SIGFOX READY™

Test Report

TEST STANDARD	:	ETSI EN 300 220-2: V3.1.1 (2017-02)
CLIENT / APPLICANT	:	WeBill (Pty) Ltd.
PRODUCT DESCRIPTION	:	Sigfox Electricity Meter
PRODUCT NAME/MODEL	:	M190RSF
REPORT DATE	:	06 September 2021
REPORT REVISION	:	1.0

ISERT (Pty) Ltd. Test reports apply only to the specific sample(s) tested under stated conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to ensure that additional production units of this model are manufactured with identical electrical and mechanical components. ISERT (Pty) Ltd. Shall have no liability for any deductions, inference or generalizations drawn by the client or others from ISERT (Pty) Ltd. Issued reports. This report shall not be used to claim, constitute or imply a product endorsement from ISERT (Pty) Ltd.

This test report was prepared by: **Name:** *HE Olivier*
Title: *Junior RF Engineer*

This report was approved by: ***Name:*** *RM van den Berg*
Title: *Technical Signatory (RF)*

T0812

Important:

The Sigfox Ready™ certification for end-products does not substitute local regulatory requirements (CE marking, FCC, ETSI or other type approval) where the End-Product is to be deployed. It is the partner`s responsibility to comply with local country regulations.

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DOCUMENT CONTROL

Version	Date	Author	Changes
1.0	2021/09/06	HE Olivier	First Issue

ACRONYMS AND ABBREVIATIONS

CW	Continuous wave
DUT	Device Under Test
EIRP	Effective Isotropic Radiated Power
EIRS	Effective Isotropic Radiated Sensitivity
ERP	Effective Radiated Power
ETSI	European Telecommunications Standards Institute
FAR	Fully Anechoic Room
GFSK	Gaussian Frequency Shift Keying
H	Horizontal
HP	Horizontal Plane (azimuth)
PC	Personal Computer
PER	Packet Error Rate
N/A	Not Available
RC	Radio Configuration
RF	Radio Frequency
RX	Receive
SG	Signal Generator
SRD	Short Range Device
TBA	To Be Announced
TX	Transmit
V	Vertical
VP	Vertical Plane (Elevation)

1. INTRODUCTION

This report details the results of tests performed on the M190RSF, henceforth referred to as Device Under Test (DUT). The DUT was tested according to the following standards and methods:

- ETSI EN 300 220-1 V3.1.1 (2017-02)
- ETSI EN 300 220-2 V3.1.1 (2017-02)
- RADIATED TEST PLAN FOR SIGFOX READY™ CERTIFICATION V0.5 (2018-09)
- RADIATED SPECIFICATION PLAN FOR SIGFOX READY™ CERTIFICATION V0.5 (2018-09)

Assessment Date(s)
2021/07/31

2. CLIENT DETAILS

Client Address	147 North Reef Road, Bedfordview, Germiston, 1401
Client contact person	PJ Venter
Manufacturer name	WeBill (Pty) Ltd.

3. SUMMARY OF TEST RESULTS

Parameter tested	Notes	Results
Transmitter Peak Effective Isotropic Radiated Power	1	10.3dBm
Antenna Radiating Pattern	1	informative
Effective Isotropic Radiated Sensitivity	2	not tested

Summary of the results

Note 1: Maximum power measured in all polarizations and orientations
Note 2: Only mandatory for bi-directional communications

4. DUT INFORMATION

The details below as declared by the client/manufacturer.

Type of Equipment:	Combined equipment
Intended use and condition:	Fixed
Sigfox radio configuration:	RC1 (868 to 868.6MHz)
Operating test frequency:	868.130MHz
Antenna location:	Internal
Antenna type:	PCB trace antenna
Antenna gain:	0dB
External supply type	AC Mains
External supply voltage	230VAC
Internal battery type	N/A
Internal battery nominal voltage	N/A
Operating Temperature Range:	-20°C to +60°C
Sigfox identifier:	Unknown
Hardware version	1.1
Software version	Not provided

