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Matériel testé : HECTOR
Equipment under test:

Constructeur: CAPTIV

Manufacturer: 2 route de Carquefou

44300 NANTES - France

Rapport délivré à : CAPTIV

Issued to: M. Valentin ROY

2 route de Carquefou 44300 NANTES - France

Référence de la proposition :

Proposal number:

122015-21779

Date de l'essai : Du 8 au 18 février 2016

Date of test: February 8th to 18th, 2016

Objectif des essais : EMC qualification accordingly to following standards:

Test purpose: - CFR 47, FCC Part 15, Subpart C

(Chapter 15.247 - Operation within the bands 902-928 MHz, 2400-2483.5 MHz,

and 5725-5850 MHz)

FCC ID: 2AHFAHECTOR

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 2	March 24 th , 2016 April 10 Th , 2016	Initial Edition Added informations	Jeremy Blancher	Laurent Chapus

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COORDONNEES



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1. Normatives References

Standard: FCC CFR 47, PART 15, Subpart C (Clause 15.247)

ANSI C63.4 (2014): American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.10 (2013): American National Standard for Testing Unlicensed Wireless Devices

DTS Measurement Guidance 558074 D01 v03r04

Determining ERP and EIRP Guidance 412172 D01 v01r01

2. Test synthesis

TEST	Paragraph number FCC Part 15	Spec. FCC Part 15	RESULTS (comments)
Conducted emissions test	15.107 (a)	Table 15.107 (a)	N/A (1)
Radiated emission test	15.109 (a)	Table 15.109 (a)	N/A (2)
6dB Bandwidth	15.247 (a) (2)	At least 500kHz	PASS
Maximum Peak Output Power	15.247 (b) (1)	0.125W max / 21dBm (Conducted) 0.500W max / 27dBm (EIRP)	PASS
Maximum Power Spectral Density	15.247 (e)	8dBm in a 3kHz band segment	PASS (3)
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	Measure at 300m 9-490kHz: 2400μV/m/F(kHz) Measure at 30m 0.490-1.705: 24000μV/m/F(kHz) 1.705-30MHz: 30μV/m Measure at 3m 30MHz-88MHz: 40 dBμV/m 88MHz-216MHz: 43.5 dBμV/m 216MHz-960MHz: 46.0 dBμV/m Above 960MHz: 54.0 dBμV/m	PASS

N/A: Not Applicable

(1): No cable

General conclusion:

Measures and tests performed on the sample of the product HECTOR, in configuration and description presented in this test report, show compliance with standards FCC CFR 47, PART 15, Subpart C.

^{(2):} Equipment functioning only with RF function

^{(3):} Test not required. Maximum Peak Output power complies with the PSD limit. See Clause 11.10.1 of ANSI C63.10 (2013).



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3. Equipment Under Test (EUT)

Nom / HECTOR Sn: N.C

Alimentation / 3V dc from internal battery (CR2032)

Power supply

Auxiliaires / SAMSUNG Android tablet, model GALAXY Tab A 9.7" (SM-T550)

Auxiliaries (Bluetooth BLE4.1 communication)

Entrées-Sorties / Câbles pour essai / Blindé / Prévu pour >3m / Input / Output Shielded Intended for >3m / Shielde

Version programme / N

Firmware version

N.C

Mode de fonctionnement /

Running mode

The tested sample is able to:

- Transmit a carrier frequency on low, middle and high channels (Bluetooth Low
- Energy
- Be in Receiver mode (no transmission)Be in standby mode (no transmission)

Programme de test / Test program / "Hector" application on Android tablet

• Equipment information:

- ISM Frequency band: 2400 to 2483.5 MHz (Tx & Rx, Wideband Data Transmission systems)
- Bluetooth chip: TEXAS INSTRUMENT, model CC2541 (Bluetooth 4 BLE)
- Antenna type: Integral (PIFA antenna, max peak gain 0dBi)
- Powered by 3V DC from internal battery (CR2032)
- Equipment intended for use as a fixed station
- Equipment designed for continuous operation

4. Test conditions

Relative Humidity : 55% Temperature : 20°C

Power supply voltage:

