

E.M.C Test Report

According to the standard:

FCC PART 15 Class B Edition 2005

Equipment under test:

RECEIVER AND TRANSMITTER RF CELL
TO A REPORT CABINE
MR360 & RC360

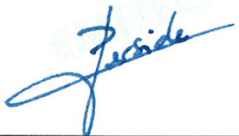
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AGATEC

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EMITECH ILE DE FRANCE

Centres de MONTIGNY
3, rue des Coudriers - CAP 78
ZA de l'Observatoire
78180 MONTIGNY LE BX
Tél. 01 30 57 55 55
Fax 01 30 43 74 48
Siret : 344 545 645 00022

Centre de SATORY
Bâtiment 147
13, route de la Minière
78000 VERSAILLES
Tél. 01 30 97 05 70
Fax 01 39 51 84 79
Siret : 344 545 645 00071

GRAND SUD

Centre de MONTPELLIER
Z.I. de la Vallée du Salaison
145, rue du Massacan - BP 25
34741 VENDARGUES Cedex
Tél. 04 67 87 11 02
Fax 04 67 70 94 55
Siret : 344 545 645 00063

ATLANTIQUE

Centre d'ANGERS
Z.I. Angers - Beaucouzé
15, rue de la Claie
49070 BEAUCOUZE
Tél. 02 41 73 26 27
Fax 02 41 73 26 40
Siret : 344 545 645 00055



364, rue Armand Japy
Technoland - BP 41039
25461 ETUPES Cedex
Tél. 03 81 90 75 90
Fax 03 81 32 36 28
Siret : 384 552 659 00029

E-mail : commercial@emitech.fr - URL : www.emitech.fr

Groupe EMITECH - S.A. au capital de 480 000 € - R.C. VERSAILLES B 344 545 645 - APE 742 C

TEST CERTIFICATION FOR: Fcc Certification

NAME OF THE EQUIPMENT UNDER TEST: RECEIVER AND TRANSMITTER RF
CELL TO A REPORT CABINE
MR360 & RC360

NAME OF THE MANUFACTURER: AGATEC

ADDRESS OF THE APPLICANT:

Company: AGATEC

Address: 31 boulevard Littré
78600 LE MESNIL LE ROI
FRANCE

Person in charge: Mr GARCIA

DATES OF TEST: 2005, the 23rd and 24th of June

TESTS LOCATIONS: EMITECH laboratory in Montigny le Bretonneux (78) - FRANCE
Open area test site in Aunainville (28) - FRANCE

TESTS OPERATOR: B. PELLERIN

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Annex: Customer's questionnaire

1. INTRODUCTION

This document submits the results of Electromagnetic Compatibility tests performed on the equipment «RECEIVER AND TRANSMITTER RF CELL TO A REPORT CABINE MR360 & RC360» herein referred to as the EUT, according to the document listed below.

2. REFERENCE DOCUMENT

FCC Part 15 Edition 2005: Code of federal regulations
Title 47- Telecommunication
Chapter 1- Federal Communication Commission
Part 15- Radio frequency devices
Subpart B- Unintentional Radiators
Limits and methods of measurement of radio disturbance
Characteristic of information technology equipment.

3. EQUIPMENT UNDER TEST (EUT) CONFIGURATION

See photographs next page.

See customer's questionnaire in annex.

See antenna factors, insertion losses and amplifier values in annex.

Modification of the equipment during the tests: No.

Photographs of the equipment under test (EUT)



4. SUMMARY OF TEST RESULTS

The following table summarizes test results of the EUT.

Designation of test	Test results				Comments
	Pass	Fail	N.A.	N.P.	
Intentional radiated emissions in the band 9 kHz – 0.49 MHz			X		Section 15.209
Intentional radiated emissions in the band 40.66 MHz – 40.70 MHz and above 70 MHz	X				Section 15.231
Modulation bandwidth in the band 915 MHz	X				Section 15.231
Unintentional radiated emissions in the band 9 kHz - 30 MHz			X		Section 15.209
Unintentional radiated emissions in the band 30 MHz – 1 GHz	X				Section 15.209
Conducted emissions on AC mains ports	X				Section 15.207

N.A.: Not Applicable

N.P.: Not Performed

In emission:

The tested sample "RECEIVER AND TRANSMITTER RF CELL TO A REPORT CABINE MR360 & RC360" complies with the requirements of the standard:

- FCC PART 15 Edition 2005

according to the limits specified in the present report.

5. **INTENTIONAL RADIATED EMISSIONS IN THE BAND 40.66 to 40.70 AND ABOVE 70 MHZ**

Standard: FCC PART 15 Edition 2005

Section: 15.231

Equipment under test arrangement

Category of equipment: Table-top equipment

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal metal ground plane.

Antenna height is 1 m above the ground plane.

For each frequency corresponding to an emission, EUT carried out a rotation through 360° with the aid of the turntable, with the aim to find the maximum of signal.

The test antenna is oriented in two orientations (perpendicular or parallel). Only the highest level is recorded.

