R051-24-10-101640-1/A Ed. 0

RADIO test report

according to standard:
FCC Part 15.247

Equipment under test:
3M Wireless Communication System Base Station XT-1D

Company:
TES ELECTRONIC SOLUTIONS

DISTRIBUTION: Mr LE CORRE **Company: TES ELECTRONIC SOLUTIONS**

Number of pages: 21 including 2 annexes

Ed.	Date	Modified pages	Written by Name / Visa	Technical Verification Quality Approval Name / Visa
0	19-Apr-10	Creation	M. DUMESNIL M. D.	P. BONNENFANT

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PRODUCT:	**3M Wireless Communication System Base Station**
Reference / model:	XT-1D
Serial number:	not communicated
MANUFACTURER:	TES ELECTRONIC SOLUTIONS

COMPANY SUBMITTING THE PRODUCT:

Company:	TES ELECTRONIC SOLUTIONS
Address:	50 place du president Sadate 29337 QUIMPER Cedex FRANCE
Responsible:	Mr LE CORRE
DATE(S) OF TEST:	01 April 2010
TESTING LOCATION:	EMITECH ATLANTIQUE laboratory at ANGERS (49) FRANCE EMITECH ATLANTIQUE open area test site in LA POUEZE (49) FRANCE
TESTED BY:	M. DUMESNIL

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TITLE **PAGE**

1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment: 3M Wireless Communication System Base Station- XT-1D in accordance with normative reference.

2. PRODUCT DESCRIPTION

Class: B (residential environment)

Antenna type: dedicated antenna

Operating frequency range: from 2401.92 MHz to 2479.68 MHz

Number of channels: 91

Channel spacing: 900 kHz

Modulation: Frequency Hopping Spread Spectrum (F.H.S.S.)
O Amplitude O Digital ⊙ Frequency O Phase

Power source: 115 Va.c (mains)

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 15 (2009)	Code of Federal Regulations Title 47 – Telecommunication Chapter 1 – Federal Communications Commission Part 15 – Radio frequency devices Subpart C – Intentional Radiators
ANSI C63.10 (2009)	Methods of Measurement of Radio-Noise Emissions from Low-voltage Electrical and Electronics Equipment in the range of 9 kHz to 40 GHz.
Public Notice DA 00-705	Filing and Measurement Guideline for Frequency Hopping Spread Spectrum Systems.

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 203: antenna requirement
Paragraph 205: restricted bands of operation
Paragraph 209: radiated emission limits; general requirements
Paragraph 247: operation within the bands 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz

5. ADD ATTACHMENTS FILES

"Synoptic"
"Block diagram"
"External photos and Product labeling"
"Assembly of components"
"Internal photos"
"Layout pcb"
"Bil of materials"
"Schematics"
"Product description"
"User guide"

6. TESTS AND CONCLUSIONS

6.1 intentional radiator (subpart C)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				*Note 1*
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS				X	*By the applicant*
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				*Note 2*
FCC Part 15.247	OPERATION WITHIN THE BAND 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz					
	(a) (1) *hopping systems*				X	*By the applicant*
	(a) (1) (i) 902 – 928 MHz			X		
	(a) (1) (ii) 5725 – 5850 MHz			X		
	(a) (1) (iii) 2400 – 2483.5 MHz				X	*By the applicant*
	(a) (2) *digital modulation techniques*			X		
	(b) *maximum peak output power*	X				*Note 3*
	(c) *operation with directional antenna gains > 6 dBi*			X		*Note 4*
	(d) *intentional radiator*	X				
	(e) *peak power spectral density*			X		
	(f) *hybrid system*			X		
	(g)			X		
	(h)			X		
	(i) *RF exposure compliance*	X				*Note 5*
DA 00-705	BAND EDGE COMPLIANCE				X	*By the applicant*

NAp: Not Applicable NAs: Not Asked

Note 1: dedicated antenna, see photos in annex 1.

Note 2: see FCC part 15.247 (d).

Note 3: conducted measurement is not possible (integral antenna), so we used the radiated method in open field.

Note 4: the antenna gain is less than 6 dBi.

