Antenna Test Report

Report No.: TEOT2404000497EP

Applicant Name: SIGNAL ELECTRONIC CO., LTD.
Manufacturer Name: SIGNAL ELECTRONIC CO., LTD.

Product Name: BLE Module
Model No.: SMD810X-S0X

Measurements performed at
SGS Taiwan Ltd.
NeiHu District, Taiwan

Issued Date: April 26, 2024

	Name	Date & Signature
Prepared by:	Walter Lin Engineer	 April 26, 2024
Approved by:	Eason Chou Supervisor	 April 26, 2024

Distribution

Revision Version

Report Number	Revision	Date	Memo
TEOT2404000497EP	00	2024/04/26	Initial creation of test report.

This test report contains a reference to the previous version test report that it replaces.

Measurement System Information

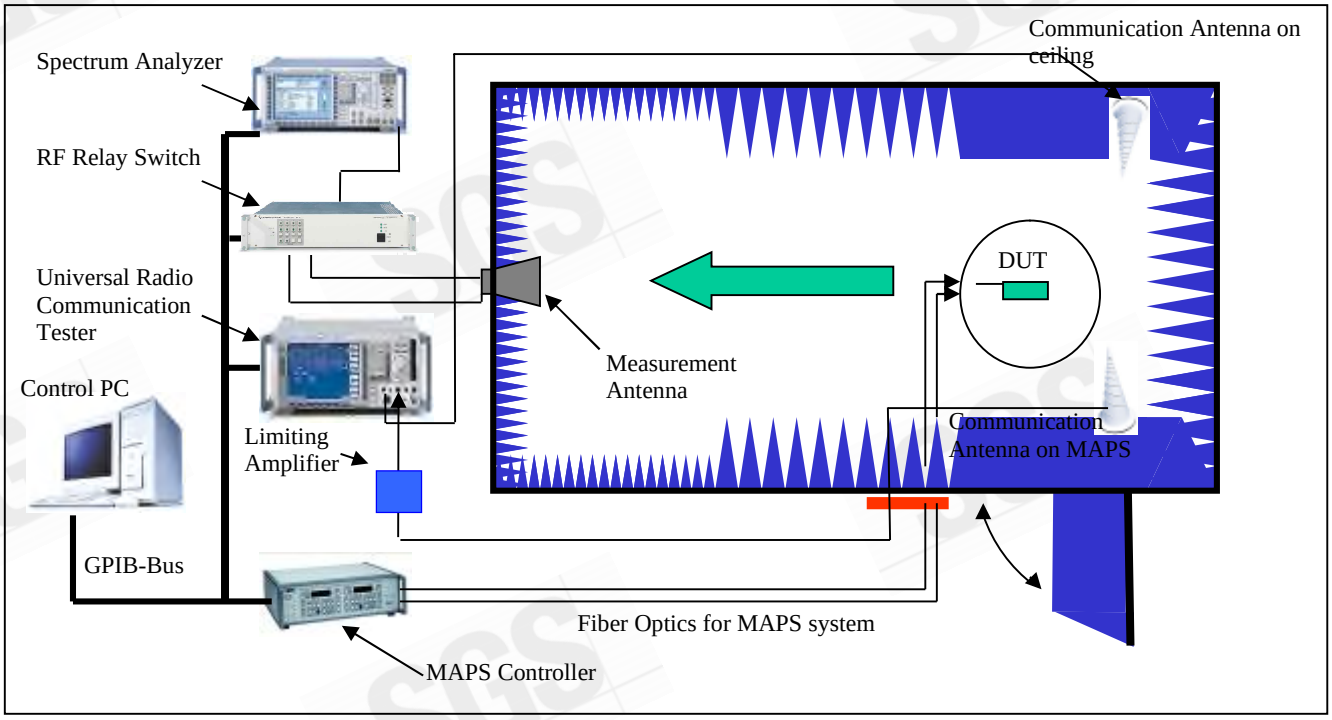
General Information

Testing Condition:

