Shenzhen Toby Technology Co., Ltd

FCC TEST REPORT

FCC ID: SY4-A02026

On Behalf of

Shanghai Huace Navigation Technology LTD.

Geodetic GNSS Receiver

Model No.: i50

Prepared for	:	Shanghai Huace Navigation Technology LTD.
Address	:	599 Gaojing Road, Building D, Shanghai 201702, China

Prepared By	:	Shenzhen Toby Technology Co., Ltd.
Address	:	1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, China

Report Number	:	TB-FCC174711
Date of Receipt	:	June 18, 2020
Date of Test	:	June 18, 2020 – July 31, 2020
Date of Report	:	July 31, 2020
Version Number	:	V0

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TEST REPORT DECLARATION

Applicant	:	Shanghai Huace Navigation Technology LTD.
Address	:	599 Gaojing Road, Building D, Shanghai 201702, China
Manufacturer	:	Shanghai Huace Navigation Technology LTD.
Address	:	599 Gaojing Road, Building D, Shanghai 201702, China
EUT Description	:	Geodetic GNSS Receiver
(A) Model No.	:	i50
(B) Trademark	:	CHCNAV

Measurement Standard Used:

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

ANSI C63.26: 2015

The device described above is tested by Shenzhen Toby Technology 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 limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Toby Technology 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 Toby Technology Co., Ltd.

Tested by (name + signature).....:	Jack Deng Project Engineer	.....
Approved by (name + signature).....:	Rebcea Project Manager	.....
Date of issue..... .....:	July 31, 2020	

Revision History

Revision	Issue Date	Revisions	Revised By
V0	July 31, 2020	Initial released Issue	Ivan Su

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	§90.213	P
Frequency Stability	FCC PART 90	§90.214	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
Note:	1. P is an abbreviation for Pass. 2. F is an abbreviation for Fail. 3. N/A is an abbreviation for Not Applicable.		

2. General Information

2.1.Description of Device (EUT)

Description	:	Geodetic GNSS Receiver
Trademark	:	CHCNAV
Model Number	:	i50
DIFF.	:	N/A
Test Voltage	:	DC 12-36V, 2A (for DC port) or DC 7.4V, 3400mAh (for replaceable lithium battery)
UHF		
Operation frequency	:	410MHz-470MHz
Conducted Power	:	0.5W(27dBm), 1W(30dBm), 2W(33dBm)
Bandwidth	:	12.5KHz, 25KHz
Modulation type	:	GMSK
Antenna Type	:	External Antenna, Maximum Gain is 4.0dBi
Software version	:	V1.0
Hardware version	:	i50_MAIN_V2.1

Note: All Conducted Power have been tested, and recorded the worst case 2W(33dBm) results in this report.

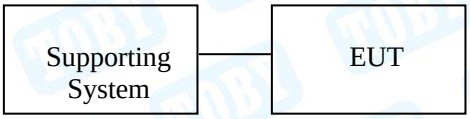
2.2.Accessories of Device (EUT)

Accessories1	:	/
Manufacturer	:	/
Model	:	/
Ratings	:	/

2.3.Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or DOC
/	/	/	/	/	/

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+BW12.5KHz+TX	at maximum rated power for transmitter
2	GMSK+BW12.5KHz+TX	at minimum rated power for transmitter
3	GMSK+BW25KHz+TX	at maximum rated power for transmitter
4	GMSK+BW25KHz+TX	at minimum rated power for transmitter

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

Description Operation Frequency

QMSK		
Test Channel	BW(KHz)	Frequency(MHz)
Low	12.5	410.125
	25	410.250
Mid	12.5	456.125
	25	456.250
High	12.5	469.975
	25	469.850

2.6.Test Conditions

Items	Required	Actual
Temperature range:	15-35℃	24℃
Humidity range:	25-75%	56%
Pressure range:	86-106kPa	98kPa

2.7.Test Facility

The testing report were performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at 1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, Guangdong, China. At the time of testing, the following bodies accredited the Laboratory:

CNAS (L5813)

The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

A2LA Certificate No.: 4750.01

The laboratory has been accredited by American Association for Laboratory Accreditation(A2LA) to ISO/IEC 17025： 2005 General Requirements for the Competence of Testing and Calibration Laboratories for the technical competence in the field of Electrical Testing. And the A2LA Certificate No.: 4750.01.

IC Registration No.: (11950A)

The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A.

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)	4.60dB
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	4.50dB
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	4.20dB
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%

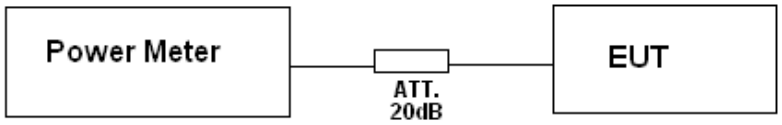
2.9.Test Equipment List

Radiation Emission Test					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 13, 2019	Jul. 12, 2020
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jul. 13, 2019	Jul. 12, 2020
Spectrum Analyzer	Rohde & Schwarz	FSVR	1311.006K40-100945-DH	Jul. 13, 2019	Jul. 12, 2020
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar.01, 2020	Feb. 28, 2022
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar.01, 2020	Feb. 28, 2022
Horn Antenna	ETS-LINDGREN	BBHA 9170	BBHA9170582	Aug.07, 2019	Aug. 06, 2020
Loop Antenna	SCHWARZBECK	FMZB 1519 B	1519B-059	Jul. 13, 2019	Jul. 12, 2020
Pre-amplifier	Sonoma	310N	185903	Mar.01, 2020	Feb. 28, 2021
Pre-amplifier	HP	8449B	3008A00849	Mar.01, 2020	Feb. 28, 2021
Pre-amplifier	EMCI	EMC02325	980217	Jul. 27, 2019	Jul. 26, 2020
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar.01, 2020	Feb. 28, 2021
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A
Antenna Conducted Emission					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 13, 2019	Jul. 12, 2020
Spectrum Analyzer	Rohde & Schwarz	ESCI	100010/007	Jul. 13, 2019	Jul. 12, 2020
MXA Signal Analyzer	Agilent	N9020A	MY49100060	Sep. 16, 2019	Sep. 15, 2020
Vector Signal Generator	Agilent	N5182A	MY50141294	Sep. 16, 2019	Sep. 15, 2020
Analog Signal Generator	Agilent	N5181A	MY50141953	Sep. 16, 2019	Sep. 15, 2020
RF Power Sensor	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO26	Sep. 16, 2019	Sep. 15, 2020
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO29	Sep. 16, 2019	Sep. 15, 2020
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO31	Sep. 16, 2019	Sep. 15, 2020
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO33	Sep. 16, 2019	Sep. 15, 2020
Attenuator 1	MACCM	20dB	N/A	Sep. 16, 2019	Sep. 15, 2020
Power Splitter	Mini-Circuits	ZFRSC-183-S+	SF559101632	Sep. 16, 2019	Sep. 15, 2020
Oscilloscope	Agilent	54833A	165521	Sep. 20, 2019	Sep. 19, 2020

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:	
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 (2W):

