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FCC Registration Number: 0020356952 (FRN) Test Firm Registration Number: 171131
IC Company Number: 9545A

Matériel testé : *Equipment under test*:	**Sensal 315**

Constructeur: Manufacturer:	**SmartAcc Technology** 13, rue des Coquelicots 31830 Plaisance du Touch -France
Rapport délivré à : *Issued to*:	**SmartAcc Technology** (M. Rudi Lenzen) 13, rue des Coquelicots 31830 Plaisance du Touch -France
Référence de la proposition : *Proposal number:*	072012-20299
Date de l'essai : *Date of test:*	June 13th to 14th, 2013
Objectif des essais : *Test purpose*:	Qualification FCC suivant les normes : *FCC qualification according to standards:* *CFR 47, Part 15 C (chapter 15.231)*
Lieu du test: *Test location:*	SMEE CE-Mesures 38 VOIRON - France
Test réalisé par : *Test realized by:*	Laurent CHAPUS
Conclusion : *Conclusion:*	L'équipement satisfait aux prescriptions des normes citées en référence. *The appliance complies with requirements of above mentioned standards.*

Ed.	**Date**	**Modifications / Pages**	**Written by: Visa**	**Approved by: Visa**
1 2 3	June 24th, 2013 July 4th, 2013 July 10th, 2013	Initial Edition Added info Added info	Jérémy Blancher	Laurent Chapus

SUMMARY

1. Test program

- **References**

FCC CFR 47, PART 15, Subpart C
Chapter 15.231 of Subpart C (Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.).

- **Test Results**

TEST	Paragraph number (FCC Part 15.247)	Spec. (FCC Part 15.247)	RESULTS (comments)
Conducted emissions test	15.107 / 15.207 (a)	Table 15.207 (a)	**N/A** (1)
De-activation time	15.231 (a) 1)	Automatically deactivate the transmitter within not more than 5 seconds of being released.	**PASS**
Periodic operations at regular intervals	15.231 (a) 3)	Maximum duration allowed 2s per hour	**PASS**
Field strength of fundamental	15.231 (b)	6042µV/m max at 315MHz (75.6dBµV/m, Average) (95.6dBµV/m, Peak)	**PASS**
Spurious emissions	15.231 (b)	604.2µV/m max for fundamental at 315MHz (55.6dBµV/m, Average) (75.6dBµV/m, Peak)	**PASS**
Unintentional radiations	15.205 / 15.209	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**
Maximum 20dB bandwidth	15.231 (c)	Shall be lower than 0.25% of center frequency	**PASS**

PASS: EUT complies with standard's requirement
FAIL: EUT does not comply with standard's requirement
NA: Not Applicable
NP: Test Not Performed
(1): Equipment powered by 3V lithium battery

- **General conclusion:**

Measures and tests performed on the sample of the product SENSAL315, in configuration and description presented in this test report, show compliance with standards FCC CFR 47, PART 15, Subpart C.

2. Equipment Under Test (EUT)

Nom /
Identification

SENSAL315 Ref N°: PCB Rev3 (Apr 2013)

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

N.C

Alimentation /
Power supply

3V from battery

Mode de fonctionnement /
Running mode

The tested samples (two) are set in following modes:
- Periodic transmit mode (14ms every 1s) with modulation
- Continuous transmit mode with FSK modulation

Information sur l'équipement /
Equipment information

- Center frequency: 315MHz (Transmit)
- Antenna type: integral
- Modulation: FSK +/-50kHz
- Transmit time:14ms every 100ms (manually operated by movement of the sensor, equipment stops to transmit when the movement stops)
- Periodic transmissions at regular predetermined intervals: every 60 min, 14ms transmission. Total transmission time is 14ms per hour.
- Battery type Lithium CR2032 3V

3. Test conditions

Relative Humidity : 55%
Temperature : 20°C

Power supply voltage:
Equipment under test: 3Vdc from battery.
All relevant tests are performed with a new battery.

