

Declared Antenna Specification

Model : **XR100-RQ**

Antenna Type : **PCB Pattern Antenna**

Maximum Peak Gain : **2.15 dBi**

Radiated Measurements

Test: Radiated Emissions

Introduction

Purpose of this test is to measure:
Radiated output power of each radio port.
Out of band emissions for each radio port.
The DUT radiation is measured using a reference antenna placed at 1m distance, in an anechoic chamber.
The DUT is enclosed in the designated enclosure and batteries, i.e. as the final product will operate.

Performance Requirements

Total Radiated output power

TRP within $2\text{ dB} \pm 1\text{ dB}$ of conducted power.
Antenna efficiency better than $-1\text{ dB} \pm 1\text{ dB}$.

Radiated spurious emissions

For ERP > 200mW, the 2nd, 3rd, 4th and 5th TX harmonic are measured since these power levels have to meet the regulatory standard.
For ERP < 200mW, the 2nd and 3rd TX harmonic are measured since these power levels have to meet the regulatory standard.

FCC Average Spurious Emissions

The FCC part 15 requirements for radiated spurious emissions are **-41.20dBm** average power measured with a **normal modulated signal and 1MHz resolution bandwidth**.
To achieve the best possible measurement accuracy, measurements at GreenPeak are conducted with an **unmodulated CW signal** instead of normal modulated signal.
1) Since CW is used a correction factor should be used to compensate for the BW difference in measurement setup. GreenPeak estimated this factor to be: **-40dB**.
2) The FCC requires a continuous signal for the spurious emission measurements but the average spurious emission level should be corrected using the DUT normal operation duty cycle (see FCC part 15.33).
For the R1C1, M20 profile, GreenPeak has measured the maximum duty cycle (DC) period, out-of-range for R1 and R2, and based on these measurements, the correction factors are 11, -12 dB for both R1 and R2.

FCC Peak Spurious Emissions

The FCC part 15.23(b) specifies the limit on peak radio emissions to be **-20dB** above maximum permitted average emission limit applicable using modulated signal and minimum 1MHz resolution bandwidth.
With the above correction the **-41.20dBm** limit (modulated CW signal) becomes: **-21.20dBm**.

ETD Spurious Emissions

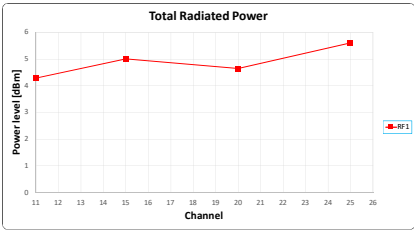
The limits on harmonic spurious emissions in the ETD domain are -30 dBm in 1MHz BW measured with 3 MHz RBW, with a peak detector in max hold mode.
The unmodulated CW signal as used by GreenPeak in providing the same results as a modulated signal measured with the ETD settings, no correction needed.

Results

Test: Total Radiated Power, CW

Measurement condition:
Channels: Ch 11 (2405MHz), CH15 (2425MHz) and Ch 25 (2475MHz)
TX power setting: W 3 (3dBm)
Unmodulated CW signal used
RBW set to 300kHz, VBW set to 3000Hz

Channel	TRP (dBm)	Expected TRP (dBm)	RP1
11	4.29	3.72	
15	5.00	-3.00	
20	4.65	4.22	
25	5.60	4.89	
Avg TRP (dBm)	4.90	0.1	



Conclusion:
- The total radiated powers are within the expected range.

Analysis: Antenna efficiency estimation

Measurement condition:
Conducted TX power setting: W 8 (8dBm)
Radiated TX power setting: W 8 (8dBm)

Channel	Antenna Efficiency (dB)
RP1	
11	-3.29
15	-2.68
20	-3.17
25	-2.26
Avg AE (dB)	-2.85

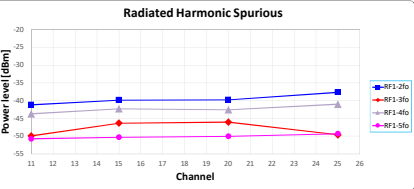
Conclusion:
- The antenna efficiencies are within the expected range.

