



UHF TEST REPORT

FCC ID: 2A7ZC-SG6

On Behalf of

GEOMATE POSITIONING PTE. LTD.

Geodetic GNSS Receiver

Model No.: SG6

Prepared for : GEOMATE POSITIONING PTE. LTD.
Address : 808 FRENCH ROAD #04-167 KITCHENER COMPLEX
SINGAPORE(200808)

Prepared By : Shenzhen Alpha Product Testing Co., Ltd.
Address : Building i, No.2, Lixin Road, Fuyong Street, Bao'an District,
518103, Shenzhen, Guangdong, China

Report Number : A2406033-C01-R05
Date of Receipt : June 18, 2024
Date of Test : June 18, 2024 – July 22, 2024
Date of Report : July 24, 2024
Version Number : V0
Result **Pass**

TABLE OF CONTENTS

Description	Page
1. Summary Of Standards And Results-----	5
1.1. Description of Standards and Results -----	5
2. General Information -----	6
2.1. Description of Device (EUT) -----	6
2.2. Accessories of Device (EUT) -----	7
2.3. Tested Supporting System Details-----	7
2.4. Block Diagram of connection between EUT and simulators -----	7
2.5. Test Mode -----	8
2.6. Test Conditions-----	9
2.7. Test Facility-----	9
2.8. Measurement Uncertainty -----	9
2.9. Test Equipment List -----	10
3. Test Results and Measurement Data-----	12
3.1. Transmitter Power (Conducted)-----	12
3.2. Occupied Bandwidth and Emission Mask -----	14
3.3. Spurious Emissions(conducted) -----	21
3.4. Radiated Spurious Emission -----	24
3.5. Transient Frequency Behavior -----	30
3.6. Behavior Frequency Stability -----	32
3.7. Modulation Characteristic-----	35
3.8. Adjacent channel power -----	36
4. Test Setup Photo -----	39
4.1. Photos of Radiated emission -----	39

TEST REPORT DECLARATION

Applicant : GEOMATE POSITIONING PTE. LTD.
Address : 808 FRENCH ROAD #04-167 KITCHENER COMPLEX SINGAPORE(200808)
Manufacturer : GEOMATE POSITIONING PTE. LTD.
Address : 808 FRENCH ROAD #04-167 KITCHENER COMPLEX SINGAPORE(200808)
EUT Description : Geodetic GNSS Receiver
(A) Model No. : SG6
(B) Trademark : 

Measurement Standard Used:

FCC CFR Title 47 Part 90, FCC CFR Title 47 Part 2

ANSI TIA-603-E:2016

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 2, Part 90, RSS-119, RSS-Gen limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....: Yannis Wen
Project Engineer



Approved by (name + signature).....: Jack Xu
Project Manager



Date of issue.....: July 24, 2024

Revision History

Revision	Issue Date	Revisions	Revised By
V0	July 24, 2024	Initial released Issue	Yannis Wen

1. Summary Of Standards And Results

1.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below:

Test Item	Test Requirement	Standards Paragraph	Result
Transmitter Power(Conducted)	FCC PART 90	§ 90.205,	P
Occupied Bandwidth & Emission Mask	FCC PART 90	§ 90.209, § 90.210	P
Spurious Emissions(conducted)	FCC PART 90	§ 90.210,	P
Spurious Emissions(Radiated)	FCC PART 90	§ 90.210,	P
Transient Frequency Behavior	FCC PART 90	§ 90.214,	P
Frequency Stability	FCC PART 90	§ 90.213,	P
Modulation Characteristics - Audio Frequency Response	FCC PART 2 FCC PART 90	§ 2.1047(a), § 90.207	N/A
Modulation Characteristics - Modulation Limiting	FCC PART 2 FCC PART 90	§ 2.1047(b), § 90.207	N/A
Adjacent channel power	FCC PART 90	§90.221	P
Note: 1. P is an abbreviation for Pass. 2. F is an abbreviation for Fail. 3. N/A is an abbreviation for Not Applicable. 4. The conclusion of this test report is judged by actual test data without considering measurement uncertainty.			

2. General Information

2.1. Description of Device (EUT)

Description	: Geodetic GNSS Receiver
Model Number	: SG6
DIFF.	: N/A
Test Voltage	: DC 5V from Type-C port, DC 7.2V from battery.

UHF

Operation frequency	: 410MHz-470MHz
Conducted Power	: 1W(30±1dBm), 0.5W(26.99±1dBm)
Channel spacing	: 12.5KHz, 25KHz
Modulation type	: GMSK
Antenna Type	: Monopole Antenna, Maximum Gain is 4dBi. (Antenna information is provided by applicant.)
Software version	: 1.1.6.7
Hardware version	: V1.2.0

Note: All Conducted Power have been tested, and recorded the worst case 1W(30±1dBm) results in this report.

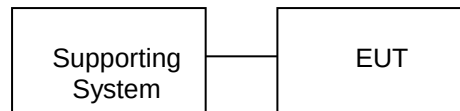
2.2. Accessories of Device (EUT)

Accessories	:	AC Adapter
Manufacturer	:	Yisheng Electronics Co., LTD
Model	:	EA1012AVRU-050
INPUT	:	100-240Vac, 1.0A, 50-60Hz
OUTPUT	:	5.0V=2.4A 12.0W
Accessories		Type-C charging cable
Manufacturer		/
Model		/
Accessories		UHF Antenna
Manufacturer		/
Model		/

2.3. Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or SDOC
1.	Notebook PC	Lenovo	ThinkPad E14	/	/

2.4. Block Diagram of connection between EUT and simulators



The sample was placed 0.8m & 1.5m for the measurement below & above 1GHz above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

2.5. Test Mode

All modes and data rates and positions were investigated.

Test modes are chosen to be reported as the worst case configuration below:

Test Mode		
Item	Description of operation mode	Note
1	GMSK+CS12.5KHz+TX	at maximum rated power for transmitter
2	GMSK+CS25KHz+TX	at maximum rated power for transmitter

Note: The worst case modes for all test are the item 1 and item 2.

Description Operation Frequency

GMSK		
Test Channel	Channel spacing (KHz)	Frequency(MHz)
Low	12.5	410.050
	25	410.050
Mid	12.5	440.000
	25	440.000
High	12.5	469.950
	25	469.950

2.6. Test Conditions

Items	Required	Actual
Temperature range:	15-35℃	22℃
Humidity range:	25-75%	54%
Pressure range:	86-106kPa	98kPa

2.7. Test Facility

Shenzhen Alpha Product Testing Co., Ltd
 Building i, No.2, Lixin Road, Fuyong Street, Bao'an District,
 518103, Shenzhen, Guangdong, China

June 21, 2018 File on Federal Communication Commission
 Registration Number: 293631

July 15, 2019 Certificated by IC
 Registration Number: 12135A

2.8. Measurement Uncertainty

(95% confidence levels, k=2)

Item	Uncertainty
Uncertainty for Power point Conducted Emissions Test	1.63dB
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	3.5dB
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.74dB(Polarize: V)
	3.76dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	3.77dB(Polarize: V)
	3.80dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (18GHz to 40GHz)	4.31 dB(Polarize: V)
	4.30 dB(Polarize: H)
Uncertainty for radio frequency	5.06×10^{-8} GHz
Uncertainty for conducted RF Power	0.40dB
Uncertainty for temperature	0.2℃
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