- Temperature: 25±3˚C
- Humidity: <80%

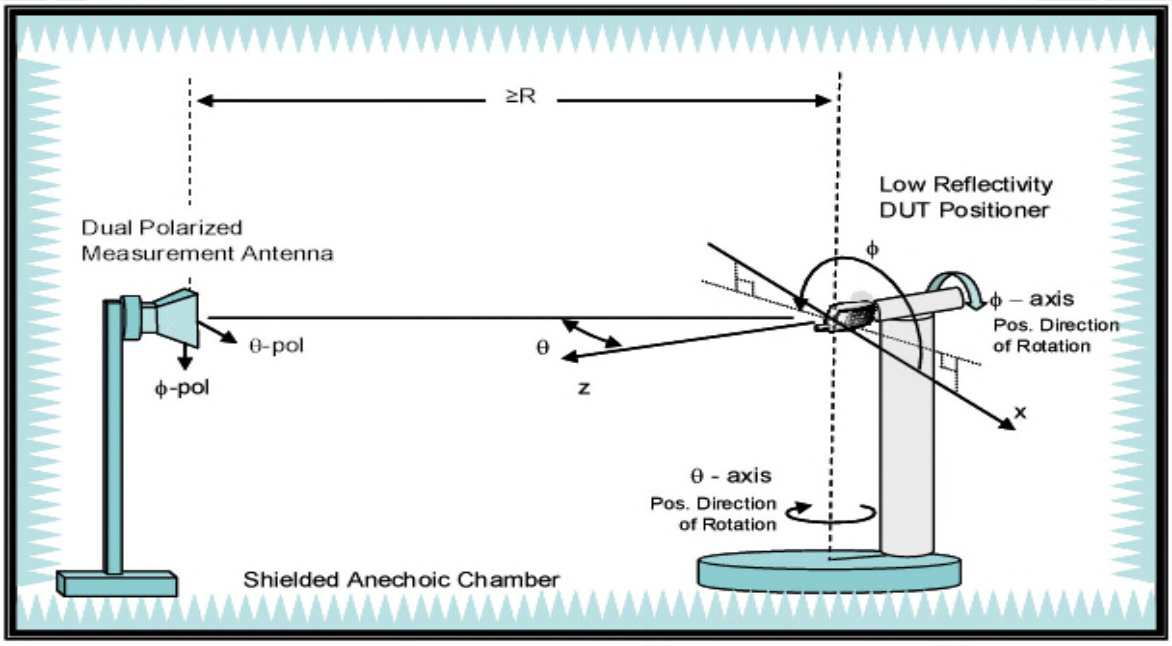
Measurement Facility:

- Measurement Chamber: ETS-Lindgren 3D fully anechoic chamber and its measuring system (AMS-8500)
- Base Station Simulator: Agilent E5515C
- ETS-Lindgren EMCO-2090 Auxiliary Ports RF Relay Switches
- Spectrum Analyzer: Agilent N9010A
- Network Analyzer: Agilent E5071C



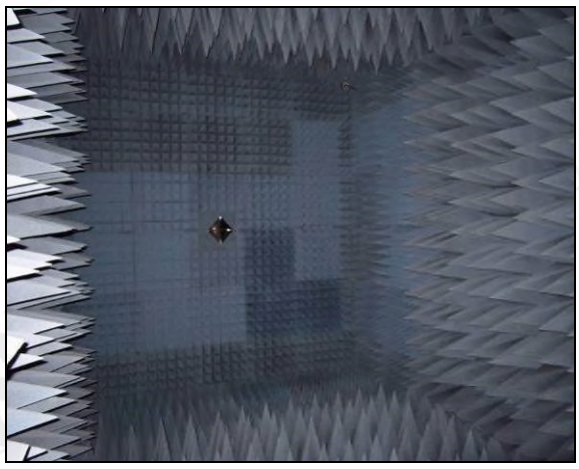
Measurements are performed in an ETS-Lindgren **AMS-8500** 3D fully anechoic test system. The test system includes a high-performance RF-shielded, rectangular anechoic chamber, a Multi-Axis Positioning System (MAPS), and *EMQuest™EMQ-100* data acquisition and analysis software. The geometry of the setup is specified below for reference.

Typical Setup for ETS-Lindgren AMS-8500:



Instruments View

Inside View



Testing Laboratory: Identification of the Responsible Test Laboratory.

