



FCC TEST REPORT
FCC ID: 2BA3P-T100L

On Behalf of

GUANGZHOU MERCURY NAVIGATION TECHNOLOGY CO., LTD
Long-distance Wireless Data transreceiver Module
Model No.: T100L

Prepared for : GUANGZHOU MERCURY NAVIGATION TECHNOLOGY CO., LTD
Address : Room C401-403, TOPS Beidou Innovation Base, No.83, Kaiyuan
Avenue, Huangpu, Guangzhou, Guangdong, China

Prepared By : Shenzhen Alpha Product Testing Co., Ltd.
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Report Number : A2303099-C01-R08
Date of Receipt : March 15, 2023
Date of Test : March 15, 2023- April 7, 2023
Date of Report : April 7, 2023
Version Number : V0

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TEST REPORT DECLARATION

Applicant : GUANGZHOU MERCURY NAVIGATION TECHNOLOGY CO., LTD
Address : Room C401-403, TOPS Beidou Innovation Base, No.83, Kaiyuan Avenue,
Huangpu, Guangzhou, Guangdong, China
Manufacturer : GUANGZHOU MERCURY NAVIGATION TECHNOLOGY CO., LTD
Address : Room C401-403, TOPS Beidou Innovation Base, No.83, Kaiyuan Avenue,
Huangpu, Guangzhou, Guangdong, China
EUT Description : Long-distance Wireless Data transceiver Module
(A) Model No. : T100L
(B) Trademark : **GINTEC**
MercuryNavi

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.

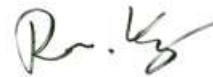
After the test, our opinion is that EUT compliance with the requirement of the above standards.

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.....: April 7, 2023

Revision History

Revision	Issue Date	Revisions	Revised By
V0	April 7, 2023	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	: Long-distance Wireless Data transreceiver Module
Model Number	: T100L
Trademark	: GINTEC MercuryNavi
DIFF.	: N/A
Test Voltage	: DC 3.3V from DC power

UHF

Operation frequency	: 410MHz-470MHz
Conducted Power	: 1W(30dBm)
Channel spacing	: 6.25KHz, 12.5KHz, 25KHz
Modulation type	: GMSK
Antenna Type	: Rod Antenna, Maximum Gain is 4.0dBi
Software version	: V1.0
Hardware version	: V1.0

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

2.2. Accessories of Device (EUT)

Accessories : /
Manufacturer : /
Model : /
Ratings : /

2.3. Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or SDOC
1.	Notebook PC	Lenovo	T430	/	/

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+CS6.25KHz+TX	at maximum rated power for transmitter
2	GMSK+CS12.5KHz+TX	at maximum rated power for transmitter
3	GMSK+CS25KHz+TX	at maximum rated power for transmitter

Note: The worst case modes for all test are the item 1 and item 3.

Description Operation Frequency

GMSK		
Test Channel	Channel spacing (KHz)	Frequency(MHz)
Low	6.25	410.050
	12.5	410.050
	25	410.050
Mid	6.25	451.000
	12.5	451.000
	25	451.000
High	6.25	469.950
	12.5	469.950
	25	469.950

2.6. Test Conditions

Items	Required	Actual
Temperature range:	15-35℃	24℃
Humidity range:	25-75%	56%
Pressure range:	86-106kPa	980kPa

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: CN0085

2.8. Measurement Uncertainty

(95% confidence levels, k=2)

Item	Uncertainty
Uncertainty for Power point Conducted Emissions Test	2.74dB
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	2.13 dB(Polarize: V)
	2.57dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.77dB(Polarize: V)
	3.80dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	4.16dB(Polarize: H)
	4.13dB(Polarize: V)
Uncertainty for radio frequency	5.4×10^{-8}
Uncertainty for conducted RF Power	0.37dB
Uncertainty for temperature	0.2℃
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

2.9. Test Equipment List

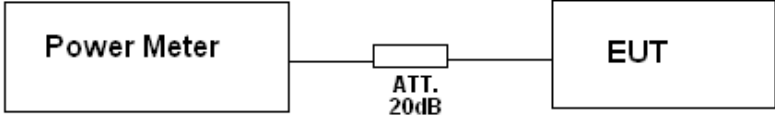
Equipment	Manufacture	Model No.	Firmware version	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	CHENYU	9*6*6	/	N/A	2022.05.17	3Year
Spectrum analyzer	ROHDE&SCHWARZ	FSV40-N	2.3	102137	2022.08.22	1Year
Spectrum analyzer	Agilent	N9020A	A.14.16	MY499100060	2022.08.22	1Year
Receiver	ROHDE&SCHWARZ	ESR	2.28 SP1	1316.3003K03-10 2082-Wa	2022.08.22	1Year
Receiver	R&S	ESCI	4.42 SP1	101165	2022.08.22	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	/	VULB 9168#627	2021.08.30	2Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	/	2106	2021.08.30	2Year
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	/	00059	2021.08.30	2Year
RF Cable	Resenberger	Cable 1	/	RE1	2022.08.22	1Year
RF Cable	Resenberger	Cable 2	/	RE2	2022.08.22	1Year
RF Cable	Resenberger	Cable 3	/	CE1	2022.08.22	1Year
Pre-amplifier	HP	HP8347A	/	2834A00455	2022.08.22	1Year
Pre-amplifier	Agilent	8449B	/	3008A02664	2022.08.22	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	/	8126-466	2022.08.22	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	/	101043	2022.08.23	1 Year
Horn Antenna	SCHWARZBECK	BBHA9170	/	00946	2021.08.30	2 Year
Preamplifier	SKET	LNPA_1840 -50	/	SK2018101801	2022.08.22	1 Year
Power Meter	Agilent	E9300A	/	MY41496628	2022.08.22	1 Year
Power Sensor	DARE	RPR3006W	/	15100041SNO91	2022.08.22	1 Year
Temp. & Humid. Chamber	Weihuang	WHTH-1000 -40-880	/	100631	2023.04.18	1 Year
Switching Mode Power Supply	JUNKE	JK12010S	/	20140927-6	2022.08.22	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	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, 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

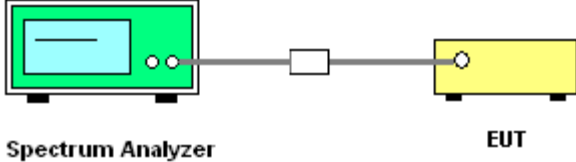
3.1.2. Test Results

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
6.25	410.050	29.351	31.201	31.85	30±1	PASS
12.5	410.050	29.126	30.976	31.85	30±1	PASS
25	410.050	29.646	31.496	31.85	30±1	PASS
6.25	440.000	29.232	31.082	31.85	30±1	PASS
12.5	440.000	29.633	31.483	31.85	30±1	PASS
25	440.000	29.269	31.119	31.85	30±1	PASS
6.25	469.950	29.742	31.592	31.85	30±1	PASS
12.5	469.950	29.845	31.695	31.85	30±1	PASS
25	469.950	29.411	31.261	31.85	30±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, RSS-119(5.5)
Test Setup:	 The diagram illustrates the test setup. On the left is a green rectangular box representing the Spectrum Analyzer. A cable connects it to a yellow rectangular box on the right, which represents the EUT (Equipment Under Test). A small white square is located on the cable between the two devices.
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 6.25KHz Channel Spacing:

Channel	Frequency (MHz)	26dB Bandwidth (KHz)	99% Occupied Bandwidth (KHz)	99% Occupied Bandwidth Limit (KHz)	Result
Low	410.050	5.001	3.704	5.8	PASS
Mid	440.000	5.030	3.756	5.8	PASS
High	469.950	4.433	3.681	5.8	PASS

GMSK 12.5KHz Channel Spacing:

Channel	Frequency (MHz)	26dB Bandwidth (KHz)	99% Occupied Bandwidth (KHz)	99% Occupied Bandwidth Limit (KHz)	Result
Low	410.050	10.09	7.488	11.25	PASS
Mid	440.000	8.920	7.212	11.25	PASS
High	469.950	8.812	6.885	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	15.67	14.718	20	PASS
Mid	440.000	17.48	13.610	20	PASS
High	469.950	19.67	13.401	20	PASS

Emission Mask:

GMSK 6.25KHz Channel Spacing:				
Channel	Frequency (MHz)	Applicable Mask	RBW	Result
Low	410.050	E	100Hz	PASS
Mid	440.000	E	100Hz	PASS
High	469.950	E	100Hz	PASS

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

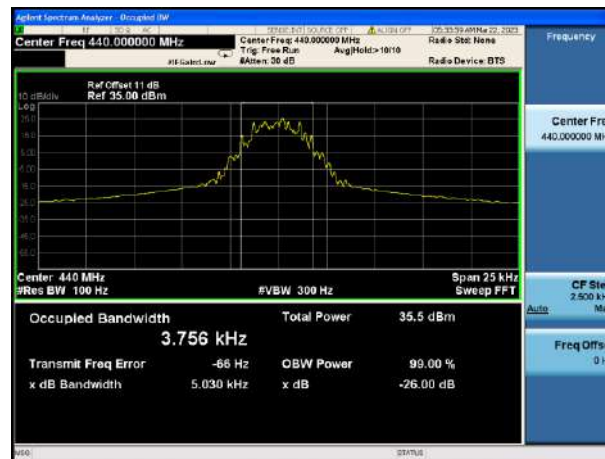
Test plots as follows:

GMSK 6.25KHz Channel Spacing: Occupied Bandwidth

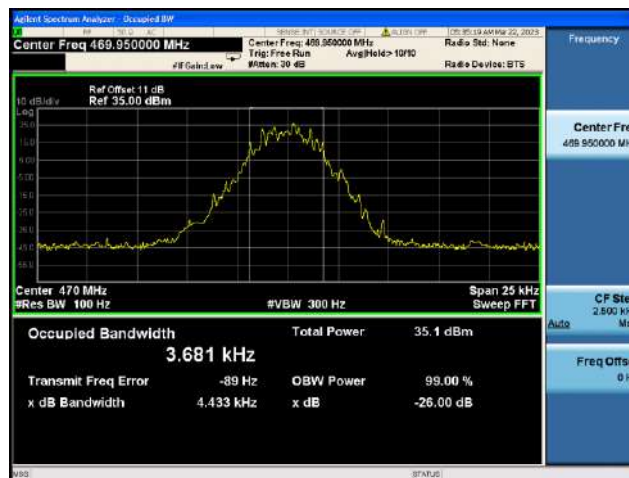
Low: 410.050MHz



Mid: 440.000MHz

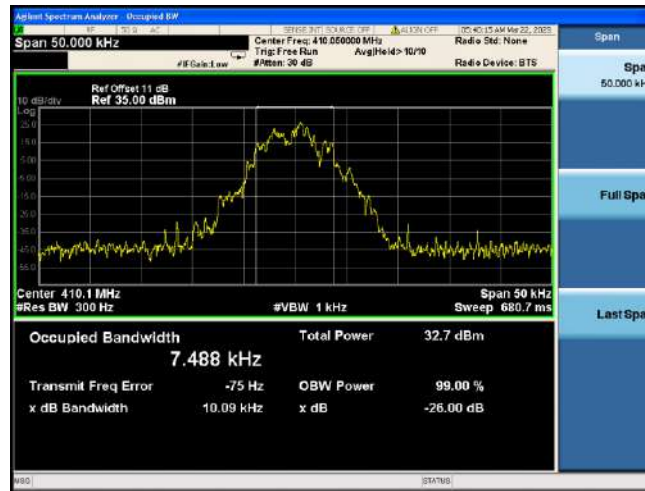


High: 470.00MHz

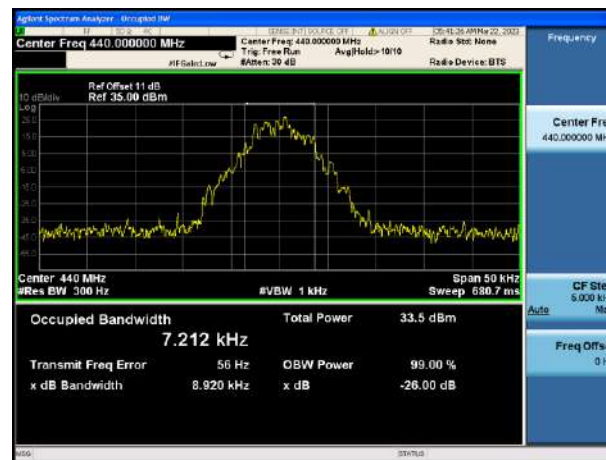


GMSK 12.5KHz Channel Spacing: Occupied Bandwidth

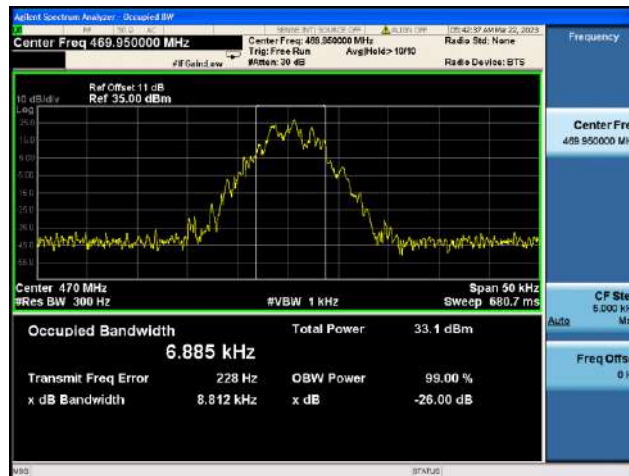
Low: 410.050MHz



Mid: 440.000MHz

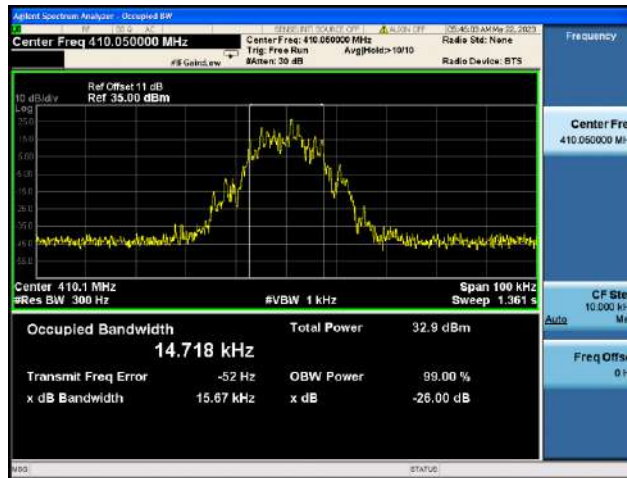


High: 470.00MHz

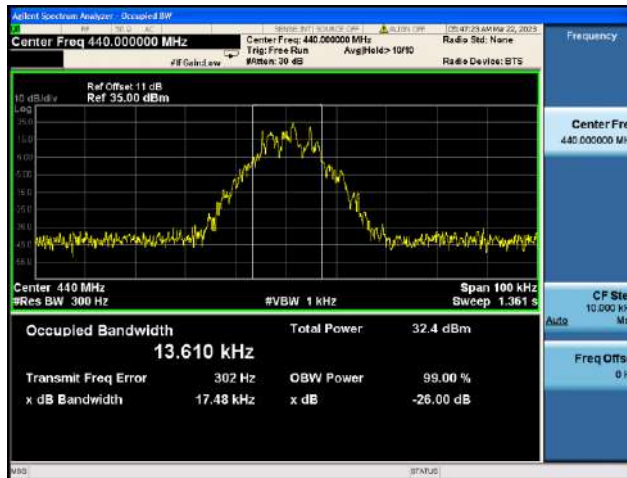


GMSK 25KHz Channel Spacing: Occupied Bandwidth

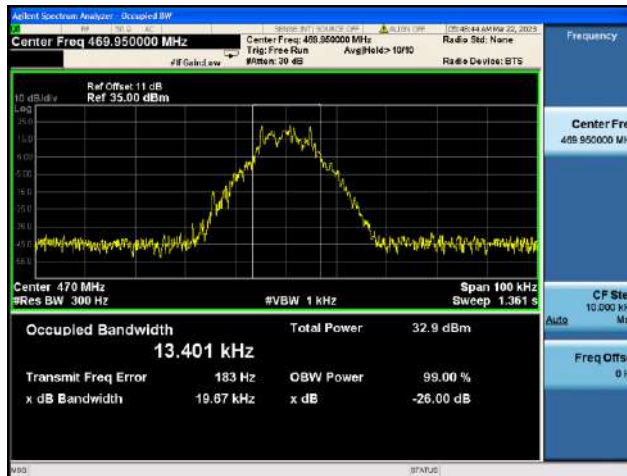
Low: 410.050MHz



Mid: 440.000MHz

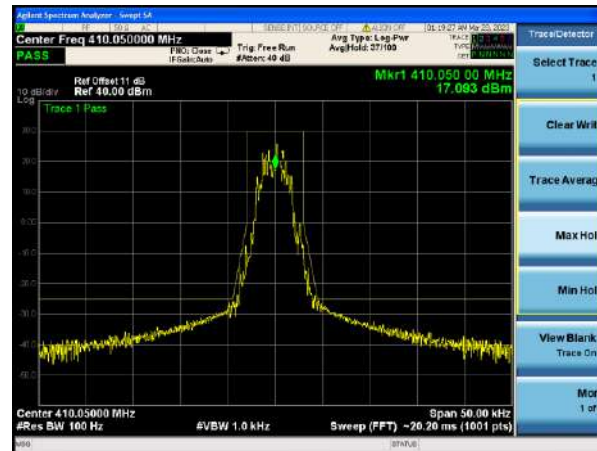


High: 469.850MHz

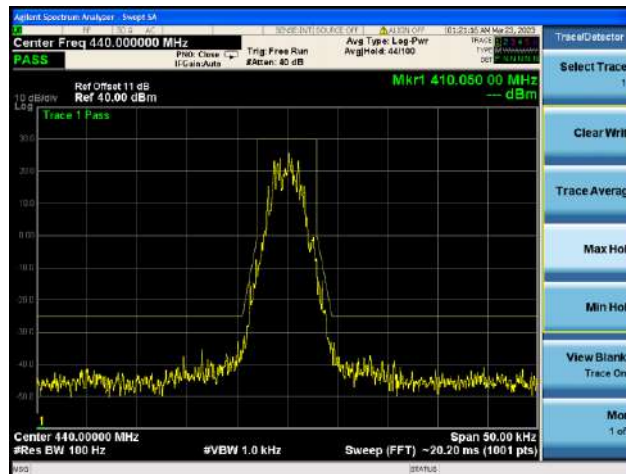


GMSK 6.25KHz Channel Spacing: Emission Mask

