

RA-24-09100521-1/A Ed. 1

“This report cancels and replaces the test report N° RA-24-09100521-1/A Edition 0”

RADIO test report

according to standards:

FCC Part 90

FCC Part 2

FCC Part 15

Equipment under test:

UHF Transceiver U-Link TRx

FCC ID:

NZI206211

Company:

MAGELLAN NAVIGATION S.A.S.

DISTRIBUTION: Mr SAGUIN

Company: ADEUNIS RF

FOR TRANSMISSION TO: Mr JUTON

Company: MAGELLAN NAVIGATION S.A.S.

Number of pages: 36 including 2 annexes

Ed.	Date	Modified pages	Written by		Technical Verification Quality Approval	
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1	22-Jun-09	4,12,13 and 14	L. BERTHAUD	LB		

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This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole manufactured products of the tested sample.



PRODUCT: UHF Transceiver

Reference / model: U-Link TRx

Part number: 206211

MANUFACTURER: ADEUNIS RF

COMPANY SUBMITTING THE PRODUCT:

Company: MAGELLAN NAVIGATION S.A.S.

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DATE(S) OF TEST: 16, 17 and 18 March 2009

TESTING LOCATION: EMITECH ATLANTIQUE laboratory at ANGERS (49) FRANCE
EMITECH ATLANTIQUE open area test site in LA POUEZE (49)
FRANCE

Registration Number by FCC: 101696/FRN: 0006 6490 08

TESTED BY: L. BERTHAUD

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1. INTRODUCTION

This report presents the results of radio test carried out on the following equipment: UHF Transceiver U-Link TRx, in accordance with normative reference.

2. PRODUCT DESCRIPTION

Class: B

Utilization: UHF Transceiver module

Modulation: GMSK BT=0.5 modulation with raw data throughput of 9600 bit/s

Antenna type: RF 50 ohms standard TNC female connector

Power level, frequency range and channels characteristics are not user adjustable.

The details pictures of the product and the circuit boards are joined with this file.

3. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below. They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

FCC Part 2 (2008)	Frequency allocations and radio treaty matters ; general rules and regulations
FCC Part 90 (2008)	Private land mobile radio services
FCC Part 15 (2008)	Code of Federal Regulations Title 47 - Telecommunication Chapter 1 - Federal Communications Commission Part 15 - Radio frequency devices Subpart C - Intentional Radiators
ANSI C63.4 (03)	American National Standard for Methods of measurement of Radio-Noise from low-voltage. Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANCI / TIA-603-C-2004	Land Mobile FM or PM Communication Equipment – Measurement and Performance Standards

4. TEST METHODOLOGY

Radio performance tests procedures given in part 15:

- Paragraph 33: frequency range of radiated measurements
- Paragraph 35: measurement detector functions and bandwidths
- Paragraph 107: conducted limits
- Paragraph 109: radiated emission limits
- Paragraph 111: antenna power conducted limits for receivers

Radio performance tests procedures given in part 2:

- Paragraph 1033: application for certification
- Paragraph 1046: measurements required: RF power output
- Paragraph 1049: measurements required: Occupied bandwidth
- Paragraph 1051: measurements required: Spurious emissions at antenna terminal
- Paragraph 1053: measurements required: Field strength of spurious radiation
- Paragraph 1055: measurements required: Frequency stability

Radio performance tests procedures given in part 90:

- Paragraph 207: types of emissions
- Paragraph 209: bandwidth limitations
- Paragraph 210: emission masks
- Paragraph 213: frequency stability
- Paragraph 214: transient frequency behaviour

5. TESTS RESULTS SUMMARY

5.1 Intentional radiators

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAP	NAs	
FCC Part 90.210	EMISSION MASKS	X				
FCC Part 90.213	FREQUENCY STABILITY	X				
FCC Part 90.214	TRANSIENT FREQUENCY BEHAVIOUR	X				
FCC Part 2.1046	RF POWER OUTPUT					Note
FCC Part 2.1049	OCCUPIED BANDWIDTH	X				
FCC Part 2.1051	SPURIOUS EMISSIONS AT ANTENNA TERMINAL	X				
FCC Part 2.1053	FIELD STRENGTH OF SPURIOUS EMISSIONS	X				
FCC Part 2.1055	FREQUENCY STABILITY	X				

NAP: Not Applicable

NAs: Not Asked

Note : UHF devices, the power is limited only by the licence issued to the user.

5.2 Unintentional radiators

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAP	NAs	
FCC Part 15.107	CONDUCTED LIMITS			X		
FCC Part 15.109	RADIATED EMISSION LIMITS	X				
FCC Part 15.111	ANTENNA POWER CONDUCTED LIMITS FOR RECEIVERS	X				

NAP: Not Applicable

NAs: Not Asked

Conclusion:

The sample UHF Transceiver U-Link TRx submitted for testing complies with the standards prescriptions:

- FCC Part 2
- FCC Part 15
- FCC Part 90

according to limits or criteria defined in this report.

6. RF POWER OUTPUT

Standard: FCC Part 2

Test procedure: Paragraph 1046

Test equipments used:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Power meter 8541B	Gigatronics	3479
Power sensor 80401A	Gigatronics	3182
Meteo station	Bioblock Scientific Meteostar	943
20 dB attenuator 8491A	Hewlett Packard	2507
10 dB attenuator 8491A	Hewlett Packard	2505

Measurement conditions:

The equipment under test is connected to the measuring equipment via 50 Ω attenuators.

Test operating condition of the equipment:

The equipment is blocked in continuous unmodulated transmission mode.

