



FCC TEST REPORT

FCC ID: SY4-A01020

On Behalf of

Shanghai Huace Navigation Technology LTD.

Geodetic GNSS Receiver

Model No.: i90, i90 Pro

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


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

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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. : i90, i90 Pro
 (B) Trademark : 

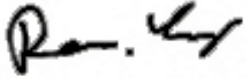
Measurement Standard Used:

FCC CFR Title 47 Part 90, FCC CFR Title 47 Part 2
ANSI C63.26: 2015

The device described above is tested by Shenzhen 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 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).....: Reak Yang
 Project Engineer 

Approved by (name + signature).....: Simple Guan
 Project Manager 

Date of issue.....: September 20, 2019

Revision History

Revision	Issue Date	Revisions	Revised By
V0	September 20, 2019	Initial released Issue	Simple Guan

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 : 

Model Number : i90, i90 Pro

DIFF. : Both models are the same, only the GPS modules inside are different, the result of this report belongs to i90.

Test Voltage : DC 7.4V from battery or 9-28VDC, DC 12V From adapter

UHF

Operation frequency : 410MHz-470MHz

Conducted Power : 1W(30dBm), 0.5W(27dBm), 2W(33dBm)

Bandwidth : 12.5KHz, 25KHz

Modulation type : GMSK

Antenna Type : External Antenna, Maximum Gain is 4.0dBi

Software version : 2.0.7

Hardware version : V1.2

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

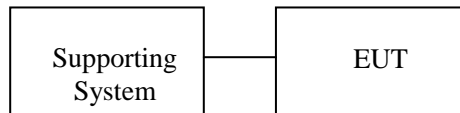
2.2. Accessories of Device (EUT)

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(MHz)	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°C	24°C
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°C
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

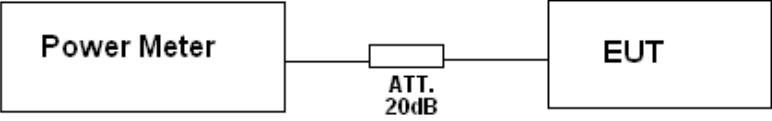
2.9. Test Equipment List

Equipment	Manufacturer	Model No.	Serial No.	Last cal.	Cal Interval
Test Receiver	ROHDE&SCHWARZ	ESCI	101165	2018.09.21	1 Year
Spectrum analyzer	ROHDE&SCHWARZ	FSU	1166.1660.26	2018.09.21	1 Year
Spectrum analyzer	Agilent	N9020A	MY499100060	2018.09.11	1 Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D(1201)	2018.09.21	1 Year
Filter	KANGMAI	ZLPF-LDC-1000-1959	1209002075	2018.09.21	1 Year
RF Cable	Resenberger	Cable 4	N/A	2018.09.21	1 Year
Signal Analyzer	Agilent	N9020A	MY499100060	2018.09.11	1 Year
vector Signal Generator	Agilent	N5182A	MY49060042	2018.09.11	1 Year
vector Signal Generator	Agilent	E4438C	US44271917	2018.09.11	1 Year
Amplifier	Agilent	8449B	3008A02664	2018.09.21	1 Year
Test Receiver	ROHDE&SCHWARZ	ESR	1316.3003K03-102082-Wa	2018.09.21	1 Year
Bilog Antenna	SCHWARZBECK	VULB 9168	9168-438	2018.04.13	1 Year
9*6*6 anechoic chamber	CHENYU	9*6*6	N/A	/	/
RF Cable	Resenberger	Cable 1	N/A	2018.09.21	1 Year
RF Cable	Resenberger	Cable 2	N/A	2018.09.21	1 Year
RF Cable	Resenberger	Cable 3	N/A	2018.09.21	1 Year
Loop Antenna	SCHWARZBECK	FMZB 1519B	00059	2018.09.26	2 Year
Attenuator	HP	8494B	DC-18G	2018.10.21	1 Year
Attenuator	HP	8496B	DC-18G	2018.10.21	1 Year
Temperature & Humidity test chamber	GZGONGWEN	GDS-250	080821	2018.10.21	1 Year
Power Meter	Agilent	E9300A	MY41496625	2018.09.21	1 Year
20dB Attenuator	ICPROBING	IATS1	82347	2018.09.21	1 Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126466	2018.09.21	1 Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	101043	2018.09.21	1 Year
Oscilloscope	Agilent	54833A	165521	2018.09.21	1 Year

3. Test Results and Measurement Data

3.1. Transmitter Power (Conducted)

3.1.1. Test Specification

Test Requirement:	Part 90.205:
Test Method:	FCC part 2.1046
Limits:	Please refer section FCC Part 90.205
Test Setup:	 <pre> graph LR PM[Power Meter] --- ATT[ATT. 20dB] ATT --- EUT[EUT] </pre>
Test Procedure:	<ul style="list-style-type: none"> 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):					
Frequency (MHz)	Maximum Conducted Output Power(Peak) (dBm)	Maximum ERP(dBm)	Stated ERP Power (dBm)	Limit (dBm)	Result
410.125	28.002	29.852	30	33	PASS
410.250	28.462	30.312	30	33	PASS
456.125	28.245	30.095	30	33	PASS
456.250	28.450	30.300	30	33	PASS
469.975	27.928	29.778	30	33	PASS
469.850	28.310	30.160	30	33	PASS

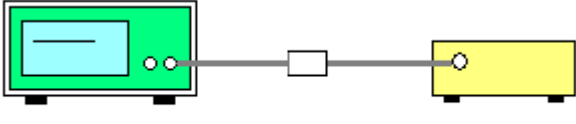
GMSK mode (0.5W):					
Frequency (MHz)	Maximum Conducted Output Power(Peak) (dBm)	Maximum ERP(dBm)	Stated ERP Power (dBm)	Limit (dBm)	Result
410.125	25.223	27.073	27	33	PASS
410.250	24.974	26.824	27	33	PASS
456.125	24.873	26.723	27	33	PASS
456.250	24.807	26.657	27	33	PASS
469.975	24.873	26.723	27	33	PASS
469.850	25.065	26.915	27	33	PASS

