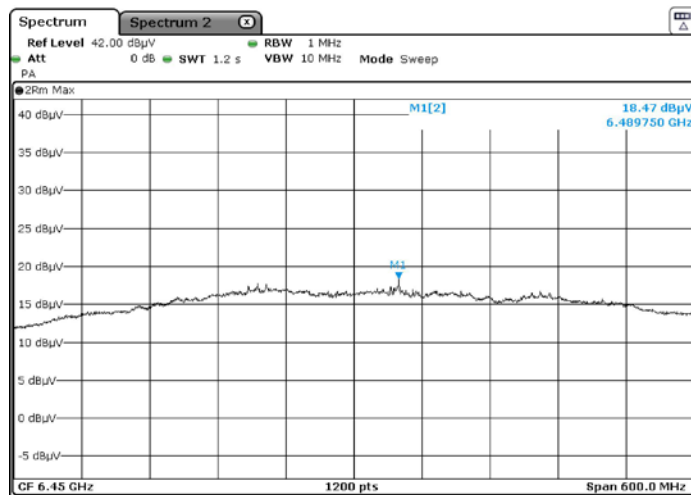
FREQ (MHz)	Receiver Amplitude (dBμV)	Total Factor	Field Strength (dBμV/m)	Equivalent EIRP (dBm)	RBW	Limit EIRP (dBm/1MHz)	Margin (dB)	Result
4126.25	19.8	36.2	47.1	<b>-48.7</b>	1MHz	-41.3	<b>-7.4</b>	<b>Pass</b>
6489.25	18.5	42.1	51.1	<b>-44.1</b>	1MHz	-41.3	<b>-2.8</b>	<b>Pass</b>
<b>RBW / VBW</b>			1MHz / 10MHz					
<b>Measurement distance:</b>			3m					
<b>Wide Measurement Uncertainty:</b>			± 5.6dB (k=2)					
<b>RESULT:</b>			PASS					
<b>Notes:</b>			<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:  <math>FS = RA + AF + CF - AG</math>            Where FS = Field Strength            RA = Receiver Amplitude            AF = Antenna Factor            CF = Cable Factor            AG = Amplifier Gain            Total factor (dB) is <math>AF + CF - AG</math>            Margin value = Emission level – Limit value            (2): <math>EIRP (dBm) = Field Strength (dBμV/m) - 95.2dB</math>            (3): 3-axis measurement performed for device under test.            (4): Measure have been done at 1m distance and corrected according to requirements of 15.209.e)  <math>(M@3m = M@1m - 9.54dB)</math></p>					



## Graphical representation of Radiated Density



Chan 2



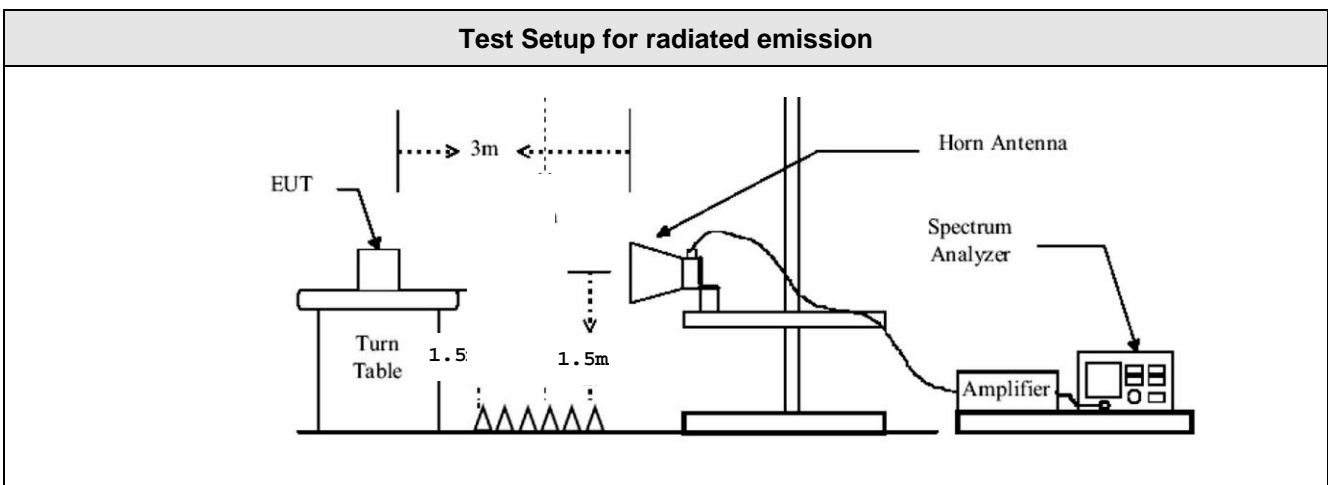
Chan 5

RBW :	1MHz
Measurement detector :	RMS (1ms / bin)

## 8. Occupied Bandwidth test

TEST: 10dB Bandwidth		Verdict
<p><b>Method:</b> The setup is in an anechoic chamber. The spectrum analyzer is connected to the measuring antenna. A radiated measurement is performed.            The RBW is 1MkHz, with VBW <math>\geq 3 \times</math> RBW.            The SPAN is wide enough to capture all products of the modulation process.            A MaxHold Peak detector is used.            The tested equipment is set to transmit operation with modulation on low and high channels.</p>		<b>Pass</b>
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	20 to 30 °C	23°C $\pm$ 2
Relative Humidity	25 to 70 %	63% $\pm$ 5
Limits		
Frequency (MHz)	Level for Bandwidth	Limit
3993.6 / Chan 2	10dB below the maximum power	At least 500kHz
6489.6 / Chan 5		
<p>Supplementary information:            Test location: SMEE            Test date: June 4<sup>th</sup>, 2018. Tested by L. CHAPUS            Power supply voltage: 3V DC from batteries</p>		

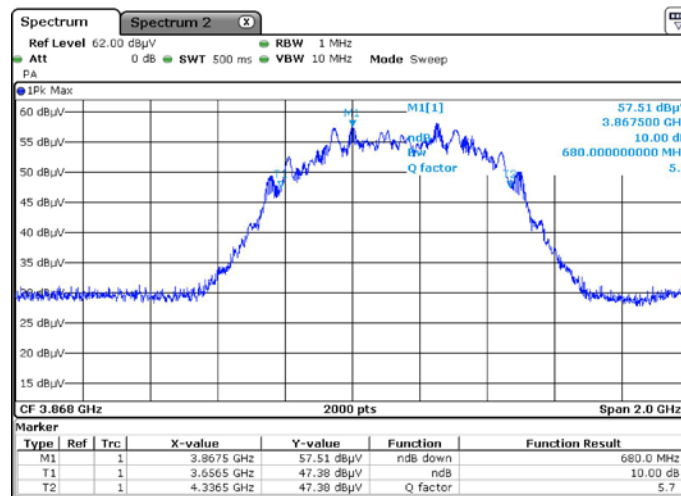
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2017/3	2018/3
RF cable	Pasternack	PE302-120	CAB-131-024	2017/3	2018/3
Anechoic chamber	COMTEST	214263	CAG-141-001	-	-
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/5	2019/5



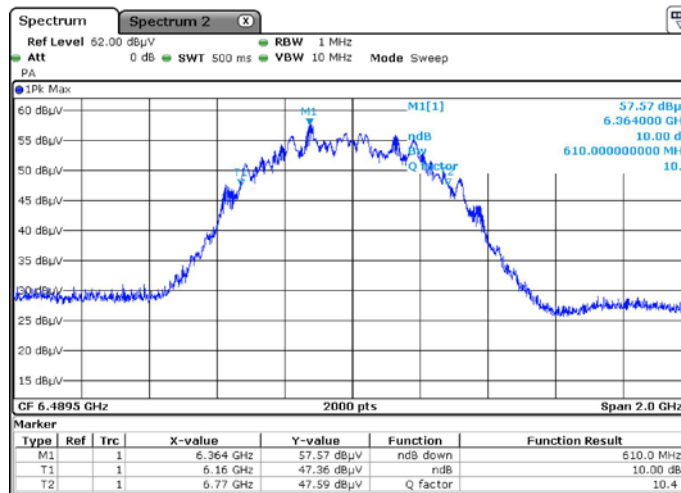
## Tabulated Results for Occupied Bandwidth

Frequency (MHz)	10dB Bandwidth (MHz)	Limit	Result
3993.6 / Chan 2	680.0	Minimum 500MHz	Pass
6489.6 / Chan 5	610.0	Minimum 500MHz	Pass

## Graphical representation of -10dBc Bandwidth



Chan 2



Chan 5

RBW : 1MHz

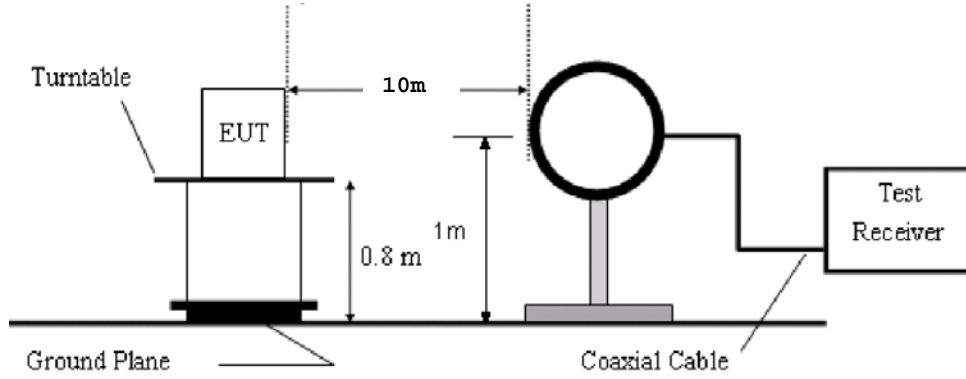
Measurement detector : Peak

**9. Radiated emissions measurements below 960MHz**

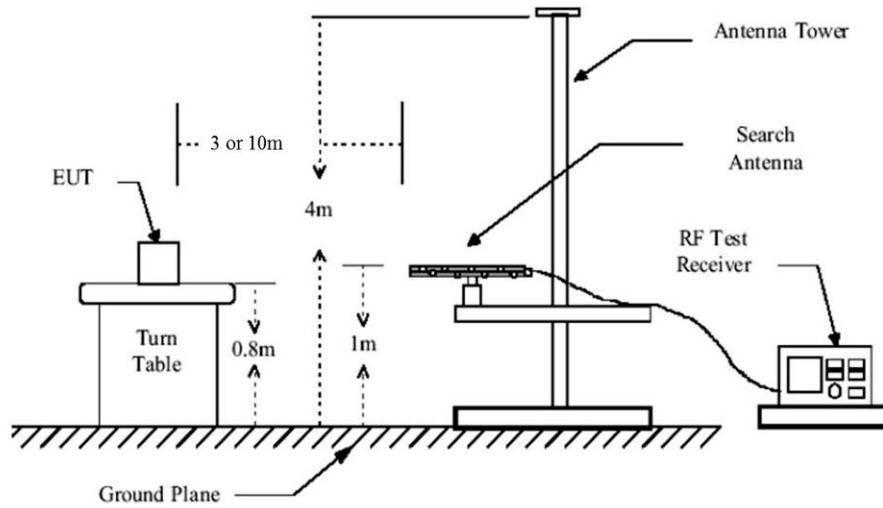
<b>TEST: Radiated emissions measurements below 960MHz</b>		<b>Verdict</b>
<p><u>Method:</u> Measurements were made on a 10 or 3-meter Open Area Test Site. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (Peak/Quasi-Peak/Average) were then performed by rotating the EUT 360° and adjusting the receive antenna height.</p> <p>The tested equipment is set to transmit operation with modulations on lowest 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 pre-scan radiated field of the EUT is performed at 3-meters of distance for frequency 9k-960MHz.</p>		<b>Pass</b>
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	20 to 30 °C	23°C ± 2
Relative Humidity	25 to 70 %	63% ± 5
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 – 960MHz	3 m measurement distance
<b>Limits (FCC / ISED)</b>		
Frequency (MHz)	Limits (dBµV/m)	
	Level / Detector / Distance	Results
0.009 to 0.090	107.6 – 87.6 / AV / 10m 127.6 – 107.6 / PK / 10m	<b>Pass</b>
0.090 to 0.110	87.6 – 85.9 / QP / 10m	<b>Pass</b>
0.110 to 0.490	85.7 – 72.9 / AV / 10m 105.7 – 92.9 / PK / 10m	<b>Pass</b>
0.490 to 1.705	52.9 – 42.1 / QP / 10m	<b>Pass</b>
1.705 to 30	48.6 / QP / 10m	<b>Pass</b>
30 to 88	40.0 / QP / 3m	<b>Pass</b>
88 to 216	43.5 / QP / 3m	<b>Pass</b>
216 to 960	46.0 / QP / 3m	<b>Pass</b>
Supplementary information: Test location: SMEE Test date: June 6 and 7 <sup>th</sup> , 2018. Tested by L. CHAPUS Power supply voltage: 3V DC from batteries		

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2017/5	2019/5
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2017/5	2019/5
Loop antenna	EMCO	6502	ANT-101-009	2017/8	2019/8
BiConiLog antenna	EMCO	3142B	ANT-101-010	2017/7	2019/7
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2014/3	2019/3
RF cable	Div	OATS/25m	CAB-101-017	2018/4	2019/4
RF cable	Pasternack RF	PE302-120	CAB-131-024	2018/4	2019/4
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2018/4	2019/4
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2018/4	2019/4
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2018/4	2019/4
Pre-amplifier	Pasternack RF	PE1524	PRE-101-002	2017/6	2018/6
Anechoic chamber	COMTEST	214263	CAG-141-001	2017/6	2020/6
OATS	Div	10m	SIT-101-001	2017/7	2020/7
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	2017/3	2019/3