4. Modifications of the equipment under test

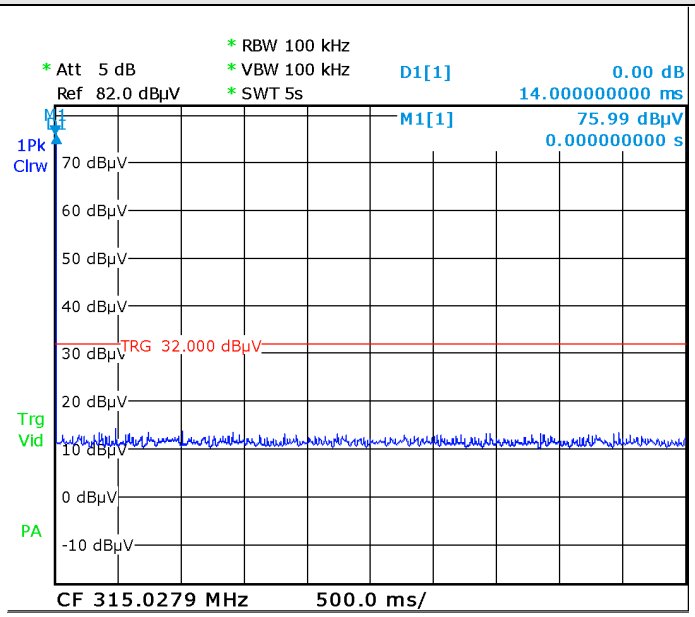
No modification applied to the tested equipment during tests.

5. De-activation time / Periodic operations at regular intervals

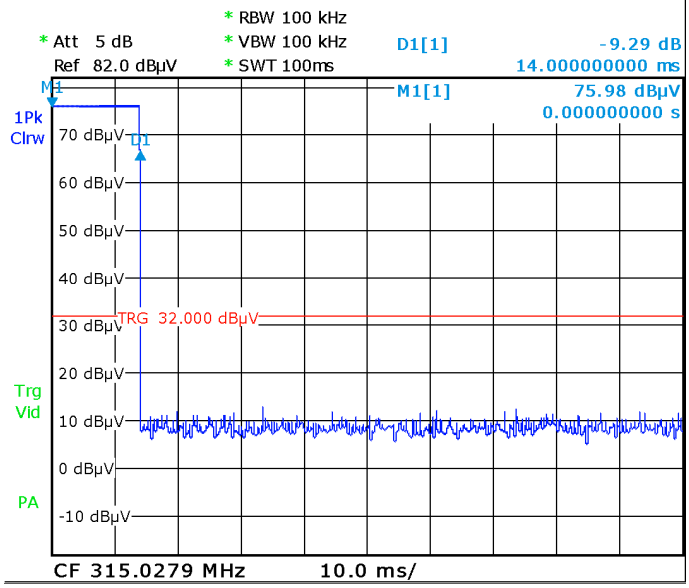
TEST: De-activate time and Periodic operations at regular intervals (Clause 15.231 (a))	**Verdict**
Method: Measurements were performed with peak detector using a 100kHz RBW. The VBW is set to 100kHz. The spectrum analyzer is connected via suitable means (GTEM cell) to the RF signal of the tested equipment. The tested equipment is set to transmit operation. Measurement is done with a zero span at fundamental frequency. The transmission duration was measured and recorded Limits: A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.	**Pass**
Supplementary information: Test location: SMEE – CE Mesures / Test date: June 14th, 2013 Power supply voltage: 3V from battery	

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
GTEM cell	TESEQ	750	GTE-101-001	2013/3	2014/3
Measuring Rec.	Rohde&Schwarz	ESL3	REC-101-001	2012/6	2014/6

Graphical representation of transmission duration



Tabulated Results for transmission duration			
FREQ	**Duration of pulse**	**Limit**	**Result**
(MHz)	(s)		
314.98	0.014	Shall be < 5s	PASS

Graphical representation of duration of periodic transmission at regular intervals


Tabulated Results for transmission duration					
FREQ	**Number of pulse**	**Duration of pulse**	**Total duration /h**	**Limit**	**Result**
(MHz)	/ hour	(s)	(s)		
314.98	1	0.014	0.014	Shall be < 2s / hour	PASS

6. Field strength of fundamental

TEST: Field strength of fundamental (Clause 15.231 (b))	**Verdict**
Method: Measurements were made in a 3-meter Open Area Test Site (OATS) that complies to CISPR 16 and ANSI C63.4 requirements. 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 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. EUT is placed 80cm above the ground reference plane. A pre-scan frequency identification of the EUT has been performed in a GTEM cell. The measured radiated field of the EUT is correlated to the corresponding measurement distance. The algorithm used for calculation is 3 axes measurement. The pre-characterization graphs are obtained in PEAK detection.	**Pass**
Supplementary information: Test location: SMEE – CE Mesures / Test date: June 13th, 2013 Power supply voltage: 3V from battery (new)	