GMSK mode (2W):					
Frequency (MHz)	Maximum Conducted Output Power(Peak) (dBm)	Maximum ERP(dBm)	Stated ERP Power (dBm)	Limit (dBm)	Result
410.125	30.662	32.512	33	33	PASS
410.250	30.802	32.652	33	33	PASS
456.125	30.764	32.614	33	33	PASS
456.250	30.259	32.109	33	33	PASS
469.975	30.556	32.406	33	33	PASS
469.850	30.650	32.500	33	33	PASS

Note: 1. $ERP = \text{Maximum Conducted Output Power(Peak)} + \text{Antenna Gain} - 2.15\text{dB}$

3.2. Occupied Bandwidth and Emission Mask

3.2.1. Test Specification

Test Requirement:	FCC Part 90.209, FCC Part 90.210
Test Setup:	 <p>The diagram illustrates the test setup. On the left is a Spectrum Analyzer, represented by a green rectangle with a blue screen and two red dots. A black cable connects it to a small white square, which is then connected to a yellow rectangle representing the EUT (Equipment Under Test). Below the diagram, the text 'Spectrum Analyzer' is aligned under the green box, and 'EUT' is aligned under the yellow box.</p>
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.
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	12.43	9.895	PASS
Mid	456.125	12.51	9.914	PASS
High	469.975	12.5	9.916	PASS

GMSK 25KHz Channel Spacing:				
Channel	Frequency (MHz)	26dB Bandwidth (KHz)	99% Occupied Bandwidth (KHz)	Result
Low	410.250	21.19	19.396	PASS
Mid	456.250	20.99	19.259	PASS
High	469.850	20.74	19.217	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

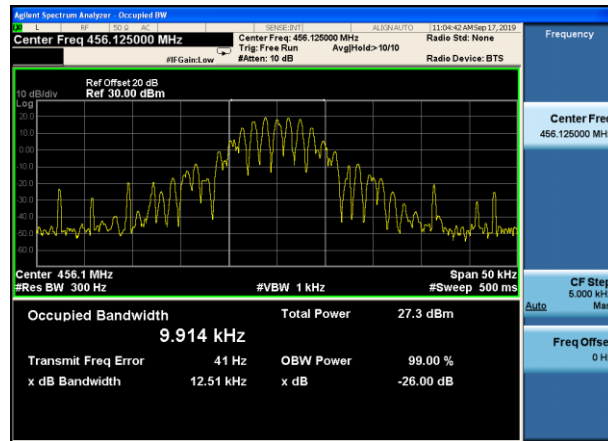
Test plots as follows:

GMSK 12.5KHz Channel Spacing: Occupied Bandwidth

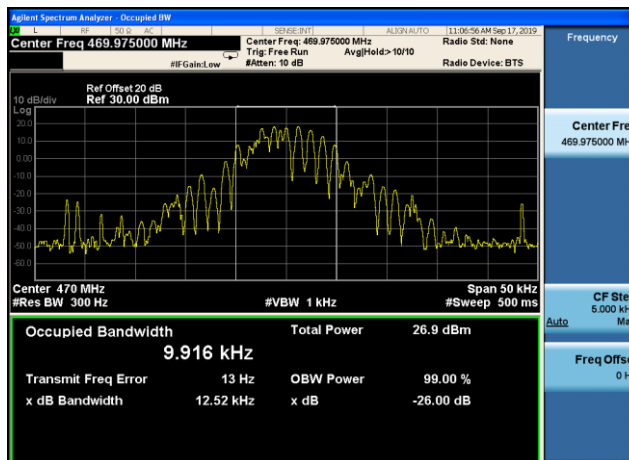
Low: 410.125MHz



Mid: 456.125MHz

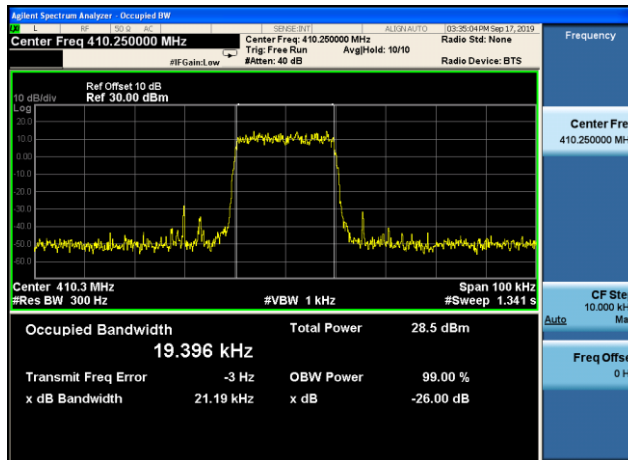


High: 469.975MHz

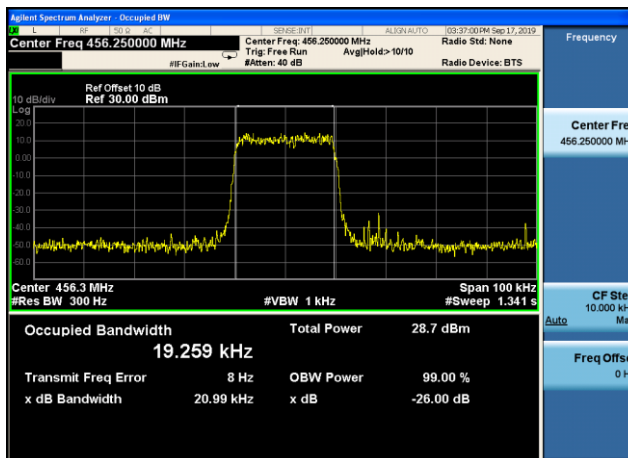


GMSK 25KHz Channel Spacing: Occupied Bandwidth

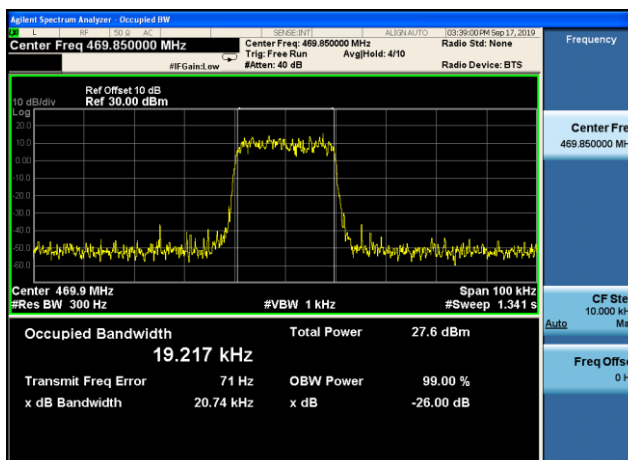
Low: 410.250MHz



Mid: 456.250MHz

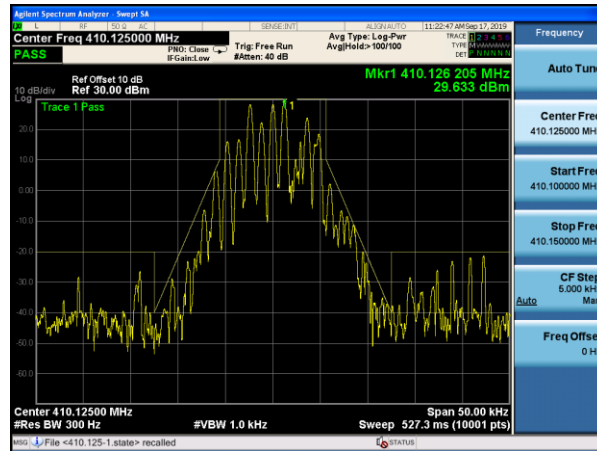


High: 469.850MHz

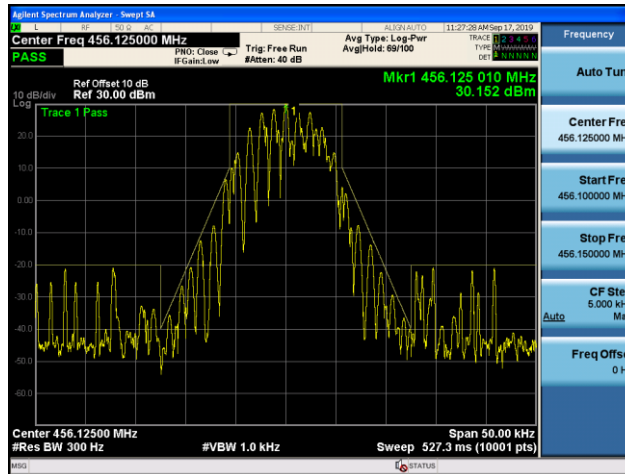


GMSK 12.5KHz Channel Spacing: Emission Mask

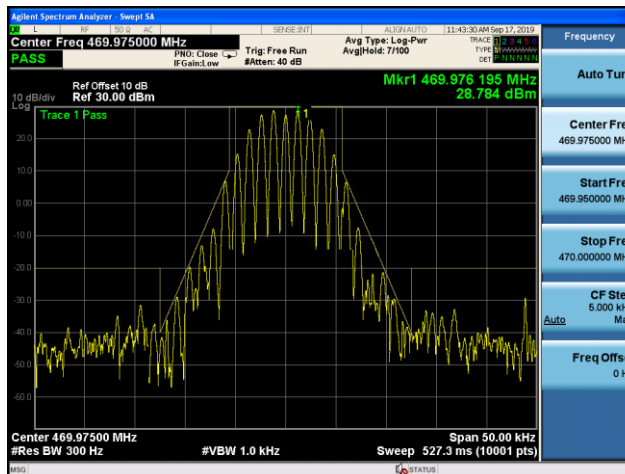
Low: 410.125MHz



Mid: 456.125MHz

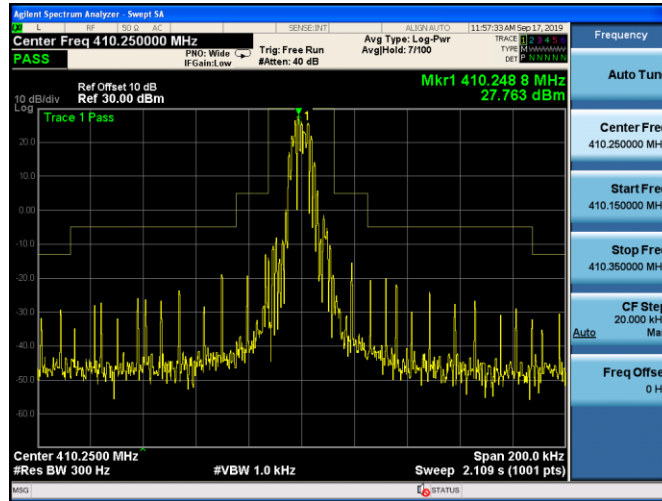


High: 469.975MHz

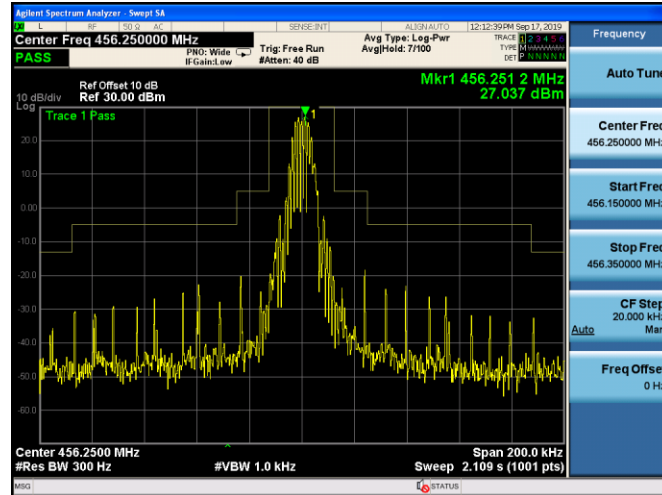


GMSK 25KHz Channel Spacing: Emission Mask

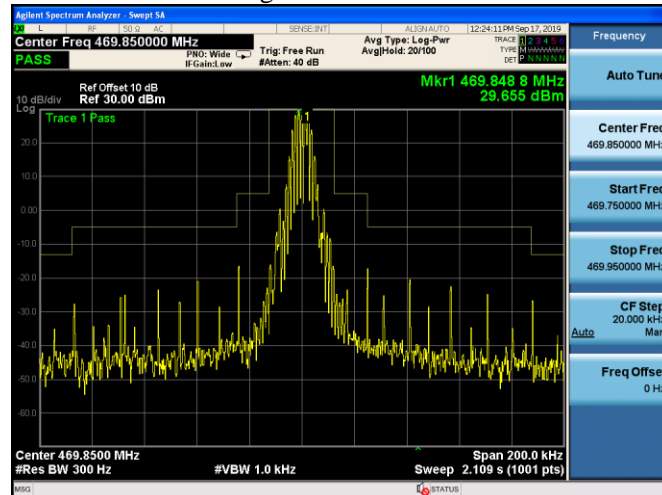
Low: 410.250MHz



Mid: 456.250MHz

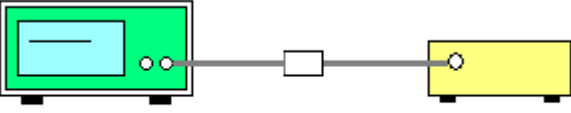


High: 469.850MHz



3.3. Spurious Emissions(conducted)

3.3.1. Test Specification

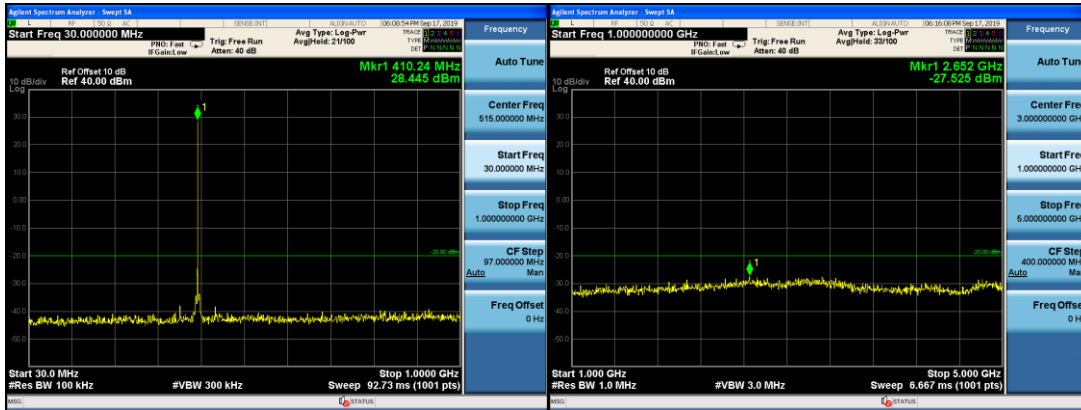
Test Requirement:	FCC Part 90.210
Test Setup:	 <p style="text-align: center;">Spectrum Analyzer EUT</p>
