



FCC TEST REPORT

FCC ID: SY4-A02045

On Behalf of

Shanghai Huace Navigation Technology Ltd.

Geodetic GNSS Receiver

Model No.: i89

Prepared for : Shanghai Huace Navigation Technology Ltd.
Address : 577 Songying Road, Qingpu District, 201706 Shanghai, China

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 : A2306175-C01-R04
Date of Receipt : August 1, 2023
Date of Test : August 1, 2023 to September 1, 2023
Date of Report : September 1, 2023
Version Number : V0

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TEST REPORT DECLARATION

Applicant : Shanghai Huace Navigation Technology Ltd.
Address : 577 Songying Road, Qingpu District, 201706 Shanghai, China
Manufacturer : Shanghai Huace Navigation Technology Ltd.
Address : 577 Songying Road, Qingpu District, 201706 Shanghai, China
EUT Description : Geodetic GNSS Receiver
(A) Model No. : i89
(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).....: Reak Yang
Project Manager



Date of issue.....: September 1, 2023

Revision History

Revision	Issue Date	Revisions	Revised By
V0	September 1, 2023	Initial released Issue	Yannis Wen

1. General Information

1.1. Description of Device (EUT)

Product Name	:	Geodetic GNSS Receiver
Model Number	:	i89
DIFF	:	N/A
Operation Frequency	:	410-470MHz
Conducted Power	:	0.5W(27dBm), 1W(30dBm)
Channel spacing	:	12.5KHz, 25KHz
Modulation Type	:	GMSK
Antenna Type	:	External antenna
Antenna Gain	:	4dBi (Max)
Remark: All Conducted Power have been tested, and recorded the worst case 1W(30dBm) results in this report.		

1.2. Test Lab information

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: 293961 Designation Number: CN1236
July 15, 2019 Certificated by IC Registration Number: CN0085

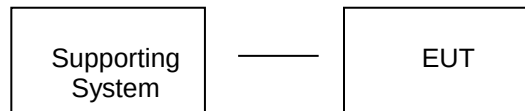
1.3. Accessories of Device (EUT)

Accessories	:	AC Adapter
Manufacturer	:	EDACPOWER ELEC.
Model	:	EA1012AVRU-050
Ratings	:	AC Input: 100-240Vac, 1.0a 50-60Hz DC Output: 5.0V $\rightarrow$ 2.4A 12.0W

1.4. Tested Supporting System Details

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

1.5. 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. Summary of test

2.1. Test Standard description:

The tests were performed according to following standards:

FCC Part 90: Private Land Mobile Radio Services

2.2. Summary of test

Item	Requirement	Method	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

2.3. Test Mode Description

No	Title	Description
TM1	GMSK+CS12.5KHz+TX	at maximum rated power for transmitter
TM2	GMSK+CS25KHz+TX	at maximum rated power for transmitter

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

2.4. 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 radio frequency	5.06×10^{-8} GHz
Uncertainty for conducted RF Power	0.40dB
Uncertainty for temperature	0.2°C
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

2.5. Test Equipment

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	MWRFtest	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	MWRFtest	2.0.0.0

3. Test Results and Measurement Data

3.1. Transmitter Power (Conducted)

3.1.1. Test Specification

Test Requirement:	Part 90.205, RSS-119(5.4)
Test Method:	FCC part 2.1046
Limits:	Please refer section FCC Part 90.205 and , RSS-119(5.4)
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	29.376	31.226	32	30±1	PASS
25	410.050	28.589	30.439	32	30±1	PASS
12.5	440.000	29.415	31.265	32	30±1	PASS
25	440.000	28.954	30.804	32	30±1	PASS
12.5	469.950	29.315	31.165	32	30±1	PASS
25	469.950	28.836	30.686	32	30±1	PASS

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	26.425	28.275	29	27±1	PASS
25	410.050	26.921	28.771	29	27±1	PASS
12.5	440.000	26.731	26.581	29	27±1	PASS
25	440.000	26.567	28.417	29	27±1	PASS
12.5	469.950	27.223	29.073	29	27±1	PASS
25	469.950	26.084	27.934	29	27±1	PASS

3.2. Occupied Bandwidth and Emission Mask

3.2.1. Test Specification

Test Requirement:	FCC Part 90.209, FCC Part 90.210, RSS-119(5.5)
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 circles indicating ports. A grey cable connects this box to a small white square, which in turn connects to a yellow rectangular box on the right representing the EUT (Equipment Under Test). Spectrum Analyzer 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	12.39	10.177	11.25	PASS
Mid	440.000	12.68	10.212	11.25	PASS
High	469.950	12.67	10.106	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	10.11	14.453	20	PASS
Mid	440.000	19.63	15.145	20	PASS
High	469.950	18.97	14.876	20	PASS

Emission Mask:

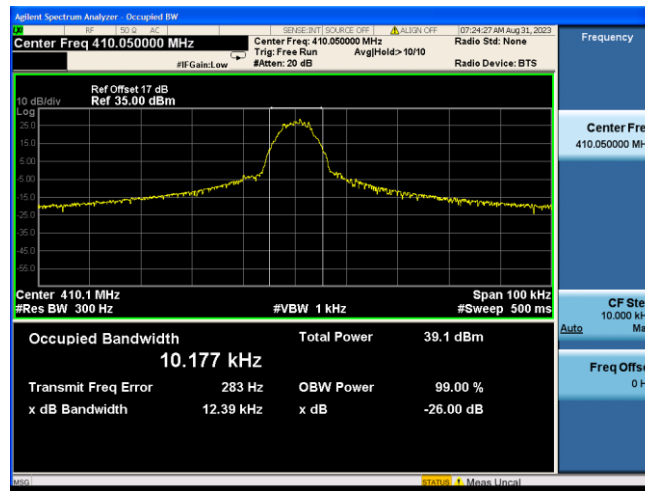
GMSK 12.5KHz Channel Spacing:				
Channel	Frequency (MHz)	Applicable Mask	RBW	Result
Low	410.050	D	100Hz	PASS
Mid	440.000	D	100Hz	PASS
High	469.950	D	100Hz	PASS

GMSK 25KHz Channel Spacing:				
Channel	Frequency (MHz)	Applicable Mask	RBW	Result
Low	410.050	C	100Hz	PASS
Mid	440.000	C	100Hz	PASS
High	469.950	C	100Hz	PASS

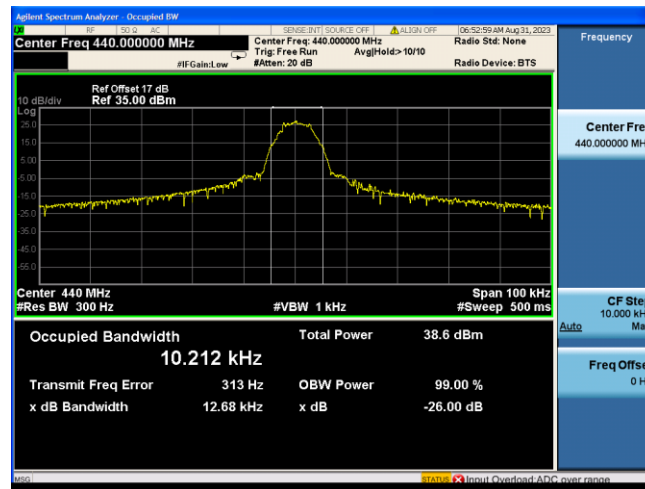
Test plots as follows:

GMSK 12.5KHz Channel Spacing: Occupied Bandwidth

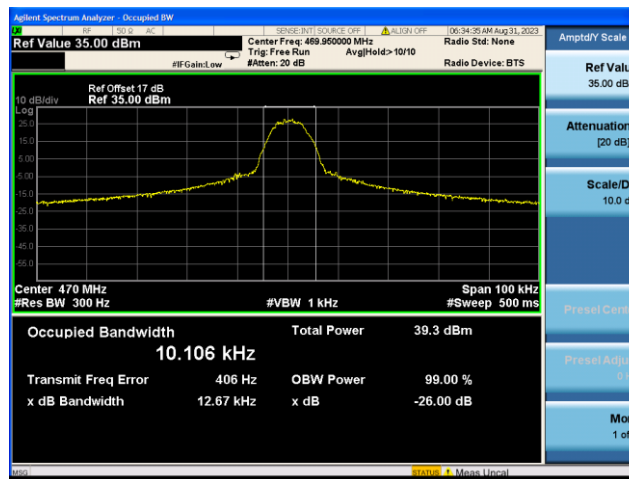
Low: 410.050MHz



Mid: 440.000MHz

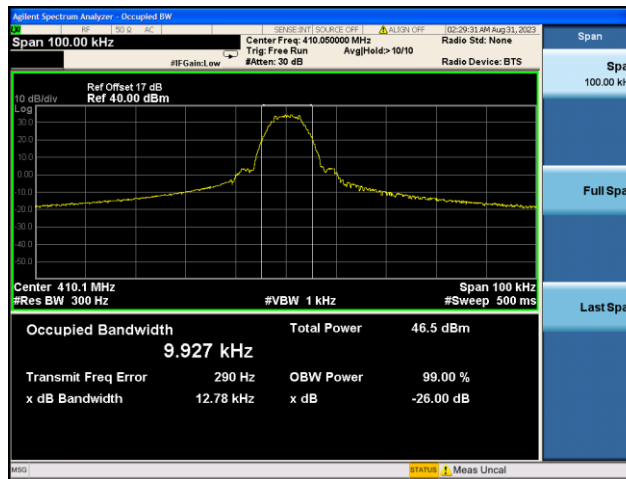


High: 470.00MHz

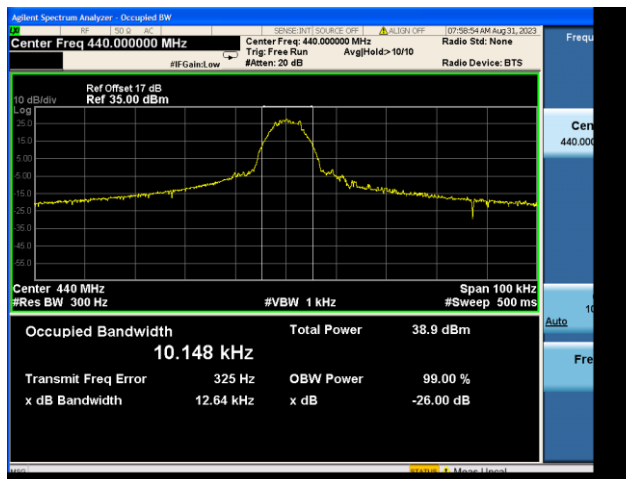


GMSK 25KHz Channel Spacing: Occupied Bandwidth

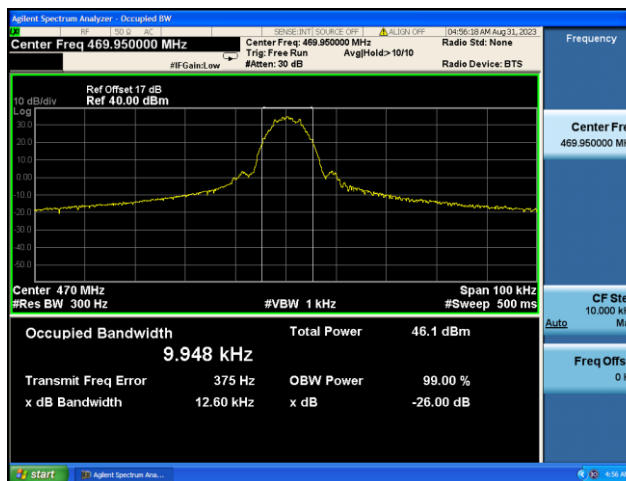
Low: 410.050MHz



Mid: 440.000MHz

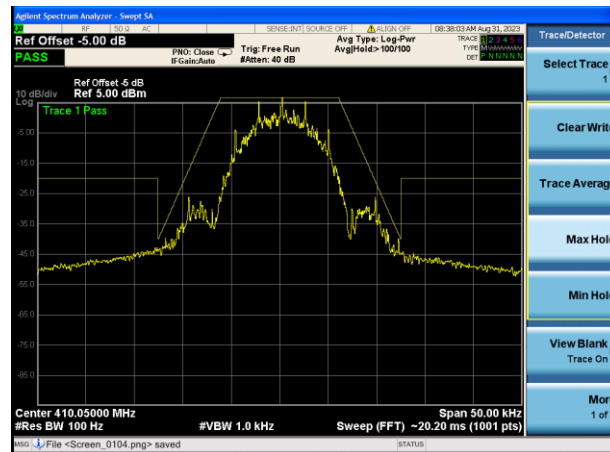


High: 469.850MHz

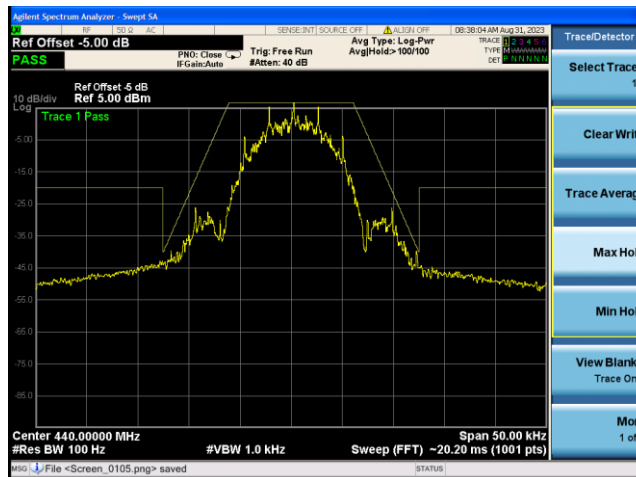


GMSK 12.5KHz Channel Spacing: Emission Mask

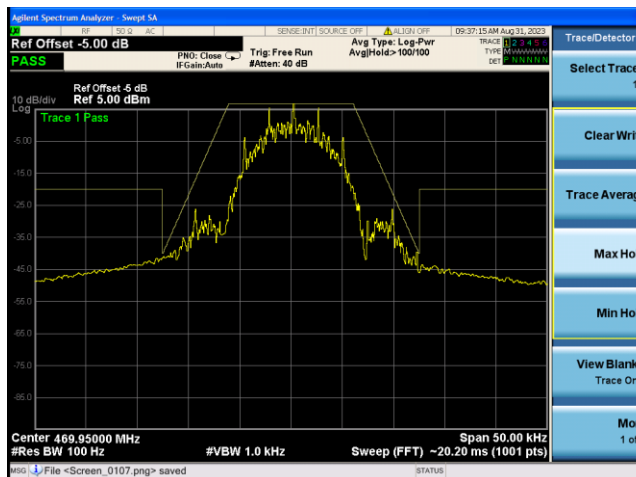
Low: 410.050MHz



Mid: 440.000MHz

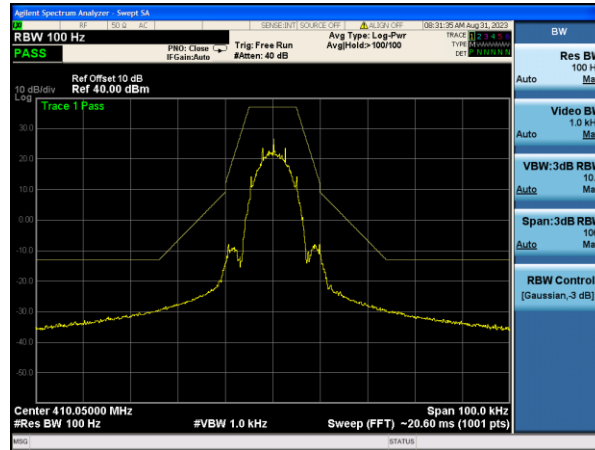


High: 469.950MHz

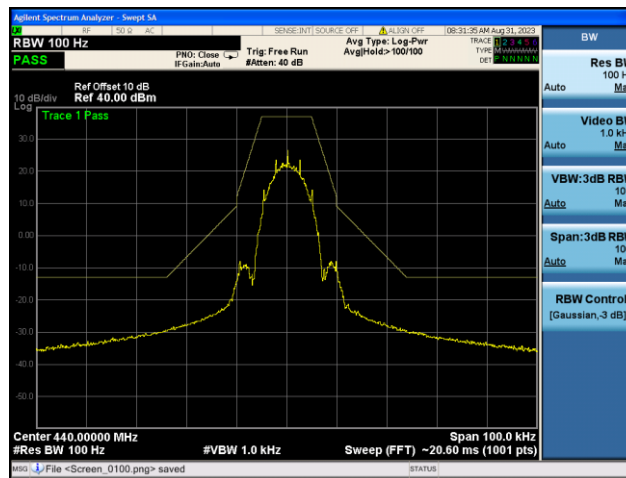