2.9. Test Equipment List

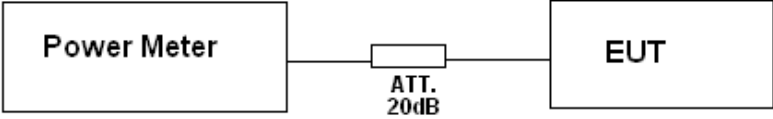
Equipment	Manufacture	Model No.	Firmware version	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	CHENYU	9*6*6	/	N/A	2022.05.17	3Year
Spectrum analyzer	ROHDE&SCHWARZ	FSV40-N	2.3	102137	2023.08.16	1Year
Spectrum analyzer	Agilent	N9020A	A.14.16	MY499100060	2023.08.16	1Year
Receiver	ROHDE&SCHWARZ	ESR	2.28 SP1	1316.3003K03-10 2082-Wa	2023.08.16	1Year
Receiver	R&S	ESCI	4.42 SP1	101165	2023.08.16	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	/	VULB 9168#627	2023.08.28	1Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	/	2106	2023.08.19	1Year
Loop Antenna	SCHWARZBECK	FMZB 1519B	/	00128	2023.08.19	1Year
RF Cable	Resenberger	Cable 1	/	RE1	2023.08.16	1Year
RF Cable	Resenberger	Cable 2	/	RE2	2023.08.16	1Year
RF Cable	Resenberger	Cable 3	/	CE1	2023.08.16	1Year
Pre-amplifier	HP	HP8347A	/	2834A00455	2023.08.16	1Year
Pre-amplifier	Agilent	8449B	/	3008A02664	2023.08.16	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	/	8126-466	2023.08.16	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	/	101043	2023.08.16	1Year
Horn Antenna	SCHWARZBECK	BBHA 9170	/	00946	2023.08.19	1Year
Preamplifier	SKET	LNPA_1840 -50	/	SK2018101801	2023.08.16	1 Year
Power Meter	Agilent	E9300A	/	MY41496628	2023.08.16	1 Year
Power Sensor	DARE	RPR3006W	/	15100041SNO91	2023.08.16	1 Year
Temp. & Humid. Chamber	Teelong	TL-HW408S	/	TL-20191205-01	2023.07.25	1 Year
Switching Mode Power Supply	JUNKE	JK12010S	/	20140927-6	2023.08.16	1 Year
Adjustable attenuator	MWRFTtest	N/A	/	N/A	N/A	N/A
10dB Attenuator	Mini-Circuits	DC-6G	/	N/A	N/A	N/A

Software Information			
Test Item	Software Name	Manufacturer	Version
RE	EZ-EMC	farad	Alpha-3A1
CE	EZ-EMC	farad	Alpha-3A1
RF-CE	MTS 8310	MW	V2.0.0.0

3. Test Results and Measurement Data

3.1. Transmitter Power (Conducted)

3.1.1. Test Specification

Test Requirement:	Part 90.205
Test Method:	FCC part 2.1046
Limits:	Please refer section FCC Part 90.205
Test Setup:	 <pre>graph LR; PM[Power Meter] --- ATT[ATT. 20dB] --- EUT[EUT]</pre>
Test Procedure:	a) Connect the equipment as illustrated. b) Turn on the power meter c) Record value
Test Result:	PASS

3.1.2. Test Results

GMSK mode (1W):						
Channel spacing (KHz)	Frequency (MHz)	Maximum Conducted Output Power(Peak) (dBm)	Maximum ERP (dBm)	Stated ERP Power (dBm)	Conducted Output Power Limit (dBm)	Result
12.5	410.050	26.777	28.627	29.815	30±1	PASS
25	410.050	26.808	28.658	29.021	30±1	PASS
12.5	440.000	26.553	28.403	29.269	30±1	PASS
25	440.000	27.322	29.172	29.084	30±1	PASS
12.5	469.950	26.999	28.849	29.293	30±1	PASS
25	469.950	27.433	29.283	29.522	30±1	PASS

Note: 1. Maximum ERP= Maximum Conducted Output Power(Peak) + Antenna Gain – 2.15dB

GMSK mode (0.5W):						
Channel spacing (KHz)	Frequency (MHz)	Maximum Conducted Output Power(Peak) (dBm)	Maximum ERP (dBm)	Stated ERP Power (dBm)	Conducted Output Power Limit (dBm)	Result
12.5	410.050	24.809	26.659	26.992	26.99±1	PASS
25	410.050	22.331	24.181	26.422	26.99±1	PASS
12.5	440.000	22.189	24.039	26.669	26.99±1	PASS
25	440.000	23.724	25.574	26.302	26.99±1	PASS
12.5	469.950	23.326	25.176	26.975	26.99±1	PASS
25	469.950	22.784	24.634	26.189	26.99±1	PASS

Note: 1. Maximum ERP= Maximum Conducted Output Power(Peak) + Antenna Gain – 2.15dB

3.2. Occupied Bandwidth and Emission Mask

3.2.1. Test Specification

Test Requirement:	FCC Part 90.209, FCC Part 90.210
Test Setup:	 The diagram illustrates the test setup. On the left is a green rectangular box representing the Spectrum Analyzer, with a blue screen and two small circular ports. A grey cable connects these ports to a small white rectangular box in the middle. Another grey cable connects the right side of the white box to a yellow rectangular box on the right, which represents the EUT (Equipment Under Test) and has a single circular port. Below the green box is the label 'Spectrum Analyzer' and below the yellow box is the label 'EUT'.
Test Procedure:	The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the Frequency band $\pm 50\text{KHz}$ from the carrier frequency for Occupied Bandwidth, the resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the Frequency band $\pm 100\text{KHz}$ from the carrier frequency for Emission Mask.
Test Result:	PASS

3.2.2. Test data

Occupied Bandwidth:

GMSK 12.5KHz Channel Spacing:

Channel	Frequency (MHz)	26dB Bandwidth (KHz)	99% Occupied Bandwidth (KHz)	99% Occupied Bandwidth Limit (KHz)	Result
Low	410.050	3.143	2.456	11.25	PASS
Mid	440.000	3.155	2.446	11.25	PASS
High	469.950	3.151	2.441	11.25	PASS

GMSK 25KHz Channel Spacing:

Channel	Frequency (MHz)	26dB Bandwidth (KHz)	99% Occupied Bandwidth (KHz)	99% Occupied Bandwidth Limit (KHz)	Result
Low	410.050	7.258	5.947	20	PASS
Mid	440.000	7.089	5.926	20	PASS
High	469.950	7.431	5.915	20	PASS

Emission Mask:

GMSK 12.5KHz Channel Spacing:

Channel	Frequency (MHz)	Applicable Mask	RBW	Result
Low	410.050	D	300Hz	PASS
Mid	440.000	D	300Hz	PASS
High	469.950	D	300Hz	PASS

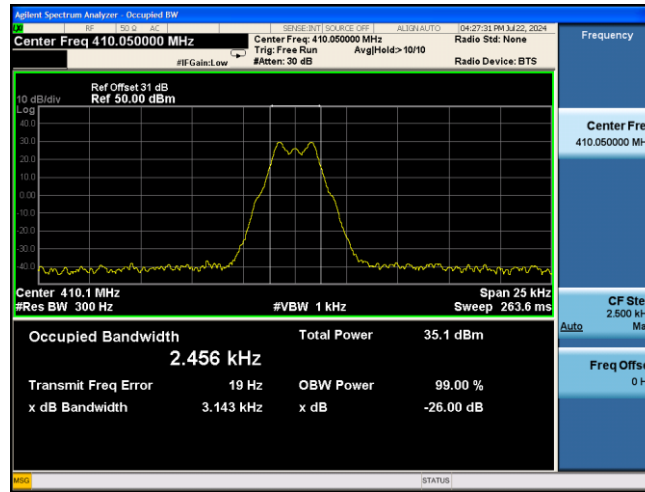
GMSK 25KHz Channel Spacing:

Channel	Frequency (MHz)	Applicable Mask	RBW	Result
Low	410.050	C	300Hz	PASS
Mid	440.000	C	300Hz	PASS
High	469.950	C	300Hz	PASS