Note 5: this type of equipment uses less than 0.5 W of output power with a high signal transmitting duty factor (section 3 from Oet 65c).

6.2 unintentional radiator (subpart B)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.107	CONDUCTED LIMITS				X	*By the applicant*
FCC Part 15.109	RADIATED EMISSION LIMITS				X	*By the applicant*
FCC Part 15.111	ANTENNA POWER CONDUCTED LIMITS FOR RECEIVER			X		

NAp: Not Applicable NAs: Not Asked

Conclusion:

The sample of 3M Wireless Communication System Base Station-XT-1D submitted to the tests complies with the regulations of the standard FCC Part 15 in accordance with the limits or criteria defined in this report.

7. MAXIMUM PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Antenna RGA60	Electrometrics	1204
Open site	EMITECH	1274
Multimeter 77-2	Fluke	0812
Meteo station meteostar	Bioblock Scientific	0943
Variac R213	Dereix	1419

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 azimuth corresponds to the front of the equipment under test.
We use for this measure outdoor test site. The measuring distance between the equipment and the test antenna is 3 m. The test antenna has been oriented in the two polarizations, we have recorded only the highest level.

A measurement of the electro-magnetic field is realized, with a resolution bandwidth and video bandwidth adjusted at 1 MHz.

Distance of antenna: 3 meters

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal

Equipment under test operating condition:

The equipment under test is blocked in continuous transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate.

Results:

Ambient temperature (°C): 17.5
Relative humidity (%): 72

Power source: 115 Va.c through a variac

Sample n° 1 Channel 1 (2401.922 MHz)

		Level dBµV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBµV/m):	P* (W)	Limit (W)	Delta with the initial report (dB)
Normal test conditions	Nominal power source (V): 115	82.90	5.45	28.61	116.96	148.98×10^{-3}	1	+0.75

Polarization of test antenna: horizontal (height: 100 cm)
Position of equipment: wall position (azimuth: 114 degrees)

Sample n° 1 Channel 47 (2441.658 MHz)

		Level dBµV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBµV/m):	P* (W)	Limit (W)	Delta with the initial report (dB)
Normal test conditions	Nominal power source (V): 115	83.88	5.50	28.72	118.10	193.70×10^{-3}	1	+0.84

Polarization of test antenna: horizontal (height: 100 cm)
Position of equipment: wall position (azimuth: 114 degrees)

Sample n° 1 Channel 91 (2479.612 MHz)

		Level dBµV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBµV/m):	P* (W)	Limit (W)	Delta with the initial report (dB)
Normal test conditions	Nominal power source (V): 115	82.58	5.55	28.84	116.97	149.32×10^{-3}	1	+0.49

Polarization of test antenna: horizontal (height: 100 cm)
Position of equipment: wall position (azimuth: 114 degrees)

* $P = (E \times d)^2 / (30 \times Gp)$ with d = 3 m and Gp = 1

Test conclusion:

RESPECTED STANDARD

8. INTENTIONAL RADIATOR

Standard: FCC Part 15

Test procedure: paragraph 15.205
paragraph 15.209
paragraph 15.247

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Spectrum analyzer FSP 40	Rohde & Schwarz	4088
Open site	Emitech	1274
Antenna RGA-60	Electrometrics	1204
Low-noise amplifier 2 to 18 GHz	Microwave DB	1922
High pass filter HP12/3200-5AA	Filtek	
Antenna WR42	IMC	1939
Low-noise amplifier 18 to 26 GHz	ALC	3036
Multimeter 77-2	Fluke	0812
Meteo station meteostar	Bioblock Scientific	0943
Variac R213	Dereix	1419

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 azimuth corresponds to the front of the equipment under test.

Frequency range: from 9 kHz to harmonic 10 ($F_{carrier} \leq 10$ GHz)

Bandwidth: 120 kHz (F < 1 GHz) or 100 kHz, following 15.205 or 15.247
1 MHz (F > 1 GHz) or 100 kHz, following 15.205 or 15.247

Distance of antenna: between 30 m and 3 m according the frequencies and the limits.

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal, only the highest level is recorded.

Equipment under test operating condition:

The equipment under test is blocked in continuous transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate.

