

1. OTA PASSIVE ANTENNA TEST REPORT

Date of Report 13/08/2024

Number of pages: 21

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Client:

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Tested devices

Bracelet P8M-GPS900W3

**Testing has been
carried out in
accordance with:**

Passive measurements per customer request

Documentation:

The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory.

Test Results:

The test results relate only to devices specified in this document

Date and 13.08.2024 **signatures:**



Sami Laukkanen
CTO

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2. SUMMARY

2.1 Test Details

Devices under Test (DUT):

Product:	Bracelet P8M-GPS900W3
Note	"Rigid PCB Ant"
Manufacturer info:	GM10000HR
SW Info:	
DUT number:	22073
Tested Frequencies:	ISM: 820-960 MHz Cell: 695-745 MHz, 1710-2170 MHz



Figure 1 DUT top/front



Figure 2 DUT back

Testing information:

2 (20)

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Testing performed:	22.5.2024
Notes:	-
Document name:	Passive_OTA_test_report_ID6667_13082024
Temperature C / Humidity RH%	22±2 / 25%±10%
Measurement performed by:	Veli-Matti Niemitalo
Document history:	24.5.2024 Draft version 13.08.2024 Signed version

TABLE OF CONTENTS

1. OTA PASSIVE Antenna Test Report	1
2. Summary	2
2.1 Test Details	2
3. Test Equipment	5
4. Test setup	7
5. RESULTS	8
5.1 Passive OTA measurements	8
5.1.1 Maximum gain and efficiency	8
5.1.2 Maximum gain (graphs)	10
5.1.3 Efficiency (graphs)	12
6. Antenna Pattern Cuts	14
6.1 ISM 820-960 MHz.....	14
6.2 CELL 695-745 MHz	15
6.3 CELL 1710-2160 MHz	16
7. Antenna Patterns	17

3. TEST EQUIPMENT

Main used test equipment is listed below. For full equipment list and calibration intervals, please contact the testing laboratory.

Type of Equipment	Type	Manufacturer	Calibration date	Calibration period	Calibration due	Purpose
Diagonal Dual Polarized Horn Measurement Antenna	114960	ETS	Included in range calibration	Included in range calibration	Included in range calibration	Probe antenna
Positioning Controller	2090	EMCO	n/a	n/a	n/a	DUT alignment
3D Positioner	Custom made	ETS-Lindgren	n/a	n/a	n/a	DUT alignment
Anechoic Chamber	4	ETS-Lindgren	23.09.2023	1 year	23.09.2024	Test range
Switching System	MSN6TD-06DEC-SP	American Microwave	Included in range calibration	Included in range calibration	Included in range calibration	Probe selection

Switching System	SW6AD-A61	Pulsar	Included in range calibration	Included in range calibration	Included in range calibration	Probe selection
Network Analyzer	E5071C	Agilent	20.05.2024	1 year	20.05.2025	Measurement transmitter / receiver
Dual-Ridge Horn Antenna	SH600	MVG	20.08.2020	n/a	n/a	Calibration antenna 1-9 GHz

