

Test report No:
5184ERM.001

Antenna Gain Test report

(*) Identification of item tested	Smart light switch
(*) Trademark	Deako
(*) Model and /or type reference tested	DS2023
Other identification of the product	FCC ID: 2AK29- DS2023 IC ID: 22393-DS2023
(*) Features	Bluetooth, Wifi
Manufacturer	Deako Inc. 4201 ROOSEVELT WAY NE, 98105, SEATTLE, WASHINGTON, USA
Test method requested, standard	-
Summary	See Annex A
Approved by (name / position & signature)	Domingo Galvez EMC&RF Lab Manager
Date of issue	05-08-2025
Report template No	FDT08_24 (*) "Data provided by the client"

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Competences and guarantees

In order to assure the traceability to other national and international laboratories, DEKRA Certification Inc. has a calibration and maintenance program for its measurement equipment.

DEKRA Certification Inc. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Certification Inc. at the time of performance of the test.

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The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
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4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Certification Inc. internal document PODT000.

Test Case	U (k=2)	Units
Passive Antenna Min/Average/Max Gain	3.30	dB

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of the product is a Wi-Fi and Bluetooth connected light switch for residential purposes.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples used for the test have been selected by: The client

Sample S/01 is composed of the following elements, accessories and auxiliary equipment:

Id	Control Number	Description	Manufacturer / Model	Serial N°	Date of Reception	Application
S/01	4935/34	Module 3	DS2023	-	1/9/2025	Element Under Test
S/01	4935/01	UART flat grey cable	-	-	12/17/2024	Accessory
S/01	4935/02	Espressif Programmer	-	-	12/17/2024	Accessory
S/01	4935/03	USB Type A (Male) to Micro B (Male) Cable	-	-	12/17/2024	Accessory
S/01	4935/06	Backplate	DS-BP1X-WHNL-UCX	-	12/17/2024	Accessory
S/01	4935/09	assembled Deako Smart Switch Sample 3	-	-	12/17/2024	Accessory

Sample S/01, was used for the following test(s): All Radiated tests indicated in appendix A.

Test sample description

Test Sample description (compulsory information for EMC and RF testing services)

Ports..... :	Port name and description		Cable			
			Specified length [m]	Attached during test	Shielded	
	Hot In		1	☒	☐	
	Neutral		1	☒	☐	
	Ground		1	☒	☐	
				☐	☐	
				☐	☐	
				☐	☐	
Supplementary information to the ports.....:		No Data Provided				
Rated power supply	Voltage and Frequency		Reference poles			
			L1	L2	L3	N
	☒	AC: 120VAC, 60Hz	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐
	☐	DC:				
	☐	DC:				
Rated Power		No Data Provided				
Clock frequencies.....:		40Mhz				
Other parameters		No Data Provided				
Software version		1				
Hardware version		1				
Dimensions in cm (W x H x D)		42.4x80.5x45.7mm				
Mounting position	☐	Tabletop equipment				
	☒	Wall/Ceiling mounted equipment				
	☐	Floor standing equipment				
	☐	Hand-held equipment				
	☐	Other: Automotive				

Modules/parts.....:	Module/parts of test item	Type	Manufacturer
	Plastic Enclosure		Deako
	DC Board		Deako
	AC Card		Deako
Accessories (not part of the test item)	Description	Type	Manufacturer
	No Data Provided		
Documents as provided by the applicant	Description	File name	Issue date
	Dekra Work Instructions	Dekra Work Instruments	12/12/24
	Declaration Equipment Data	FDT30_18 Declaration Equipment Data - VA	01/14/2025

Copy of marking plate:



⁽³⁾ Only for Medical Equipment

Identification of the client

Deako Inc.
4201 ROOSEVELT WAY NE,
98105, SEATTLE, WASHINGTON,
USA

Testing period and place

Test Location	DEKRA Certification Inc.
Date (start)	05-01-2025
Date (finish)	05-05-2025

Document history

Report number	Date	Description
5021ERM.001	05-08-2025	First release

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the semi anechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Yuqi Wang, Yuri Barone and Koji Nishimoto.

Internal procedure (PERMUSA404) was used to perform the antenna gain tests.

Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

Summary

	Product Certification Antenna Test
Report Section	Requirement – Test case
A.1	5.1 Passive Antenna Max Gain

List of equipment used during the test

1. Equipment used for Product Certification Antenna Test

CONTROL NUMBER	DESCRIPTION	MANUFACTURER	MODEL	LAST CALIBRATION	NEXT CALIBRATION	CERTIFICATION NUMBER
0018	Spectrum Analyzer	Agilent SA	N9010A	10-04-2024	10-04-2026	HCT2024A02072
0019	Switch/Control System	Agilent	3499C	N/A	N/A	N/A
0030	Positioning Controller	ETC EMCO	2090	N/A	N/A	N/A
0033	Anechoic Chamber	ETS-LINDGREN	AMS-8500	N/A	N/A	N/A
1006	Signal Generator	Rohde & Schwarz	SMC100A	02-20-2024	02-20-2026	HCT2024A01288
1296	Spiral Antenna	ETS LINDGREN	3102L	N/A	N/A	N/A

Appendix A: Test results (Product Certification Antenna Test)

Appendix A Content

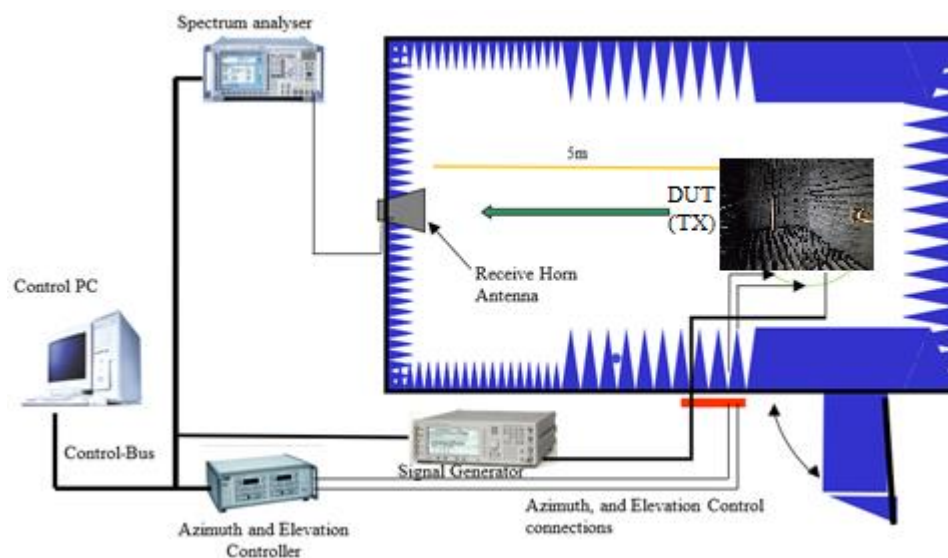
PRODUCT INFORMATION11

SECTION A.1: Passive Antenna Min/Average/Max Gain12

PRODUCT INFORMATION

Information	Description
Modulation	802.11b (DSSS/CCK)
Operation mode 1: Single Antenna Equipment	
- Operating Frequency Range	2.400 GHz to 2.4835 GHz
- Nominal Channel Bandwidth	20 MHz
- RF Output Power	20dBm
Antenna type	PCB - Inverted F
Nominal Voltage	
- Supply Voltage	120 Vac
- Type of power source	AC voltage
Equipment type	Wi-Fi
Geo-location capability	No