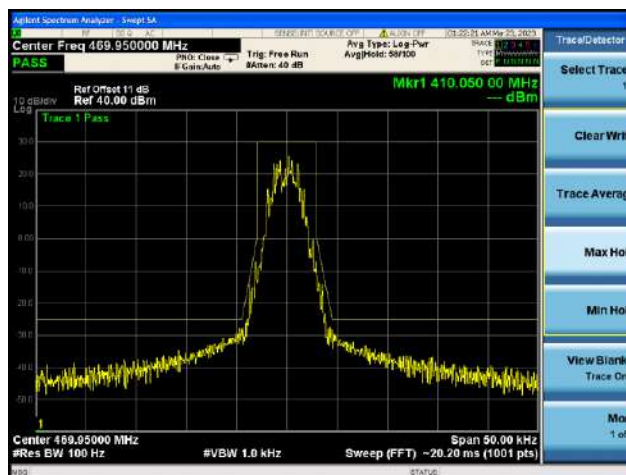
Low: 410.050MHz



Mid: 440.000MHz

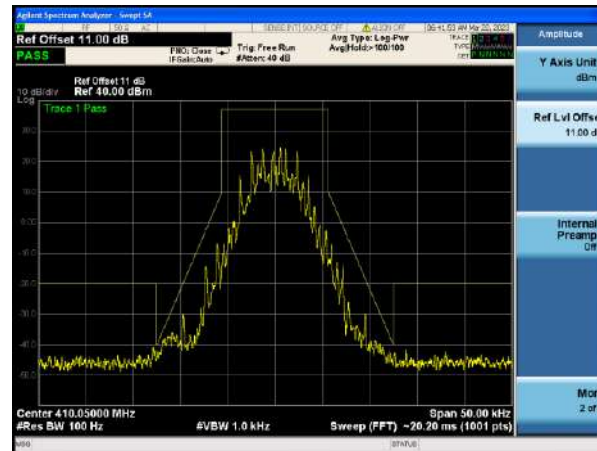


High: 469.950MHz

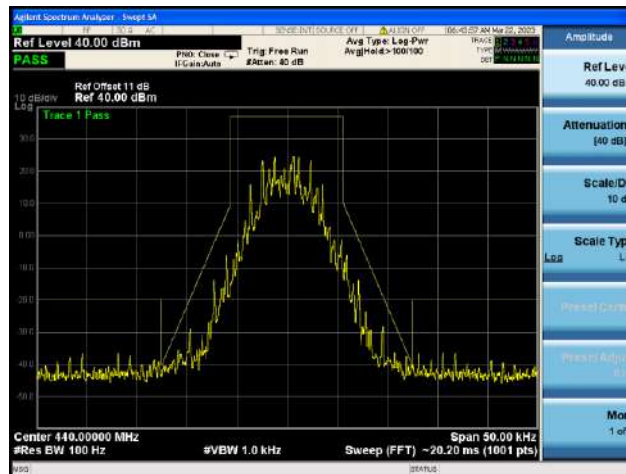


GMSK 12.5KHz Channel Spacing: Emission Mask

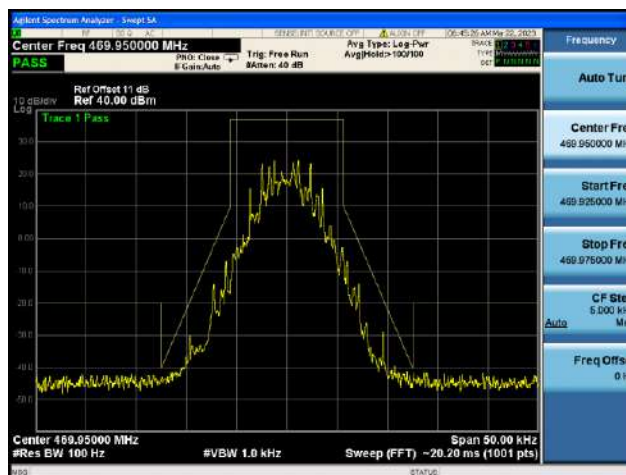
Low: 410.050MHz



Mid: 440.000MHz

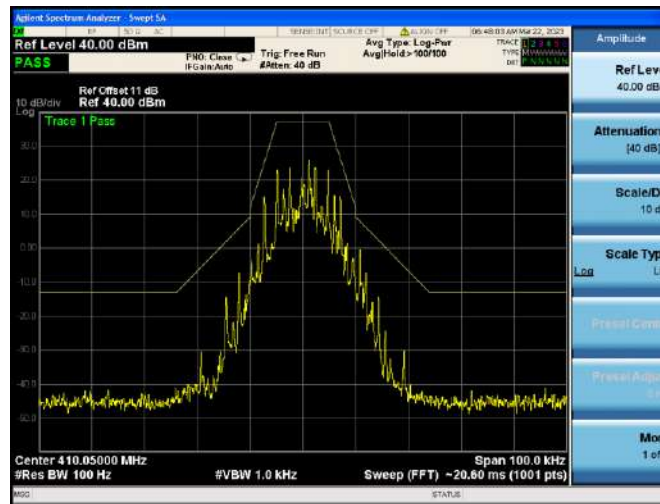


High: 469.950MHz

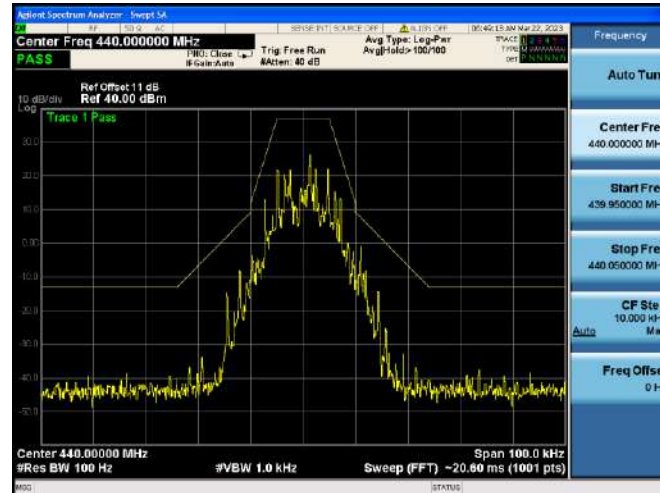


GMSK 25KHz Channel Spacing: Emission Mask

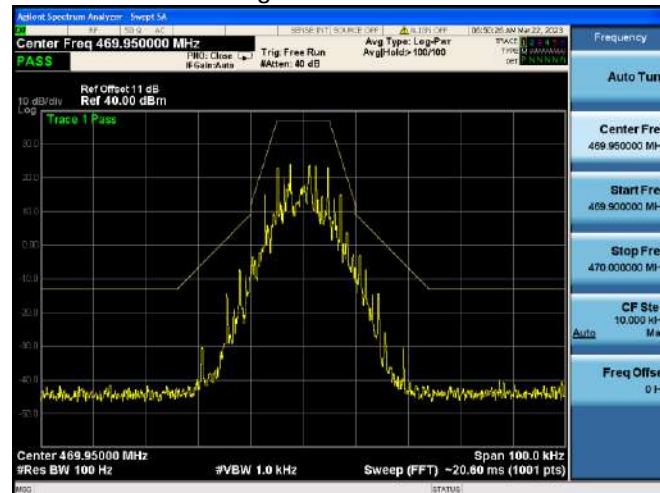
Low: 410.050MHz



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.

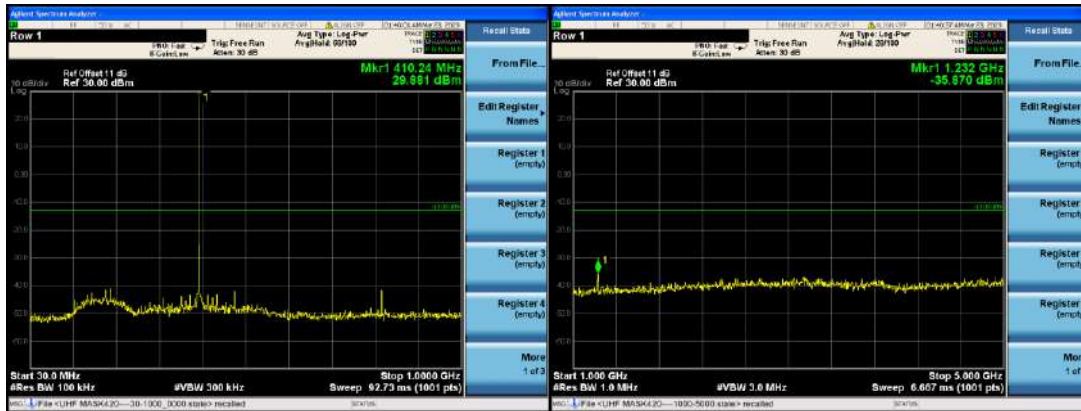
Test Result:	PASS
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3.3.2. Test data

Test plots as follows:

GMSK 6.25KHz Channel Spacing:

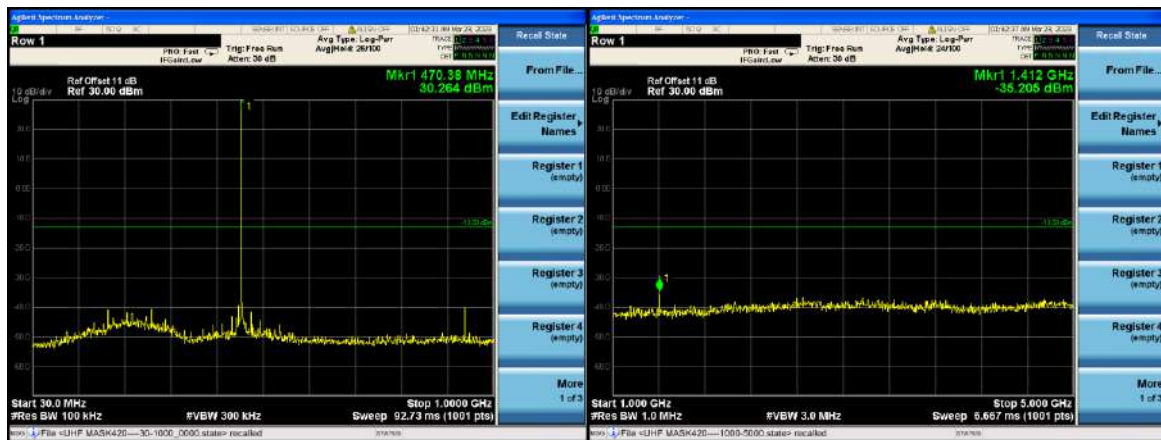
Low: 410.050MHz



Mid: 440.000MHz

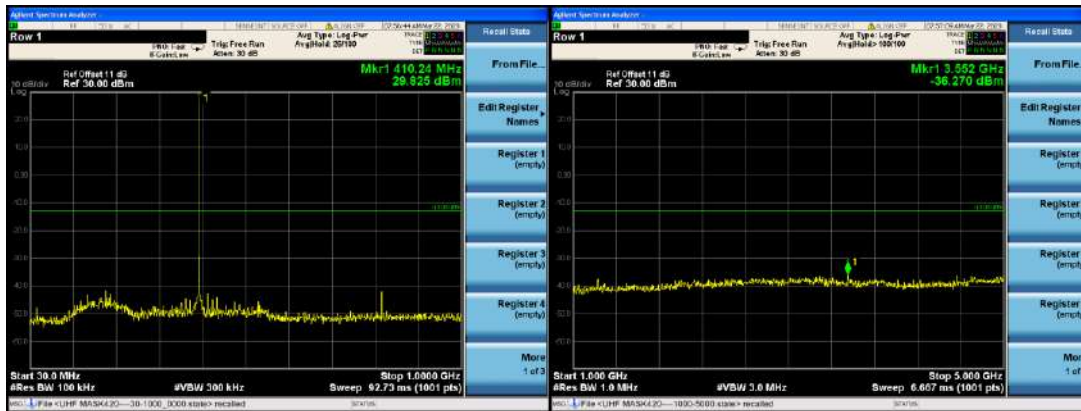


High: 469.950MHz

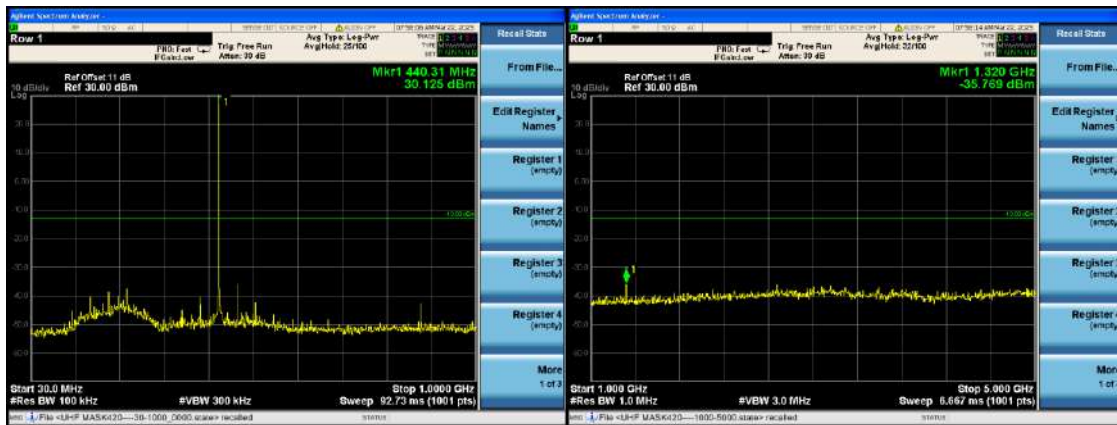


GMSK 12.5KHz Channel Spacing:

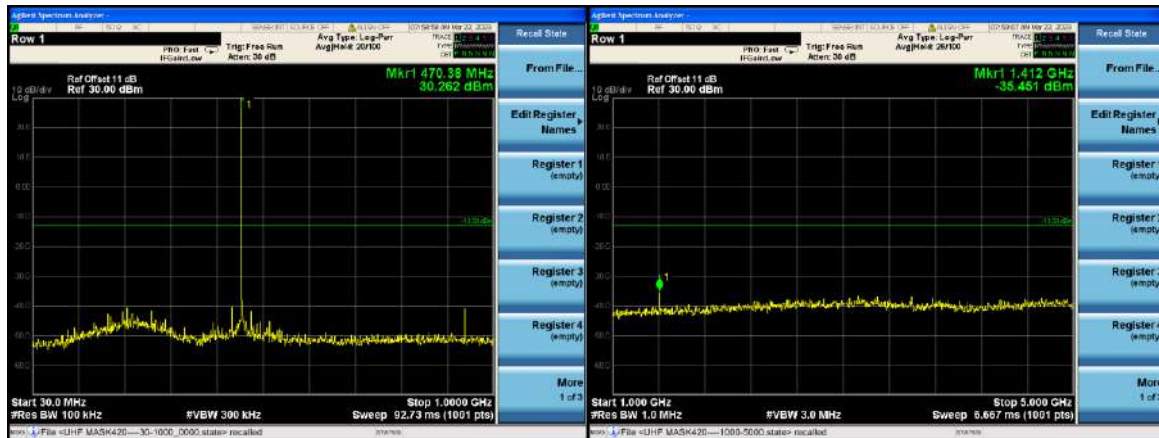
Low: 410.050MHz



Mid: 440.000MHz

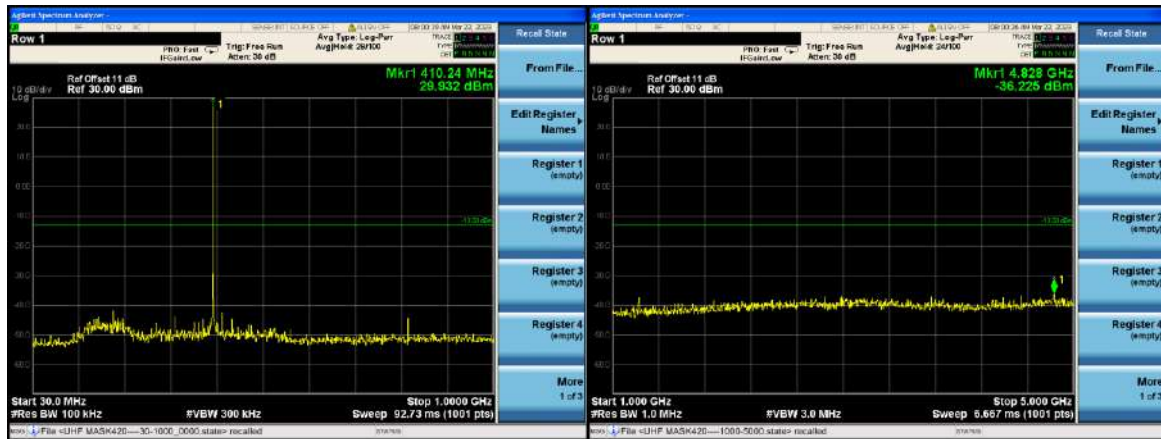


High: 469.950MHz

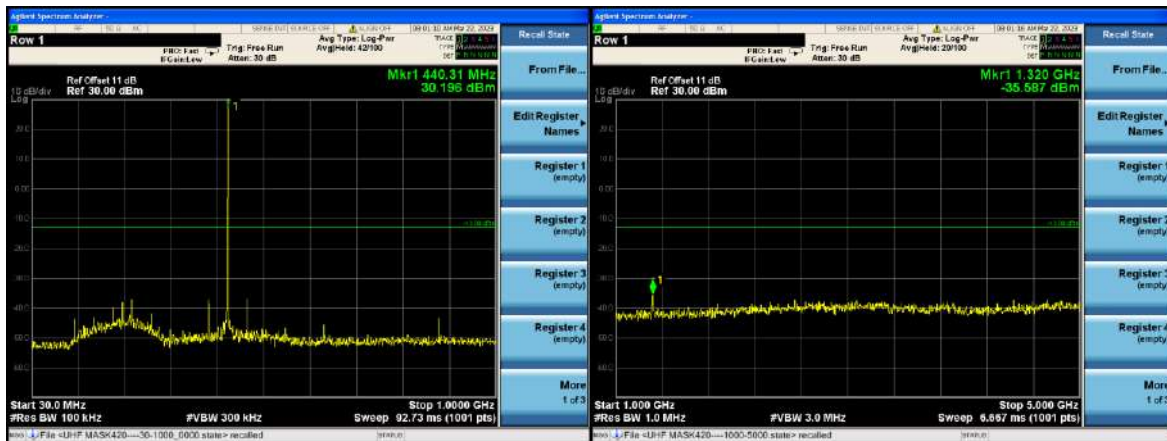


GMSK 25KHz Channel Spacing:

Low: 410.050MHz



Mid: 440.000MHz

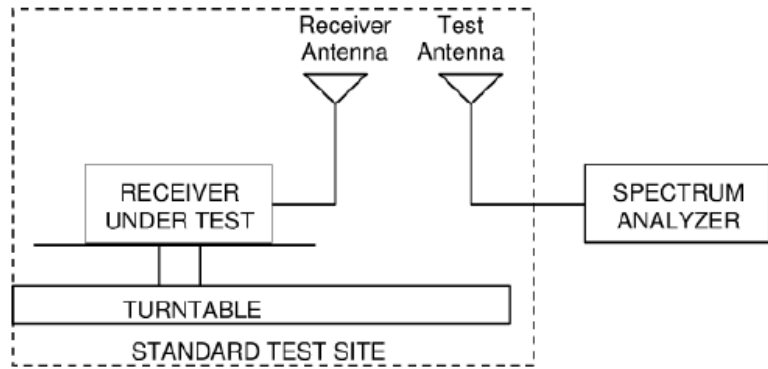


High: 469.950MHz



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 6.25KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
150.753	-94.23	V	0.24	31.35	-63.12	-25	-38.12
359.807	-90.52	V	0.26	31.34	-59.44	-25	-34.44
671.423	-92.68	V	0.42	31.24	-61.86	-25	-36.86
862.653	-93.87	V	0.58	30.71	-63.74	-25	-38.74
1263.815	-78.90	V	1.23	26.38	-53.75	-25	-28.75
3863.073	-78.38	V	1.68	25.47	-54.59	-25	-29.59
287.133	-94.89	H	0.43	31.24	-64.08	-25	-39.08
400.204	-96.20	H	0.45	30.68	-65.97	-25	-40.97
478.017	-94.05	H	0.64	30.85	-63.84	-25	-38.84
676.575	-97.80	H	0.79	31.12	-67.47	-25	-42.47
1369.176	-82.38	H	1.29	26.12	-57.55	-25	-32.55
3258.122	-77.69	H	1.62	25.41	-53.90	-25	-28.9