Test: Radiated Spurious, Average Power, CW

Measurement condition:
Channels: Ch 11 (2405MHz), CH15 (2425MHz), Ch 20 (2450MHz) and Ch 25 (2475MHz)
TX power settings: W 8 (8dBm)
CW, un-modulated
CUT1: 15, 20 and 25/2405, 2425, 2450 and 2475 MHz
RBW: 300Hz, VBW: 300Hz

FCC Peak limit (dBm) (average power)	-41.2
FCC Peak limit (dBm) (peak power)	-42.2
FCC Peak limit (dBm)	-30.0
Duty Cycle @ 250kHz	10.0%
Duty Cycle @ 800kHz	13.0%

Channel	2nd Harmonic Post (dBm)	3rd Harmonic Post (dBm)	4th Harmonic Post (dBm)	5th Harmonic Post (dBm)
RP1				
11	-41.2	-43.9	-42.7	-51.8
15	-39.9	-46.3	-42.3	-50.4
20	-39.8	-46.1	-44.6	-50.1
25	-37.7	-49.6	-41.0	-49.3
Max (dBm)	-37.7	-46.1	-41.0	-49.3
Min Margin (dB)	7.7	11.7	11.7	12.7
FCC BW Correction @250kHz (dB)	6	6	6	6
FCC BW Correction @800kHz (dB)	6	6	6	6
FCC Duty Cycle Correction @250kHz (dB)	6	6	6	6
FCC Max Corrected @250kHz (dBm)	-49.7	-58.1	-53.0	-61.4
FCC Margin	8.5	16.9	11.8	10.2
FCC BW Correction @250kHz (dB)	0	2	6	6
ETD BW Correction @1MHz LE (dBm)	18	18	18	18
FCC Duty Cycle Correction @1MHz LE (dBm)	18	18	18	18
FCC Max Corrected @1MHz LE (dBm)	-55.4	-65.9	-61.0	-69.3
FCC Margin	14.2	24.6	19.0	20.1



Conclusion:
- No issue with FCC and ETD requirements on the radiated spurious emissions in TX mode.

PASS
MARGINAL
FAIL

Summary

Multiple Frequency

Multiple Cut

3D-View

Reserved

Operator :
Operator Name

Date :
2023-07-11

Customer :
Customer Name

Time :
오후 4:03:01

Description :
Test Descriptions

Antenna Type

☒ Linear Polarization Type

☐ Circular Polarization Type

MIMO Analysis

Sphere Type

☒ Sphere

☐ Upper Hemi-Sphere

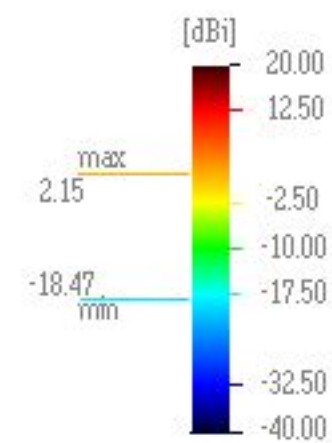
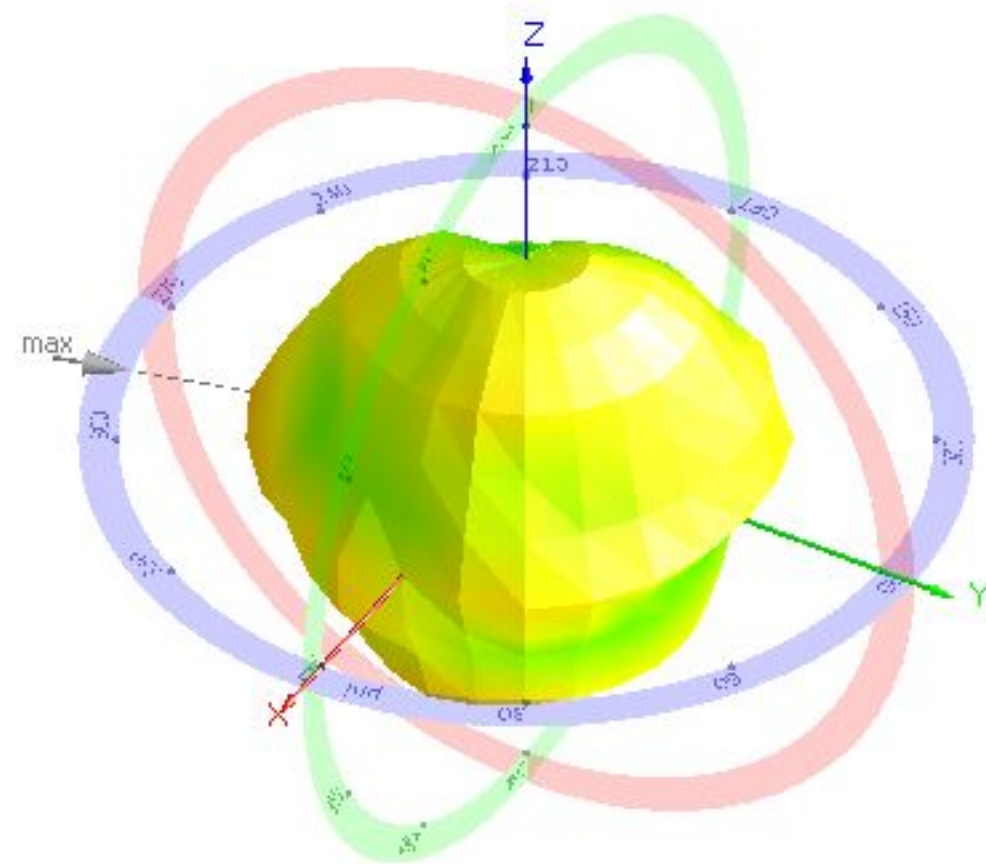
3D Result Summary :

