

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

Matériel testé :
Equipment under test:

IDENTEC SOLUTIONS / i-PORTM352 SAT (Module RF)
(Trademark / Marketing name or product reference)

Client / Demandeur: **IDENTEC SOLUTIONS AG**
Customer / Applicant : Millennium Park 2
A-6890 Lustenau - Austria

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

Numéro d'affaire : 12099
Work number :

Référence de la proposition : 082017-22617
Proposal number:

Date de l'essai : 28 au 30 mars 2018 / 12 september 2018
Date of test: March 28th to 30th, 2018 / September 12th, 2018

Objectif des essais : EMC qualification according 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)

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 26 th , 2018	Initial Edition	Laurent Chapus	Régis ANCEL
2	September 12 th , 2018	TCB review (ATCB022997)		

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1. Normatives References

FCC qualification following:		
Standards	Applied	Title
ANSI C63.4 (2014)	X	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C63.10 (2013)	X	American National Standard for Testing Unlicensed Wireless Devices
CFR47, Part 15	X	Telecommunication – Federal Communication Commission – Radio frequency devices, Sections 15.207 / 15.209 / 15.247

Note: Following guidances are used

- DTS Measurement Guidance 558074 D01 v04
- Determining ERP and EIRP Guidance 412172 D01 v01r01

Deviation from standards: None.

2. Test synthesis

TEST	Paragraph number FCC Part 15 /	Spec. FCC Part 15	RESULTS (comments)
Conducted emissions test	15.207 (a)	15.207 (a)	PASS
Radiated emission test	15.209 (a)	Table 15.209 (a)	PASS
6dB Bandwidth	15.247 (a) (2)	At least 500kHz	PASS
Fundamental emission output power	15.247 (b) (3)	1W max / 30dBm (Conducted) 4W max / 36dBm (EIRP)	PASS
Maximum Power Spectral Density	15.247 (e)	8dBm in a 3kHz band segment	PASS
Unwanted emissions into Non Restricted Frequency Bands	15.247 (d) /	-20dBc in any 100kHz outside frequency band.	PASS
Unwanted emissions into Restricted Frequency Bands	15.209 / 15.247 (d) / 15.205	<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

- General conclusion:**

Measures and tests performed on the sample of the products i-PORTM352 SAT (Module), in configuration and description presented in this test report, show compliance with standards FCC CFR 47, PART 15, Subpart C.

3. Equipment Under Test (EUT)

Nom /
Identification

**IDENTEC SOLUTIONS / i-PORTM352
SAT (Module)**

Sn: 0052

FCC ID:

OO4-ILR-IPM352SA

Alimentation /
Power supply

24V DC for RS422 interface board
3.3V for RF module

Auxiliaires /
Auxiliaries

- Interface board RS422 IDENTEC SOLUTIONS / i-Port-M-IF-422 Sn: 000003
- Power supply adapter XP-POWER (Class I with PE)
Model: VEC65US24
- Laptop PC ASUS – F200M (KX529H) with its power supply adapter
- USB to RS422 converter

Entrées-Sorties /
Input / Output

	Câbles pour essai / Cables for test	Blindé / Shielded	Prévu pour >3m / Intended for >3m
Antenna Port 1 (SMA)	None	Coaxial	No
Antenna Port 2 (SMA)	None	Coaxial	No
Auxiliary ports:			
- RS422	5m, RJ45	Yes	Yes
- DC port	1.8m, 2 wires	No	No

Version programme /
Firmware version

V102.03

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

Programme de test /
Test program /

Gen3 Tag Certification v1.0.0.19789

• Equipment information:

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: Half wave dipole antenna (COMPOTEK CTA 2450/5/DR/SM/W1)
- Antenna Gain: 5.0dBi (Max. gain)

4. Test conditions

Power supply voltage:

Equipment under test : 24V DC from external power supply (RS422 board)

5. Modifications of the EUT

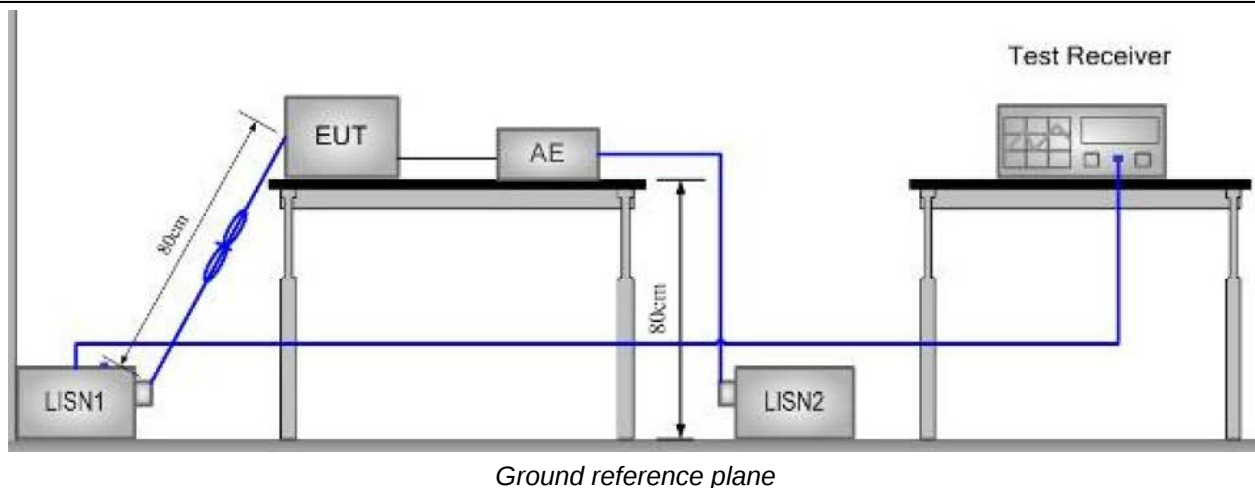
None

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

TEST: Limits for conducted disturbance 150kHz – 30MHz				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		20 to 30 °C		23°C ± 2
Relative Humidity		25 to 70 %		40% ± 5
Fully configured sample scanned over the following frequency range		Frequency range on each side of line		Measurement Point
		150kHz to 30MHz		AC input port (110V) Power adapter
Limits				
Frequency (MHz)	Limit dB (µV)			
	Quasi-Peak	Result	Average	Result
0.15 – 0.50	66 \ 56	PASS	56 \ 46	PASS
0.50 - 5	56	PASS	46	PASS
5 – 30	60	PASS	50	PASS
Supplementary information: Test location: SMEE Test date: March 28 th , 2018. Tested by L. CHAPUS Power supply voltage: 110V/60Hz to power adapter				

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Attenuator / limiter	SMEE	ATT#2	ATT-171-010	2017/6	2018/6
Cable RF	Div	1m	CAB-101-021	2017/4	2018/4
LISN (50Ω / 50µH) (Meas.)	AFJ	LS16C	RSI-101-001	2017/6	2019/6
Measuring receiver	Rohde&Schwarz	ESRP	REC-151-002	2017/3	2019/3
EMC Software	NEXIO	BAT EMC V3.8	SOF-101-001	-	-
AC power supply	PACIFIC POWER	AMX-125	101-002	-	-