Results:

Declared power by the applicant (mW): 500 (Low power)
4000 (High power)

Sample N° 1 450 MHz

			Measured levels (mW) at:		Limits
			Low power	High power	(mW)
Normal test conditions	Temperature (°C): 22 Humidity (%): 34	Nominal power source (V): 11	446.684	3311.311	*

Sample N° 1 460 MHz

			Measured levels (mW) at:		Limits
			Low power	High power	(mW)
Normal test conditions	Temperature (°C): 22 Humidity (%): 34	Nominal power source (V): 11	446.684	3548.134	*

Sample N° 1 470 MHz

			Measured levels (mW) at:		Limits
			Low power	High power	(mW)
Normal test conditions	Temperature (°C): 22 Humidity (%): 34	Nominal power source (V): 11	478.630	3311.311	*

* for UHF devices, the power is limited only by the licence issued to the user.

Measurement uncertainty: ± 0.75 dB

7. CONDUCTED UNWANTED EMISSIONS

Standard: FCC Part 2

Test procedure: Paragraph 1051

Test equipments used:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Meteo station	Bioblock Scientific Meteostar	943
Variable notch filter 250-500 MHz	Trilithic	1531

Measurement conditions:

The measure applies from 30 MHz to harmonic 10 ($F_{\text{carrier}} \leq 1 \text{ GHz}$) of the equipment.

The equipment under test is connected to the measuring equipment via a 50 Ω variable notch filter.

Resolution bandwidth:

$30 \text{ MHz} \leq F < 1000 \text{ MHz}$:	100 kHz (Peak)
$1000 \text{ MHz} \leq F$:	1 MHz (Peak)

Test operating condition of the equipment:

The equipment is blocked in continuous unmodulated transmission mode.

Results:

Ambient temperature (°C): 22

Relative humidity (%): 33

Power supply: 11 Vd.c. (power source provided by the applicant)

Sample N° 1 450 MHz

Highest power level: +35.2 dBm

Frequency(ies) (MHz)	Level recorded (dBm)	Protection (dB _{carrier})	Limit (dB)
133.36	-45.7	80.9	≥ 56*
161.67	-43.8	79	
304.84	-41.8	77	
900	-40.9	76.1	

Lowest power level: +26.5 dBm

Frequency(ies) (MHz)	Level recorded (dBm)	Protection (dB _{carrier})	Limit (dB)
131.76	-43.8	70.3	≥ 47*
160.71	-45	71.5	
311.65	-38.5	65	
900	-52.4	78.9	

Sample N° 1 460 MHz

Highest power level: +35.5 dBm

Frequency(ies) (MHz)	Level recorded (dBm)	Protection (dB _{carrier})	Limit (dB)
131.57	-45.6	81.1	≥ 56*
320.79	-42.3	77.8	
920	-41.7	77.2	
3220	-37.5	73	

Lowest power level: +26.5 dBm

Frequency(ies) (MHz)	Level recorded (dBm)	Protection (dB _{carrier})	Limit (dB)
131.55	-45	71.5	≥ 47*
325.37	-41.4	67.9	

Sample N° 1 470 MHz

Highest power level: +35.2 dBm

Frequency(ies) (MHz)	Level recorded (dBm)	Protection (dB _{carrier})	Limit (dB)
132.73	-43.3	78.5	≥ 56*
159.48	-41	76.2	
185.18	-40.6	75.8	
295.75	-36.3	71.5	
940	-42.9	78.1	
3290	-46.8	82	

Lowest power level: +26.8 dBm

Frequency(ies) (MHz)	Level recorded (dBm)	Protection (dB _{carrier})	Limit (dB)
133.09	-45.3	72.1	≥ 47*
158.01	-42.7	69.5	
187.25	-42.4	69.2	
296.82	-39	65.8	
940	-49.5	76.3	

* limits calculations for 12.5 kHz channel spacing equipments: limit (dBc): 50+10Log (Power Output Watts)

Measurement uncertainty: ±4 dB

Test conclusion:

RESPECTED STANDARD

8. RADIATED UNWANTED EMISSIONS

Standard: FCC part 2

Test procedure: Paragraph 1053

Test equipments used:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Biconical antenna HP 11966C	Hewlett Packard	728
Log periodic antenna HL 223	Rohde & Schwarz	1999
Open site	Emitech	1274
Antenna RGA-60	Electrometrics	1204
Low-noise amplifier 1 – 18 GHz	ALC	2648
High pass filter HPM 11630	Micro-Tronics	1673
Meteo station AB888	Oregon Scientific	1539
Dipole antenna DB4	EMCO	1640
Antenna RGA-60	Electrometrics	1938
RF synthetizer	anritsu	4648

Measurement conditions:

The measure applies to outdoor test site from 30 MHz to harmonic 10 ($F_{\text{carrier}} \leq 1 \text{ GHz}$) of the equipment.

Measuring distance between the equipment and the test antenna: 3 m.

Height support of the equipment: 0.8 m.

The test antennas have been oriented in two polarizations (vertical and horizontal), we have recorded only the highest level.

The equipment under test is then substituted by a signal generator and a calibrated antenna. The equivalent radiated power is finally calculated with the formula : $P_d(\text{dBa}) = P_g(\text{dBa}) - \text{cable loss (dB)} + \text{antenne gain (dB)}$ where P_d is the dipole equivalent power, P_g the generator output power and antenna gain the corrected gain to an ideal half wave dipole.

Resolution bandwidth:

$$\begin{aligned} 30 \text{ MHz} \leq F < 1000 \text{ MHz:} & \quad 10 \text{ kHz (Peak)} \\ 1000 \text{ MHz} \leq F: & \quad 1 \text{ MHz (Peak)} \end{aligned}$$

Video bandwidth : $30 \text{ MHz} \leq F < 1000 \text{ MHz} : 300 \text{ kHz}$
 $1000 \text{ MHz} \leq F : 3 \text{ MHz}$

Test operating condition of the equipment:

The equipment is blocked in continuous unmodulated transmission mode.