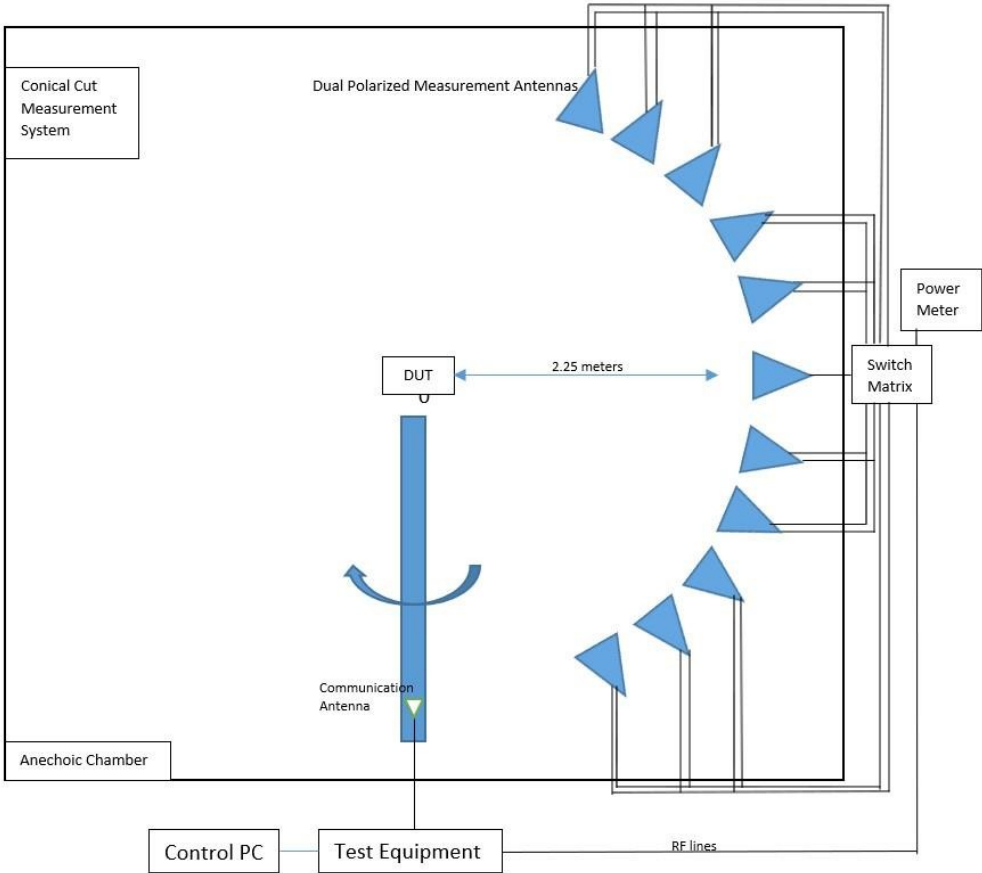


Figure 3. Laboratory 4 chamber schematic.

4. TEST SETUP

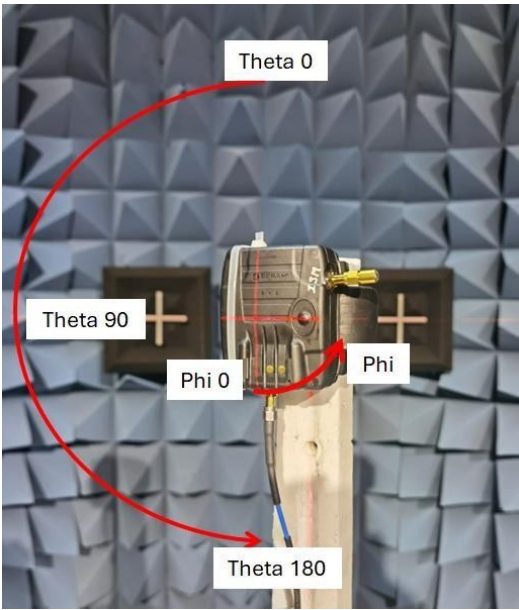


Figure 4 DUT in Free Space passive measurement and coordinate system

Vertical laser in DUT setup position denotes $\phi=0$, horizontal laser denotes $\theta=90$. $\theta=0$ is directly up from DUT, and $\theta=180$ is down from DUT.

This report covers two individual PCB trace antennas, one for cellular bands and one for 900MHz ISM bands.

5. RESULTS

5.1 Passive OTA measurements

5.1.1 Maximum gain and efficiency

Frequency [MHz]	Max gain [dBi]	Efficiency [dB]
820	-8.5	-12.0
830	-7.7	-10.9
840	-6.5	-9.7
850	-5.4	-8.2
860	-4.5	-7.4
870	-3.5	-6.5
880	-3.1	-6.1
890	-3.1	-6.0
900	-3.0	-6.4
910	-4.0	-7.4
920	-5.1	-8.1
930	-6.3	-9.3

940	-7.3	-10.3
950	-8.3	-11.4
960	-9.4	-12.6

Table 1 ISM 820-960 MHz max gain and efficiency

Frequency [MHz]	Max gain [dBi]	Efficiency [dB]
695	-0.2	-4.2
705	-0.8	-4.6
715	-1.5	-5.5
725	-2.2	-6.1
735	-3.4	-6.6
745	-4.1	-7.4

