APPROVAL NUMBER

DATE : Nov. 1st 2022

SHEET NUMBER : 2N-01

SPECIFICATION FOR APPROVAL

CUSTOMER : LEETEK

DESIGNATION	430-450-470Mhz External Antenna (RP)
PART NUMBER	E450110WRP2.0
MODEL NUMBER	450Mhz (RP-SMA)

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Contents

1 General

1.1 Product Description

430Mhz-450Mhz-470Mhz External Antenna for use in a portable unit for wireless communication (referred to as a radio).

1.2 Product Number

ECTM Product Number : E450110WRP2.0

LEETEK Product Name : 450Mhz (RP-SMA)

1.3 Units, Definitions, and Abbreviations

Unless otherwise stated, SI units are used.

Tx	Transmit Band
Rx	Receive Band
PCB	Printed Circuit Board
VSWR	Voltage Standing Wave Ratio
dBi	Antenna gain in dB (Isotropic)
CW	Continuous Wave
g	Acceleration of gravity (approx 9.8 m/s^2)
RH	Relative Humidity

"Without mechanical damage" implies full mechanical functionality according to specification and compliance with visual requirements according to specification drawing.

"Without permanent mechanical damage" as above but allows reversible misalignment or deformation and minor visual damage (no through-cuts or holes).

1.4 Interface

All properties are guaranteed under the condition that antenna/radio interface is designed in accordance with instructions provided by Ectm. Functionality with other equipment (such as couplers etc.) is not guaranteed unless this has been agreed upon separately.

1.5 Conditions

Unless otherwise stated all temperature tolerances are ±3°C and all RH tolerances are ±5 percentage units.

Unless otherwise stated all values are valid at 20°C and 50% RH.

1.6 Coordinate System

The coordinate system for the radio is defined as follows ;

- Origin in center of gravity.
- Positive X axis is perpendicular to, and directed from, front plane.
- Positive Y axis is perpendicular to, and directed from, right side plane(as seen from front).
- Positive Z axis is perpendicular to, and directed from, top plane.

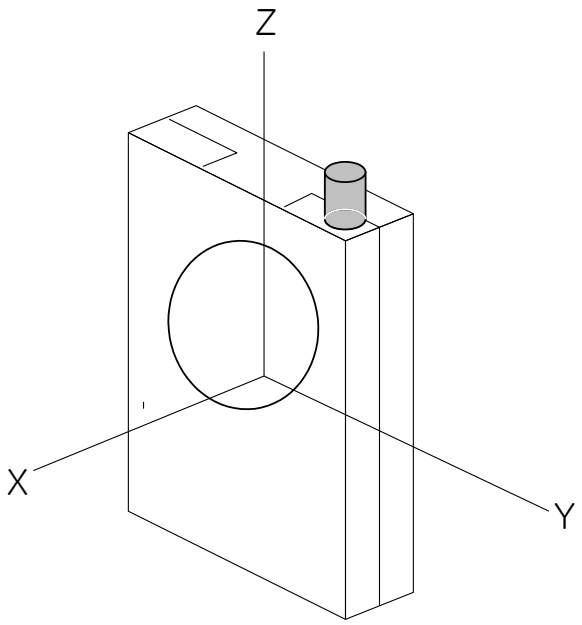


Figure 1.6.1 Coordinate system for the radio.

2 Electrical Properties

2.1 Frequency Bands

2.1.1 430Mhz-450MHz-470Mhz Band

430Mhz~450Mhz~470Mhz,

2.2 Impedance

2.2.1 Nominal Value

50 Ohms

2.2.2 Method

Ectm will supply engineering assistance to ensure that the impedance over the frequency bands is as close to 50 ohms as possible after matching. Both free space and talk position are considered, with priority given to talk position.

2.3 VSWR

Below are listed the maximum values of the worst matched frequency within each band including production variation influences.

2.3.1 VSWR at Free Space

433Mhz : 1.74, 450Mhz : 1.41, 470Mhz : 1.91,

2.3.2 Tolerance of Center Frequency

Center Frequency at 450Mhz Band : Standard ± 15 MHz

2.3.3 Method of Measurement

A 50 ohms coaxial cable is connected (soldered) to the 50 ohms feeding point on the PCB. The connection of the coaxial cable is done so as to introduce a minimum of mismatch. In the other end, the coaxial cable is connected to a network analyzer. The analyzer is calibrated so that the reference plane is at the 50 ohms feeding point. The radio, including the PCB must not in any significant way differ from the mass produced radio, e.g. the antenna feeding parts have to be equivalent to the parts in mass production. Free space means that the radio is attached to a nonconductive surface.