DUT details

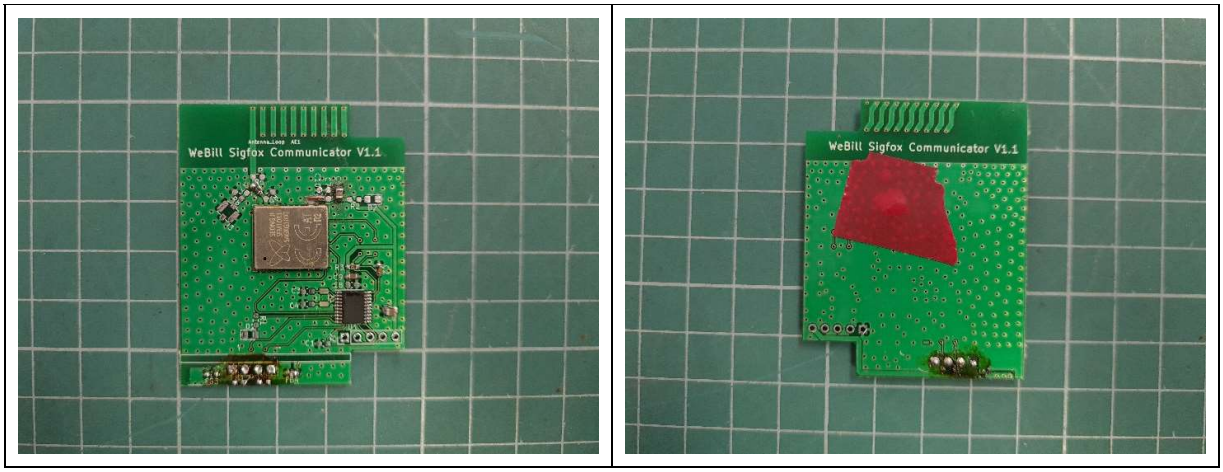
The following variant models were not tested as part of this evaluation but have been identified by the manufacturer as being electrically and wireless identical, depopulated or with reasonable similarity to the model tested. iSERT (Pty) Ltd. does not make any claims of compliance for variants that were not tested.

Model	Variant difference
-	-

Variants table

DUT external angle photo

DUT external photos



DUT internal photos

DUT photo in FAR

The DUT has been tested as an in-depended unit with Ancillary/auxiliary equipment. The following equipment/accessories were used to form a representative test configuration during this assessment.

Type/description	Manufacturer	Model	Serial number
None			

List of Ancillary/auxiliary equipment

Notes:

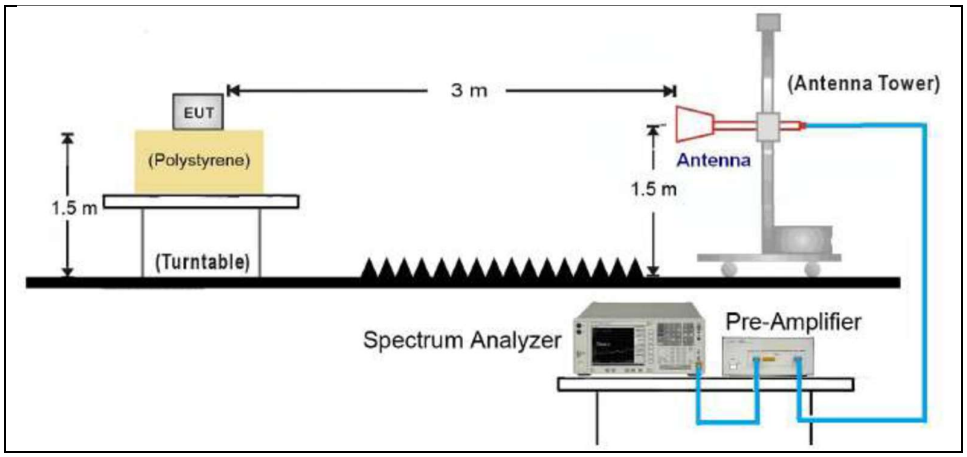
1. *The above equipment/cables were placed in the worst-case configuration to maximize the emissions during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*
3. *The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein.*