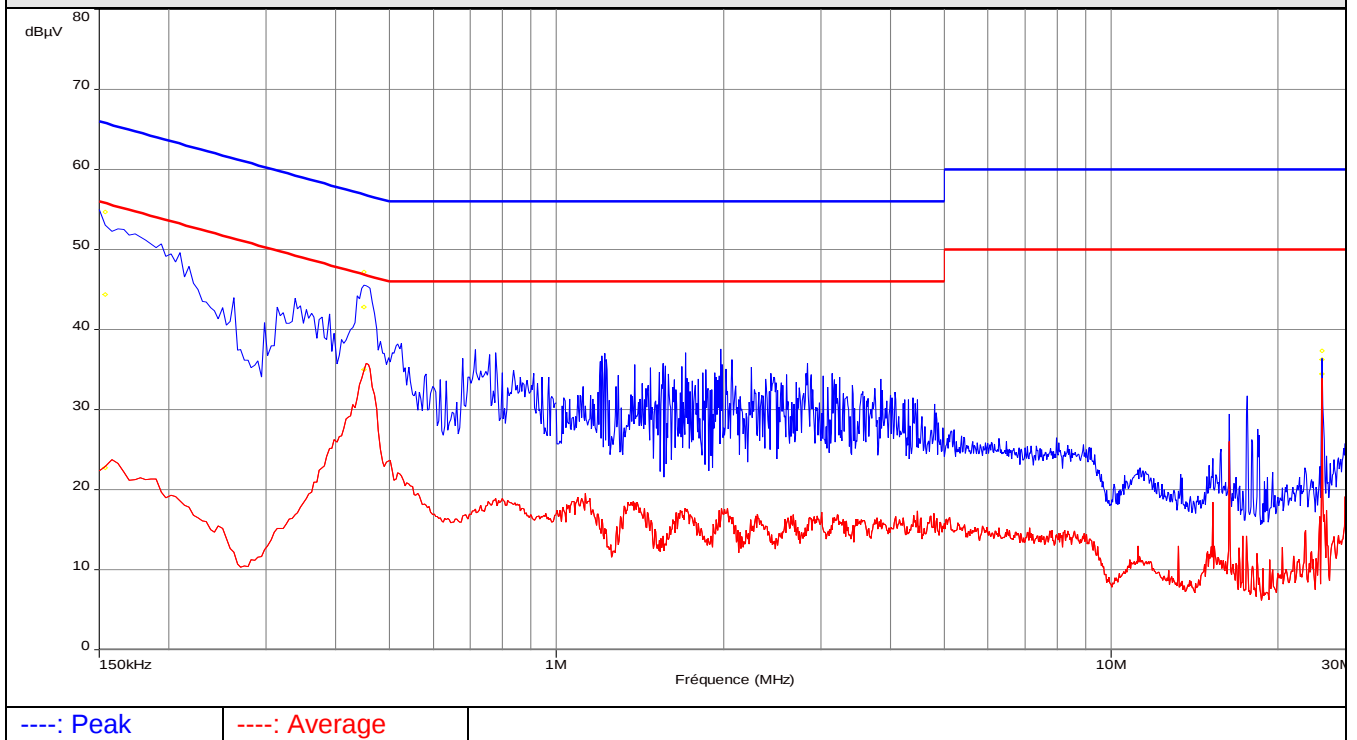
Test Setup for conducted emission



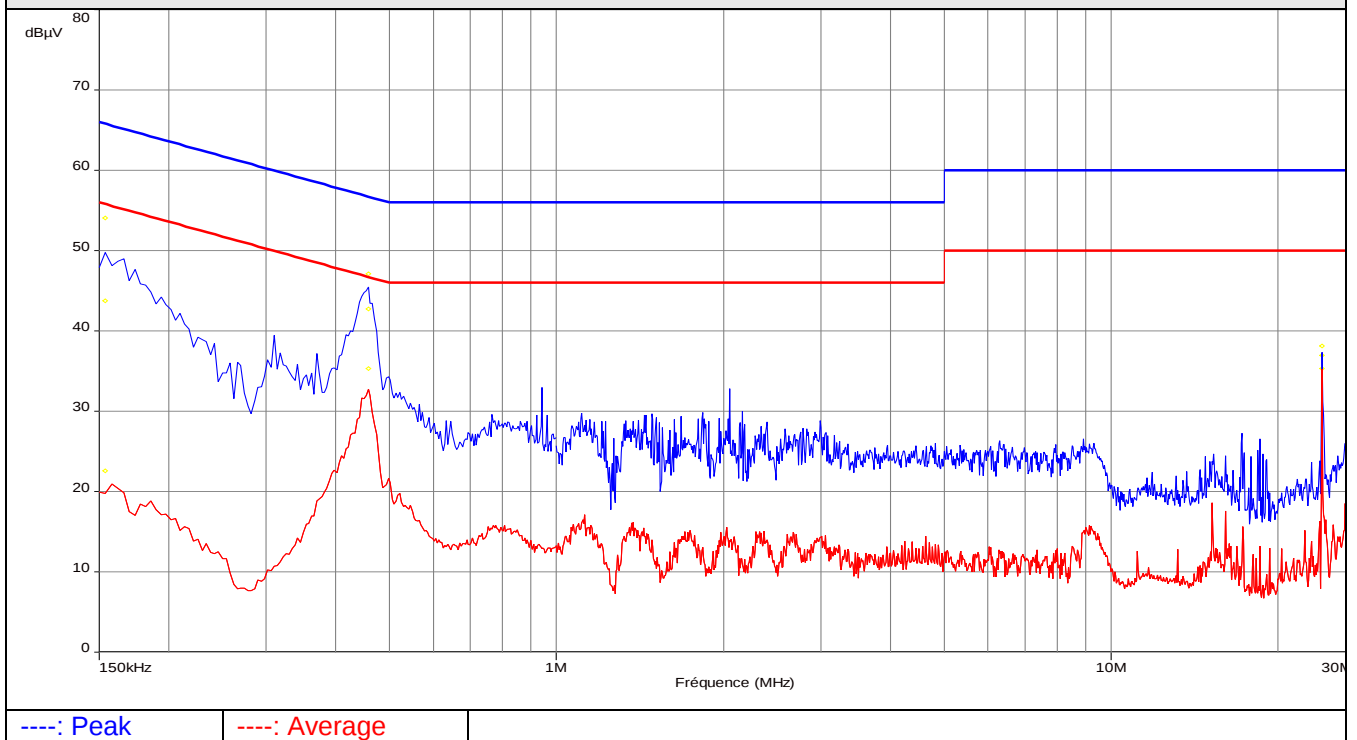
Tabulated Results for Mains Terminal Disturbance Voltage on AC port

FREQ (MHz)	Meas. PK (dBμV)	Mes. QP (dBμV)	LIMIT QP (dBμV)	Margin QP (dB)	Mes. AV (dBμV)	LIMIT AV (dBμV)	Margin AV (dB)	Line
0.154	54.7	44.4	65.8	-21.4	22.7	55.8	-33.1	L1
0.450	47.2	42.8	56.9	-14.1	35.0	46.9	-11.9	L1
24.001	37.3	36.2	60.0	-23.8	34.5	50.0	-15.5	L1
0.154	54.1	43.7	65.8	-22.1	22.6	55.8	-33.2	Neutral
0.458	47.1	42.8	56.7	-14.0	35.3	46.7	-11.4	Neutral
24.001	38.2	37.0	60.0	-23.0	35.3	50.0	-14.7	Neutral
Frequency band investigated:			150kHz-30MHz					
RBW:			9kHz					
Voltage:			110V/60Hz					
Limit:			FCC Part 15.209 a)					
Final measurement detector:			Quasi-Peak and CISPR Average (AV)					
Wide Measurement Uncertainty:			± 3.5dB (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 (A negative margin shows compliance to limit) Same results for all running mode (Antenna port 1 and port 2)					

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



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



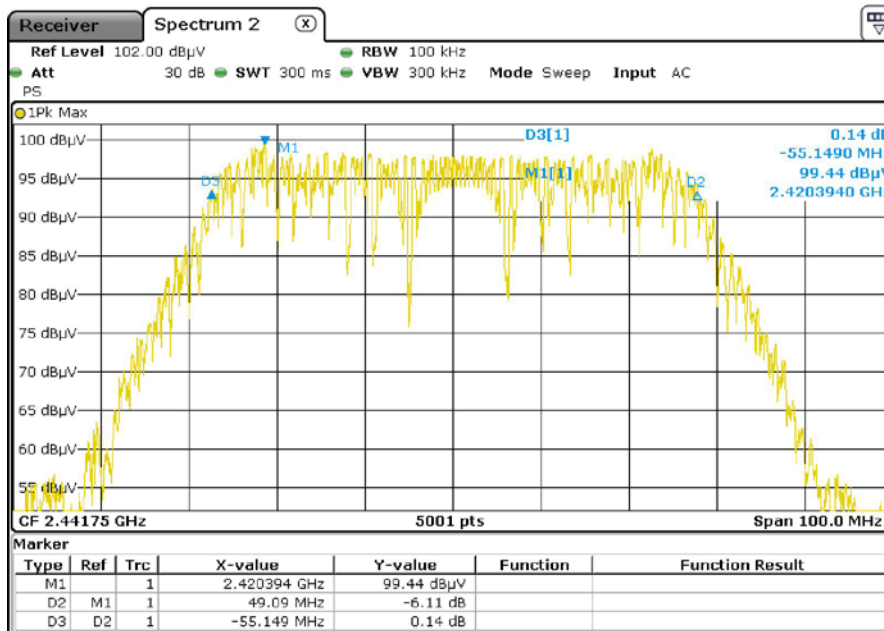
7. DTS Bandwidth

TEST: 6dB Bandwidth			Verdict
Method: RF Output of EUT is connected directly to a spectrum analyser. A conducted measurement is performed. The RBW is 100kHz, with VBW ≥ 3 x RBW. The SPAN is wide enough to capture all products of the modulation process. A MaxHold Peak detector is used. The tested equipment is set to transmit operation with modulation.			Pass
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	10 to 40 °C	24°C ± 2	
Relative Humidity	10 to 90 %	57% ± 5	
Limits – FCC Part 15.247 (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: September 12 th , 2018. Tested by L. CHAPUS			