Results:

Ambient temperature (°C): 15.5
Relative humidity (%): 51

Power source: 115 Va.c through a variac

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

Channel 1 (F=2401.922 MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Delta with the initial report (dB)
4803.844	P	161	283	1000	V	59.26	73.98*	14.72	-0.15
4803.844	Av	161	283	1000	V	35.34	53.98*	18.64	-0.77
7205.766	P	174	290	100	V	64.32	98.10	33.78	+2.74

Channel 47 (F=2441.658 MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Delta with the initial report (dB)
4883.316	P	221	0	1000	V	58.06	73.98*	15.92	-0.11
4883.316	Av	221	0	1000	V	36.41	53.98*	17.57	-0.41
7324.974	P	242	338	1000	V	70.05	73.98*	3.93	+1.77
7324.974	Av	242	338	1000	V	41.99	53.98*	11.99	-1.20

Channel 91 (F=2479.612 MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Delta with the initial report (dB)
4959.224	P	130	0	1000	V	57.10	73.98*	16.88	-3.79
4959.224	Av	130	0	1000	V	36.88	53.98*	17.10	-1.16
7438.836	P	115	346	1000	V	71.62	73.98*	2.36	+4.66
7438.836	Av	115	346	1000	V	42.54	53.98*	11.44	-0.96

* restricted bands of operation in 15.205, this limit corresponding at the 15.209 section.

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

Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 118.10 dBµV/m on channel 47.
So the applicable limit is 98.10 dBµV/m.
In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

Test conclusion:

RESPECTED STANDARD

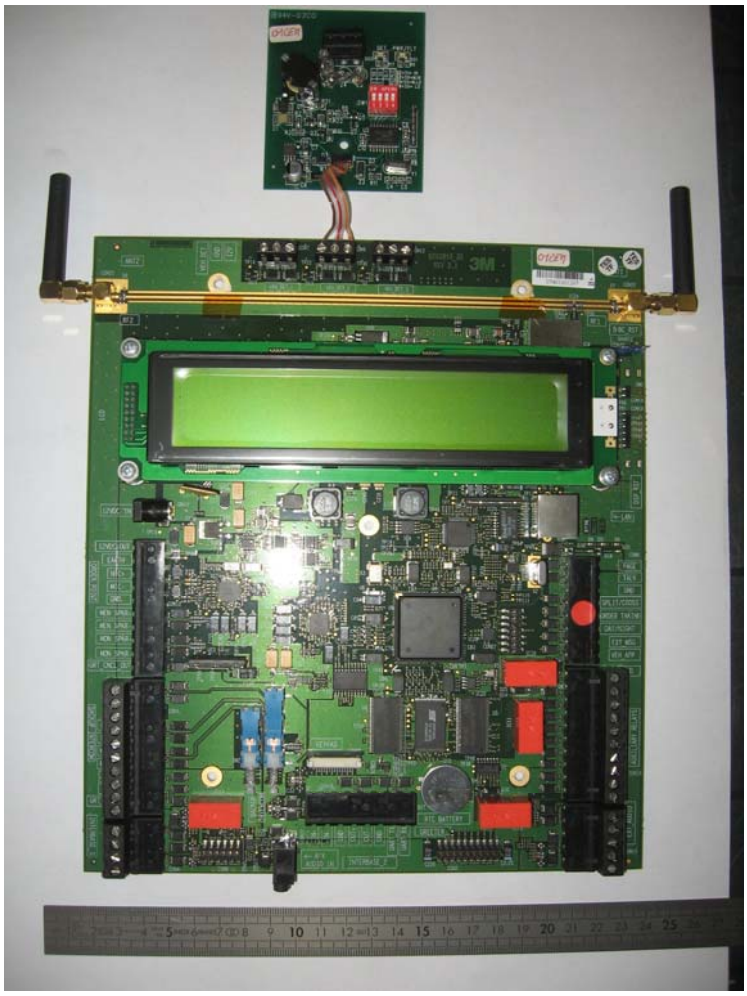
□□□ End of report, 2 annexes to be forwarded □□□

