

DOCUMENT No.  
PH0200-020-1

TELLUSART  
SEARCH AND RESCUE TRANSPONDER  
ENVIRONMENTAL TEST RESULTS REPORT

## ISSUE STATE

This Issue consists of the following Pages:

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ENGINEER,

Approved : ..... Date : .....  
TEST ENGINEER

Approved : *[Signature]* Date : 23/9/99  
PROJECT ENGINEER

Approved : ..... Date : .....  
QA ENGINEER

Approved : ..... Date : .....  
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Approved : *[Signature]* Date : 23/9/99  
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## 1. SCOPE

This document contains the test results of the environmental tests performed by Halleria CC on the TELLUSART MKII Search and Rescue Transponder manufactured by Halleria CC. The tests were performed according to the procedures as set out in [Ref 1]. The objective of this document is to consolidate the results of all the environmental tests required to qualify the TELLUSART MKII design for EU Type Approval under the Marine Equipment Directive.

## 2. APPLICABLE DOCUMENTS

[Ref. 1]	Environmental Test Procedure For The TELLUSART Search And Rescue Transponder	PH0200-010-1
[Ref. 2]	Acceptance Test Procedure for SART Electronic Assembly Type 3A	PH0200-009-1
[Ref. 3]	International Standard for GMDSS Part1: Radar Transponder – Marine Search and Rescue (SART) – Operational and performance requirements, methods of testing and required test results.	CEI/IEC 1097-1
[Ref. 4]	International Standard for Maritime navigation and radio communication equipment and systems – General requirements – Methods of testing and required test results	CEI/IEC 945

## 3. TEST REQUIREMENTS

All the environmental tests were carried out in accordance with the procedures detailed in document [Ref. 1] Environmental Test Procedure For The TELLUSART Search And Rescue Transponder Doc. No. PH0200-010-1

### 3.1 Test Sequence

The test sequence as specified in Table 1 of [Ref 1] was not followed. The sequence in [Ref 1] was determined by scheduling the tests according to time and effort required. The sequence therefore started with the test that involved the least time and effort. This meant that if any failure was experienced during one of the tests in the sequence, the amount of re-testing would have been kept to a minimum.

However, no procedure of any required test is dependent on the procedure of another. Therefore, the test sequence does not have any effect on the environmental test results.

The qualification testing was carried out in accordance with the sequence in Table 1 of this document.

Table 1: Qualification Test Sequence

Sequence Number	Test Description	Test Reference Number	Result sheet to be completed
1	Acceptance Test	PH0200-010-1/001	PH0200-001-1 Page 26
2	Low Temp Storage/Oper -20 °C	PH0200-010-1/002	PH0200-009-1 Page 8
	Low Temp Storage/Oper +25 °C	PH0200-010-1/003	PH0200-009-1 Page 8
3	Dry Heat Cycle +85 °C	PH0200-010-1/004	PH0200-009-1 Page 8
	Dry Heat Cycle +25 °C	PH0200-010-1/005	PH0200-009-1 Page 8
4	Radiated Emissions	None	None
5	Electrostatic Discharge	PH0200-010-1/006	PH0200-009-1 Page 8
6	Radiated Interference	None	None
7	Acceptance Test	PH0200-010-1/007	PH0200-001-1 Page 26
8	20m Drop into Water	PH0200-010-1/008 for unit 1	PH0200-009-1 Page 8
9	20m Drop into Water	PH0200-010-1/009 for unit 2	PH0200-009-1 Page 8
10	Acceptance Test	PH0200-010-1/010 for unit 1	PH0200-001-1 Page 26
11	Acceptance Test	PH0200-010-1/011 for unit 2	PH0200-001-1 Page 26

### 3.2 Test Items

[Ref 1] states the requirement that two TELLUSART units should be subjected to the qualification tests.

Due to the stability of the original design and judging further by the extent (little) of the re-design, it was agreed that initially only one unit would be subjected to the qualification tests. If however, during any qualification test, the test result would vary considerably from the expected result, then the test would have been repeated on a second unit.

The temperature and EMC qualification tests were done on the TELLUSART unit with serial number 00701.

It was decided to keep unit 00701 as a reference unit because it passed the temperature and EMC qualification tests. On that basis, and through the fact that the Drop Test only qualifies the mechanical soundness of the design, it was further decided not to risk the electrical functionality of Unit 00701 by also subjecting it to the drop test.