Results:

Ambient temperature (°C): 21.5

Relative humidity (%): 42

Power supply: 11 Vd.c. (power source provided by the applicant)

Sample N° 1 450 MHz

Highest power level: + 37.3 dBm

Frequency(ies) (MHz)	Polarization (V or H)	Substitution level (dBm)	Protection (dB _{carrier})	Limit (dB)
900	V	-27	64.3	≥ 56*
3600.01	V	-56.9	94.2	

V: Vertical

H: Horizontal

Lowest power level: + 28.9 dBm

Frequency(ies) (MHz)	Polarization (V or H)	Substitution level (dBm)	Protection (dB _{carrier})	Limit (dB)
900	V	-43.2	72.1	≥ 47*

V: Vertical

H: Horizontal

1

Sample N° 1 460 MHz

Highest power level: + 35.8 dBm

Frequency(ies) (MHz)	Polarization (V or H)	Substitution level (dBm)	Protection (dB _{carrier})	Limit (dB)
920	V	-27.7	63.5	≥ 56*

V: Vertical

H: Horizontal

Lowest power level: + 29.1 dBm

Frequency(ies) (MHz)	Polarization (V or H)	Substitution level (dBm)	Protection (dB _{carrier})	Limit (dB)
920	V	-34.6	63.7	≥ 47*

V: Vertical

H: Horizontal

Sample N° 1 470 MHz

Highest power level: + 35 dBm

Frequency(ies) (MHz)	Polarization (V or H)	Substitution level (dBm)	Protection (dB _{carrier})	Limit (dB)
940	V	-26.6	61.6	≥ 56*

V: Vertical
H: Horizontal

Lowest power level: +29.4 dBm

Frequency(ies) (MHz)	Polarization (V or H)	Substitution level (dBm)	Protection (dB _{carrier})	Limit (dB)
940	V	-29.9	59.3	≥ 47*

V: Vertical
H: Horizontal

Measurement uncertainty:

$F < 62.5 \text{ MHz}$:	$\pm 4.4 \text{ dB}$
$62.5 \text{ MHz} \leq F \leq 1 \text{ GHz}$:	$\pm 2.6 \text{ dB}$
$F > 1 \text{ GHz}$:	$\pm 4.1 \text{ dB}$

Test conclusion:

RESPECTED STANDARD

9. OCCUPIED BANDWIDTH

Standard: FCC Part 2
FCC Part 90

Test procedure: Paragraph 1049
Paragraph 210

Test equipments used:

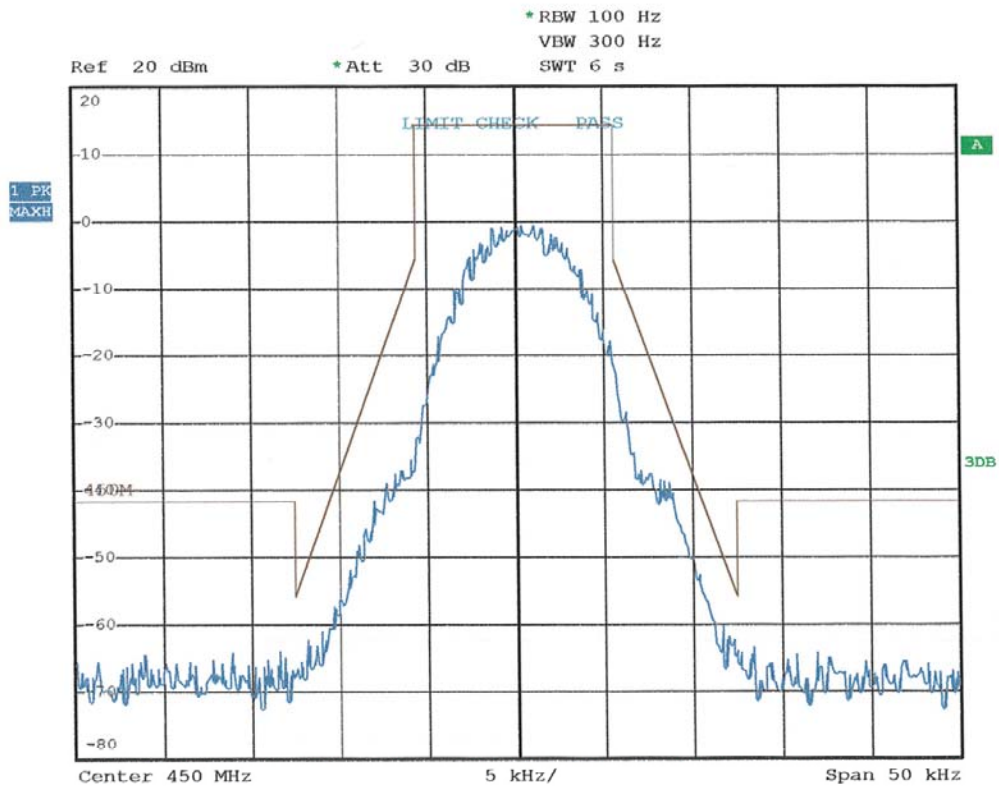
TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Meteo station	Bioblock Scientific Meteostar	943
20 dB attenuator 8491A	Hewlett Packard	2507
10 dB attenuator 8491A	Hewlett Packard	2505

Measurement conditions:

The equipment under test is connected to the measuring equipment via 50 Ω attenuators.