Equipment under test : 3V DC from CR2032 battery

5. Modifications of the EUT

None

6. Special accessory

None



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7. 6dB Bandwidth

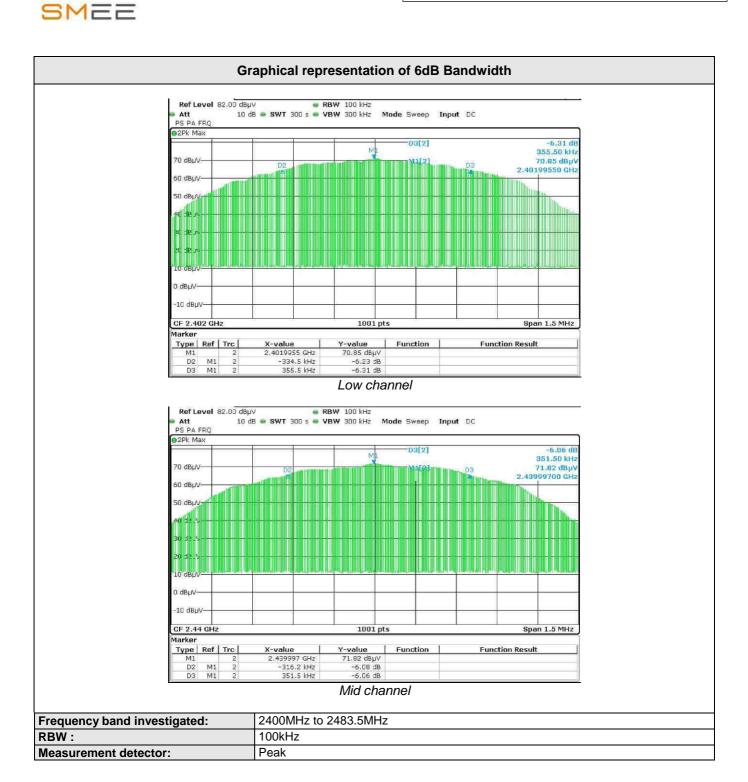
TEST: 6dB Bandwidth / FCC part		Verdict				
Method: The setup is in an anechoic chamber. The spectrum analyzer is connected to the measuring antenna. The tested equipment is set to transmit operation with modulations on lowest, middle and highest channel.						
Laboratory Parameters:	Required prior to the test	During	the test			
Ambient Temperature	10 to 40 °C	20°C				
Relative Humidity	10 to 90 %	55%				
	Limits – FCC Part 15.247 (a)					
Frequency (MHz)	Level for Bandwidth	Li	mit			
2402.0						
2440.0	2440.0 6dB below the maximum output power At least 500kH.					
2480.0						
Supplementary information:						

Supplementary information: Test location: SMEE – CE Mesures / Test date: February 9th, 2016 Power supply voltage: 3V from battery (fully charged)

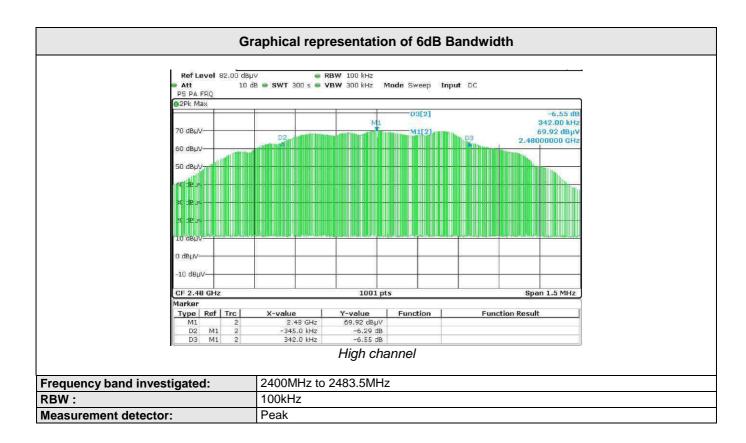
Test Equipment Used								
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due			
Measuring Rec.	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7			
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7			
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2015/3	2016/3			
RF cable	Pasternack	PE302-120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

Tabulated Results for Occupied Bandwidth				
Frequency (MHz)	6dB Bandwidth (kHz)	Result		
2402.0	690.0 kHz	Pass		
2440.0	667.7 kHz	Pass		
2480.0	687.0 kHz	Pass		