GMSK 25KHz Channel Spacing: Emission Mask

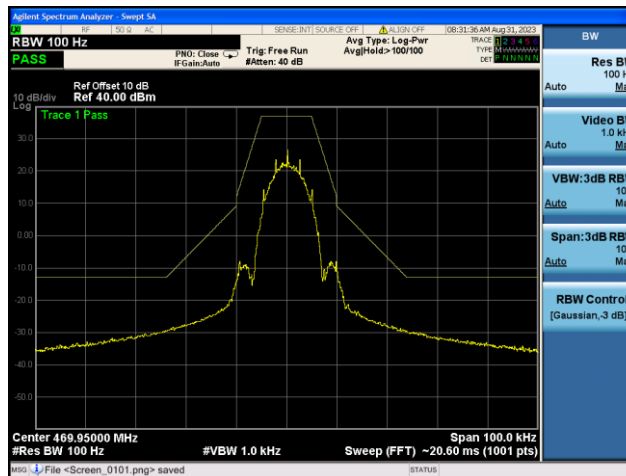
Low: 410.050MHz



Mid: 440.000MHz



High: 469.950MHz



3.3. Spurious Emissions(conducted)

3.3.1. Test Specification

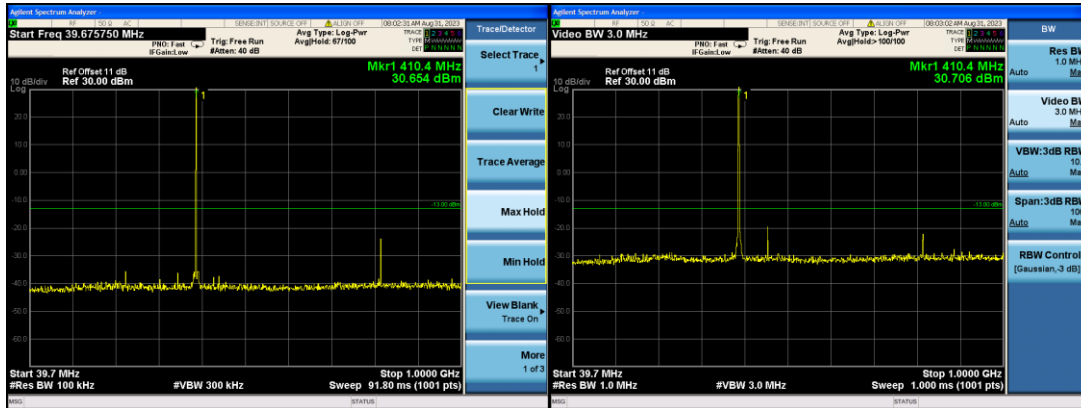
Test Requirement:	FCC Part 90.210, RSS-119(5.8)
Test Setup:	 Spectrum Analyzer EUT
Test Limit:	Modulation Type: GMSK FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 12: For 6.25 bandwidth: On any frequency removed from the center of the authorized bandwidth by a displacement frequency (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

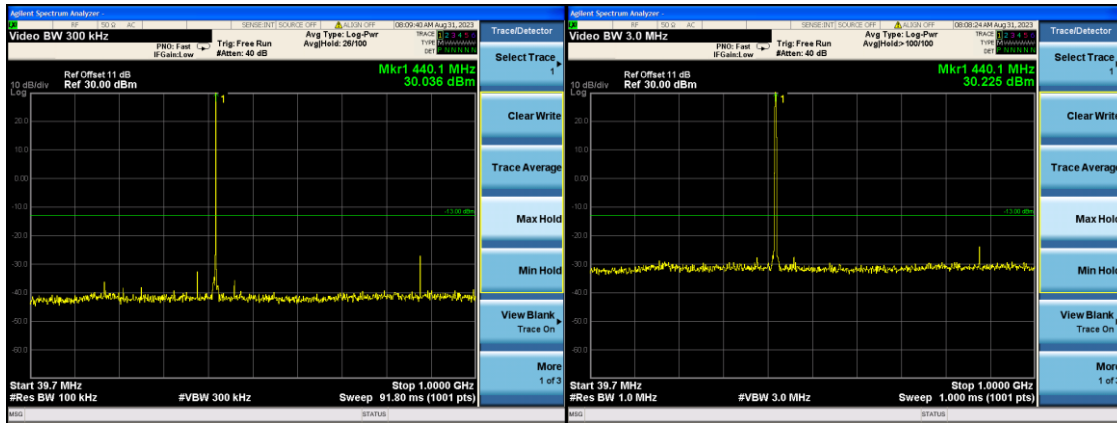
Test plots as follows:

GMSK 12.5KHz Channel Spacing:

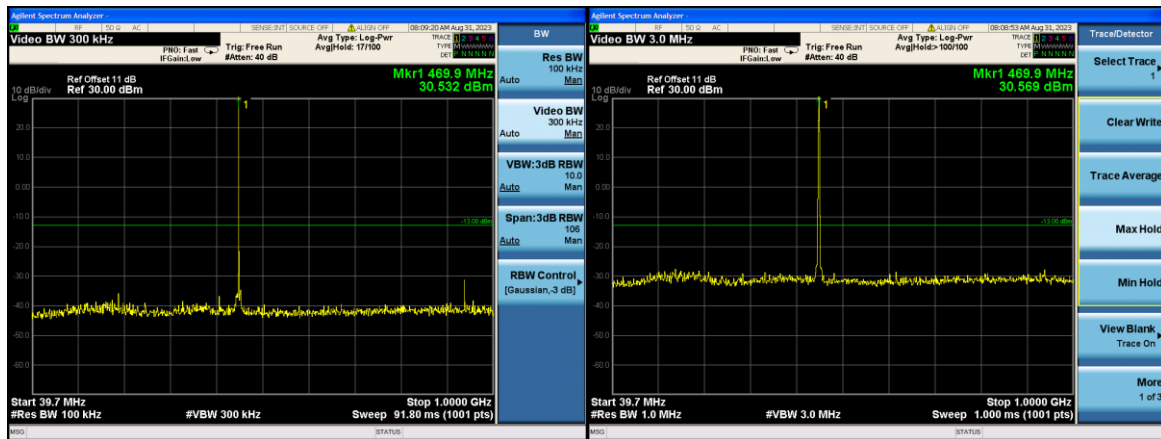
Low: 410.050MHz



Mid: 440.000MHz

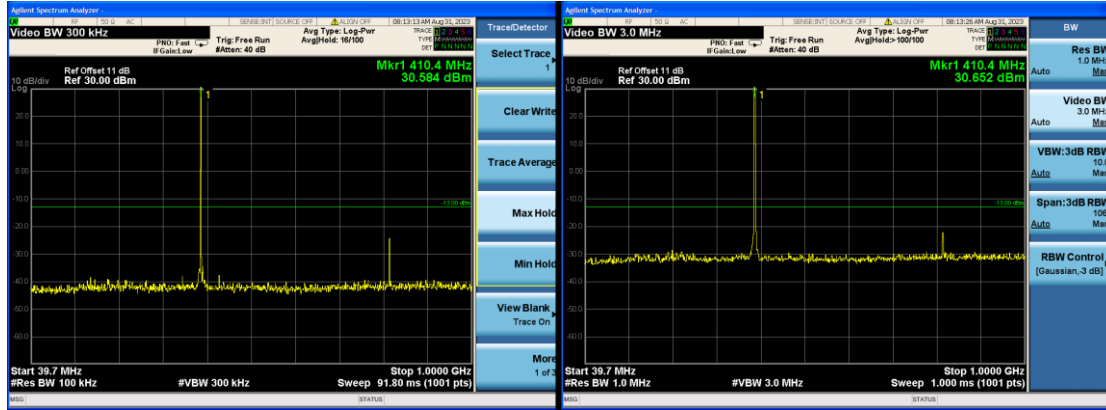


High: 469.950MHz

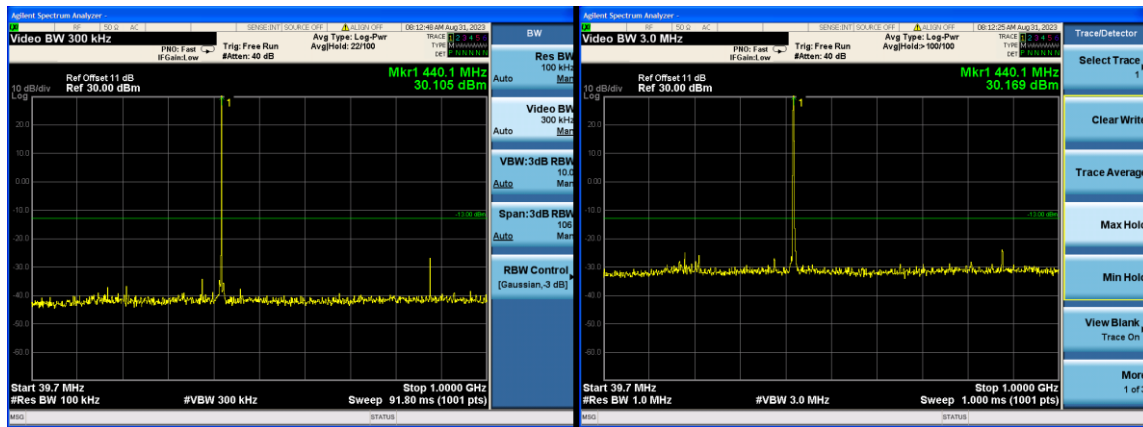


GMSK 25KHz Channel Spacing:

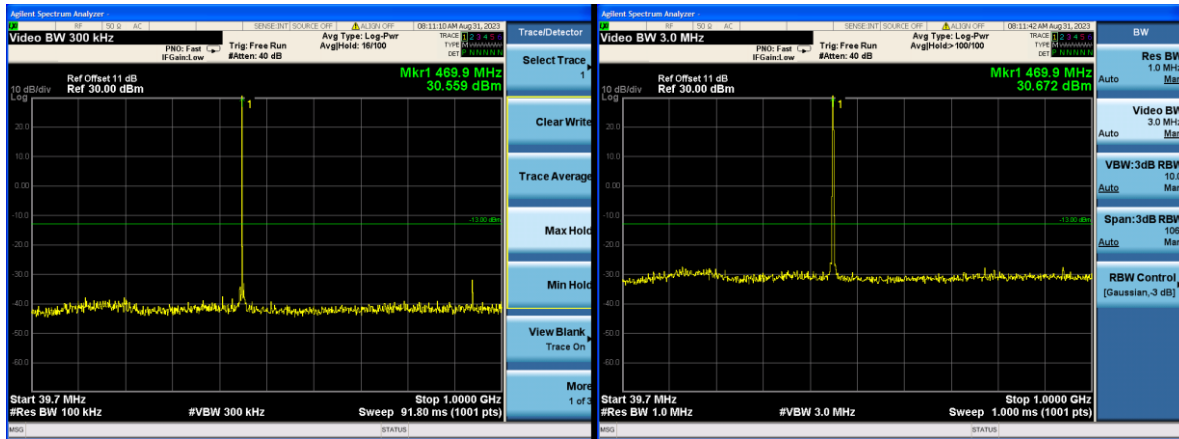
Low: 410.050MHz



Mid: 440.000MHz

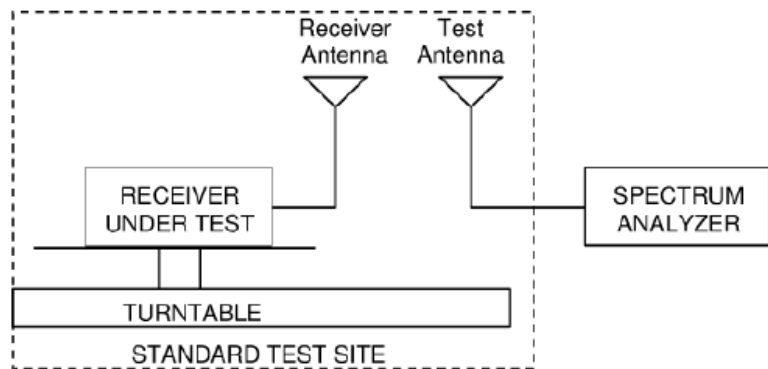


High: 469.950MHz



3.4. Radiated Spurious Emission

3.4.1. Test Specification

Test Requirement:	FCC Part 90.210, RSS-119(5.8)															
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)
151.841	-91.032	V	0.24	31.35	-59.922	-20	-39.922
360.810	-88.810	V	0.26	31.34	-57.730	-20	-37.730
671.038	-96.272	V	0.42	31.24	-65.452	-20	-45.452
865.368	-93.148	V	0.58	30.71	-63.018	-20	-43.018
1262.318	-83.932	V	1.23	26.38	-58.782	-20	-38.782
3866.271	-86.051	V	1.68	25.47	-62.261	-20	-42.261
284.636	-93.671	H	0.43	31.24	-62.861	-20	-42.861
400.123	-92.154	H	0.45	30.68	-61.924	-20	-41.924
478.893	-95.715	H	0.64	30.85	-65.505	-20	-45.505
678.276	-95.142	H	0.79	31.12	-64.812	-20	-44.812
1369.145	-85.703	H	1.29	26.12	-60.873	-20	-40.873
3258.887	-81.812	H	1.62	25.41	-58.022	-20	-38.022

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)
159.596	-92.663	V	0.24	31.35	-61.553	-20	-41.553
368.663	-98.207	V	0.26	31.34	-67.127	-20	-47.127
665.123	-99.143	V	0.42	31.24	-68.323	-20	-48.323
859.597	-100.069	V	0.58	30.71	-69.939	-20	-49.939
1263.476	-82.147	V	1.23	26.38	-56.997	-20	-36.997
3857.395	-82.231	V	1.68	25.47	-58.441	-20	-38.441
293.256	-95.991	H	0.43	31.24	-65.181	-20	-45.181
397.329	-102.180	H	0.45	30.68	-71.950	-20	-51.950
474.938	-101.836	H	0.64	30.85	-71.626	-20	-51.626
686.478	-90.734	H	0.79	31.12	-60.404	-20	-40.404
1362.977	-86.883	H	1.29	26.12	-62.053	-20	-42.053
3262.627	-75.342	H	1.62	25.41	-51.552	-20	-31.552

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)
147.190	-94.866	V	0.24	31.35	-63.756	-20	-43.756
361.601	-94.016	V	0.26	31.34	-62.936	-20	-42.936
672.010	-98.582	V	0.42	31.24	-67.762	-20	-47.762
867.288	-95.045	V	0.58	30.71	-64.915	-20	-44.915
1259.646	-82.913	V	1.23	26.38	-57.763	-20	-37.763
3858.065	-85.298	V	1.68	25.47	-61.508	-20	-41.508
287.303	-96.152	H	0.43	31.24	-65.342	-20	-45.342
404.251	-90.453	H	0.45	30.68	-60.223	-20	-40.223
471.951	-99.315	H	0.64	30.85	-69.105	-20	-49.105
676.286	-97.726	H	0.79	31.12	-67.396	-20	-47.396
1373.314	-87.428	H	1.29	26.12	-62.598	-20	-42.598
3262.627	-80.778	H	1.62	25.41	-56.988	-20	-36.988

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)
149.178	-94.231	V	0.24	31.35	-63.121	-13	-50.121
360.868	-89.535	V	0.26	31.34	-58.455	-13	-45.455
677.266	-91.916	V	0.42	31.24	-61.096	-13	-48.096
870.013	-90.244	V	0.58	30.71	-60.114	-13	-47.114
1259.759	-82.234	V	1.23	26.38	-57.084	-13	-44.084
3857.821	-81.514	V	1.68	25.47	-57.724	-13	-44.724
289.003	-92.992	H	0.43	31.24	-62.182	-13	-49.182
404.587	-99.659	H	0.45	30.68	-69.429	-13	-56.429
477.932	-96.142	H	0.64	30.85	-65.932	-13	-52.932
682.920	-94.949	H	0.79	31.12	-64.619	-13	-51.619
1369.193	-84.111	H	1.29	26.12	-59.281	-13	-46.281
3260.204	-78.878	H	1.62	25.41	-55.088	-13	-42.088

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

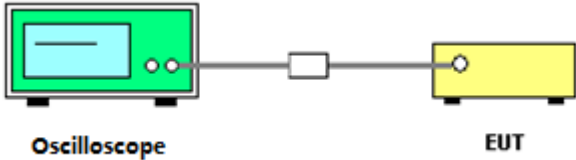
Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
151.913	-93.566	V	0.24	31.35	-62.456	-13	-49.456
365.196	-93.698	V	0.26	31.34	-62.618	-13	-49.618
674.885	-93.249	V	0.42	31.24	-62.429	-13	-49.429
867.072	-97.632	V	0.58	30.71	-67.502	-13	-54.502
1257.304	-79.789	V	1.23	26.38	-54.639	-13	-41.639
3861.310	-79.570	V	1.68	25.47	-55.780	-13	-42.780
285.227	-93.512	H	0.43	31.24	-62.702	-13	-49.702
402.154	-96.740	H	0.45	30.68	-66.510	-13	-53.510
473.838	-95.965	H	0.64	30.85	-65.755	-13	-52.755
681.918	-93.085	H	0.79	31.12	-62.755	-13	-49.755
1372.087	-83.690	H	1.29	26.12	-58.860	-13	-45.860
3257.390	-80.987	H	1.62	25.41	-57.197	-13	-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)
150.981	-92.588	V	0.24	31.35	-61.478	-13	-48.478
353.572	-92.577	V	0.26	31.34	-61.497	-13	-48.497
665.850	-89.879	V	0.42	31.24	-59.059	-13	-46.059
863.982	-96.384	V	0.58	30.71	-66.254	-13	-53.254
1253.878	-84.060	V	1.23	26.38	-58.910	-13	-45.910
3855.932	-80.995	V	1.68	25.47	-57.205	-13	-44.205
286.161	-100.313	H	0.43	31.24	-69.503	-13	-56.503
398.361	-96.047	H	0.45	30.68	-65.817	-13	-52.817
474.432	-94.424	H	0.64	30.85	-64.214	-13	-51.214
677.866	-99.456	H	0.79	31.12	-69.126	-13	-56.126
1370.616	-82.786	H	1.29	26.12	-57.956	-13	-44.956
3261.173	-80.944	H	1.62	25.41	-57.154	-13	-44.154