- **OTA Laboratory:**
  SGS Taiwan Ltd. Wireless Laboratory
  No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803.
  Telephone: +886 2 2299 3279
  Fax: +886 2 2298 0488
  Internet: http://www.tw.sgs.com

- **Testing Location:**
  1F, No. 8, Alley 15, Lane 120, Sec. 1, NeiHu Road, NeiHu District, Taipei City 114, Taiwan 11446.

Details of Applicant:

Applicant's name:	**SIGNAL ELECTRONIC CO., LTD.**
Applicant's address:	**4F-2, No.3, Park St. Nankang Software Park Taiwan, R. O. C.**
Contact person:	**Jon Liao**
Telephone:	**(02)2655-7577 ext : 259**
Fax:	**(02)2655-7578**
E-mail:	**jon@e-signal.com.tw**

Details of Manufacturer:

Manufacturer's name:	**SIGNAL ELECTRONIC CO., LTD.**
Manufacturer's address:	**4F-2, No.3, Park St. Nankang Software Park Taiwan, R. O. C.**
Contact person:	**Jon Liao**
Telephone:	**(02)2655-7577 ext : 259**
Fax:	**(02)2655-7578**
E-mail:	**jon@e-signal.com.tw**

Details of EUT:

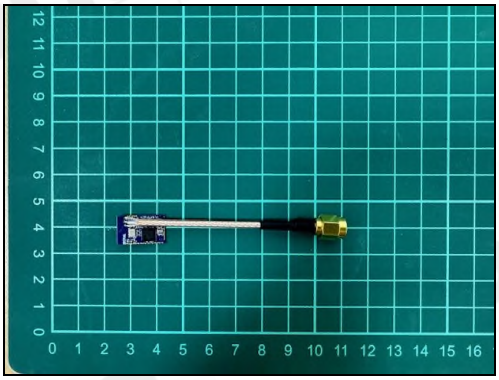
Device Description:	**BLE Module**
Device Manufacturer:	**SIGNAL ELECTRONIC CO., LTD.**
Device Model:	**SMD810X-S0X**
Hardware Version:	**N/A**
Software Version:	**N/A**
Frequency Range:	**2400 MHz ~ 2500 MHz**
Antenna Type:	**PCB Antenna**

Duration of Tests:

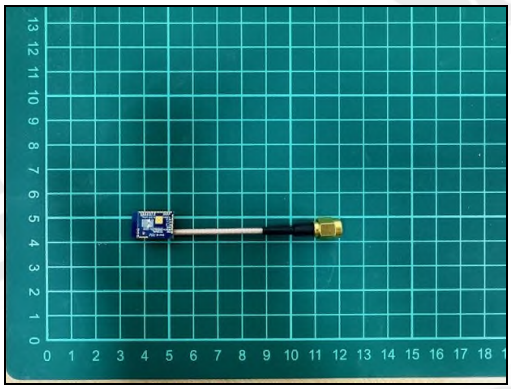
Sample Receive Date:	**2024-04-22**
Test Starting Date:	**2024-04-22**
Test Ending Date:	**2024-04-26**
Report Issued Date:	**2024-04-26**

Photographs of EUT:

Front View



Back View



List of Equipment

Equipment Summary Sheet

Equipment Description	Manufacturer	Identification no.	Current calibration date	Next calibration date
Network analyzer	Agilent	E5071C	2023/10/26	2024/10/25
Measurement software	ETS-Lindgren	EMQuest 1.14	N/A	N/A
Multi axis positioning system(MAPSTM)	ETS-Lindgren	EMCO 2115	N/A	N/A
Multi axis positioning system(MAPSTM)	ETS-Lindgren	EMCO 2110	N/A	N/A
MAPSTM controller	ETS-Lindgren	EMCO 2090	N/A	N/A
Fully anechoic test system	ETS-Lindgren	AMS-8500	2024/03/03	2025/03/02
Horn antenna	ETS-Lindgren	3164-10	2024/03/03	2025/03/02

Reference Measurement Procedure

The reference measurement procedure is described in SGS Working Instruction WI-TESP-EO-101 to 108 for OTA services. Measurements are made by placing the probe in contact with the sample and measuring the admittance or reflection coefficient with respect to the open-circuit end, using a network analyzer or equivalent instrumentation.