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8. Maximum Peak Output power

TEST: Maximum peak conducted output power / FCC part 15.247 Method: Measurements were performed with peak detector using a 1MHz RBW. The VBW is set to 3MHz. The spectrum analyzer is connected via suitable means to the RF output of the tested equipment. (Conducted measurement). For field strength, the measure is performed on a 3m Open Area Test Site. The tested equipment is set to transmit operation with modulations on lowest, middle and highest channel. Pass						
Laboratory Parameters:	Required prior to the test	Required prior to the test During the test				
Ambient Temperature	10 to 40 °C	20°C				
Relative Humidity	10 to 90 %	55%				
	Limits – FCC Part 15.247 (b)					
	Limits (c	dBμV/m)				
Frequency (MHz)	Level / Detector / Distance	Result	6			
2400 to 2483.5	27 dBm / Pk / 3m (Radiated)	Pass				
2400 to 2483.5	21 dBm / Pk (Conducted)	Pass				

	Test Equipment Used							
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due			
Measuring Rec.	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7			
Horn antenna	ETS-LINDGREN	3115	ANT-141-013	2015/7	2018/7			
RF cable	Div	OATS/25m	CAB-101-017	2014/3	2015/3			
OATS	Div	3 / 10m	SIT-101-001	2014/5	2015/5			
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-			
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-			



Tabula	ated Resu	Its for Maxin	num peak output pov	wer (Radiated r	measurement)		
FREQ	Field S	trength 3m	Calculed EIRP	Limit	Result		
(MHz)	(dE	βμV/m)	(dBm)	(dBm)			
2402	,	05,6 0,3 27.0 Pass					
2440		95,2	-0,1	27.0	Pass		
2480	•	95,5	0,2	27.0	Pass		
RBW:		1MHz					
Measurement distance:		3m					
Limit:		FCC Part 15	5.247 (b)				
Final measurement detec	tor:	Peak					
Wide Measurement Unce	rtainty:	± 5.2dB (k=2	2)				
RESULT:		PASS					
Note:		3m. Three horizontal arthe maximum The power (EIRP = (E x Where D is measured	orthogonal axis mend vertical antenna (non peak field strength. EIRP) was calculated d)²/30	asurements ar neasure) polarizusing the followers from which	est Site at a distance of the performed for both exation in order to obtain wing equation: the field strength was		

Tabulated Results for Maximum peak output power (Conducted)							
FREQ Calculated EIRP Calculated conducted power Limit Result							
(MHz)	(dBm)	(dBm)	(dBm)				
2402	0,3	0,3	21.0	Pass			
2440	-0,1	-0,1	21.0	Pass			
2480	0,2	0,2	21.0	Pass			
Note:	e: Conducted power is calculated from EIRP with antenna gain of 0dBi.						



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Unwanted emissions in Non-Restricted Frequency bands

TEST: Unwanted emissions in Non	-Postricted From	ioney Bands / ECC part	15 247	Vordict		
TEST: Unwanted emissions in Non	-Restricted Frequ	ency bands / FCC part	15.247	Verdict		
Method: Measurements were made in a 3-meter Open Area Test Site (OATS) that complies to ANSI C63.4. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 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 realised at 3-meters of distance. Antenna is 1.25-meters high.						
Laboratory Parameters:	Required prior to the test During the test					
Ambient Temperature	10	20°C				
Relative Humidity	10	0 to 90 %	55%			
Fully configured sample scanned	Frequency range on each side of line		Measurement Point			
over the following frequency range	30M	Hz – 25GHz	3 m measurement distance			
	Limits – FCC I	Part 15.247 (d)				
		Limits (dBµV/n	n)			
Frequency (MHz)	Detector / Analyser RBW	Limit	Resul	ts		
30 to 25000	Pk / 100kHz	Pk / 100kHz 20dB below the maximum Peak level Pass				
Supplementary information:		2040				

Test location: SMEE – CE Mesures / Test date: February 17th, 2016 Power supply voltage: 3V from battery (fully charged)