According to 15.231 (b) the field strength of emissions from intentional radiators operated under these frequencies bands shall not exceed the following:

Limits for Fundamental		
Fundamental frequency (MHz)	µV/meter	dBµV/m
40.66 – 40.70	2250	67.04
70 – 130	1250	61.94
130 – 174	1250 to 3750	61.94 to 71.48
174 – 260	3750	71.48
260 – 470	3750 to 12500	71.48 to 81.94
Above 470	12500	81.94

NOTE:
(1) Where F is the frequency in MHz, the formula for calculating the maximum permitted fundamental field strengths are as follows:
for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F)-6136.3636;
for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F)- 7083.3333.

(2) The above field strength limits are specified at a distance of 3meters. The tighter limits apply at the band edges.

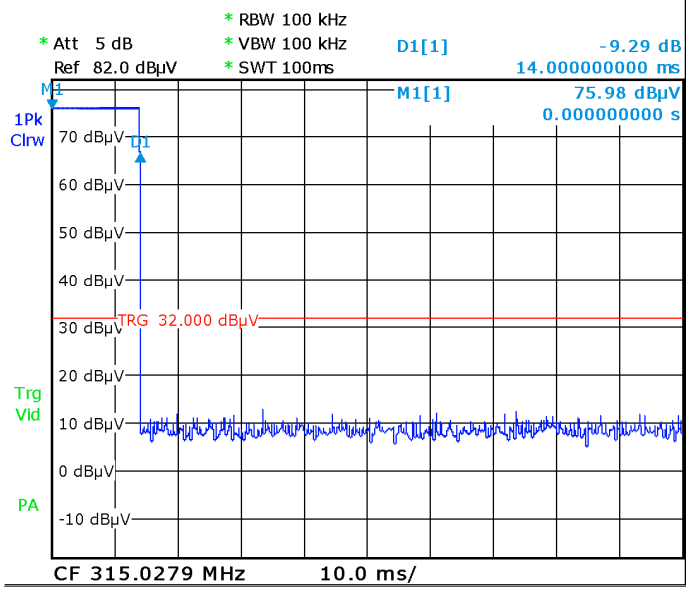
(3) At 315MHz, the limit is 6041.67µV/m (75.6dBµV/m). Intentional radiators shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. A peak limit shall be applied 20dB above the average limit.

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2012/8	2013/8
RF cable	Div	2m	CAB-101-011	2013/3	2014/3
RF cable	Div	OATS/25m	CAB-101-017	2013/3	2014/3
GTEM cell	TESEQ	750	GTE-101-001	2013/3	2014/3
OATS	Div	3 / 10m	SIT-101-001	2012/8	2013/8
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-
Measuring Rec	Rohde&Schwarz	ESL3	REC-101-001	2012/6	2014/6

Tabulated Results for Radiated Field Strength of fundamental OATS measurement 3m									
Test Frequency (MHz)	Meter Reading dB(µV)	Detector (Pk/QP/Av)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Total Factor (dB)	Level dB(µV/m)	Limit dB(µV/m)	Margin (dB)
314.98	72.0	Pk	V	0	1.45	17.0	**89.0**	95.6	-6.6
314.98	54.9 (1)	Av	V	0	1.45	17.0	**71.9**	75.6	-3.7

Supplementary information:
Frequency list measured on the Open Area Test Site has been created with pre-scan results.
Worst case results for 3 axes position.
Equipment transmits continuously.

RBW:	120kHz
Measurement distance:	3m
Limit:	15.231
Wide Measurement Uncertainty:	± 5.2dB (k=2)
Field Strength Calculation:	The field strength 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 (Level dBµV/m) RA = Receiver Amplitude (Meter reading dBµV) AF = Antenna Factor CF = Cable Factor AG = Amplifier Gain Total factor (dB) is AF + CF – AG Margin value = Emission level – Limit value (1): The average value of fundamental frequency emission is: Average = Peak value + 20log(Duty Cycle) Where the duty factor (DC) is calculated from following formula: DC = Tx ON on a period of 100ms (14/100ms) 20log(DC)=-17.1dB

Graphical representation for Duty Cycle corrector factor

Pulse width : 14ms Number of pulse within 100ms: 1 Duty cycle average factor = 20log(1x14/100)= -17.1dB