5. TEST METHODOLOGY

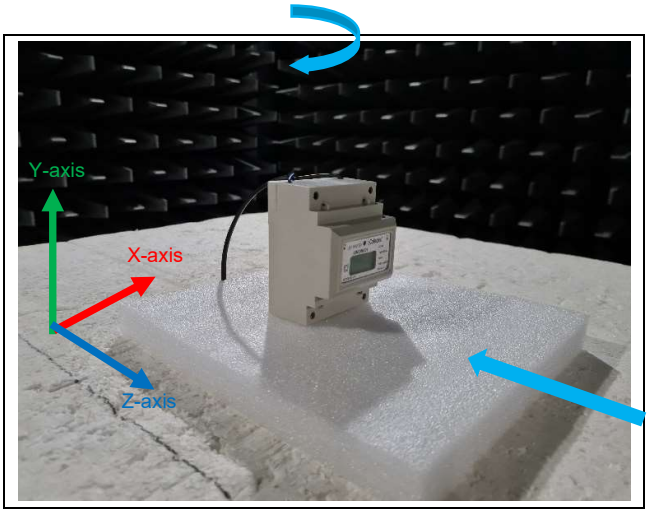
5.1 TEST LOCATION

All radiated and conducted emission measurements were performed at the premises of iSERT in the address below. ISERT (PTY (LTD) is an ISO 17025 accredited laboratory so all radiated testing was performed in a CISPR-16 fully anechoic shielded chamber at an antenna-to-EUT distance of 3 meters unless otherwise stated.

Facility location:
129 Khai-Apple street
Montana
Pretoria
South Africa
0182



5.2 EUT ORIENTATION DURING TESTING



DUT front facing the RX antenna at a 0° starting position and rotating clockwise

5.3 LIST OF TEST EQUIPMENT

The test equipment used for the tests is shown below:

Instrument	Manufacturer	Model	Serial number	Next Calibration date
Spectrum Analyzer	Agilent	N9020A	MY52330018	May 2022
Network Analyzer	Agilent	E5062A	MY44100409	November 2021
Tuned Dipole antenna	Com-power	AD-100	040195	May 2022
Tuned Dipole antenna	Com-power	AD-100	040196	May 2022
Coaxial Cable	AH Systems	SAC-26G-2	2584-2	August 2021
Coaxial Cable	AH Systems	SAC-18G-4	1763	August 2021
Temperature Hygrometer	Flus	ET-951W	2015106449	November 2021

List of test equipment

6. MEASUREMENT OF UNCERTAINTY

For the test methods in the present document the uncertainty figures were calculated according to the methods described in the TR 100 028 [2] and corresponds to an expansion factor (coverage factor) k = 2 (which provide confidence levels of 95,45 % in case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Parameter	Uncertainty
RF conducted power	±0.25dB
RF radiated power	±2.18dB
Temperature	±1.0%
Humidity	±5.0%

Measurement uncertainty

7. TEST CONDITIONS

7.1 NORMAL ENVIRONMENTAL CONDITIONS

All measurements were taken under conditions of temperature and humidity that were within the limits specified in ETSI EN 300 220-1 V3.1.1 (2017-02) clause 4.3.3.1.

Condition	Value	Limit
Temperature	20°C to 22°C	15°C to 35°C
Relative Humidity	35% to 39%	20% to 75%

Normal Environmental conditions

7.2 NORMAL TEST POWER SOURCE

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage and shall be between 49 Hz and 51 Hz.

For devices operating from batteries, the normal test voltage shall be declared by the equipment manufacturer and agreed by the accredited test laboratory.

Source	Value	Comment
Internal	N/A	N/A
External	230VAC	AC Mains

Normal Test Power Source parameters

7.3 EXTREME TEST CONDITIONS

The DUT was not assessed under extreme test conditions.

8. TEST DETAIL

8.1 EFFECTIVE ISOTROPIC RADIATED POWER

8.1.1 DUT mode

Frequency	Power Level	Modulation	Duty cycle
868.13	Maximum setting as declared by the manufacturer	None	CW

8.1.2 Test Procedure

DUT is activated in CW TX test mode (non-modulated Continuous Wave mode) at dedicated RC frequency test and maximum power.

The maximum ERP (Effective Radiated Power) is measured and recorded following the ETSI EN 300-220 (2017-02) standard test procedure and is converted to EIRP value.

During measurement, DUT shall be placed in normal use position as declared by the provider

8.1.3 Test Specification

DUT EIRP must conform at least the high limit of the regulation in each RC.