Test Limit:	<p>Modulation Type: GMSK FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 12: For 12.5 bandwidth: On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz at least: High: $50 + 10 \log (P_{\text{watts}}) = 50 + 10 \log (3.0) = 54.77 \text{ dB}$ Low: $50 + 10 \log (P_{\text{watts}}) = 50 + 10 \log (1.0) = 50.00 \text{ dB}$ 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 34.77 dBm for High rated power and 30.00 for lower rated power. High: Limit (dBm) = $34.77 - 50 - 10 \log (3.0) = -20 \text{ dBm}$ Low: 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: High: $43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (3.0) = 47.77 \text{ dB}$ Low: $43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (1.0) = 43.00 \text{ dB}$ 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 34.77 dBm for High rated power and 30.00 for lower rated power. High: Limit (dBm) = $34.77 - 43 - 10 \log (3.0) = -13 \text{ dBm}$ Low: 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. 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.</p>
Test Result:	PASS

3.3.2. Test data

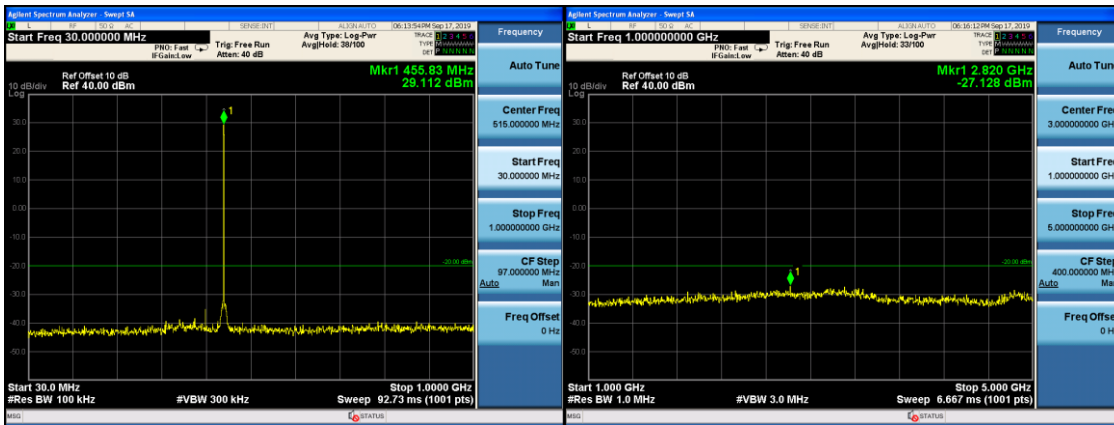
Test plots as follows:

GMSK 12.5KHz Channel Spacing:

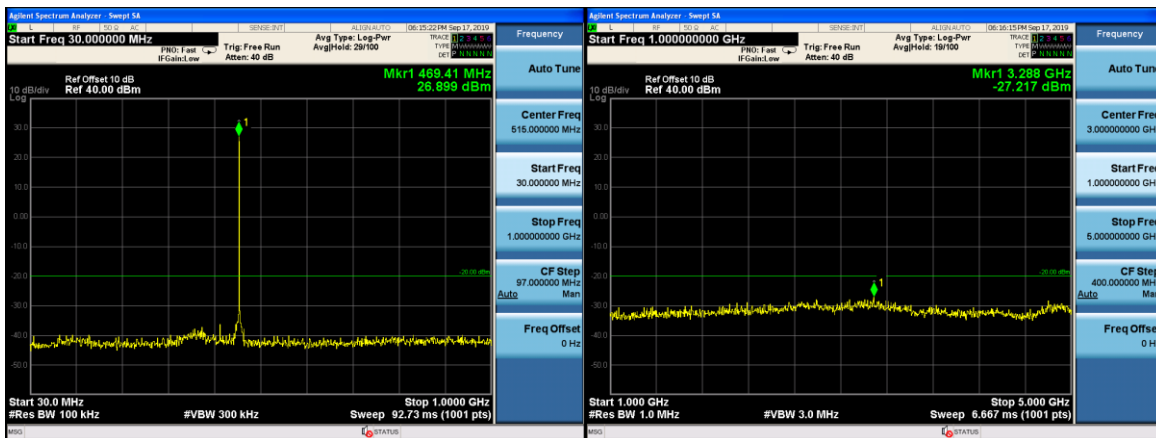
Low: 410.125MHz



Mid: 456.125MHz

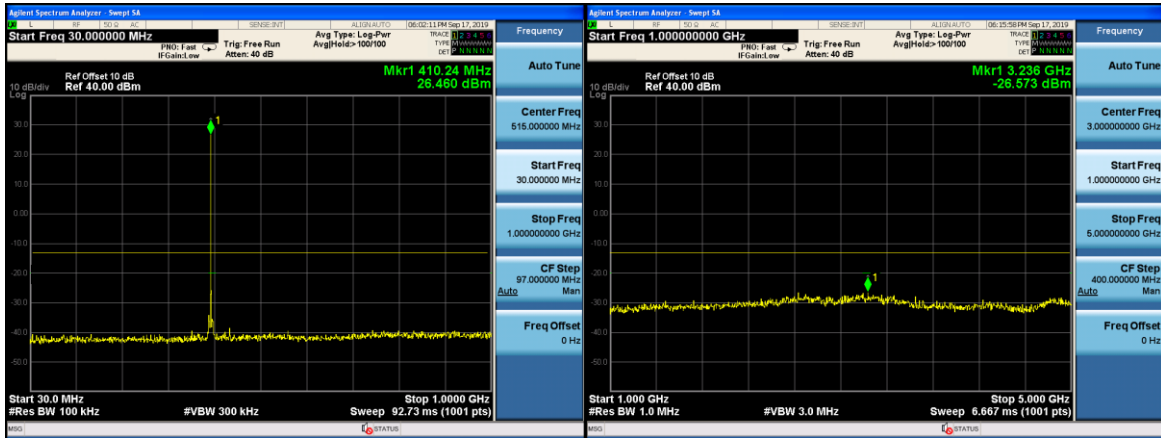


High: 469.975MHz

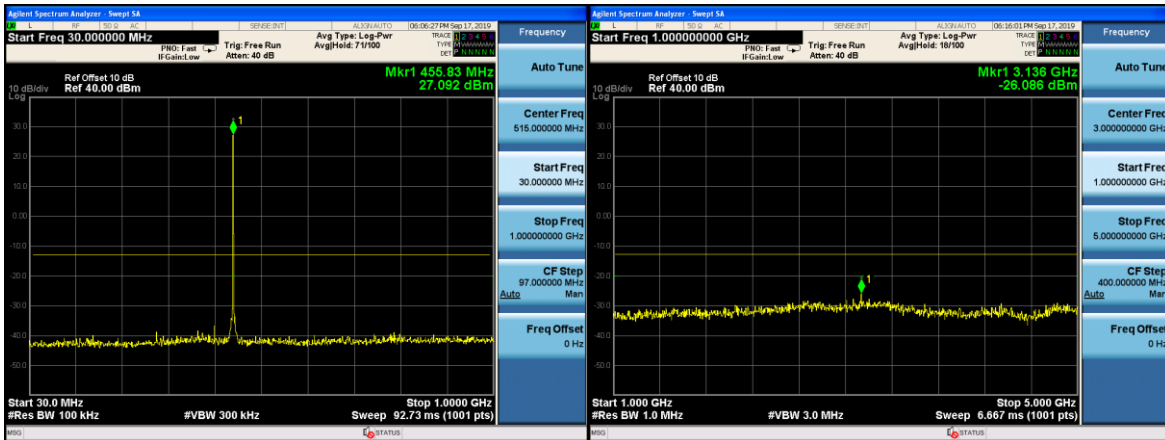


GMSK 25KHz Channel Spacing:

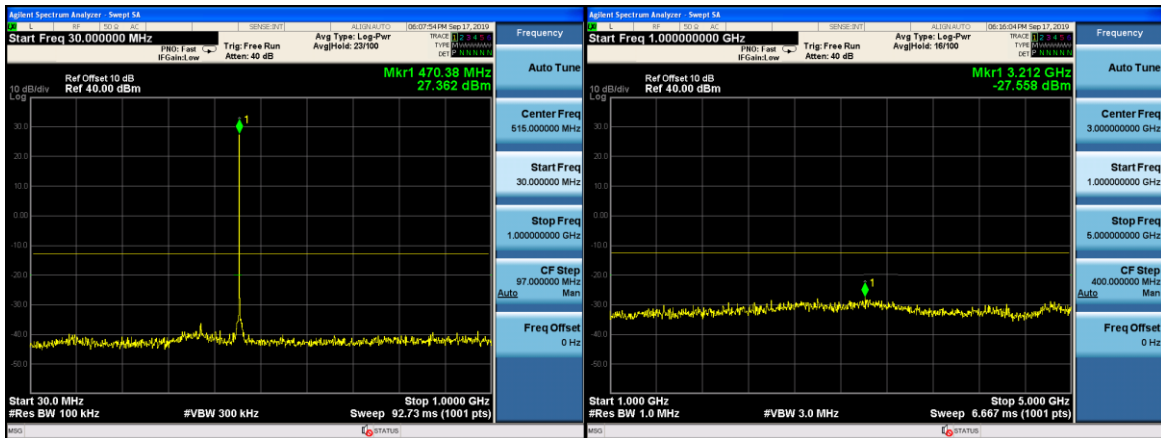
Low: 410.250MHz



Mid: 456.250MHz



High: 469.850MHz



3.4. Radiated Spurious Emission

3.4.1. Test Specification

Test Requirement:	FCC Part 90.210															
Test Method:	ANSI C63.26															
Measurement Distance:	3 m															
Antenna Polarization:	Horizontal & Vertical															
Operation mode:	Refer to item 4.1															
Receiver Setup:	<table border="1"> <thead> <tr> <th>Frequency</th> <th>RBW</th> <th>VBW</th> </tr> </thead> <tbody> <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> </tbody> </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:	<p>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.</p> <p>For equipment using 12.5 kHz channel spacing, on any frequency removed from the center of</p> <p>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.</p>															
Test setup:	<p>The diagram shows a 'RECEIVER UNDER TEST' on a 'TURNTABLE' within a 'STANDARD TEST SITE'. A 'Receiver Antenna' is positioned above the receiver, and a 'Test Antenna' is positioned to the right. A 'SPECTRUM ANALYZER' is connected to the Test Antenna.</p>															
Test Procedure:	<p>The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.</p> <p>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.</p> <p>The frequency range up to teeth harmonic of the fundamental frequency was investigated.</p> <p>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</p>															

	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
863.444	-96.19	V	0.58	30.71	-66.06	-20	-46.06
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	0.64	30.85	-66.31	-20	-46.31
675.773	-98.28	H	0.79	31.12	-67.95	-20	-47.95
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
862.247	-94.69	V	0.58	30.71	-64.56	-20	-44.56
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	0.64	30.85	-62.57	-20	-42.57
683.561	-96.27	H	0.79	31.12	-65.94	-20	-45.94
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
867.135	-93.23	V	0.58	30.71	-63.10	-20	-43.10
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	0.64	30.85	-66.25	-20	-46.25
677.316	-100.10	H	0.79	31.12	-69.77	-20	-49.77
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	-95.12	V	0.24	31.35	-64.01	-13	-51.01
360.122	-91.72	V	0.26	31.34	-60.64	-13	-47.64
672.254	-93.18	V	0.42	31.24	-62.36	-13	-49.36
867.320	-94.41	V	0.58	30.71	-64.28	-13	-51.28
1259.385	-82.65	V	1.23	26.38	-57.50	-13	-44.50
3856.570	-80.80	V	1.68	25.47	-57.01	-13	-44.01
287.978	-94.23	H	0.43	31.24	-63.42	-13	-50.42
402.660	-97.24	H	0.45	30.68	-67.01	-13	-54.01
475.190	-95.59	H	0.64	30.85	-65.38	-13	-52.38
678.902	-94.01	H	0.79	31.12	-63.68	-13	-50.68
1370.493	-83.39	H	1.29	26.12	-58.56	-13	-45.56
3258.430	-79.97	H	1.62	25.41	-56.18	-13	-43.18

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	-95.12	V	0.24	31.35	-64.01	-13	-51.01
361.299	-90.52	V	0.26	31.34	-59.44	-13	-46.44
670.384	-93.94	V	0.42	31.24	-63.12	-13	-50.12
859.190	-93.05	V	0.58	30.71	-62.92	-13	-49.92
1262.116	-84.85	V	1.23	26.38	-59.70	-13	-46.70
3860.246	-78.69	V	1.68	25.47	-54.9	-13	-41.9
285.515	-94.74	H	0.43	31.24	-63.93	-13	-50.93
404.347	-95.68	H	0.45	30.68	-65.45	-13	-52.45
472.970	-95.03	H	0.64	30.85	-64.82	-13	-51.82
682.270	-96.59	H	0.79	31.12	-66.26	-13	-53.26
1370.178	-79.86	H	1.29	26.12	-55.03	-13	-42.03
3261.045	-83.27	H	1.62	25.41	-59.48	-13	-46.48

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	-94.30	V	0.24	31.35	-63.19	-13	-50.19
363.368	-91.19	V	0.26	31.34	-60.11	-13	-47.11
670.811	-93.95	V	0.42	31.24	-63.13	-13	-50.13
865.805	-93.77	V	0.58	30.71	-63.64	-13	-50.64
1258.551	-79.43	V	1.23	26.38	-54.28	-13	-41.28
3858.923	-79.14	V	1.68	25.47	-55.35	-13	-42.35
291.012	-95.71	H	0.43	31.24	-64.90	-13	-51.90
400.454	-95.91	H	0.45	30.68	-65.68	-13	-52.68
475.645	-95.10	H	0.64	30.85	-64.89	-13	-51.89
680.453	-98.49	H	0.79	31.12	-68.16	-13	-55.16
1373.809	-82.84	H	1.29	26.12	-58.01	-13	-45.01
3264.509	-77.82	H	1.62	25.41	-54.03	-13	-41.03