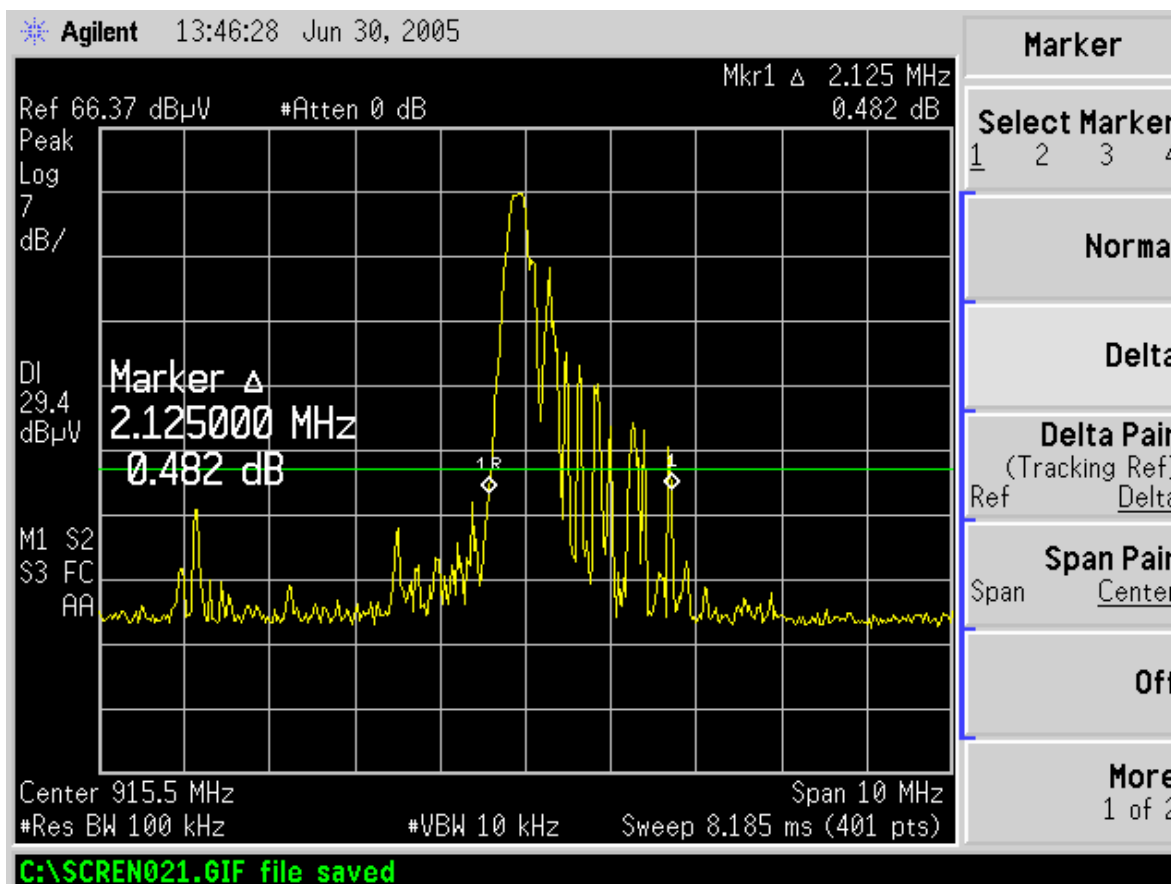
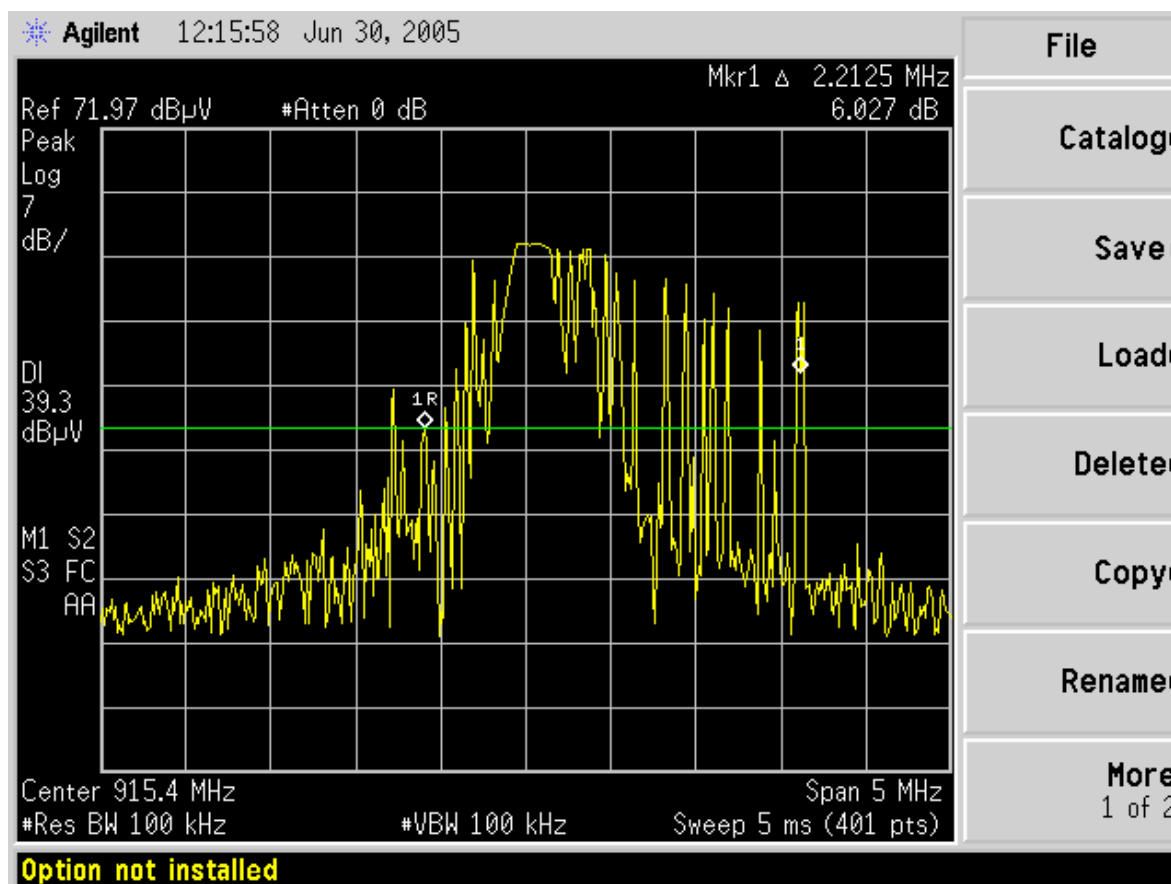
Frequency range: 40.66 – 40.70 and above 70 MHz.

