

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

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Prepared By Address

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

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

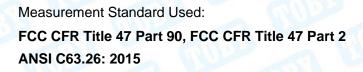
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Applicant		Shanghai Huace Navigation Technology LTD.	
Address	a:	599 Gaojing Road, Building D, Shanghai 201702, China	
Manufacturer		Shanghai Huace Navigation Technology LTD.	
Address	:	599 Gaojing Road, Building D, Shanghai 201702, China	
EUT Description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

- (A) Model No.
- Trademark (B)



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.

CHCNAV

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
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Revision	Issue Date	sue Date Revisions	
VO	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	Р
Occupied Bandwidth & Emission Mask	FCC PART 90	§90.209, §90.210	P
Spurious Emissions(conducted)	FCC PART 90	§90.210	Р
Spurious Emissions(Radiated)	FCC PART 90	§90.210	P
Transient Frequency Behavior	FCC PART 90	§90.213	Р
Frequency Stability	FCC PART 90	§90.214	Р
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	1	i50_MAIN_V2.1
Notes All Conducted Dour		any been tested and recorded the warst sees 211/(22dDm) recults in th

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	1	1
Manufacturer		1
Model	:	1
Ratings	1:00	1

2.3. Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or DOC
1					

2.4.Block Diagram of connection between EUT and simulators

Supporting EUT System

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					
	ltem	Description of operation mode	Note			
19	1	GMSK+BW12.5KHz+TX	at maximum rated power for transmitter			
	2	GMSK+BW12.5KHz+TX	at minimum rated power for transmitter			
201	3	GMSK+BW25KHz+TX	at maximum rated power for transmitter			
0	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)		
	12.5	410.125		
Low	25	410.250		
Mid	12.5	456.125		
	25	456.250		
Llink	12.5	469.975		
High	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°C
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

2.9.Test Equipment List

Radiation Emissio	n 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 Conducte	d 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
	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO26	Sep. 16, 2019	Sep. 15, 2020
RF Power Sensor	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO29	Sep. 16, 2019	Sep. 15, 2020
	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO31	Sep. 16, 2019	Sep. 15, 2020
	DARE!! Instruments	RadiPowerRPR3006W	17100015SNO33	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
	initial encoded				

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:	Power Meter EUT
Test Procedure:	a) Connect the equipment as illustrated.b) Turn on the power meterc) 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

Frequency (MHz) Maximum Conducted Output Power(Peak) (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

3.2.1.Test Specification	and a nut	
Test Requirement:	FCC Part 90.209, FCC Part 90.210	TUDA
Test Setup:	Spectrum Analyzer EUT	E E
Test Procedure:	The resolution bandwidth of the spectrum a 300 Hz and the spectrum was recorded in the 50KHz from the carrier frequency.	
Test Result:	PASS	

3.2.2.Test data

Occupied Bandwidth:

	A WILL			E IIII
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:

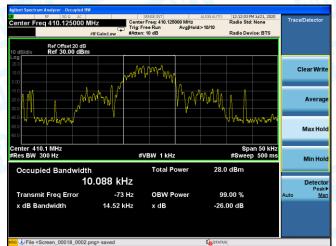
Channel	Frequency (MHz)	26dB Bandwidth (KHz)	99% Occupied Bandwidth (KHz)	Result
Low	410.250	21.29	19.315	PASS
Mid	456.250	21.35	19.406	PASS
High	469.850	21.17	19.317	PASS

Emission Mask:

GMSK 12.5	KHz Channel Spacing	g:	1	COB
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 25KH	Hz Channel Spacing:	(III)	mOB)	
Channel	Frequency (MHz)	Applicable Mask	RBW	Result
Low	410.250	В	300	PASS
Mid	456.250	В	300	PASS
High	469.850	В	300	PASS