Antenna Gain and Efficiency

Test Result										
Frequency (MHz)	2400	2402	2404	2406	2408	2410	2412	2414	2416	2418
Point Values										
Ant. Port Input Pwr. (dBm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Rad. Pwr. (dBm)	**-12.10**	**-12.06**	**-12.05**	**-12.13**	**-12.19**	**-12.15**	**-12.09**	**-12.11**	**-12.22**	**-12.25**
Peak EIRP (dBm)	-3.86	-3.82	-3.82	-3.89	-3.93	-3.96	-3.85	-3.77	-3.91	-3.94
Directivity (dBi)	8.24	8.24	8.24	8.24	8.26	8.19	8.23	8.33	8.31	8.30
Efficiency (dB)	-12.10	-12.06	-12.05	-12.13	-12.19	-12.15	-12.09	-12.11	-12.22	-12.25
Efficiency (%)	**6.16**	**6.22**	**6.24**	**6.12**	**6.05**	**6.10**	**6.18**	**6.16**	**6.00**	**5.96**
Gain (dBi)	-3.86	-3.82	-3.82	-3.89	-3.93	-3.96	-3.85	-3.77	-3.91	-3.94
NHPRP ±Pi/4 (dBm)	-15.50	-15.45	-15.44	-15.52	-15.57	-15.52	-15.47	-15.48	-15.60	-15.60
NHPRP ±Pi/6 (dBm)	-17.56	-17.50	-17.50	-17.57	-17.61	-17.56	-17.50	-17.52	-17.63	-17.64
NHPRP ±Pi/8 (dBm)	-18.90	-18.85	-18.85	-18.91	-18.95	-18.91	-18.85	-18.88	-18.99	-19.01
Upper Hem. PRP (dBm)	-17.27	-17.21	-17.20	-17.26	-17.30	-17.25	-17.19	-17.19	-17.28	-17.30
Lower Hem. PRP (dBm)	-13.68	-13.64	-13.64	-13.73	-13.78	-13.75	-13.70	-13.72	-13.84	-13.88

Test Result										
Frequency (MHz)	2420	2422	2424	2426	2428	2430	2432	2434	2436	2438
Point Values										
Ant. Port Input Pwr. (dBm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Rad. Pwr. (dBm)	**-12.26**	**-12.23**	**-12.26**	**-12.26**	**-12.26**	**-12.32**	**-12.33**	**-12.31**	**-12.22**	**-12.16**
Peak EIRP (dBm)	-3.97	-3.83	-3.93	-3.90	-3.89	-3.96	-3.94	-3.96	-3.86	-3.75
Directivity (dBi)	8.28	8.39	8.33	8.35	8.37	8.36	8.39	8.35	8.35	8.41
Efficiency (dB)	-12.26	-12.23	-12.26	-12.26	-12.26	-12.32	-12.33	-12.31	-12.22	-12.16
Efficiency (%)	**5.95**	**5.99**	**5.94**	**5.95**	**5.95**	**5.86**	**5.85**	**5.87**	**6.00**	**6.08**
Gain (dBi)	-3.97	-3.83	-3.93	-3.90	-3.89	-3.96	-3.94	-3.96	-3.86	-3.75
NHPRP ±Pi/4 (dBm)	-15.62	-15.58	-15.63	-15.62	-15.61	-15.66	-15.67	-15.66	-15.55	-15.50
NHPRP ±Pi/6 (dBm)	-17.65	-17.60	-17.65	-17.64	-17.63	-17.68	-17.70	-17.68	-17.57	-17.51
NHPRP ±Pi/8 (dBm)	-19.01	-18.98	-19.03	-19.02	-19.01	-19.06	-19.08	-19.07	-18.97	-18.91
Upper Hem. PRP (dBm)	-17.31	-17.25	-17.29	-17.28	-17.28	-17.31	-17.31	-17.29	-17.16	-17.09
Lower Hem. PRP (dBm)	-13.88	-13.87	-13.90	-13.90	-13.90	-13.98	-13.99	-13.97	-13.89	-13.84