7. Spurious Emissions

TEST: Field strength of spurious emission (Clause 15.231 (b))	**Verdict**
Method: Measurements were made in a 3-meter Open Area Test Site (OATS) that complies to CISPR 16 and ANSI C63.4 requirements. 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 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. EUT is placed 80cm above the ground reference plane. A pre-scan frequency identification of the EUT has been performed in a GTEM cell. The measured radiated field of the EUT is correlated to the corresponding measurement distance. The algorithm used for calculation is 3 axes measurement. The pre-characterization graphs are obtained in PEAK detection.	**Pass**
Supplementary information: Test location: SMEE – CE Mesures / Test date: June 13th, 2013 Power supply voltage: 3V from battery (new)	

According to 15.231 (b) the field strength of emissions from intentional radiators operated under these frequencies bands shall not exceed the following:

Limits for Spurious		
Fundamental frequency (MHz)	µV/meter	dBµV/m
40.66 – 40.70	225	47.04
70 – 130	125	41.94
130 – 174	125 to 375	41.94 to 51.48
174 – 260	375	51.48
260 – 470	375 to 1250	51.48 to 61.94
Above 470	1250	61.94

NOTE:
(1) The above field strength limits are specified at a distance of 3meters. The tighter limits apply at the band edges. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

(3) At 315MHz, the limit is 604.167µV/m (55.6dBµV/m). Intentional radiators shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. A peak limit shall be applied 20dB above the average limit.

In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Log-periodic antenna	TDK	PLP3003	ANT-101-001	2012/8	2013/8
Biconnic antenna	COM-POWER	AB- 900	ANT-101-003	2012/8	2013/8
Horn antenna	COM-POWER	AH-118	ANT-101-004	2012/8	2013/8
RF cable	Div	2m	CAB-101-011	2013/3	2014/3
RF cable	Div	OATS/25m	CAB-101-017	2013/3	2014/3
Pre-amplifier	PE	PE1524	PRE-101-002	2013/3	2014/3
GTEM cell	TESEQ	750	GTE-101-001	2013/3	2014/3
OATS	Div	3 / 10m	SIT-101-001	2012/8	2013/8
Antenna mast	Innco- Systems	MA4000EP	MAT-101-001	-	-
Turntable	Innco- Systems	DS1200S	PLA-101-001	-	-
Measuring Rec	Rohde&Schwarz	ESL3	REC-101-001	2012/6	2014/6
Spectrum analyzer	AGILENT	HP 8563E	ASP-111-003	2012/9	2014/9
Ref. Comb generator	SMEE	EMR-10M	REF-111-002	-	-

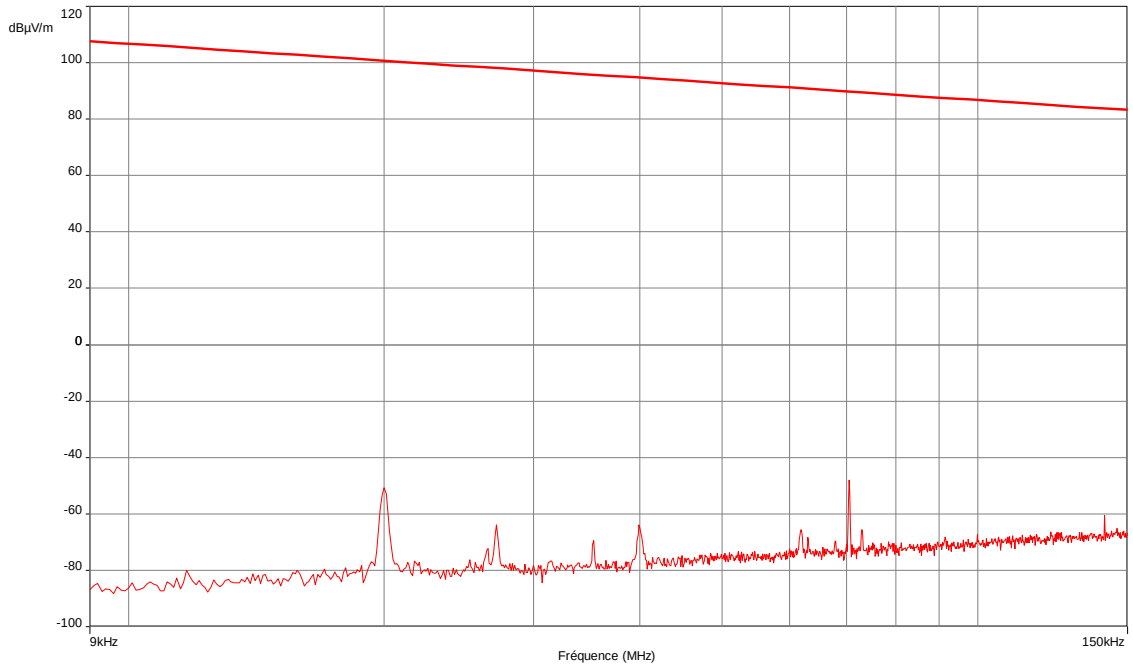
Tabulated Results for Spurious Emissions – EUT emitting (315MHz)
OATS 3m