Test Equipment Used							
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due		
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2015/8	2016/8		
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2015/8	2016/8		
Loop antenna	EMCO	6502	ANT-101-009	2015/3	2016/3		
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	2015/3	2016/3		
RF cable	Pasternack	PE302-120	CAB-131-024	2015/3	2016/3		
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2015/3	2016/3		
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2015/3	2016/3		
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2015/3	2016/3		
High-pass filter	Mini-Circuit	VHF-3100+	FIL-151-006	2015/3	2016/3		
Pre-amplifier	PE	PE1524	PRE-101-002	2015/3	2016/3		
Anechoic chamber	COMTEST	214263	CAG-141-001	-	-		
OATS	Div	10m	SIT-101-001	2015/8	2016/8		
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-		
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-		
Turntable	Innco- Systems	CT0800	PLA-141-001	-	-		
Measuring Rec	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7		
Spectrum analyzer	AGILENT HP	8563E	ASP-111-003	2013/9	2016/9		

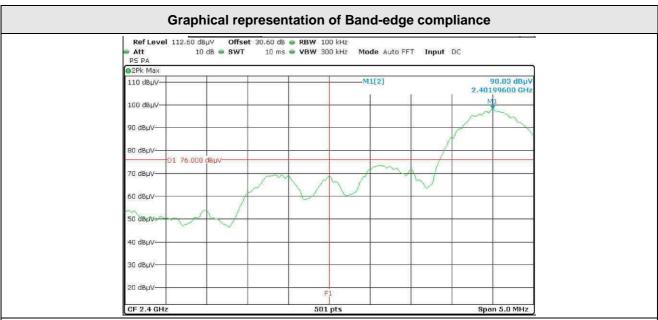


Tabulated Results for Peak Output Power Reference level					
FREQ		Field Strength 3m			
(MHz)		(dBµV/m)			
2402.0		95,3			
2440.0		94,9			
2480.0		95,2			
RBW:	100kHz				
Measurement distance:	3m	3m			
Limit: Ref. level only –		For 15.247 (d)			
Final measurement detector: Peak					
Wide Measurement Uncertainty:	± 5.2dB (k=2)				
Note:	Only for identification of limit in non-restricted band Limit is 74.9 dBµV/m Peak for out-of-band frequencies in Non- Restricted bands (with a 100kHz RBW on the spectrum analyser)				

Tal	bulated R	esults for Unwa	nted emissions in Non-Res	stricted bands		
FREQ	Field	Strength 3m	Limit	Result		
(MHz)	((dBµV/m)	(dBµV/m)	(dBµV/m)		
2400.0		70.0	74.9	Pass		
9608.0		53.4	74.9	Pass		
9760.0	52.9		74.9	Pass		
9920.0	53.6		74.9	Pass		
RBW:		100kHz				
Measurement distance:		3m				
Limit:		15.247 (d)				
Final measurement detector:		Peak				
Wide Measurement Uncertainty:		± 5.2dB (k=2)				
RESULT:	PASS					
Note:		(1): All frequencies in non-restricted bands not specified in the tabulated have margin > 10dB.				



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Low bandedge compliance

F1 = 2400MHz

Peak level at 2400MHz is $70.0dB\mu V/m$ (limit is $74.9dB\mu V/m$)

RESULT: PASS

Note: Radiated measurement



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10. Unwanted emissions in Restricted Frequency bands

TEST: Unwanted emissions into Restricted Frequency Bands / FCC part 15.205, 15.209, 15.247				
Method: Measurements were made in a 10 or 3-meter Open Area Test Site (OATS) that complies to ANSI C63.4. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (Peak, Quasi-peak, Average) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. A pre-scan frequency identification of the EUT has been performed in full anechoic chamber. The measured radiated field of the EUT is realised at 3-meters of distance. Antenna is 1.25-meters high.				
Laboratory Parameters:	Required prior to the test	During th	e test	
Ambient Temperature	10 to 40 °C	20°C	;	
Relative Humidity	10 to 90 %	55%	1	
Fully configured sample scanned over the following frequency range	Frequency range on each side of line	Measureme	nt Point	
	9kHz – 30MHz	10 m measurem	ent distance	
	30MHz – 25GHz	3 m measureme	ent distance	
Lin	nits – FCC Part 15.205, 15.209, 15.247			
- (141)	Limits (dBµV/m)			
Frequency (MHz)	Level / Detector / Distance	e 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		