ANNEX 1: PHOTOS OF THE EQUIPMENT UNDER TEST

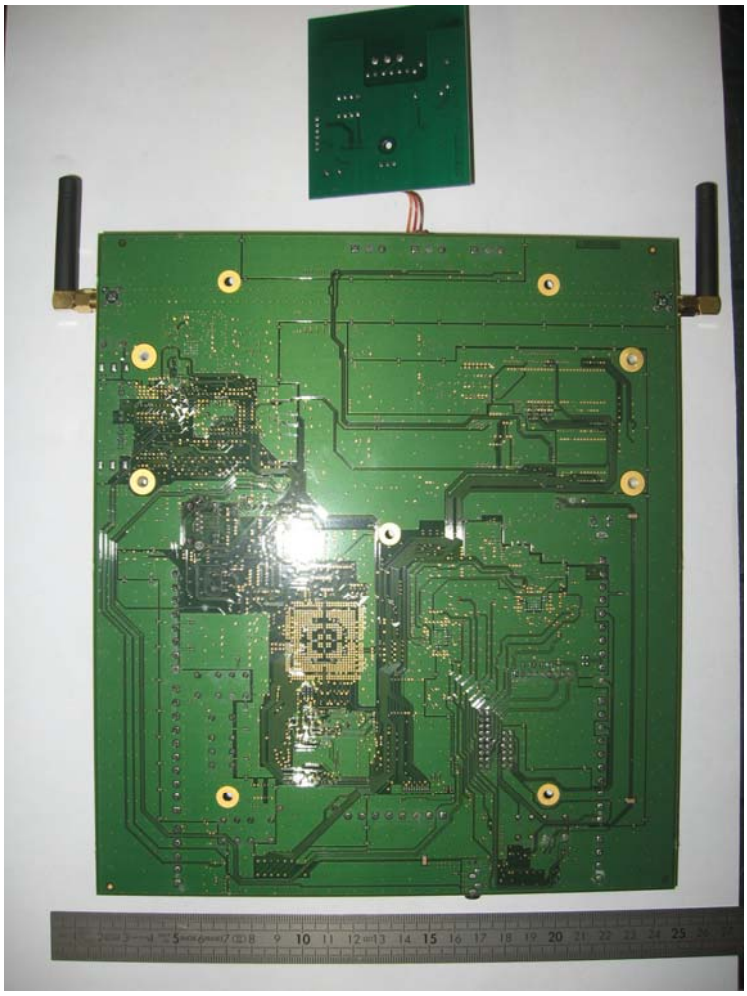
GENERAL VIEW

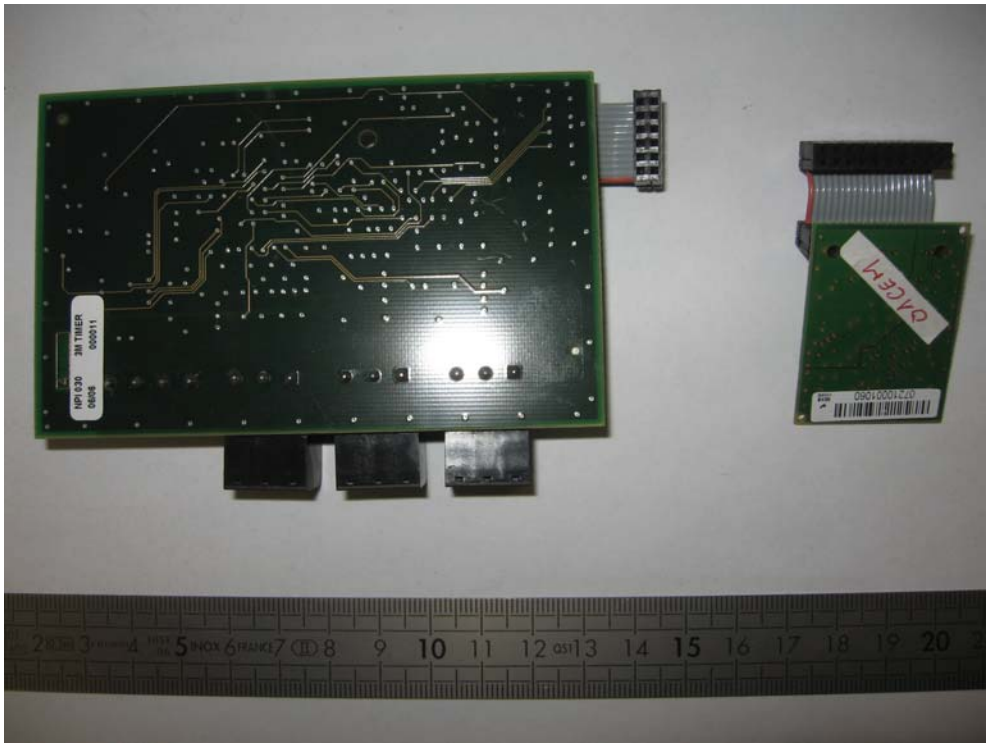