N°	Frequency (MHz)	Meter reading (dBµV/m)	Total factor (dB)	Measured field (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Peak / Average	Comments
1	630.05	23.5	24.8	48.3	75.6	**-27.3**	PK	Not in restricted band
	630.05	6.4	24.8	31.2	55.6	**-24.4**	AV	
2	945.10	21.8	28.5	50.3	75.6	**-25.3**	PK	Not in restricted band
	945.10	4.7	28.5	33.2	55.6	**-22.4**	AV	
3	1259.7	17.4	31.7	49.1	75.6	**-26.5**	PK	Not in restricted band
	1259.7	0.3	31.7	32.0	55.6	**-23.6**	AV	
4	1574.6	16.8	33.3	50.1	74.0	**-23.9**	PK	Restricted band
	1574.6	-0.3	33.3	33.0	54.0	**-21.0**	AV	
5	1889.5	13.6	36.1	49.7	75.6	**-25.9**	PK	Not in restricted band
	1889.5	-3.5	36.1	32.6	55.6	**-23.0**	AV	
6	2205.2	17.8	37.6	55.4	74.0	**-18.6**	PK	Restricted band
	2205.2	0.7	37.6	38.3	54.0	**-15.7**	AV	
7	2520.2	13.1	38.4	51.5	75.6	**-24.1**	PK	Not in restricted band
	2520.2	-4.0	38.4	34.4	55.6	**-21.2**	AV	
8	2835.2	17.4	40.4	57.8	74.0	**-16.2**	PK	Restricted band
	2835.2	0.3	40.4	40.7	54.0	**-13.3**	AV	
9	3150.4	23.5	20.5	44.0	75.6	**-31.6**	PK	Not in restricted band
	3150.4	6.4	20.5	26.9	55.6	**-28.7**	AV	

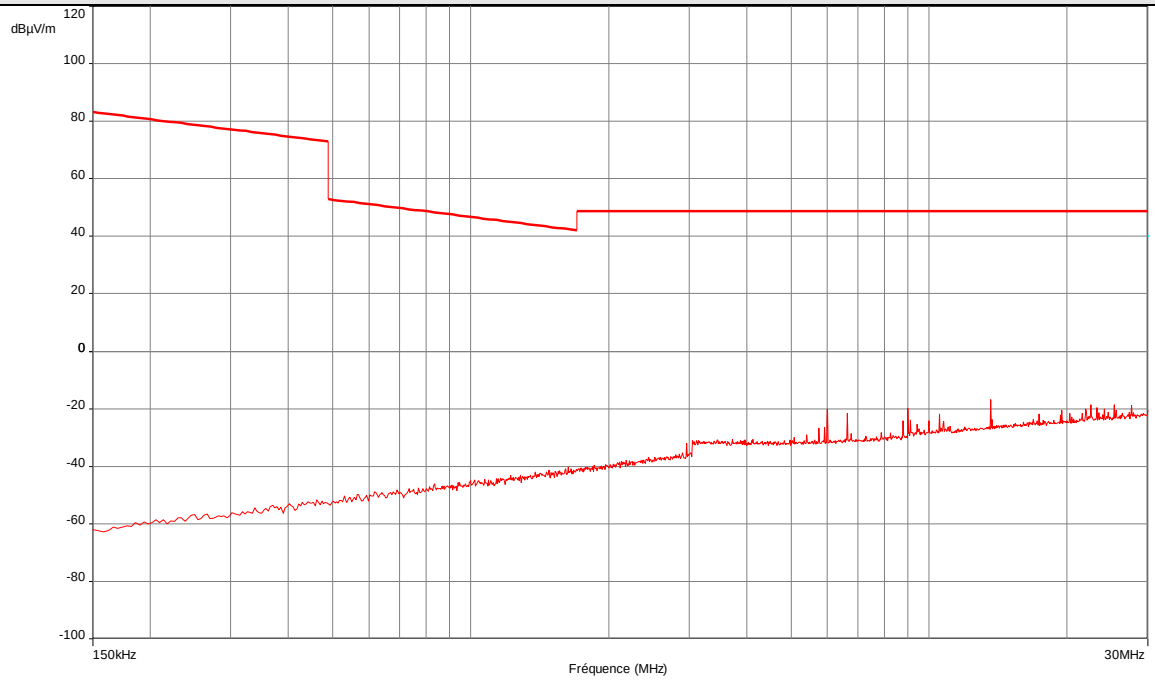
Note 1: Peak measurement with 100 kHz RBW and VBW when frequency below 1GHz.
Note 2: Peak measurement with 1MHz RBW and VBW when frequency above 1GHz
Note 3: Worst case measurement for three orthogonal axis of EUT.
Note 4: Equipment transmits continuously.
Note 5: The field strength is calculated by 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 (Level dBµV/m)
RA = Receiver Amplitude (Meter reading dBµV)
AF = Antenna Factor
CF = Cable Factor
AG = Amplifier Gain
Total factor (dB) is AF + CF – AG
Margin value = Emission level – Limit value
Note 6: The average value of spurious emission is:
Average = Peak value + 20log(Duty Cycle)
Where the duty factor (DC) is calculated from following formula:
DC = Tx ON on a period of 100ms (14/100ms)
20log(DC)=-17.1dB