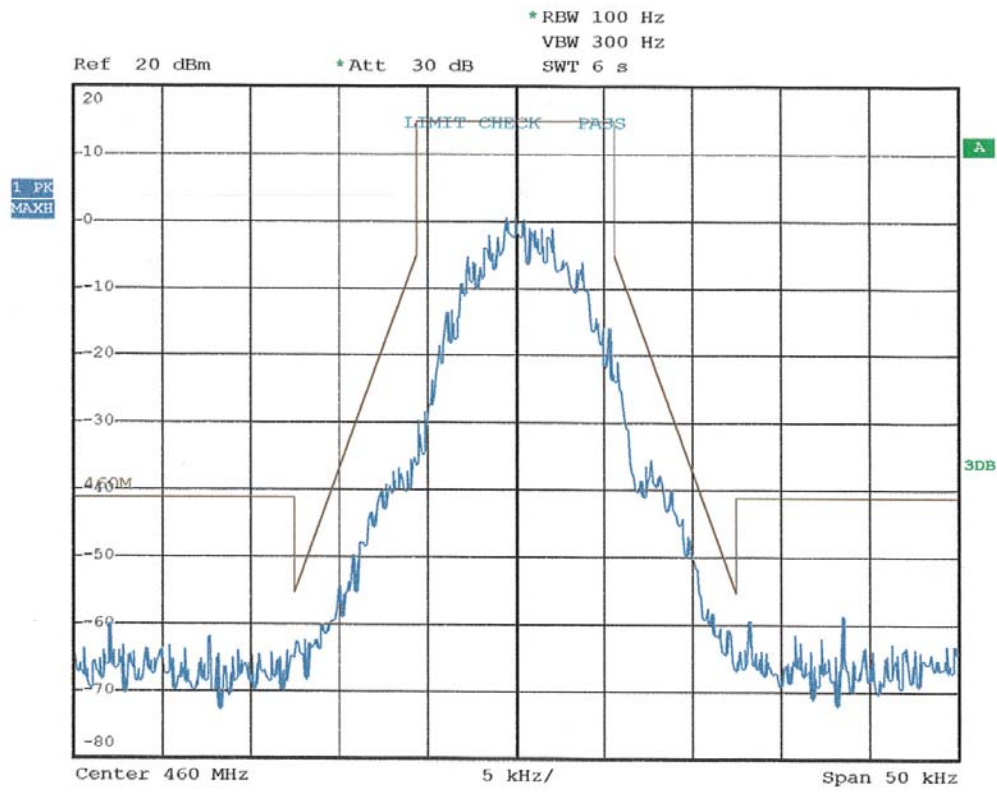
Test operating condition of the equipment:

The equipment is blocked in continuous modulated transmission mode by internal data signal.



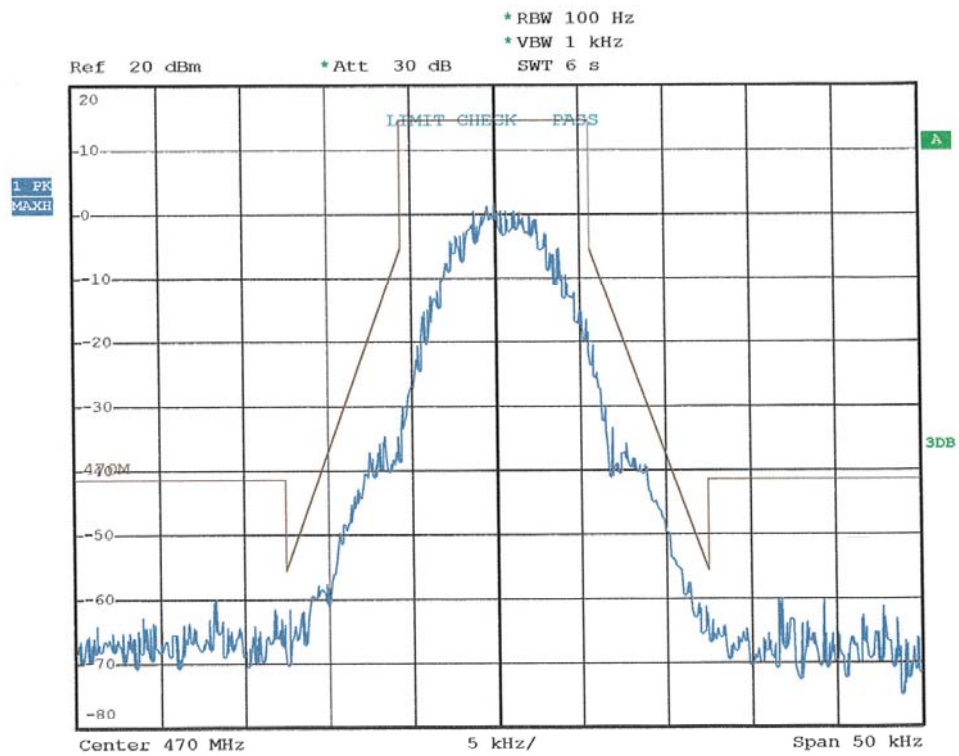
223

Date: 18.MAR.2009 06:15:14



223

Date: 18.MAR.2009 05:40:36



223

Date: 18.MAR.2009 05:19:41

Test conclusion:

RESPECTED STANDARD

10. TRANSIENT FREQUENCY BEHAVIOUR

Standard: FCC Part 90

Test procedure: Paragraph 214

Test equipment used:

TYPE	MANUFACTURER	EMITECH NUMBER
Domain analyser HP 53310 A	Hewlett Packard	4649
Modulation analyzer HP 8901B	Hewlett Packard	1211
Radiofrequency generator SME06	Rohde & Schwarz	1669
Coupler P3-03-412N	Pulsar	6107