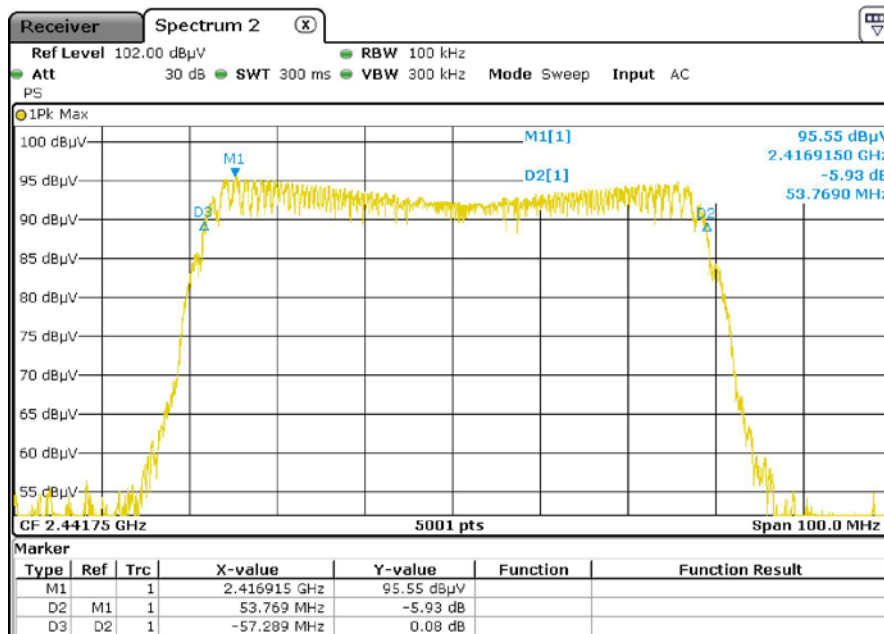
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec	Rohde&Schwarz	ESRP	REC-151-002	2017/3	2019/3

Tabulated Results for Occupied Bandwidth		
Frequency (MHz)	6dB Bandwidth (kHz)	Result
2441.75	55 149 kHz	Pass (1Mb/s data rate)
2441.75	57 289 kHz	Pass (0.25Mb/s data rate)

Graphical representation of 6dB Bandwidth



1Mb/s Data Rate



0.25Mb/s Data Rate

Frequency band investigated: 2400MHz to 2483.5MHz

RBW : 100kHz

Measurement detector: Peak

8. Maximum conducted output power

TEST: Maximum conducted output power			Verdict
Method: A conducted measurement is performed. 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	24°C ± 2	
Relative Humidity	10 to 90 %	57% ± 5	
Limits – FCC Part 15.247 (b)			
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: September 12 th , 2018. Tested by L. CHAPUS			

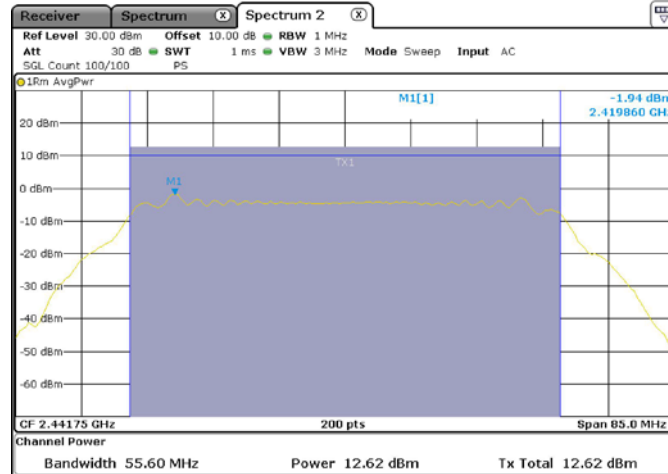
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESRP	REC-151-002	2017/3	2019/3

Tabulated Results for Maximum output power (Conducted)					
ANT1 port					
FREQ (MHz)	Measured conducted power (dBm)	Duty cycle factor (dB)	Maximum output power (dBm)	Limit (dBm)	Result
2441.75 (Data rate 1Mb/s)	12.6	5.9	18.5	30.0	Pass
2441.75 (Data rate 0.25Mb/s)	11.8	7.3	19.1	30.0	Pass
ANT2 port					
FREQ (MHz)	Measured conducted power (dBm)	Duty cycle factor (dB)	Maximum output power (dBm)	Limit (dBm)	Result
2441.75 (Data rate 1Mb/s)	12.3	5.9	18.2	30.0	Pass
2441.75 (Data rate 0.25Mb/s)	11.5	7.3	18.8	30.0	Pass
Limit:		FCC Part 15.247			
RESULT:		PASS			
Note:		- Method used as per KDB 558074 D01 DTS Meas Guidance v04 : AVGSA-2 (Trace 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			

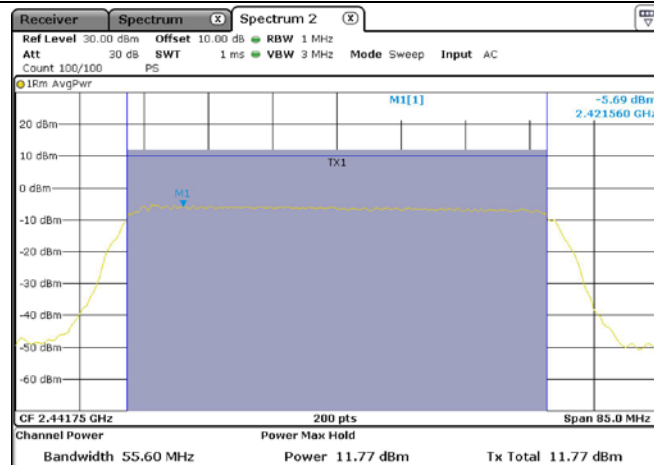
Tabulated Results for Maximum output power (Radiated)

ANT1 port					
FREQ (MHz)	Maximum output power Conducted (dBm)	Antenna Gain (dBi)	Maximum output power Radiated (dBm)	Limit (dBm)	Result
2441.75 (Data rate 1Mb/s)	18.5	5.0	23.5	36.0	Pass
2441.75 (Data rate 0.25Mb/s)	19.1	5.0	24.1	36.0	Pass
ANT2 port					
FREQ (MHz)	Maximum output power (dBm)	Antenna Gain (dBi)	Maximum output power (dBm)	Limit (dBm)	Result
2441.75 (Data rate 1Mb/s)	18.2	5.0	23.2	36.0	Pass
2441.75 (Data rate 0.25Mb/s)	18.8	5.0	23.8	36.0	Pass
Limit:		FCC Part 15.247			
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	250
Sweep time	20s (Data rate 1Ms/s) and 20s (Data rate 250ks/s)
Note:	Channel power function of the spectrum analyser used

Tabulated Results for Duty Cycle measurement

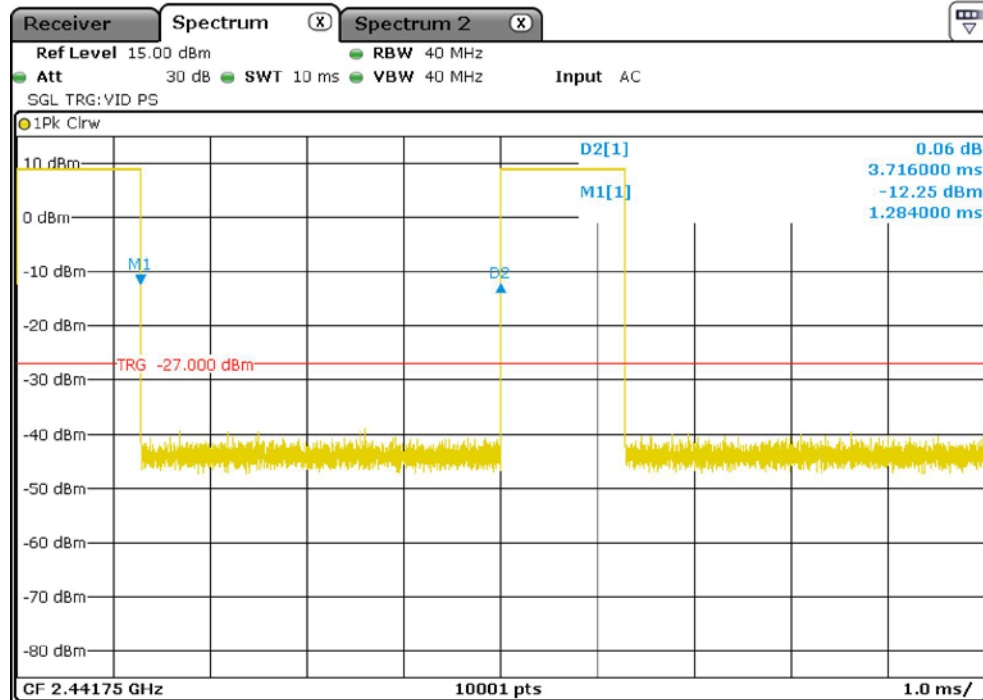
ANT1 / ANT2 access

FREQ (MHz)	Tx ON	Tx OFF	Duty Cycle (x)	10*log(1/x) (dB)
2441.75 (Data rate 1Mb/s)	1.284ms	3.716ms	0.2568	5.9
2441.75 (Data rate 0.25Mb/s)	5.071ms	21.925ms	0.1878	7.3