Frequency (MHz)	Maximum Conducted Output Power(Peak) (dBm)	Maximum ERP(dBm)	Stated ERP Power (dBm)	Limit (dBm)	Result
410.125	28.857	30.875	33	33	PASS
410.250	29.381	31.597	33	33	PASS
456.125	30.003	31.853	33	33	PASS
456.250	29.015	31.373	33	33	PASS
469.975	29.348	30.978	33	33	PASS
469.850	29.374	30.692	33	33	PASS

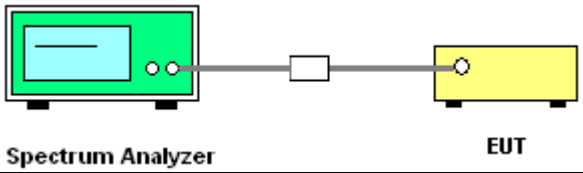
GMSK mode (1W):					
Frequency (MHz)	Maximum Conducted Output Power(Peak) (dBm)	Maximum ERP(dBm)	Stated ERP Power (dBm)	Limit (dBm)	Result
410.125	27.768	29.618	30	33	PASS
410.250	26.889	28.739	30	33	PASS
456.125	26.753	28.603	30	33	PASS
456.250	26.701	28.551	30	33	PASS
469.975	27.046	28.896	30	33	PASS
469.850	27.147	28.997	30	33	PASS

GMSK mode (0.5W):					
Frequency (MHz)	Maximum Conducted Output Power(Peak) (dBm)	Maximum ERP(dBm)	Stated ERP Power (dBm)	Limit (dBm)	Result
410.125	23.426	25.276	27	33	PASS
410.250	23.352	25.202	27	33	PASS
456.125	23.444	25.294	27	33	PASS
456.250	23.668	25.518	27	33	PASS
469.975	24.449	26.299	27	33	PASS
469.850	24.689	26.539	27	33	PASS

Note: 1. 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:	
Test Procedure:	The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the Frequency band ± 50KHz from the carrier frequency.
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)	Result
Low	410.125	14.52	10.088	PASS
Mid	456.125	12.97	9.779	PASS
High	469.975	14.04	10.298	PASS

GMSK 25KHz Channel Spacing:				
Channel	Frequency (MHz)	26dB Bandwidth (KHz)	99% Occupied Bandwidth (KHz)	Result
Low	410.250	21.29	19.315	PASS
Mid	456.250	21.35	19.406	PASS
High	469.850	21.17	19.317	PASS

Emission Mask:

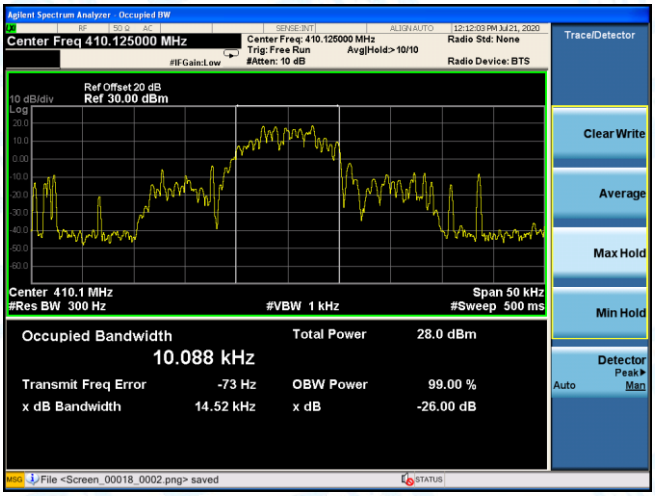
GMSK 12.5KHz Channel Spacing:				
Channel	Frequency (MHz)	Applicable Mask	RBW	Result
Low	410.125	D	300	PASS
Mid	456.125	D	300	PASS
High	469.975	D	300	PASS

GMSK 25KHz Channel Spacing:				
Channel	Frequency (MHz)	Applicable Mask	RBW	Result
Low	410.250	B	300	PASS
Mid	456.250	B	300	PASS
High	469.850	B	300	PASS

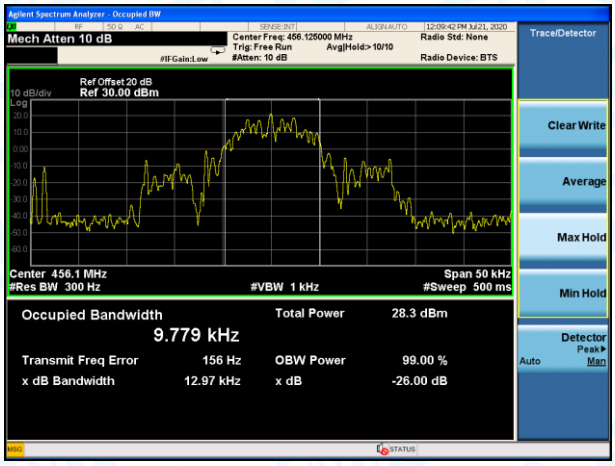
Test plots as follows:

GMSK 12.5KHz Channel Spacing: Occupied Bandwidth

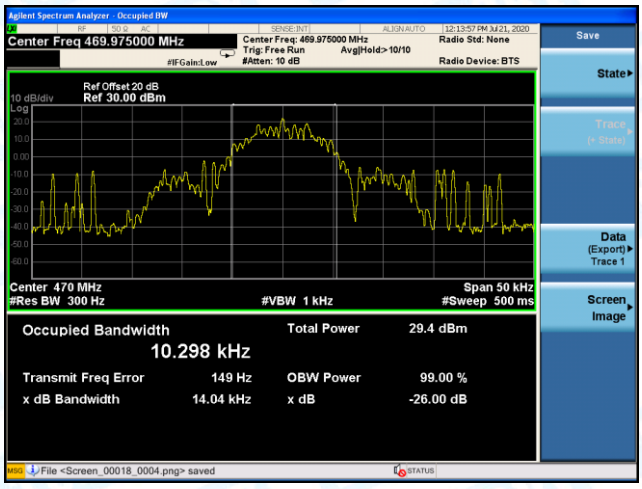
Low: 410.125MHz



Mid: 456.125MHz

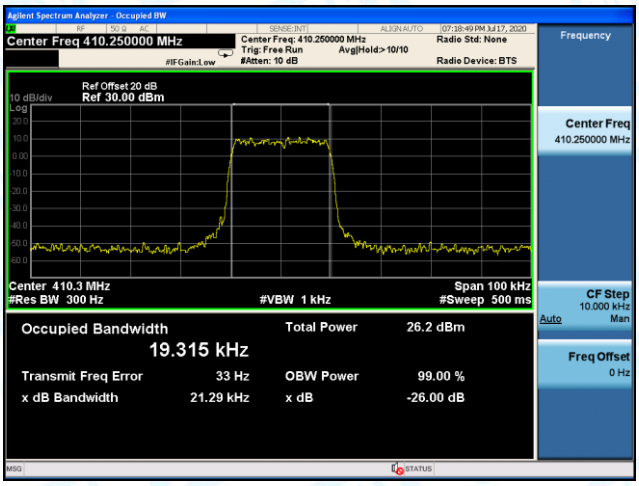


High: 469.975MHz

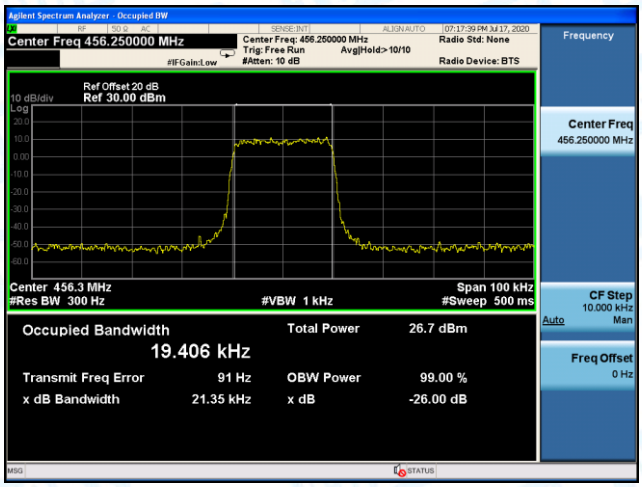


GMSK 25KHz Channel Spacing: Occupied Bandwidth

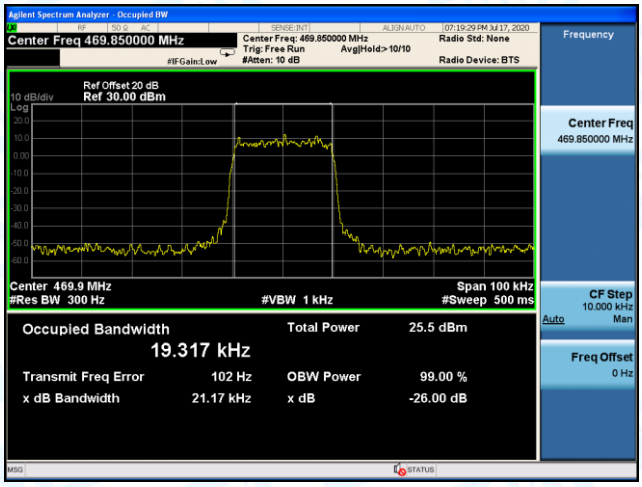
Low: 410.250MHz



Mid: 456.250MHz

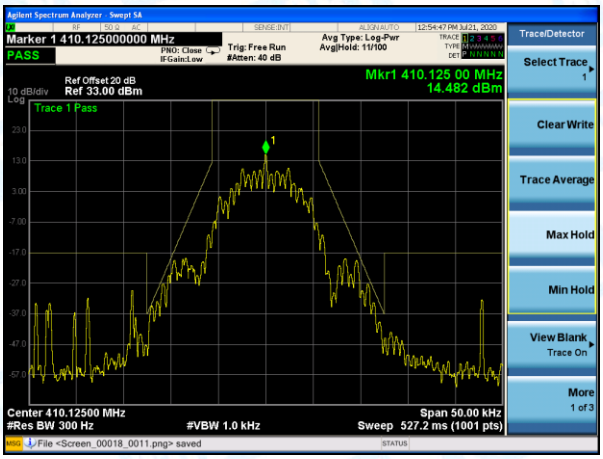


High: 469.850MHz

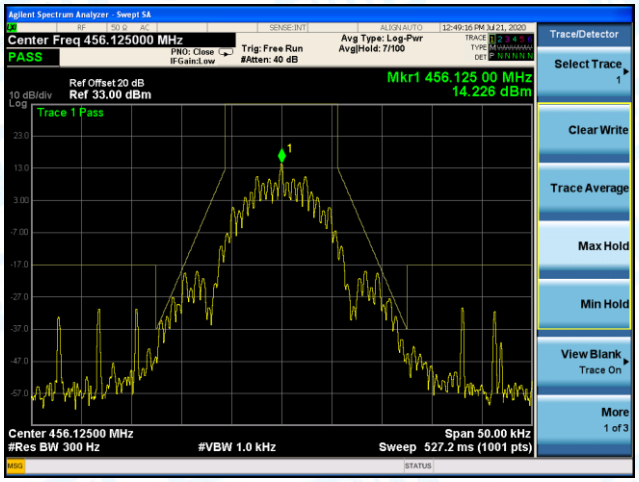


GMSK 12.5KHz Channel Spacing: **Emission Mask**

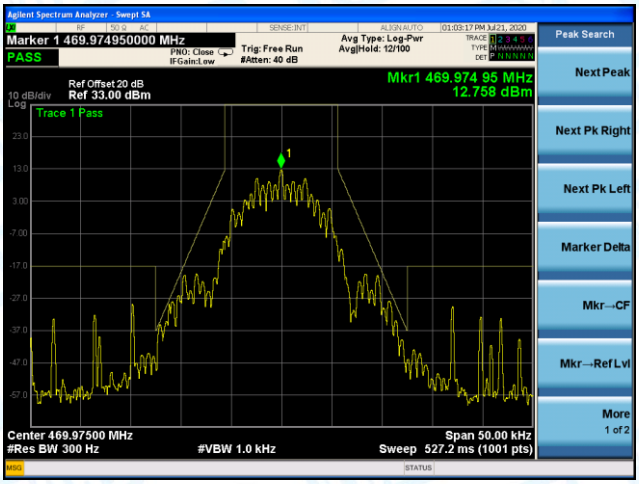
Low: 410.125MHz



Mid: 456.125MHz

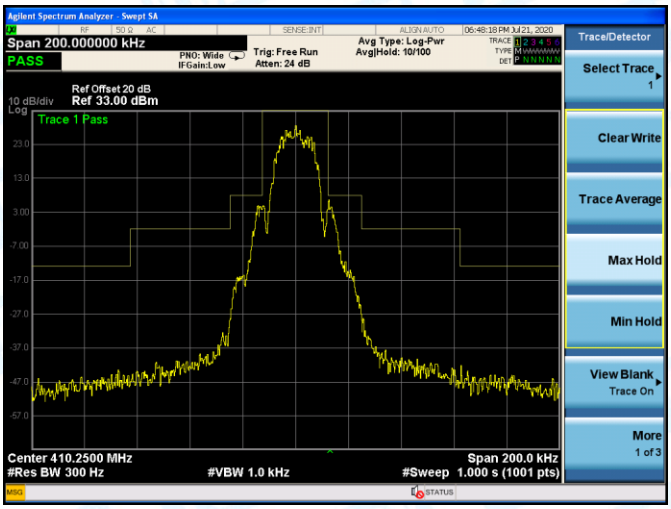


High: 469.975MHz

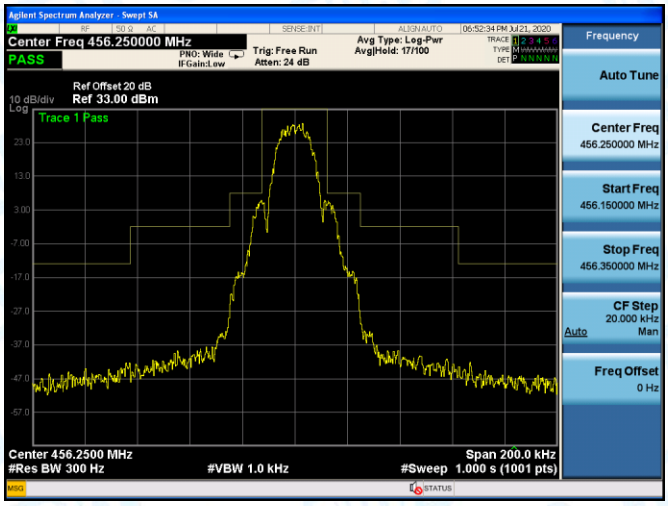


GMSK 25KHz Channel Spacing: **Emission Mask**

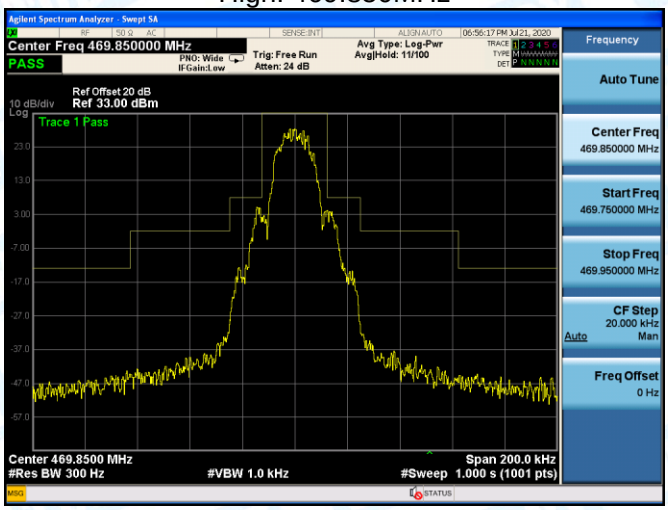
Low: 410.250MHz



Mid: 456.250MHz

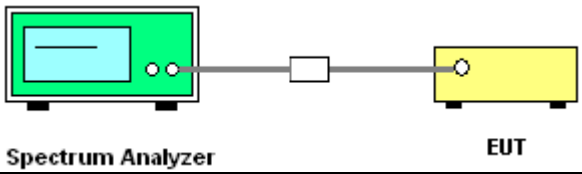


High: 469.850MHz



3.3. Spurious Emissions(conducted)

3.3.1.Test Specification

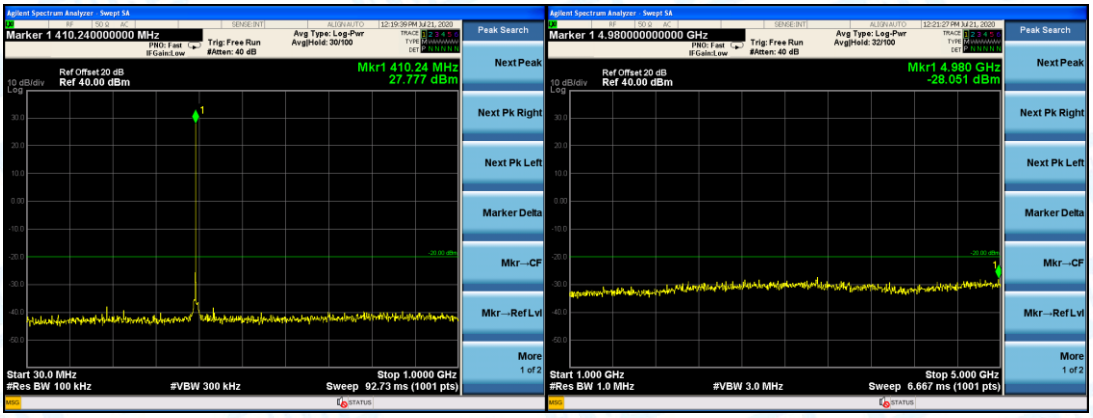
Test Requirement:	FCC Part 90.210
Test Setup:	