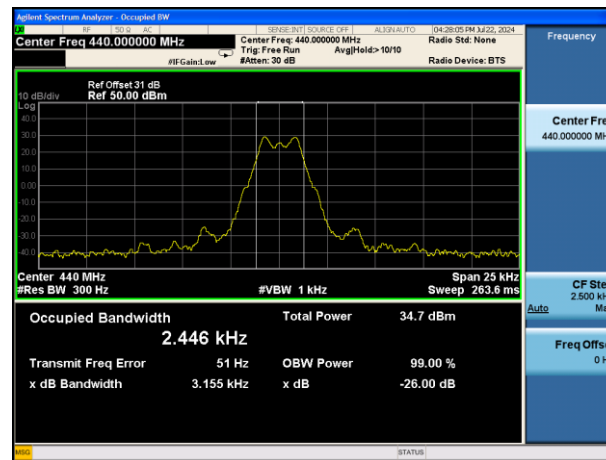
Test plots as follows:

GMSK 12.5KHz Channel Spacing: Occupied Bandwidth

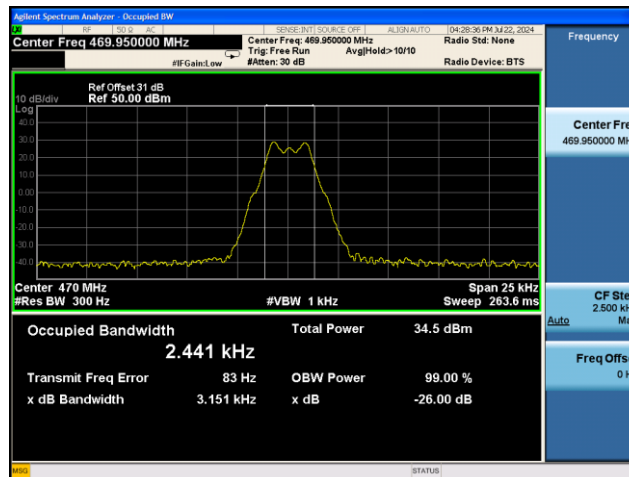
Low: 410.050MHz



Mid: 440.000MHz

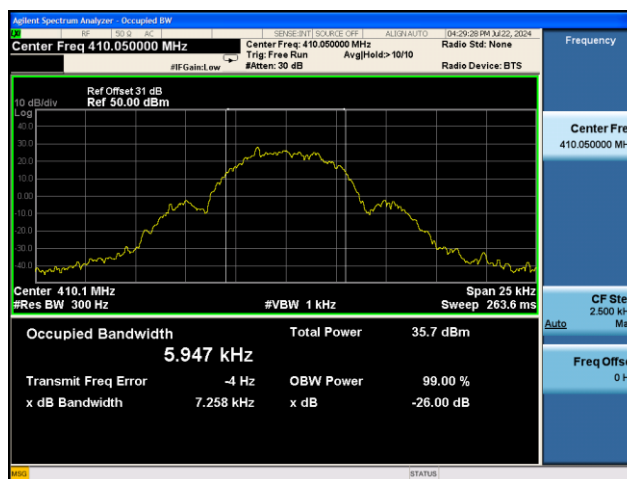


High: 470.00MHz



GMSK 25KHz Channel Spacing: Occupied Bandwidth

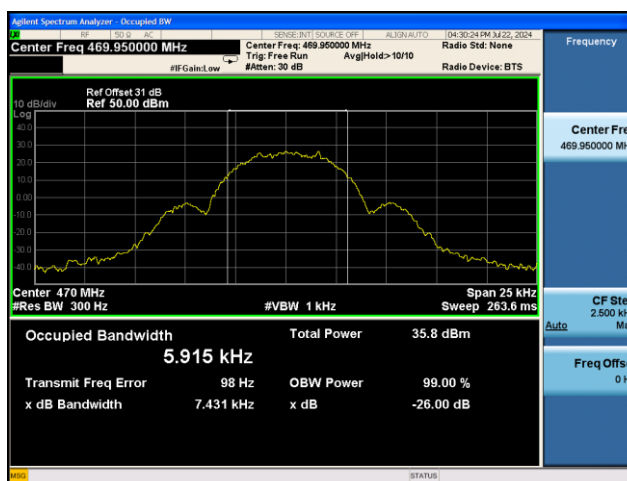
Low: 410.050MHz



Mid: 440.000MHz

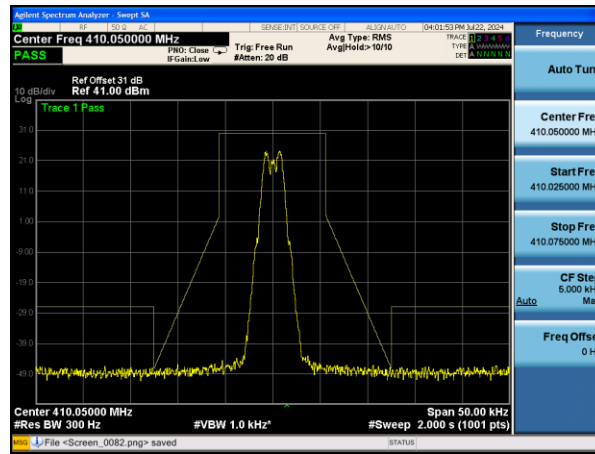


High: 469.850MHz

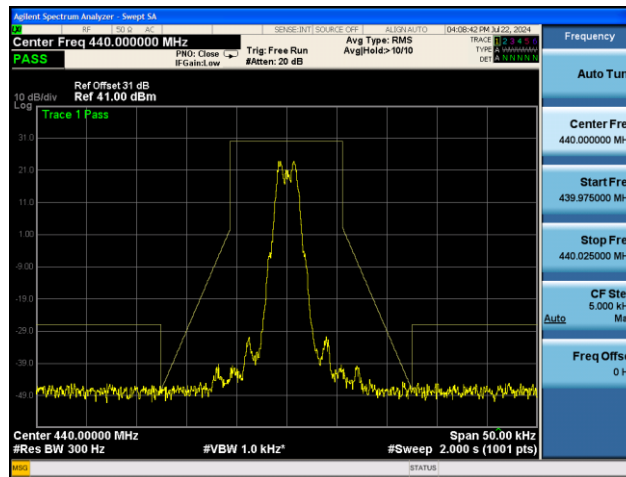


GMSK 12.5KHz Channel Spacing: Emission Mask

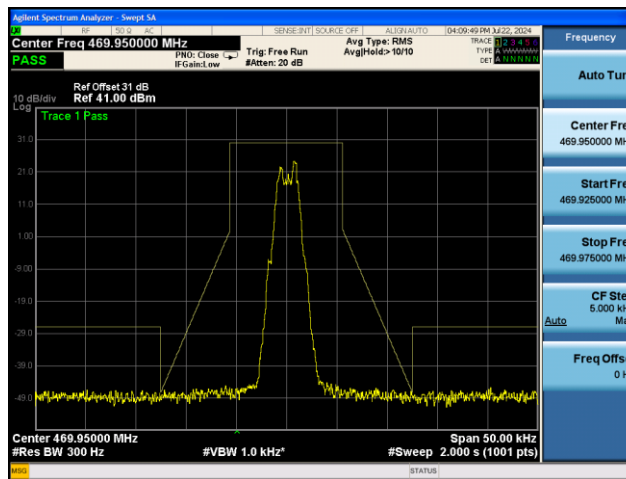
Low: 410.050MHz



Mid: 440.000MHz

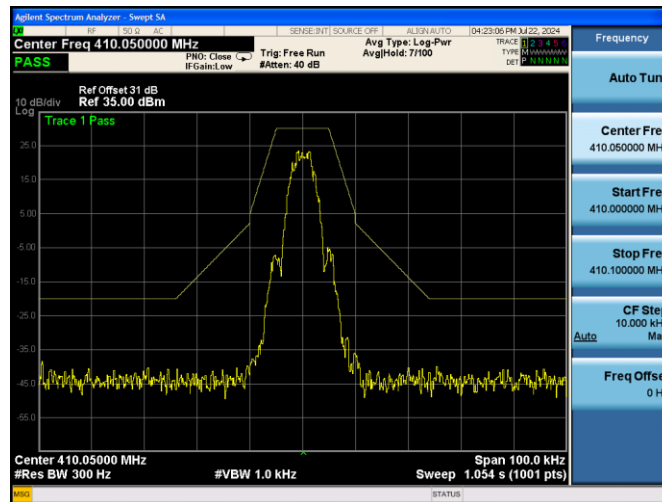


High: 469.950MHz

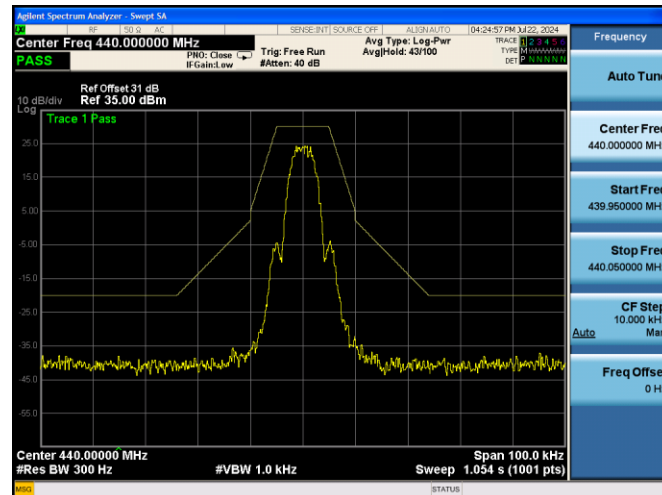


GMSK 25KHz Channel Spacing: Emission Mask

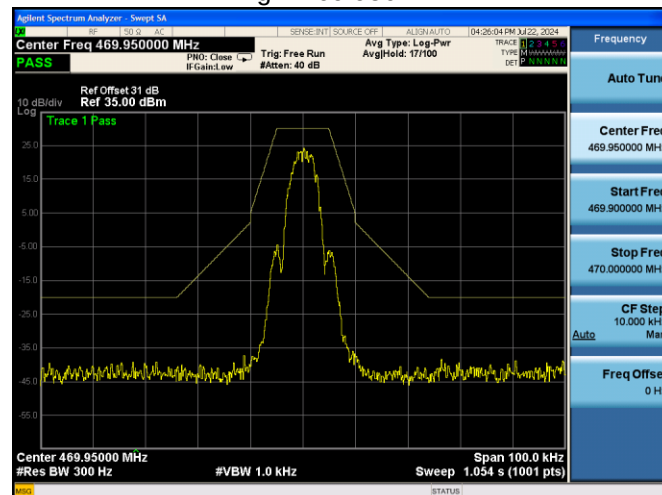
Low: 410.050MHz



Mid: 440.000MHz

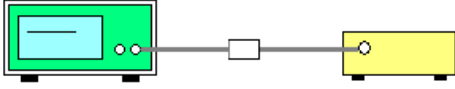


High: 469.950MHz



3.3. Spurious Emissions(conducted)

3.3.1. Test Specification

Test Requirement:	FCC Part 90.210
Test Setup:	 Spectrum Analyzer EUT
Test Limit:	Modulation Type: GMSK FCC Part 22.359, 74.462, 80.211 and 90.210: For 6.25 bandwidth: On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 6.25 kHz at least: $55 + 10 \log (P_{\text{watts}}) = 55 + 10 \log (1.0) = 55.00 \text{ dB}$ Calculation: Limit (dBm) = EL-55-10log10 (TP) Notes: EL is the emission level of the Output Power expressed in dBm, In this application, the EL is 30 dBm for High rated power. High: Limit (dBm) = $30 - 55 - 10 \log (3.0) = -25 \text{ dBm}$ For 12.5 bandwidth: On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz at least: $50 + 10 \log (P_{\text{watts}}) = 50 + 10 \log (1.0) = 50.00 \text{ dB}$ Note: In general, the worst case attenuation requirement shown above was applied. Calculation: Limit (dBm) = EL-50-10log10 (TP) Notes: EL is the emission level of the Output Power expressed in dBm, In this application, the EL is 30 dBm for High rated power. Limit (dBm) = $30.00 - 50 - 10 \log (1.0) = -20 \text{ dBm}$ For 25 kHz bandwidth: On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 62.5 kHz at least: $43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (1.0) = 43.00 \text{ dB}$ Note: In general, the worst case attenuation requirement shown above was applied. Calculation: Limit (dBm) = EL-43-10log10 (TP) In this application, the EL is 30 dBm for High rated power. Limit (dBm) = $30.00 - 43 - 10 \log (1.0) = -13 \text{ dBm}$ Note: 1. In general, the worst case attenuation requirement shown above was applied. For emission inside from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of channel spacing, emission mask limit should be compliant. 2. The measurement frequency range from 9 KHz to 5 GHz. 3. *** means that the emission level is too low to be measured or at least 20 dB down than the limit. 4. ERP for below 1GHz and EIRP above 1GHz.

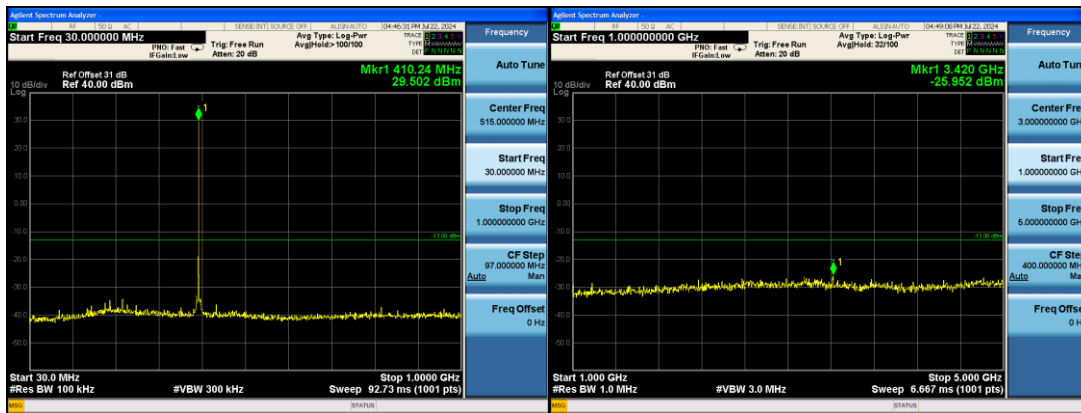
Test Result:**PASS**

3.3.2. Test data

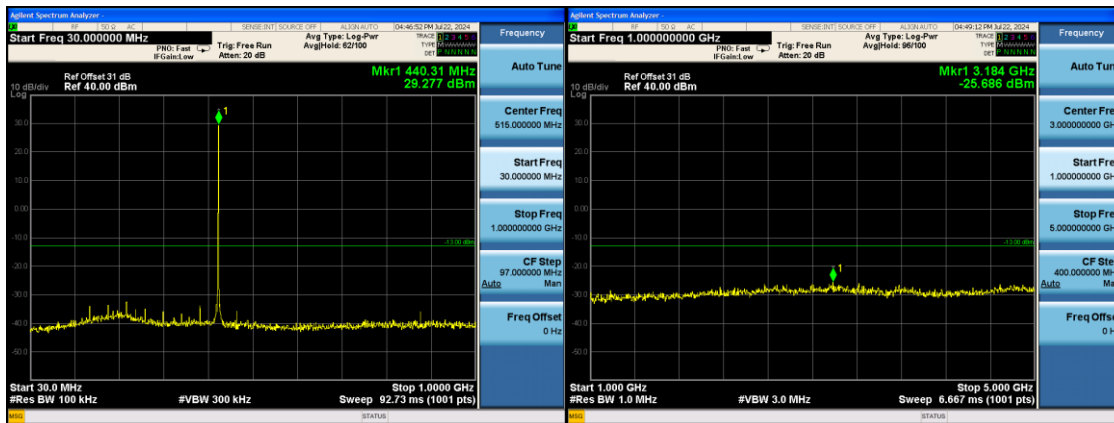
Test plots as follows:

GMSK 12.5KHz Channel Spacing:

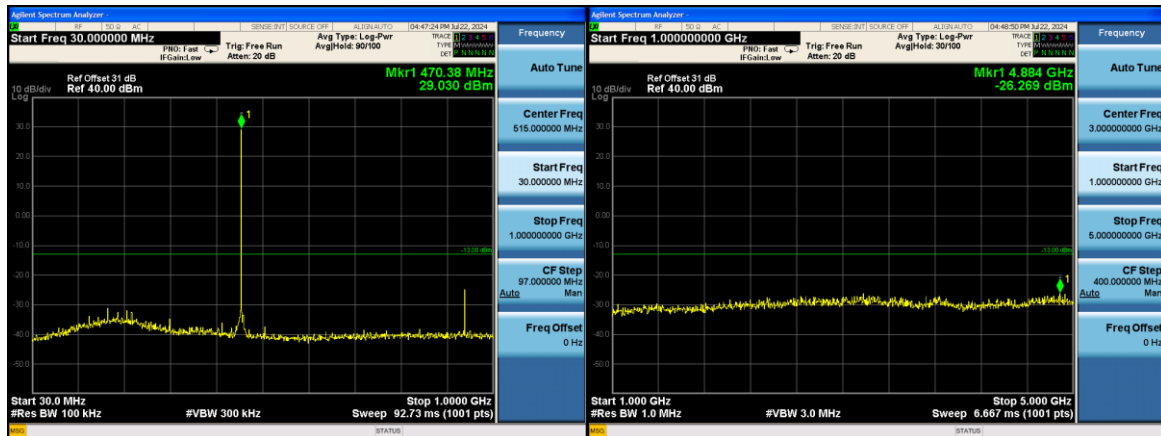
Low: 410.050MHz



Mid: 440.000MHz

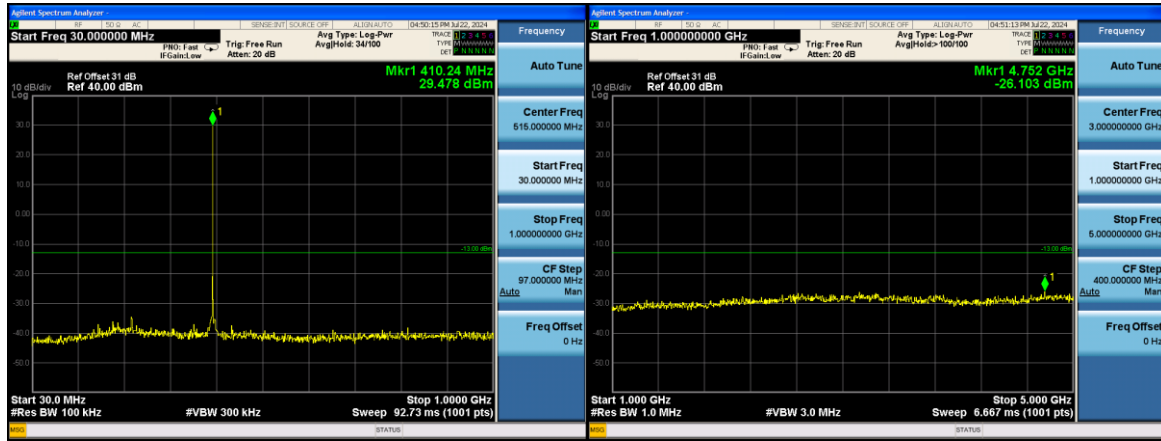


High: 469.950MHz

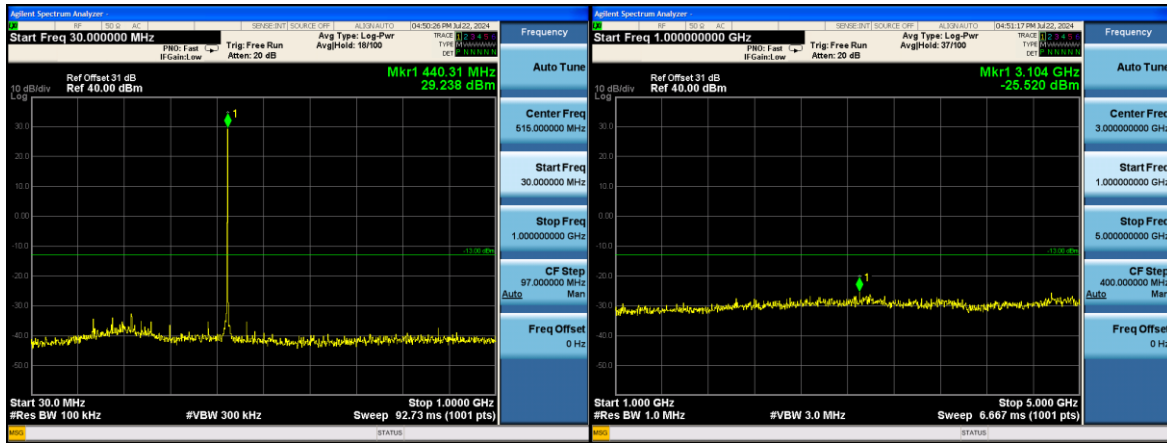


GMSK 25KHz Channel Spacing:

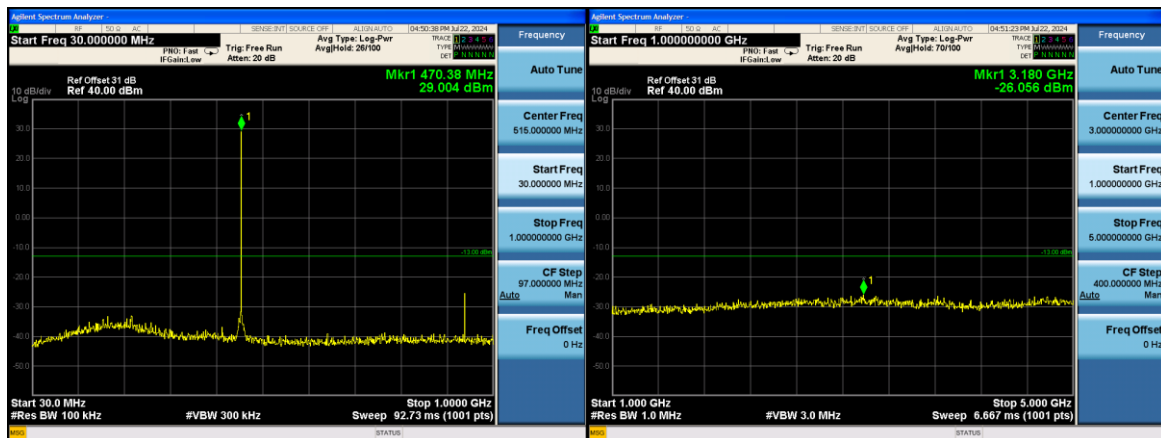
Low: 410.050MHz



Mid: 440.000MHz

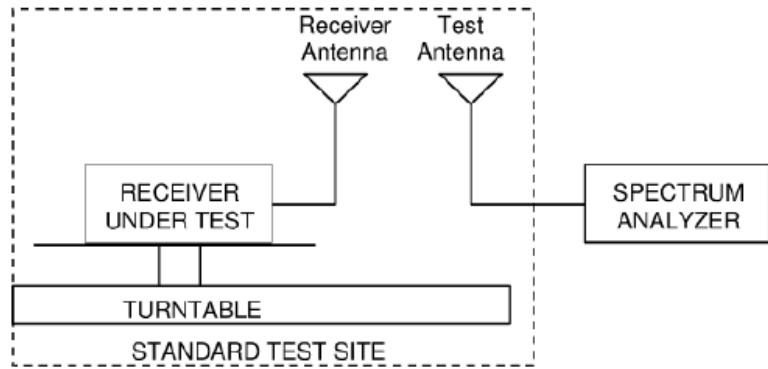


High: 469.950MHz



3.4. Radiated Spurious Emission

3.4.1. Test Specification

Test Requirement:	FCC Part 90.210															
Test Method:	ANSI C63.26															
Measurement Distance:	3 m															
Antenna Polarization:	Horizontal & Vertical															
Operation mode:	Refer to item 4.1															
Receiver Setup:	<table><tr><td>Frequency</td><td>RBW</td><td>VBW</td></tr><tr><td>9kHz- 150kHz</td><td>200Hz</td><td>1kHz</td></tr><tr><td>150kHz- 30MHz</td><td>9kHz</td><td>30kHz</td></tr><tr><td>30MHz-1GHz</td><td>100KHz</td><td>300KHz</td></tr><tr><td>Above 1GHz</td><td>1MHz</td><td>3MHz</td></tr></table>	Frequency	RBW	VBW	9kHz- 150kHz	200Hz	1kHz	150kHz- 30MHz	9kHz	30kHz	30MHz-1GHz	100KHz	300KHz	Above 1GHz	1MHz	3MHz
Frequency	RBW	VBW														
9kHz- 150kHz	200Hz	1kHz														
150kHz- 30MHz	9kHz	30kHz														
30MHz-1GHz	100KHz	300KHz														
Above 1GHz	1MHz	3MHz														
Limit:	For equipment using 25 kHz channel spacing, on any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10\log (P)$ dB. For equipment using 12.5 kHz channel spacing, on any frequency removed from the center of The authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log(P)$ dB or 70 dB, whichever is the lesser attenuation.															
Test setup:																
Test Procedure:	The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT .The test was performed by placing the EUT on 3-orthogonal axis. The frequency range up to teeth harmonic of the fundamental frequency was investigated. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a															

	non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution. Spurious emissions in dB =10, 1g (TXpwr in Watts/0.001)-the absolute level Spurious attenuation limit in dB =50+10 Log10 (power out in Watts) for EUT with a 12.5 kHz and 25KHz channel bandwidth.
Test results:	PASS

3.4.2. Test Data

GMSK:

Test Mode: Low: 410.050MHz, Channel Spacing 12.5KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
151.578	-91.271	V	0.24	31.35	-61.68	-20	-40.161
361.052	-89.740	V	0.26	31.34	-59.47	-20	-38.660
672.602	-92.266	V	0.42	31.24	-61.07	-20	-41.446
862.329	-98.848	V	0.58	30.71	-62.79	-20	-48.718
1265.477	-83.190	V	1.23	26.38	-52.79	-20	-38.040
3863.439	-81.328	V	1.68	25.47	-52.30	-20	-37.538
285.426	-97.697	H	0.43	31.24	-64.64	-20	-46.887
400.481	-95.057	H	0.45	30.68	-65.79	-20	-44.827
477.322	-98.467	H	0.64	30.85	-64.81	-20	-48.257
677.425	-98.651	H	0.79	31.12	-67.33	-20	-48.321
1370.139	-81.691	H	1.29	26.12	-57.29	-20	-36.861
3257.891	-80.078	H	1.62	25.41	-53.86	-20	-36.288

Test Mode: Mid: 440.000MHz, Channel Spacing 12.5KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
152.934	-91.147	V	0.24	31.35	-62.97	-20	-40.037
363.283	-91.584	V	0.26	31.34	-57.78	-20	-40.504
670.773	-99.485	V	0.42	31.24	-64.06	-20	-48.665
863.157	-97.588	V	0.58	30.71	-62.24	-20	-47.458
1262.408	-89.606	V	1.23	26.38	-52.50	-20	-44.456
3860.838	-81.841	V	1.68	25.47	-55.72	-20	-38.051
288.046	-100.839	H	0.43	31.24	-66.33	-20	-50.029
399.707	-94.037	H	0.45	30.68	-67.26	-20	-43.807
479.675	-98.032	H	0.64	30.85	-63.85	-20	-47.822
682.998	-101.963	H	0.79	31.12	-66.35	-20	-51.633
1367.813	-85.481	H	1.29	26.12	-56.40	-20	-40.651
3262.627	-84.794	H	1.62	25.41	-53.63	-20	-41.004

Test Mode: High: 469.950MHz, Channel Spacing 12.5KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
151.484	-93.607	V	0.24	31.35	-64.54	-20	-42.497
364.883	-95.189	V	0.26	31.34	-59.94	-20	-44.109
674.944	-99.161	V	0.42	31.24	-60.89	-20	-48.341
868.783	-97.768	V	0.58	30.71	-65.72	-20	-47.638
1258.336	-87.619	V	1.23	26.38	-54.18	-20	-42.469
3858.996	-81.556	V	1.68	25.47	-53.01	-20	-37.766
290.815	-97.724	H	0.43	31.24	-63.08	-20	-46.914
406.557	-95.649	H	0.45	30.68	-67.12	-20	-45.419
472.840	-95.515	H	0.64	30.85	-63.34	-20	-45.305
677.276	-98.606	H	0.79	31.12	-67.87	-20	-48.276
1372.323	-86.432	H	1.29	26.12	-56.68	-20	-41.602
3265.582	-81.330	H	1.62	25.41	-53.22	-20	-37.540

Test Mode: Low: 410.050MHz, Channel Spacing 25KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
149.271	-92.254	V	0.24	31.35	-63.72	-25	-48.144
361.037	-89.720	V	0.26	31.34	-61.36	-25	-45.640
669.741	-94.562	V	0.42	31.24	-62.69	-25	-50.742
867.899	-96.603	V	0.58	30.71	-61.86	-25	-53.473
1258.131	-82.428	V	1.23	26.38	-52.99	-25	-44.278
3853.541	-82.609	V	1.68	25.47	-55.06	-25	-45.819
289.262	-92.289	H	0.43	31.24	-64.36	-25	-48.479
403.210	-97.951	H	0.45	30.68	-64.16	-25	-54.721
475.723	-95.002	H	0.64	30.85	-64.37	-25	-51.792
678.727	-95.049	H	0.79	31.12	-69.42	-25	-51.719
1369.919	-84.466	H	1.29	26.12	-57.05	-25	-46.636
3257.174	-78.423	H	1.62	25.41	-52.15	-25	-41.633

Test Mode; Mid: 440.000MHz, Channel Spacing 25KHz

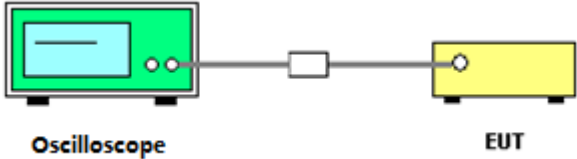
Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
158.907	-94.699	V	0.24	31.35	-61.95	-25	-50.589
363.680	-92.112	V	0.26	31.34	-61.02	-25	-48.032
669.315	-95.365	V	0.42	31.24	-64.18	-25	-51.545
859.047	-93.488	V	0.58	30.71	-61.59	-25	-50.358
1264.475	-82.779	V	1.23	26.38	-53.49	-25	-44.629
3862.460	-79.856	V	1.68	25.47	-55.22	-25	-43.066
285.328	-96.419	H	0.43	31.24	-65.71	-25	-52.609
403.405	-98.129	H	0.45	30.68	-65.08	-25	-54.899
473.582	-96.499	H	0.64	30.85	-64.86	-25	-53.289
680.870	-93.648	H	0.79	31.12	-68.76	-25	-50.318
1373.064	-82.509	H	1.29	26.12	-57.79	-25	-44.679
3262.163	-78.550	H	1.62	25.41	-55.49	-25	-42.260

Test Mode: High: 469.950MHz, Channel Spacing 25KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
151.413	-98.069	V	0.24	31.35	-63.43	-25	-53.959
362.858	-90.994	V	0.26	31.34	-60.89	-25	-46.914
667.135	-95.156	V	0.42	31.24	-63.53	-25	-51.336
861.629	-95.601	V	0.58	30.71	-62.73	-25	-52.471
1255.421	-79.481	V	1.23	26.38	-52.36	-25	-41.331
3858.404	-77.158	V	1.68	25.47	-52.87	-25	-40.368
288.751	-99.011	H	0.43	31.24	-65.53	-25	-55.201
401.253	-98.658	H	0.45	30.68	-63.74	-25	-55.428
474.933	-92.660	H	0.64	30.85	-65.59	-25	-49.450
677.819	-100.728	H	0.79	31.12	-65.70	-25	-57.398
1372.821	-85.882	H	1.29	26.12	-56.01	-25	-48.052
3262.372	-79.390	H	1.62	25.41	-54.10	-25	-42.600