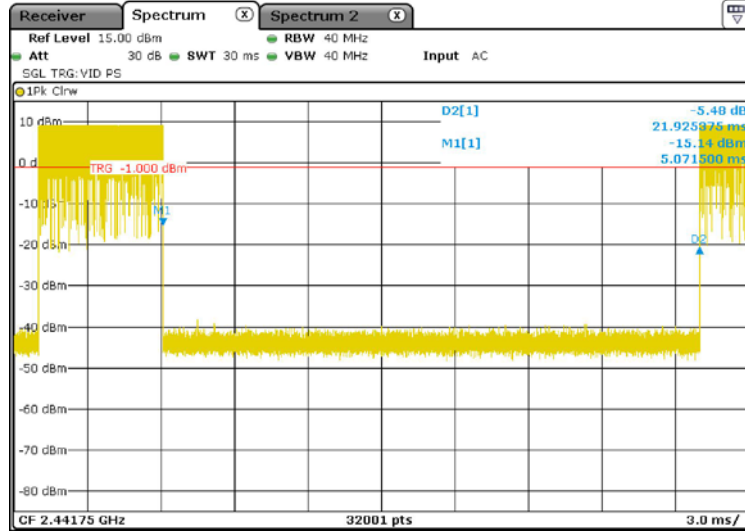
Note:

Method used as per KDB 558074 D01 DTS Meas Guidance v04:
Zero-span mode on a spectrum analyzer

Graphical Representation of Duty Cycle (Data rate 1Mb/s)



Graphical Representation of Duty Cycle (Data rate 0.25Mb/s)



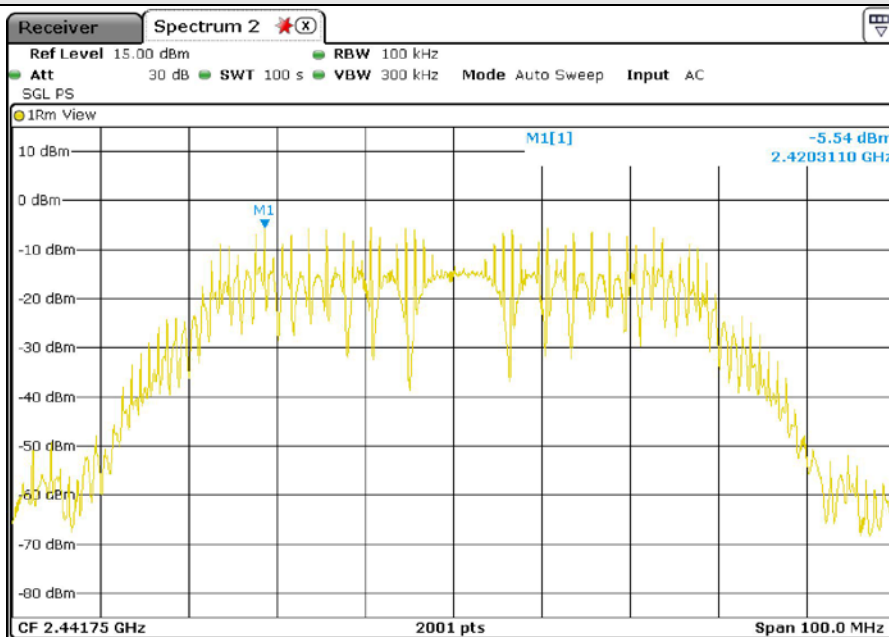
9. Maximum Power Spectral Density Level in the fundamental emission

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	23°C ± 2
Relative Humidity	10 to 90 %	40% ± 5
Limits – FCC Part 15.247 (e)		
Frequency (MHz)	Level	Limit
2441.75	8 dBm/3kHz	Pass
Supplementary information: Test location: SMEE Test date: March 28 th , 2018. Tested by L. CHAPUS		

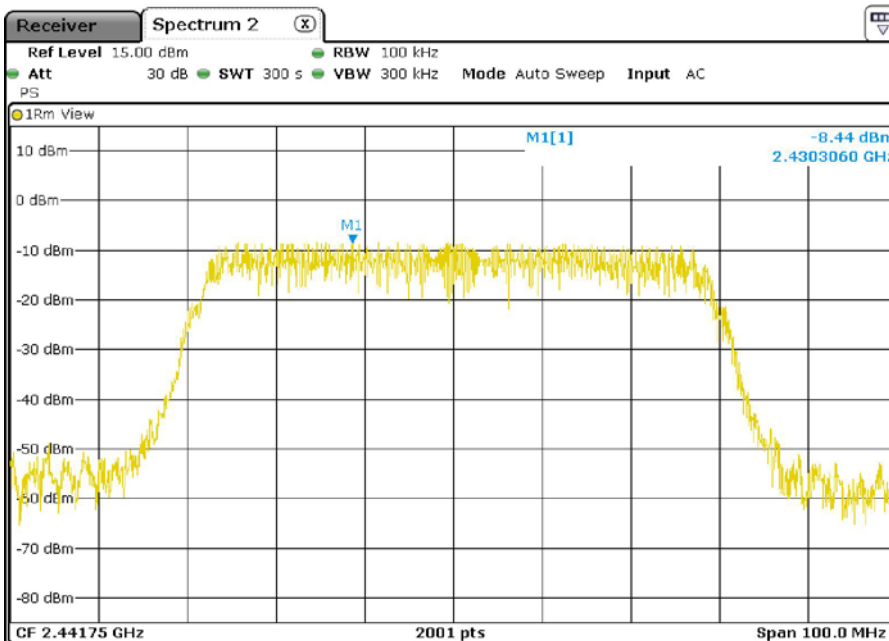
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Measuring Rec.	Rohde&Schwarz	ESRP	REC-151-002	2017/3	2019/3

Tabulated Results for Maximum Power Spectral Density					
ANT1 access					
Frequency (MHz)	PSD measured	Duty cycle factor (dB)	PSDc	Limit	Result
2441.75 (Data rate 1Mb/s)	-5.5 dBm/100kHz	5.9	0.4	8 dBm/3kHz	Pass
2441.75 (Data rate 0.25Mb/s)	-8.4 dBm/100kHz	7.3	-1.1	8 dBm/3kHz	Pass
ANT2 access					
Frequency (MHz)	PSD measured	Duty cycle factor (dB)	PSDc	Limit	Result
2441.75 (Data rate 1Mb/s)	-5.0 dBm/100kHz	5.9	0.9	8 dBm/3kHz	Pass
2441.75 (Data rate 0.25Mb/s)	-8.3 dBm/100kHz	7.3	-1.0	8 dBm/3kHz	Pass
RBW:	100kHz				
Limit:	FCC Part 15.247				
Final measurement detector:	Peak				
RESULT:	PASS				
Note:	PSDc (Corrected) = PSD measured + Duty Cycle Factor				

Graphical representation of Power Spectral Density (Antenna port 1)



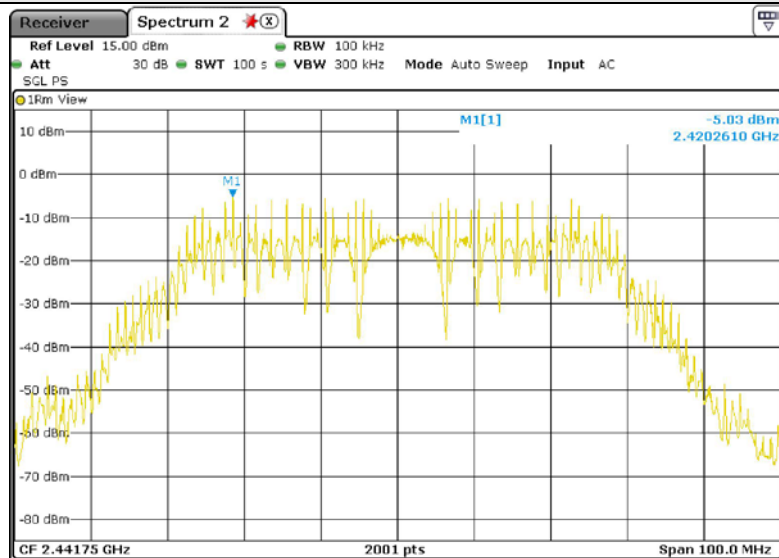
Data rate 1Ms/s



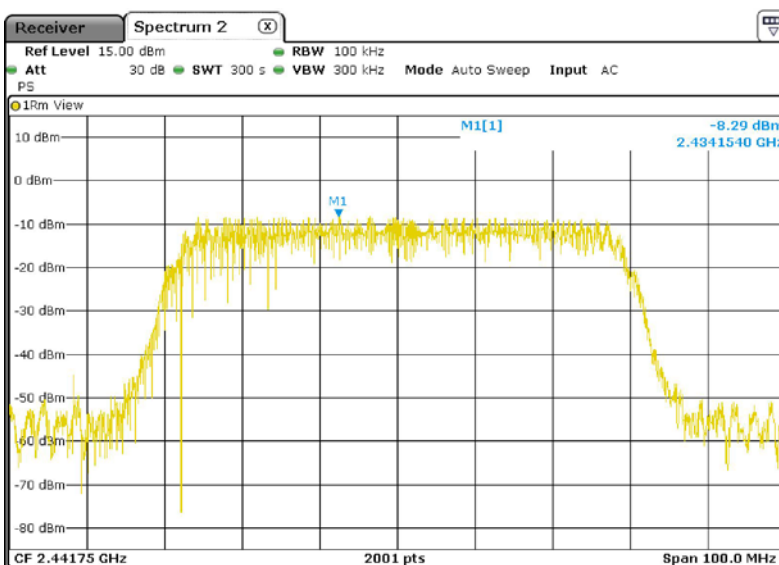
Data rate 250ks/s

Frequency:	2441.75MHz
SPAN:	100MHz
Sweep time:	100s (Data rate 1Ms/s) and 300s (Data rate 250ks/s)
RBW / VBW:	100kHz / 300kHz
Measurement detector:	RMS