Table 2 Cell 670-720 MHz max gain and efficiency

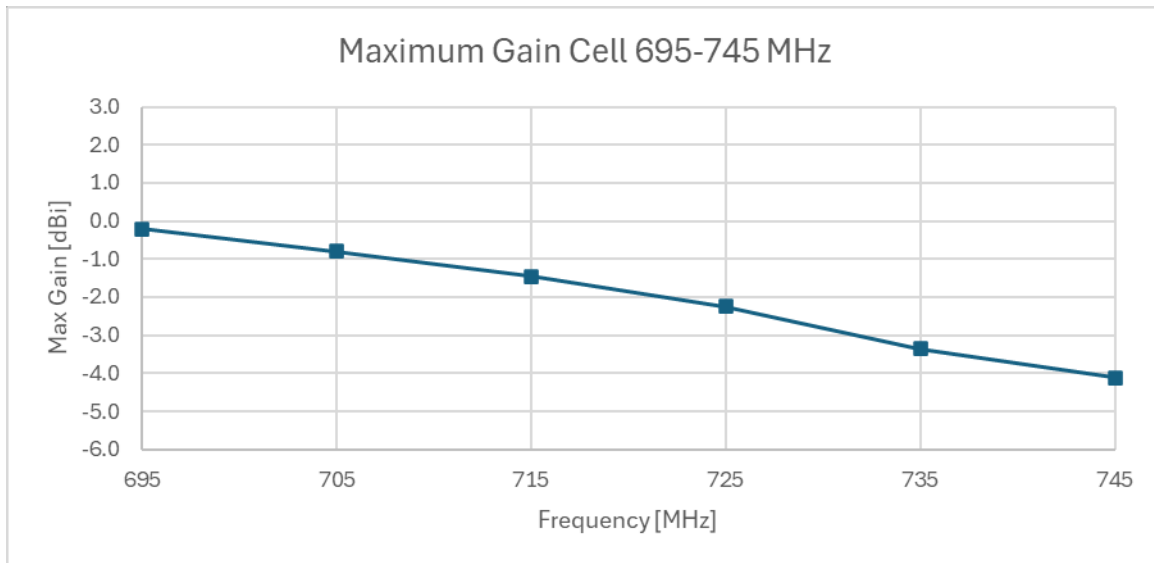
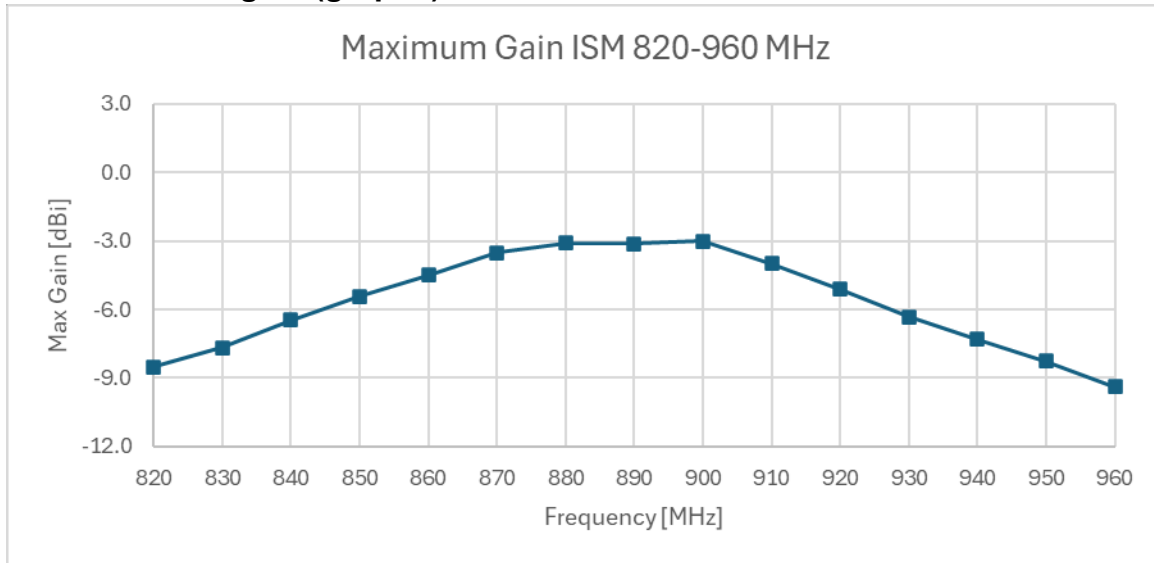
Frequency [MHz]	Max gain [dBi]	Efficiency [dB]
1710	-0.2	-5.4
1720	-0.3	-5.3
1730	-0.6	-5.2
1740	-1.4	-5.7
1750	-1.0	-5.0
1760	-1.4	-5.5
1770	-0.9	-5.1
1780	-1.1	-5.4
1790	-1.3	-5.4
1800	-1.3	-5.3
1810	-1.3	-5.4
1820	-1.1	-5.5
1830	-0.5	-5.1
1840	-0.5	-5.1
1850	-0.6	-5.4
1860	0.0	-5.1
1870	-0.1	-5.4
1880	-0.1	-5.5
1890	0.0	-5.3
1900	0.4	-4.9