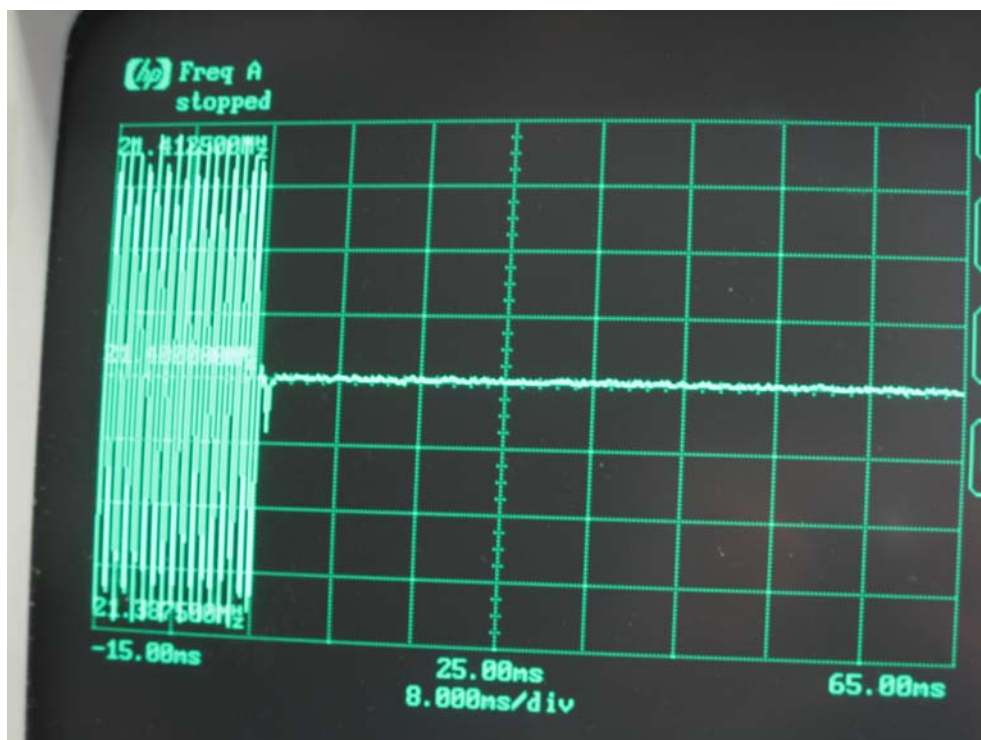
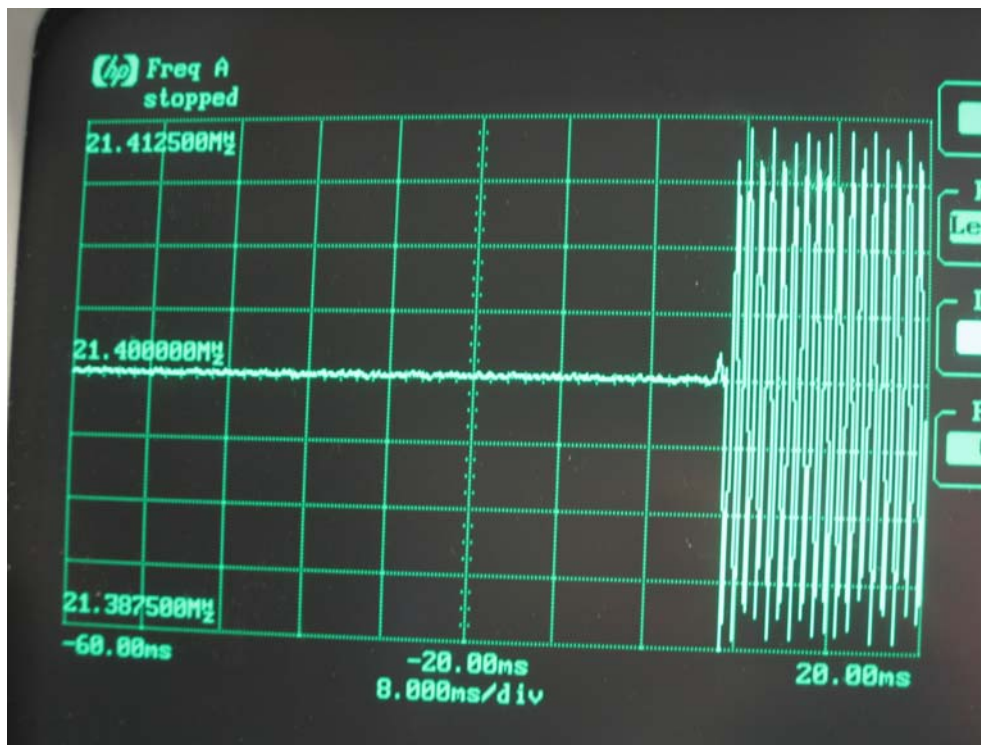
Measurement conditions:

The carrier frequency is measured with the transmitter connected to a receiver via a 50 Ω coupler. The transient behaviour of the transmitter is defined as the time-dependency of transmitter frequency, power and spectrum when the RF output power is switched on and off.