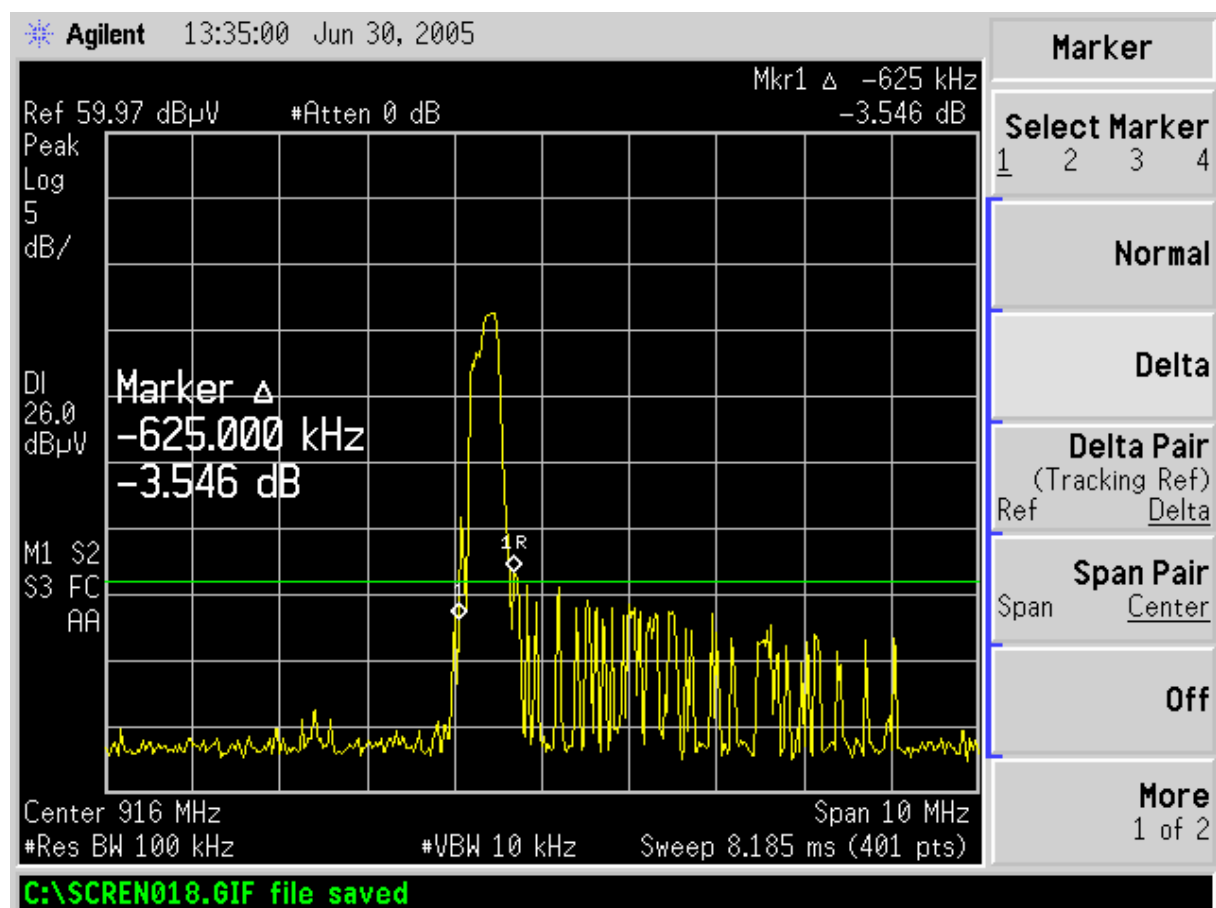