Test Result										
Frequency (MHz)	2440	2442	2444	2446	2448	2450	2452	2454	2456	2458
Point Values										
Ant. Port Input Pwr. (dBm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Rad. Pwr. (dBm)	**-12.23**	**-12.30**	**-12.26**	**-12.16**	**-12.13**	**-12.19**	**-12.24**	**-12.17**	**-12.05**	**-12.05**
Peak EIRP (dBm)	-3.83	-3.96	-3.89	-3.71	-3.78	-3.74	-3.86	-3.78	-3.64	-3.62
Directivity (dBi)	8.41	8.34	8.36	8.45	8.36	8.44	8.39	8.40	8.41	8.43
Efficiency (dB)	-12.23	-12.30	-12.26	-12.16	-12.13	-12.19	-12.24	-12.17	-12.05	-12.05
Efficiency (%)	**5.98**	**5.89**	**5.95**	**6.08**	**6.12**	**6.04**	**5.97**	**6.06**	**6.24**	**6.23**
Gain (dBi)	-3.83	-3.96	-3.89	-3.71	-3.78	-3.74	-3.86	-3.78	-3.64	-3.62
NHPRP ±Pi/4 (dBm)	-15.58	-15.64	-15.60	-15.50	-15.46	-15.53	-15.58	-15.50	-15.38	-15.38
NHPRP ±Pi/6 (dBm)	-17.59	-17.66	-17.62	-17.52	-17.47	-17.55	-17.60	-17.51	-17.39	-17.40
NHPRP ±Pi/8 (dBm)	-18.98	-19.06	-19.02	-18.93	-18.88	-18.96	-19.02	-18.92	-18.81	-18.82
Upper Hem. PRP (dBm)	-17.18	-17.24	-17.18	-17.08	-17.03	-17.09	-17.12	-17.06	-16.91	-16.93
Lower Hem. PRP (dBm)	-13.91	-13.98	-13.94	-13.85	-13.83	-13.89	-13.95	-13.88	-13.76	-13.76

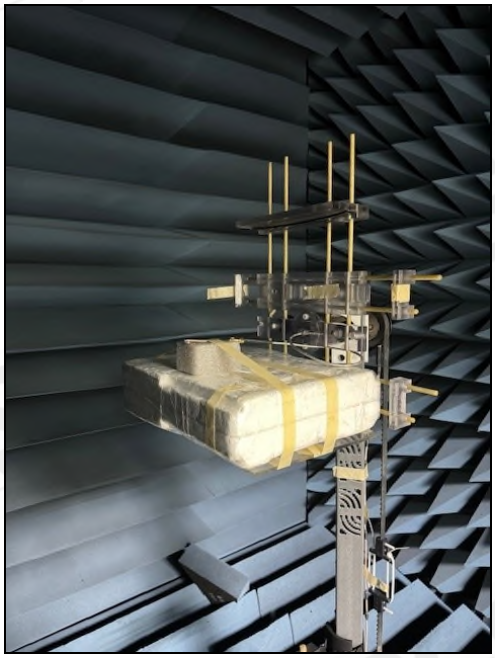
Test Result										
Frequency (MHz)	2460	2462	2464	2466	2468	2470	2472	2474	2476	2478
Point Values										
Ant. Port Input Pwr. (dBm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Rad. Pwr. (dBm)	**-12.02**	**-11.99**	**-11.90**	**-11.92**	**-11.90**	**-11.80**	**-11.71**	**-11.67**	**-11.70**	**-11.68**
Peak EIRP (dBm)	-3.64	-3.54	-3.49	-3.52	-3.47	-3.31	-3.31	-3.21	-3.26	-3.23
Directivity (dBi)	8.38	8.45	8.41	8.40	8.43	8.49	8.40	8.45	8.44	8.44
Efficiency (dB)	-12.02	-11.99	-11.90	-11.92	-11.90	-11.80	-11.71	-11.67	-11.70	-11.68
Efficiency (%)	**6.28**	**6.32**	**6.46**	**6.43**	**6.45**	**6.61**	**6.74**	**6.81**	**6.76**	**6.79**
Gain (dBi)	-3.64	-3.54	-3.49	-3.52	-3.47	-3.31	-3.31	-3.21	-3.26	-3.23
NHPRP ±Pi/4 (dBm)	-15.35	-15.33	-15.23	-15.25	-15.23	-15.12	-15.04	-14.99	-15.01	-14.98
NHPRP ±Pi/6 (dBm)	-17.37	-17.35	-17.25	-17.26	-17.24	-17.13	-17.06	-16.99	-17.02	-16.98
NHPRP ±Pi/8 (dBm)	-18.78	-18.77	-18.66	-18.68	-18.65	-18.55	-18.47	-18.40	-18.43	-18.40
Upper Hem. PRP (dBm)	-16.89	-16.87	-16.77	-16.77	-16.75	-16.65	-16.57	-16.51	-16.54	-16.53
Lower Hem. PRP (dBm)	-13.73	-13.70	-13.61	-13.64	-13.62	-13.52	-13.43	-13.39	-13.43	-13.40