3.5. Transient Frequency Behavior

3.5.1. Test Specification

Test Requirement:	FCC Part 90.214																																				
Test Setup:																																					
Test Limit	<table border="1"> <thead> <tr> <th rowspan="3">Frequency Range</th> <th rowspan="3">Channel Bandwidth</th> <th colspan="3">Frequency Tolerance (ppm)</th> </tr> <tr> <th rowspan="2">Fixed and Base Station</th> <th colspan="2">Mobile Stations</th> </tr> <tr> <th>> 2W</th> <th>≤ 2W</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>* 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.</p>	Frequency Range	Channel Bandwidth	Frequency Tolerance (ppm)			Fixed and Base Station	Mobile Stations		> 2W	≤ 2W	150-174MHz	6.25	1.0	2.0	2.0	12.5	2.5	5.0	5.0	25	5.0	5.0	50.0*	421-512MHz	6.25	0.5	1.0	1.0	12.5	1.5	2.5	2.5	25	2.5	5.0	5.0
Frequency Range	Channel Bandwidth			Frequency Tolerance (ppm)																																	
				Fixed and Base Station	Mobile Stations																																
		> 2W	≤ 2W																																		
150-174MHz	6.25	1.0	2.0	2.0																																	
	12.5	2.5	5.0	5.0																																	
	25	5.0	5.0	50.0*																																	
421-512MHz	6.25	0.5	1.0	1.0																																	
	12.5	1.5	2.5	2.5																																	
	25	2.5	5.0	5.0																																	
Test Procedure:	<p>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.</p>																																				
Test Result:	PASS																																				