Test Mode: Mid: 440.000MHz, Channel Spacing 6.25KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
157.911	-94.18	V	0.24	31.35	-63.07	-25	-38.07
362.588	-90.55	V	0.26	31.34	-59.47	-25	-34.47
669.972	-92.89	V	0.42	31.24	-62.07	-25	-37.07
862.586	-93.77	V	0.58	30.71	-63.64	-25	-38.64
1263.083	-78.78	V	1.23	26.38	-53.63	-25	-28.63
3857.439	-78.10	V	1.68	25.47	-54.31	-25	-29.31
292.620	-95.00	H	0.43	31.24	-64.19	-25	-39.19
397.340	-95.79	H	0.45	30.68	-65.56	-25	-40.56
477.536	-94.26	H	0.64	30.85	-64.05	-25	-39.05
682.949	-97.35	H	0.79	31.12	-67.02	-25	-42.02
1366.759	-82.49	H	1.29	26.12	-57.66	-25	-32.66
3262.627	-77.65	H	1.62	25.41	-53.86	-25	-28.86

Test Mode: High: 469.950MHz, Channel Spacing 6.25KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
149.819	-94.44	V	0.24	31.35	-63.33	-25	-38.33
366.378	-90.51	V	0.26	31.34	-59.43	-25	-34.43
671.133	-92.77	V	0.42	31.24	-61.95	-25	-36.95
866.455	-93.68	V	0.58	30.71	-63.55	-25	-38.55
1259.762	-78.83	V	1.23	26.38	-53.68	-25	-28.68
3860.704	-78.21	V	1.68	25.47	-54.42	-25	-29.42
292.127	-94.61	H	0.43	31.24	-63.80	-25	-38.80
407.252	-96.14	H	0.45	30.68	-65.91	-25	-40.91
476.193	-94.21	H	0.64	30.85	-64.00	-25	-39.00
679.120	-97.89	H	0.79	31.12	-67.56	-25	-42.56
1371.936	-81.97	H	1.29	26.12	-57.14	-25	-32.14
3265.395	-77.90	H	1.62	25.41	-54.11	-25	-29.11

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)
150.753	-94.10	V	0.24	31.35	-62.99	-20	-42.99
359.807	-90.04	V	0.26	31.34	-58.96	-20	-38.96
671.423	-93.05	V	0.42	31.24	-62.23	-20	-42.23
862.653	-94.08	V	0.58	30.71	-63.95	-20	-43.95
1263.815	-78.94	V	1.23	26.38	-53.79	-20	-33.79
3863.073	-77.95	V	1.68	25.47	-54.16	-20	-34.16
287.133	-95.28	H	0.43	31.24	-64.47	-20	-44.47
400.204	-95.53	H	0.45	30.68	-65.30	-20	-45.30
478.017	-94.17	H	0.64	30.85	-63.96	-20	-43.96
676.575	-97.74	H	0.79	31.12	-67.41	-20	-47.41
1369.176	-82.42	H	1.29	26.12	-57.59	-20	-37.59
3258.122	-77.76	H	1.62	25.41	-53.97	-20	-33.97

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)
157.911	-93.83	V	0.24	31.35	-62.72	-20	-42.72
362.588	-90.03	V	0.26	31.34	-58.95	-20	-38.95
669.972	-92.75	V	0.42	31.24	-61.93	-20	-41.93
862.586	-93.35	V	0.58	30.71	-63.22	-20	-43.22
1263.083	-78.40	V	1.23	26.38	-53.25	-20	-33.25
3857.439	-78.17	V	1.68	25.47	-54.38	-20	-34.38
292.620	-94.73	H	0.43	31.24	-63.92	-20	-43.92
397.340	-95.78	H	0.45	30.68	-65.55	-20	-45.55
477.536	-94.39	H	0.64	30.85	-64.18	-20	-44.18
682.949	-97.78	H	0.79	31.12	-67.45	-20	-47.45
1366.759	-82.24	H	1.29	26.12	-57.41	-20	-37.41
3262.627	-77.60	H	1.62	25.41	-53.81	-20	-33.81

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)
149.819	-93.81	V	0.24	31.35	-62.70	-20	-42.70
366.378	-90.20	V	0.26	31.34	-59.12	-20	-39.12
671.133	-92.79	V	0.42	31.24	-61.97	-20	-41.97
866.455	-94.10	V	0.58	30.71	-63.97	-20	-43.97
1259.762	-78.59	V	1.23	26.38	-53.44	-20	-33.44
3860.704	-78.25	V	1.68	25.47	-54.46	-20	-34.46
292.127	-94.76	H	0.43	31.24	-63.95	-20	-43.95
407.252	-95.73	H	0.45	30.68	-65.50	-20	-45.50
476.193	-94.30	H	0.64	30.85	-64.09	-20	-44.09
679.120	-97.48	H	0.79	31.12	-67.15	-20	-47.15
1371.936	-82.65	H	1.29	26.12	-57.82	-20	-37.82
3265.395	-77.49	H	1.62	25.41	-53.70	-20	-33.70

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)
146.884	-94.45	V	0.24	31.35	-63.34	-25	-38.34
361.661	-90.58	V	0.26	31.34	-59.50	-25	-34.50
672.403	-93.10	V	0.42	31.24	-62.28	-25	-37.28
869.253	-93.35	V	0.58	30.71	-63.22	-25	-38.22
1260.906	-78.42	V	1.23	26.38	-53.27	-25	-28.27
3859.099	-78.44	V	1.68	25.47	-54.65	-25	-29.65
289.522	-94.86	H	0.43	31.24	-64.05	-25	-39.05
400.914	-95.61	H	0.45	30.68	-65.38	-25	-40.38
476.804	-94.64	H	0.64	30.85	-64.43	-25	-39.43
681.363	-97.77	H	0.79	31.12	-67.44	-25	-42.44
1370.675	-82.35	H	1.29	26.12	-57.52	-25	-32.52
3261.429	-77.57	H	1.62	25.41	-53.78	-25	-28.78

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)
157.631	-94.04	V	0.24	31.35	-62.93	-25	-37.93
364.164	-90.16	V	0.26	31.34	-59.08	-25	-34.08
672.658	-92.97	V	0.42	31.24	-62.15	-25	-37.15
857.656	-93.60	V	0.58	30.71	-63.47	-25	-38.47
1261.789	-78.60	V	1.23	26.38	-53.45	-25	-28.45
3860.792	-78.02	V	1.68	25.47	-54.23	-25	-29.23
286.101	-95.03	H	0.43	31.24	-64.22	-25	-39.22
404.305	-95.55	H	0.45	30.68	-65.32	-25	-40.32
472.706	-94.32	H	0.64	30.85	-64.11	-25	-39.11
684.044	-97.64	H	0.79	31.12	-67.31	-25	-42.31
1372.293	-82.12	H	1.29	26.12	-57.29	-25	-32.29
3261.991	-77.80	H	1.62	25.41	-54.01	-25	-29.01

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)
150.444	-94.04	V	0.24	31.35	-62.93	-25	-37.93
360.103	-90.13	V	0.26	31.34	-59.05	-25	-34.05
671.514	-93.34	V	0.42	31.24	-62.52	-25	-37.52
863.778	-93.56	V	0.58	30.71	-63.43	-25	-38.43
1256.913	-79.03	V	1.23	26.38	-53.88	-25	-28.88
3854.891	-78.27	V	1.68	25.47	-54.48	-25	-29.48
288.493	-95.14	H	0.43	31.24	-64.33	-25	-39.33
398.954	-95.73	H	0.45	30.68	-65.50	-25	-40.50
474.968	-94.44	H	0.64	30.85	-64.23	-25	-39.23
681.111	-97.39	H	0.79	31.12	-67.06	-25	-42.06
1372.828	-82.46	H	1.29	26.12	-57.63	-25	-32.63
3265.247	-77.36	H	1.62	25.41	-53.57	-25	-28.57

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 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, 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 --- 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 6.25KHz Channel Spacing	3.6	2	0.0055
	3.5	6	0.0141
	3.4	2	0.0046
	3.3	7	0.0169
	3.2	2	0.0052
	3.1	6	0.0134
Limit	1.25ppm		
Middle Channel 12.5KHz Channel Spacing	3.6	8	0.0177
	3.5	3	0.0075
	3.4	4	0.0080
	3.3	2	0.0054
	3.2	7	0.0158
	3.1	5	0.0111
Limit	2.5ppm		
Middle Channel 25KHz Channel Spacing	3.6	4	0.0094
	3.5	7	0.0149
	3.4	3	0.0072
	3.3	7	0.0161
	3.2	7	0.0159
	3.1	4	0.0083
Limit	5ppm		

Mode	Temperature (°C)	Frequency error (Hz)	frequency error (ppm)
Middle Channel 6.25KHz Channel Spacing	-20	9	0.0198
	-10	6	0.0131
	0	3	0.0070
	10	8	0.0175
	20	6	0.0127
	30	3	0.0075
	40	4	0.0093
	50	8	0.0185
Limit	1.25ppm		
Middle Channel 12.5KHz Channel Spacing	-20	4	0.0082
	-10	7	0.0152
	0	8	0.0188
	10	4	0.0083
	20	4	0.0090
	30	4	0.0102
	40	6	0.0142
	50	9	0.0193
Limit	2.5ppm		
Middle Channel 25KHz Channel Spacing	-20	4	0.0084
	-10	8	0.0182
	0	5	0.0113
	10	8	0.0181
	20	5	0.0118
	30	5	0.0124
	40	5	0.0115
	50	4	0.0084
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.