Graphical representation of Power Spectral Density (Antenna port 2)



Data rate 1Ms/s



Data rate 250ks/s

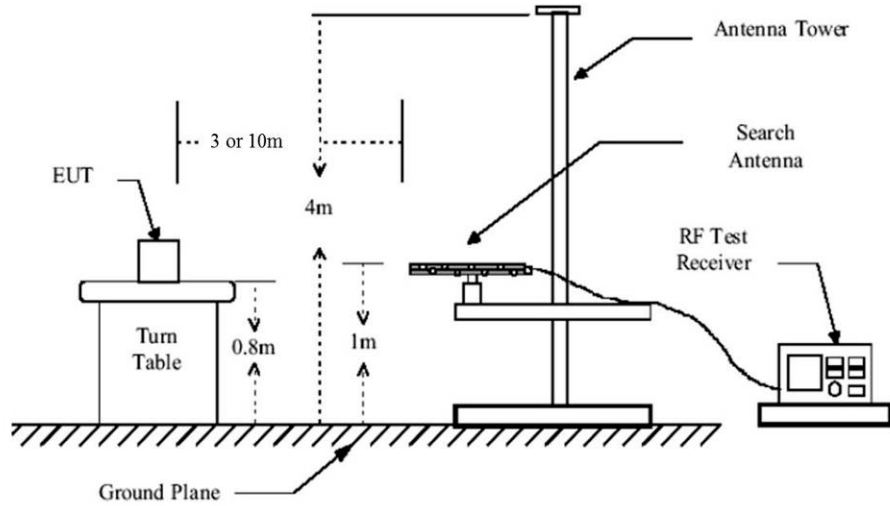
Frequency:	2441.75MHz
SPAN:	100MHz
Sweep time:	100s (Data rate 1Ms/s) and 300s (Data rate 250ks/s)
RBW / VBW:	100kHz / 300kHz
Measurement detector:	RMS

10. Unwanted emissions in Non-Restricted Frequency bands

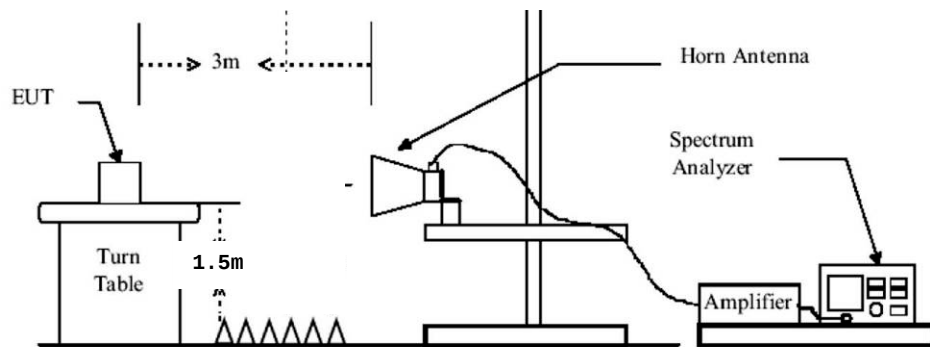
TEST: Unwanted emissions in Non-Restricted Frequency Bands			Verdict
<u>Method:</u> Measurements were made in a 3-meter Open Area Test Site (OATS). Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive 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. A pre-scan frequency identification of the EUT has been performed in full anechoic chamber. The measured radiated field of the EUT is performed (or corrected) at 3-meters of distance. Antenna is 1.25-meters high.			Pass
Laboratory Parameters:	Required prior to the test	During the test	
Ambient Temperature	10 to 40 °C	23°C ± 2	
Relative Humidity	10 to 90 %	43% ± 5	
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)			
Frequency (MHz)	Limits (dBµV/m)		
	Detector / Analyser RBW	Limit	Results
30 to 25000	Pk / 100kHz	20dB below the maximum Peak level	Pass
Supplementary information: Test location: SMEE Test date: March 30 th , 2018. Tested by L. CHAPUS			

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
Horn antenna	ETS-LINDGREN	3116	ANT-161-014	2017/12	2022/12
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/5	2019/5
RF cable	Div	OATS/25m	CAB-101-017	2017/4	2018/4
RF cable	Pasternack RF	PE302-120	CAB-131-024	2017/6	2018/6
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2017/4	2018/4
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2017/4	2018/4
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2017/6	2018/6
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
Anechoic chamber	COMTEST	214263	CAG-141-001	2017/6	2020/6
High-Pass filter	Mini-circuit	VHF-3100+	FIL-151-006	2017/6	2018/6
High-Pass filter	Mini-circuit	VHF-6010+	FIL-171-008	2017/6	2018/6
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-
Turntable	Innco- Systems	CT0800	PLA-141-001		
Pre-amplifier	PE	1524	PRE-101-002	2017/6	2018/6
Pre-amplifier	SMEE	18-40GHz	PRE-171-004	2017/12	2018/12
Measuring receiver	Rohde&Schwarz	ESRP	REC-151-003	2017/3	2019/3
OATS	Div	10m	SIT-101-001	2017/7	2020/7
EMC Software	NEXIO	BAT EMC V3.8	SOF-101-001	-	-

Test Setup for radiated emission



Test setup for 30-1000MHz

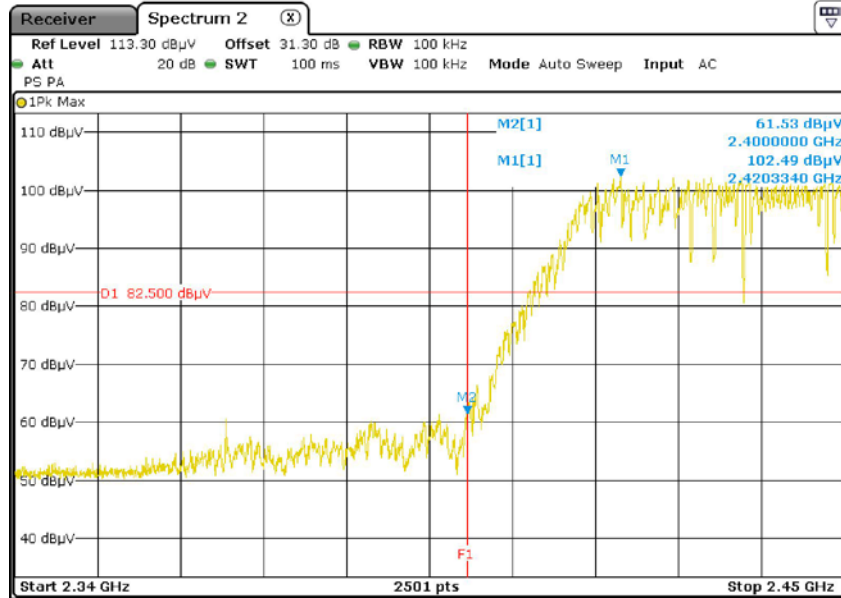


Test setup for 1-25GHz

Tabulated Results for Peak Output Power Reference level	
FREQ	Field Strength 3m
(MHz)	(dBμV/m)
2441.75	102.5
RBW:	100kHz
Measurement distance:	3m
Limit:	Ref. level only – For 15.247
Final measurement detector:	Peak
Wide Measurement Uncertainty:	± 5.6dB (k=2)
Note:	Only for identification of limit in non-restricted band Limit is 82.5 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)
2198.550	60.0	82.5	-22.5	Pass
2303.900	66.5	82.5	-16.0	Pass
RBW:	100kHz			
Measurement distance:	3m			
Limit:	For 15.247			
Final measurement detector:	Peak			
Wide Measurement Uncertainty:	± 5.6dB (k=2)			
RESULT:	PASS			
Notes:	(1): The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follow: $FS = RA + AF + CF - AG$ Where FS = Field Strength RA = Receiver Amplitude AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain Total factor (dB) is $AF + CF - AG$ Margin value = Emission level – Limit value (2): Peak pre-scans not performed at 3-meters distance are corrected as follow: $M@3m = M@D_m + 20 \times \log(D_m / 3m)$ Where D is the measurement distance in meter (3): All frequencies not specified have margin < -20dB (4): 3-axis measurement performed for device under test.			