Nevertheless, Sigfox will give a high limit recommendation to comply with its technology approach of:

- Low consumption
- Balanced budget link between uplink and downlink

It is highly recommended to achieve the Sigfox recommended limits. DUT will be classified in each RC, based on the EIRP measurement value following the criteria declared in the tables below:

Radio Configuration	Uplink class	EIRP limit (dBm)
RC1	0u	12dBm ≤ EIRP < 16dBm
	1u	7dBm ≤ EIRP < 12dBm
	2u	2dBm ≤ EIRP < 7dBm
	3u	EIRP < 2dBm
RC2	0u	20dBm ≤ EIRP < 24dBm
	1u	15dBm ≤ EIRP < 20dBm
	2u	10dBm ≤ EIRP < 15dBm
	3u	EIRP < 10dBm
RC3a, RC3c	0u	12dBm ≤ EIRP < 16dBm
	1u	7dBm ≤ EIRP < 12dBm
	2u	2dBm ≤ EIRP < 7dBm
	3u	EIRP < 2dBm
RC4	0u	20dBm ≤ EIRP < 24dBm
	1u	15dBm ≤ EIRP < 20dBm
	2u	10dBm ≤ EIRP < 15dBm
	3u	EIRP < 10dBm

DUT classification table

8.1.4 Test results

Frequency (MHz)	RX antenna polarization	EUT orientation	EUT Angle (°)	Measured level (dBm)	Substituted			EIRP level (dBm)
					SG level (dBm)	ANT gain (dBi)	Cable loss (dB)	
868.130	H	YZ	30	-32.9	11.3	1.64	4.0	8.9
868.130	V	XZ	250	-31.5	12.7	1.64	4.0	10.3

EIRP results

WARNING:
"If EIRP measurement value is higher than the Sigfox recommended limit, manufacturer must verify that his product complies with its local regulation limits and with any target country where the device is to be deployed"

8.2 RADIATION PATTERN

8.2.1 DUT mode

Frequency	Power Level	Modulation	Duty cycle
868.130	Maximum as declared by the manufacturer	None	CW

8.2.2 Test Procedure

DUT is activated with CW TX test mode (non-modulated Continuous Wave mode) at dedicated RC frequency test and power.

Radiated power is recorded for every 5° step of the turn table in vertical and horizontal polarization.

The radiation pattern in vertical and horizontal polarization shall be derived from the DUT where maximum EIRP occurs. It shall be normalized to maximum EIRP value and represented in polar coordinates. The measurement unit is dBm.

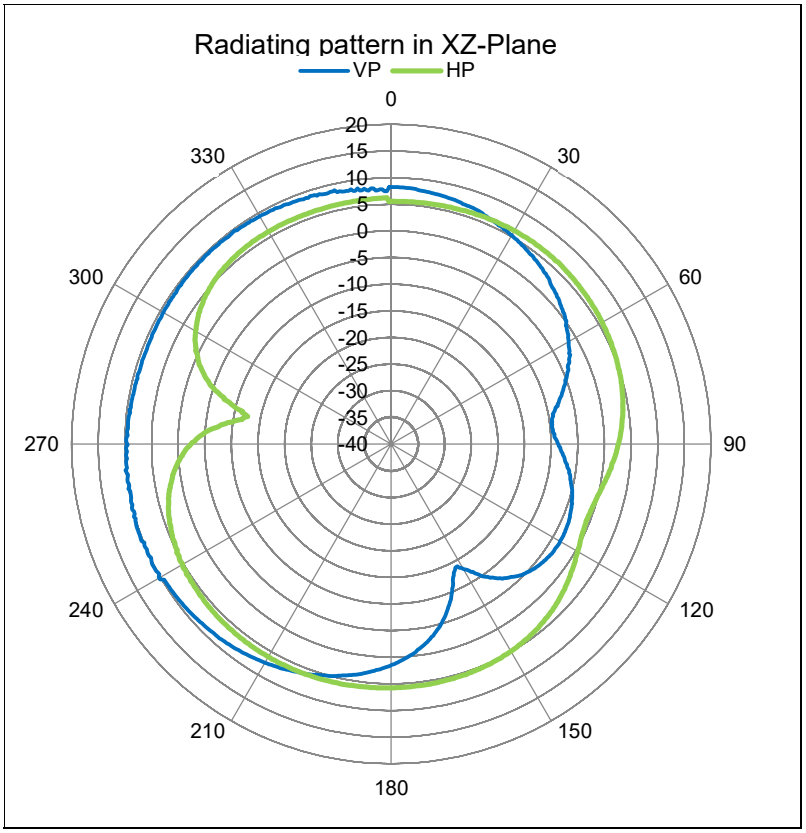
8.2.3 Test Specification

An antenna radiates energy in most cases with some directional dependence. Radiation pattern measurement gives information of the radiation pattern shape and antenna polarization. Omni-directional antennas are the preferred option for most applications because of the star architecture of the Sigfox network.