Graphical representation of Radiated Disturbance Measurement (Peak detection, GTEM pre-scan) 9kHz-150kHz (10m)

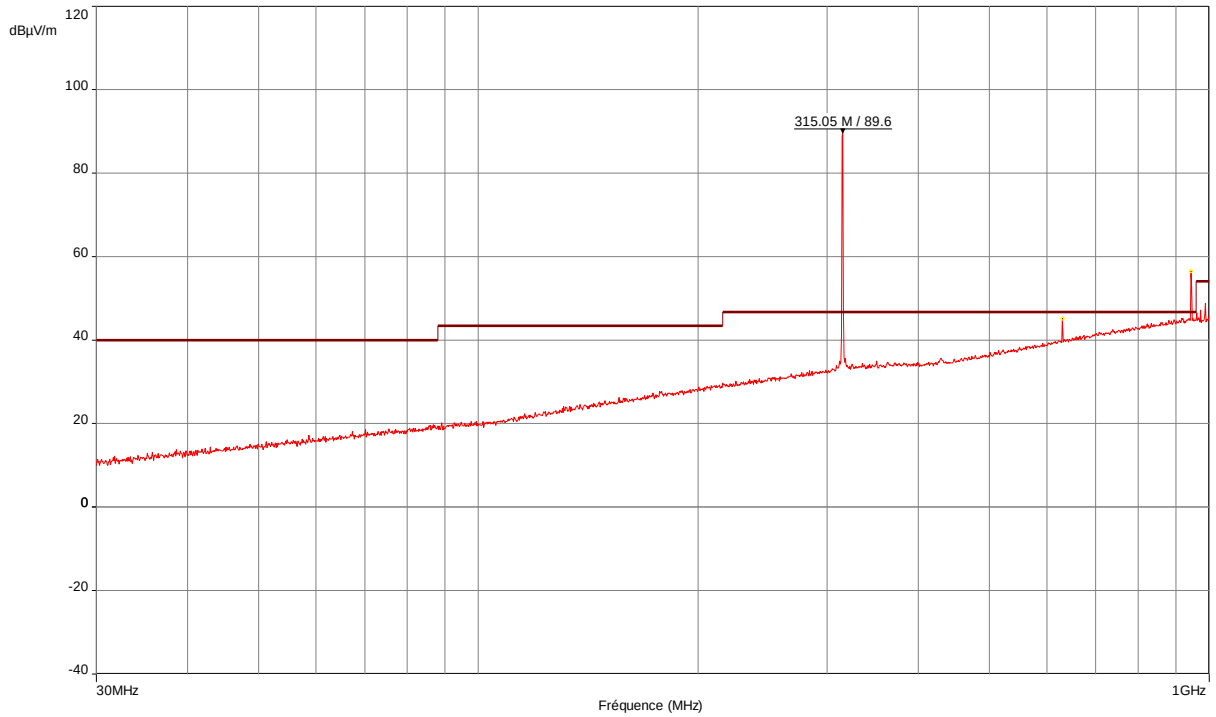


Graphical representation of Radiated Disturbance Measurement (Peak detection, GTEM pre-scan) 150kHz-30MHz (10m)