Test Limit:	Modulation Type: GMSK FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 12: For 12.5 bandwidth: On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz at least: High: 50 + 10 log (Pwatts) = 50 + 10 log (3.0) =54.77 dB Low: 50 + 10 log (Pwatts) = 50 + 10 log (1.0) =50.00 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 34.77 dBm for High rated power and 30.00 for lower rated power. High: Limit (dBm) = 34.77 – 50 – 10log (3.0) = -20 dBm Low: Limit (dBm) = 30.00 – 50 – 10log (1.0) = -20 dBm For 25 kHz bandwidth: On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 62.5 kHz at least: High: 43 + 10 log (Pwatts) = 43 + 10 log (3.0) = 47.77 dB Low: 43 + 10 log (Pwatts) = 43 + 10 log (1.0) = 43.00 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 34.77 dBm for High rated power and 30.00 for lower rated power. High: Limit (dBm) = 34.77 – 43 – 10log (3.0) = -13 dBm Low: Limit (dBm) = 30.00 – 43 – 10log (1.0) = -13 dBm Note: 1. In general, the worst case attenuation requirement shown above was applied. 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

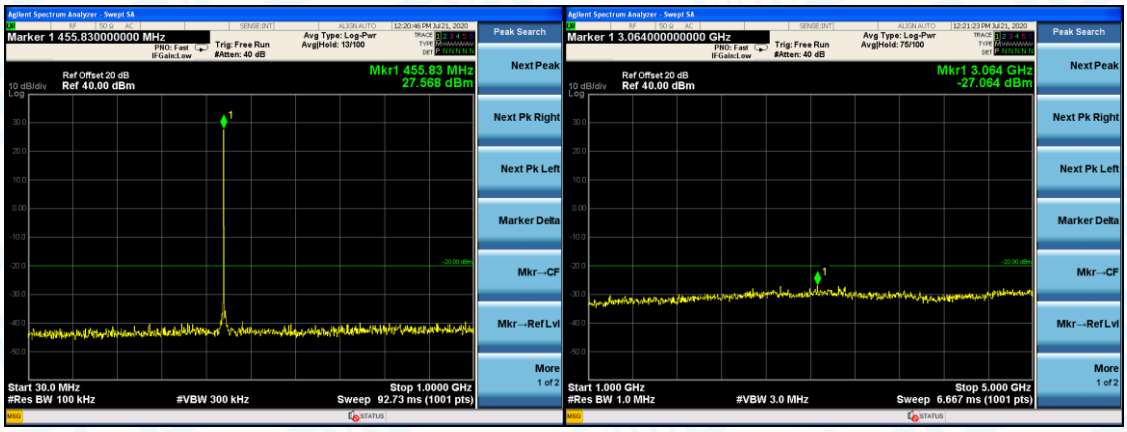
Test plots as follows:

GMSK 12.5KHz Channel Spacing:

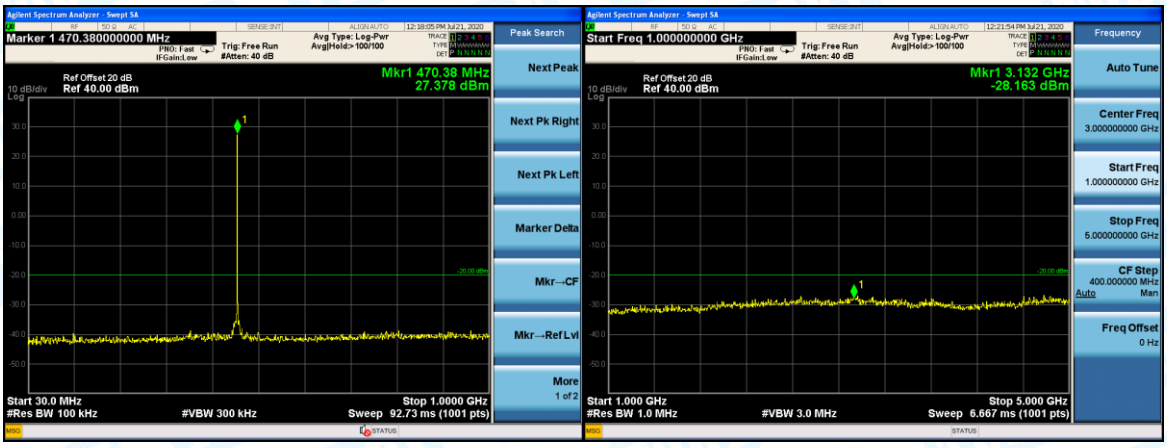
Low: 410.125MHz



Mid: 456.125MHz

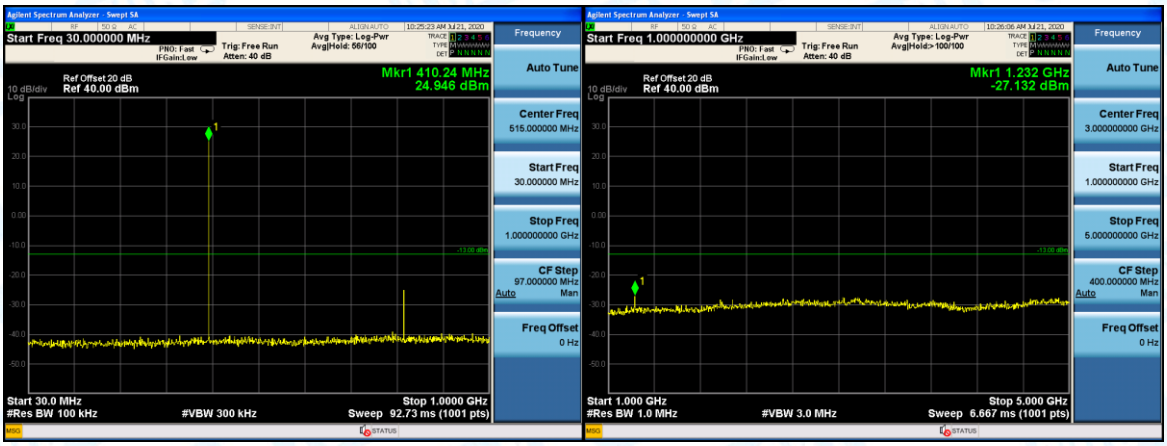


High: 469.975MHz

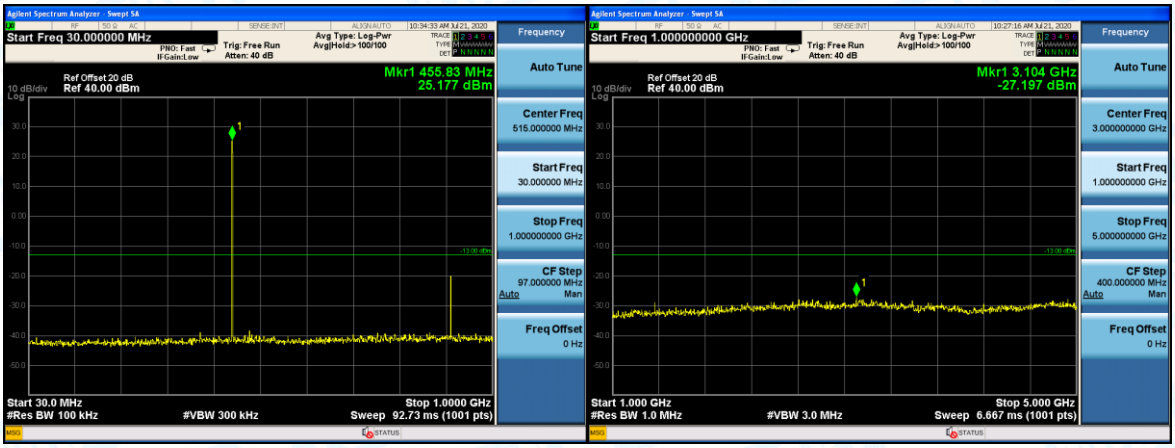


GMSK 25KHz Channel Spacing:

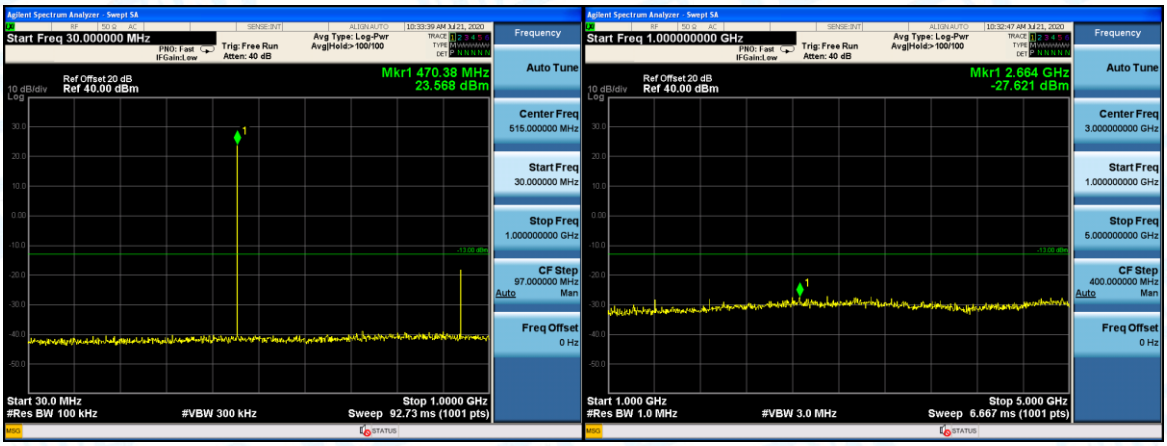
Low: 410.250MHz



Mid: 456.250MHz

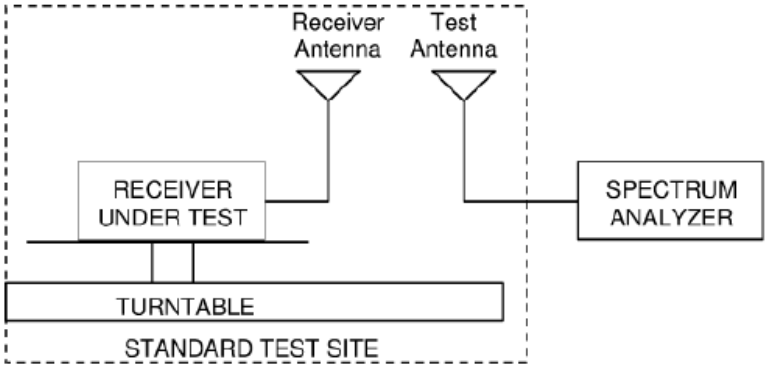


High: 469.850MHz



3.4. Radiated Spurious Emission

3.4.1.Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC Part 90.210</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.26</td></tr>
<tr><td>Measurement Distance:</td><td>3 m</td></tr>
<tr><td>Antenna Polarization:</td><td>Horizontal & Vertical</td></tr>
<tr><td>Operation mode:</td><td>Refer to item 4.1</td></tr>
<tr><td>Receiver Setup:</td><td>
<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>
</td></tr>
<tr><td>Limit:</td><td>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 + 10log (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 (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log(P) dB or 70 dB, whichever is the lesser attenuation.</td></tr>
<tr><td>Test setup:</td><td> 
</td></tr>
<tr><td>Test Procedure:</td><td>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</td></tr>
</table>