DUT shall show an omni directional pattern to comply with the star Sigfox network topology.

Directional antenna is allowed in case of dedicated end-user application (end-product mounted on a wall can radiated in the main direction opposite to the wall).

8.2.4 Test results



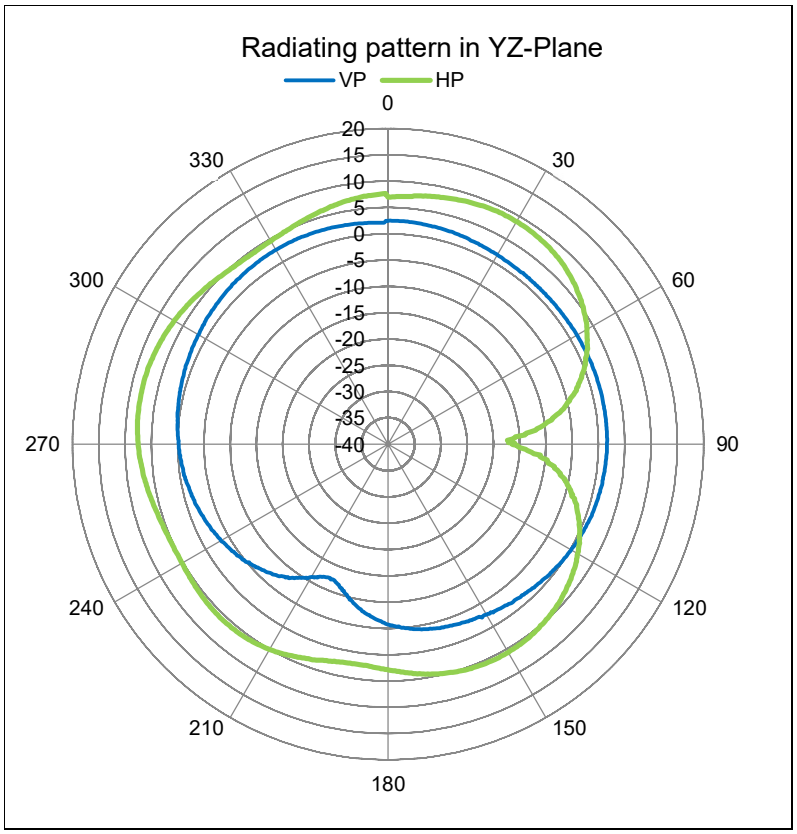
Radiation pattern polar plot (EIRP) in XZ-Plane

Angle (°)	Power EIRP (dBm)	Angle (°)	Power EIRP (dBm)	Angle (°)	Power EIRP (dBm)
0/360	5.6	120	0.0	240	5.3
5	5.6	125	1.0	245	4.8
10	5.7	130	2.0	250	4.4
15	5.8	135	3.0	255	3.5
20	5.9	140	3.7	260	2.3
25	6.1	145	4.3	265	0.7
30	6.2	150	4.8	270	-1.7
35	6.3	155	5.1	275	-5.2
40	6.3	160	5.3	280	-10.9
45	6.3	165	5.5	285	-9.1
50	6.2	170	5.6	290	-3.6
55	6.0	175	5.7	295	-0.2
60	5.8	180	5.7	300	2.1
65	5.6	185	5.8	305	3.7
70	5.3	190	5.9	310	4.7
75	4.9	195	6.0	315	5.4
80	4.4	200	6.1	320	5.8
85	3.8	205	6.1	325	6.0
90	3.1	210	6.1	330	6.0
95	2.2	215	6.1	335	6.1
100	1.2	220	6.1	340	6.0
105	0.2	225	6.0	345	6.0
110	-0.4	230	5.9	350	6.1
115	-0.6	235	5.6	355	6.2