Units 40541 and 40542 were subjected to the Drop Test.

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### **3.3 Environmental Test Results**

#### **3.3.1 Test 1 - Acceptance Test Results**

##### **3.3.1.1 Test Reference Number**

Test Reference Number = PH0200-010-1/001 - See attached result sheet.

##### **3.3.1.2 Comment**

No failures detected during Acceptance Test

#### **3.3.2 Test 2 - Low Temperature Storage/Operation Test Results**

##### **3.3.2.1 Test Reference Number**

Test Reference Number = PH0200-010-1/002 - See attached result sheet for test done at -20 deg C.

Test Reference Number = PH0200-010-1/003 - See attached result sheet for test done at 25 deg C.

##### **3.3.2.2 Comment**

The Transmit Pulse parameters were measured at +25 deg C but were not measured at -20 deg C due to the unavailability of the Pulse Power meter. The requirement to do this measurement as well was deemed to be not critical at -20 deg C as any variation in the Transmit Pulse parameters would have translated into a change in the reading of the Average Power Meter and/or the picture of the pulse spectrum on the Spectrum Analyser.

No failures detected during Low Temperature Storage/Operation Test

#### **3.3.3 Test 3 - Dry Heat Cycle Test Results**

##### **3.3.3.1 Test Reference Number**

Test Reference Number = PH0200-010-1/004 - See attached result sheet for test done at -20 deg C.

Test Reference Number = PH0200-010-1/005 - See attached result sheet for test done at 25 deg C.

##### **3.3.3.2 Comment**

The Transmit Pulse parameters were measured at +25 deg C but were not measured at +65 deg C due to the unavailability of the Pulse Power meter. The requirement to do this measurement as well was deemed to be not critical at +65 deg C as any variation in the Transmit Pulse parameters would have translated into a change in the reading of the Average Power Meter and/or the picture of the pulse spectrum on the Spectrum Analyser.

The initial setting of the temperature compensation to medium was inadequate such that the TELLUSART did not meet its temperature requirement. The temperature compensation setting was then changed to maximum.

No further failures was detected during Dry Heat Cycle Test.

### **3.3.4 Test 4 - Radiated Emissions Test Results**

#### **3.3.4.1 Test Reference Number**

None

#### **3.3.4.2 Comment**

No failures detected during Radiated Emissions Test. See attached report from the Houwteq EMC facility Doc No. 9302-08-99, Page 10.

### **3.3.5 Test 5 - Electrostatic Discharge Test Results**

#### **3.3.5.1 Test Reference Number**

Test Reference Number = PH0200-010-1/006 - See attached result sheet for post Electrostatic Discharge Test TELLUSART functional ATP.

#### **3.3.5.2 Comment**

No failures detected during Electrostatic Discharge Test. See attached report from the Houwteq EMC facility Doc No. 9302-08-99, Page 21.

### **3.3.6 Test 6 - Radiated Interference Test Results**

#### **3.3.6.1 Test Reference Number**

None

#### **3.3.6.2 Comment**

Initially the TELLUSART unit was found to be sensitive to radiated RF over a wide frequency range. The unit was also more sensitive to vertically polarised RF signals. The following changes had to be made to the unit in order to pass the radiated susceptibility test.

i) Common mode and differential mode bypassing capacitors were added at the terminals where the battery supply is brought on to the PCB. (The battery wires act as an antenna to pick up RF interference. This action had the most drastic effect on improving the susceptibility.)

ii) Additional bypassing capacitors (combination of small and larger value capacitor) were added on the LNA's gate and drain supply lines to be able to suppress RF -"noise" over a wider bandwidth. (After action (i) the only susceptibility problem still existed around 400 MHz. By adding a smaller capacitor to the LNA power lines, it was possible to suppress this problem as well.)

iii) Fitting conductive tape at the junction where the antenna protrudes out of the TELLUSART "can" enclosure to increase shielding and to enable current flow on the outside surface of the TELLUSART structure for any RF induced current. (This was done to improve the overall shielding and proper grounding of the TELLUSART electronic and enclosure assembly. It was found that self-triggering sometimes experienced during manufacturing was much less with the added shielding than without it.)

No further failures were detected during the Radiated Interference Test. See attached report from the Houwteq EMC facility Doc No. 9302-08-98, Page 18.