2.3.3 Electrical Performance Assurance

Sampling Plan

2.4 Gain

Below are average gain values of the frequency with the lowest peak gain within each band including production variation influences.

2.4.1 Values

Unit

	434MHz,	450MHz ,	470Mhz
(dBi)	-1.19	-0.81	-1.08

2.4.2 Method of Measurement

The connection is done according to 2.3.2, Radiation patterns are measured at the Tx and Rx band edges for each band defined in 2.1.1 and 2.1.2. The measurements are Performed so as to minimize the influence of the cables.

Only the coplanar polarization component is measured.

The antenna is measure in 2 orthogonal E-planes in free space, according to figure 2.4.1. The antenna is also measured in talk position. Calibration for absolute measurements is done with a reference antenna, which is in turn calibrated by a certified calibration company.

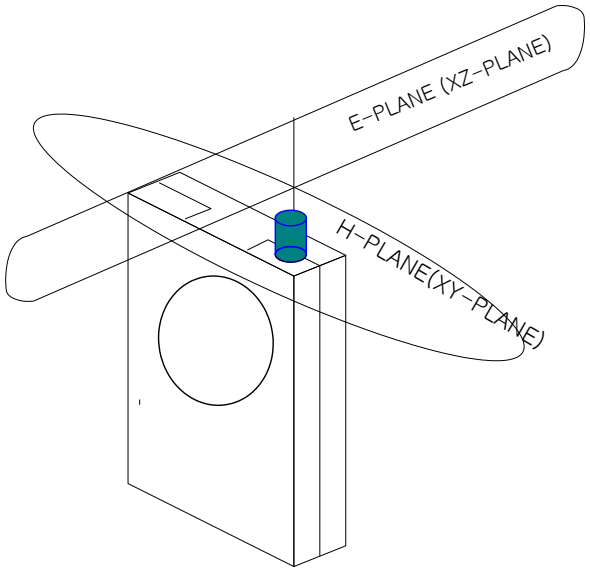


Figure 2.4.1

2.5 Power Rating

2.5.1 Maximum Value

P = 3 W (CW)

2.5.2 Post Test requirements

Without mechanical damage and electrical performance according to 2.3.1 and 2.4.1, after the test.

2.5.3 Method of Measurement

The connection is done according to 2.3.1 The specified power, P, is applied for 10 minutes at the middle frequency of each Tx band defined in 2.1.1. Immediately after the test the VSWR is measured.

3 Mechanical Properties

3.1 Drop

3.1.1 Number of Drops

5-drop in stubby mode.

3.1.2 Drop Height

1.5 m

3.1.3 Drop Angle

Radio is rotated 30° around positive of negative X-axis to ensue radio lands on antenna.

3.1.4 Fixture Weight

Fixture is equivalent to the weight of the radio with its heaviest battery pack.

3.1.5 Post Test Requirements

Without permanent mechanical damage and electrical performance according to 2.3.1 and 2.4.1 after test.

3.1.6 Method of Measurement

The antenna is attached to radio (if available, otherwise to test fixture of equal weight). The radio is dropped with antenna downward onto a tile-covered concrete surface.

4 Environmental Resistance Properties

4.1 Operational Temperature

4.1.1 Low Operational Temperature

T_{LO}=-20℃

4.1.2 High Operational Temperature

T_{HI}=+80℃ at 50% RH

4.1.3 Post Test Requirements

Without mechanical damage. electrical performance according to 2.3.1 after test.

4.1.4 Method of Measurement

The antenna is kept at +20℃ at 50% RH for at least 1 hour.

The antenna is placed at temperature T_{LO} and after 1 hour the VSWR is measured.

The antenna is kept at +20℃ at 50% RH for at least 1 hour.

The antenna is placed at temperature T_{HI} and after 1 hour the VSWR is measured.

4.2 Temperature Cycling

4.2.1 Low Cycling Temperature

T_{LO}=-40℃

4.2.2 High Cycling Temperature

T_{HI}=+85℃

4.2.3 Post Test Requirements

Without mechanical damage and electrical performance according to 2.3.1 and 2.4.1, after relaxing period at +20℃ and 50% RH.