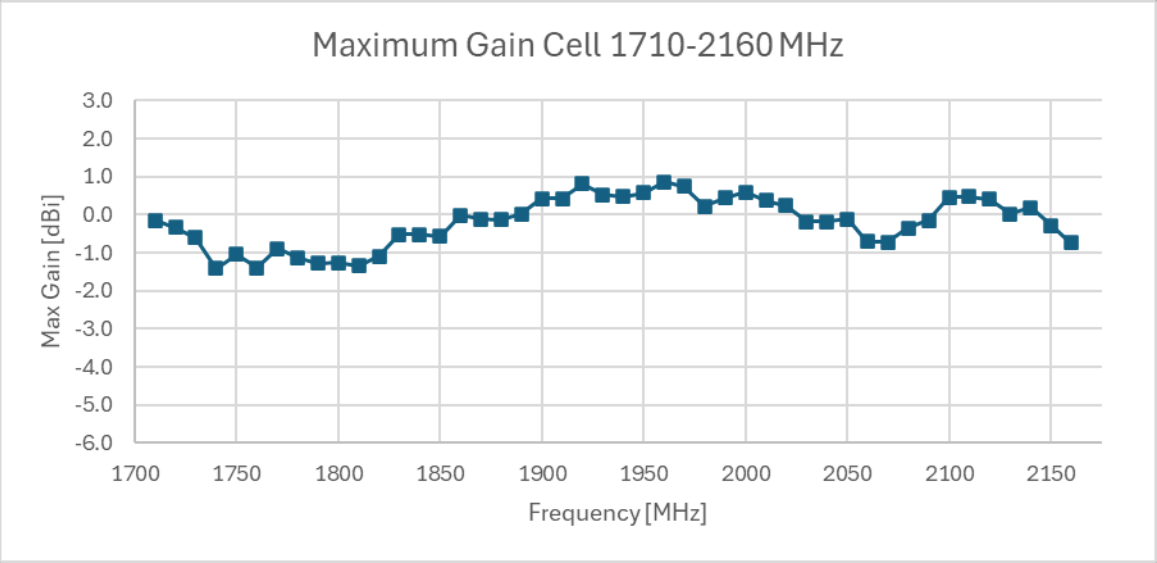
Frequency [MHz]	Max gain [dBi]	Efficiency [dB]
1940	0.5	-4.9
1950	0.6	-4.9
1960	0.9	-4.6
1970	0.7	-4.6
1980	0.2	-4.7
1990	0.4	-4.6
2000	0.6	-4.8
2010	0.4	-4.7
2020	0.2	-4.5
2030	-0.2	-4.6
2040	-0.2	-4.6
2050	-0.1	-4.5
2060	-0.7	-4.5
2070	-0.7	-4.6
2080	-0.4	-4.5
2090	-0.2	-4.7
2100	0.5	-4.5
2110	0.5	-4.7
2120	0.4	-4.7
2130	0.0	-5.1

1910	0.4	-5.2	2140	0.2	-5.1
1920	0.8	-4.9	2150	-0.3	-5.4
1930	0.5	-4.9	2160	-0.7	-5.7