Radiation pattern table results in azimuth XZ-plane

Angle (°)	Power EIRP (dBm)	Angle (°)	Power EIRP (dBm)	Angle (°)	Power EIRP (dBm)
0/360	8.2	120	-3.4	240	9.7
5	8.1	125	-3.4	245	10.2
10	7.8	130	-3.9	250	10.3
15	7.4	135	-4.8	255	10.0
20	6.9	140	-6.4	260	9.9
25	6.4	145	-8.6	265	9.9
30	5.6	150	-11.6	270	9.8
35	4.8	155	-13.6	275	9.5
40	4.0	160	-9.6	280	9.4
45	3.2	165	-5.8	285	9.3
50	1.9	170	-3.0	290	9.3
55	0.7	175	-0.7	295	9.3
60	-0.7	180	1.0	300	9.4
65	-2.2	185	2.4	305	9.4
70	-4.0	190	3.7	310	9.6
75	-6.1	195	4.8	315	9.6
80	-8.4	200	5.6	320	9.6
85	-9.7	205	6.5	325	9.5
90	-9.3	210	7.2	330	9.4
95	-8.0	215	7.8	335	9.2
100	-6.6	220	8.4	340	8.9
105	-5.3	225	8.7	345	8.6
110	-4.4	230	9.1	350	8.2
115	-3.8	235	9.4	355	7.8

Radiation pattern table results in elevation XZ-plane



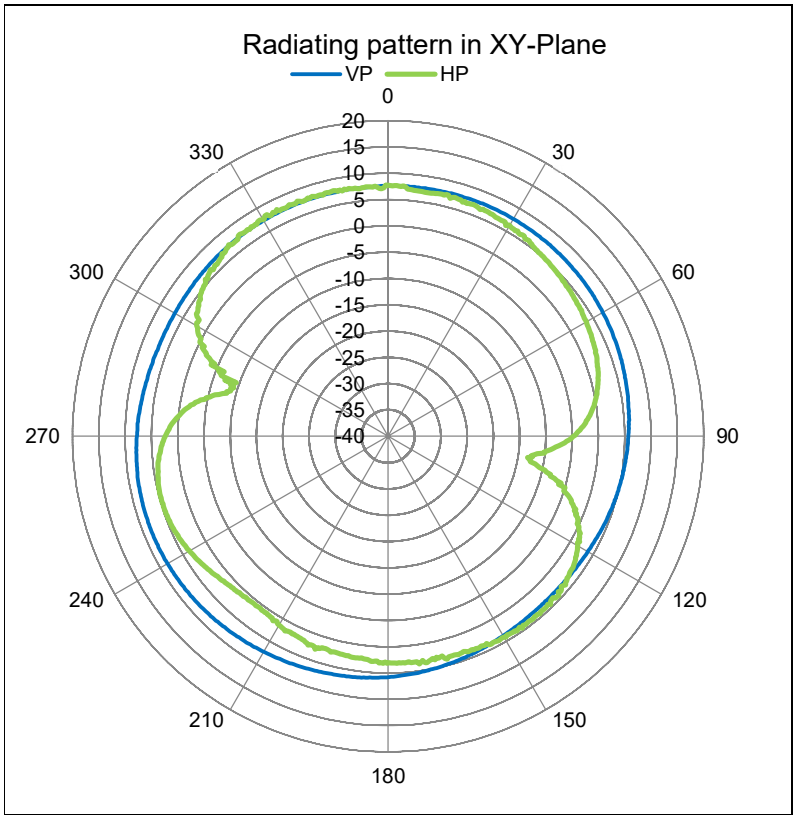
Radiation pattern polar plot (EIRP) in YZ-Plane

Angle (°)	Power EIRP (dBm)	Angle (°)	Power EIRP (dBm)	Angle (°)	Power EIRP (dBm)
0/360	6.97	120	1.08	240	5.28
5	7.28	125	2.42	245	5.28
10	7.71	130	3.50	250	5.42
15	8.16	135	4.34	255	5.85
20	8.54	140	4.93	260	6.41
25	8.82	145	5.39	265	6.97
30	8.90	150	5.63	270	7.41
35	8.80	155	5.68	275	7.75
40	8.51	160	5.54	280	7.89
45	7.99	165	5.19	285	7.92
50	7.14	170	4.62	290	7.75
55	6.00	175	3.93	295	7.47
60	4.52	180	3.13	300	7.03
65	2.77	185	2.51	305	6.45
70	0.58	190	2.25	310	5.82
75	-2.01	195	2.50	315	5.21
80	-5.33	200	3.24	320	4.68
85	-9.79	205	4.03	325	4.47
90	-16.38	210	4.89	330	4.60
95	-13.43	215	5.42	335	4.94
100	-8.11	220	5.77	340	5.54
105	-5.08	225	5.87	345	6.14
110	-2.26	230	5.76	350	6.82
115	-0.61	235	5.53	355	7.34