3.5. Transient Frequency Behavior

3.5.1. Test Specification

Test Requirement:	FCC Part 90.214, RSS-119(5.9)				
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 12.5KHz, EUT power setting: Maximum.

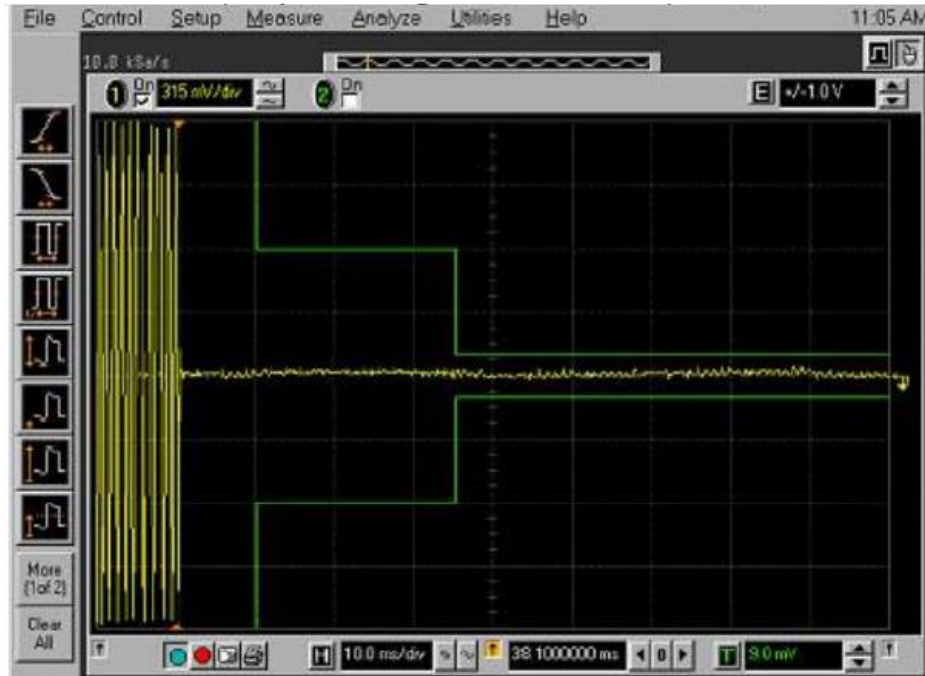
Power On



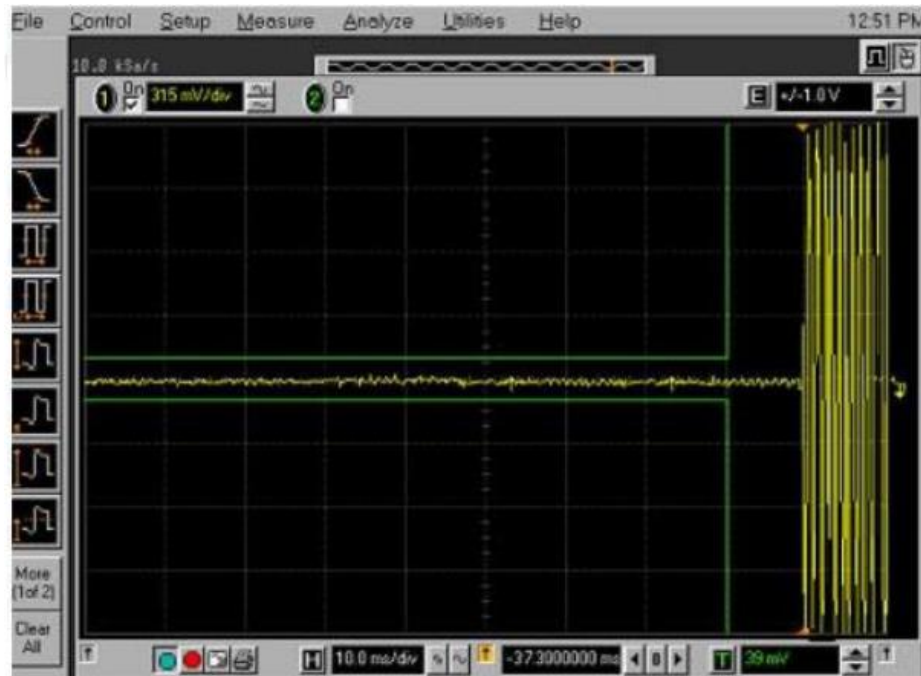
Power Off



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



Power Off



3.6. Behavior Frequency Stability

3.6.1. Test Specification

Test Requirement:	FCC Part 90.213, RSS-119(5.3)
Test Method:	ANSI C63.26, RSS-Gen
Test Setup:	<pre> graph LR Laptop[Laptop] --- EUT[Equipment Under Test] EUT --- ACDC[AC/DC Adapter] EUT --- Att[Attenuator(s)] Att --- MCC[Mini-Circuit Combiner] MCC --- RFTS[RF Communication Test Set] MCC --- MA[Modulation Analyzer] MCC --- RFD[RF Detector] RFD --- 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	7.6	7.11	0.016
	7.5	-7.38	-0.017
	7.4	21.94	0.050
	7.3	19.17	0.044
	7.2	-3.43	-0.008
	7.1	-5.40	-0.012
Limit	2.5ppm		
Middle Channel 25KHz Channel Spacing	7.6	-5.33	-0.012
	7.5	13.87	0.032
	7.4	29.00	0.066
	7.3	-9.43	-0.021
	7.2	-9.90	-0.022
	7.1	-3.09	-0.007
Limit	5ppm		

Mode	Temperature (°C)	Frequency error (Hz)	frequency error (ppm)
Middle Channel 12.5KHz Channel Spacing	-20	5.76	0.013
	-10	27.18	0.062
	0	1.62	0.004
	10	10.69	0.024
	20	-8.65	-0.020
	30	2.93	0.007
	40	25.73	0.058
	50	7.86	0.018
Limit	2.5ppm		
Middle Channel 25KHz Channel Spacing	-20	9.37	0.021
	-10	8.85	0.020
	0	6.88	0.016
	10	20.16	0.046
	20	-8.64	-0.020
	30	-0.64	-0.001
	40	4.16	0.009
	50	24.23	0.055
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.