Graphical representation of Band-edge compliance



Low bandedge compliance

F1 = 2400MHz

Total factor directly added on graphical representation (Total factor = 31.3dB)

RESULT: PASS

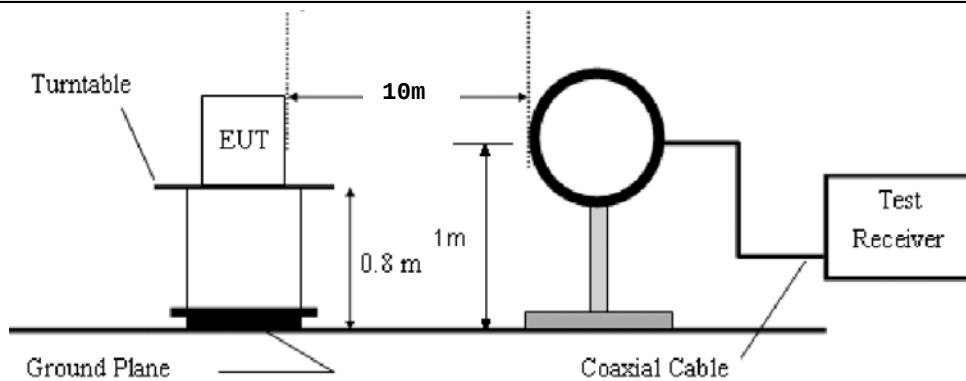
Note: Radiated measurement

11. Unwanted emissions in Restricted Frequency bands

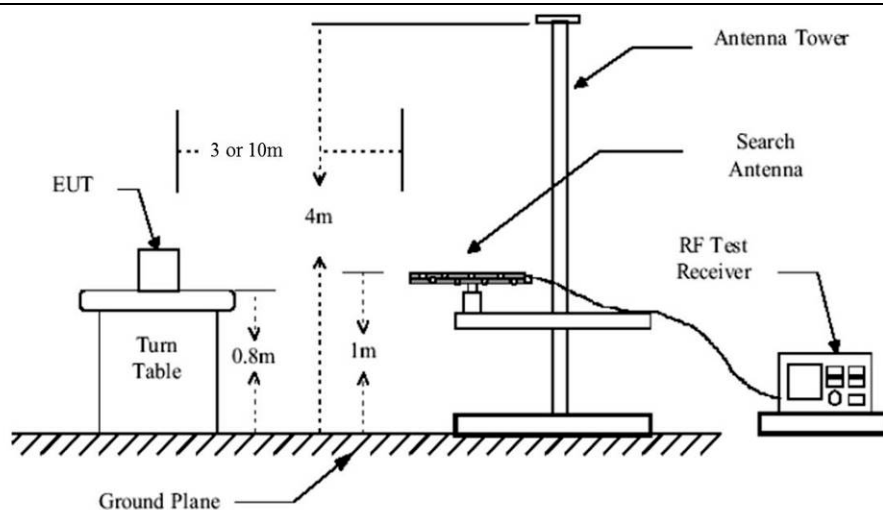
TEST: Unwanted emissions into Restricted Frequency Bands		Verdict
Method: Measurements were made in a 10 or 3-meter Open Area Test Site (OATS) that complies to ANSI C63.4. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (Peak, Quasi-peak, Average) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. A pre-scan frequency identification of the EUT has been performed in full anechoic chamber. The measured radiated field of the EUT is performed (or corrected) at 3-meters of distance. Antenna is 1.25-meters high.		Pass
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	10 to 40 °C	23°C ± 2
Relative Humidity	10 to 90 %	43% ± 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 – 25GHz	3 m measurement distance
Limits – FCC Part 15.205, 15.209 (a), 15.247 (d)		
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	Pass
0.090 to 0.110	87.6 – 85.9 / QP / 10m	Pass
0.110 to 0.490	85.7 – 72.9 / AV / 10m 105.7 – 92.9 / PK / 10m	Pass
0.490 to 1.705	52.9 – 42.1 / QP / 10m	Pass
1.705 to 30	48.6 / QP / 10m	Pass
30 to 88	40.0 / QP / 3m	Pass
88 to 216	43.5 / QP / 3m	Pass
216 to 960	46.0 / QP / 3m	Pass
960-1000	54.0 / QP / 3m	Pass
Above 1GHz	54.0 / AV / 3m 74.0 / PK / 3m	Pass
Supplementary information: Test location: SMEE Test date: March 30th, 2018. Tested by L. CHAPUS		

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
Horn antenna	ETS-LINDGREN	3116	ANT-161-014	2017/12	2022/12
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2017/5	2019/5
RF cable	Div	OATS/25m	CAB-101-017	2017/4	2018/4
RF cable	Pasternack RF	PE302-120	CAB-131-024	2017/6	2018/6
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2017/4	2018/4
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2017/4	2018/4
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2017/6	2018/6
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
Anechoic chamber	COMTEST	214263	CAG-141-001	2017/6	2020/6
High-Pass filter	Mini-circuit	VHF-3100+	FIL-151-006	2017/6	2018/6
High-Pass filter	Mini-circuit	VHF-6010+	FIL-171-008	2017/6	2018/6
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-
Turntable	Innco- Systems	CT0800	PLA-141-001		
Pre-amplifier	PE	1524	PRE-101-002	2017/6	2018/6
Pre-amplifier	SMEE	18-40GHz	PRE-171-004	2017/12	2018/12
Measuring receiver	Rohde&Schwarz	ESRP	REC-151-003	2017/3	2019/3
OATS	Div	10m	SIT-101-001	2017/7	2020/7
EMC Software	NEXIO	BAT EMC V3.8	SOF-101-001	-	-

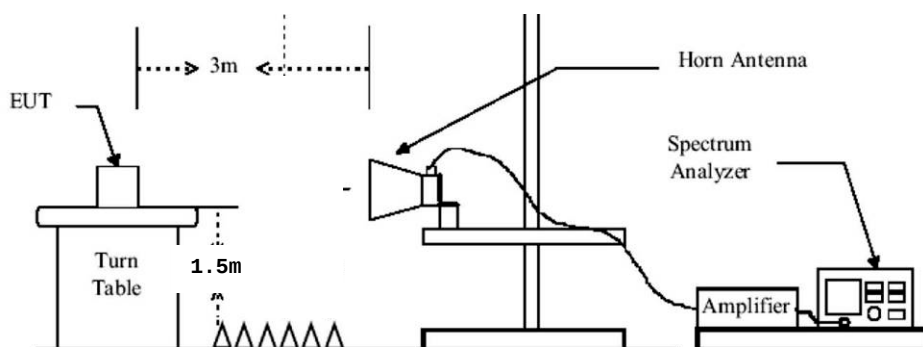
Test Setup for radiated emission



Test setup for 9k-30MHz



Test setup for 30-1000MHz



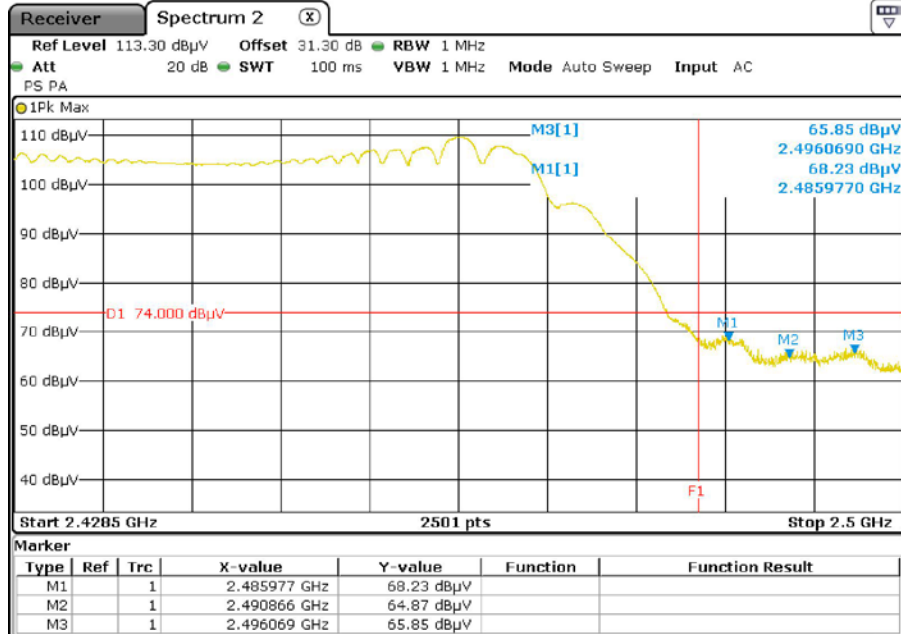
Test setup for 1-25GHz

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				
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								
Final measurement detector:		Quasi-Peak								
Wide Measurement Uncertainty:		± 5.2dB (k=2)								
RESULT:		PASS								
Field Strength Calculation:		The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follow: $FS = RA + AF + CF - AG$ Where FS = Field Strength RA = Receiver Amplitude AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain Total factor (dB) is AF + CF – AG Margin value = Emission level – Limit value								