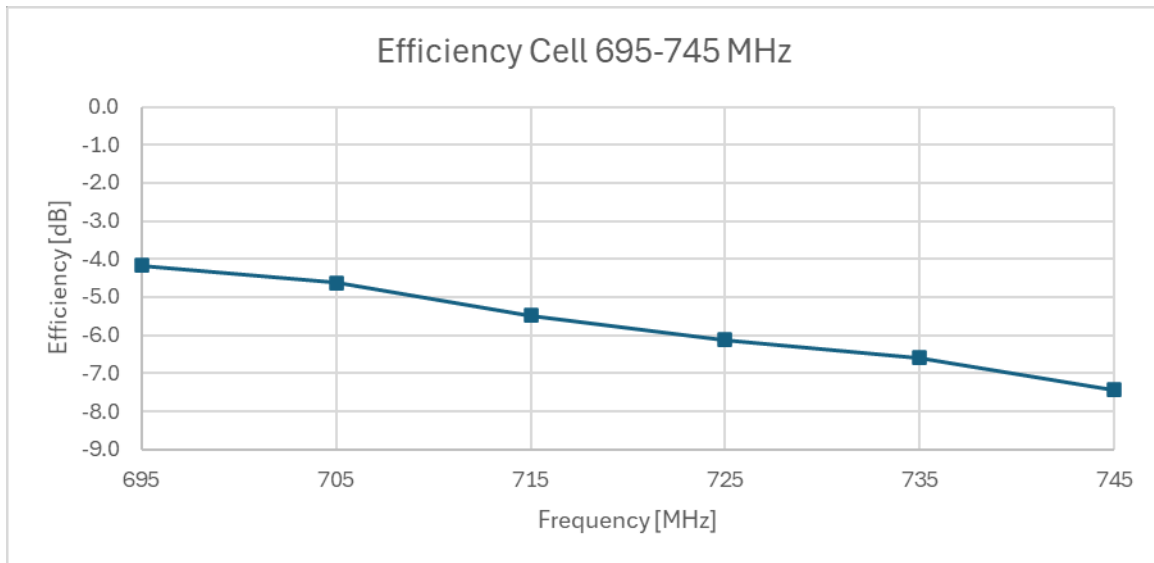
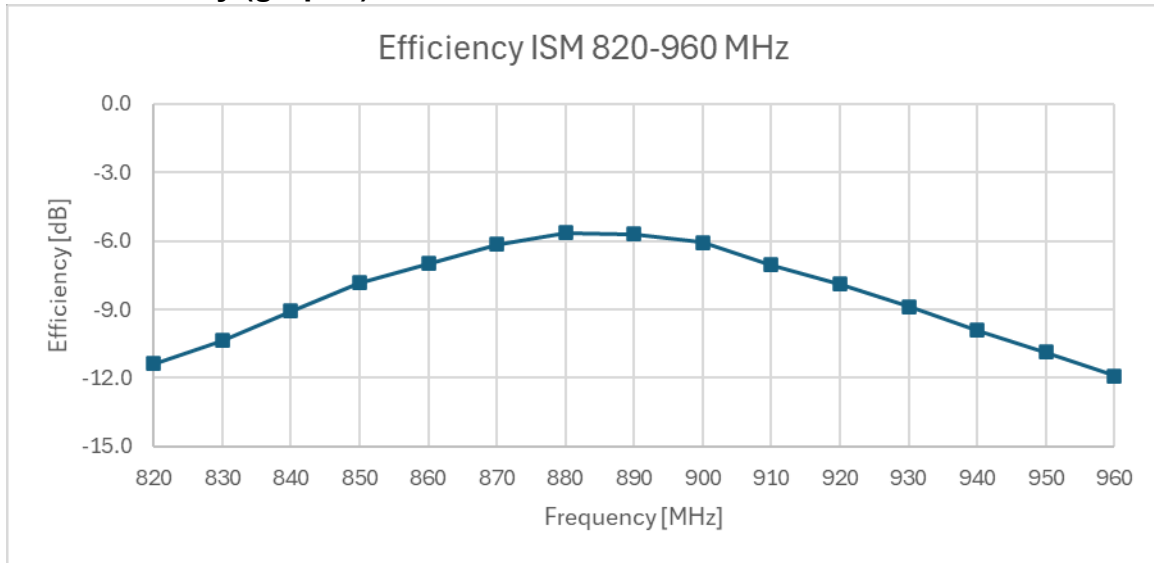
Table 3 Cell 1710-2160 MHz max gain and efficiency