------ : Peak measure

Graphical representation of Radiated Disturbance Measurement (Peak detection, GTEM pre-scan) 30MHz-1GHz (3m)

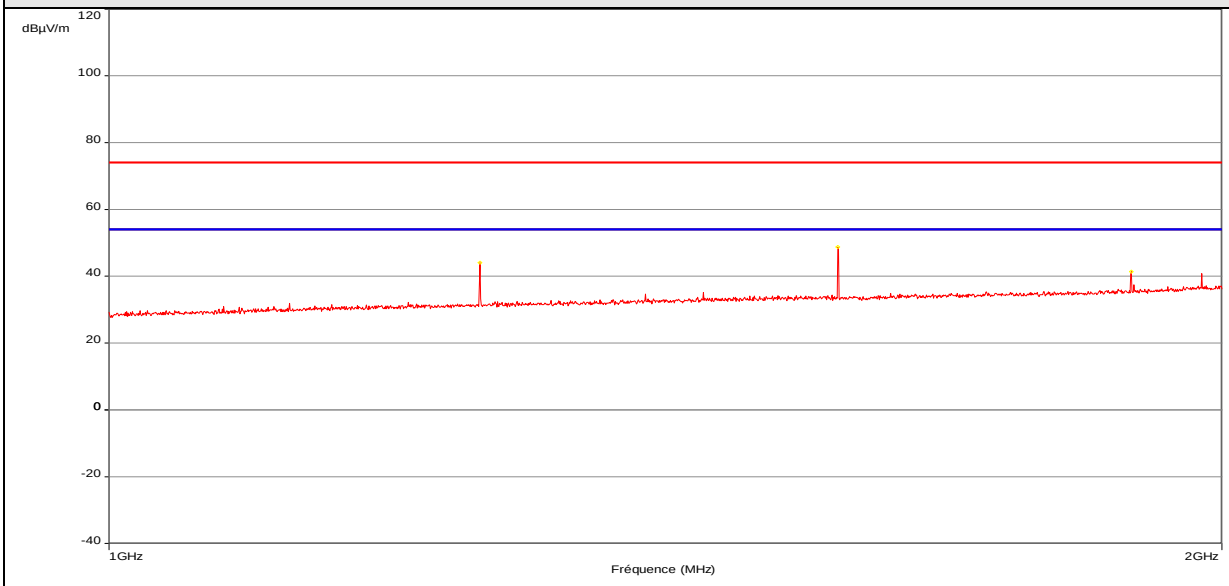


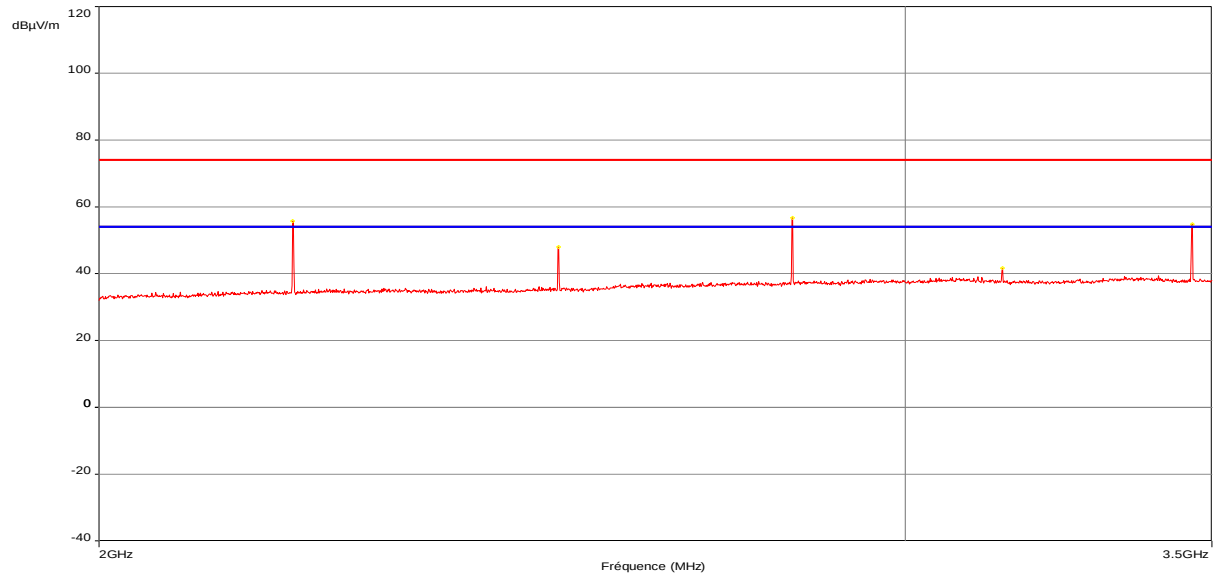
Frequency (MHz)	Level Peak (dBµV/m)	Limit Peak (dBµV/m)	Note
315.050	89.6	95.6	Intentional radiation
630.050	45.2	75.6	Not in restricted band
945.100	56.6	75.6	Not in restricted band