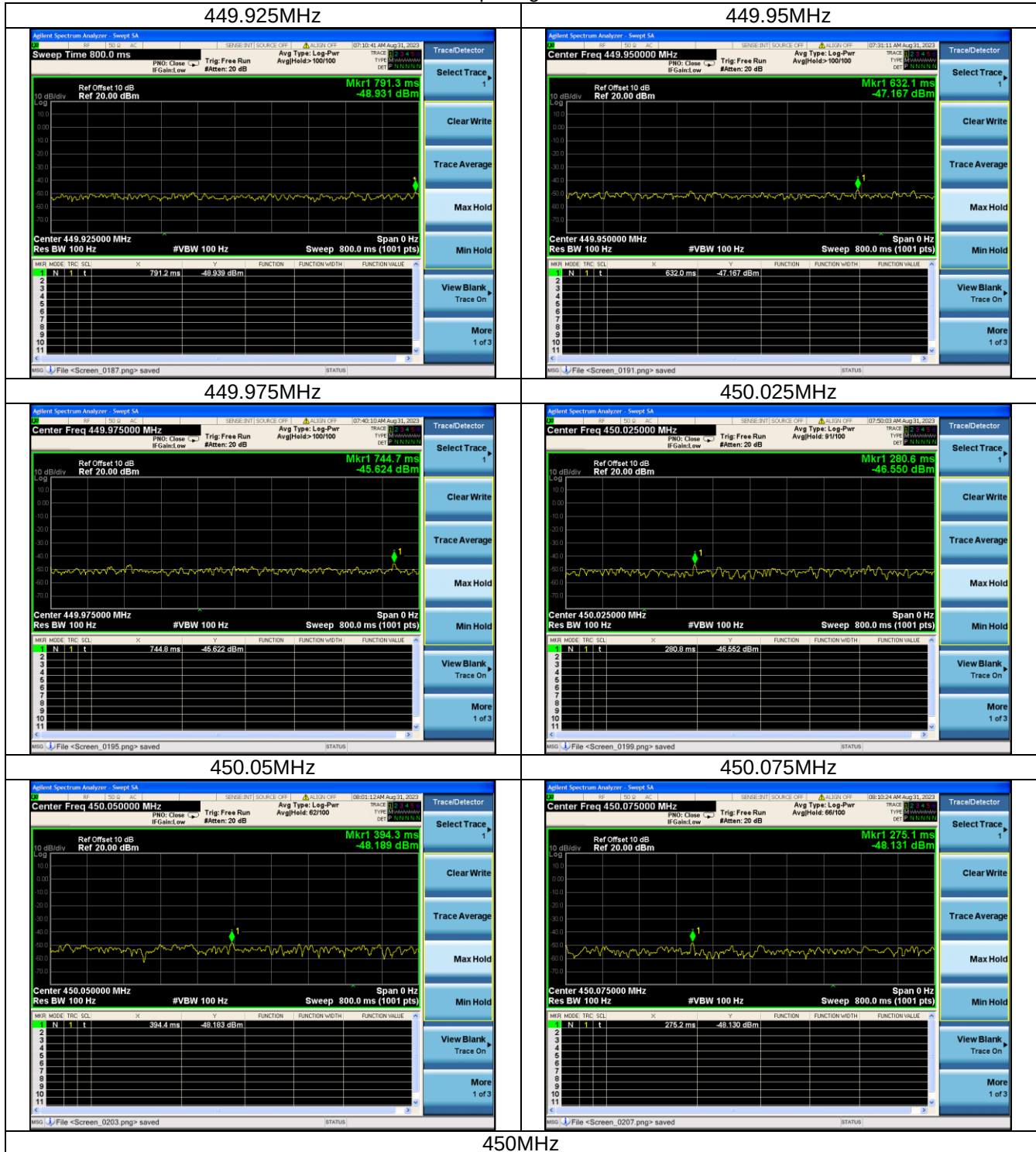
3.8. Adjacent channel power

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><thead><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></thead><tbody><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></tbody></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.												