Test Setup for radiated emission



*Test setup for 9k-30MHz*

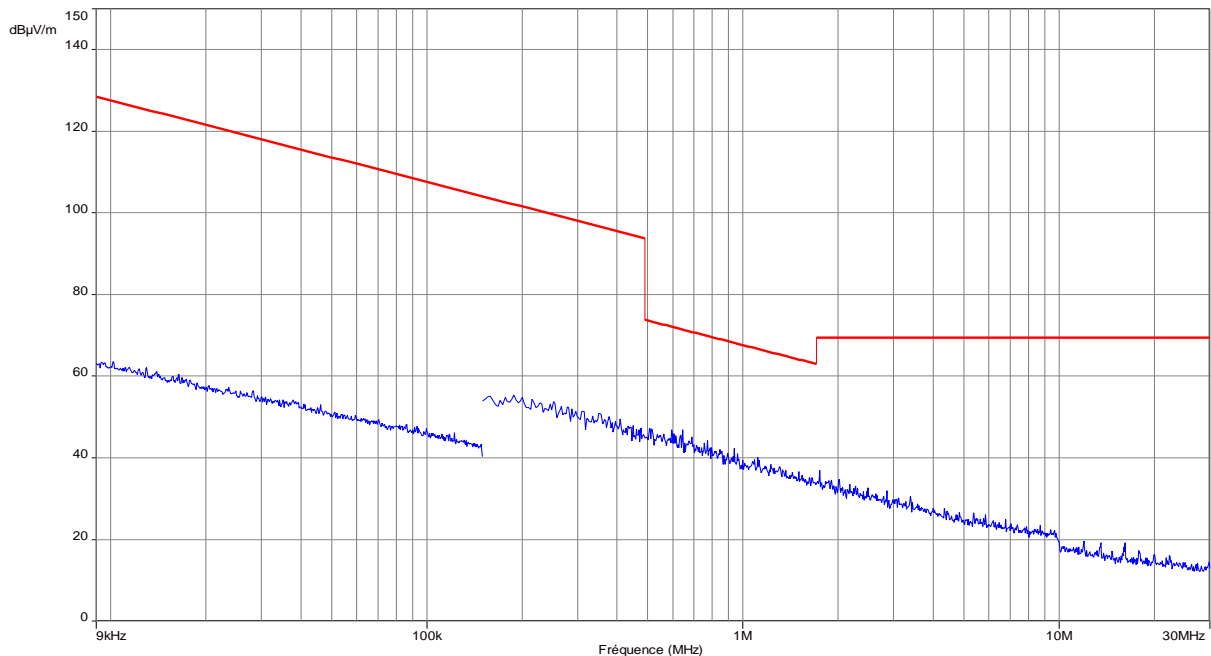
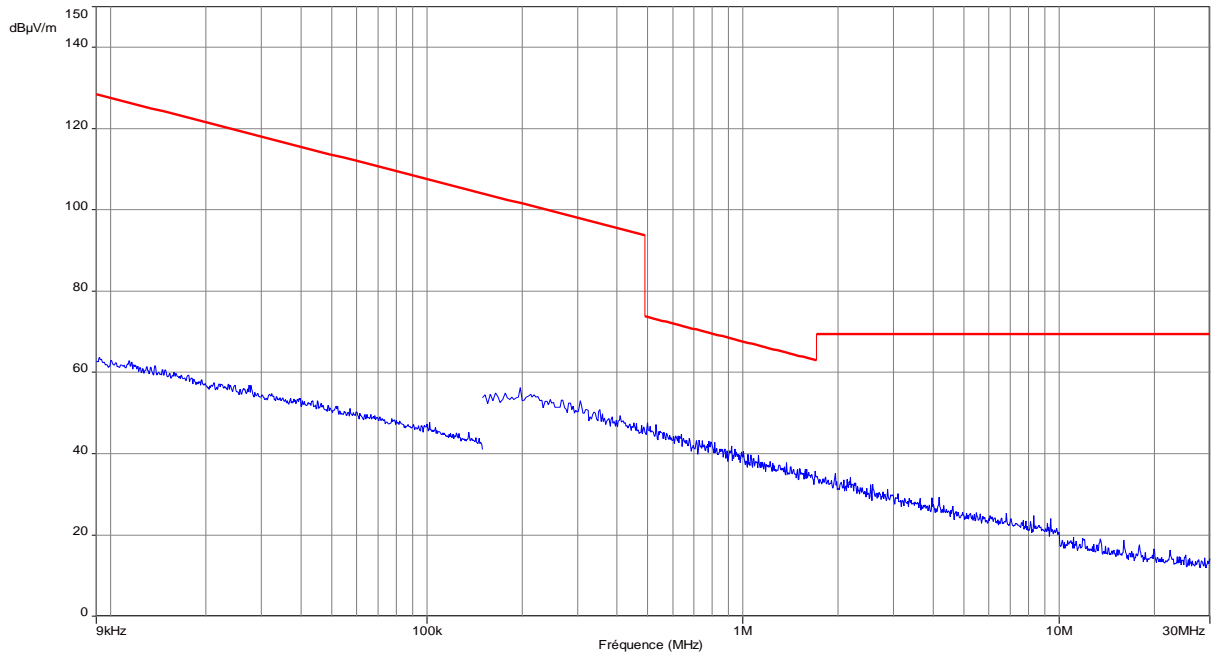


*Test setup for 30-1000MHz*

Tabulated Results for Unwanted emissions (9kHz-30MHz)							
FREQ	RF field @ 30m	Limit @ 30m	Margin	Antenna		Table angle	Correc. Fact. (CF)
MHz	(QP) dBµV/m	(QP) dBµV/m	dB	Angle (Degree)	Position	Degree	dB
No frequency observed (Level at least 10dB below limits)							
Supplementary information: Frequency list measured on the Open Area Test Site has been created with pre-scan results.							
<b>Frequency band investigated:</b>		9kHz-30MHz					
<b>RBW:</b>		200Hz (9kHz-150kHz) 9kHz (150kHz-30MHz)					
<b>Measurement distance:</b>		10m					
<b>Limit:</b>		FCC Part 15.209 – RSS 220 5.2.1 (c)					
<b>Final measurement detector:</b>		Quasi-Peak / Average					
<b>Wide Measurement Uncertainty:</b>		± 3.5dB (k=2)					
<b>Note:</b>		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-960MHz)					
FREQ	Meter reading	Total factor	Field level	Limit	Margin
MHz	(QP) dBµV	dB	(QP) dBµV/m	(QP) dBµV/m	dB
No frequency observed (Level at least 10dB below limits)					
Supplementary information: Frequency list measured on the Open Area Test Site has been created with pre-scan results.					
<b>Frequency band investigated:</b>		30MHz-960MHz			
<b>RBW:</b>		120kHz			
<b>Measurement distance:</b>		3m			
<b>Limit:</b>		FCC Part 15.209 – RSS 220 5.2.1 (c)			
<b>Final measurement detector:</b>		Quasi-Peak			
<b>Wide Measurement Uncertainty:</b>		± 5.6dB (k=2)			
<b>RESULT:</b>		PASS			
<b>Notes:</b>		(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			

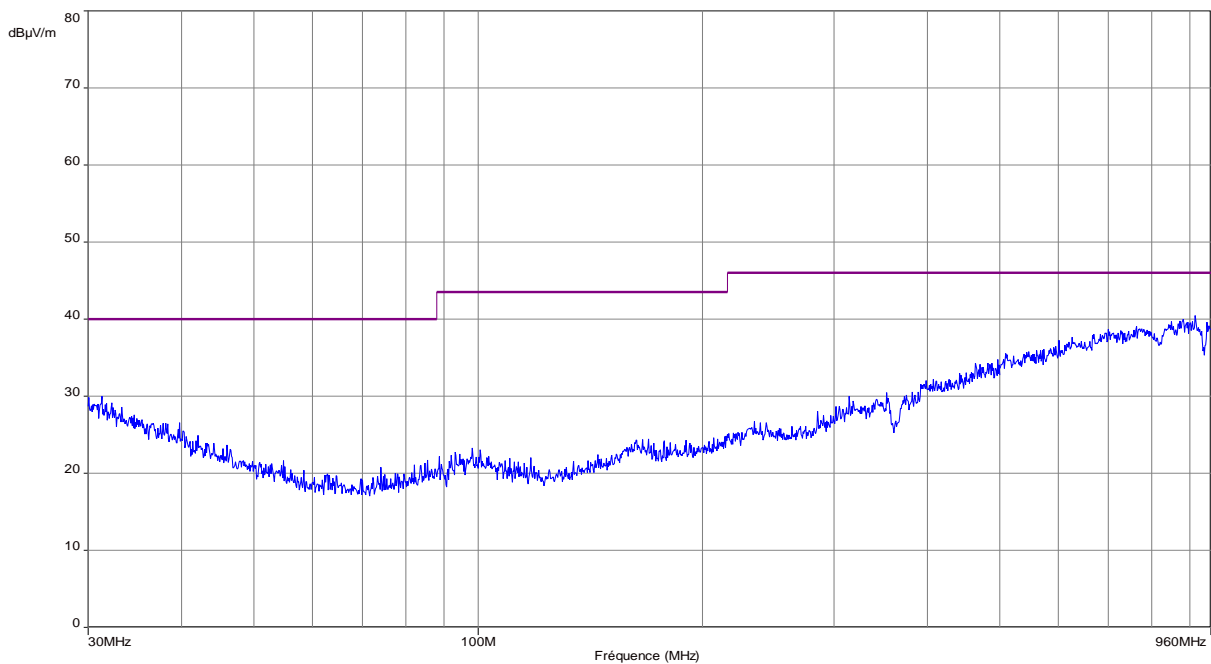
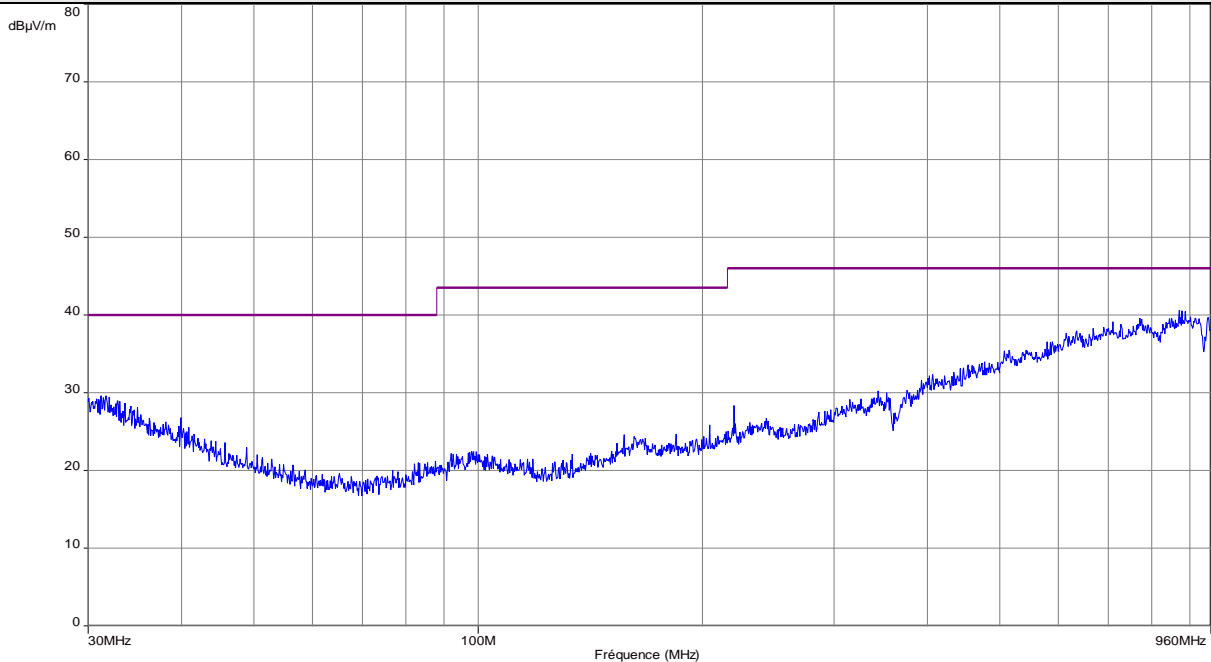
**Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 9kHz-30MHz / 3m / Parallel & Perpendicular antenna position / Transmit mode)**



<b>Frequency band investigated:</b>	9kHz-30MHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	200Hz (9kHz-150kHz) 9kHz (150kHz-30MHz)
<b>Antenna polarization :</b>	Parallel / Perpendicular to measurement axis
<b>Measurement detector:</b>	Peak



**Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-960MHz / 3m / Horizontal & Vertical / Transmit mode)**



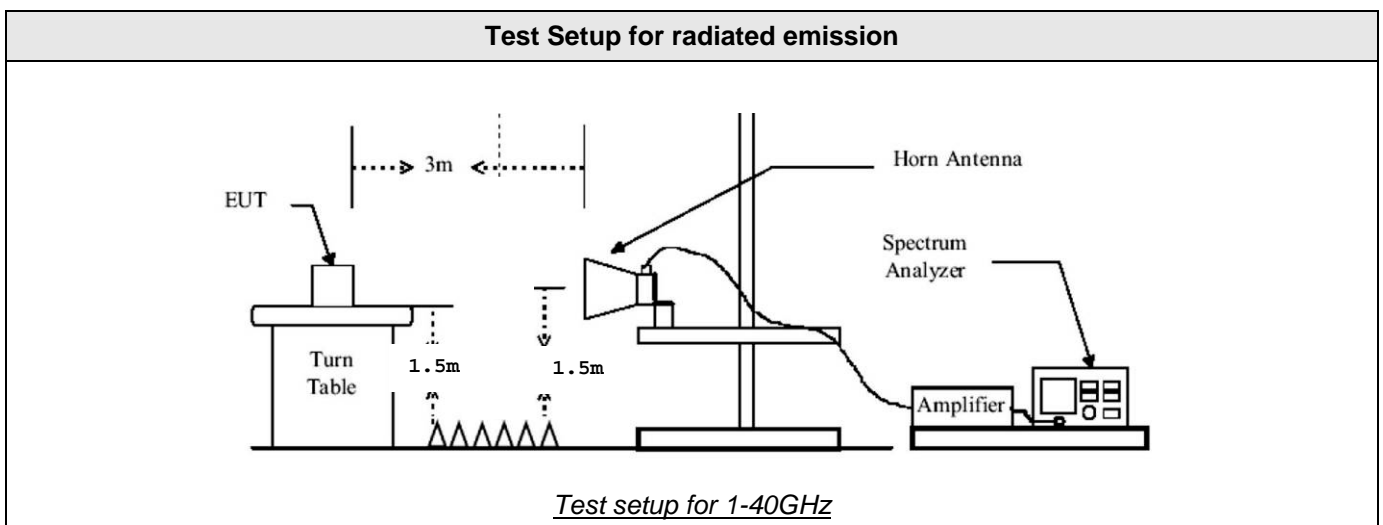
Notes: Pre-scan graph only for identification purpose.  
Same result for transmit mode on channel 2 or channel 5

<b>Frequency band investigated:</b>	30MHz-960MHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	100kHz
<b>Antenna polarization :</b>	Horizontal & Vertical
<b>Measurement detector:</b>	Peak

**10. Radiated emissions measurements above 960MHz**

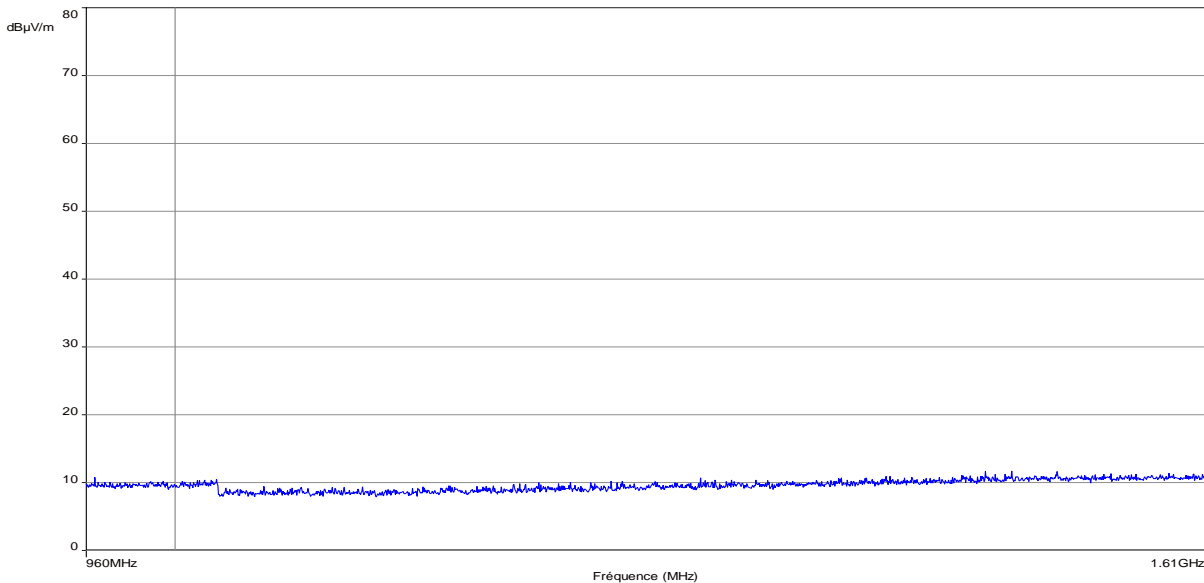
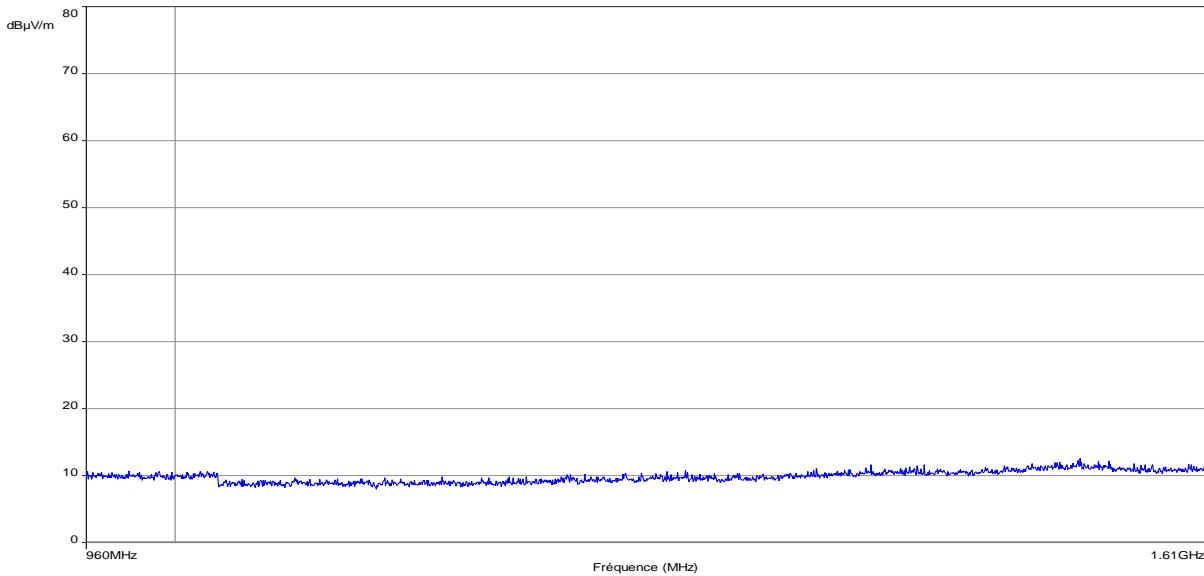
<b>TEST: Unwanted emissions into Restricted Frequency Bands</b>			<b>Verdict</b>
<p>Method: Measurements were made in a 3-meter Full Anechoic Chamber that complies to ANSI C63.10. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements were then performed by rotating the EUT 360° and adjusting the receive antenna height.</p> <p>The tested equipment is set to transmit operation with modulations on lowest and highest channel. Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength, with 60° rotation on each axis. (Clause 6.6.5 of ANSI C63.10).</p> <p>A pre-scan frequency identification of the EUT has been performed in full anechoic chamber. The measured pre-scan radiated field of the EUT is performed at 3 or 1-meters of distance for frequency 960MHz-40GHz.</p>			<b>Pass</b>
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	20 to 30 °C	23°C ± 2	
Relative Humidity	25 to 70 %	63% ± 5	
Fully configured sample scanned over the following frequency range	Frequency range on each side of line	Measurement Point	
	960MHz – 40GHz	3 m measurement distance	
<b>Limits – FCC Part 15.517 (c) and (d)</b>			
Frequency (MHz)	Limits		
	EIRP (dBm)	Field Strength (dBµV/m)	Results
960-1610	-75.3 (RBW 1MHz)	19.9	<b>PASS</b>
1610-1990	-53.3 (RBW 1MHz)	41.9	<b>PASS</b>
1990-3100	-51.3 (RBW 1MHz)	43.9	<b>PASS</b>
3100-10600	-41.3 (RBW 1MHz)	53.9	<b>PASS</b>
Above 10600	-51.3 (RBW 1MHz)	43.9	<b>PASS</b>
1164-1240	-85.3 (RBW 1kHz)	9.9	<b>PASS</b>
1559-1610	-85.3 (RBW 1kHz)	9.9	<b>PASS</b>
<b>Limits – ISED RSS-220 Section 5.2.1 (d)</b>			
Frequency (MHz)	Limits		
	EIRP (dBm)	Field Strength (dBµV/m)	Results
960-1610	-75.3 (RBW 1MHz)	19.9	<b>PASS</b>
1610-4750	-70.0 (RBW 1MHz)	25.2	<b>PASS</b>
4750-10600	-41.3 (RBW 1MHz)	53.9	<b>PASS</b>
Above 10600	-51.3 (RBW 1MHz)	43.9	<b>PASS</b>
1164-1240	-85.3 (RBW 1kHz)	9.9	<b>PASS</b>
1559-1610	-85.3 (RBW 1kHz)	9.9	<b>PASS</b>
Supplementary information: Test location: SMEE Test date: June 6 and 7 <sup>th</sup> , 2018. Tested by L. CHAPUS Power supply voltage: 3V DC from batteries			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2017/5	2019/5
BiConiLog antenna	EMCO	3142B	ANT-101-010	2017/7	2019/7
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2014/3	2019/3
Horn antenna	ETS-LINDGREN	3116	ANT-161-014	2017/12	2022/12
RF cable	Div	OATS/25m	CAB-101-017	2018/4	2019/4
RF cable	Pasternack RF	PE302-120	CAB-131-024	2018/4	2019/4
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2018/4	2019/4
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2018/4	2019/4
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2018/4	2019/4
RF cable	HUBER+SUHNER	SF102 (K/2m)	CAB-171-034	2017/5	2019/5
RF cable	HUBER+SUHNER	SF102 (K/3m)	CAB-171-034	2017/5	2019/5
Pre-amplifier	Pasternack RF	PE1524	PRE-101-002	2017/6	2018/6
Pre-amplifier	SMEE	18-40GHz	PRE-171-004	2017/12	2018/12
Anechoic chamber	COMTEST	214263	CAG-141-001	2017/6	2020/6
OATS	Div	10m	SIT-101-001	2017/7	2020/7
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	2017/3	2019/3
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/5	2019/5



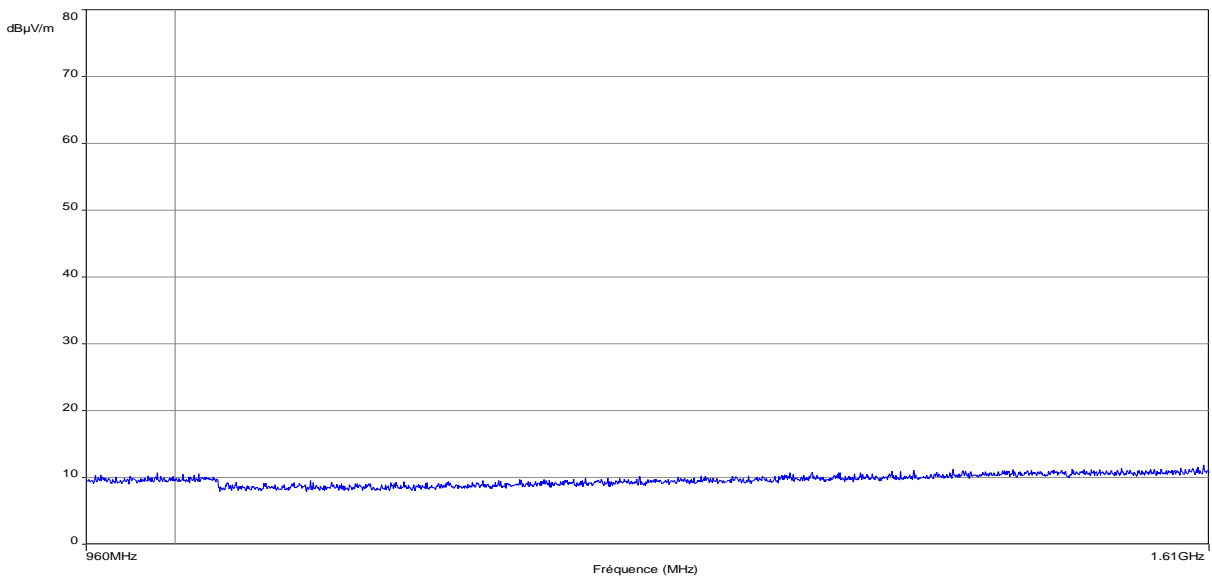
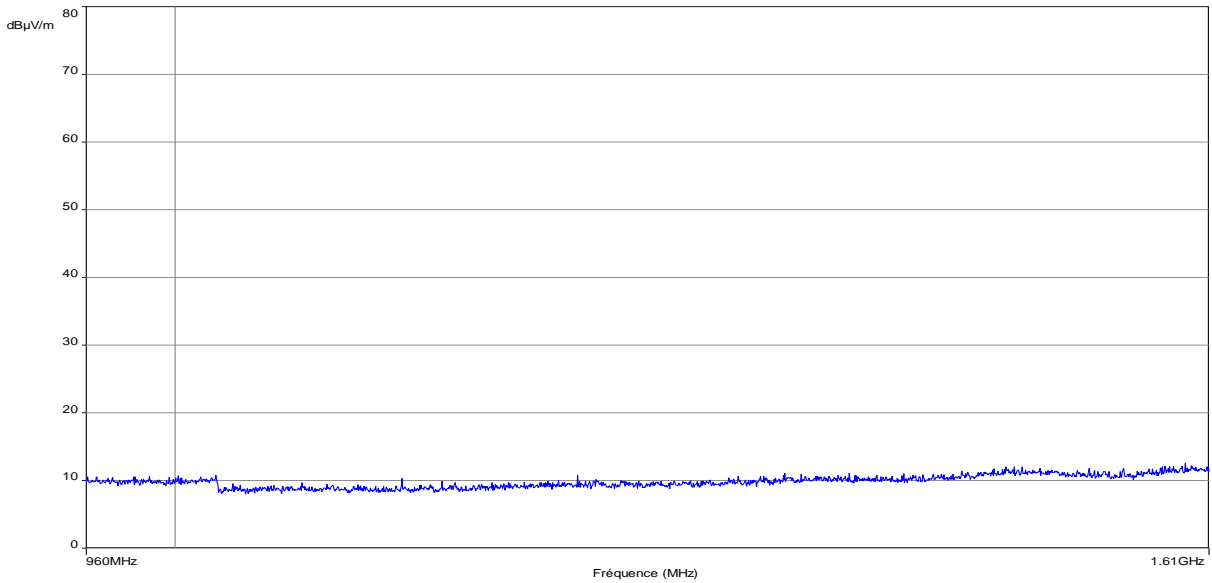
Tabulated Results for Unwanted emissions (960MHz-40GHz)					
Transmit mode on channel 2					
FREQ (MHz)	Field Strength 3m (dBμV/m)	Equivalent EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
7987.000	47.9	<b>-47.3</b>	-41.3	<b>-6.0</b>	<b>Pass</b>
Transmit mode on channel 5					
12979.200	33.1	<b>-61.1</b>	-51.3	<b>-10.8</b>	<b>Pass</b>
<b>RBW</b>		1MHZ			
<b>Measurement distance:</b>		3m			
<b>Final measurement detector:</b>		RMS (1ms / bin)			
<b>Wide Measurement Uncertainty:</b>		± 5.6dB (k=2)			
<b>RESULT:</b>		PASS			
<b>Notes:</b>		<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:  <math>FS = RA + AF + CF - AG</math>            Where FS = Field Strength            RA = Receiver Amplitude            AF = Antenna Factor            CF = Cable Factor            AG = Amplifier Gain            Total factor (dB) is <math>AF + CF - AG</math></p> <p>(2): <math>EIRP (dBm) = Field Strength (dB\mu V/m) - 95.2dB</math></p> <p>(3): 3-axis measurement performed for device under test.</p> <p>(4): Measures have been done at 1m distance and corrected according to requirements of 15.209.e) (<math>M@3m = M@1m - 9.54dB</math>)</p>			

**Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 960MHz-1.61GHz / 3m / Horizontal and vertical / Transmit mode on channel 2)**



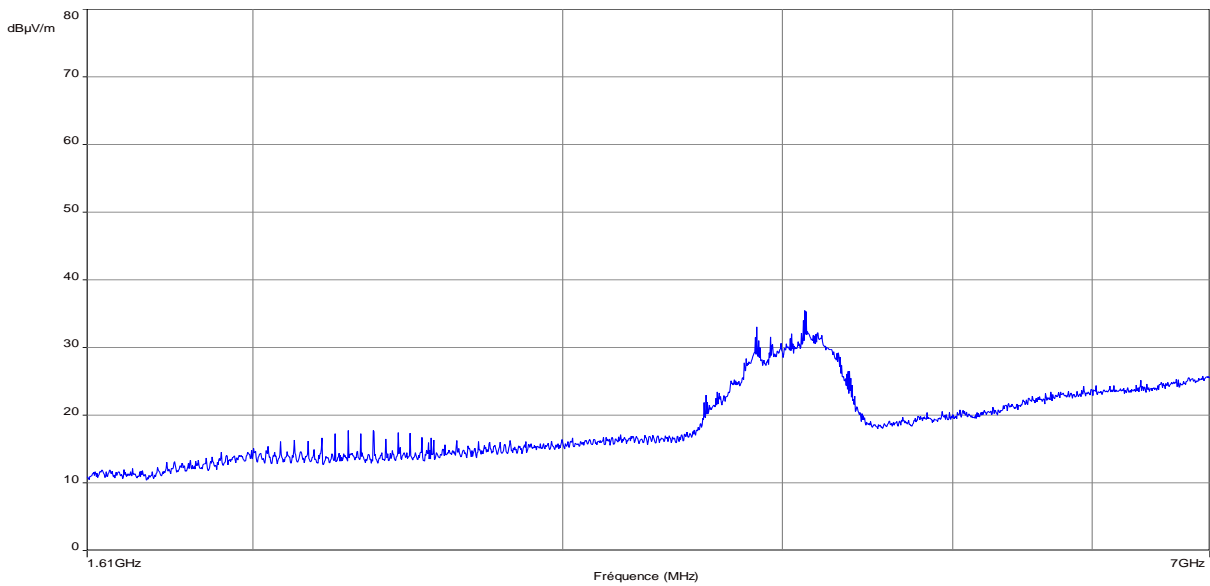
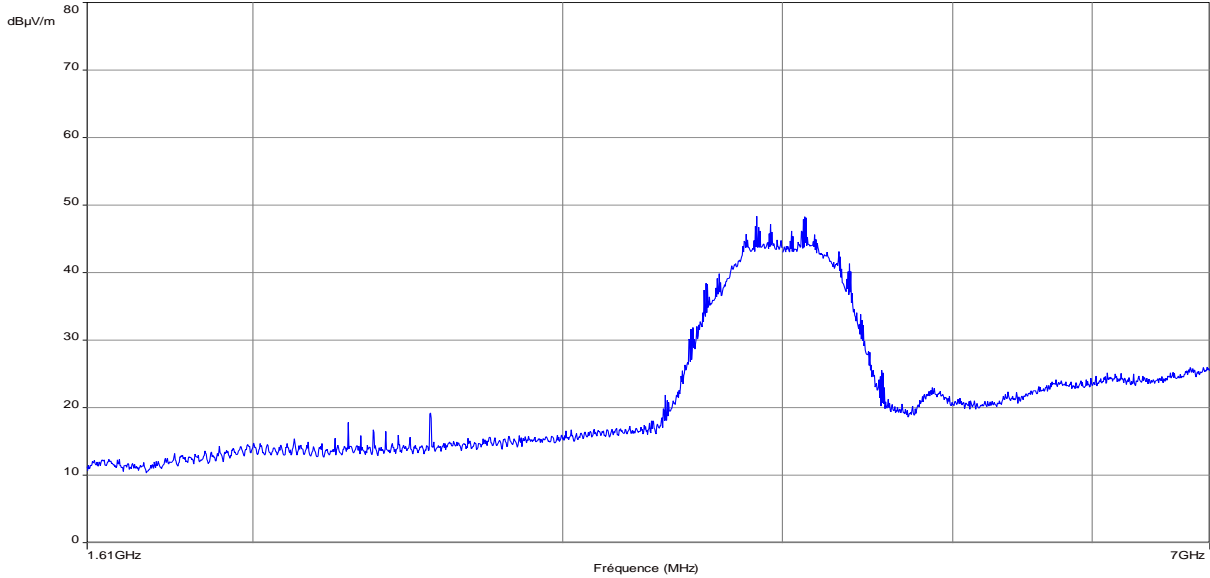
<b>Frequency band investigated:</b>	960-1610MHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	1MHz
<b>Detector :</b>	RMS (1ms / bin)
<b>Limit:</b>	19.9 dBµV/m (Equivalent EIRP -75.3dBm)

**Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 960MHz-1.61GHz / 3m / Horizontal and vertical / Transmit mode on channel 5)**



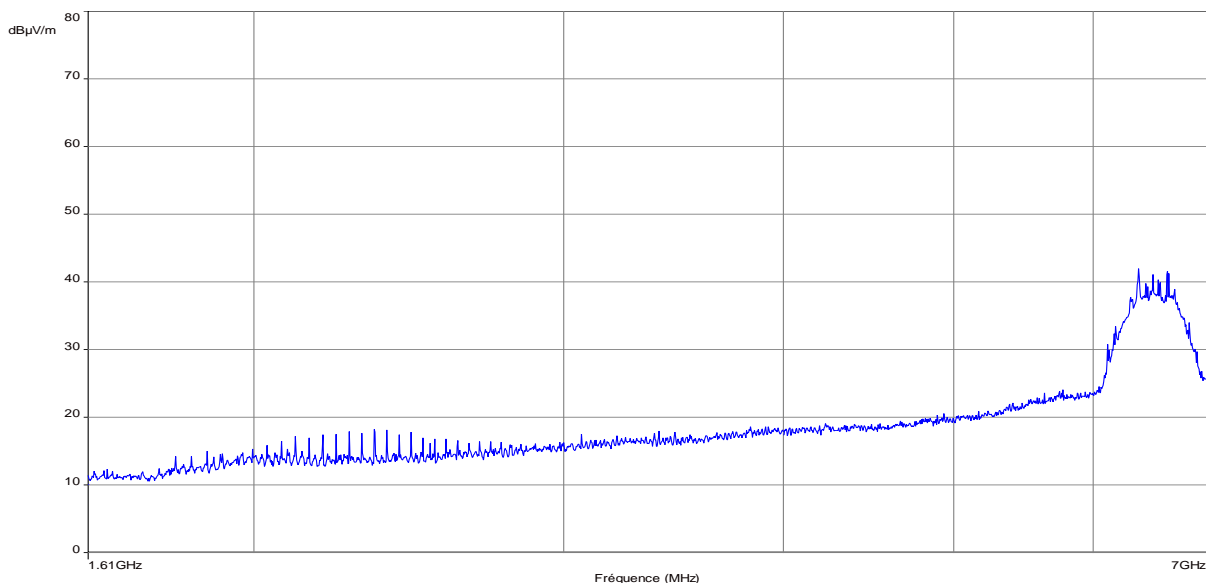
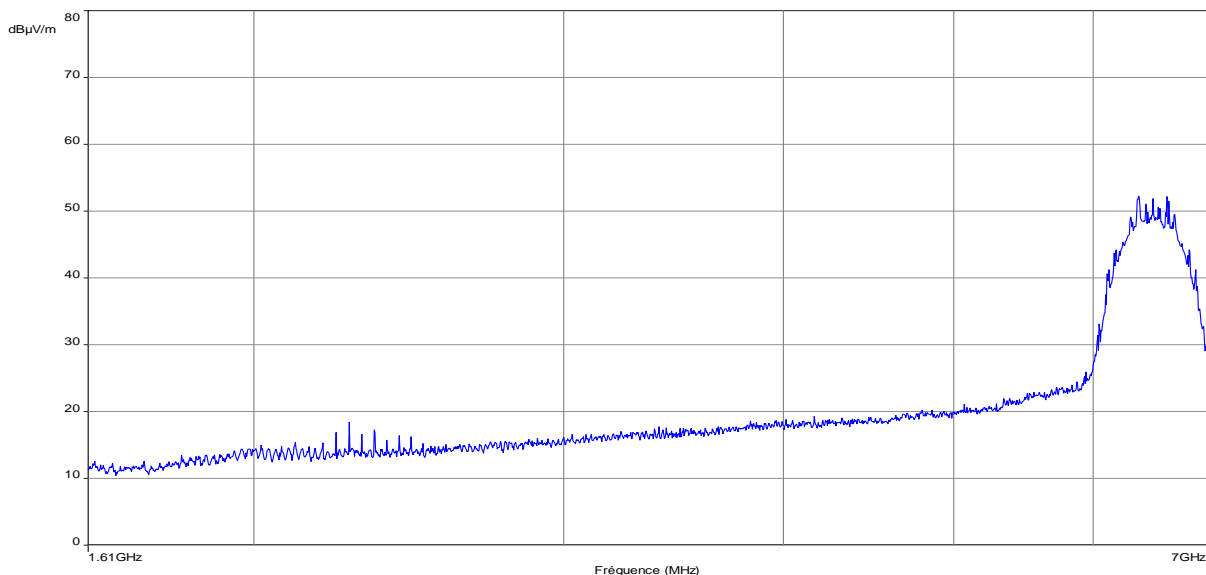
<b>Frequency band investigated:</b>	960-1610MHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	1MHz
<b>Detector :</b>	RMS (1ms / bin)
<b>Limit:</b>	19.9 dBµV/m (Equivalent EIRP -75.3dBm)

**Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 1.61GHz-7GHz / 3m / Horizontal and vertical / Transmit mode on channel 2)**



<b>Frequency band investigated:</b>	1610-7000MHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	1MHz
<b>Detector :</b>	RMS (1ms / bin)
<b>Limit FCC Section 15.517 (c) &amp; (d)</b>	1610-1990: 41.9 dBµV/m (Equivalent EIRP -53.3dBm) 1990-3100: 43.9 dBµV/m (Equivalent EIRP -51.3dBm) 3100-10600: 53.9 dBµV/m (Equivalent EIRP -41.3dBm)
<b>Limit RSS 220 Section 5.2.1 (d)</b>	1610-4750: 25.2 dBµV/m (Equivalent EIRP -70.0dBm) 4750-10600: 53.9 dBµV/m (Equivalent EIRP -41.3dBm)