### **3.3.7 Test 7 - Acceptance Test Results**

#### **3.3.7.1 Test Reference Number**

Test Reference Number = PH0200-010-1/007 - See attached result sheet.

#### **3.3.7.2 Comment**

No failures detected during Acceptance Test

### **3.3.8 Test 8 – 20m Drop into Water Test Results (First TELLUSART Unit)**

#### **3.3.8.1 Test Reference Number**

Test Reference Number = PH0200-010-1/008 - See attached result sheet for post 20m Drop into Water Test TELLUSART functional ATP.

#### **3.3.8.2 Comment**

Each unit was dropped three times (each major axis orientation) from a height of 20 meter into water.

No failures detected during 20m Drop into Water Test on the first TELLUSART unit

### **3.3.9 Test 9 – 20m Drop into Water Test Results (Second TELLUSART Unit)**

#### **3.3.9.1 Test Reference Number**

Test Reference Number = PH0200-010-1/009 - See attached result sheet for post 20m Drop into Water Test TELLUSART functional ATP.

#### **3.3.9.2 Comment**

No failures detected during 20m Drop into Water Test on the second TELLUSART unit

### **3.3.10 Test 10 – Final Acceptance Test Results (First TELLUSART Unit)**

#### **3.3.10.1 Test Reference Number**

Test Reference Number = PH0200-010-1/010 - See attached result sheet.



**3.3.10.2 Comment**

No failures detected during Final Acceptance Test

**3.3.11 Test 11 – Final Acceptance Test Results (Second TELLUSART Unit)****3.3.11.1 Test Reference Number**

Test Reference Number = PH0200-010-1/011 - See attached result sheet.

**3.3.11.2 Comment**

No failures detected during Final Acceptance Test

**4. CONCLUSION**

The only failure experienced during the re-qualification of the partly re-developed TELLUSART system was during the Radiated Susceptibility Tests. After adding extra filtering on the internal DC power distribution lines and adding conductive tape to electrically connect the waveguide antenna to the housing of the Electronic Assembly (see Para 3.3.6.2), the Radiated Susceptibility Tests were conducted on the unit again. This time without any failure.

At this point of the qualification process the temperature tests have been completed. Careful consideration was given to the changes made to the system and in particular to whether it would have any effect to the functionality of a TELLUSART unit when it is subjected to high and low temperatures. It was concluded that since the TELLUSART unit is battery operated and therefore the internal DC voltage distribution lines would not carry any PSU induced voltage ripple, that the extra filtering to prevent the RF interference would have no effect on the unit's functionality at temperature. The results of the temperature qualification were therefore judged as not affected and that part of the qualification was thus regarded as complete.

Based on the attached test result sheets it is accepted that the TELLUSART MKII system design has been successfully re-qualified in accordance with the qualification requirements of the TELLUSART as agreed between the TELLUSART manufacturer and the TELLUSART re-development systems engineer.

## APPENDIX D: TEST RESULT SHEET: TELLUSART

Date:	30/5/99
Tests Performed By:	J S KRANTZ
Signature	<i>J S Krantz</i>
Tests Checked By QA:	D. F. FROST
Signature	<i>D F Frost</i>
Test Ref. No.	PH0200-010-1/001

[illegible]



QA Representative: \_\_\_\_\_

A handwritten signature in black ink, appearing to be "D. J. Smith", written over a horizontal line.

Date: \_\_\_\_\_

21/9/99

## APPENDIX A: TEST RESULT SHEET: TELLUSART

Date:	30/5/99
Serial Number	00701
Tests Performed By:	JJ. KRANTZ
Signature	<i>JJ Krantz</i>
Tests Checked By QA:	D. F. FROST
Signature	<i>D. F. Frost</i>
Test Ref. No.	PH0200-010-1/002