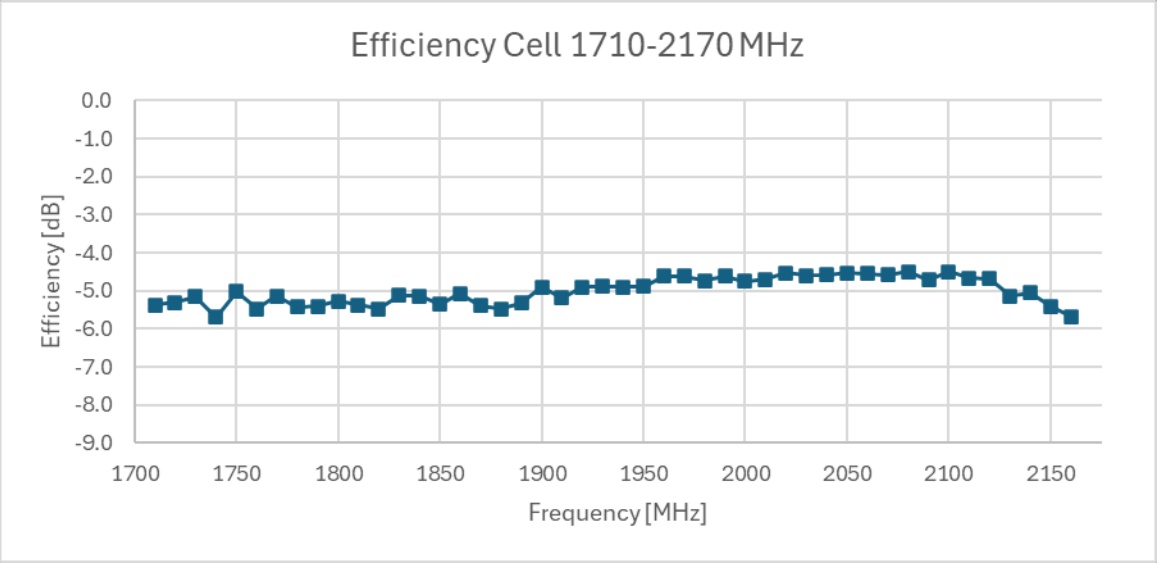
5.1.2 Maximum gain (graphs)





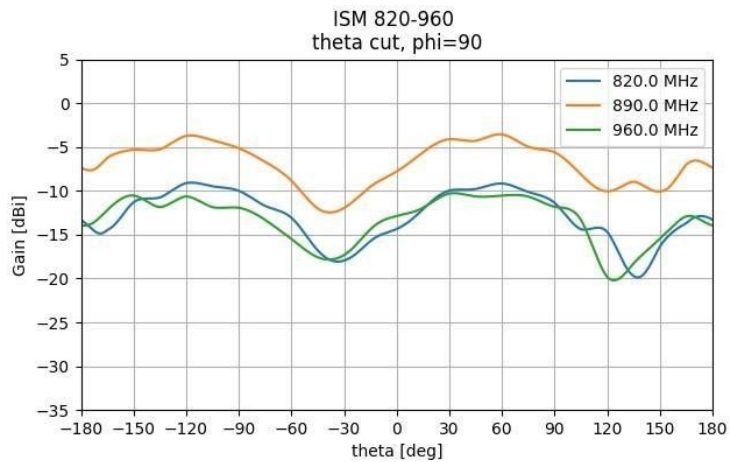
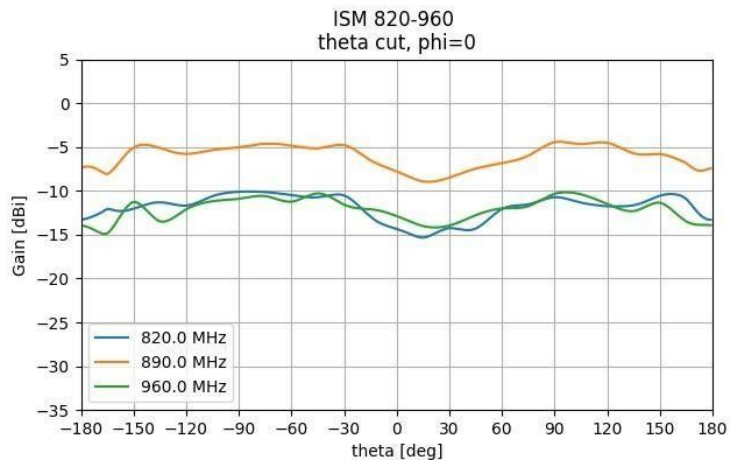
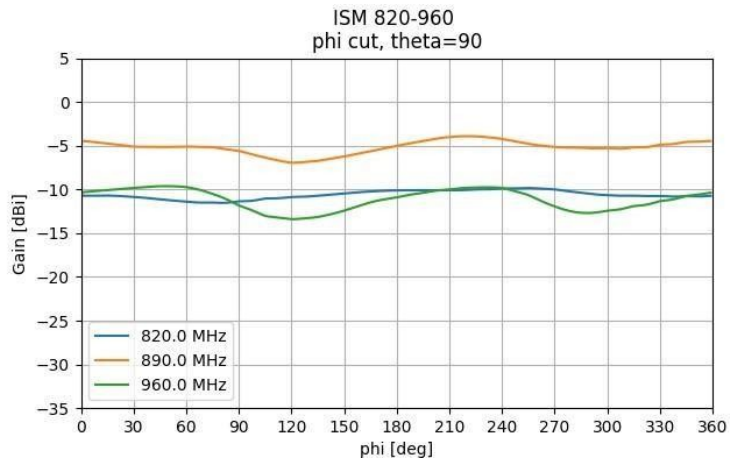
5.1.3 Efficiency (graphs)