	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 Log_{10} (power out in Watts) for EUT with a 12.5 kHz and 25KHz channel bandwidth.
Test results:	PASS

3.4.2.Test Data

Test Mode: Low: 410.125MHz, Channel Spacing 12.5KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
152.648	-93.25	V	0.24	31.35	-62.14	-20	-42.14
360.904	-93.90	V	0.26	31.34	-62.82	-20	-42.82
673.313	-96.86	V	0.42	31.24	-66.04	-20	-46.04
820.250	-48.19	V	0.57	30.71	-18.05	-20	1.95
1263.509	-85.11	V	1.23	26.38	-59.96	-20	-39.96
3864.166	-80.99	V	1.68	25.47	-57.2	-20	-37.2
285.253	-96.62	H	0.43	31.24	-65.81	-20	-45.81
399.050	-94.21	H	0.45	30.68	-63.98	-20	-43.98
479.190	-96.52	H	0.46	30.85	-66.13	-20	-46.13
820.250	-46.28	H	0.57	30.71	-16.14	-20	3.86
1368.694	-85.26	H	1.29	26.12	-60.43	-20	-40.43
3258.712	-81.59	H	1.62	25.41	-57.8	-20	-37.8

Test Mode: Mid: 456.125MHz, Channel Spacing 12.5KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
155.210	-94.35	V	0.24	31.35	-63.24	-20	-43.24
364.462	-93.29	V	0.26	31.34	-62.21	-20	-42.21
669.814	-94.91	V	0.42	31.24	-64.09	-20	-44.09
912.250	-94.69	V	0.64	29.71	-65.62	-20	-45.62
1261.405	-80.70	V	1.23	26.38	-55.55	-20	-35.55
3858.853	-78.07	V	1.68	25.47	-54.28	-20	-34.28
290.754	-93.25	H	0.43	31.24	-62.44	-20	-42.44
397.852	-95.81	H	0.45	30.68	-65.58	-20	-45.58
479.276	-92.78	H	0.44	30.85	-62.37	-20	-42.37
912.250	-96.27	H	0.64	29.71	-67.2	-20	-47.2
1368.272	-83.99	H	1.29	26.12	-59.16	-20	-39.16
3262.627	-82.00	H	1.62	25.41	-58.21	-20	-38.21

Test Mode: High: 469.975MHz, Channel Spacing 12.5KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
149.976	-92.66	V	0.24	31.35	-61.55	-20	-41.55
363.698	-93.52	V	0.26	31.34	-62.44	-20	-42.44
672.157	-93.38	V	0.42	31.24	-62.56	-20	-42.56
939.950	-93.23	V	0.65	29.69	-64.19	-20	-44.19
1259.426	-84.83	V	1.23	26.38	-59.68	-20	-39.68
3858.867	-82.64	V	1.68	25.47	-58.85	-20	-38.85
290.920	-95.47	H	0.43	31.24	-64.66	-20	-44.66
405.147	-96.38	H	0.45	30.68	-66.15	-20	-46.15
473.758	-96.46	H	0.44	30.85	-66.05	-20	-46.05
939.950	-100.10	H	0.65	29.69	-71.06	-20	-51.06
1372.894	-84.09	H	1.29	26.12	-59.26	-20	-39.26
3264.131	-81.73	H	1.62	25.41	-57.94	-20	-37.94

Test Mode: Low: 410.250MHz, Channel Spacing 25KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
149.365	-95.89	V	0.24	31.35	-64.78	-13	-51.78
360.122	-92.33	V	0.26	31.34	-61.25	-13	-48.25
672.254	-93.62	V	0.42	31.24	-62.8	-13	-49.8
820.500	-49.38	V	0.57	30.70	-19.25	-13	-6.25
1259.385	-83.35	V	1.23	26.38	-58.20	-13	-45.20
3856.570	-81.70	V	1.68	25.47	-57.91	-13	-44.91
287.978	-94.71	H	0.43	31.24	-63.90	-13	-50.90
402.660	-97.66	H	0.45	30.68	-67.43	-13	-54.43
475.190	-95.93	H	0.46	30.85	-65.54	-13	-52.54
820.500	-46.57	H	0.57	30.70	-16.44	-13	-3.44
1370.493	-84.15	H	1.29	26.12	-59.32	-13	-46.32
3258.430	-80.20	H	1.62	25.41	-56.41	-13	-43.41

Test Mode; Mid: 456.250MHz, Channel Spacing 25KHz

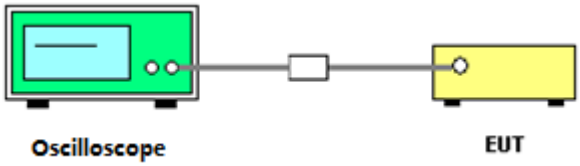
Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
157.727	-95.90	V	0.24	31.35	-64.79	-13	-51.79
361.299	-91.35	V	0.26	31.34	-60.27	-13	-47.27
670.384	-94.13	V	0.42	31.24	-63.31	-13	-50.31
912.500	-50.19	V	0.64	29.72	-21.11	-13	-8.11
1262.116	-85.16	V	1.23	26.38	-60.01	-13	-47.01
3860.246	-78.80	V	1.68	25.47	-55.01	-13	-42.01
285.515	-95.70	H	0.43	31.24	-64.89	-13	-51.89
404.347	-95.77	H	0.45	30.68	-65.54	-13	-52.54
472.970	-95.42	H	0.44	30.85	-65.01	-13	-52.01
912.500	-47.78	H	0.64	29.72	-18.7	-13	-5.7
1370.178	-79.95	H	1.29	26.12	-55.12	-13	-42.12
3261.045	-83.56	H	1.62	25.41	-59.77	-13	-46.77