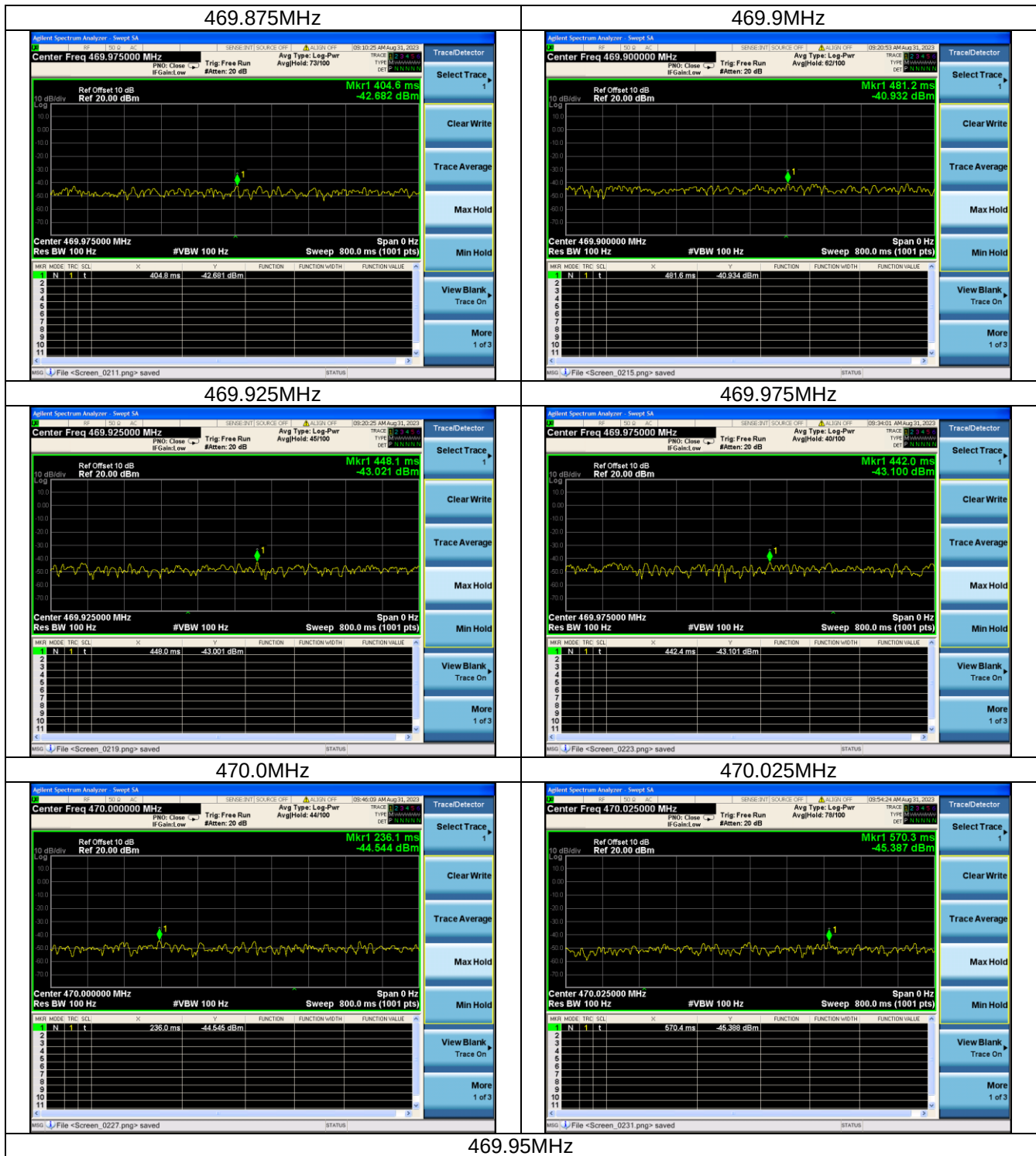
GMSK 25KHz spacing 450MHz-470MHz

Carrier frequency (MHz)	Test Frequency (MHz)	Test Value (dBm)	Limit (dBm)	Result
450.000	449.925	-48.931	30-70=-40	PASS
	449.95	-47.167	30-70=-40	PASS
	449.975	-45.624	30-55=-25	PASS
	450.025	-46.550	30-55=-25	PASS
	450.05	-48.189	30-70=-40	PASS
	450.075	-48.131	30-70=-40	PASS
469.950	469.875	-42.682	30-70=-40	PASS
	469.900	-40.932	30-70=-40	PASS
	469.925	-43.021	30-55=-25	PASS
	469.975	-43.100	30-55=-25	PASS
	470.000	-44.544	30-70=-40	PASS
	470.025	-45.387	30-70=-40	PASS

GMSK 25KHz spacing 450MHz-470MHz



450MHz

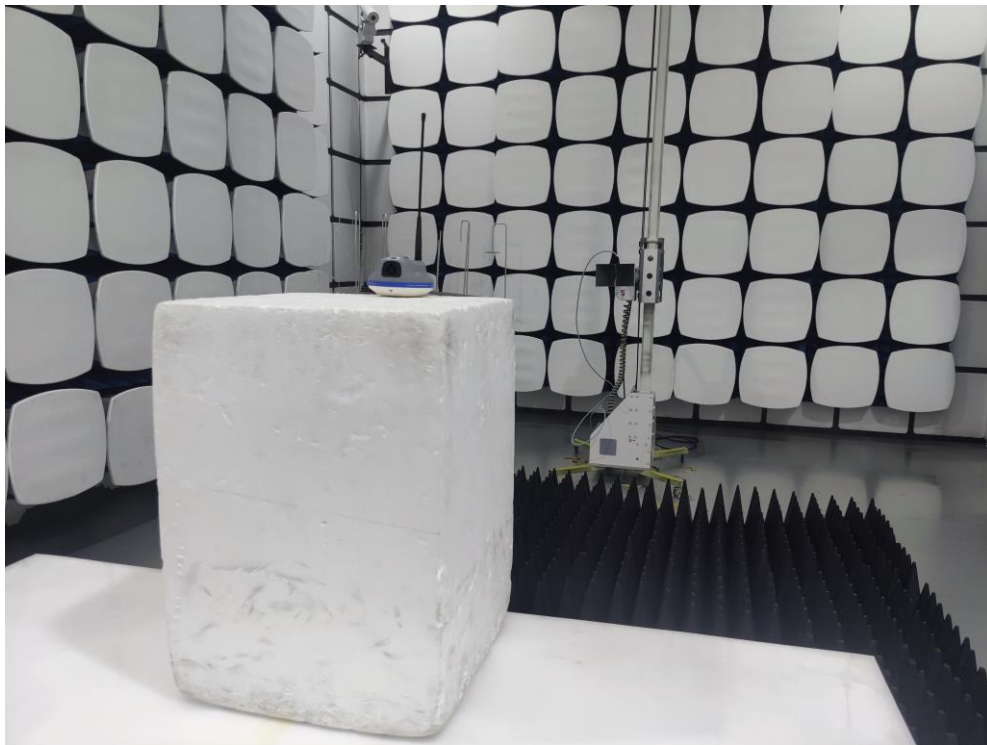
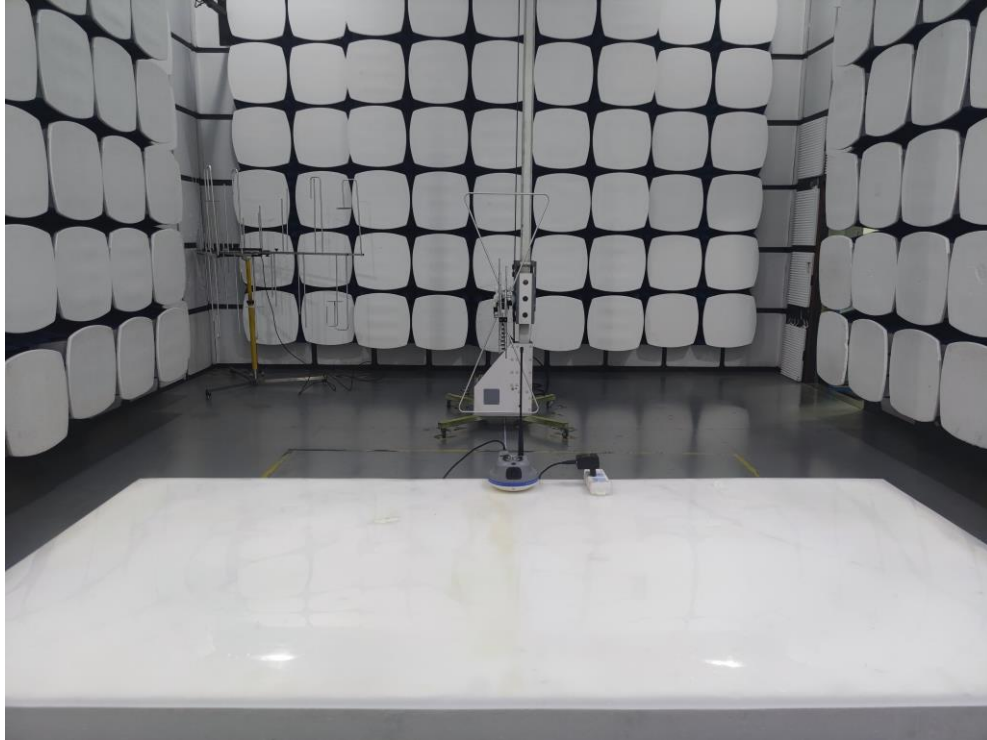


469.95MHz

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

4. Test Setup Photo

4.1. Photos of Radiated emission



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