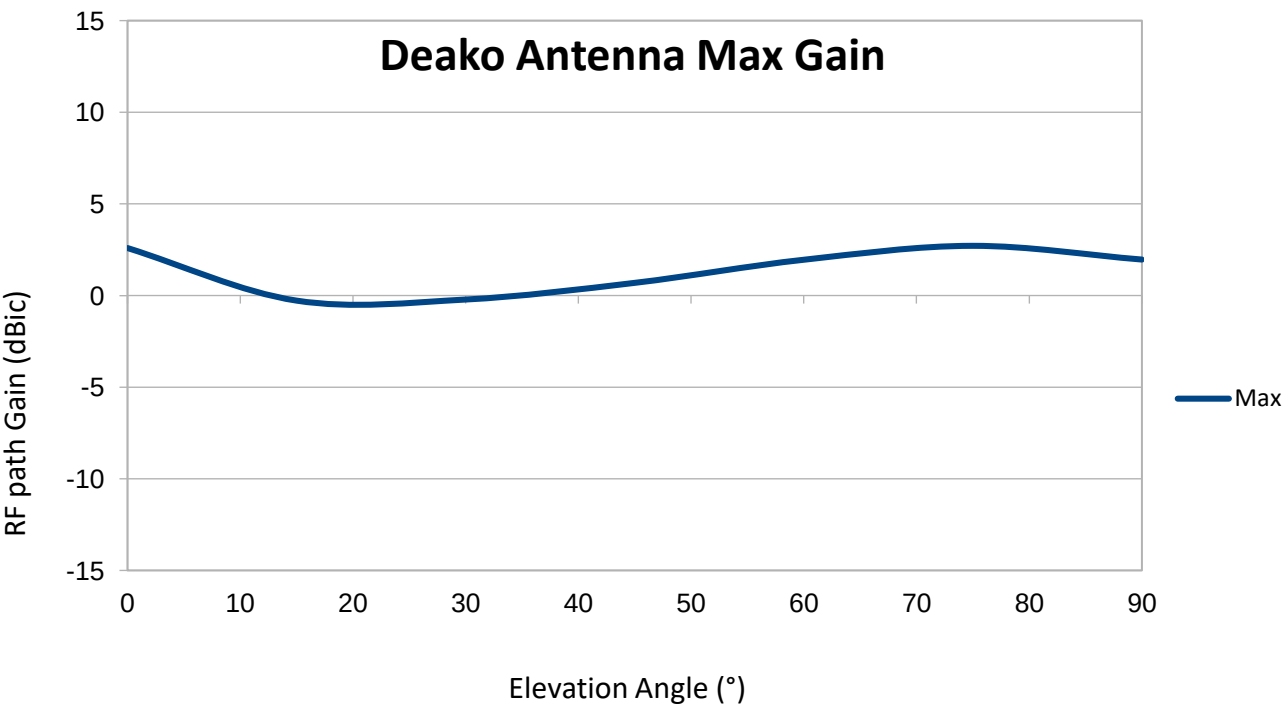
Test Case ID:	Deako Non-removable Internal PCB trace antenna
Test Condition TC 01	<u>Modulation:</u> DSSS (b mode) <u>Test Frequency for Antenna tests:</u> Channel 2412 MHz All measurements shall be done at room temperature.
Test Condition TC 02	<u>Modulation:</u> DSSS (b mode) <u>Test Frequency for Antenna tests:</u> Channel 2437 MHz All Gain measurements shall be done at room temperature.
Test Condition TC 03	<u>Modulation:</u> DSSS (b mode) <u>Test Frequency for Antenna tests:</u> Channel 2462 MHz All Gain measurements shall be done at room temperature.
TEST SETUP:	



The following measurement shows the pure antenna gain without including any cable losses. Internal procedure (PERMUSA404) was used to perform the antenna gain tests.

TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

Frequency: 2412 MHz
Elevation Angle: 0 to 90°: Whereas 90° is towards RX antenna.
Azimuth Angle: -180 to 180°
Detector: + Peak