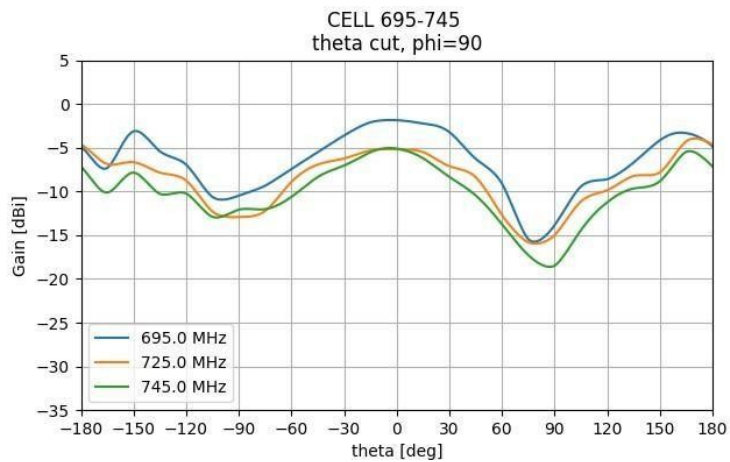
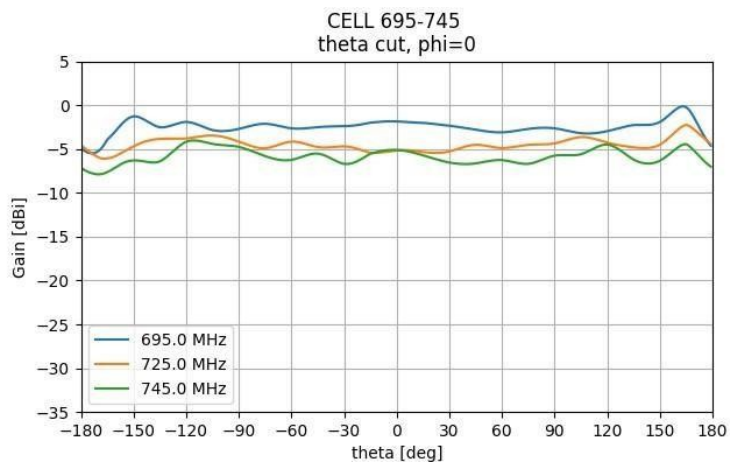
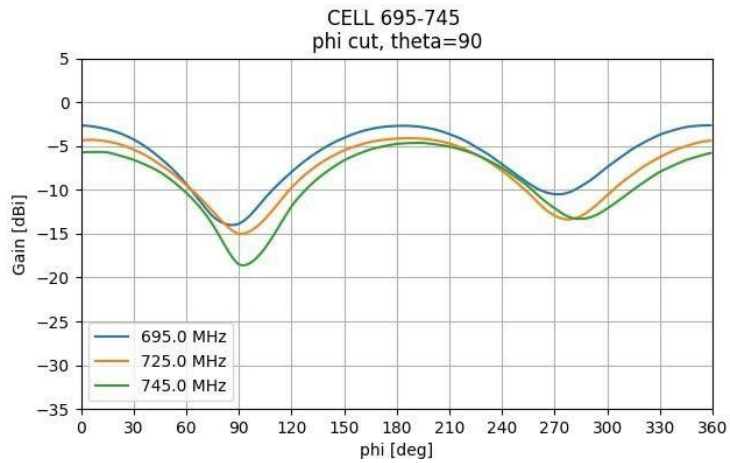