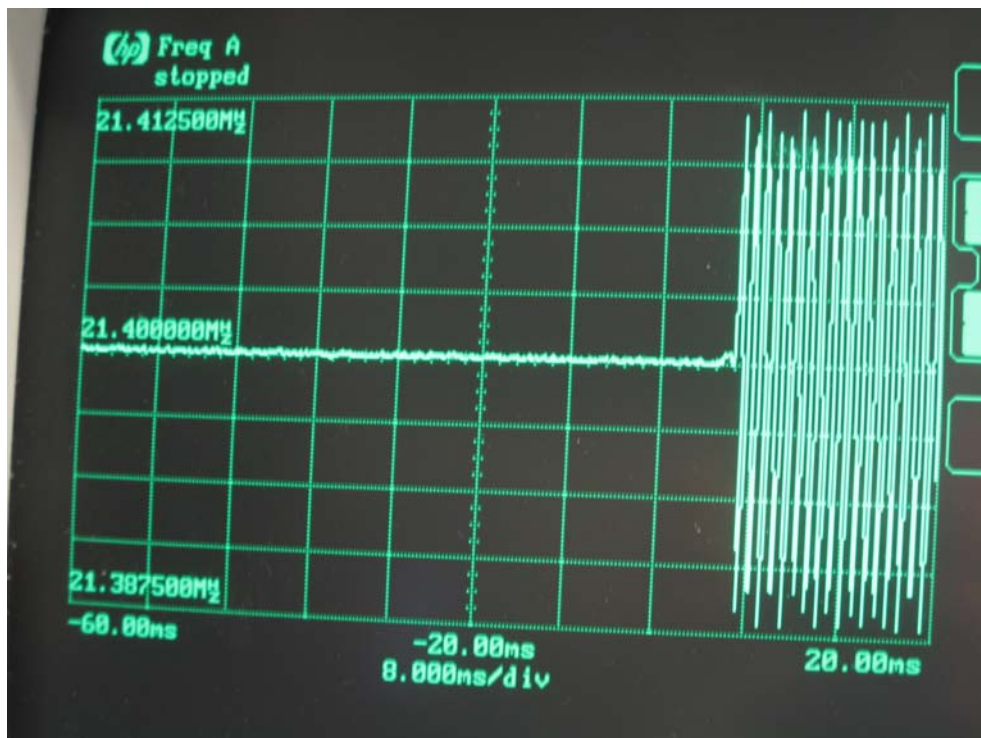
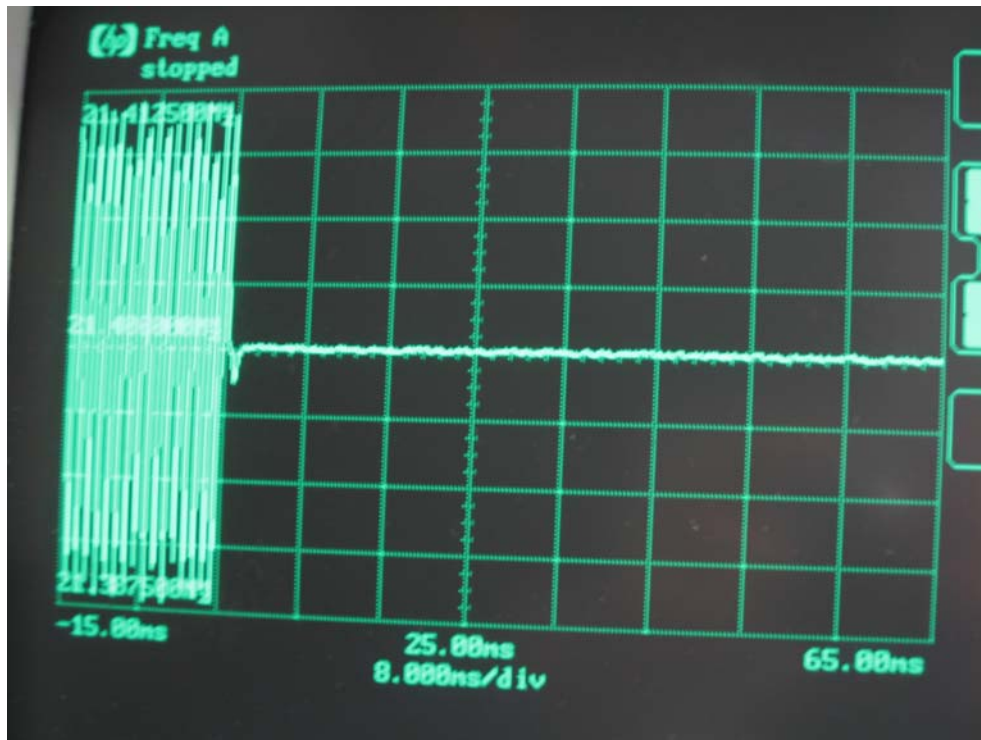
Test operating condition of the equipment:

The transmitter is modulated in continuous mode by internal data signal.

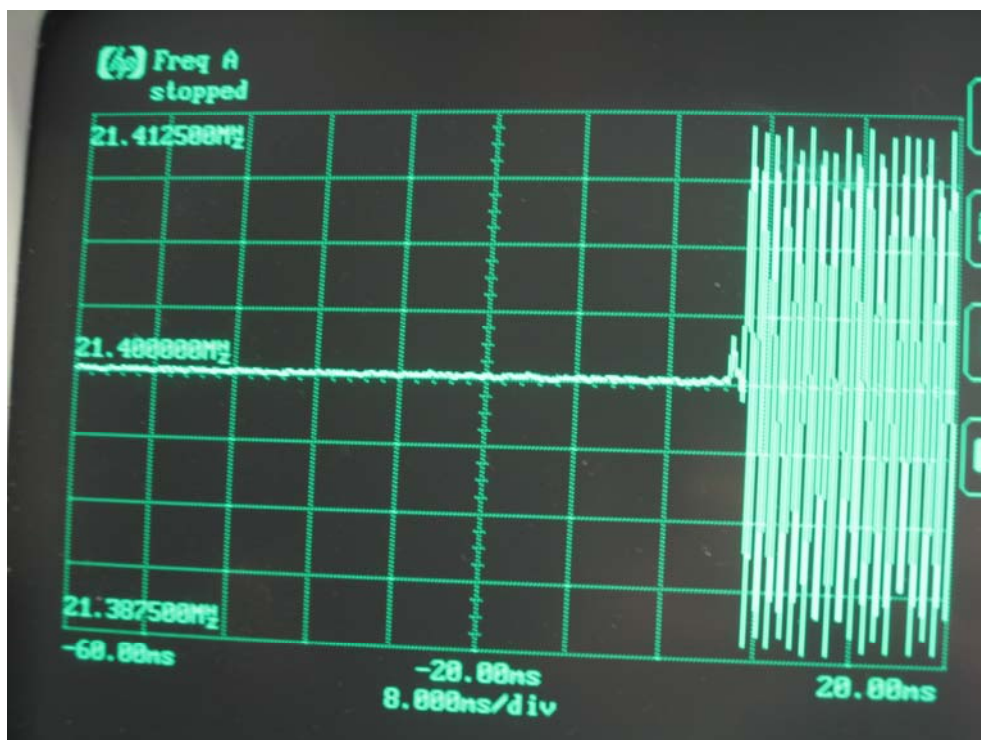
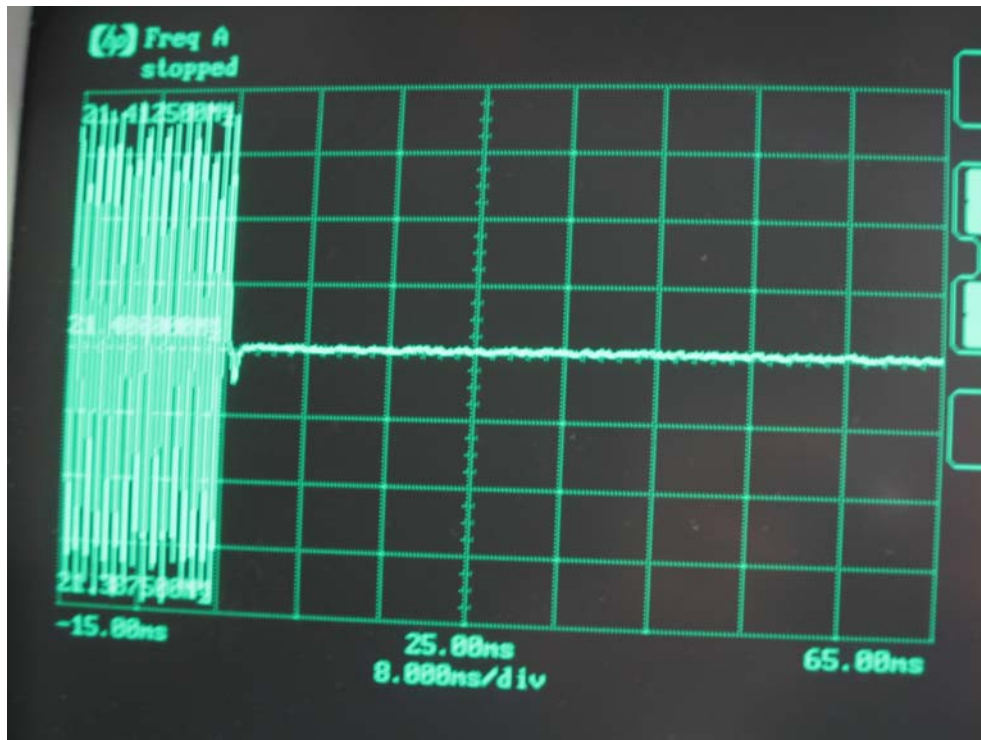
450 MHz