Test plots as follows: GMSK 12.5KHz Channel Spacing: Occupied Bandwidth



Low: 410.125MHz

Mid: 456.125MHz



High: 469.975MHz



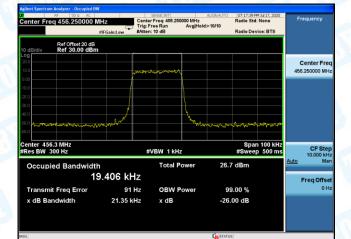
a ⇒File <Screen_00018_0004.png> saved

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GMSK 25KHz Channel Spacing: Occupied Bandwidth

07:18:49 PM Jul 17, 202 Radio Std: None Center Freq: 410.250000 MHz Trig: Freq Run Avg|Hold>10/10 Frequency Freq 410.250000 MHz Radio Device: BTS Ref Offset 20 dB Ref 30.00 dBm Center Free 410.250000 MH enter 410.3 MHz Res BW 300 Hz Span 100 kHz #Sweep 500 ms CF Step 10.000 kH: Mar #VBW 1 kHz Occupied Bandwidth 19.315 kHz Auto 26.2 dBm Total Power Freq Offse Transmit Freq Error 33 Hz OBW Power 99.00 % x dB Bandwidth 21.29 kHz x dB -26.00 dB

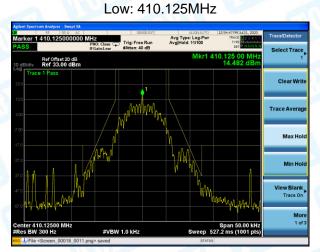
Mid: 456.250MHz



High: 469.850MHz

enter Fre	RF 50 Q AC 9 q 469.850000	MHz #IFGain:Low	SENSE:INT Center Freq: 469.85 Trig: Free Run #Atten: 10 dB		>10/10	07:19:29 P Radio Std: Radio Dev		Fi	requency
dB/div	Ref Offset 20 dB Ref 30.00 dB								
99 0.0 0.0			hummhumh						Center Fre 9.850000 MH
.0									
.0									
10 10 10 10	mmm	manne		hun	whenh	welv-yur	᠕ᢩᡣ᠕ᠰ᠕ᠰ᠆ᠬ		
enter 469 tes BW 3			#VBW 1kH	z		Spar #Sweep	n 100 kHz 500 ms		CF Ste
Occupi	ed Bandwid	th	Total F	ower	25.5	dBm		<u>Auto</u>	Ma
	1	9.317 k⊦	z						Freq Offse
Transmi	it Freq Error	102	Hz OBW I	ower	99.	00 %			0 H
x dB Ba	ndwidth	21.17 k	Hz xdB		-26.0	10 dB			

Low: 410.250MHz



GMSK 12.5KHz Channel Spacing: Emission Mask

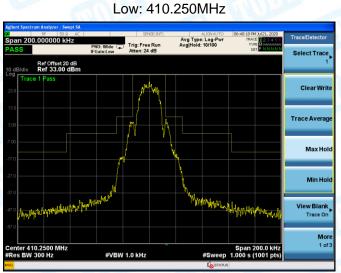
Mid: 456.125MHz



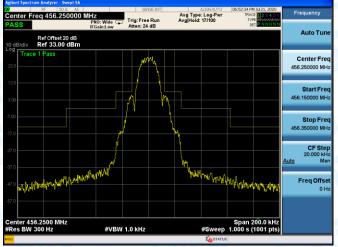
High: 469.975MHz



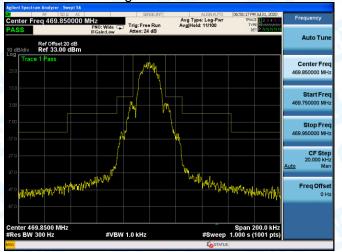




Mid: 456.250MHz



High: 469.850MHz



3.3. Spurious Emissions(conducted)

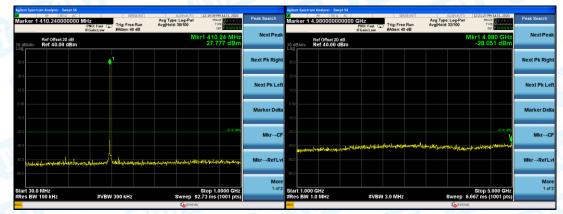
3.3.1.Test Specification

Test Requirement:	FCC Part 90.210
Test Setup:	
	Spectrum Analyzer EUT
Test Limit:	Modulation Type: GMSK FCC Part 22.359, 74.462, 80.211 and 90.210 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) = 34.77 - 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