Tabulated Results for Unwanted emissions (1GHz-25GHz)					
FREQ (MHz)	Field Strength 3m (dBμV/m)	Detector	Limit (dBμV/m)	Margin (dBμV/m)	Result
2208.100	60.7	Pk	74	-13.3	Pass
2208.100	44.7	Avg	54	-9.3	Pass
2240.300	62.2	Pk	74	-11.8	Pass
2240.300	45.7	Avg	54	-8.3	Pass
2271.900	59.5	Pk	74	-14.5	Pass
2271.900	42.9	Avg	54	-11.1	Pass
2336.030	64.7	Pk	74	-9.3	Pass
2336.030	47.7	Avg	54	-6.3	Pass
2367.900	67.6	Pk	74	-6.4	Pass
2367.900	49.8	Avg	54	-4.2	Pass
2389.000	68.3	Pk	74	-5.7	Pass
2389.000	49.8	Avg	54	-4.2	Pass
2485.970	67.7	Pk	74	-6.3	Pass
2485.970	48.2	Avg	54	-5.8	Pass
2496.300	64.5	Pk	74	-9.5	Pass
2496.300	46.3	Avg	54	-7.7	Pass
RBW		1MHz			
Measurement distance:		3m			
Limit:		FCC Part 15.205, 15.209, 15.247			
Final measurement detector:		Peak / Average			
Wide Measurement Uncertainty:		± 5.6dB (k=2)			
RESULT:		PASS			
Notes:		(1): The field strength (level) is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follow: $FS = RA + AF + CF - AG$ Where FS = Field Strength RA = Receiver Amplitude AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain Total factor (dB) is $AF + CF - AG$ Margin value = Emission level – Limit value (2): Peak pre-scans not performed at 3-meters distance are corrected as follow: $M@3m = M@D_m + 20 \times \log(D_m / 3m)$ Where D is the measurement distance in meter (3): All frequencies not specified have margin < -10dB (for peak and average detector) (4): 3-axis measurement performed for device under test.			

Graphical representation of Band-edge compliance



High bandedge compliance

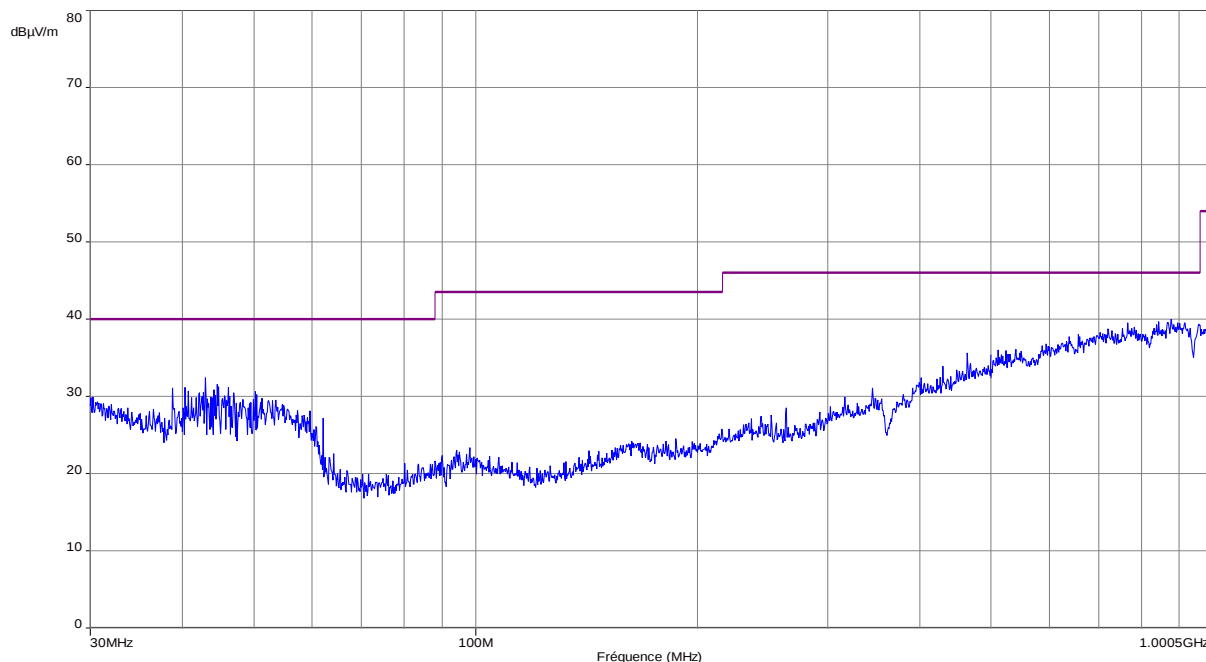
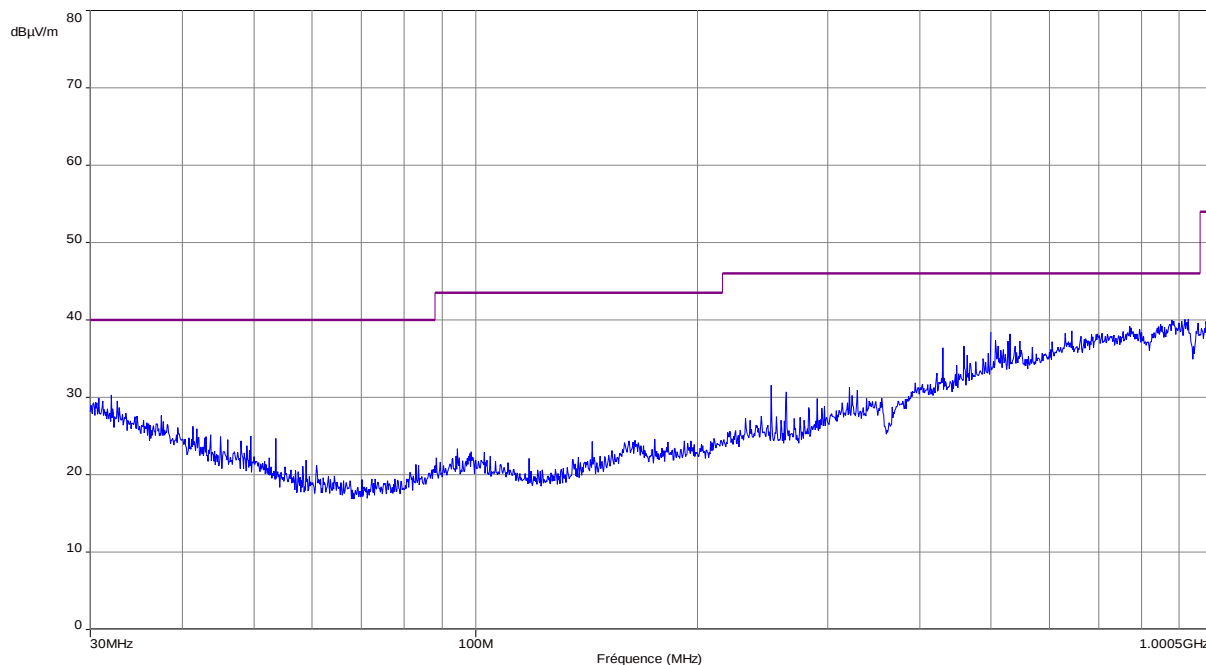
F1 = 2483.5MHz