Test Result											
Frequency (MHz)	2480	2482	2484	2486	2488	2490	2492	2494	2496	2498	2500
Point Values											
Ant. Port Input Pwr. (dBm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Rad. Pwr. (dBm)	**-11.56**	**-11.46**	**-11.40**	**-11.44**	**-11.39**	**-11.31**	**-11.20**	**-11.20**	**-11.16**	**-11.06**	**-11.05**
Peak EIRP (dBm)	-3.19	-3.11	-2.96	-3.03	-3.01	-2.88	-2.78	-2.84	-2.85	-2.72	-2.71
Directivity (dBi)	8.37	8.35	8.44	8.41	8.38	8.43	8.42	8.36	8.30	8.35	8.34
Efficiency (dB)	-11.56	-11.46	-11.40	-11.44	-11.39	-11.31	-11.20	-11.20	-11.16	-11.06	-11.05
Efficiency (%)	**6.99**	**7.14**	**7.24**	**7.18**	**7.26**	**7.40**	**7.59**	**7.59**	**7.66**	**7.83**	**7.85**
Gain (dBi)	-3.19	-3.11	-2.96	-3.03	-3.01	-2.88	-2.78	-2.84	-2.85	-2.72	-2.71
NHPRP ±Pi/4 (dBm)	-14.85	-14.75	-14.69	-14.72	-14.67	-14.58	-14.46	-14.45	-14.39	-14.29	-14.29
NHPRP ±Pi/6 (dBm)	-16.85	-16.75	-16.69	-16.72	-16.67	-16.57	-16.46	-16.45	-16.38	-16.28	-16.29
NHPRP ±Pi/8 (dBm)	-18.27	-18.16	-18.11	-18.12	-18.08	-17.98	-17.87	-17.86	-17.79	-17.69	-17.71
Upper Hem. PRP (dBm)	-16.41	-16.30	-16.25	-16.28	-16.23	-16.13	-16.03	-16.02	-15.99	-15.89	-15.86
Lower Hem. PRP (dBm)	-13.28	-13.19	-13.13	-13.16	-13.12	-13.04	-12.93	-12.93	-12.88	-12.80	-12.79