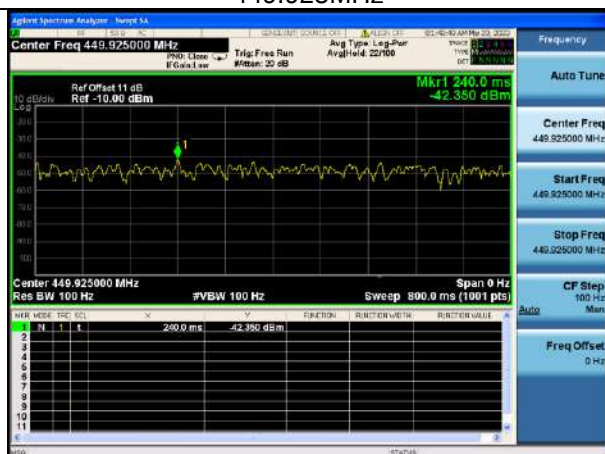
3.8. Adjacent channel power

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	-42.350	30-70=-40	PASS
	449.95	-43.496	30-70=-40	PASS
	449.975	-39.870	30-55=-25	PASS
	450.025	-40.514	30-55=-25	PASS
	450.05	-42.054	30-70=-40	PASS
	450.075	-42.331	30-70=-40	PASS
469.950	469.875	-44.211	30-70=-40	PASS
	469.900	-43.523	30-70=-40	PASS
	469.925	-43.593	30-55=-25	PASS
	469.975	-42.500	30-55=-25	PASS
	470.000	-44.128	30-70=-40	PASS
	470.025	-43.104	30-70=-40	PASS

449.925MHz



Agilent Spectrum Analyzer - Sweep 1A

Center Freq 449.950000 MHz

Ref Offset 11 dB
Ref -10.00 dBm

Min: -10.00 dBm
Max: 11.00 dBm

Resolution BW 100 Hz

Span 0 Hz

Sweep 800.0 ms (100 pts)

Marker 1 197.6 ms
-43.496 dBm

Marker	Freq	Power
1	449.950000 MHz	-43.496 dBm

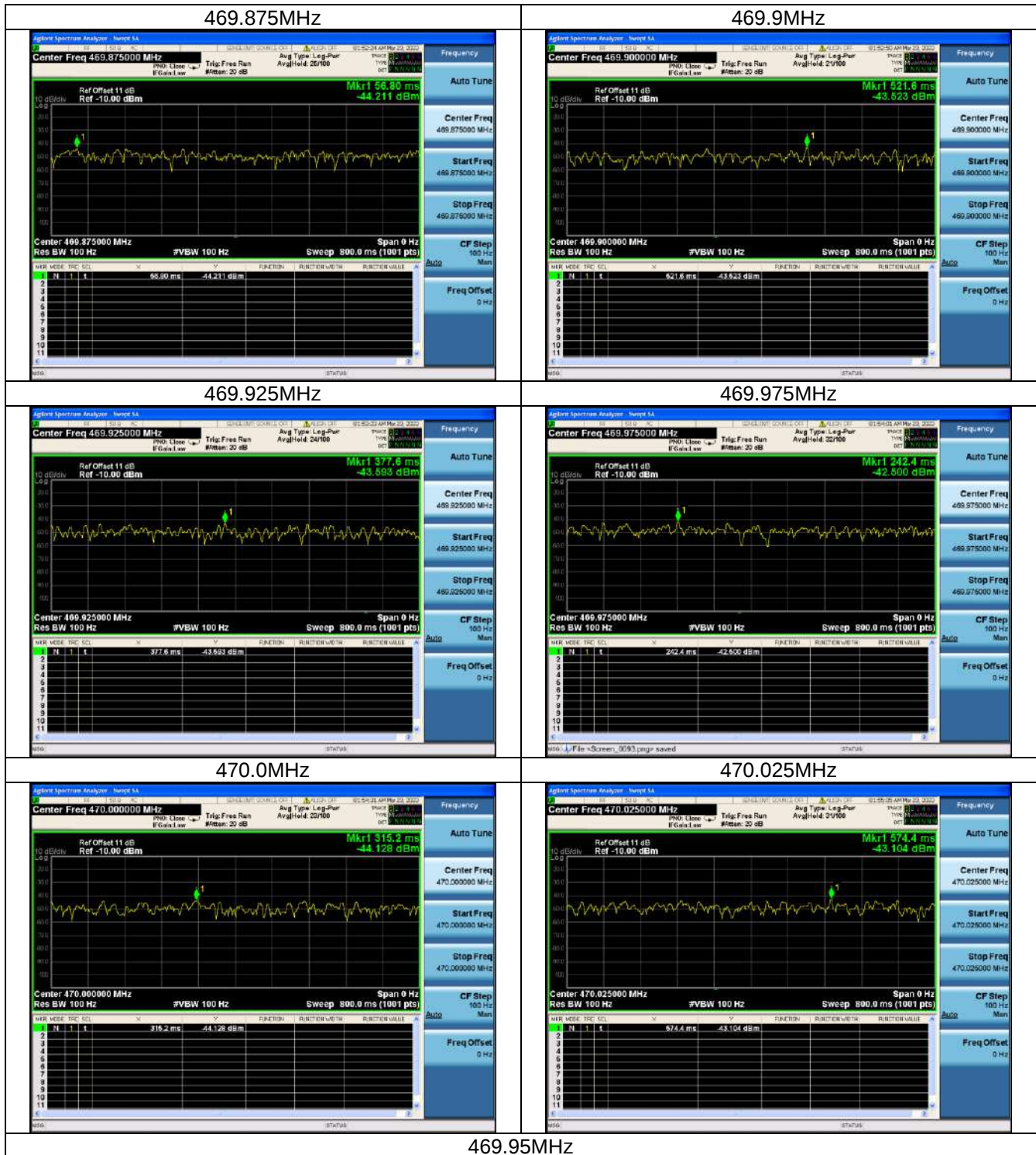
Rohde & Schwarz Spectrum Analyzer - Channel SA
 Center Freq 449.975000 MHz
 Ref Offset 11 dB
 Ref -10.00 dBm
 Mk1 324.0 ms
 -39.870 dBm
 Auto Tune
 Center Freq 449.975000 MHz
 Start Freq 449.975000 MHz
 Stop Freq 449.975000 MHz
 CF Step 100 Hz
 Freq Offset 0 Hz

[illegible]

Signal Spectrum Analyzer - Noise MA
 Center Freq 450.050000 MHz
 Ref Offset 11 dB
 Ref -10.00 dBm
 Trig Freq Span
 Mean: 20 dB
 Mkr1 452.4 ms
 -42.084 dBm
 Center 450.050000 MHz
 Res BW 100 Hz
 Span 0 Hz
 Sweep 800.0 ms (1001 pts)
 N 1 t
 552.4 ms
 -42.084 dBm
 Frequency
 Auto Tune
 Center Freq
 450.050000 MHz
 Start Freq
 450.050000 MHz
 Stop Freq
 450.050000 MHz
 CF Step
 100 Hz
 Man
 Freq Offset
 0 Hz

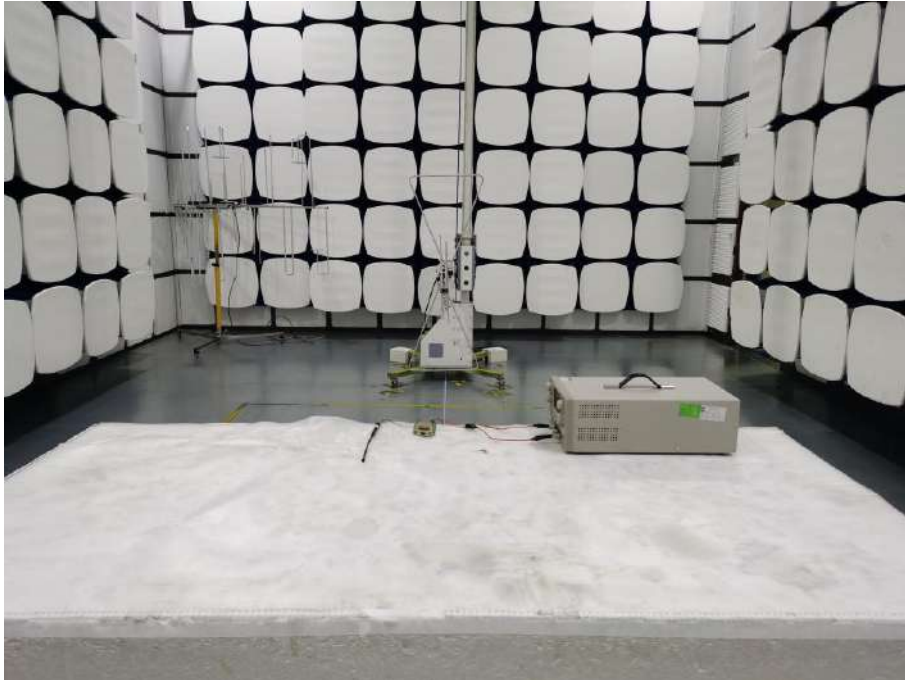
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450MHz