6. ANTENNA PATTERN CUTS

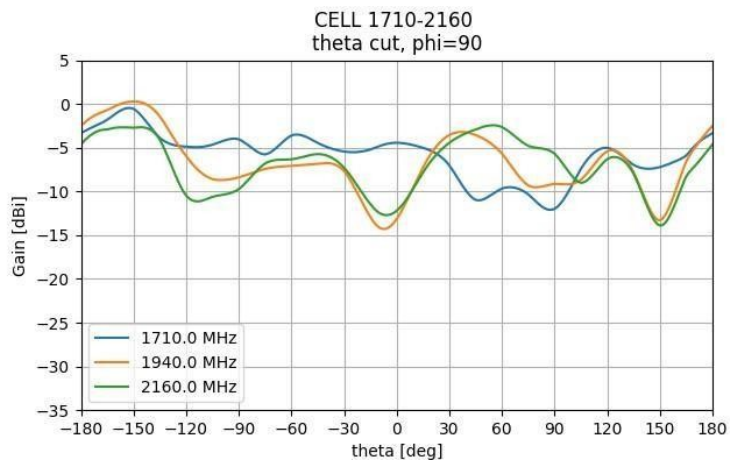
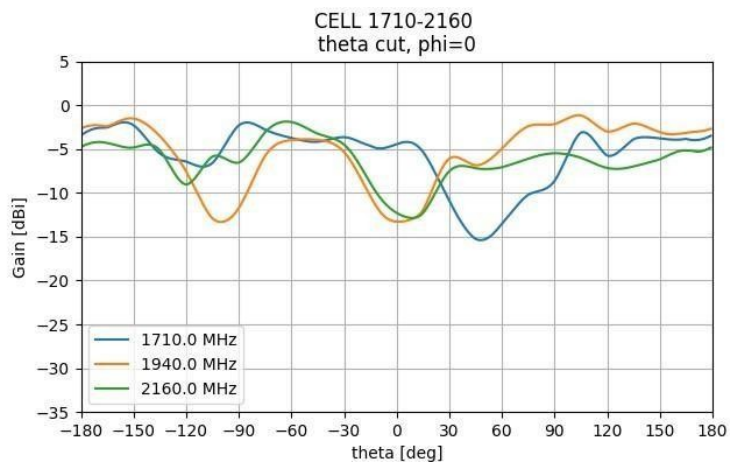
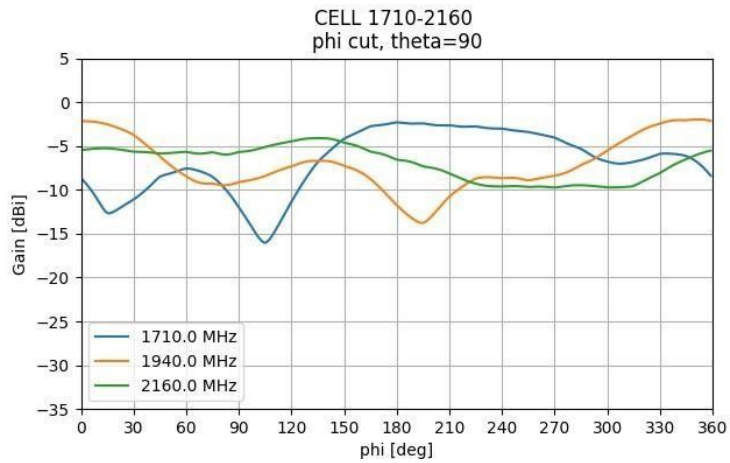
6.1 ISM 820-960 MHz



6.2 CELL 695-745 MHz



6.3 CELL 1710-2160 MHz



7. ANTENNA PATTERNS