		Theta-Pol					Phi-Pol(\					Pwr Sum				
No	Freq.[MHz]	Eff.[%]	Avg.[dBi]	Peak[dBi]	Theta]	Phi[de	Eff.[%]	Avg.[dBi]	Peak[dBi]	Theta]	Phi[de	Eff.[%]	Avg.[dBi]	Peak[dBi]	Theta]	Phi[de
1	2400.000	40.63	-3.91	1.61	90.00	285.00	9.20	-10.36	-3.92	15.00	120.00	49.83	-3.03	2.15	90.00	285.00
2	2410.000	36.28	-4.40	0.96	90.00	285.00	8.46	-10.73	-4.67	60.00	105.00	44.74	-3.49	1.57	90.00	285.00
3	2420.000	35.61	-4.48	0.72	90.00	285.00	8.52	-10.70	-4.53	60.00	105.00	44.13	-3.55	1.42	90.00	285.00
4	2430.000	32.79	-4.84	0.26	105.00	270.00	8.14	-10.89	-4.71	60.00	105.00	40.93	-3.88	0.98	90.00	285.00
5	2440.000	27.02	-5.68	-0.52	105.00	270.00	6.97	-11.57	-5.51	60.00	105.00	33.99	-4.69	0.26	105.00	270.00
6	2450.000	26.33	-5.80	-0.73	105.00	270.00	7.16	-11.45	-5.41	90.00	135.00	33.49	-4.75	0.18	105.00	270.00
7	2460.000	24.26	-6.15	-1.25	45.00	15.00	6.89	-11.62	-5.59	90.00	135.00	31.15	-5.07	-0.31	105.00	270.00
8	2470.000	22.30	-6.52	-1.14	45.00	15.00	6.42	-11.92	-5.52	30.00	270.00	28.72	-5.42	-0.90	105.00	270.00
9	2480.000	23.43	-6.30	-0.53	45.00	15.00	6.78	-11.69	-4.81	30.00	270.00	30.21	-5.20	-0.34	45.00	15.00
10	2490.000	22.20	-6.54	-0.51	45.00	15.00	6.45	-11.91	-4.63	30.00	270.00	28.65	-5.43	-0.35	45.00	15.00
11	2500.000	23.48	-6.29	-0.11	45.00	15.00	6.66	-11.77	-4.27	30.00	270.00	30.14	-5.21	0.02	45.00	15.00