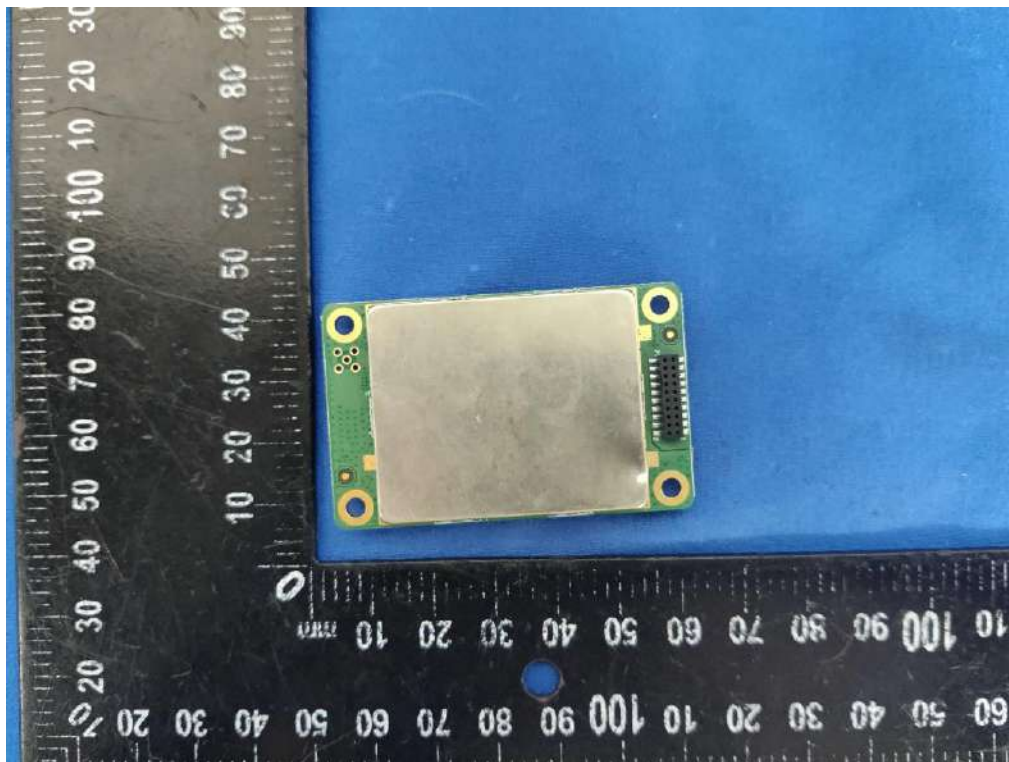
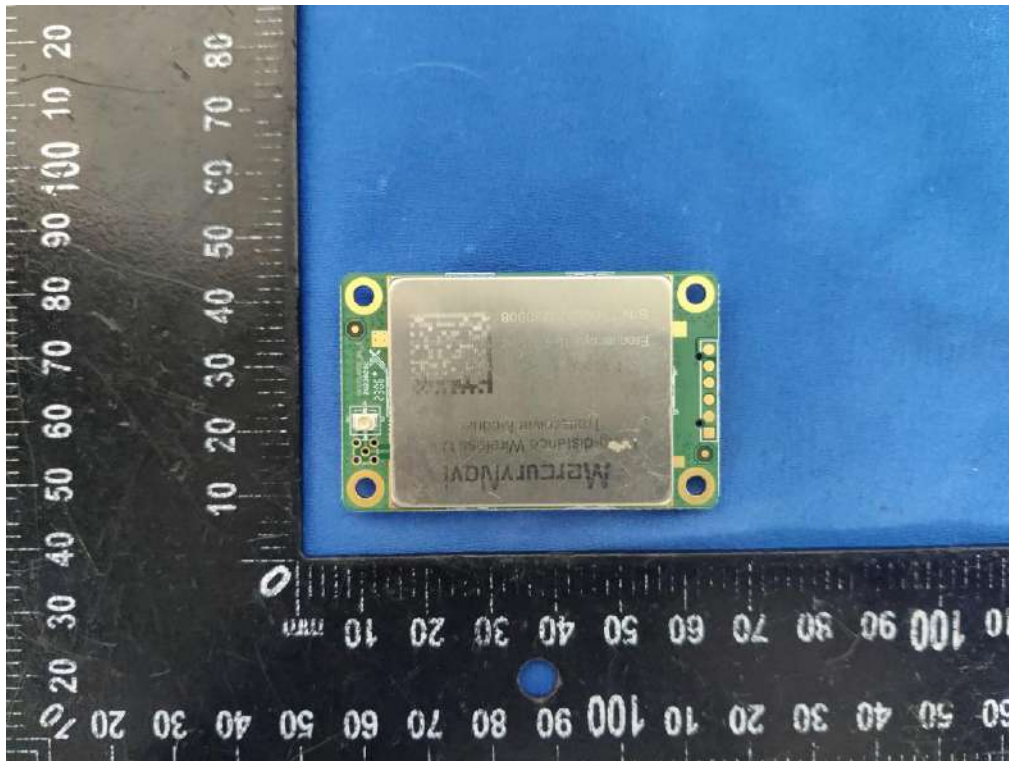
4. Test Setup Photo