INTERNAL VIEW

Printed circuit board: face 1

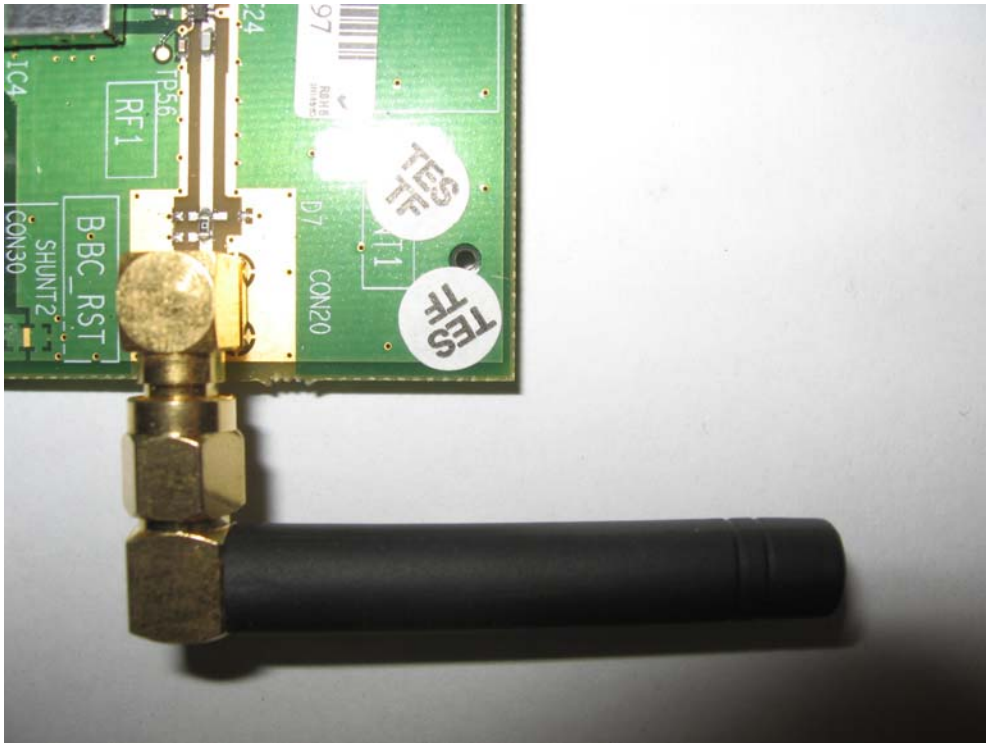


Printed circuit board: face 2





ANTENNA 1:



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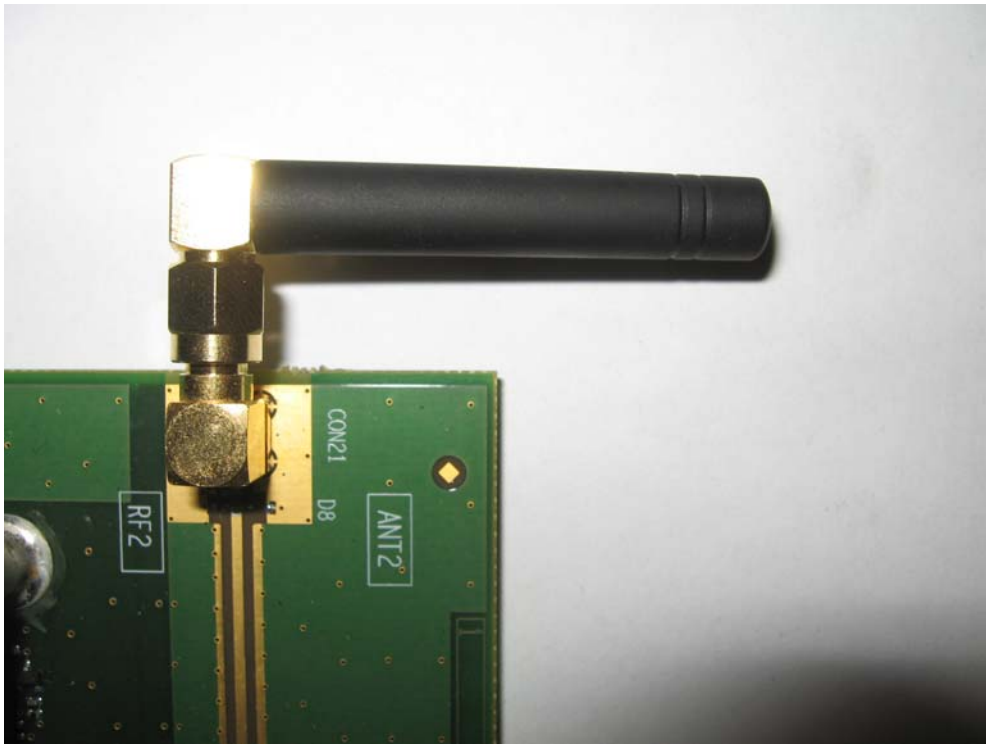
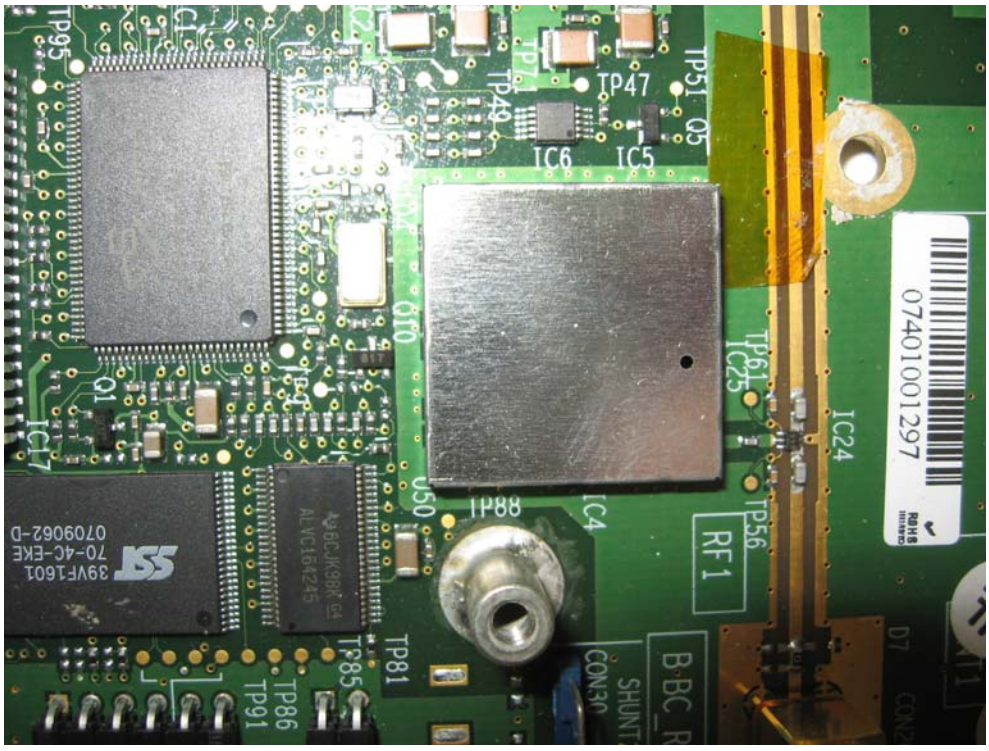


RADIO MODULE



BRIDGE

ANNEX 2: TEST SET UP AND OPEN AREA TEST SITE