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

RESULT: PASS

Note: Radiated measurement

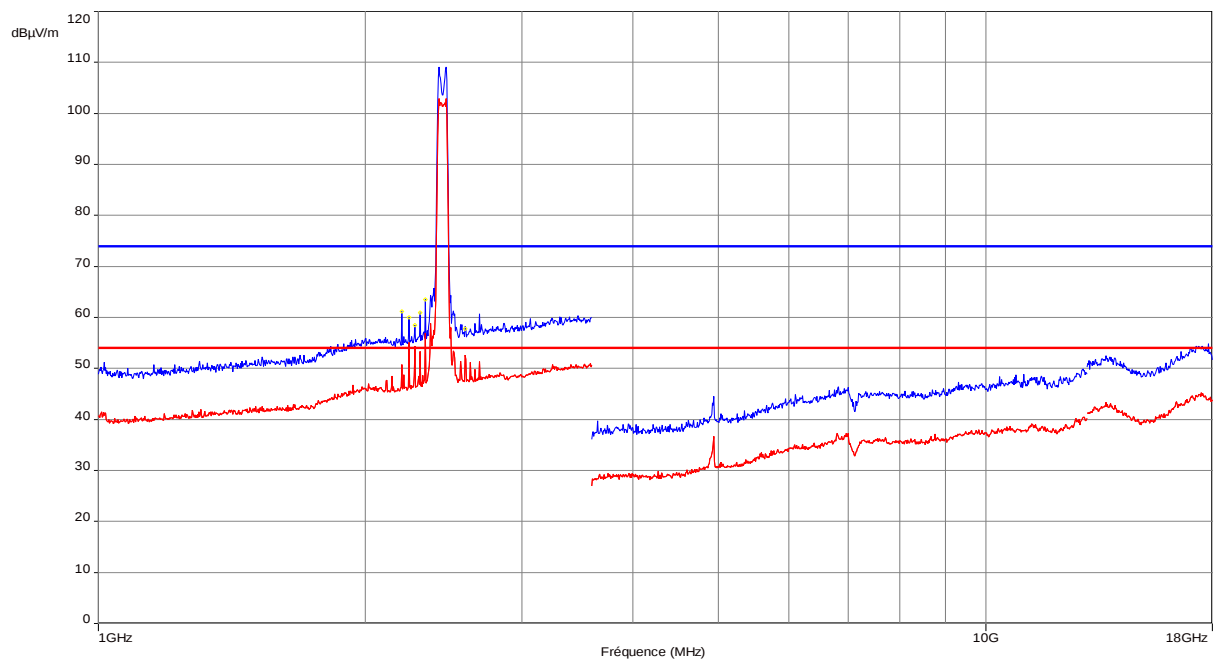
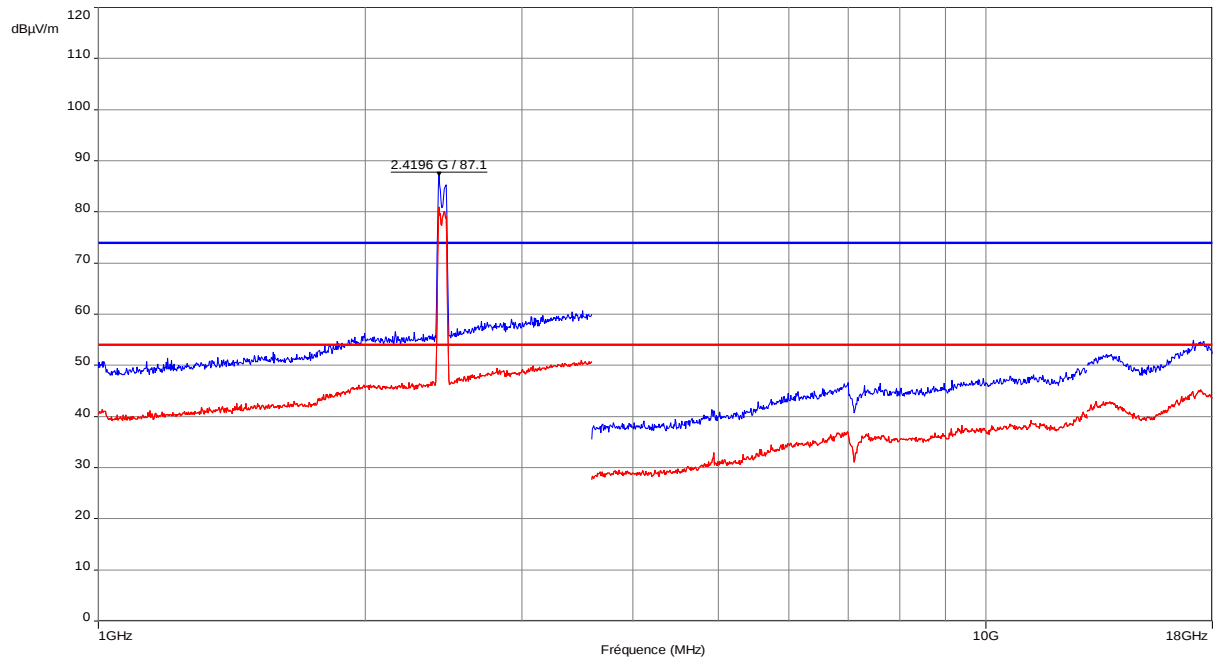
Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal & Vertical / Transmit mode)



Note: Pre-scan graph only for identification purpose.

Frequency band investigated:	30MHz-1GHz
Unit :	dBμV/m
RBW :	100kHz
Antenna polarization :	Horizontal & Vertical
Limit:	15.247
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5.6dB (k=2)

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-18GHz / 3m / Horizontal & Vertical / Transmit mode)

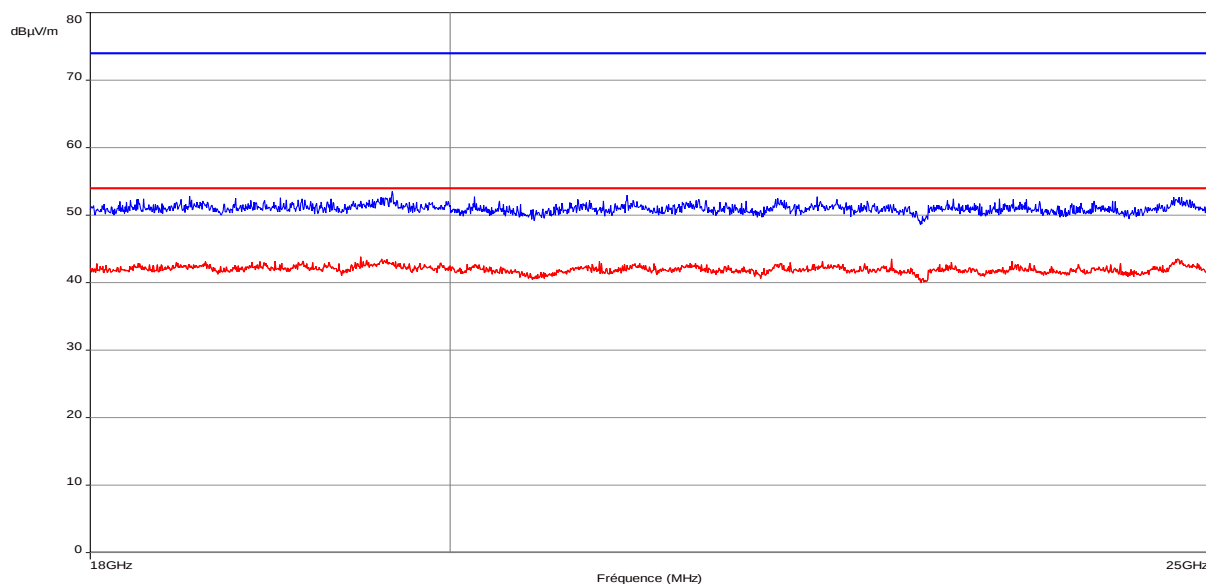
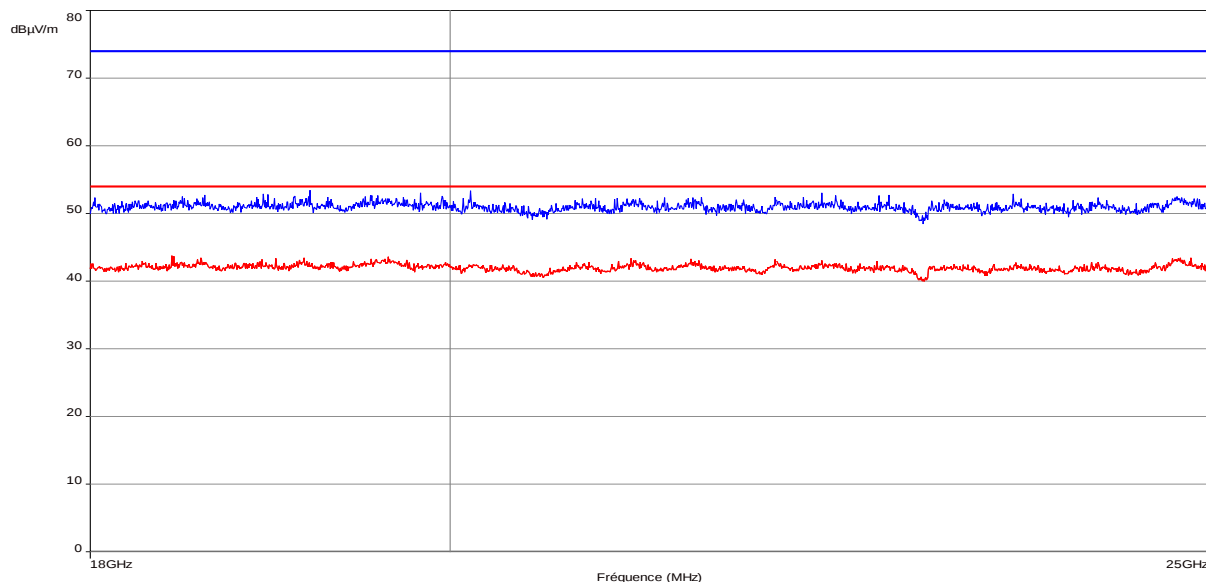


Note: Pre-scan graph only for identification purpose.

Frequency band investigated:	1GHz-18GHz
Unit :	dBμV/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5.6dB (k=2)

MARKER LIST		
FREQUENCY (MHz)	LEVEL (dBμV/m)	Polarization
2198.08	61.1	Vertical
2240.2	60.0	Vertical
2272.18	58.5	Vertical
2304.16	60.9	Vertical
2335.88	63.5	Vertical
2591.98	57.8	Vertical

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
Limit:	15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5.6dB (k=2)