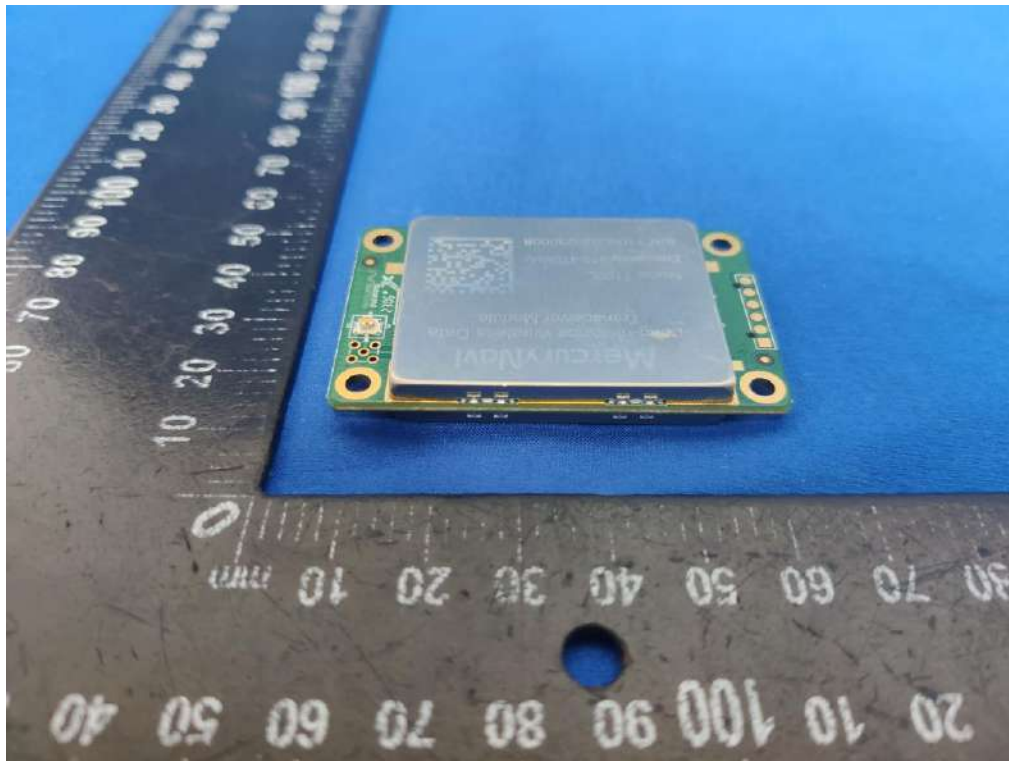
4.1. Photos of Radiated emission

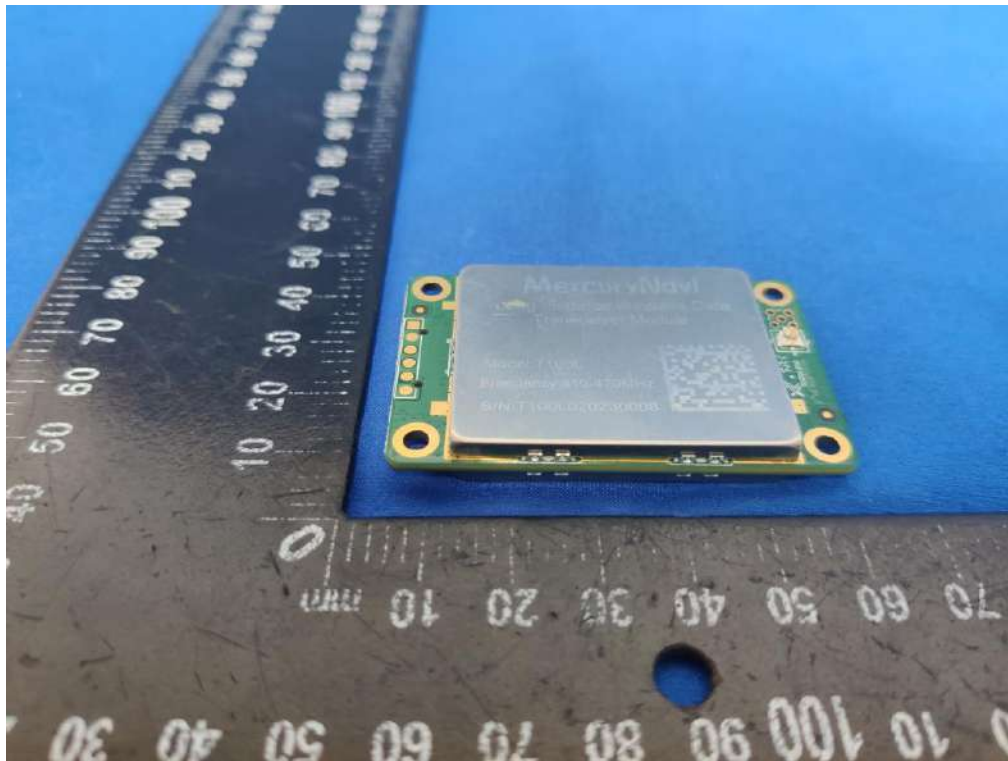


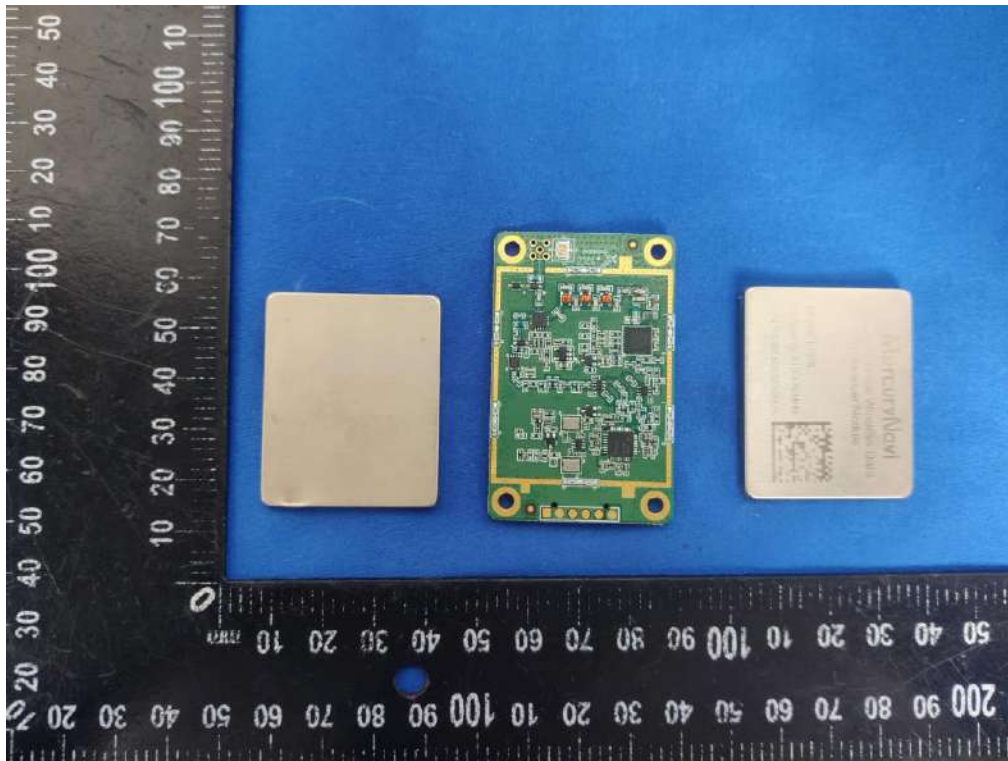
5. EUT Photo

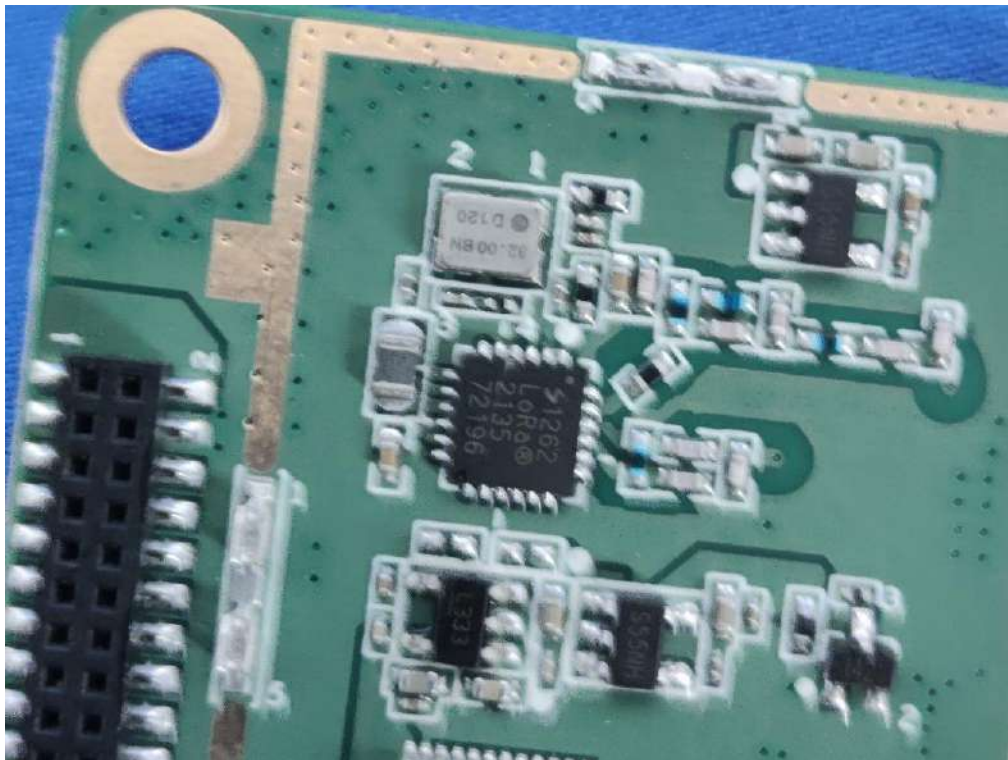
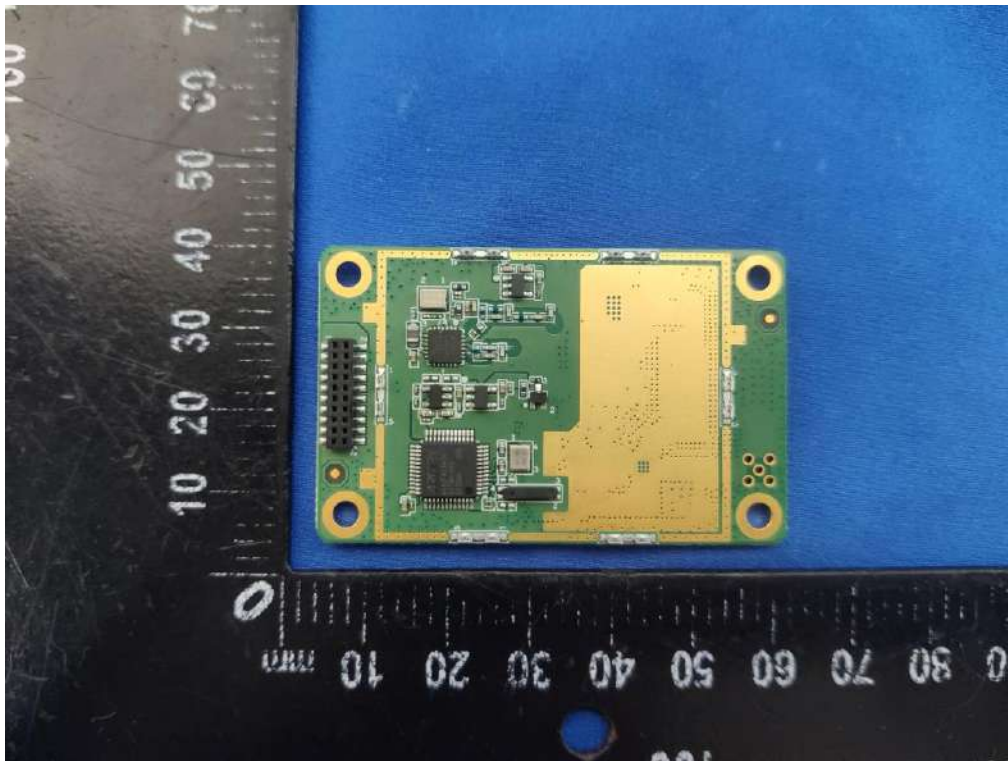


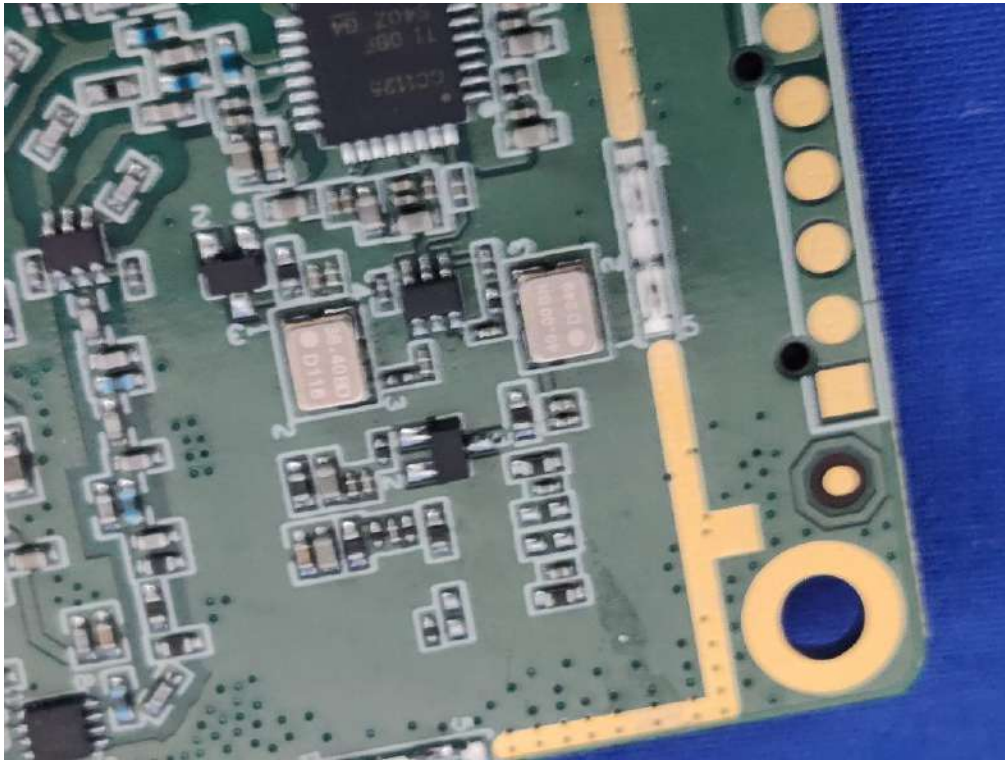












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