4.2.4 Method of Measurement

The antenna is placed in a climatic chamber. The temperature is cycled as follows : The temperature is kept constant at T_{LO} for 1/2 hour, moved to a chamber at T_{HO} during 20 seconds, kept constant at T_{HO} for 1/2 hour, and then moved back to the chamber at T_{LO} during 20 seconds. This procedure is repeated 32 times.

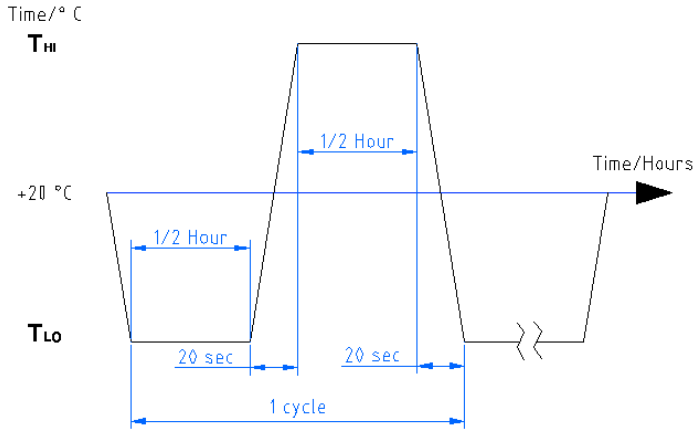


Figure 4.2.1 Temperature Cycling

4.3 Humidity

4.3.1 Humidity

85% RH

4.3.2 Temperature

+55℃

4.3.3 Post Test Requirements

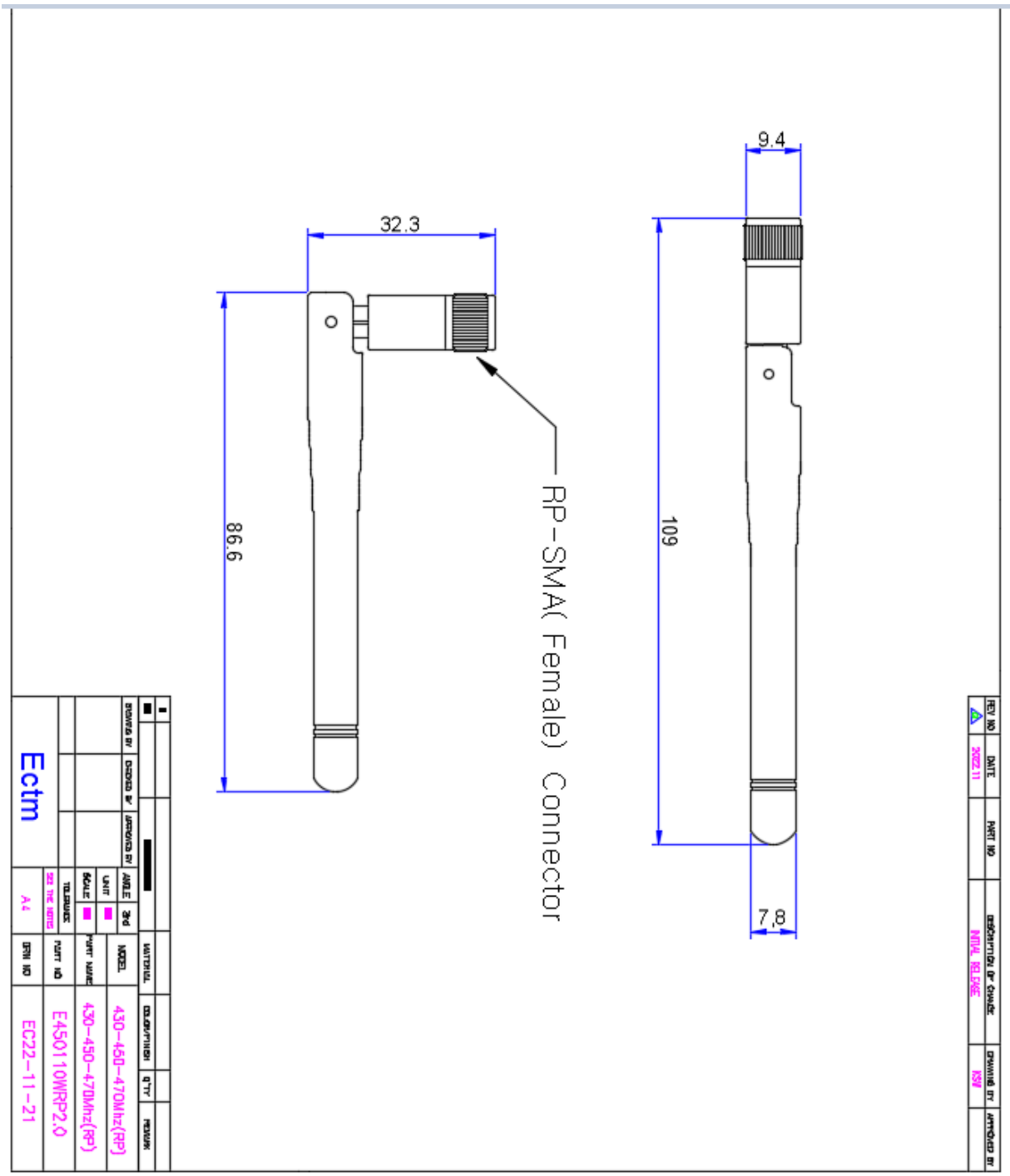
Without mechanical damage and electrical performance according to 2.3.1 and 2.4.1, after test.