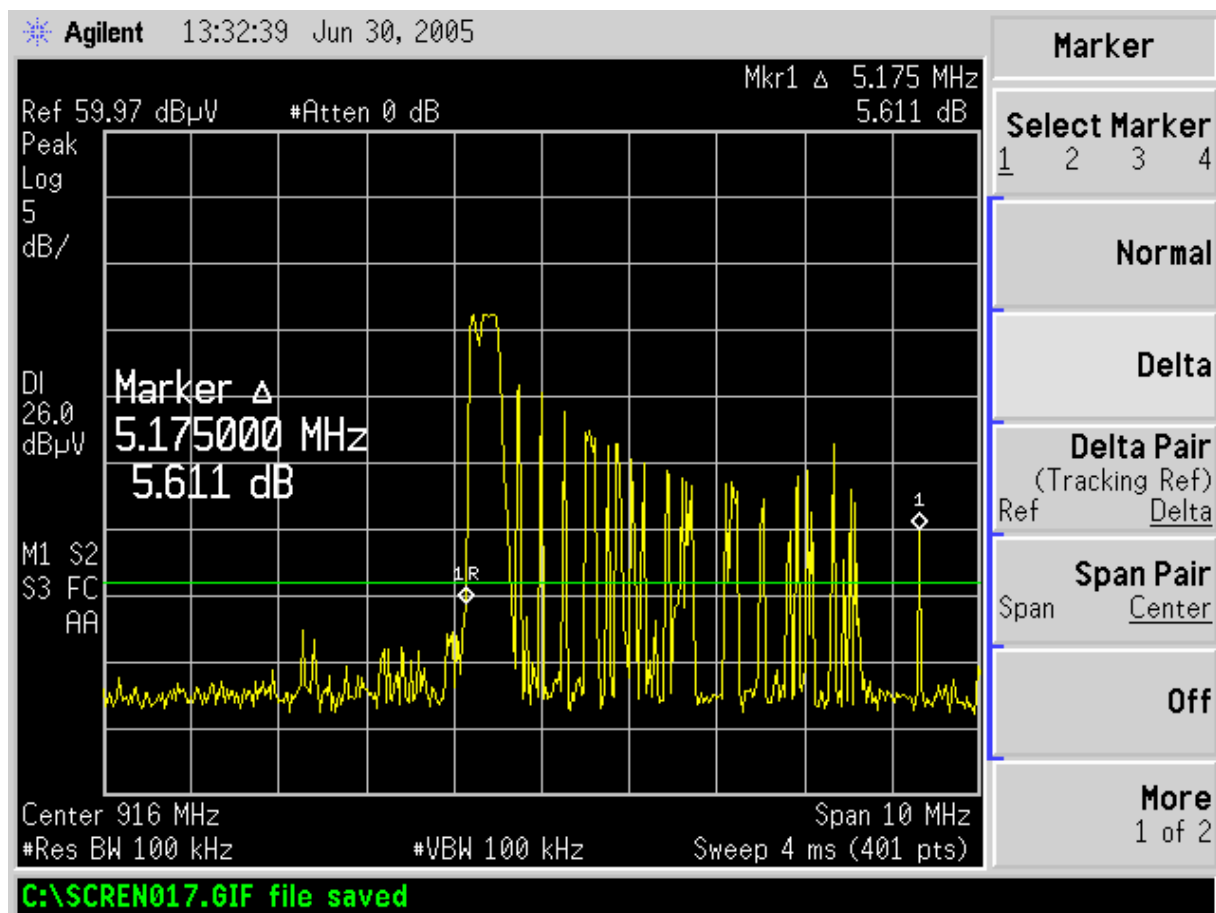
Detection mode: Average.