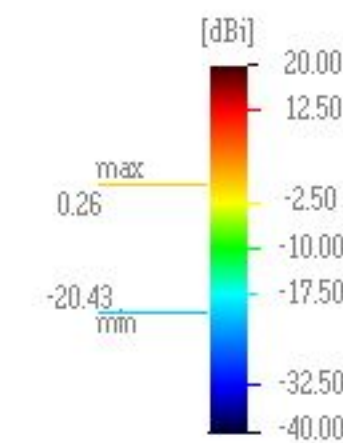
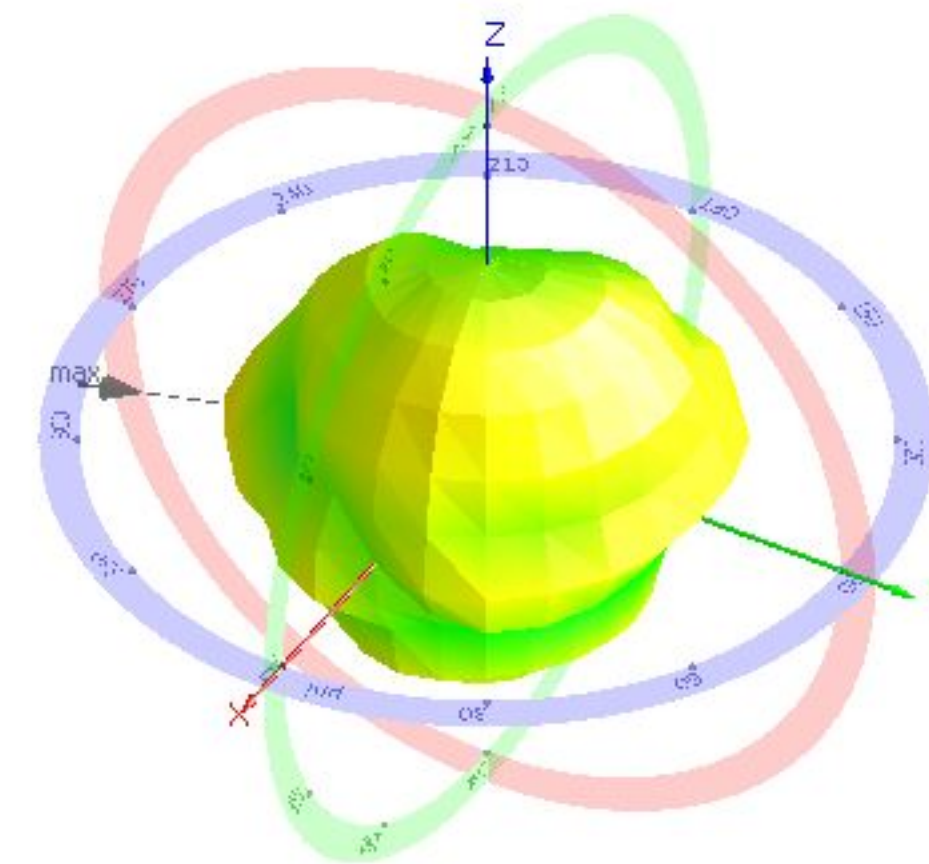


zm

2400.000MHz



2440.000MHz



Plot Data

Polarization :

Powr-Sum

Frequency :

[MHz]
2400,000
2410,000
2420,000
2430,000
2440,000
2450,000
2460,000
2470,000
2480,000
2490,000
2500,000

Graph Option

☐ AutoRotation☐ View Phone☐ SphereMapping☐ Interpolation

x2

Scale

☐ Auto ☒ User Defined

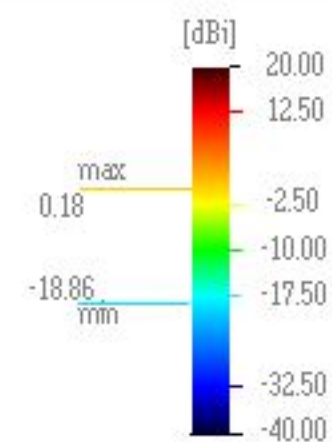
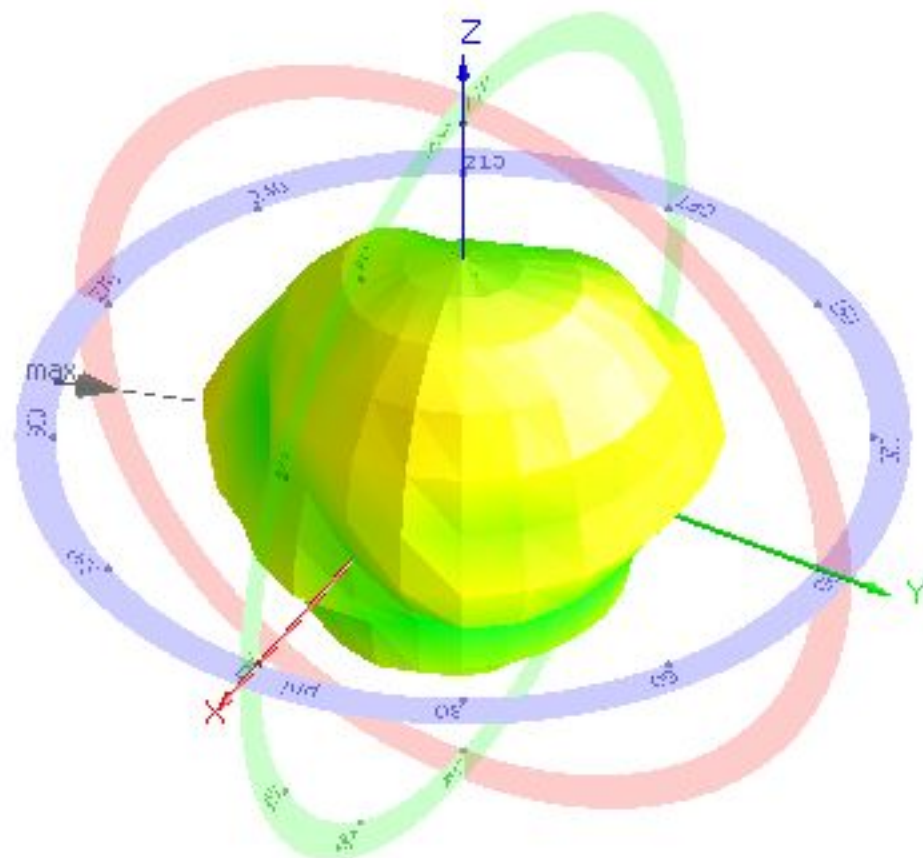
Max : 20