4.3.4 Method of Measurement

The antenna is placed in a climatic chamber for 24 hours.

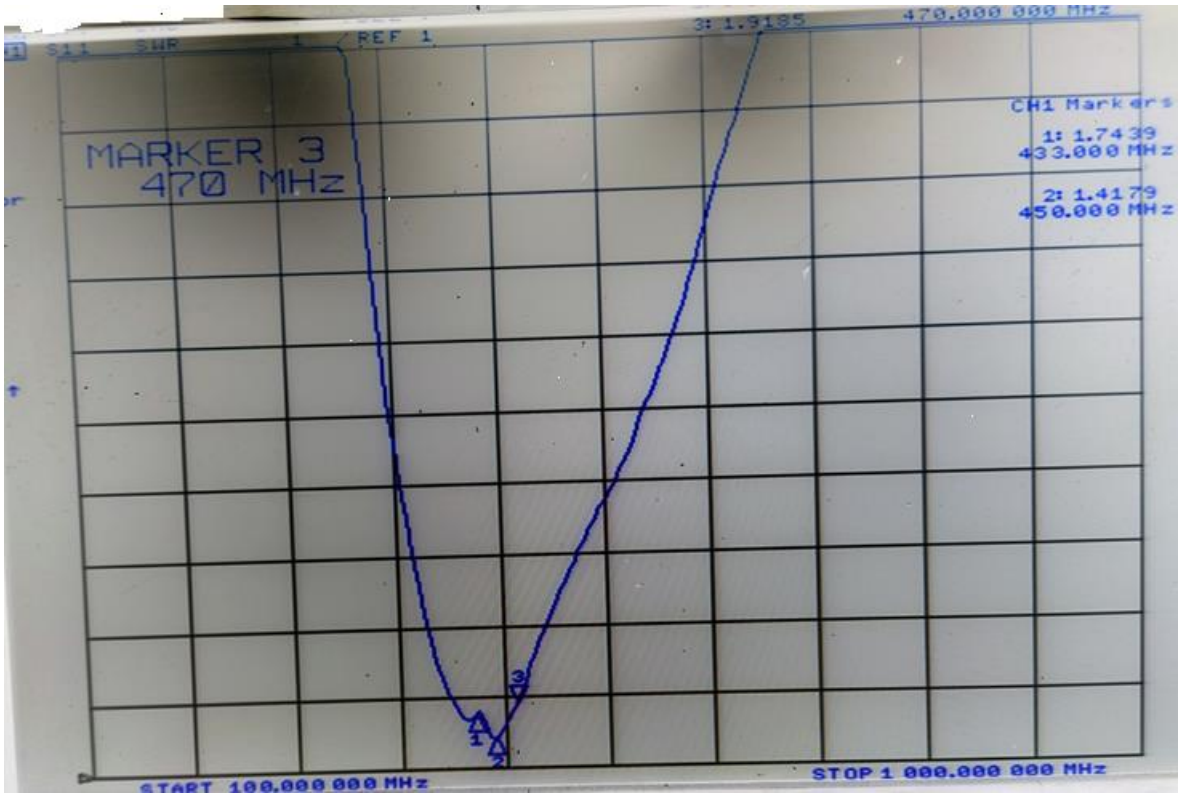
The antenna is taken out from the chamber and measure after another 24 hours in +20℃ and 50% RH