ent Spectrum Analyzer - Swept SA			Agilent Spectrum Analyzer - Swept SA
arker 1 455.830000000 MHz PN0: Fast C	AUGNAUTO 12:20:46 PM 3u/21, 2020 Avg Type: Log-Pwr Avg[Hold: 13/100 11/16	Peak Search	O FF SOG AC SERVED/T AUXIAUTO 12212137M X021203 PROC AC Marker 1 3.064000000000 GHz Avg Type: Log-Pwr PMoc Big 2 3 4 57 PMoc Big 2 3 4 57 PMoc Big 2 3 4 57 PROC Fuel Trig: Free Run Avg Type: Log-Pwr PMoc Big 2 3 4 57 PMoc Big 2 3 4 57
Ref Offset 20 dB	Mkr1 455.83 MH 27.568 dBn	Next Peak	k Ref Offset 20 dB Mkr1 3.084 GHz 19 giblidin Ref 40.00 dBm -27.084 dBm
□ ∳ 1		Next Pk Right	Next Pk Ri
		Next Pk Left	20 Next Pk L
0 		Marker Delta	a 00 Marker D
		Mkr→CF	2020 - 20
managering and the second second and a state of the second s	فأومدناه بالمتوجوعها الإفراقية والمتألف	Mkr→RefLvi	
art 30.0 MHz	Stop 1.0000 GH:		2 Start 1.000 GHz Stop 5.000 GHz 1
es BW 100 kHz #VBW 300 kHz	Sweep 92.73 ms (1001 pts		#Res BW 1.0 MHz #VBW 3.0 MHz Sweep 6.667 ms (1001 pts)

High: 469.975MHz

igilent Spectrum Analyzer - Swept SA					Agiler	it Spectrum J	Inalyzer - Swe	pt SA							
RF 50 R AC Marker 1 470.380000000 I	MHz PN0: Fast Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr AvgIHold>100/100	12:18:05 PM Jul 21, 2020 TRACE 1 2 3 4 5 6 TYPE M	Peak Search	Sta	t Freq 1	RF 50 Ω	AC DOO GHz PNO: Fa		ee Run		ALIGNAUTO Log-Pwr >100/100	TRAC TVI	4 Jul 21, 2020 2 1 2 3 4 5 6	Frequency
Ref Offset 20 dB Q dB/div Ref 40.00 dBm	IFGain:Low #Atten: 40 dB	M	kr1 470.38 MHz 27.378 dBm	Next Peak	10 dl	R B/div R	ef Offset 20 ef 40.00 d	IFGain:Lo	w #Atten:	40 dB		N	/kr1 3.1 -28.1		Auto Tun
30.0	1			Next Pk Right	30.0										Center Fre 3.000000000 GH
10.0				Next Pk Left											Start Fre 1.000000000 GF
100				Marker Delta											Stop Fre 5.000000000 GH
			-20.00 dBm	Mkr→CF		a se de bie	والمراطور	المرد المحمد ومحمد المراجع الم	a.	1 1	مەربىلەت مەربىي	(Markaura)	فرمله ففاشهل در	00 00 00 00. بو جنول طور فر ا	CF Ste 400.000000 Mi Auto Mi
0.0 Here and the second s	and the second	adarahi na shakaraki mahiri	taanaana katherina faaqa	Mkr→RefLvl			ALL AND A								Freq Offs 01
Start 30.0 MHz			Stop 1.0000 GHz	More 1 of 2		t 1.000 G							Stop 5	.000 GHz	
Res BW 100 kHz	#VBW 300 kHz	Sweep 9	2.73 ms (1001 pts)		#Re	s BW 1.0	MHz	#	VBW 3.0 MH	z		Sweep 6		1001 pts)	