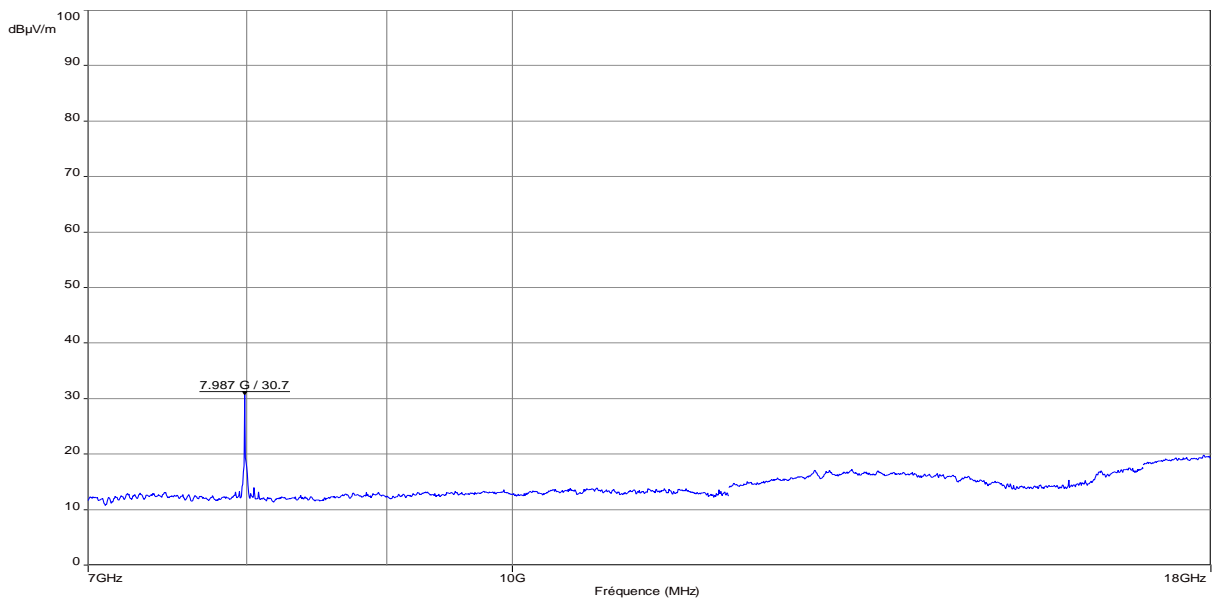
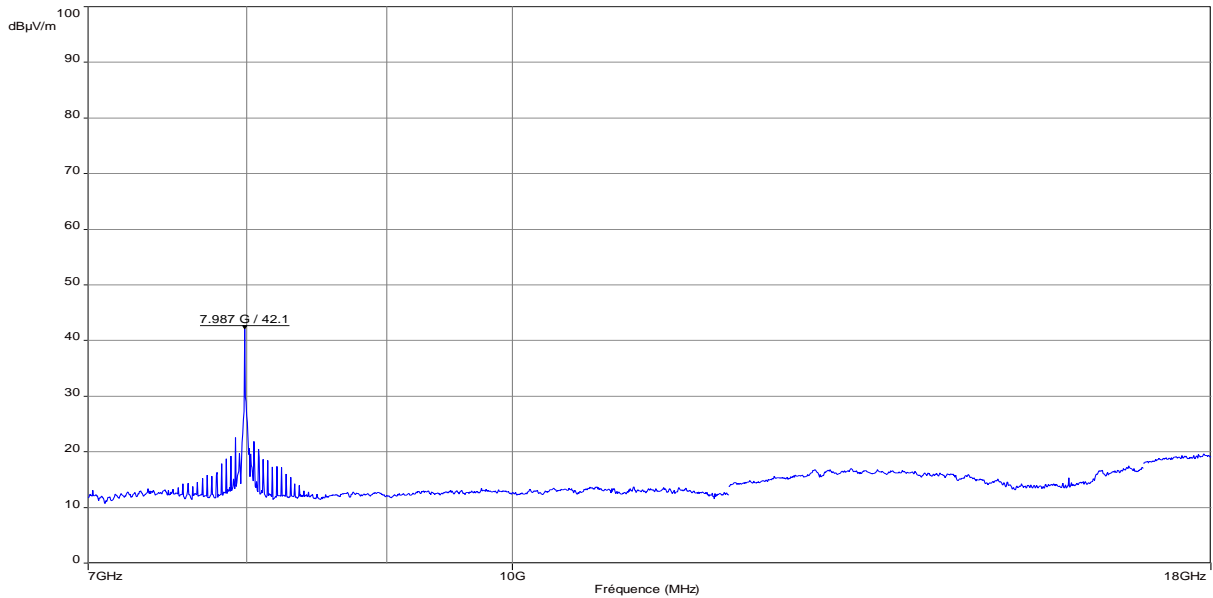
**Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 1.61GHz-7GHz / 3m / Horizontal and vertical / Transmit mode on channel 5)**



<b>Frequency band investigated:</b>	1610-7000MHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	1MHz
<b>Detector :</b>	RMS (1ms / bin)
<b>Limit FCC Section 15.517 (c) &amp; (d)</b>	1610-1990: 41.9 dBµV/m (Equivalent EIRP -53.3dBm) 1990-3100: 43.9 dBµV/m (Equivalent EIRP -51.3dBm) 3100-10600: 53.9 dBµV/m (Equivalent EIRP -41.3dBm)
<b>Limit RSS 220 Section 5.2.1 (d)</b>	1610-4750: 25.2 dBµV/m (Equivalent EIRP -70.0dBm) 4750-10600: 53.9 dBµV/m (Equivalent EIRP -41.3dBm)

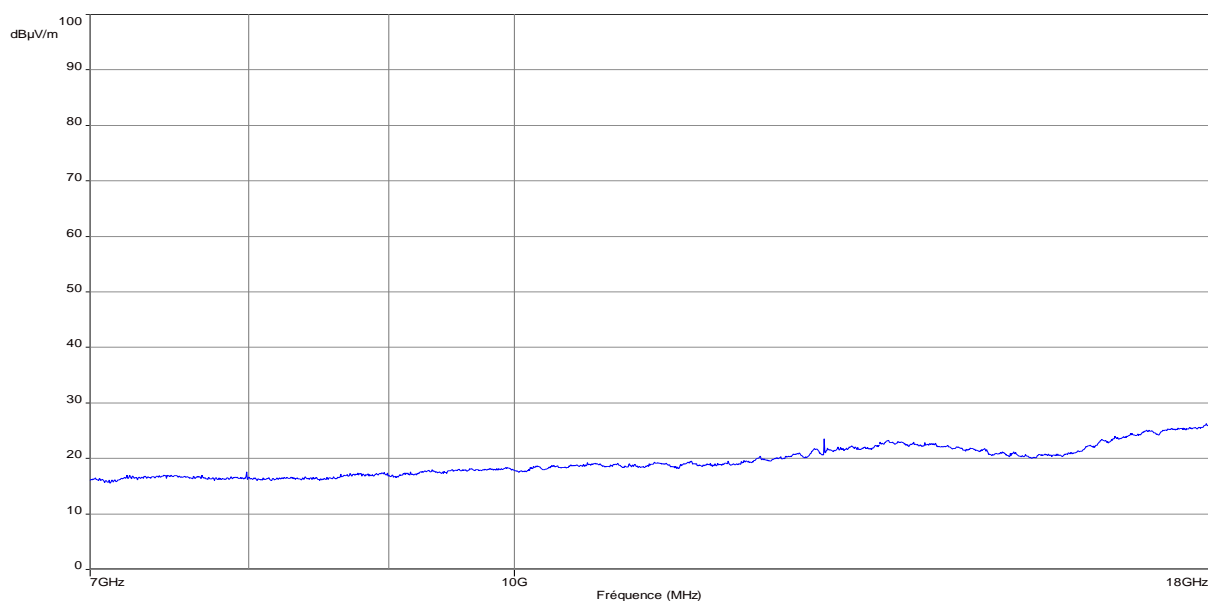
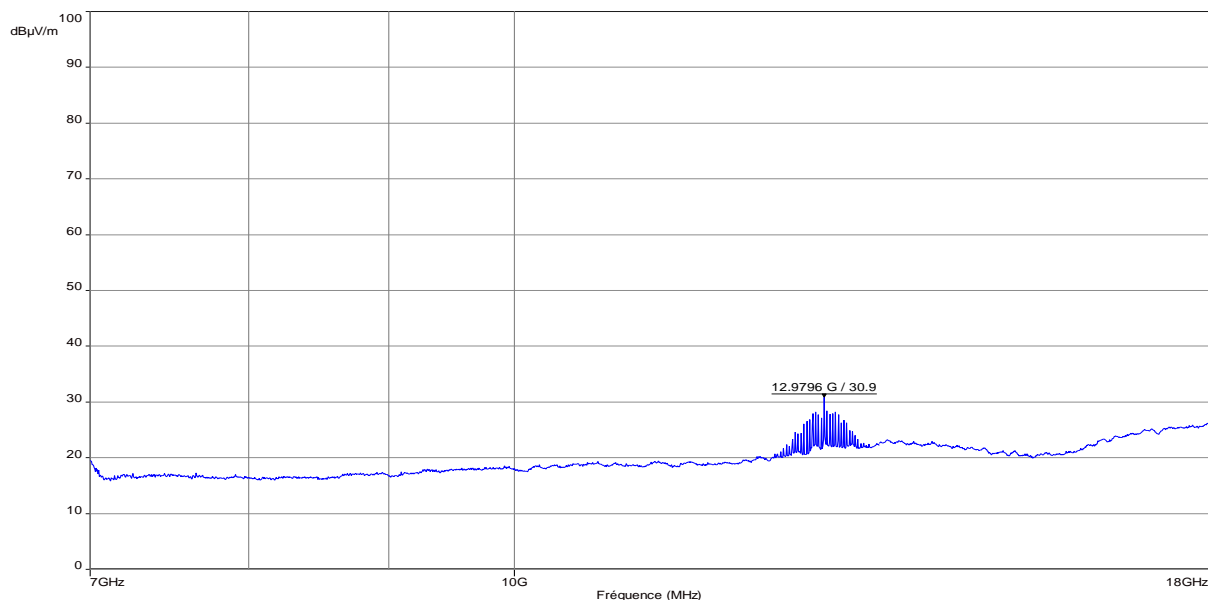


**Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 7-18GHz / 3m / Horizontal and vertical / Transmit mode on channel 2)**



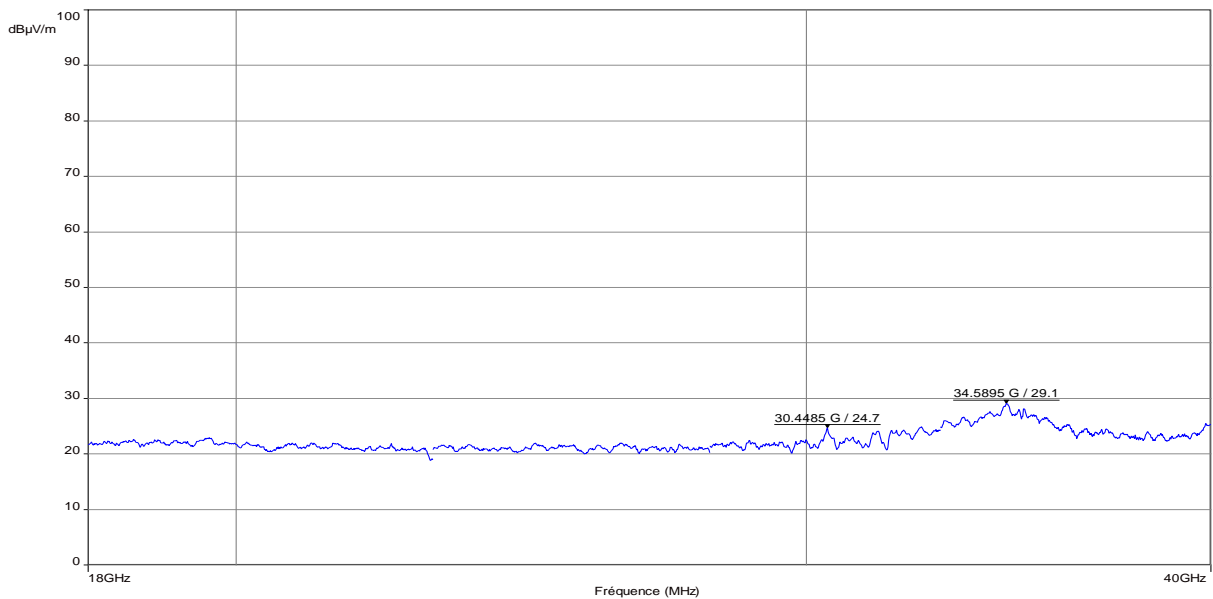
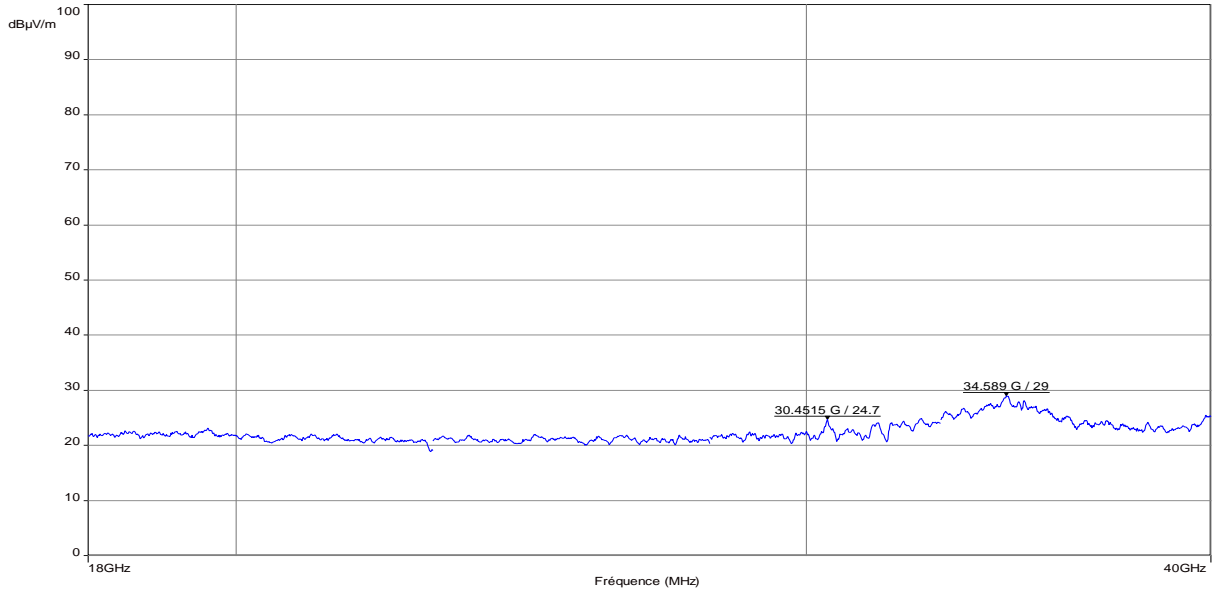
<b>Frequency band investigated:</b>	7-18GHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	1MHz
<b>Detector :</b>	RMS (1ms / bin)
<b>Limit FCC Section 15.517 (c) &amp; (d)</b>	7000-10600: 53.9 dBµV/m (Equivalent EIRP -41.3dBm)
<b>Limit RSS 220 Section 5.2.1 (d)</b>	Above 10600: 43.9 dBµV/m (Equivalent EIRP -51.3dBm)

**Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 7-18GHz / 3m / Horizontal and vertical / Transmit mode on channel 5)**



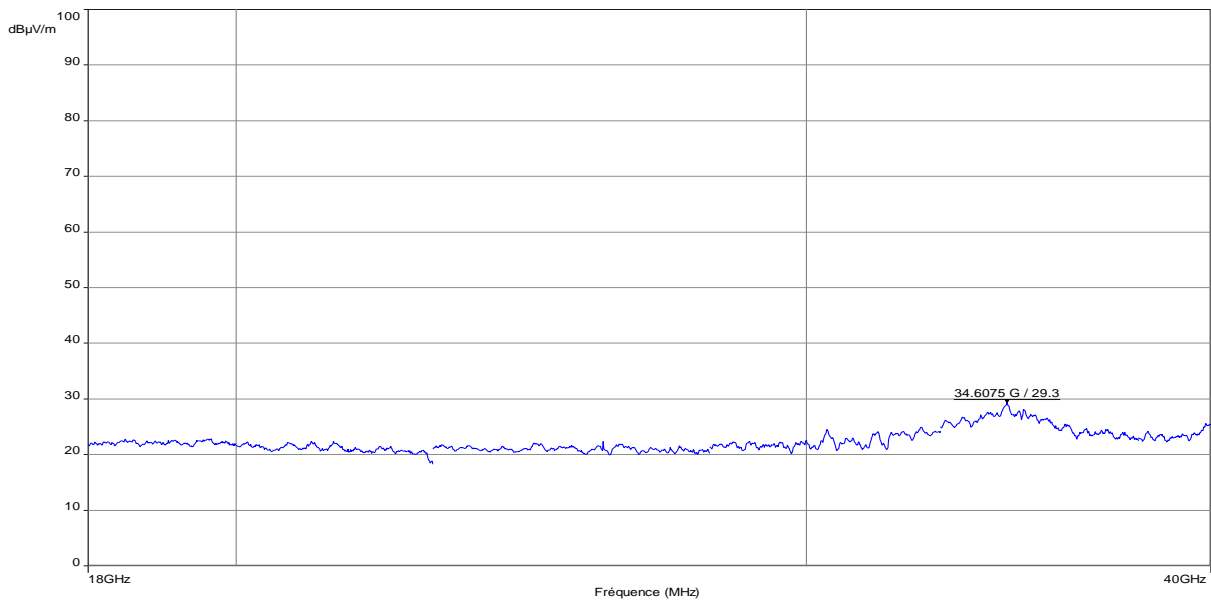
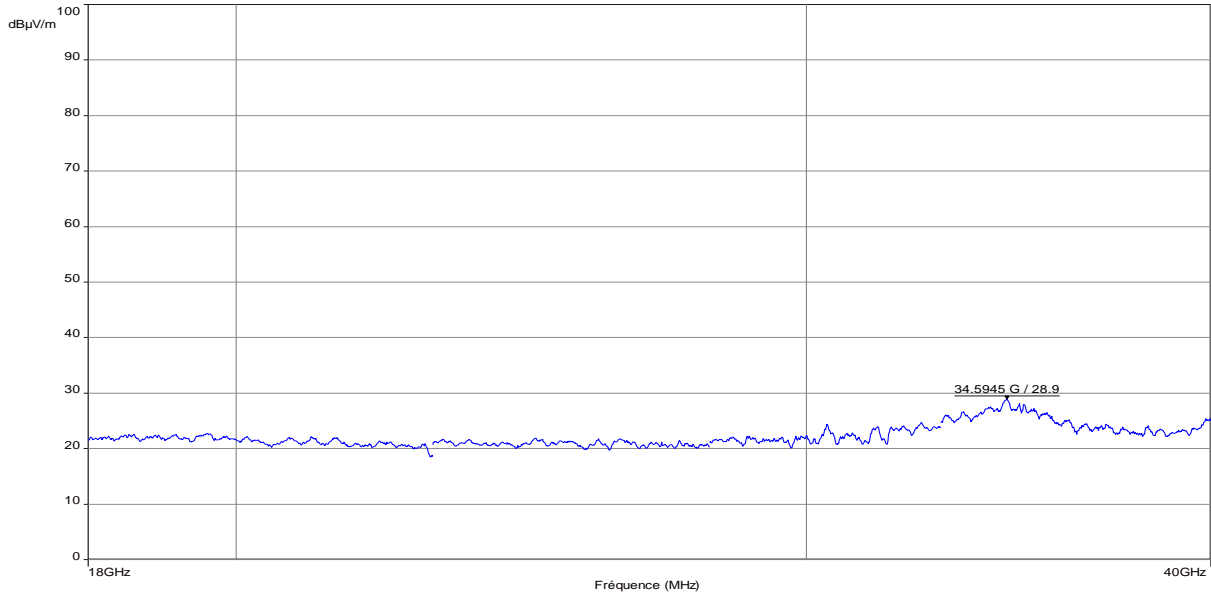
<b>Frequency band investigated:</b>	7-18GHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	1MHz
<b>Detector :</b>	RMS (1ms / bin)
<b>Limit FCC Section 15.517 (c) &amp; (d)</b>	7000-10600: 53.9 dBµV/m (Equivalent EIRP -41.3dBm)
<b>Limit RSS 220 Section 5.2.1 (d)</b>	Above 10600: 43.9 dBµV/m (Equivalent EIRP -51.3dBm)

**Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 18-40GHz / 3m / Horizontal and vertical / Transmit mode on channel 2)**



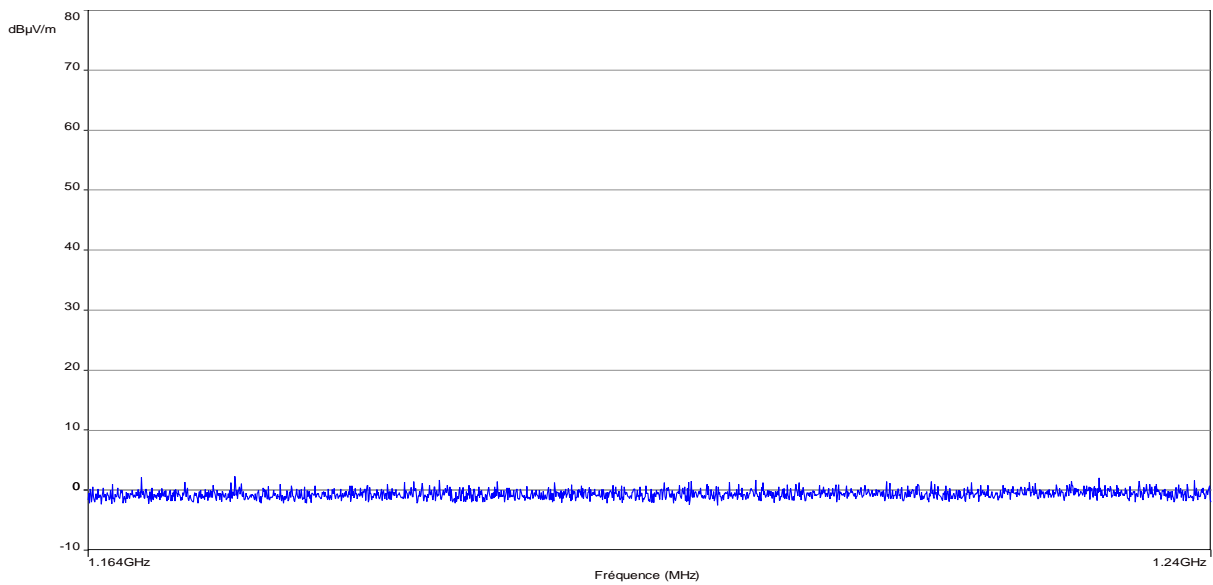
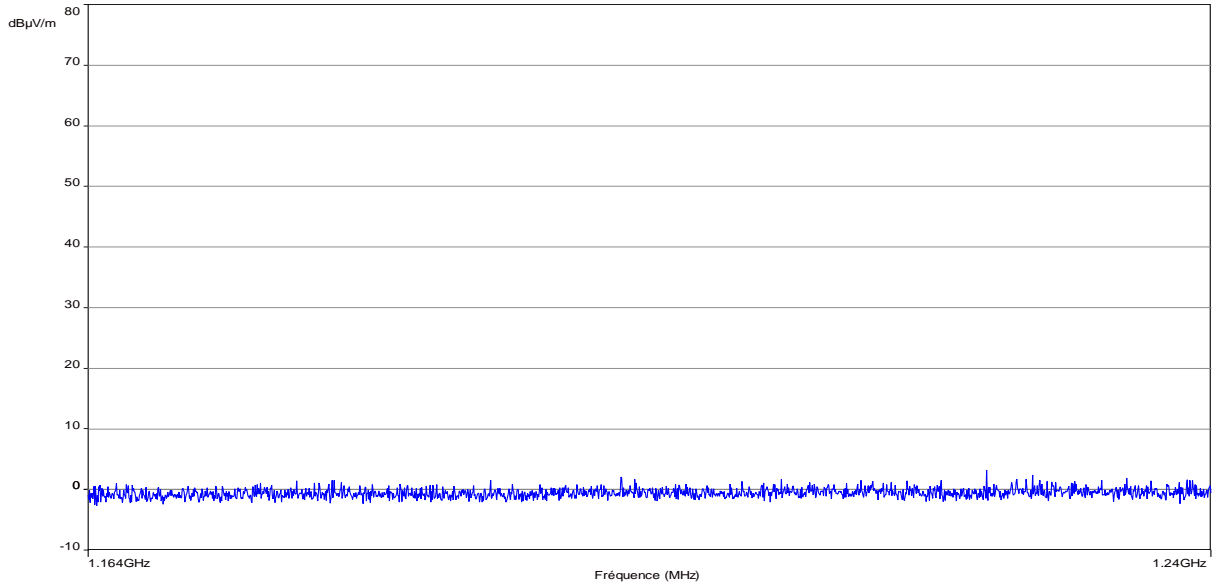
<b>Frequency band investigated:</b>	18-40GHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	1MHz
<b>Detector :</b>	RMS (1ms / bin)
<b>Limit FCC Section 15.517 (c) &amp; (d)</b>	Above 10600: 43.9 dBµV/m (Equivalent EIRP -51.3dBm)
<b>Limit RSS 220 Section 5.2.1 (d)</b>	

**Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 18-40GHz / 3m / Horizontal and vertical / Transmit mode on channel 5)**