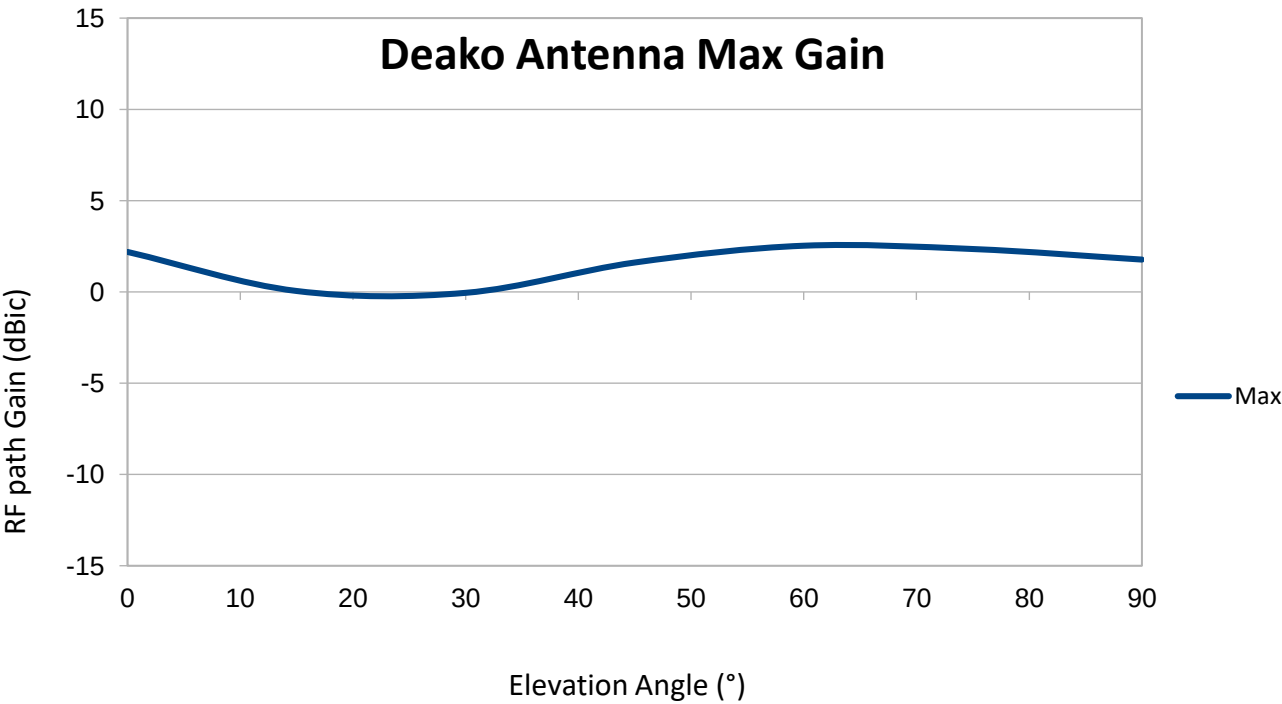
Antenna Gain (dBi)	Elevation Angle (°)						
	0	15	30	45	60	75	90
Max	2.6	-0.3	-0.2	0.7	2.0	2.7	2.0

TEST RESULTS (Cont.):