GMSK 25KHz Channel Spacing:

Low: 410.250MHz



Mid: 456.250MHz

nt Spectrum Analyzer - Swept SA				Agilant		nalyzer - Swi									
treq 30.00000 MHz PN0: Fast ↓ Trig: Free Run IFGaint.ow	Avg Type: Log-Pwr Avg Hold>100/100	10:34:33 AM 3.421, 2020 TRACE 1 2 3 4 5 6 TVRI M DET P N N N N N		Star		50 Ω .000000	000 GHz	NO: Fast G			Avg Typ Avg Hold	e: Log-Pwr I> 100/100	TRA TV	M 3.J 21, 2020 TE 1 2 3 4 5 6 PE M N N N N N ET P N N N N N	Frequency
Ref Offset 20 dB B/div Ref 40.00 dBm	М	kr1 455.83 MHz 25.177 dBm	Auto Tune	10 dB		of Offset 20 ef 40.00 c						I	Mkr1 3.1 -27.1	04 GHz 97 dBm	Auto Tur
••••••••••••••••••••••••••••••••••••••			Center Freq 515.000000 MHz	30.0											Center Fre 3.000000000 GH
			Start Freq 30.000000 MHz	20.0											Start Fr 1.000000000 G
		-13.00 dBm	Stop Freq 1.00000000 GHz	0.00 -10.0										-13.00 dBn	Stop Fr 5.000000000 0
			CF Step 97.000000 MHz <u>Auto</u> Man	-20.0		بر رواندا الم		andikari	ومغارات فالعدار	1 August Bucksey	فارور المحودورا	and internation	a shisted of	و المارد المراجع	CF S 400.000000 M Auto
n Langer of a start of faith of galaxy to galaxy to the start of the	yi ani yanga shiyika kuya kurkurkurkurkurkurkurkurkurkurkurkurkurk	and high the providence in a second	Freq Offset 0 Hz	-40.0	d geod ^{er} eiserei	kayeesterde ge	A.M. Group and an					• • • • • • • • • • • • • • • • • • •	de fan i se rece		Freq Off 0
t 30.0 MHz		Stop 1.0000 GHz			t 1.000 G								Stop 5	.000 GHz	
s BW 100 kHz #VBW 300 kHz	Sweep 9	2.73 ms (1001 pts)		#Res	BW 1.0	MHz		#VBV	V 3.0 MHz			Sweep 6	667 ms	1001 pts)	

High: 469.850MHz

Agilent Spectrum Analyzer - Swept SA	SENSE-INT	ALIGNAUTO	10:33:39 AM 3/21, 2020		Agilen	t Spectrum A	nalyzer - Swep			or N	ENT		ALIGNAUTO	10:32:47 AM J	121, 2020	
Start Freq 30.000000 MHz	NO: Fast Gain:Low Atten: 40 dB	Avg Type: Log-Pwr Avg Hold>100/100	10:33:39 AM 3:121, 2020 TRACE 2 3 4 5 6 TYPE MUNININN DET P NNNNN	Frequency	Star	t Freq 1.	0000000	00 GHz	l: Fast 😱 in:Low	Trig: Free Atten: 40	Run	Avg Type Avg Hold:	: Log-Pwr		123456	Frequency
10 dB/div Ref 40.00 dBm		Mk	r1 470.38 MHz 23.568 dBm	Auto Tune	10 dE	Re Bidiv Re	f Offset 20 d f 40.00 dE	≝B Bm					N	4kr1 2.66 -27.62	4 GHz 1 dBm	Auto Tune
30.0	∮ ¹			Center Freq 515.000000 MHz	30.0											Center Freq 3.000000000 GHz
20.0				Start Freq 30.000000 MHz	20.0 10.0											Start Freq 1.000000000 GHz
0.00 -10.0			.13.00 dBe	Stop Freq 1.000000000 GHz	0.00										-13.00 dBm	Stop Freq 5.000000000 GHz
-20.0				CF Step 97.000000 MHz <u>Auto</u> Man	-20.0					1 Canadau	and Blook and	dum . e	واخداستين كالمساولين		utetala	CF Step 400.000000 MHz Auto Man
-40.0	ม _ี กระดงจะมีประวังงารจะระบบ (การป	a print the second of the second	antan ang ang ang ang ang ang ang ang ang a	Freq Offset 0 Hz	-40.0	han an a	ار خدم برواندویل ا	a and a second					an a			Freq Offset 0 Hz
-50.0					-50.0											
Start 30.0 MHz #Res BW 100 kHz	#VBW 300 kHz	Sweep 92	Stop 1.0000 GHz 2.73 ms (1001 pts)			t 1.000 G s BW 1.0			#VBW	3.0 MHz			Sweep 6	Stop 5.0 .667 ms (1)		