Min : -40

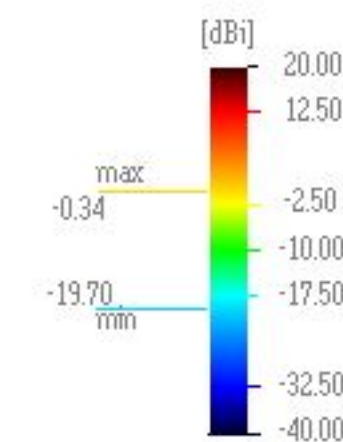
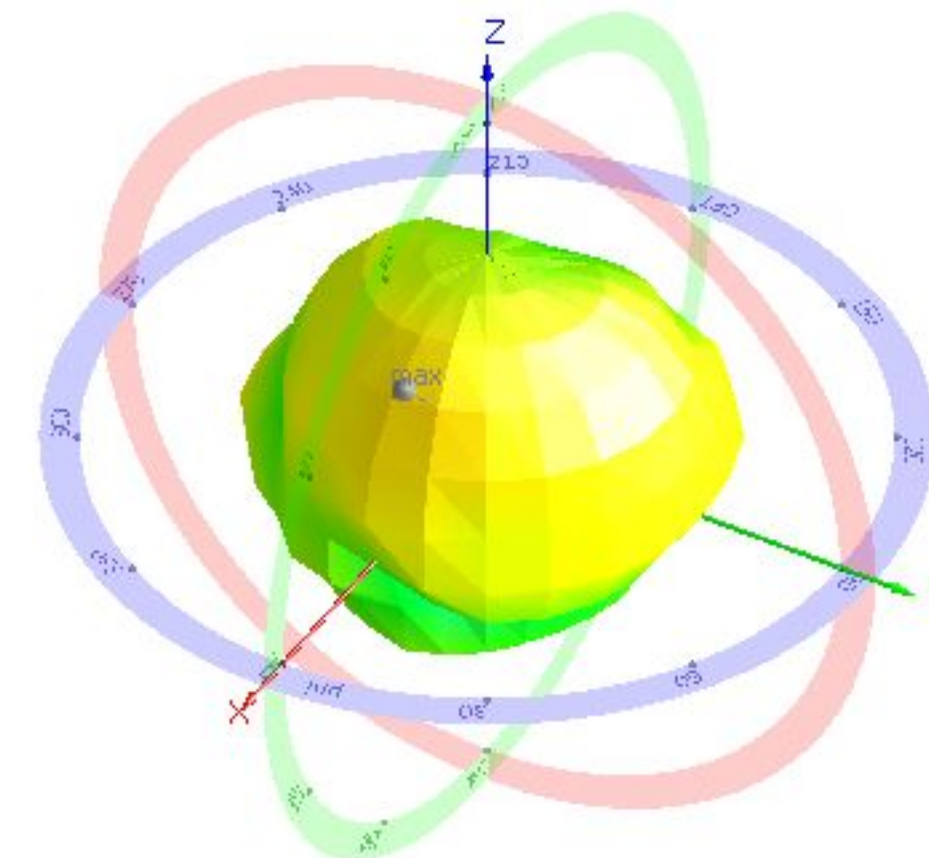
Apply



2450.000MHz



2480.000MHz



zm

zm