Resolution bandwidth: 9 kHz.

Measurement distance: 10 meters.

Results:





6. INTENTIONAL RADIATED EMISSIONS IN THE BAND 30 MHZ – 1 GHZ

Standard: FCC PART 15 Edition 2005

Section: 15.209

Equipment under test arrangement

Category of equipment: Table-top equipment

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal metal ground plane.

For maximum meter reading at each frequency, the antenna height is adjusted between 1 m and 4 m above the ground plane. A 360 degrees rotation of the EUT is performed in vertical and horizontal polarization. The frequency azimuth and antenna height are presented in the tables on the next pages.

Frequency range: 30 MHz – 1 GHz.

Detection mode: Quasi-Peak

Resolution bandwidth: 120 kHz (for 30 MHz – 1 GHz)

Measurement distance: 10 meters (for 30 MHz – 1 GHz)

Limit: The EUT must satisfy requirements of the section 15.209 as shown in table below.

Frequency range (MHz)	Limit for Class B (dB μ V/m)
30 to 88	30.0
88 to 216	33.5
216 to 960	36.0
960 to 1000	44.0

Operating mode during the test: Normal mode.

Instrumentation test list:

Meter	N° Emitech	Category	Mark	Type
187	16/004	OATS	Emitech	Site champ libre
1057	02/045	Receiver	Rohde & Schwarz	ESVP
1097	18/082	Filter	Trilithic	6HC1300-2.5-KK
1144	24/195	Biconical antenna	Schwarzbeck	VHBA 9123
2150	03/135	Harmonics/Flicker analyser	Schaffner	Proflin 2115-400
2152	03/136	Harmonics/Flicker analyser	Schaffner	Proflin 2115-400
2160	02/066	Spectrum analyzer	Agilent Technologies	E7405A
2862	35/239	Câble	Câbles & Connectiques	N-2m
2864	35/241	Câble	Câbles & Connectiques	N-SMA
3106	24/571	Antenna	Schwarzbeck	UHALP 9108
3229	01/127	Amplifier	Miteq	AMF-6D-010250-70-7P
3374	24/604	Antenna	Emco	3115

Results:

Table reference	Comments
Table 1	Measurement in vertical polarization
Table 2	Measurement in horizontal polarization

Observation during the test:

The equipment complies with the requirements of the standard FCC PART 15.209 Edition 2005

TEST SITE: Open area test site

RADIATED EMISSION: Electric field

STANDARD: FCC Part 15.209 Edition 2005

TEST DISTANCE: 10 m (for 30 MHz - 1 GHz)

POLARIZATION: Vertical

MODEL: RECEIVER AND TRANSMITTER RF CELL TO A REPORT CABINE MR360 & RC360

TABLE 1

FREQUENCY (MHz)	ANTENNA HEIGHT (cm)	AZIMUTH (degrees)	MEASUREMENT (dBµV/m)	LIMIT (dBµV/m)
915.418	113	0	38.8	46
1831.1	120	0	52.7	54
2746.2	180	0	42.24	54
3661.8	180	100	35.37	54

No frequency has been measured above the ambient noise.

TABLE 2

TEST SITE: Open area test site

RADIATED EMISSION: Electric field

STANDARD: FCC Part 15.209 Edition 2005

TEST DISTANCE: 10 m (for 30 MHz - 1 GHz)

POLARIZATION: Horizontal

MODEL: RECEIVER AND TRANSMITTER RF CELL TO A REPORT CABINE MR360 & RC360

FREQUENCY (MHz)	ANTENNA HEIGHT (cm)	AZIMUTH (degrees)	MEASUREMENT (dBµV/m)	LIMIT (dBµV/m)
915.418	142	0	39.0	46
1831.1	105	0	36.07	54
2746.3	132	340	31.2	54

No frequency has been measured above the ambient noise.

7. MEASUREMENT OF CONDUCTED EMISSION ON AC MAINS PORTS

Standard: FCC Part 15 Edition 2005

Section: 15.207

Equipment under test arrangement:

Category of equipment: Table-top equipment

The equipment under test (EUT) is operating on a non conductive test table at 0.8 m above the horizontal metal ground plane and at 0.4 m above the vertical metal ground plane.

The EUT is supplied through LISN (Line Impedance Stabilization Network) bonded to the ground reference plane.

Frequency range: 150 kHz - 30 MHz.

Detection mode: Peak

Resolution:

Frequency range	Resolution bandwidth	Video bandwidth
150 kHz - 30 MHz	10 kHz	30 kHz

Limit: The EUT must satisfy requirements of the section 15.207 as shown in table below.

Frequency range (MHz)	Limit (dB μ V)	
	Quasi-peak	Average
0,15 to 0,5	66 - 56	56 - 46
0,5 to 5	56	46
5 to 30	60	50

Operating mode during the test: Normal mode.

Instrumentation test list:

Meter	Nr Emitech	Category	Mark	Type
0	34/073	Software	Nexio	V 3.1.4.15
758	18/054	Transient limiter	Hewlett Packard	11947 A
1104	24/187	LISN	PMM	L2-16
1960	01/092	Preamplifier	NHI	1-8GHz/2W - 8-12GHz/1W
2492	02/072	Spectrum analyzer	Hewlett Packard	8593A
2812	35/189	Cable	-	N-2m
2820	35/197	Cable	-	N-2m

Results:

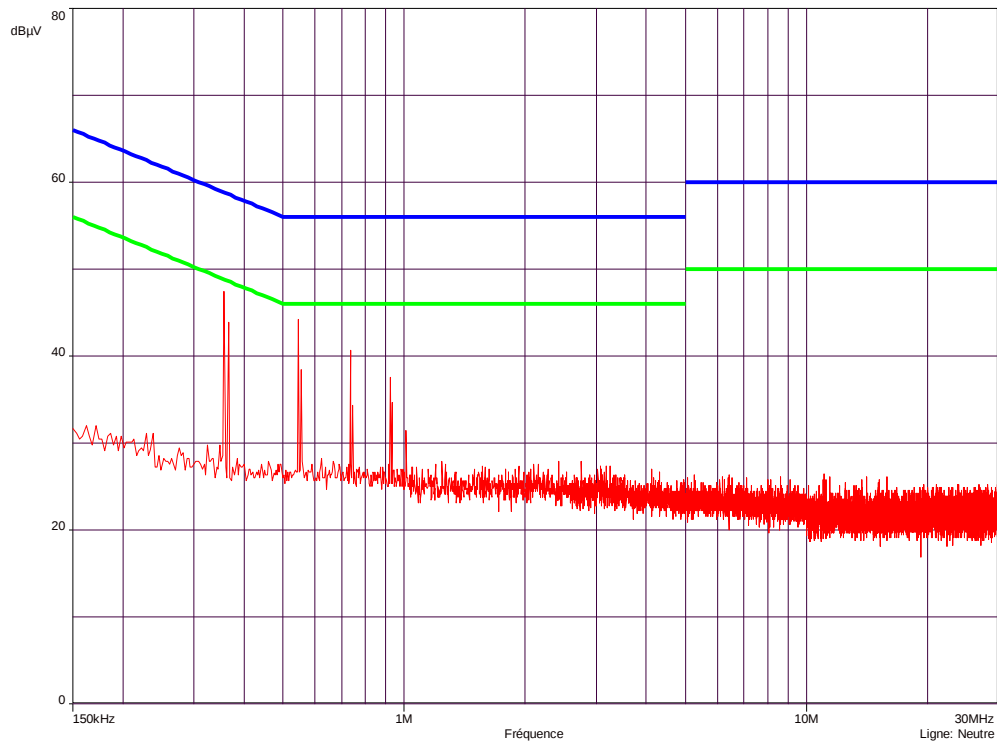
Curve reference	Comments
Curve 1	Measurement of peak detection on wire 1
Curve 2	Measurement of peak detection on wire 2

Observation during the test:

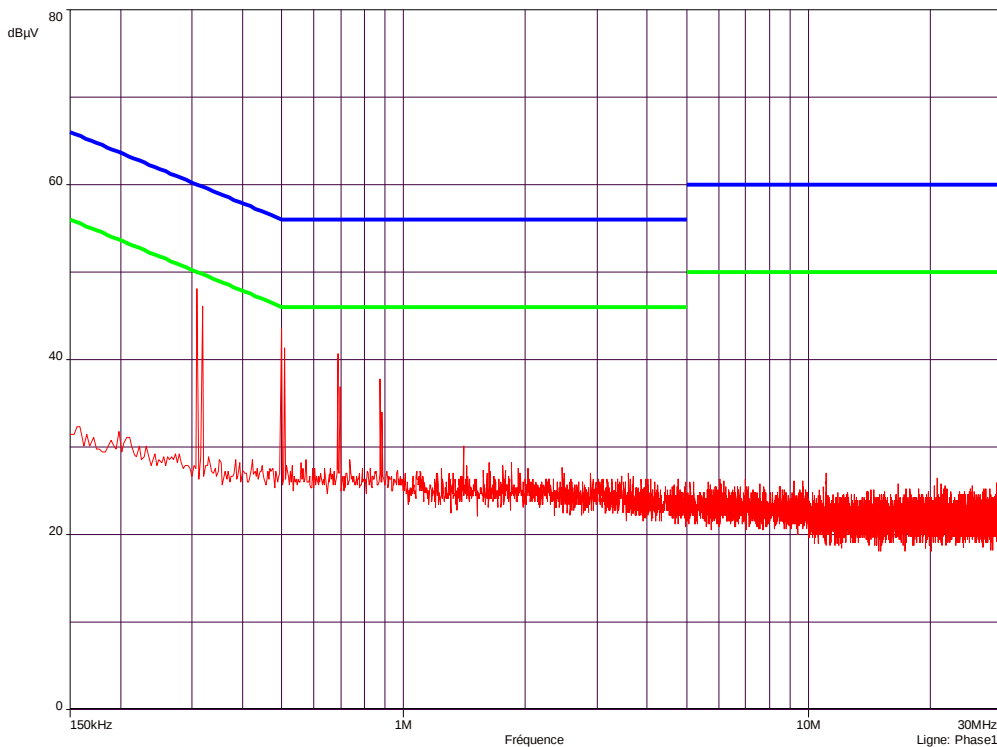
The equipment complies with the requirements of the standard FCC PART 15.207 Edition 2005.

RECEIVER AND TRANSMITTER RF CELL TO A REPORT CABINE

Curve 1



Curve 2



□□□ End of report, appendix to be forwarded □□□

ANNEX 1

Customer's questionnaire

- A - PARTIE ADMINISTRATIVE **Administrative Part**

Formulaire à retourner par courriel au :
Please, return this form by e-mail to:

Nom contact EMITECH : Jean Luc TISSERAND
EMITECH contact's name :

(Il est important de remplir complètement les questionnaires dans chaque langue du rapport désiré, car ils sont nécessaires à l'établissement de notre proposition technique et financière ainsi qu'au bon déroulement de la prestation).

(It's very important to fill in properly the forms in every language of required report, because they are necessary for the quotation and for a good progress of tests).