Test Mode: High: 469.850MHz, Channel Spacing 25KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
154.820	-94.66	V	0.24	31.35	-63.55	-13	-50.55
363.368	-91.83	V	0.26	31.34	-60.75	-13	-47.75
670.811	-94.20	V	0.42	31.24	-63.38	-13	-50.38
939.700	-50.02	V	0.65	29.68	-20.99	-13	-7.99
1258.551	-79.87	V	1.23	26.38	-54.72	-13	-41.72
3858.923	-79.76	V	1.68	25.47	-55.97	-13	-42.97
291.012	-96.24	H	0.43	31.24	-65.43	-13	-52.43
400.454	-96.60	H	0.45	30.68	-66.37	-13	-53.37
475.645	-95.90	H	0.64	30.85	-65.69	-13	-52.69
939.700	-48.64	H	0.65	29.68	-19.61	-13	-6.61
1373.809	-83.06	H	1.29	26.12	-58.23	-13	-45.23
3264.509	-78.65	H	1.62	25.41	-54.86	-13	-41.86

3.5. Transient Frequency Behavior

3.5.1.Test Specification

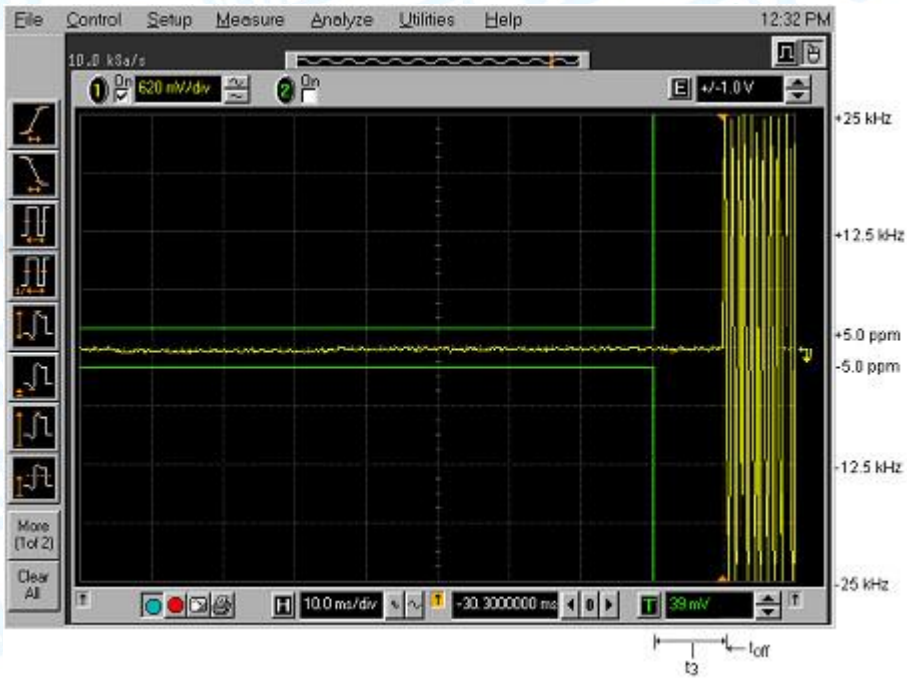
<table>
<tr><td>Test Requirement:</td><td>FCC Part 90.214</td></tr>
<tr><td>Test Setup:</td><td> 
</td></tr>
<tr><td>Test Limit</td><td>
<table>
<tr><th rowspan="2">Frequency Range</th><th rowspan="2">Channel Bandwidth</th><th colspan="3">Frequency Tolerance (ppm)</th></tr>
<tr><th>Fixed and Base Station</th><th colspan="2">Mobile Stations</th></tr>
<tr><th></th><th></th><th>> 2W</th><th>≤ 2W</th></tr>
<tr><td rowspan="3">150-174MHz</td><td>6.25</td><td>1.0</td><td>2.0</td><td>2.0</td></tr>
<tr><td>12.5</td><td>2.5</td><td>5.0</td><td>5.0</td></tr>
<tr><td>25</td><td>5.0</td><td>5.0</td><td>50.0*</td></tr>
<tr><td rowspan="3">421-512MHz</td><td>6.25</td><td>0.5</td><td>1.0</td><td>1.0</td></tr>
<tr><td>12.5</td><td>1.5</td><td>2.5</td><td>2.5</td></tr>
<tr><td>25</td><td>2.5</td><td>5.0</td><td>5.0</td></tr>
</table>
* Stations operating in the 154.45 MHz or the 173.2 to 173.4 MHz bands must have a frequency stability of 5 ppm.
* Paging transmitters operating on paging-only frequencies must operate with frequency stability of 5 ppm in the 150-174 MHz band and 2.5 ppm in the 421-512 MHz band.
</td></tr>
<tr><td>Test Procedure:</td><td>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. 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. The result was recorded.</td></tr>
<tr><td>Test Result:</td><td>PASS</td></tr>
</table>