Radiation pattern table results in azimuth YZ-plane

Angle (°)	Power EIRP (dBm)	Angle (°)	Power EIRP (dBm)	Angle (°)	Power EIRP (dBm)
0/360	2.49	120	0.39	240	-3.61
5	2.47	125	-0.10	245	-2.88
10	2.37	130	-0.49	250	-2.26
15	2.22	135	-1.02	255	-1.62
20	2.06	140	-1.45	260	-1.09
25	1.83	145	-1.98	265	-0.65
30	1.65	150	-2.30	270	-0.24
35	1.45	155	-2.97	275	0.12
40	1.37	160	-3.26	280	0.51
45	1.40	165	-3.60	285	0.78
50	1.33	170	-4.10	290	1.10
55	1.38	175	-4.67	295	1.31
60	1.44	180	-5.44	300	1.60
65	1.53	185	-6.49	305	1.90
70	1.59	190	-7.81	310	2.12
75	1.63	195	-9.54	315	2.29
80	1.65	200	-11.19	320	2.44
85	1.66	205	-12.26	325	2.59
90	1.65	210	-11.33	330	2.67
95	1.60	215	-9.59	335	2.69
100	1.47	220	-7.92	340	2.66
105	1.32	225	-6.48	345	2.57
110	1.08	230	-5.43	350	2.41
115	0.74	235	-4.35	355	2.24

Radiation pattern table results in elevation YZ-plane



Radiation pattern polar plot (EIRP) in XY-Plane

Angle (°)	Power EIRP (dBm)	Angle (°)	Power EIRP (dBm)	Angle (°)	Power EIRP (dBm)
0/360	7.73	120	1.23	240	3.43
5	7.14	125	2.41	245	4.10
10	6.95	130	3.45	250	4.54
15	7.28	135	4.37	255	4.74
20	6.72	140	4.24	260	4.55
25	6.55	145	4.27	265	3.92
30	6.38	150	4.18	270	2.76
35	6.15	155	3.94	275	0.91
40	5.45	160	3.75	280	-2.03
45	5.00	165	3.48	285	-6.87
50	4.62	170	3.44	290	-7.17
55	4.18	175	3.23	295	-2.13
60	3.77	180	3.09	300	1.43
65	3.23	185	2.81	305	3.68
70	2.71	190	2.63	310	5.21
75	1.85	195	2.27	315	6.10
80	0.74	200	2.36	320	7.07
85	-0.83	205	1.87	325	7.51
90	-3.23	210	1.68	330	7.78
95	-6.95	215	0.88	335	7.59
100	-12.50	220	0.81	340	7.75
105	-9.14	225	1.04	345	7.64
110	-4.39	230	1.66	350	7.44
115	-1.33	235	2.56	355	7.58

Radiation pattern table results in azimuth XY-plane

Angle (°)	Power EIRP (dBm)	Angle (°)	Power EIRP (dBm)	Angle (°)	Power EIRP (dBm)
0/360	7.65	120	4.00	240	8.39
5	7.66	125	3.74	245	8.46
10	7.67	130	3.51	250	8.48
15	7.70	135	3.39	255	8.41
20	7.71	140	3.39	260	8.28
25	7.74	145	3.47	265	8.09
30	7.74	150	3.68	270	7.87
35	7.72	155	3.93	275	7.59
40	7.69	160	4.30	280	7.34
45	7.60	165	4.66	285	7.06
50	7.53	170	5.02	290	6.88
55	7.39	175	5.36	295	6.79
60	7.23	180	5.69	300	6.80
65	7.07	185	5.95	305	6.89
70	6.86	190	6.26	310	6.99
75	6.60	195	6.47	315	7.11
80	6.35	200	6.73	320	7.24
85	6.12	205	6.99	325	7.33
90	5.83	210	7.21	330	7.36
95	5.55	215	7.48	335	7.42
100	5.28	220	7.72	340	7.45
105	4.96	225	7.96	345	7.48
110	4.67	230	8.13	350	7.50
115	4.33	235	8.28	355	7.54

Radiation pattern table results in elevation XY-plane