3.5.2. Test data

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

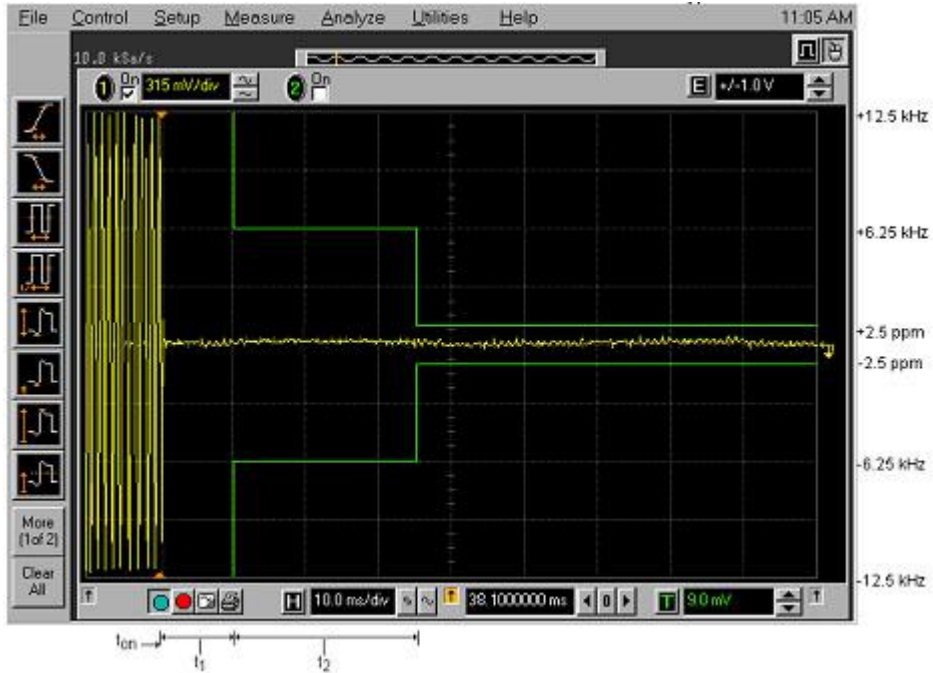
Power On



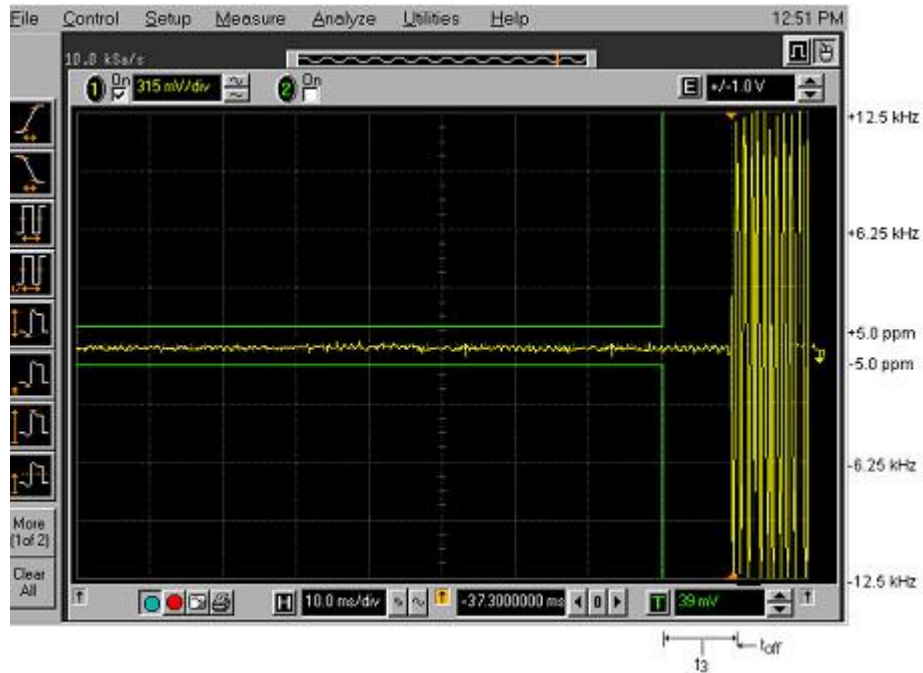
Power Off



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:	<pre> graph TD Laptop[Laptop] --- EUT[Equipment Under Test] EUT --- ACDC[AC/DC Adapter] EUT --- Att[Attenuator(s)] Att --- MC[Mini-Circuit Combiner] RF[RF Communication Test Set] --- MC MC --- RFDet[RF Detector] MC --- Mod[Modulation Analyzer] RFDet --- Osc[Hewlett Packard Infinium Digitizing Oscilloscope] </pre>
Test Procedure:	<p>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.</p> <p>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.</p> <p>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.</p>
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	-39	-0.0855
	7.0	-38	-0.0833
	6.8	-39	-0.0855
	6.6	-39	-0.0855
Limit	2.5ppm		
Middle Channel 25KHz Channel Spacing	7.2	-42	-0.0921
	7.0	-40	-0.0877
	6.8	-42	-0.0921
	6.6	-42	-0.0921
Limit	5ppm		

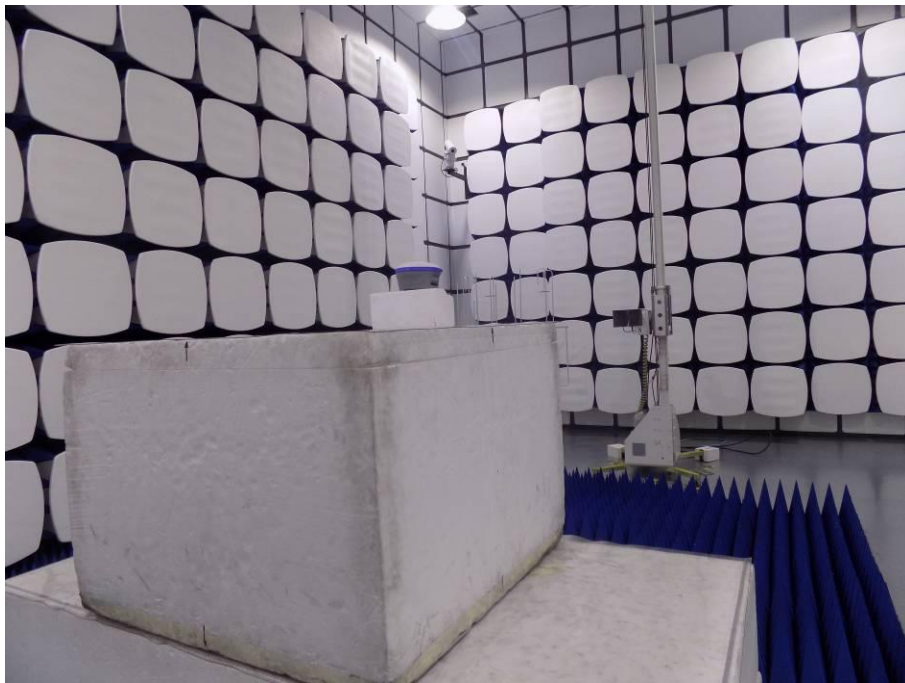
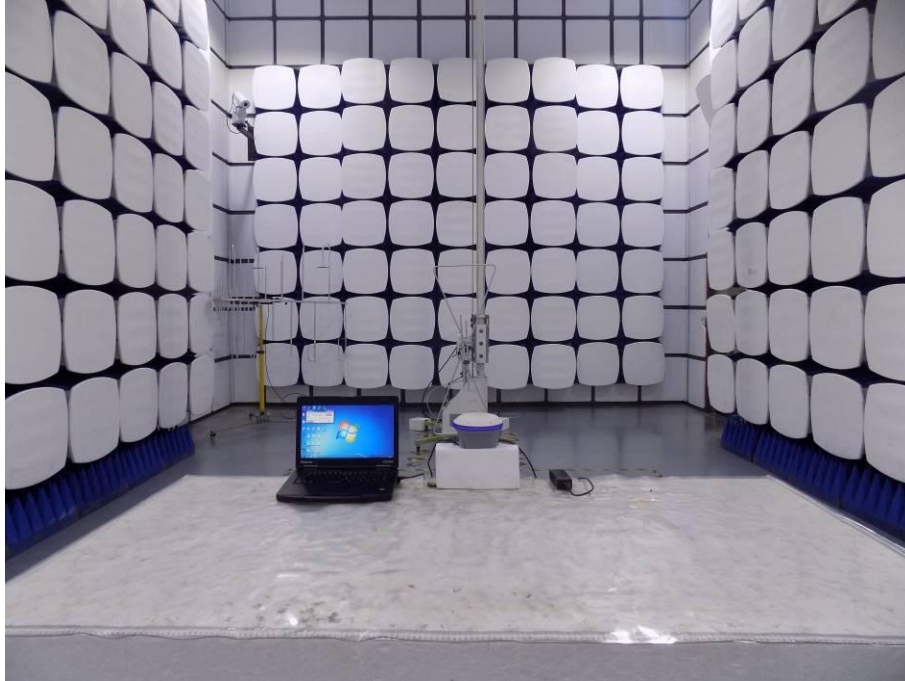
Mode	Temperature (°C)	Frequency error (Hz)	frequency error (ppm)
Middle Channel 12.5KHz Channel Spacing	-20	-34	-0.0740
	-10	-28	-0.0613
	0	-28	-0.0606
	10	-51	-0.1110
	20	-15	-0.0338
	30	-32	-0.0707
	40	-48	-0.1053
	50	-23	-0.0501
Limit	2.5ppm		
Middle Channel 25KHz Channel Spacing	-20	-32	-0.0693
	-10	-21	-0.0455
	0	-26	-0.0581
	10	-52	-0.1131
	20	-20	-0.0429
	30	-29	-0.0629
	40	-42	-0.0917
	50	-22	-0.0487
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. TEST SETUP PHOTO

Please refer to the report A1907162-C01-R06.

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