3.4. Radiated Spurious Emission

Test Requirement:	FCC Part 90.210
Test Method:	ANSI C63.26
Measurement Distance:	3 m
Antenna Polarization:	Horizontal & Vertical
Operation mode:	Refer to item 4.1
Receiver Setup:	FrequencyRBWVBW9kHz-150kHz200Hz1kHz150kHz-9kHz30kHz30MHz-30MHz-1GHz100KHz300KHzAbove 1GHz1MHz3MHz
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 + 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.
Test setup:	Receiver Test Antenna Antenna RECEIVER UNDER TEST TURNTABLE STANDARD TEST SITE
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 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

Frequency	Reading level	Antenna	Cable loss	Ant.Gain	Emission level	Limit	Margin
(MHz)	(dBm)	Polarization		(dBi)	(dBm)	(dBm)	(dB)
152.648	-93.25	V	0.24	31.35	<u>-62.14</u>	-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	Н	0.43	31.24	-65.81	-20	-45.81
399.050	-94.21	Н	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	Н	0.57	30.71	-16.14	-20	3.86
1368.694	-85.26	Н	1.29	26.12	-60.43	-20	-40.43
3258.712	-81.59	Н	1.62	25.41	-57.8	-20	-37.8

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

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

Frequency	Reading level	Antenna	Cable loss		Emission level	Limit	Margin
(MHz)	(dBm)	Polarization	(dB)	(dBi)	(dBm)	(dBm)	(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	Н	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	Н	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	АН 🕚	1.29	26.12	-59.16	-20	-39.16
3262.627	-82.00	Н	1.62	25.41	-58.21	-20	-38.21

Frequency	Reading level	Antenna	Cable loss	Ant.Gain	Emission level	Limit	Margin
(MHz)	(dBm)	Polarization	(dB)	(dBi)	(dBm)	(dBm)	(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	Н	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	Н	0.65	29.69	-71.06	-20	-51.06
1372.894	-84.09	Н	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: High: 469.975MHz, Channel Spacing 12.5KHz

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

Frequency	Reading level	Antenna	Cable loss	Ant.Gain	Emission level	Limit	Margin
(MHz)	(dBm)	Polarization	(dB)	(dBi)	(dBm)	(dBm)	(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	Н	0.46	30.85	-65.54	-13	-52.54
820.500	-46.57	Н	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	Н	1.62	25.41	-56.41	-13	-43.41

Frequency	Reading level	Antenna	Cable loss	Ant.Gain	Emission level	Limit	Margin
(MHz)	(dBm)	Polarization		(dBi)	(dBm)	(dBm)	(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	Н	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	Н	0.44	30.85	-65.01	-13	-52.01
912.500	-47.78	Н	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	Н	1.62	25.41	-59.77	-13	-46.77

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

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

Frequency	Reading level	Antenna	Cable loss	Ant.Gain	Emission level	Limit	Margin
(MHz)	(dBm)	Polarization	(dB)	(dBi)	(dBm)	(dBm)	(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	Н	0.43	31.24	-65.43	-13	-52.43
400.454	-96.60	Н	0.45	30.68	-66.37	-13	-53.37
475.645	-95.90	Н	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	Н	1.29	26.12	-58.23	-13	-45.23
3264.509	-78.65	H	1.62	25.41	-54.86	-13	-41.86