Test Setup

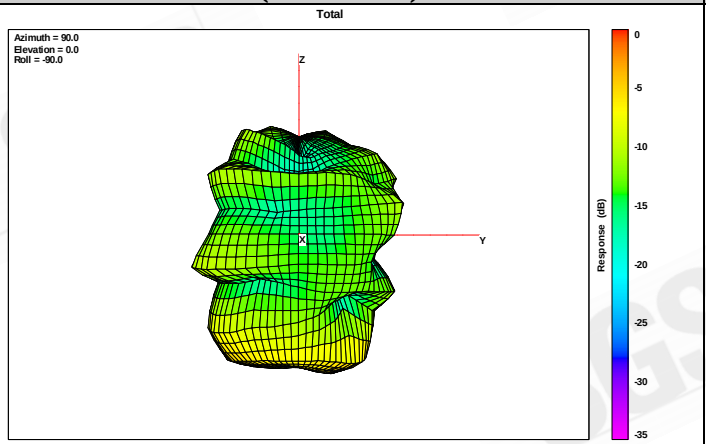
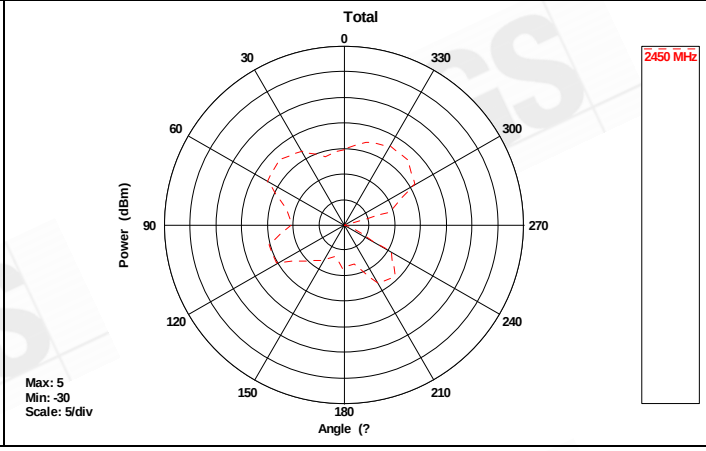
Free Space - Front View

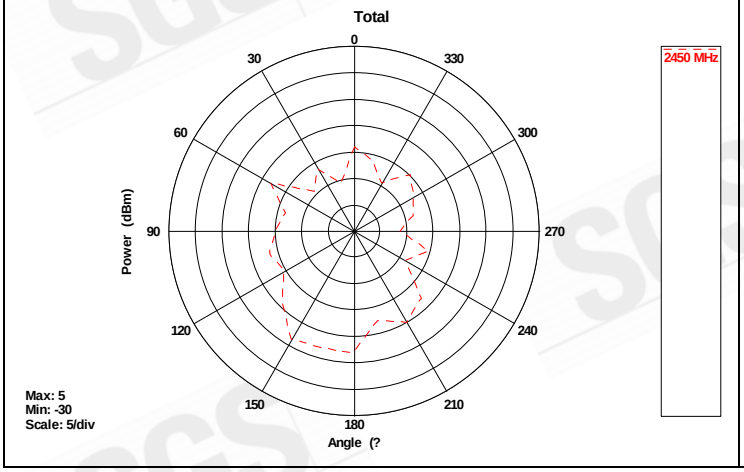
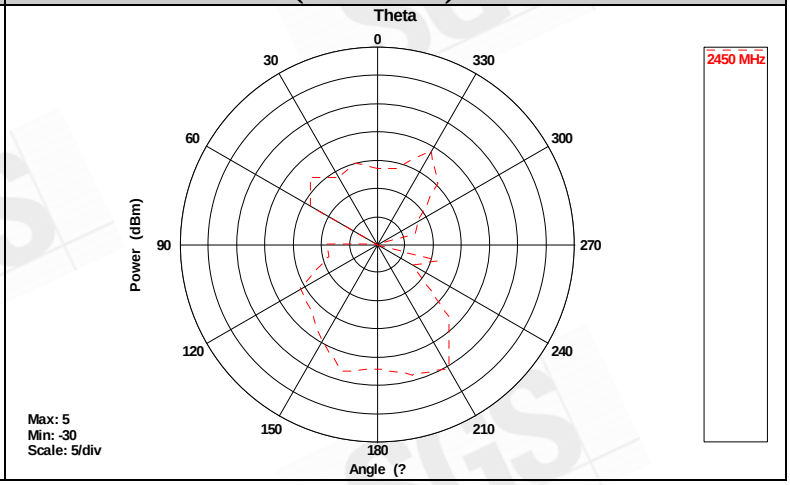
Free Space - Side View



Antenna 3D Plot Matrix

All plots in this section show the total EIRP (EIRPθ + EIRPφ) with the +x-axis pointing out of the page, +y-axis pointing top of the page, and +z-axis pointing left of the page.

Free Space EIRP (2450 MHz) - 3D	Free Space EIRP (2450 MHz) – XY cut
	

Free Space EIRP (2450 MHz) – XZ cut	Free Space EIRP (2450 MHz) – YZ cut
	

End of Report