460 MHz



470 MHz



Test conclusion:

RESPECTED STANDARD

11. FREQUENCY STABILITY

Standard: FCC Part 2
FCC Part 90

Test procedure: Paragraph 1055
Paragraph 213

Test equipments used:

TYPE	MANUFACTURER	EMITECH NUMBER
Modulation analyzer HP 8901B	Hewlett Packard	1211
Climatic chamber	MPC	2593
Meteo station	Bioblock Scientific Meteostar	943
20 dB attenuator 8491A	Hewlett Packard	2507

Measurement conditions:

The equipment is directly connected to the measuring equipment via a 50 Ω attenuator.

Test operating condition of the equipment:

The transmitter is not modulated.

Results:

Ambient temperature (°C): 23

Relative humidity (%): 35

Power source: 11 Vd.c. (power source provided by the applicant)

450 MHz

Reference Frequency measured at 25°C and 11 Vd.c.: 449.999926 MHz

Temperature (°C)	Frequency (MHz)	Frequency Stability (PPM)	Limit (ppm)
-30	449.999894	-0.07	±2.5
-20	449.999922	-0.01	
-10	449.999908	-0.04	
0	449.999946	+0.04	
+10	450.000008	+0.18	
+20	449.999984	+0.13	
+30	449.999910	-0.04	
+40	449.999879	-0.10	
+50	449.999880	-0.10	

Voltage (V)	Frequency (MHz)	Frequency Stability (PPM)	Limit (ppm)
9	449.999944	+0.04	±2.5
9.35 (-15%)	449.999946	+0.04	
12.65 (+15%)	449.999946	+0.04	
28	449.999934	+0.02	

460 MHz

Reference Frequency measured at 25°C and 11 Vd.c.: 459.999908 MHz

Temperature (°C)	Frequency (MHz)	Frequency Stability (PPM)	Limit (ppm)
-30	459.999880	-0.06	±2.5
-20	459.999916	-0.02	
-10	459.999890	-0.03	
0	459.999943	+0.08	
+10	459.999993	+0.18	
+20	459.999964	+0.12	
+30	459.999898	-0.02	
+40	459.999861	-0.10	
+50	459.999851	-0.12	

Voltage (V)	Frequency (MHz)	Frequency Stability (PPM)	Limit (ppm)
9	459.999899	-0.02	±2.5
9.35 (-15%)	459.999910	<0.01	
12.65 (+15%)	459.999912	<0.01	
28	459.999896	-0.03	

470 MHz

Reference Frequency measured at 25°C and 11 Vd.c.: 469.999873 MHz

Temperature (°C)	Frequency (MHz)	Frequency Stability (PPM)	Limit (ppm)
-30	469.999843	-0.06	±2.5
-20	469.999899	+0.06	
-10	469.999877	+0.01	
0	469.999947	+0.16	
+10	469.999979	+0.23	
+20	469.999946	+0.16	
+30	469.999895	+0.05	
+40	469.999849	-0.05	
+50	469.999840	-0.07	

Voltage (V)	Frequency (MHz)	Frequency Stability (PPM)	Limit (ppm)
9	469.999890	+0.04	±2.5
9.35 (-15%)	469.999890	+0.04	
12.65 (+15%)	469.999886	+0.03	
28	469.999888	+0.03	

Test conclusion:

RESPECTED STANDARD

12. RADIATED EMISSION LIMITS

Standard: FCC Part 15

Test procedure: paragraph 109

Test equipment:

TYPE	BRAND	EMITECH NUMBER
Test receiver	Rohde & Schwarz ESVS 10	1219
Biconical antenna	Hewlet Packard 11966 C	728
Log periodic antenna	Rohde & Schwarz HL 223	1999
Double ridged guide antenna	Electrometrics EM 6961	1204
Spectrum analyzer	Rohde & Schwarz FSP40	4088
Open area test site	EMITECH	1274
Preamplifier 1 to 18 GHz	DBS Microwave DB97-1852	2648
High pass filter	Micro-tronics HPM11630	1673

Test set up:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuths correspond to the front of the equipment under test.