3.5.2.Test data

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

Power On

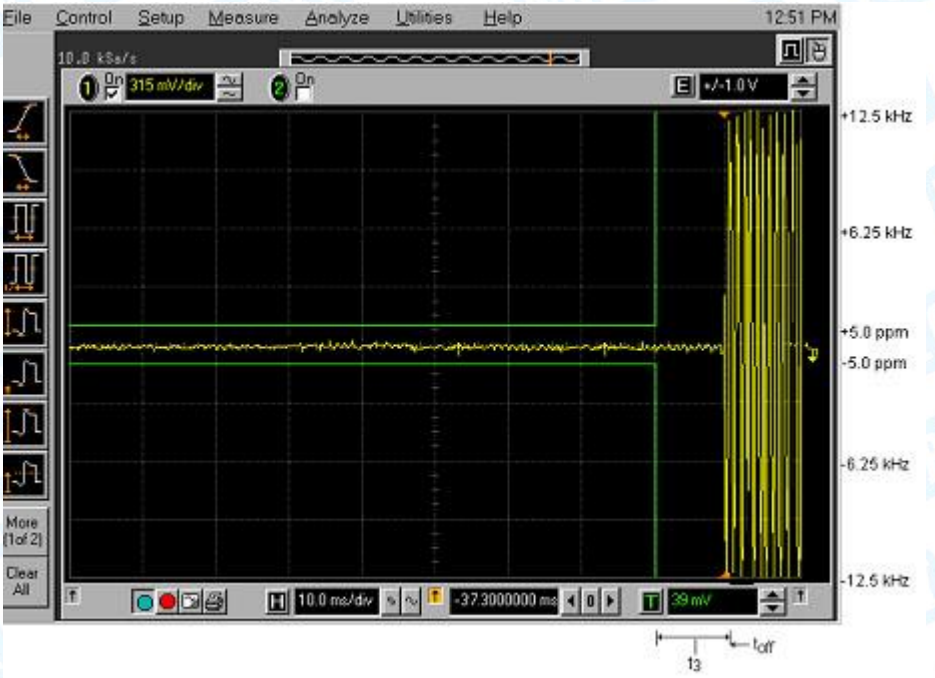
Power Off



Test Plots for channel spacing 12.5KHz. EUT power setting: Maximum

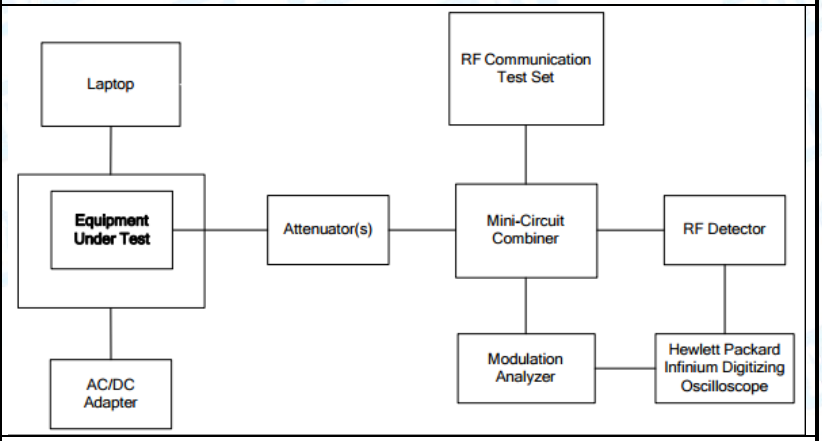
Power On

Power Off



3.6. Behavior Frequency Stability

3.6.1.Test Specification

Test Requirement:	FCC Part 90.213
Test Method:	ANSI C63.26
Test Setup:	
Test Procedure:	Method of Measurement (using a Modulation Domain Analyzer). The output of the EUT was connected to a power meter in order to get a reference power measurement. And the reference level is -20dBm. Once the reference power measurement was determined, an external signal source was connected to the Modulation Domain Analyzer in order to set the trigger level. The EUT was connected to the Modulation Domain Analyzer. In order to capture a single-shot turn-on of the transmitter signal, the modulation domain analyzer was set to trigger on the rising edge of the waveform. Plots were taken. The modulation domain analyzer was then adjusted to trigger on the falling edge of the transmitter waveform in order to capture a single-shot turn-off transient of the transmitter signal. Plots were taken.
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	7.2	-32	-0.0780
	7.0	-37	-0.0902
	6.8	-29	-0.0707
	6.6	-33	-0.0805
Limit	2.5ppm		
Middle Channel 25KHz Channel Spacing	7.2	-35	-0.0853
	7.0	-36	-0.0878
	6.8	-34	-0.0829
	6.6	-36	-0.0878
Limit	5ppm		

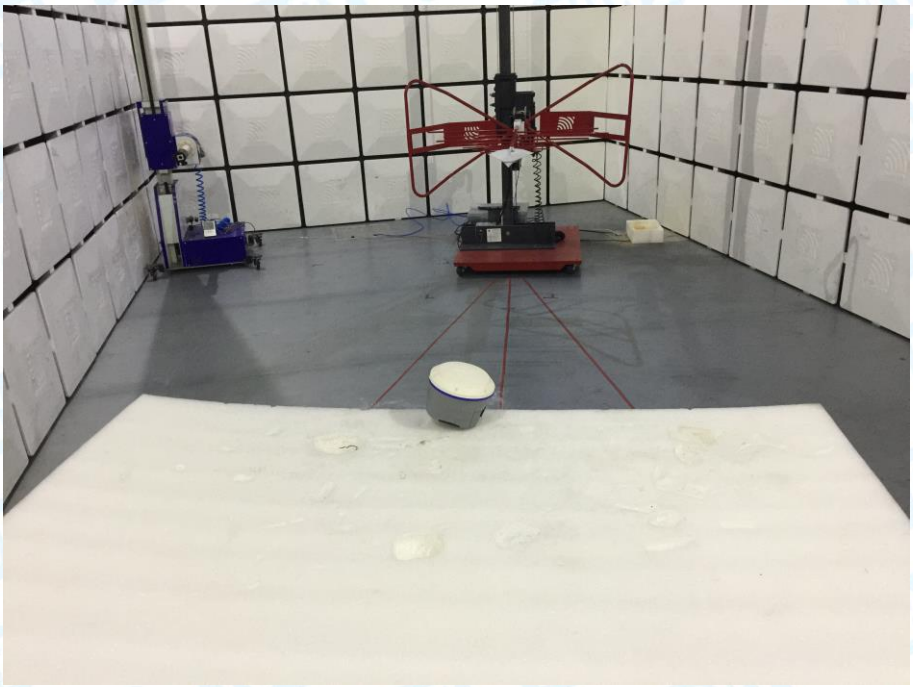
Mode	Temperature (℃)	Frequency error (Hz)	frequency error (ppm)
Middle Channel 12.5KHz Channel Spacing	-20	-31	-0.0756
	-10	-20	-0.0488
	0	-23	-0.0561
	10	-43	-0.1048
	20	-10	-0.0244
	30	-26	-0.0634
	40	-39	-0.0951
	50	-18	-0.0439
Limit	2.5ppm		
Middle Channel 25KHz Channel Spacing	-20	-26	-0.0634
	-10	-12	-0.0293
	0	-19	-0.0463
	10	-49	-0.1194
	20	-11	-0.0268
	30	-21	-0.0512
	40	-38	-0.0926
	50	-18	-0.0439
Limit	5ppm		

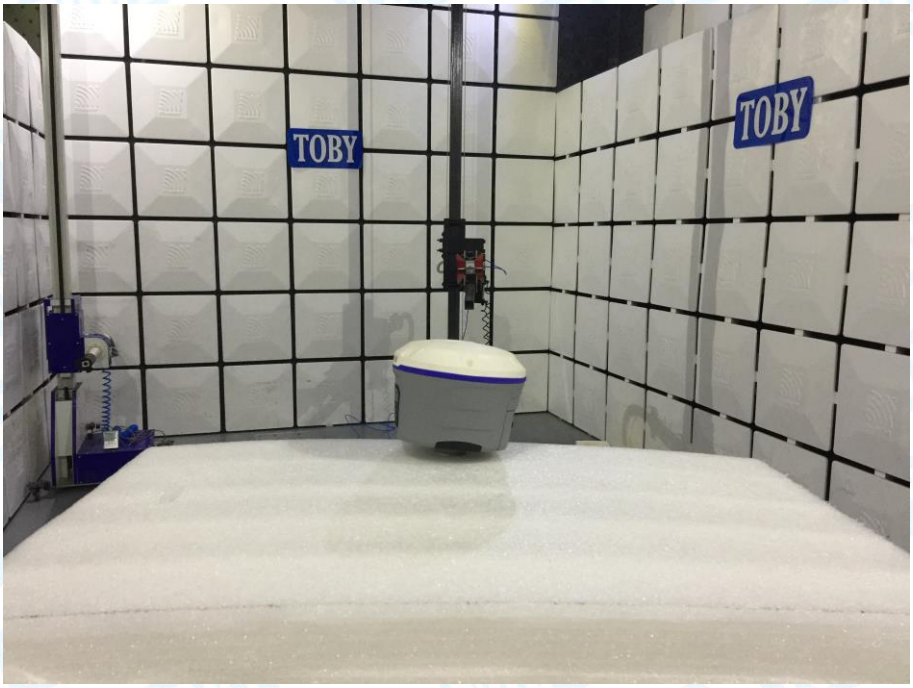
3.7. Modulation Characteristic

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.

4. Test Setup Photo

4.1.Photos of Radiated emission





5. Photographs Of The EUT

Please refer to separated files for External Photos of the EUT and Internal Photos of the EUT.

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