Certificate #4338.01

Radio Test Report

Report No.: STS2307029W05

Issued for

Guangzhou Devecent Information Technology Co.,Ltd.

Rm 402, Building A, No.11, CaiPin Road, Science City, HuangPu District, GuangZhou, GuangDong, China

Product Name:	High Precision GNSS Receiver
Brand Name:	ZX,TokNav, SphereFix, GINTEC, Meridian, KanQ
Model Name:	M68K Pro
Series Model(s)	M68K, M68K Lite, T20, T20Pro, T30, SP30, SP40, SP40Pro, F200,G20Plus, M8, M8S
FCC ID:	2BB82-M68K
Test Standards:	FCC Part 90 Rules

TEST REPORT

Applicant's Name ..... :	Guangzhou Devecent Information Technology Co.,Ltd.
Address ..... :	Rm 402, Building A, No.11, CaiPin Road, Science City, HuangPu District, GuangZhou, GuangDong, China
Manufacture's Name ..... :	Guangzhou Devecent Information Technology Co.,Ltd.
Address ..... :	Rm 402, Building A, No.11, CaiPin Road, Science City, HuangPu District, GuangZhou, GuangDong, China

Product Description

Product Name ..... :	High Precision GNSS Receiver
Brand Name ..... :	ZX,TokNav, SphereFix, GINTEC, Meridian, KanQ
Model Name..... :	M68K Pro
Series Model ..... :	M68K, M68K Lite, T20, T20Pro, T30, SP30, SP40, SP40Pro, F200,G20Plus, M8, M8S
Test Standards ..... :	FCC Part 90 Rules
Test Procedure ..... :	C63.26-2015

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test ..... :	
Date of receipt of test item ..... :	06 July 2023
Date of performance of tests.. :	06 July 2023 ~ 30 Aug. 2023
Date of Issue ..... :	30 Aug. 2023
Test Result ..... :	Pass

Testing Engineer : Lenon.Hou

(Lenon Hou)

Technical Manager : Sean She

(Sean she)

Authorized Signatory : Chris Chen

(Chris Chen)

SHENZHEN STS TEST SERVICES CO.,LTD. TESTING APPROVAL

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	30 Aug. 2023	STS2307029W05	ALL	Initial Issue

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

Emission			
Standard	Item	Result	Remarks
FCC Part 90.205	Maximum Transmitter Power	PASS	
FCC Part 90.209	Occupied Bandwidth	PASS	
FCC Part 90.210	Emission Mask	PASS	
FCC Part 90.210	Transmitter Radiated Spurious Emssion	PASS	
FCC Part 90.210	Spurious Emssion on Antenna Port	PASS	
FCC Part 90.213	Frequency Stability Test	PASS	
FCC Part 90.210	Transient Frequency Behavior	PASS	
FCC Part 2.1047	Modulation Characteristic	N/A	

NOTE:

(1) “N/A” denotes test is not applicable in this Test Report.

1.1 TEST FACILITY

SHENZHEN STS TEST SERVICES CO., LTD
Add. : 101, Building B, Zhuoke Science Park, No.190 Chongqing Road, ZhanChengShequ, Fuhai Sub-District, Bao'an District, Shenzhen, Guang Dong, China
FCC test Firm Registration Number: 625569
IC test Firm Registration Number: 12108A
A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	RF output power, conducted	±1.197dB
2	Unwanted Emissions, conducted	±2.896dB
3	All emissions, radiated 9K-30MHz	±3.84dB
4	All emissions, radiated 30M-1GHz	±3.94dB
5	All emissions, radiated 1G-6GHz	±4.59dB
6	All emissions, radiated>6G	±5.22dB
7	Conducted Emission (9KHz-150KHz)	±2.14dB
8	Conducted Emission (150KHz-30MHz)	±2.54dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