Reference Paragraph	Test	Condition	Allowed Range	Result	Pass/Fail
3.3.1	Supply Current (mA)	Receive	(< 45)	39	P
		Standby	(< 80)	72	P
		Transmit	(< 125)	116	P
3.3.2	Frequency Range (GHz)	f-3dB-Low	(>9.14, <9.20)	9.194	P
		f-3dB-High	(> 9.50, <9.56)	9.551	P
3.3.3	Transmit Pulse <i>NA: Test only done at +25°C</i>	Peak Power	28 dBm		
		Power Var	+/- 2 dB		
		Pulse Width	100 +/- 5 uS		
		Rise Time	<250 nS		
		Fall Time	<650 nS		
3.3.4	Receive Sensitivity (dBm)	9.20 GHz	<-50 dBm	-56.2	P
		9.35 GHz	<-50 dBm	-55.3	P
		9.50 GHz	<-50 dBm	-55.7	P
3.3.5	Transmit Power (dBm)	0°	>+26 dBm	+28.55	P
		90°	>+26 dBm	+28.04	P
		180°	>+26 dBm	+28.35	P
		270°	>+26 dBm	+28.05	P

## APPENDIX A: TEST RESULT SHEET: TELLUSART

Date:	30/5/99
Serial Number	00701
Tests Performed By:	JJ KRANTZ
Signature	<i>JJ Krantz</i>
Tests Checked By QA:	D.F. FROST
Signature	<i>D.F. Frost</i>
Test Ref. No.	PH0200-010-1/003

Reference Paragraph	Test	Condition	Allowed Range	Result	Pass/Fail
3.3.1	Supply Current (mA)	Receive	(< 45)	40.2	P
		Standby	(< 80)	74.1	P
		Transmit	(< 125)	118.0	P
3.3.2	Frequency Range (GHz)	f-3dB-Low	(>9.14, <9.20)	9.167	P
		f-3dB-High	(> 9.50, <9.56)	9.533	P
3.3.3	Transmit Pulse	Peak Power	28 dBm	29.22	P
		Power Var	+/- 2 dB	1.98	P
		Pulse Width	100 +/- 5 uS	98.8	P
		Rise Time	<250 nS	225	P
		Fall Time	<650 nS	640	P
3.3.4	Receive Sensitivity (dBm)	9.20 GHz	<-50 dBm	-54.2	P
		9.35 GHz	<-50 dBm	-53.7	P
		9.50 GHz	<-50 dBm	-54.3	P
3.3.5	Transmit Power (dBm)	0°	>+26 dBm	28.64	P
		90°	>+26 dBm	28.21	P
		180°	>+26 dBm	28.50	P
		270°	>+26 dBm	28.18	P

## APPENDIX A: TEST RESULT SHEET: TELLUSART

Date:	30/5/99
Serial Number	00701
Tests Performed By:	J J KRANTZ
Signature	<i>JJ Krantz</i>
Tests Checked By QA:	D. F. FROST
Signature	<i>D. F. Frost</i>
Test Ref. No.	PH0200-010-1/004

Reference Paragraph	Test	Condition	Allowed Range	Result	Pass/Fail
3.3.1	Supply Current (mA)	Receive	(< 45)	43	P
		Standby	(< 80)	76	P
		Transmit	(< 125)	120	P
3.3.2	Frequency Range (GHz)	f-3dB-Low	(>9.14, <9.20)	9.149	P
		f-3dB-High	(> 9.50, <9.56)	9.505	P
3.3.3	Transmit Pulse NA: Test only done at 25°C	Peak Power	28 dBm	29	
		Power Var	+/- 2 dB		
		Pulse Width	100 +/- 5 uS		
		Rise Time	<250 nS		
		Fall Time	<650 nS		
3.3.4	Receive Sensitivity (dBm)	9.20 GHz	<-50 dBm	-52.2	P
		9.35 GHz	<-50 dBm	-52.0	P
		9.50 GHz	<-50 dBm	-52.5	P
3.3.5	Transmit Power (dBm)	0°	>+26 dBm	28.9	P
		90°	>+26 dBm	27.7	P
		180°	>+26 dBm	27.9	P
		270°	>+26 dBm	27.7	P

## APPENDIX A: TEST RESULT SHEET: TELLUSART

Date:	30/5/99
Serial Number	00701
Tests Performed By:	J J Kramb
Signature	<i>J J Kramb</i>
Tests Checked By QA:	D. F. FROST
Signature	<i>D. F. Frost</i>
Test Ref. No.	PH0200-010 -1/005