Theta Angle (°)	0	15	30	45	60	75	90
Azimuth Phi Angle (°)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)
0	-6.0	-5.0	-7.1	-7.4	-4.5	-3.2	-5.0
10	-0.6	-1.9	-4.8	-4.7	-2.7	-2.0	-4.6
20	1.7	-0.5	-3.2	-2.3	-1.4	-1.0	-4.4
30	2.6	-0.3	-1.6	-1.0	-0.1	-0.2	-3.9
40	2.2	-0.4	-0.6	0.1	0.9	0.6	-3.1
50	0.9	-0.7	-0.2	0.6	1.5	1.0	-2.5
60	-0.2	-1.2	-0.4	0.7	1.9	1.6	-2.1
70	-0.4	-1.8	-0.8	0.4	2.0	2.0	-1.5
80	0.1	-2.5	-1.5	-0.2	1.8	2.3	-1.2
90	0.6	-3.6	-2.6	-0.7	1.6	2.7	-0.5
100	0.7	-4.3	-4.2	-1.8	1.3	2.6	0.2
110	-0.4	-4.3	-5.9	-3.1	1.1	2.1	1.1
120	-1.1	-3.8	-7.8	-4.4	0.8	1.2	1.2
130	-0.3	-3.6	-10.4	-6.1	0.1	-0.3	0.4
140	-0.2	-1.3	-12.5	-4.5	-0.4	-6.5	-0.5
150	-0.8	-3.0	-12.4	-3.7	-0.4	-5.1	-1.7
160	-1.8	-3.8	-9.9	-4.7	-0.4	-3.2	-2.9
170	-2.8	-4.9	-8.4	-5.6	-0.9	-1.5	-3.9
180	-3.4	-5.2	-7.8	-8.6	-1.4	-0.3	-4.2
190	-3.9	-4.6	-9.7	-13.0	-1.9	0.4	-3.5
200	-5.3	-3.7	-10.5	-11.2	-1.6	0.7	-2.2
210	-8.6	-3.3	-10.1	-6.7	-1.1	0.7	-0.9
220	-12.9	-3.6	-8.6	-3.7	-0.3	0.4	0.1
230	-16.9	-3.2	-8.3	-2.3	0.5	0.5	1.0
240	-15.6	-3.1	-9.9	-1.3	0.8	0.3	1.8
250	-14.2	-4.2	-18.0	-1.1	-3.2	-0.1	2.0
260	-12.8	-5.6	-1.5	-1.7	-4.4	-0.2	0.4
270	-11.9	-6.5	-1.6	-2.9	-4.0	-0.7	-0.6
280	-10.6	-8.8	-3.1	-3.7	-3.6	-1.4	-1.9
290	-9.2	-9.0	-6.2	-4.2	-2.8	-2.0	-3.2
300	-7.8	-7.8	-10.2	-4.7	-2.9	-3.0	-4.3
310	-6.2	-7.7	-12.7	-5.3	-3.2	-4.0	-5.7
320	-5.6	-8.6	-10.9	-5.7	-4.0	-5.3	-6.9
330	-5.5	-9.3	-10.7	-6.1	-5.1	-6.6	-7.2
340	-6.0	-11.6	-13.4	-5.7	-6.3	-7.7	-7.0
350	-9.1	-15.7	-14.4	-4.6	-6.7	-7.5	-6.9
360	-13.1	-8.7	-7.1	-3.0	-6.1	-6.6	-6.4

TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#02
TEST RESULTS:	PASS

Frequency: 2437 MHz
Elevation Angle: 0 to 90°: Whereas 90° is towards RX antenna.
Azimuth Angle: -180 to 180°
Detector: + Peak



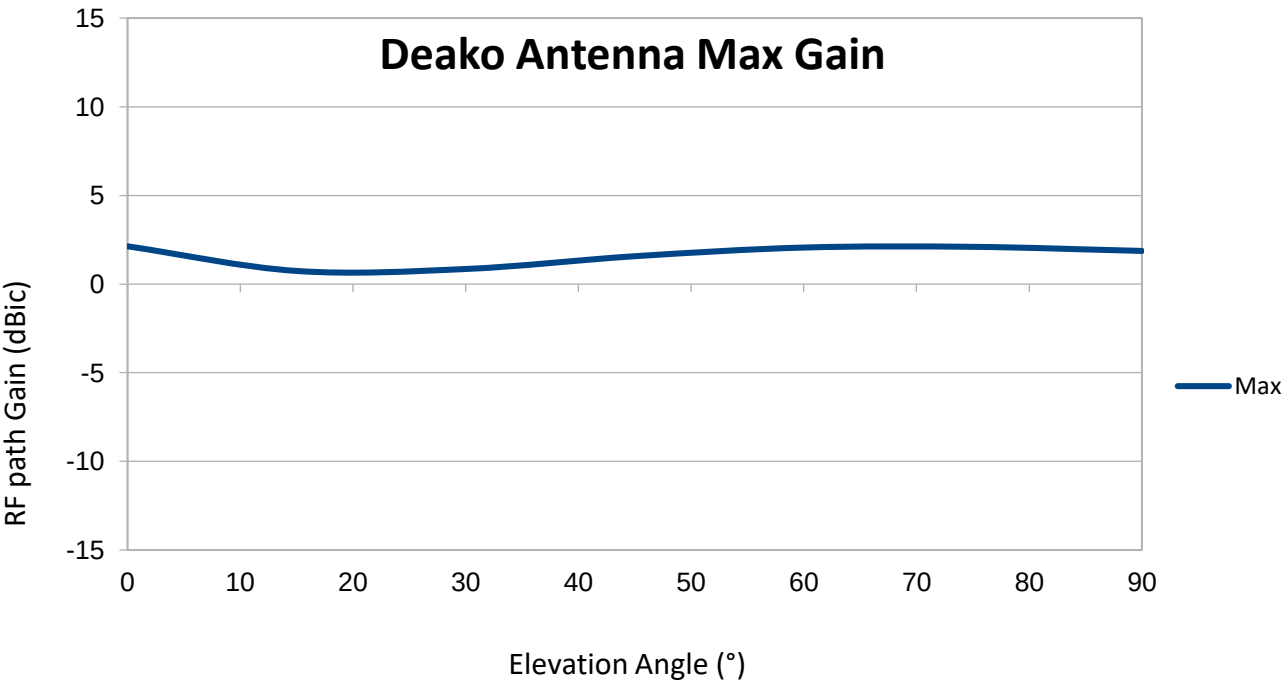
Antenna Gain (dBi)	Elevation Angle (°)						
	0	15	30	45	60	75	90
Max	2.2	0.0	-0.1	1.6	2.5	2.3	1.8