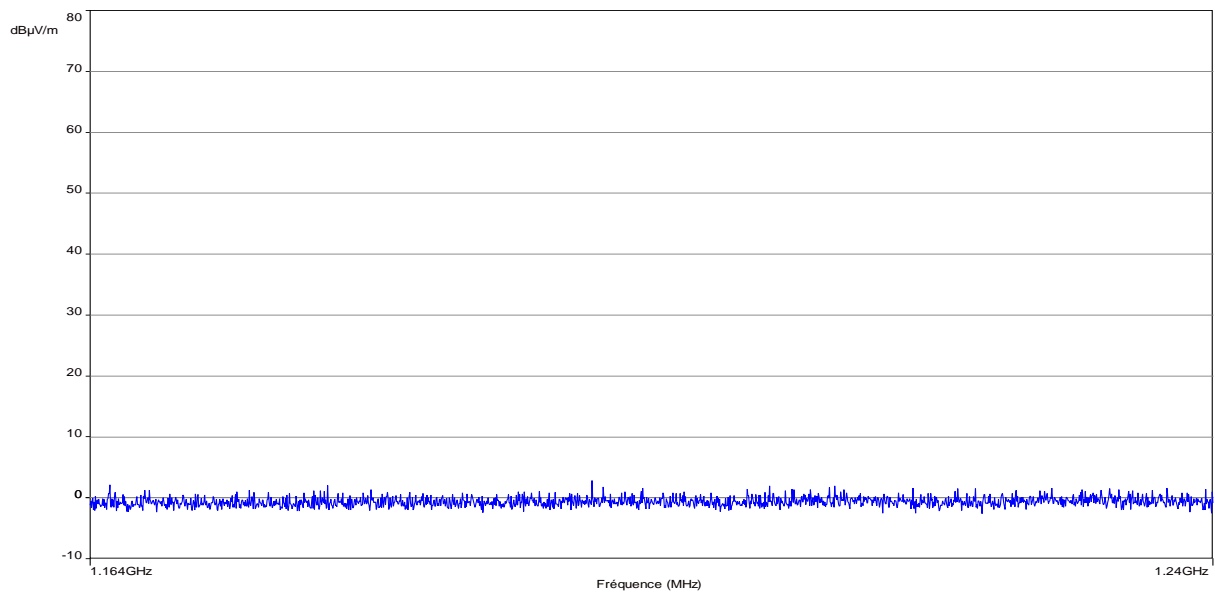
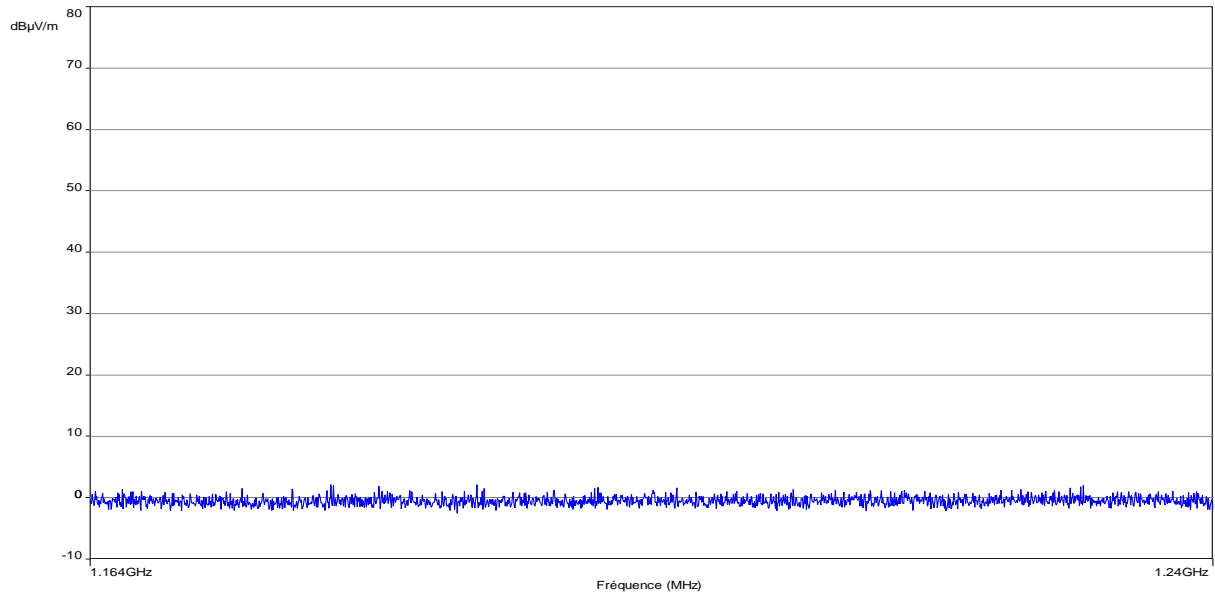
<b>Frequency band investigated:</b>	18-40GHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	1MHz
<b>Detector :</b>	RMS (1ms / bin)
<b>Limit FCC Section 15.517 (c) &amp; (d)</b>	Above 10600: 43.9 dBµV/m (Equivalent EIRP -51.3dBm)
<b>Limit RSS 220 Section 5.2.1 (d)</b>	

**Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 1164-1240MHz / 3m / Horizontal and vertical / Transmit mode on channel 2)**



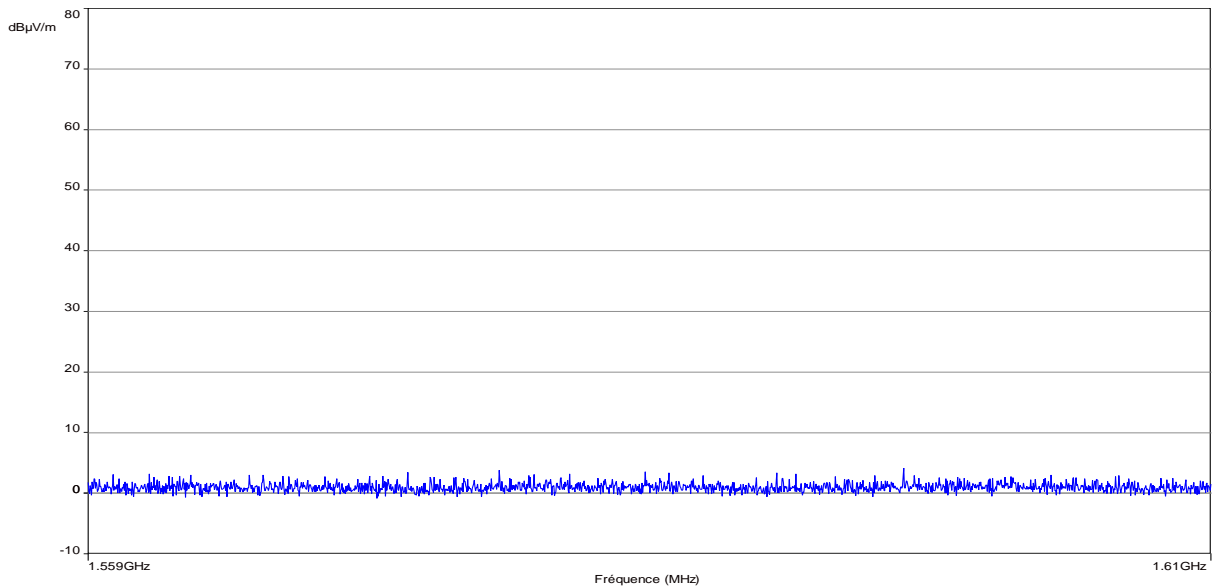
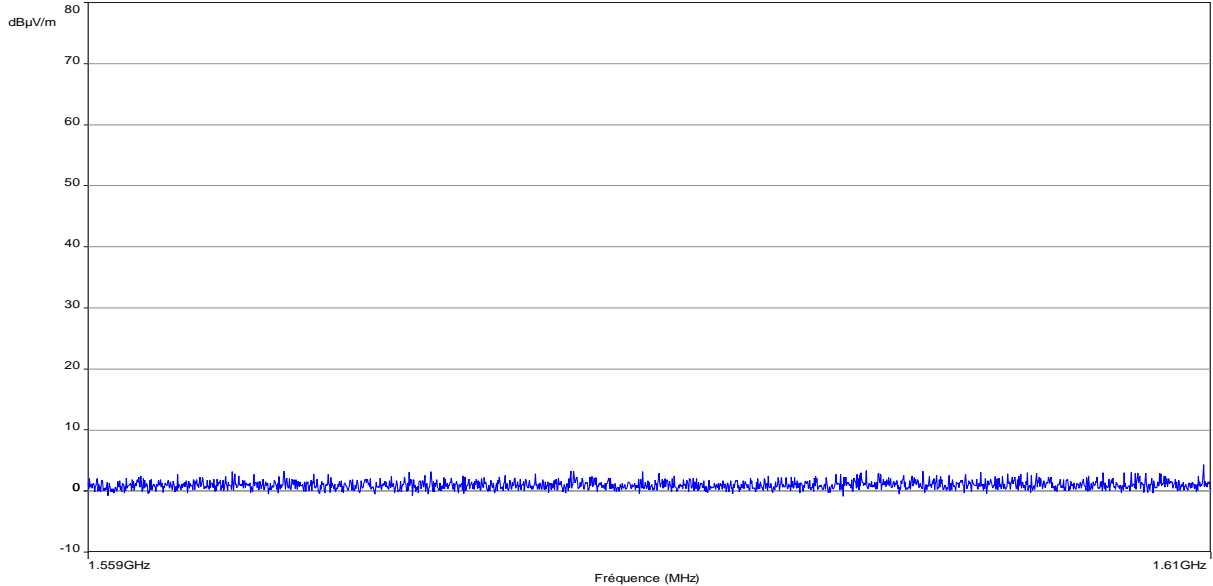
<b>Frequency band investigated:</b>	1164-1240MHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	20kHz
<b>Detector :</b>	RMS (1ms / bin)
<b>Limit FCC Section 15.517 (c) &amp; (d)</b>	1164-1240: 9.9 dBµV/m (Equivalent EIRP -85.3dBm)
<b>Limit RSS 220 Section 5.2.1 (d)</b>	1559-1610: 9.9 dBµV/m (Equivalent EIRP -85.3dBm)

**Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 1164-1240MHz / 3m / Horizontal and vertical / Transmit mode on channel 5)**



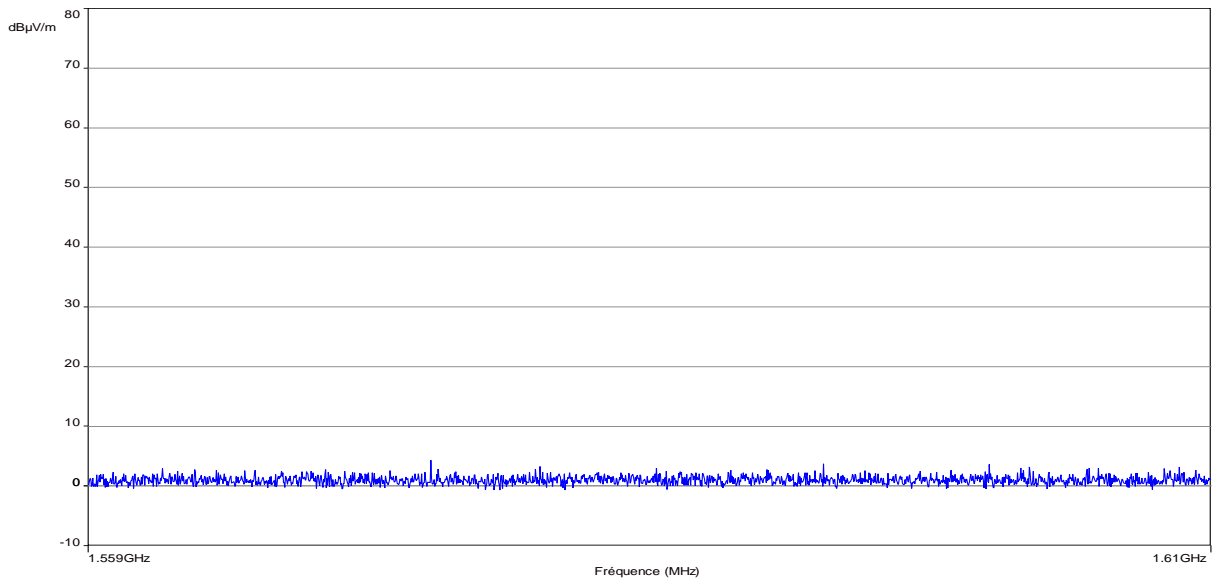
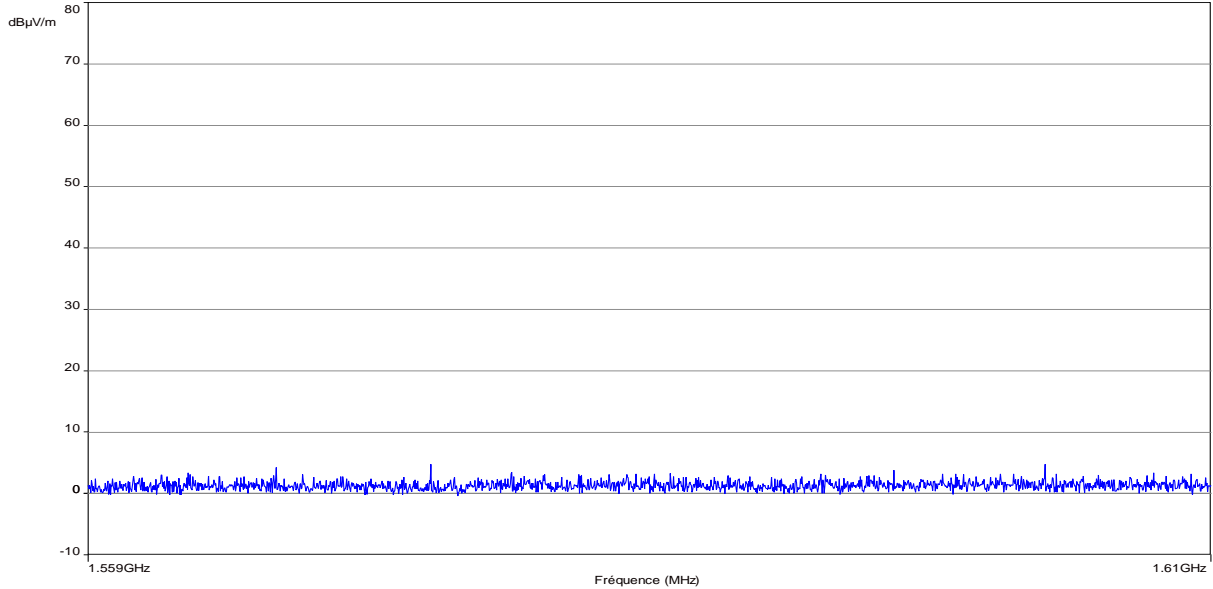
<b>Frequency band investigated:</b>	1164-1240MHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	20kHz
<b>Detector :</b>	RMS (1ms / bin)
<b>Limit FCC Section 15.517 (c) &amp; (d)</b>	1164-1240: 9.9 dBµV/m (Equivalent EIRP -85.3dBm)
<b>Limit RSS 220 Section 5.2.1 (d)</b>	1559-1610: 9.9 dBµV/m (Equivalent EIRP -85.3dBm)

**Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 1559-1610MHz / 3m / Horizontal and vertical / Transmit mode on channel 2)**



<b>Frequency band investigated:</b>	1559-1610MHz
<b>Unit :</b>	dBµV/m
<b>RBW :</b>	20kHz
<b>Detector :</b>	RMS (1ms / bin)
<b>Limit FCC Section 15.517 (c) &amp; (d)</b>	1164-1240: 9.9 dBµV/m (Equivalent EIRP -85.3dBm)
<b>Limit RSS 220 Section 5.2.1 (d)</b>	1559-1610: 9.9 dBµV/m (Equivalent EIRP -85.3dBm)

**Graphical representation of Radiated Disturbance Measurement (Anechoic chamber pre-scan, 1559-1610MHz / 3m / Horizontal and vertical / Transmit mode on channel 5)**



<b>Frequency band investigated:</b>	1559-1610MHz
<b>Unit :</b>	dB $\mu$ V/m
<b>RBW :</b>	20kHz
<b>Detector :</b>	RMS (1ms / bin)
<b>Limit FCC Section 15.517 (c) &amp; (d)</b>	1164-1240: 9.9 dB $\mu$ V/m (Equivalent EIRP -85.3dBm)
<b>Limit RSS 220 Section 5.2.1 (d)</b>	1559-1610: 9.9 dB $\mu$ V/m (Equivalent EIRP -85.3dBm)



**11. Peak level of the emissions contained within a 50 MHz bandwidth**

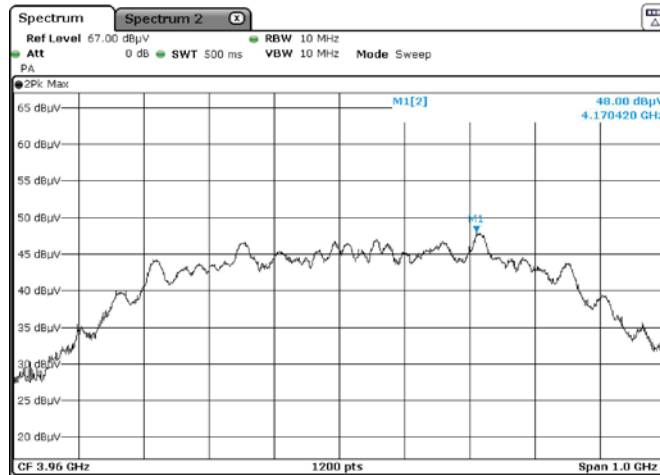
<b>TEST: Peak level of the emissions contained within a 50 MHz bandwidth</b>		<b>Verdict</b>
<p><u>Method:</u> Measurements were made in a 3-meter Full Anechoic Chamber that complies to ANSI C63.10. Final measurements were performed by rotating the EUT 360° and adjusting the receive antenna height. The tested equipment is set to transmit operation with modulations on lowest and highest channel. Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength, with 60° rotation on each axis. (Clause 6.6.5 of ANSI C63.10).</p>		<b>Pass</b>
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	20 to 30 °C	23°C ± 2
Relative Humidity	25 to 70 %	63% ± 5
<b>Limits FCC 15.517 (e)</b>		
Frequency (MHz)	Limits EIRP	
	dBm	Results
3100-10600	0	<b>PASS (Chan 2 / Chan 5)</b>
Supplementary information: Test location: SMEE Test date: June 4 <sup>th</sup> , 2018. Tested by L. CHAPUS Power supply voltage: 3V DC from batteries		
<b>Limits RSS-220 5.2.1 (g)</b>		
Frequency (MHz)	Limits EIRP	
	dBm	Results
4750-10600	0	<b>PASS (Chan 5)</b>

<b>Test Equipment Used</b>					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
RF cable	Pasternack	PE302-120	CAB-131-024	2017/3	2018/3
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2017/3	2018/3
Anechoic chamber	COMTEST	214263	CAG-141-001	2017/6	2020/6
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/3	2020/3

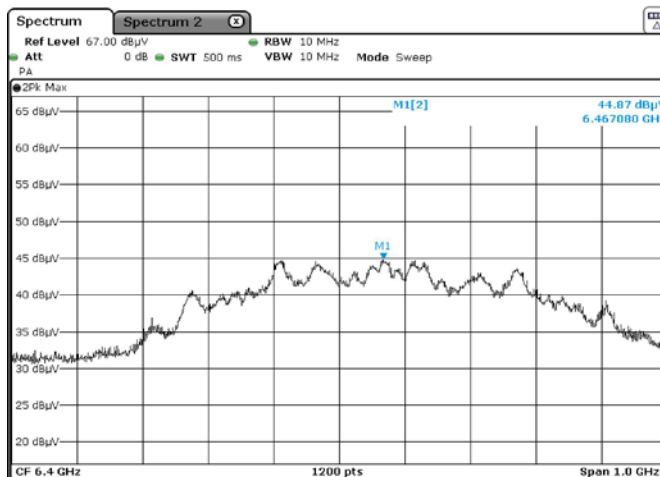
### Tabulated Results for Peak level of the emissions (Within 50MHz)

FREQ (MHz)	Receiver Amplitude (dBμV)	Total Factor (dB)	Field Strength (dBμV/m)	Equivalent EIRP (dBm)	RBW (MHz)	Limit EIRP (dBm)	Margin (dB)	Result / Comments
4170.42	48.0	36.8	75.3	-	10MHz	-	-	-
4170.42	56.0	36.8	83.3	<b>-10.0</b>	40MHz	0	<b>-10.0</b>	<b>Pass (3)</b>
6467.08	44.9	42.1	77.5	-	10MHz	-	-	-
6467.08	52.2	42.1	84.8	<b>-8.5</b>	40MHz	0	<b>-8.5</b>	<b>Pass (3)</b>
<b>Measurement distance:</b>			3m					
<b>Measurement detector:</b>			Peak					
<b>Wide Measurement Uncertainty:</b>			± 5.6dB (k=2)					
<b>RESULT:</b>			PASS					
<b>Notes:</b>			<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:  <math>FS = RA + AF + CF - AG</math>            Where FS = Field Strength            RA = Receiver Amplitude            AF = Antenna Factor            CF = Cable Factor            AG = Amplifier Gain            Total factor (dB) is <math>AF + CF - AG</math></p> <p>(2): <math>EIRP (dBm) = Field Strength (dBμV/m) - 95.2dB</math></p> <p>(3): The equivalent EIRP is increased by a the following RBW factor:  <math>20\log(50/40) = 1.94dB</math> (40MHz RBW used instead of 50MHz)            40MHz RBW used with in zero span mode on highest level observed.</p> <p>(4): 3-axis measurement performed for device under test.</p> <p>(5): Measures have been done at 1m distance and corrected according to requirements of 15.209.e) (<math>M@3m = M@1m - 9.54dB</math>)</p>					

## Graphical representation of Peak Power within 50MHz bandwidth



Chan 2



Chan 5

Frequency band investigated:	3993.6MHz and 6489.6MHz
RBW :	10MHz (40MHz RBW measure performed with zero span on marker)
Measurement detector:	Peak

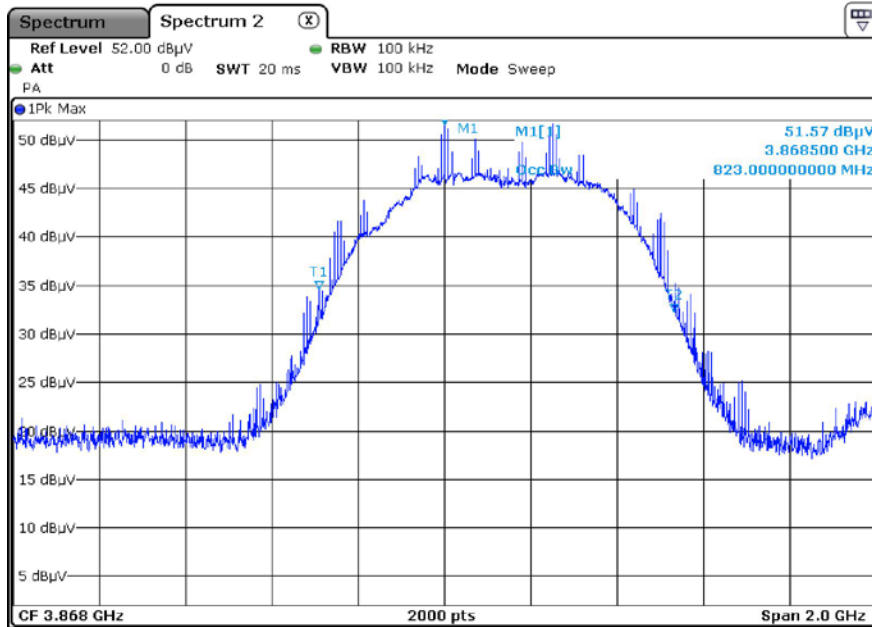
**12. Occupied bandwidth (99%)**

<b>TEST: Occupied bandwidth (99%) / RSS-GEN</b>			<b>Verdict</b>
<p><u>Method:</u> The setup is in an anechoic chamber. The spectrum analyzer is connected to the measuring antenna. A radiated measurement is performed.            The RBW is set in the range of 1% to 5% of the occupied bandwidth, with VBW <math>\geq 3 \times</math> RBW.            The SPAN is wide enough to capture all products of the modulation process.            A MaxHold Peak detector is used.            Measure is performed with OBW 99% function of the spectrum analyser.            The tested equipment is set to transmit operation with modulation on low and high channels.</p>			<b>Pass</b>
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	20 to 30 °C	23°C $\pm$ 2	
Relative Humidity	25 to 70 %	63% $\pm$ 5	
Supplementary information: Test location: SMEE Test date: June 4 <sup>th</sup> , 2018. Tested by L. CHAPUS Power supply voltage: 3V DC from batteries			

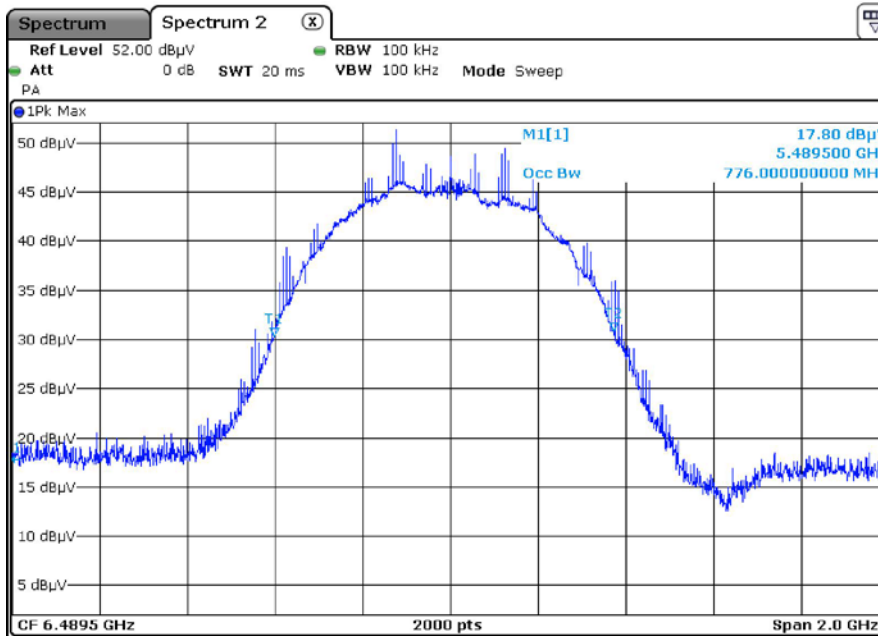
<b>Test Equipment Used</b>					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7
RF cable	Pasternack	PE302-120	CAB-131-024	2017/3	2018/3
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2017/3	2018/3
Anechoic chamber	COMTEST	214263	CAG-141-001	2017/6	2020/6
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/3	2020/3

<b>Tabulated Results for Occupied Bandwidth</b>	
<b>Frequency (MHz) / Channel</b>	<b>99% Occupied Bandwidth (MHz)</b>
3993.6 / Chan 2	823.0
6489.6 / Chan 5	776.0

## Graphical representation of Occupied Bandwidth (99%)



Chan 2



Chan 5

Frequency band investigated:	3993.6MHz and 6489.6MHz
RBW :	100kHz
Measurement detector:	Peak