Reference Paragraph	Test	Condition	Allowed Range	Result	Pass/Fail
3.3.1	Supply Current (mA)	Receive	(< 45)	41	P
		Standby	(< 80)	74	P
		Transmit	(< 125)	119	P
3.3.2	Frequency Range (GHz)	f-3dB-Low	(>9.14, <9.20)	9.162	P
		f-3dB-High	(> 9.50, <9.56)	9.526	P
3.3.3	Transmit Pulse	Peak Power	28 dBm	29.22	P
		Power Var	+/- 2 dB	1.98	P
		Pulse Width	100 +/- 5 uS	98.8	P
		Rise Time	<250 nS	225.0	P
		Fall Time	<650 nS	638.0	P
3.3.4	Receive Sensitivity (dBm)	9.20 GHz	<-50 dBm	-54.5	P
		9.35 GHz	<-50 dBm	-53.5	P
		9.50 GHz	<-50 dBm	-54.3	P
3.3.5	Transmit Power (dBm)	0°	>+26 dBm	28.83	P
		90°	>+26 dBm	28.18	P
		180°	>+26 dBm	28.50	P
		270°	>+26 dBm	28.22	P



**RADIATED EMISSIONS TESTS RESULT SHEET****TEST REFERENCE - PARAGRAPH 3.4.3.3**LOCATION HouwtechDATE: FROM 16/8/99 TO 16/8/99SYSTEM S/N 00701Previous Test the Test Items Have Undergone PH0200-009-1

During the test the radiated emissions must comply with the levels specified in [Ref 2] Clause 9.3.2. (Houwtech EMC Test Report)

Remarks PASS. See Tellusant MKII EMC Test Report.Doc: 9302-08-99, page 10Initial Failure Analysis None

Sign Off

Conducted by: J. Kaup Date: \_\_\_\_\_QA Representative: [Signature] Date: 21/9/99

**ELECTROSTATIC DISCHARGE TESTS RESULT SHEET****TEST REFERENCE - PARAGRAPH 3.4.3.5**LOCATION HorwitzerDATE: FROM 16/8/99 TO 16/8/99SYSTEM S/N 00701Previous Test the Test Items Have Undergone PH0200-009-1Results of Operational Tests (See Operational Test Result Sheet for Detailed Results)Post Test Operation (Tellusart Acceptance Test (Ref 3)) PASS

Test Ref. No. PH0200-010-1/006

Remarks See Doc: 9302-08-99, Page 21Initial Failure Analysis None

Sign Off

Conducted by: J. Kauf Date: \_\_\_\_\_QA Representative: [Signature] Date: 21/9/99

## APPENDIX A: TEST RESULT SHEET: TELLUSART

Date:	16/8/99
Serial Number	00701
Tests Performed By:	JS KRANTZ
Signature	<i>JS Krantz</i>
Tests Checked By QA:	D. F. FROST
Signature	<i>D.F. Frost</i>
Test Ref. No.	PH0200-010-1/006

Reference Paragraph	Test	Condition	Allowed Range	Result	Pass/Fail
3.3.1	Supply Current (mA)	Receive	(< 45)	38	P
		Standby	(< 80)	74	P
		Transmit	(< 125)	117	P
3.3.2	Frequency Range (GHz)	f-3dB-Low	(>9.14, <9.20)	9.172	P
		f-3dB-High	(> 9.50, <9.56)	9.54	P
3.3.3	Transmit Pulse  NA	Peak Power	28 dBm		
		Power Var	+/- 2 dB		
		Pulse Width	100 +/- 5 uS		
		Rise Time	<250 nS		
		Fall Time	<650 nS		
3.3.4	Receive Sensitivity (dBm)	9.20 GHz	<-50 dBm	-57.4	P
		9.35 GHz	<-50 dBm	-55.9	P
		9.50 GHz	<-50 dBm	-54.2	P
3.3.5	Transmit Power (dBm)	0°	>+26 dBm	27.49	P
		90°	>+26 dBm	29.73	P
		180°	>+26 dBm	27.01	P
		270°	>+26 dBm	29.30	P

RADIATED INTERFERENCE TEST RESULT SHEETTEST REFERENCE - PARAGRAPH 3.4.3.4LOCATION HawthorpeDATE: FROM 16/8/99 TO 16/8/99SYSTEM S/N 00701Previous Test the Test Items Have Undergone PH0200-009-1Results of Operational Tests (See Operational Test Result Sheet for Detailed Results) SeeDoc: 9302-08-99, page 17 for Test Procedure.During Test Operation (Tellusart Acceptance Test (Ref 3)) PASS

Test Ref. No. \_\_\_\_\_

Remarks See Doc: 9302-08-99, page 18 for Test Results.Initial Failure Analysis See Doc: 9302-08-99, Page 18 for a  
description of initial susceptibility results and  
remedial modifications that was implemented.