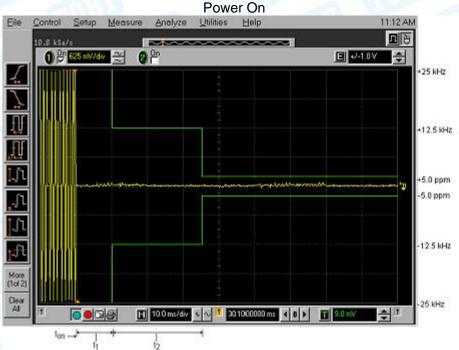
3.5. Transient Frequency Behavior

3.5.1.Test Specification

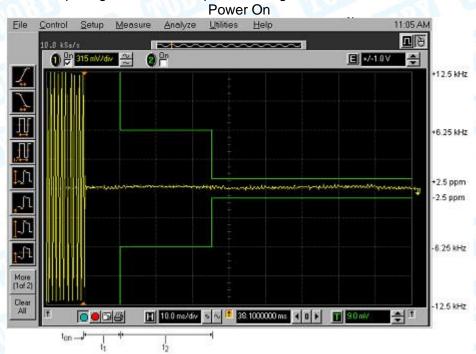
Test Requirement:	FCC Part 9	0.214	B.		100
Test Setup:	Oscilloscope EUT				
		Channel Bandwidth	Frequency Tolerance (ppm)		
	Frequency Range		Fixed and Base		Stations
			Station	> 2W	≤ 2W
		6.25	1.0	2.0	2.0
	150-174MHz	12.5	2.5 5.0	5.0 5.0	5.0 50.0*
Test Limit		25 6.25	5.0	5.0	50.0"
	421-512MHz	12.5	1.5	2.5	2.5
	421-012MHZ	25	2.5	5.0	5.0
	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.				
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. 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.				
Test Result:	PASS	RUD		MAR.	12 CON

3.5.2.Test data

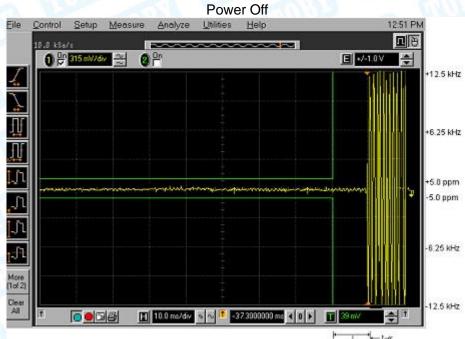
Test Plots for channel spacing 25KHz, EUT power setting: Maximum.



Power Off Elle Control Setup Measure Analyze Utilities Help 12:32 PM DE 10.0 kSa/s ① 분 620 mW/dyr 관 0 ⁰ E +/-1.0V ÷ +25 kHz 1 Ð +12.5 kHz Ð Lſı +5.0 ppm 1 J1 -5.0 ppm 1 -12.5 kHz 11 More (Tof 2) Clear -25 kHz Ħ 10.0 ms/div 🗴 🐔 -30. 3000000 ms 📢 0 🕨 0000 T 39.m ÷1 +-torr 13



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



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3.6. Behavior Frequency Stability

3.6.1.Test Specification

Test Requirement:	FCC Part 90.213		
Test Method:	ANSI C63.26		
Test Setup:	Laptop RF Communication Test Set Equipment Under Test Attenuator(s) Mini-Circuit Combiner RF Detector Hewlett Packard Ac/DC Adapter Hewlett Packard Oscilloscope		
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

Mode	Voltage (V)	Frequency error (Hz)	frequency error (ppm)
Middle Channel 12.5KHz	7.2	-32	-0.0780
	7.0	-37	-0.0902
	6.8	-29	-0.0707
Channel Spacing	6.6	-33	-0.0805
Limit	2.5ppm		
	7.2	-35	-0.0853
Middle Channel	7.0	-36	-0.0878
25KHz Channel	6.8	-34	-0.0829
Spacing	6.6	-36	-0.0878
Limit	5ppm		

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