TEST RESULTS (Cont.):

Theta Angle (°)	0	15	30	45	60	75	90
Azimuth Phi Angle (°)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)
0	-2.1	-2.6	-5.0	-4.7	-2.4	-4.5	-6.6
10	1.1	-0.6	-3.0	-2.5	-1.1	-3.3	-6.6
20	2.2	0.0	-1.7	-0.7	-0.1	-2.3	-6.0
30	2.2	-0.2	-0.6	0.7	0.9	-1.3	-5.2
40	1.1	-0.7	-0.1	1.2	1.5	-0.4	-4.1
50	-0.6	-1.8	-0.1	1.6	2.1	0.4	-3.2
60	-1.9	-2.9	-0.1	1.6	2.3	1.2	-2.6
70	-2.1	-3.9	-0.8	1.2	2.5	1.9	-2.0
80	-1.7	-4.9	-1.8	0.4	2.2	2.2	-1.4
90	-1.5	-5.3	-2.8	-0.5	2.0	2.3	-0.7
100	-1.4	-4.5	-4.0	-2.3	1.6	2.3	0.1
110	-1.5	-3.5	-5.5	-7.3	1.2	1.8	1.0
120	-1.4	-2.4	-7.0	-8.9	0.8	0.6	1.7
130	-1.6	-2.1	-8.6	-9.2	0.9	-0.3	1.8
140	-2.1	-3.3	-10.1	-8.9	1.1	-1.0	1.3
150	-2.9	-5.0	-10.2	-4.4	1.0	-5.2	0.5
160	-3.8	-5.9	-8.1	-3.4	0.8	-4.5	-0.5
170	-4.3	-5.7	-7.0	-3.7	0.4	-3.2	-1.7
180	-4.2	-3.9	-6.3	-6.0	-0.4	-2.3	-2.7
190	-4.3	-2.4	-8.4	-9.1	-1.3	-1.7	-3.2
200	-5.8	-2.1	-8.7	-7.8	-1.6	-1.4	-3.0
210	-7.1	-2.6	-7.9	-5.6	-1.1	-1.0	-2.4
220	-9.4	-3.3	-6.8	-3.9	-0.1	-1.3	-1.3
230	-13.2	-3.5	-6.8	-2.8	0.7	-1.8	-0.5
240	-19.6	-4.5	-7.2	-2.4	1.2	-2.2	0.5
250	-19.9	-5.4	-7.1	-1.9	2.1	-2.6	-3.0
260	-18.7	-7.6	-1.1	-2.2	2.5	-2.5	-4.3
270	-7.9	-8.6	-1.6	-2.8	-2.8	-2.4	-2.0
280	-5.5	-9.3	-2.7	-2.6	-2.3	-2.5	-3.2
290	-4.5	-8.6	-4.9	-2.4	-1.7	-2.8	-4.6
300	-3.7	-6.5	-6.8	-3.2	-1.5	-2.9	-5.7
310	-3.1	-6.1	-7.8	-3.3	-2.1	-3.9	-6.7
320	-2.8	-6.9	-8.9	-4.0	-3.0	-5.0	-7.8
330	-3.5	-8.8	-9.6	-4.6	-4.4	-6.7	-7.8
340	-5.1	-11.3	-12.5	-5.1	-6.1	-8.0	-8.3
350	-10.4	-11.9	-11.7	-4.4	-6.6	-8.3	-8.3
360	-9.5	-5.7	-6.2	-2.8	-5.6	-7.7	-8.2

TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#03
TEST RESULTS:	PASS

Frequency: 2462 MHz
Elevation Angle: 0 to 90°: Whereas 90° is towards RX antenna.
Azimuth Angle: -180 to 180°
Detector: + Peak



Antenna Gain (dBi)	Elevation Angle (°)						
	0	15	30	45	60	75	90
Max	2.1	0.7	0.8	1.6	2.1	2.1	1.9

TEST RESULTS (Cont.):

Theta Angle (°)	0	15	30	45	60	75	90
Azimuth Phi Angle (°)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)
0	-0.3	-0.5	-2.1	-2.5	-1.3	-5.2	-10.2
10	1.7	0.7	-0.8	-1.0	-0.6	-4.3	-9.6
20	2.1	0.6	0.1	0.1	0.0	-3.3	-9.2
30	1.4	-0.4	0.5	0.9	0.6	-2.4	-8.1
40	-0.3	-1.4	0.8	1.4	1.0	-1.5	-6.8
50	-2.6	-2.4	0.8	1.6	1.2	-0.6	-5.4
60	-4.0	-3.3	0.7	1.5	1.3	0.3	-4.5
70	-4.2	-3.9	0.4	1.1	1.2	0.9	-3.9
80	-3.2	-3.9	-0.3	0.1	1.2	1.4	-3.0
90	-2.0	-3.5	-1.3	-0.9	1.2	1.7	-1.8
100	-1.0	-2.8	-2.1	-2.8	1.1	2.1	-0.4
110	-0.6	-2.0	-3.2	-5.1	1.1	2.0	0.9
120	-0.5	-1.4	-4.6	-7.7	1.3	1.1	1.8
130	-1.1	-2.4	-5.6	-8.7	1.7	-0.4	1.9
140	-2.5	-6.0	-7.3	-5.2	1.9	-1.1	1.4
150	-4.8	-8.8	-7.6	-2.8	1.8	-3.8	0.5
160	-7.1	-15.5	-6.3	-2.3	1.5	-3.6	-0.7
170	-7.0	-12.7	-4.9	-2.6	1.1	-2.8	-2.1
180	-5.3	-4.3	-4.4	-3.9	0.2	-2.3	-3.5
190	-4.7	-1.3	-4.9	-5.0	-0.6	-1.8	-4.0
200	-4.8	-0.4	-5.5	-4.0	-0.9	-1.7	-3.9
210	-4.9	-0.7	-3.9	-2.6	-0.5	-2.0	-3.3
220	-6.1	-1.6	-3.3	-1.9	0.6	-2.4	-2.4
230	-8.2	-2.8	-3.2	-1.9	1.4	-3.0	-1.1
240	-11.8	-4.0	-3.9	-2.1	2.0	-3.6	-0.2
250	-11.9	-6.4	-5.2	-2.4	1.3	-4.4	-7.4
260	-14.7	-9.1	-0.8	-3.0	2.1	-4.7	-6.2
270	-7.7	-8.5	-1.8	-3.3	-1.9	-4.7	-3.6
280	-4.6	-6.9	-3.6	-3.4	-1.2	-4.8	-4.6
290	-3.3	-5.3	-4.8	-3.1	-0.7	-4.8	-5.8
300	-2.0	-4.6	-5.2	-3.8	-0.9	-5.0	-6.6
310	-1.3	-4.8	-5.6	-3.8	-1.5	-6.4	-7.2
320	-1.1	-5.6	-6.9	-4.4	-2.7	-8.0	-7.6
330	-2.1	-7.7	-8.6	-5.0	-4.2	-9.9	-7.0
340	-4.2	-13.0	-11.5	-4.3	-5.2	-10.5	-7.2
350	-9.2	-12.8	-7.9	-2.9	-5.0	-9.4	-7.0
360	-7.7	-5.7	-3.4	-1.1	-3.8	-7.7	-6.8