5 Antenna Drawing



6 VSWR and Efficiency & Radiation Pattern(3D)

6.1 VSWR DATA



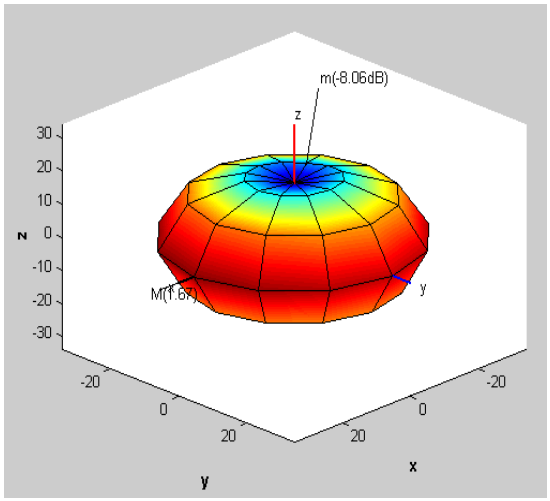
6.2 Efficiency (3D)

	2	3	4	5	6	7
Frequency [MHz]	**420**	**434**	**440**	**450**	**460**	**470**
Efficiency [dBi]	**-1.28**	**-1.19**	**-1.40**	**-0.81**	**-0.94**	**-1.08**
Efficiency [%]	**74.5**	**76.0**	**72.4**	**82.9**	**80.5**	**78.0**
TRG_{θ} [dBi]	-1.34	-1.26	-1.49	-0.89	-1.02	-1.16
$Gain_{\theta\ Peak}$ [dBi]	1.47	1.65	1.71	2.06	1.92	1.71
$Gain_{\theta\ Min}$ [dBi]	-8.45	-8.64	-8.91	-8.08	-8.48	-8.72
TRG_{φ} [dBi]	-19.65	-19.11	-18.68	-18.22	-18.53	-18.33
$Gain_{\varphi\ Peak}$ [dBi]	-14.85	-14.55	-14.09	-13.89	-14.01	-13.41
$Gain_{\varphi\ Min}$ [dBi]	-40.70	-40.35	-39.23	-37.48	-38.04	-33.49
UHRG [dBi]	-4.40	-4.52	-4.75	-4.18	-4.42	-4.68
UHRG/TRG [%]	48.7	46.5	46.3	46.1	44.9	43.7
H-Plane	1.31	1.22	0.93	1.50	1.35	1.04
E1-Plane, AVG [dBi]	-2.57	-2.44	-2.64	-2.04	-2.16	-2.28
E2-Plane, AVG [dBi]	-2.80	-2.72	-2.94	-2.36	-2.50	-2.65
Peak Gain [dBi]	1.50	1.67	1.74	2.09	1.95	1.74
Directivity [dBi]	2.78	2.86	3.15	2.90	2.89	2.82
Minimum Gain [dBi]	-8.09	-8.06	-8.19	-7.48	-8.06	-8.29
Test Condition						
Antenna Type						

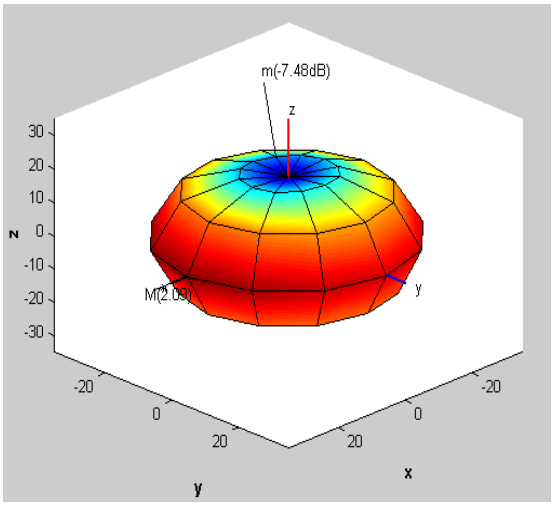
Average Efficiency	**dBi**	**76.28**	**%**

6.3 Radiation Pattern (3D)

-434Mhz



-450Mhz



-460Mhz