Note: Pre-scan graph only for identification purpose.

------ : Peak measure

Graphical representation of Radiated Disturbance Measurement (Peak detection, GTEM pre-scan) 1GHz-3.5GHz (3m)





Frequency (MHz)	Level Peak (dBµV/m)	Limit Peak (dBµV/m)	Note
1259.70	44.0	75.6	Not in restricted band
1574.60	48.7	74.0	Restricted band
1890.20	41.4	75.6	Not in restricted band
2204.60	55.8	74.0	Restricted band
2520.20	48.0	75.6	Not in restricted band
2834.70	56.7	74.0	Restricted band
3150.40	41.7	75.6	Not in restricted band

Note: Pre-scan graph only for identification purpose.

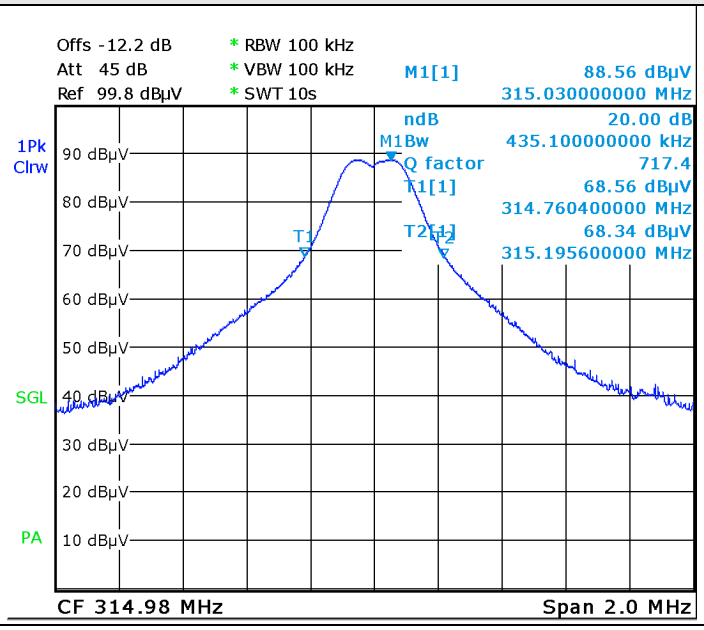
------ : Peak measure

8. Occupied bandwidth (20dB)

TEST: 20dB occupied bandwidth measurement (Clause 15.231 (c))	**Verdict**
Method: Measurements were performed with peak detector using a 100kHz RBW. The VBW is set to 100kHz. The spectrum analyzer is connected to the GTEM cell. The tested equipment is placed in the GTEM cell at the maximum field strength of fundamental. The tested equipment is set to transmit operation. Limits: The maximum 20 dB bandwidth shall be lower than 0.25% of the center frequency	**Pass**
Supplementary information: Test location: SMEE – CE Mesures / Test date: June 14th, 2013 Power supply voltage: 3V from battery	

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
GTEM cell	TESEQ	750	GTE-101-001	2013/3	2014/3
Measuring Rec.	Rohde&Schwarz	ESL3	REC-101-001	2012/6	2014/6

Graphical representation Occupied Bandwidth



Tabulated Results for Occupied Bandwidth			
FREQ	**20dB bandwidth**	**Limit**	**Result**
(MHz)	(kHz)		
314.98	435.100	Shall be < 787.5kHz	PASS