Power supply voltage: 3V from battery (fully charged)



Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2015/8	2016/8
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2015/8	2016/8
Loop antenna	EMCO	6502	ANT-101-009	2015/3	2016/3
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	2015/3	2016/3
RF cable	Pasternack	PE302-120	CAB-131-024	2015/3	2016/3
RF cable	HUBER+SUHNER	RG214U	CAB-141-026	2015/3	2016/3
RF cable	HUBER+SUHNER	RG214U	CAB-141-029	2015/3	2016/3
RF cable	HUBER+SUHNER	SF104	CAB-141-030	2015/3	2016/3
High-pass filter	Mini-Circuit	VHF-3100+	FIL-151-006	2015/3	2016/3
Pre-amplifier	PE	PE1524	PRE-101-002	2015/3	2016/3
Anechoic chamber	COMTEST	214263	CAG-141-001	-	-
OATS	Div	10m	SIT-101-001	2015/8	2016/8
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-
Turntable	Innco- Systems	CT0800	PLA-141-001	-	-
Measuring Rec	Rohde&Schwarz	ESRP	REC-151-002	2015/7	2018/7
Spectrum analyzer	AGILENT HP	8563E	ASP-111-003	2013/9	2016/9



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 1				Site has been cre	eated with pre-so	an results.			
Frequency ban	Frequency band investigated:			9kHz-30MHz					
RBW:			200	200Hz (9kHz-150kHz)					
			9kl	Hz (150kHz-30MH	Hz)				
Measurement distance:			10r	n					
Limit:			FC	C Part 15.205 - 1	5.209				
Final measurement detector:			Quasi-Peak						
Wide Measurement Uncertainty:			± 5 dB (k=2)						
Note:		*1: acc	: Correction facto Measure have cording to require @30m = M@10m	been done at ments of 15.209	10m distance	and corrected			

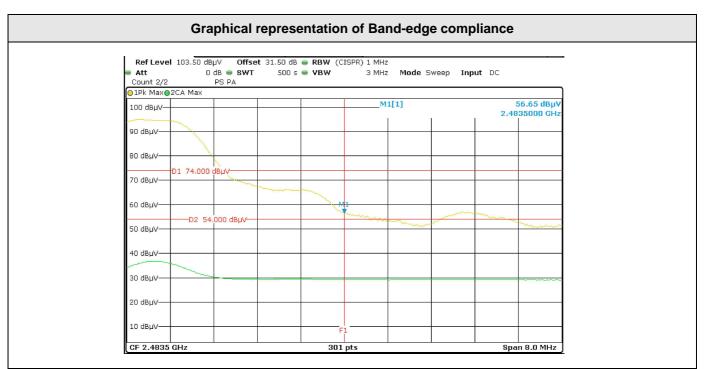
	Tabulated Results for Unwanted emissions (30MHz-1GHz)									
FREQ	Meter reading	Meter reading	CF total	Field level	Field level	Pol	Antenna height	Table angle	Limit	Margin
MHz	(QP) dBµV	(Pk) dBµV	dB	(QP) dBµV/m	(Pk) dBµV/m		cm	Degré	(QP) dBµV/m	dB
				Margii	n > 10dB					
	tary information list measured		Δrea Test	Sita has haar	n created wit	h nra-	ecan reculte			
	y band inve		TAICA TOST	30MHz-1G		прис-с	ocari results.			
RBW:	,	Juliu III		120kHz						
Measuren	nent distan	ce:		3m						
Limit:				FCC Part 15.205 - 15.209						
Final mea	surement d	letector:		Quasi-Peak						
Wide Mea	surement l	Jncertainty	:	± 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	d Results for Unwa				
FREQ	Fiel	d level	Detector	Limit	Result		
(MHz)	dB	βμV/m		(dBµV/m)			
2483.5		58.2	Pk	74	Pass		
2483.5	2	29.8	Av	54	Pass		
4804,0	ţ	55.4	Pk	74	Pass		
4804,0	;	39.3	Av	54	Pass		
4880,0	ţ	54.8	Pk	74	Pass		
4880,0	:	38.4	Av	54	Pass		
4960,0		55.5	Pk	74	Pass		
4960,0	;	38.7	Av	54	Pass		
7206,0	(61.8	Pk	74	Pass		
7206,0	4	46.1	Av	54	Pass		
7320,0	(62.5	Pk	74	Pass		
7320,0	4	16.2	Av	54	Pass		
7440,0	(63.2	Pk	74	Pass		
7440,0	4	16.6	Av	54	Pass		
12010,0	(64.4	Pk	74	Pass		
12010,0	4	18.3	Av	54	Pass		
12200,0	(65.0	Pk	74	Pass		
12200,0	4	19.1	Av	54	Pass		
12400,0	(66.1	Pk	74	Pass		
12400,0		50.0	Av	54	Pass		
RBW / VBW		1MHz / 3MHz (Peak) 1MHz / 10Hz (AV)					
Measurement distance:		3m					
Limit:			FCC Part 15.205 - 15.209				
Final measurement detector:		Peak / Average					
Wide Measurement Uncertainty:		± 5.2dB (k=2	± 5.2dB (k=2)				
		PASS					
Note:		(1): Performed on OATS at 3m distance(2): Above 10GHz, frequencies were measured at 1m distance and corrected with the Correction Factor :					
	CF = 20log(1 meter / 3 meters) = -9.5dB						