A 1- Client (pour lequel l'essai ou la certification est demandé) : *Client (for whom the testing/certification is requested)*

Société/Company : AGATEC
Contact/Contact name : M. GARCIA Carlos
Adresse/Address : 21 Bd Littré
78 600 Le Mesnil Le Roi

Tél : 01-34-93-36-33

Fax : 01-34-93-35-89

Email : c.garcia@agatec.com

A 2- Représentant ou Mandataire (pour le client ci-dessus si différent du client) : *Authorised Representative (if different than client)*

Société/Company :
Contact/Contact name :
Adresse/Address :

Tél :

Fax :

Email :

A 3- Fabricant (si différent du client) : *Manufacturer (if different than client)*

Société/Company :
Contact/Contact name :
Adresse/Address :

Tél :

Fax :

Email :

Nota important : *Ce formulaire A (administratif) ainsi que le formulaire B (parties techniques) et les questionnaires spécifiques CEM & Radio seront intégrés dans le rapport d'essai*

Important notice: *This form A (administrative) and the form B (technical part) and the specific EMC & Radio forms will be integrate in the test report.*

-B - PARTIE TECHNIQUE

Technical part (for all types of equipment)

Descriptif de la configuration à tester (joindre des photos et/ou des schémas)
Equipment's specification to test (join photos and/or schemes)

Désignation/fonction : Cellule de réception laser avec émission RF vers un Report Cabine
Designation/function:

Marque commerciale/Trade mark : 1) MR360 Cellule de réception
Référence/Modèle/Type : 2) RC360 Report Cabine

Produit/product : ☒ OUI ☐ NON **Système/system :** ☐ OUI ☐ NON

Nbre d'éléments (si système)/Nb of element (if system) :

Gamme de produits/product's range : série/serial : ☐ OUI ☒ NON
 présérie/pilot run : ☐ OUI ☐ NON
 prototype/prototype : ☒ OUI ☐ NON

Alimentation/supply : mono : Vac tri : Vac avec ou sans neutre :
with or without neutral:

Batterie/battery : 7,8 Vdc adaptateur secteur/adaptor :
 autre/other : Chargeur pour cellule : 230Vac/12V Vdc 400 mA
 préciser/specify : 8 to 28 Vdc pour le Report Cabine

Plage de tension/voltage range : voir ci dessus
Fréquence ou plage de fréquence/frequency range :
Courant nominal/nominal current : MR360 : 47 mA et RC360 : 85 mA
Puissance/power : MR360 : 0,37W et RC360 : 2W

Si le produit est embarqué/has the equipment been fitted : Oui
Type de véhicule/kind of vehicle : Excavateur

Connexion à un réseau de télécommunication/connection to telecom network :

RTC/CRT : ☐ OUI ☒ NON
 RNIS/ISDN : ☐ OUI ☒ NON
 ADSL : ☐ OUI ☒ NON
 Ethernet : ☐ OUI ☒ NON
Fonction/liaison radio/function/radio link : ☒ OUI ☐ NON
Autres/others :

Poids/weight : 0,250 kg for RC360 et 1,8kg pour MR360 **Taille/size :** (L x l x h):
 MR360 : 100 mm x 53 mm x 340 mm et RC360 : 105 mm x 20 mm x 197 mm
Température max. d'utilisation/max. temperature use : -10 °C à +50°C
Présence de liquide (ou produit dangereux)/liquid's presence (or dangerous product) : Non
Connexions particulières (eau, gaz...)/specific connection (water,gas...) : Non

Légende/legend : ☐ cocher la case appropriée/put a cross if appropriate
 OUI for YES
 NON for NO

Technical part (continued)

[illegible]

Section C-2-1 – Schéma de la configuration/Configuration's scheme :

Représentez ou fournissez SVP, l'ensemble de la configuration en précisant la longueur des câbles d'interconnexion et mettre en évidence la ou les partie(s) sous test :

Please draw or provide all the configuration and precise the length of interconnecting cable and underscore all parts under test:

Section C-2-2 – Procédure de contrôle utilisée lors des essais/Procedure used during the test

Cette section permet de décrire comment l'équipement sera contrôlé lors des essais
This section permits to show how the product will be checked during the test:

Un laser sera pointé sur la cellule de détection afin de faire éclairer sur cette dernière la position « zéro » (ensemble composé de 10 LEDS). Côté Report Cabine il faudra vérifier que la même position « zéro » est également éclairée (ensemble composé de 3 LEDS).

Section C-2-3 – Critères de susceptibilité/Susceptibilities's criterion

Dans cette section veuillez indiquer quelle(s) fonctionnalité(s) ne doit pas être dégradée (ou jusqu'à quel niveau elle peut l'être) lorsque l'équipement en test est perturbé :

Please indicate which functionalities must not be damaged (or until which level it can be) when the product in test is disrupt :

Pendant les essais de perturbation il faudra vérifier qu'il n'y a pas d'incidence sur la position des LED éclairées (toujours niveau « zéro ») et qu'elles ne s'éteignent pas.

NB : ces LED clignotent environ à 3 fois par seconde, cette fréquence correspond à la fréquence de rafraîchissement par RF du niveau émis par la cellule de réception vers le Report Cabine. Il sera toléré que la fréquence de rafraîchissement soit inférieure pendant la perturbation. Il ne sera pas toléré un changement de niveau aussi bien côté cellule de réception que du côté Report Cabine.