Only the emissions radiated by the cabinet and the structure are checked.

Frequency range: from 30 MHz to harmonic 10 ($F_{\text{carrier}} \leq 1 \text{ GHz}$)

Detection mode: Quasi-peak or average ($F < 1 \text{ GHz}$)
Peak ($F > 1 \text{ GHz}$)

Bandwidth: 120 kHz ($F < 1 \text{ GHz}$)
1 MHz ($F > 1 \text{ GHz}$)

Distance of antenna: 3 meters

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal (only the highest level is recorded)

Equipment under test operating condition:

The equipment is blocked in continuous reception mode which corresponds to the standby mode of the transmitter.

Results:

Ambient temperature (°C): 21
Relative humidity (%): 43

Power source: 11 Vd.c. (power source provided by the applicant).

The polarity column refers to the antenna polarity at which the maximum emissions level is measured.

450 MHz

FREQUENCIES (MHz)	Detector	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
52.16	QP	100	217	120	V	22.6	40	17.4
151.98	QP	229	123	120	H	42	43.52	1.52

460 MHz

FREQUENCIES (MHz)	Detector	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
46.09	QP	100	335	120	V	36.6	40	3.4
69.07	QP	100	233	120	V	35.9	40	4.1
147.78	QP	222	246	120	H	34.2	43.52	9.32

470 MHz

FREQUENCIES (MHz)	detector	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
46.06	QP	100	283	120	V	22	40	18

Any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Test conclusion:

RESPECTED STANDARD

13. ANTENNA POWER CONDUCTED LIMITS FOR RECEIVERS

Standard: FCC Part 15

Test procedure: paragraph 111

Test equipments used:

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum analyzer FSP40	Rohde & Schwarz	4088
Test receiver ESVS 10	Rohde & Schwarz	1219
Low-noise amplifier 1 – 18 GHz	ALC	2648
High pass filter HPM 11630	Micro-Tronics	1673
Meteo station	Bioblock Scientific Meteostar	943

Measurement conditions:

The measure applies from 30 MHz to harmonic 10 ($F \leq 1$ GHz) of the equipment.

The equipment under test is connected to the measuring equipment.

Resolution bandwidth:

$30 \text{ MHz} \leq F < 1000 \text{ MHz}$:	120 kHz (Quasi-Peak)
$1000 \text{ MHz} \leq F$:	1 MHz (Peak)

Test operating condition of the equipment:

The equipment is blocked in continuous reception mode.

Results:

Ambient temperature (°C): 22.5

Relative humidity (%): 33

Power source: 11 Vd.c. (power source provided by the applicant)

Sample N° 1 450 MHz

Receiver ON		
Frequency(ies) (MHz)	Levels (nW)	Limits (nW)
740	0.04	2

Sample N° 1 460 MHz

Receiver ON		
Frequency(ies) (MHz)	Levels (nW)	Limits (nW)
141.06	0.01	2

Sample N° 1 470 MHz

Not any spurious has been detected.

Measurement uncertainty: ± 0.75 dB

Test conclusion:

RESPECTED STANDARD

□□□ End of report, 2 annexes to be forwarded □□□

ANNEX 1: PHOTOS OF THE EQUIPMENT UNDER TEST

GENERAL VIEW



Printed circuit board: face 1



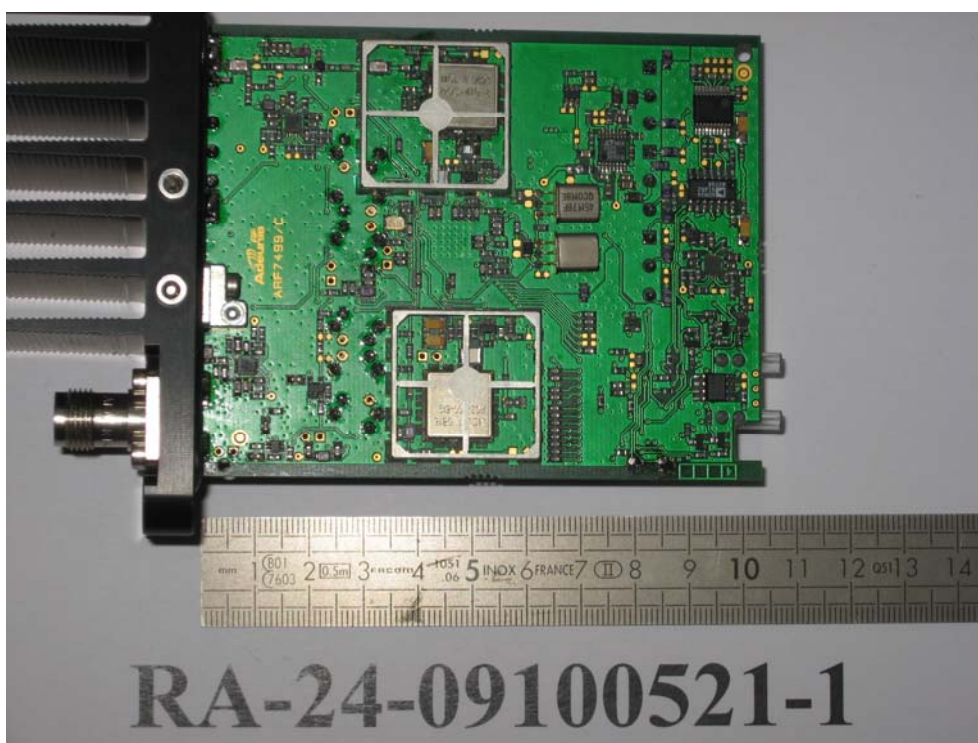
Printed circuit board: face 2



Printed circuit board without shield: face 1



Printed circuit board without shield: face 2



ANNEX 2: TEST SET UP RADIATED MEASUREMENT AND OPEN AREA TEST SITE

Test set up radiated measurement with antenna



Test set up radiated measurement with 50 Ω resistor load



OPEN AREA TEST SITE