3.5. Transient Frequency Behavior

3.5.1. Test Specification

Test Requirement:	FCC Part 90.214				
Test Setup:	 Oscilloscope EUT				
Test Limit	Channel Bandwidth (kHz)	Time Intervals (Notes 1, 2)	Maximum Frequency Difference (kHz)	Transient Duration Limit (ms)	
				138-174 MHz	406.1-512 MHz
25	t_1		± 25	5	10
		t_2	± 12.5	20	25
		t_3	± 25	5	10
	12.5	t_1	± 12.5	5	10
		t_2	± 6.25	20	25
		t_3	± 12.5	5	10
	6.25	t_1	± 6.25	5	10
		t_2	± 3.125	20	25
		t_3	± 6.25	5	10
Test Procedure:	The EUT was set in the climate chamber and connected to an external DC power supply and AC power supply. The RF output was directly connected to Oscilloscope. The coupling loss of the additional cables was recorded and taken in account for all the measurements. The result was recorded.				
Test Result:	PASS				

3.5.2. Test data

Test Plots for channel spacing 25KHz, EUT power setting: Maximum.

Power On



Power Off



Remark: Only list the worst data for channel spacing 25KHz, modulation GMSK.

3.6. Behavior Frequency Stability

3.6.1. Test Specification

Test Requirement:	FCC Part 90.213
Test Method:	ANSI C63.26
Test Setup:	<pre> graph LR Laptop[Laptop] --- EUT[Equipment Under Test] EUT --- ACDC[AC/DC Adapter] EUT --- Att[Attenuator(s)] Att --- MC[Mini-Circuit Combiner] MC --- RFTS[RF Communication Test Set] MC --- MA[Modulation Analyzer] MC --- RFDR[RF Detector] RFDR --- HPO[Hewlett Packard Infinium Digitizing Oscilloscope] </pre>
Test Procedure:	Method of Measurement: After temperature stabilization (approx. 20 min for each stage), the frequency for the lower, the middle and the highest frequency range was recorded. For Frequency stability Vs. Voltage the EUT was connected to a DC power supply or AC power supply and the voltage was adjusted in the required ranges.
Test Result:	PASS

3.6.2. Test data

Conclusion: PASS			
Mode	Voltage (V)	Frequency error (Hz)	frequency error (ppm)
Middle Channel 12.5KHz Channel Spacing	10	28.07	0.064
	11	-9.25	-0.021
	12	29.90	0.068
	13	9.64	0.022
	14	17.19	0.039
	15	17.56	0.040
Limit	2.5ppm		
Middle Channel 25KHz Channel Spacing	10	-7.41	-0.017
	11	9.07	0.021
	12	17.25	0.039
	13	3.24	0.007
	14	27.98	0.064
	15	8.96	0.020
Limit	5ppm		

Mode	Temperature (°C)	Frequency error (Hz)	frequency error (ppm)
Middle Channel 12.5KHz Channel Spacing	-20	9.82	0.022
	-10	9.25	0.021
	0	23.89	0.054
	10	2.06	0.005
	20	-0.05	0.000
	30	-1.75	-0.004
	40	-2.83	-0.006
	50	15.88	0.036
Limit	2.5ppm		
Middle Channel 25KHz Channel Spacing	-20	27.07	0.062
	-10	-3.98	-0.009
	0	-6.76	-0.015
	10	-0.58	-0.001
	20	-4.44	-0.010
	30	1.34	0.003
	40	-3.22	-0.007
	50	8.17	0.019
Limit	5ppm		

3.7. Modulation Characteristic

Test Requirement:	FCC Part 90.207
Test Result:	According to FCC § 2.1047(d), Part 22, 74, 90 there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