Par une perturbation continue (équipement proche d'un émetteur par exemple) :

For a continuous disruption (i.e. product nearby from a transmitter) :

Par une perturbation transitoire (décharge électrostatique par exemple) :

For a transient disruption (i.e. electrostatic discharge) :

***J* e soussigné, déclare, être légalement autorisé à signer pour la société présentant le produit ou système en essai, et certifie que les informations fournies sont correctes et complètes.**

***I* hereby, declare being, legally authorised to sign for the company presenting the product or system under test, and certify that provided information are right and complete.**

Fait à/Doing at :

Mesnil Le Roi

Le/The : 17 Juin 2 005

Nom/Name :

Carlos Garcia

Signature :

ANNEX 2

Antenna factors, insertion losses and amplifier values

BILL OF MATERIAL

The test antenna used for the radiated emission between 9 kHz and 30 MHz is the active loop antenna n°315. Antenna factors are given in table 1.

The test antenna used for the radiated emission between 30 MHz and 300 MHz is the biconical antenna n°1144. Antenna factors are given in table 2.

The test antenna used for the radiated emission between 300 MHz and 1 GHz is the log-periodic antenna n°3106. Antenna factors are given in table 3.

The measuring receiver n°1057 used in the frequency range 30 MHz to 1 GHz has an integrated preamplifier.

The test cable used between 9 kHz and 1 GHz to connect the antennas to the receiver/analyzer for measurements at a distance of 10 meters has losses given in table 4.

The test antenna used for the radiated emission between 1 GHz and 12 GHz is the horn antenna n°3374. Antenna factors are given in table 5.

The amplifier n°3229 and its cable used to connect the spectrum analyzer to the test cable has gain values given in the table 6.

The test cable used between 1 GHz and 12 GHz to connect the horn antenna to the amplifier for measurements at a distance of 3 meters has losses given in table 7.

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
0.009	21.3	0.75	20.3
0.01	21.5	1	20.4
0.015	20.9	1.5	20.7
0.02	20.4	2	20.5
0.03	20.7	3	20.2
0.05	20.1	5	19.9
0.075	19.8	8	19.9
0.1	19.9	10	19.6
0.15	19.7	15	19.1
0.2	20.3	20	20.1
0.3	20.8	25	20.8
0.5	20.8	30	22.3

TABLE 1 : ACTIVE LOOP ANTENNA

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
30	19.3	120	13.7
35	15.9	125	14.1
40	14.5	140	14.2
45	14.3	150	14.1
50	10.5	160	15.7
60	9.2	175	16.5
70	6.5	180	17.3
80	7.8	200	17.2
90	8.5	250	18.3
100	9.7	300	20.2

TABLE 2 : BICONICAL ANTENNA

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
300	16.0	700	21.9
400	16.8	800	21.9
500	19.1	900	23.2
600	21.6	1000	24.4

TABLE 3 : LOG-PERIODIC ANTENNA

Frequency (MHz)	loss (dB)	Frequency (MHz)	loss (dB)
0.01	0.2	125	1.3
0.1	0.4	140	1.3
1	0.5	150	1.2
10	0.6	160	1.6
30	0.7	180	1.6
35	0.8	200	1.6
40	0.8	250	1.8
45	0.9	300	2.1
50	0.8	400	2.4
60	1.0	500	2.7
70	1.0	600	3.1
80	1.1	700	3.5
90	1.2	800	3.7
100	1.3	900	3.9
120	1.2	1000	4.3

TABLE 4 : TEST CABLE FOR 10M MEASUREMENT

Frequency (GHz)	Antenna factor (dB/m)	Frequency (GHz)	Antenna factor (dB/m)
1.0	24.5	7.0	37.3
1.5	26.9	7.5	38.1
2.0	29.1	8.0	38.3
2.5	30.1	8.5	38.7
3.0	31.9	9.0	39.1
3.5	32.5	9.5	39.2
4.0	33.7	10.0	39.4
4.5	33.6	10.5	39.5
5.0	34.9	11.0	39.7
5.5	35.7	11.5	40.1
6.0	36.0	12.0	40.1
6.5	36.2	/	/

TABLE 5 : HORN ANTENNA

Frequency (GHz)	Gain value (dB)	Frequency (GHz)	Gain value (dB)
1.0	43.9	7.0	34.7
1.5	44.7	7.5	34.2
2.0	45.3	8.0	35.2
2.0	34.6	8.0	30.5
2.5	36.3	8.5	30.8
3.0	34.1	9.0	31.3
3.5	34.6	9.5	31.1
4.0	35.4	10.0	30.7
4.5	34.8	10.5	29.5
5.0	35.3	11.0	30.3
5.5	35.2	11.5	31.0
6.0	35.3	12.0	29.8
6.5	34.9	/	/

TABLE 6 : AMPLIFIER (1-2GHz/2-8GHz/8-12GHz) + 2M CABLE

Frequency (GHz)	loss (dB)	Frequency (GHz)	loss (dB)
1.0	5.3	4.5	11.2
1.5	6.4	5.0	12.0
2.0	7.4	6.0	12.8
2.5	8.3	8.0	15.8
3.0	9.0	10.0	17.6
3.5	9.2	12.0	18.9
4.0	10.5	/	/

TABLE 7 : TEST CABLE FOR 3M MEASUREMENT