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High bandedge compliance

Radiated Peak level is 58.2dBµV/m (limit 74dBµV/m)

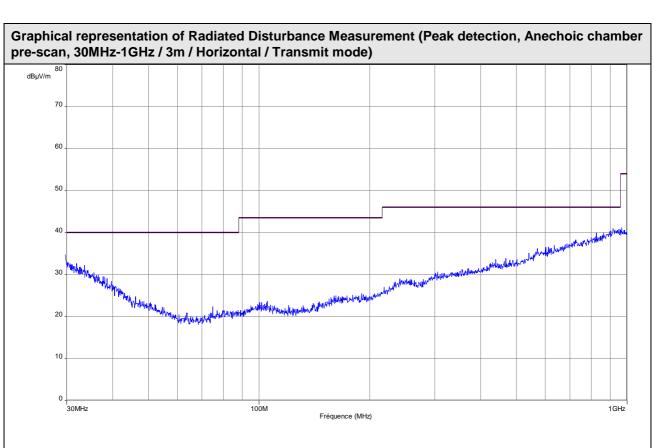
Radiated Average level is 29.8dBµV/m (limit 54dBµV/m, Average detector measurement)

RESULT: PASS

Note: radiated measurement (3m on OATS)



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Note: Pre-scan graph only for identification purpose.

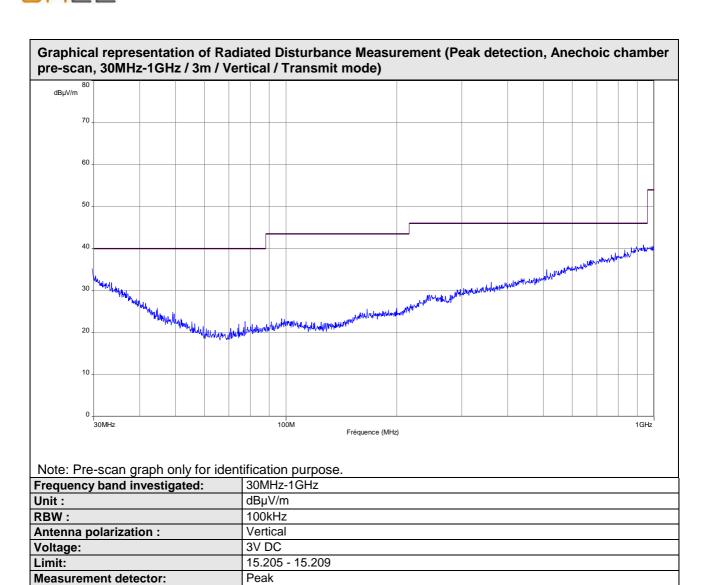
Frequency band investigated:	30MHz-1GHz
Unit:	dBμV/m
RBW:	100kHz
Antenna polarization :	Horizontal
Voltage:	3V DC
Limit:	15.205 - 15.209
Measurement detector:	Peak
Wide Measurement Uncertainty:	± 5dB (k=2)



Wide Measurement Uncertainty:

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± 5dB (k=2)