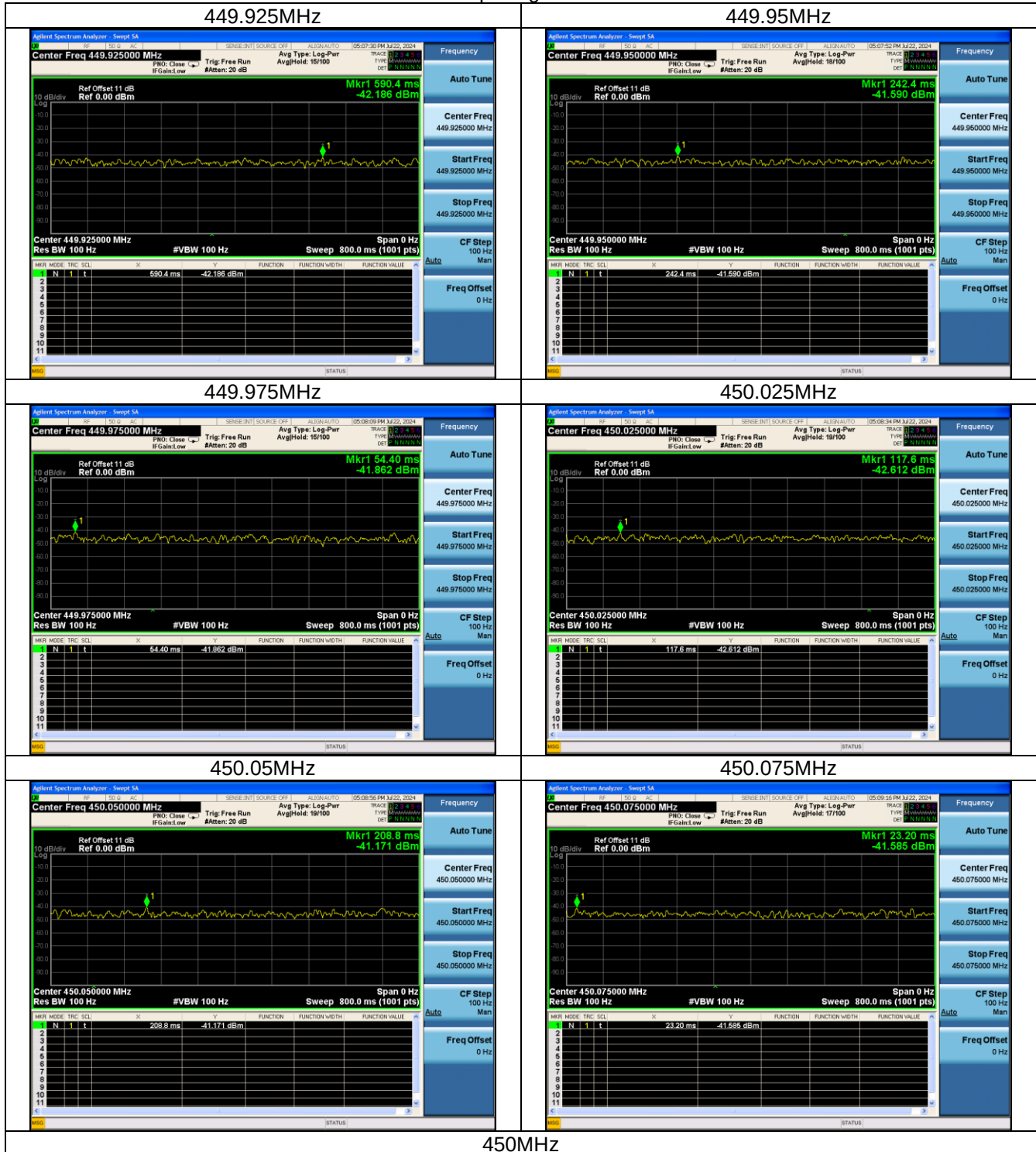
3.8. Adjacent channel power

Test Requirement:	FCC Part 90.221												
Test Setup:	 Spectrum AnalyzerEUT												
Test Limit:	Maximum adjacent power levels for frequencies in the 450–470 MHz band, no need compliance with below -36dBm: <table><tr><th>Frequency offset</th><th>Maximum ACP (dBc) for devices 1 watt and less</th><th>Maximum ACP (dBc) for devices above 1 watt</th></tr><tr><td>25 kHz</td><td>– 55 dBc</td><td>– 60 dBc</td></tr><tr><td>50 kHz</td><td>– 70 dBc</td><td>– 70 dBc</td></tr><tr><td>75 kHz</td><td>– 70 dBc</td><td>– 70 dBc</td></tr></table>	Frequency offset	Maximum ACP (dBc) for devices 1 watt and less	Maximum ACP (dBc) for devices above 1 watt	25 kHz	– 55 dBc	– 60 dBc	50 kHz	– 70 dBc	– 70 dBc	75 kHz	– 70 dBc	– 70 dBc
Frequency offset	Maximum ACP (dBc) for devices 1 watt and less	Maximum ACP (dBc) for devices above 1 watt											
25 kHz	– 55 dBc	– 60 dBc											
50 kHz	– 70 dBc	– 70 dBc											
75 kHz	– 70 dBc	– 70 dBc											
Test method:	The resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the Frequency band 0Kz from the wanted frequency												
Test result:	Pass.												

GMSK 25KHz spacing 450MHz-470MHz

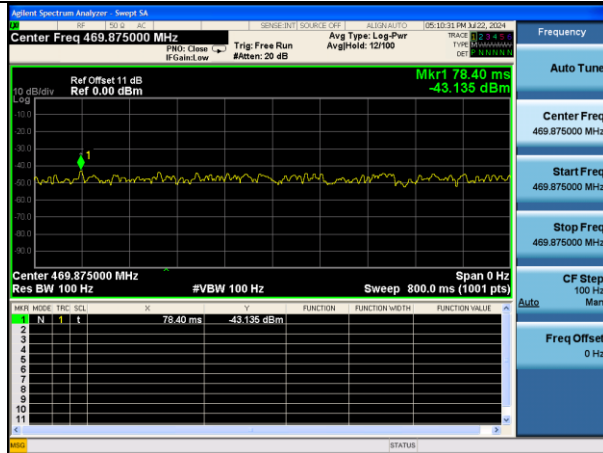
Carrier frequency (MHz)	Test Frequency (MHz)	Test Value (dBm)	Limit (dBm)	Result
450.000	449.925	-42.186	44-70=-26	PASS
	449.95	-41.590	44-70=-26	PASS
	449.975	-41.862	44-55=-11	PASS
	450.025	-42.612	44-55=-11	PASS
	450.05	-41.171	44-70=-26	PASS
	450.075	-41.585	44-70=-26	PASS
469.950	469.875	-43.135	44-70=-26	PASS
	469.900	-44.218	44-70=-26	PASS
	469.925	-44.029	44-55=-11	PASS
	469.975	-42.381	44-55=-11	PASS
	470.000	-43.062	44-70=-26	PASS
	470.025	-42.983	44-70=-26	PASS

GMSK 25KHz spacing 450MHz-470MHz

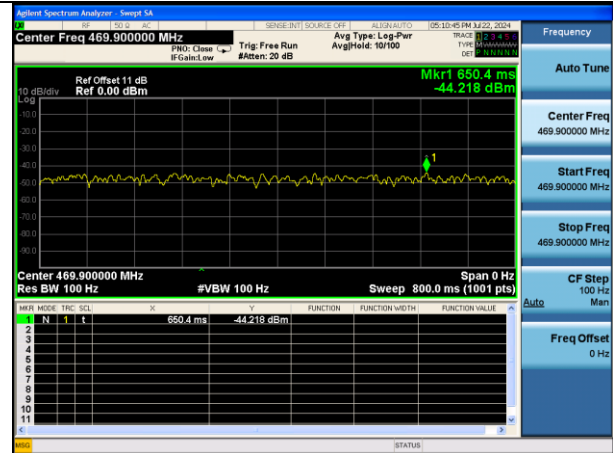


450MHz

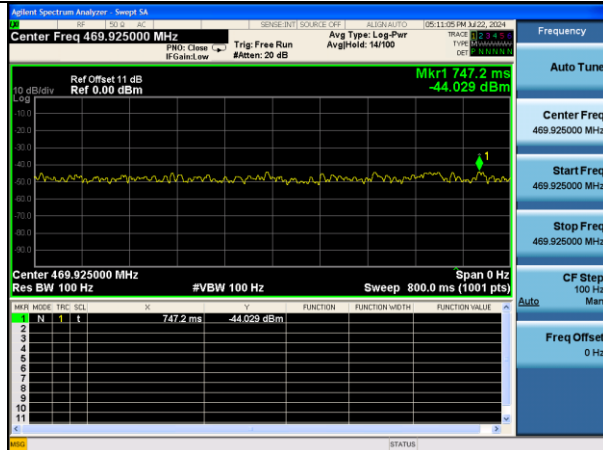
469.875MHz



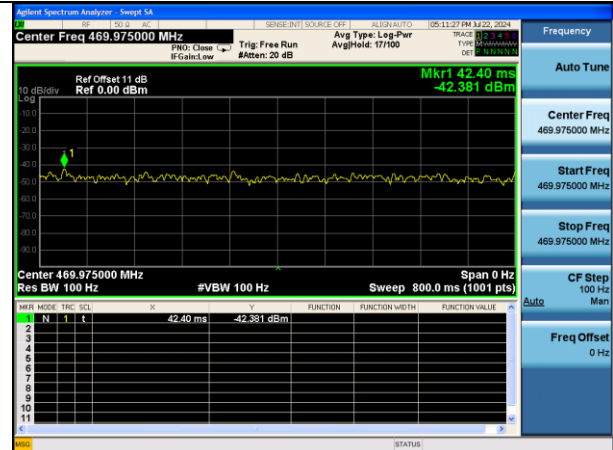
469.9MHz



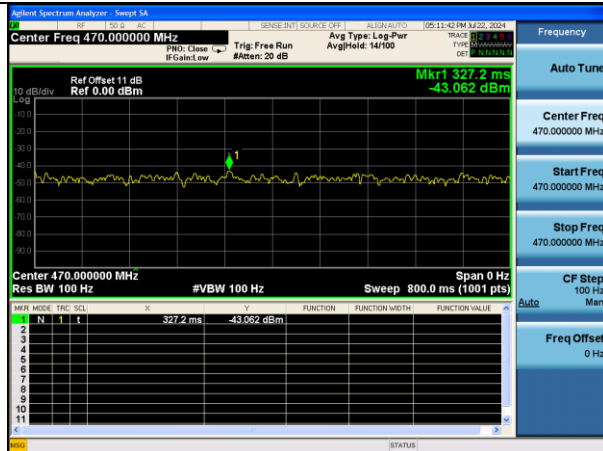
469.925MHz



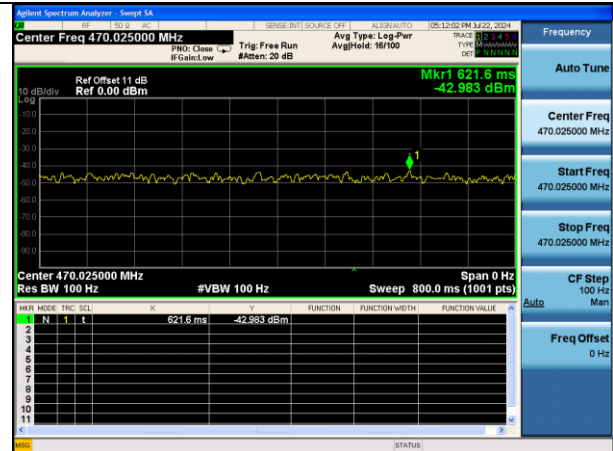
469.975MHz



470.0MHz



470.025MHz



469.95MHz

4. Test Setup Photo

4.1. Photos of Radiated emission



----- END OF REPORT-----