Sign Off

Conducted by: J. Kang Date: \_\_\_\_\_QA Representative: [Signature] Date: 21/9/99



## APPENDIX A - Result Sheets

## TELLUSART Qualification Tests

20 METER DROP INTO WATER TEST RESULT SHEETTEST REFERENCE - PARAGRAPH 3.4.3.1LOCATION Helderborg College Swimming PoolDATE: FROM 6/9/99 TO 6/9/99SYSTEM S/N 40541 and 40542Previous Test the Test Items Have Undergone PHO 200-009-1Results of Visual Examination (Note any Defects or Discrepancies)

ATP No	Description	Specification	Result	
				P/F
3.4.3.1	Visual Inspection	No leakage or damage	P	P

Remarks None; Result noted above applies for both units testedResults of Operational Tests (See Operational Test Result Sheet for Detailed Results)

Tellusart Acceptance Test (Ref 3) \_\_\_\_\_

Test Ref. No. PH0200-010-1/008 &amp; 9

Remarks Each unit was dropped three times (each major axis-orientation) from height of 20m into waterInitial Failure Analysis None

Sign Off

Conducted by: JJ Kauf Date: \_\_\_\_\_QA Representative: [Signature] Date: 2/19/99

## APPENDIX A: TEST RESULT SHEET: TELLUSART

Date:	6/9/99
Serial Number	40541
Tests Performed By:	J J. KRANTZ
Signature	<i>JJ Krantz</i>
Tests Checked By QA:	D. F. FROST
Signature	<i>D Frost</i>
Test Ref. No.	PH0200-010-1/008

Reference Paragraph	Test	Condition	Allowed Range	Result	Pass/Fail
3.3.1	Supply Current (mA)	Receive	(< 45)	26	P
		Standby	(< 80)	57	P
		Transmit	(< 125)	111	P
3.3.2	Frequency Range (GHz)	f-3dB-Low	(>9.14, <9.20)	9.162	P
		f-3dB-High	(> 9.50, <9.56)	9.535	P
3.3.3	Transmit Pulse (N/A)	Peak Power	28 dBm		
		Power Var	+/- 2 dB	±	
		Pulse Width	100 +/- 5 uS	±	
		Rise Time	<250 nS		
		Fall Time	<650 nS		
3.3.4	Receive Sensitivity (dBm)	9.20 GHz	<-50 dBm	-54	P
		9.35 GHz	<-50 dBm	-53	P
		9.50 GHz	<-50 dBm	-53	P
3.3.5	Transmit Power (dBm)	0°	>+26 dBm	28.7	P
		90°	>+26 dBm	27.4	P
		180°	>+26 dBm	27.9	P
		270°	>+26 dBm	27.4	P



## APPENDIX A: TEST RESULT SHEET: TELLUSART

Date:	6/9/99
Serial Number	40542
Tests Performed By:	J-J. KRAWITZ
Signature	<i>J. Krawitz</i>
Tests Checked By QA:	D. F. FROST
Signature	<i>D. Frost</i>
Test Ref. No.	PH0200-010-1/009

Reference Paragraph	Test	Condition	Allowed Range	Result	Pass/Fail
3.3.1	Supply Current (mA)	Receive	(< 45)	27	P
		Standby	(< 80)	58	P
		Transmit	(< 125)	113	P
3.3.2	Frequency Range (GHz)	f-3dB-Low	(> 9.14, < 9.20)	9.162	P
		f-3dB-High	(> 9.50, < 9.56)	9.535	P
3.3.3	Transmit Pulse • N/A	Peak Power	28 dBm		
		Power Var	+/- 2 dB		
		Pulse Width	100 +/- 5 uS		
		Rise Time	<250 nS		
		Fall Time	<650 nS		
3.3.4	Receive Sensitivity (dBm)	9.20 GHz	<-50 dBm	-54	P
		9.35 GHz	<-50 dBm	-53	P
		9.50 GHz	<-50 dBm	-52	P
3.3.5	Transmit Power (dBm)	0°	>+26 dBm	28.7	P
		90°	>+26 dBm	27.5	P
		180°	>+26 dBm	28.2	P
		270°	>+26 dBm	27.4	P