<table>
<tr><td>Product Name:</td><td>High Precision GNSS Receiver</td></tr>
<tr><td>Brand Name:</td><td>ZX,TokNav, SphereFix, GINTEC, Meridian, KanQ</td></tr>
<tr><td>Model Name:</td><td>M68K Pro</td></tr>
<tr><td>Series Model:</td><td>M68K, M68K Lite, T20, T20Pro, T30, SP30, SP40, SP40Pro, F200,G20Plus, M8, M8S</td></tr>
<tr><td>Model Difference description:</td><td>Differences in screen function and brand.
<table>
<tr><td>Brand</td><td>LED Model</td><td>LCD Model</td></tr>
<tr><td>ZX</td><td>M68K</td><td>M68K Pro</td></tr>
<tr><td>ZX</td><td>M68K Lite</td><td>/</td></tr>
<tr><td>TokNav</td><td>T20</td><td>T20Pro</td></tr>
<tr><td>TokNav</td><td>T30</td><td>/</td></tr>
<tr><td>SphereFix</td><td>SP30</td><td>/</td></tr>
<tr><td>SphereFix</td><td>SP40</td><td>SP40Pro</td></tr>
<tr><td>GINTEC</td><td>F200</td><td>/</td></tr>
<tr><td>GINTEC</td><td>G20Plus</td><td>/</td></tr>
<tr><td>Meridian</td><td>M8</td><td>/</td></tr>
<tr><td>KanQ</td><td>M8S</td><td>/</td></tr>
</table></td></tr>
<tr><td>Operation Frequency Range</td><td>421-470 MHz</td></tr>
<tr><td>Maximum Transmitter Power:</td><td>36.902dBm</td></tr>
<tr><td>Channel Separation:</td><td>6.25KHz</td></tr>
<tr><td>Modulation type:</td><td>Digital mode: 4FSK</td></tr>
<tr><td>Rating</td><td>Input: 5VDC 3A or 15VDC 2A IP68 Class III(Supplied by USB type C port or 7.4V, 6500mAh internal rechargeable battery pack)</td></tr>
<tr><td>Temperature Range:</td><td>-30℃-50℃</td></tr>
<tr><td>Test frequency list:</td><td>See Note 3</td></tr>
<tr><td>Software version number:</td><td>m68.2.438.2307.1755</td></tr>
<tr><td>Hardware version number:</td><td>M68K-PCBA.1.1.230225</td></tr>
</table>

Note:

1. For a more detailed features description, please refer to the manufacturer’s specifications or the User's Manual.

2. Table for Filed Antenna

Ant	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	ZX,TokNav, SphereFix, GINTEC, Meridian, KanQ	M68K Pro	Rod antenna	N/A	2dBi	Antenna

The EUT antenna is Rod Antenna. No antenna other than that furnished by the responsible party shall be used with the device.

3. Test frequency list

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01(Low)	421.05	02	421.05625	03	421.0625
…	…	…	…	…	…
3912	445.49325	3913(Mid)	445.5	3914	445.50625
…	…	…	…	…	…
7823	469.9375	7824	469.94375	7825(High)	469.95

Note:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test,please see the above listed frequency for testing.

2.2 EUT OPERATION MODE

The EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

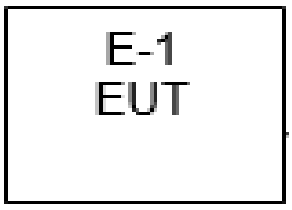
2.3 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Test Mode	Power level	Modulation Type	Channel Separation	Frenquency
Mode1	Low power	4FSK	6.25kHz	Low channel(421.05MHz)
				Mid channel(445.5MHz)
				High channel(469.95MHz)
Mode2	High power			Low channel(421.05MHz)
				Mid channel(445.5MHz)
				High channel(469.95MHz)

2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission Test



2.5 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
N/A	N/A	N/A	N/A	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
N/A	N/A	N/A	N/A	N/A	N/A

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

2.7 TEST EQUIPMENT

RF Radiation Test Equipment					
Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Temperature & Humidity	SW-108	SuWei	N/A	2023.03.03	2024.03.02
Wireless Communications Test Set	R&S	CMW 500	117239	2023.03.01	2024.02.29
Pre-Amplifier(0.1M-3GHz)	EM	EM330	060665	2023.02.28	2024.02.27
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2022.09.29	2023.09.28
Positioning Controller	MF	MF-7802	MF-780208587	N/A	N/A
Signal Analyzer	R&S	FSV 40-N	101823	2022.09.29	2023.09.28
Switch Control Box	N/A	N/A	N/A	N/A	N/A
Filter Box	BALUN Technology	SU319E	BL-SZ1530051	N/A	N/A
Video Controller	SKET	FCS C-3	N/A	N/A	N/A
Bilog Antenna	TESEQ	CBL6111D	34678	2022.09.30	2024.09.29
Horn Antenna	SCHWARZBECK	BBHA 9120D	02014	2021.10.11	2023.10.10
Antenna Mast	MF	MFA-440H	N/A	N/A	N/A
Turn Table	MF	N/A	N/A	N/A	N/A
AC Power Source	APC	KDF-11010G	F214050035	N/A	N/A
DC Power Supply	Zhaoxin	RXN 605D	20R605D11010081	N/A	N/A
Test SW	EMC Test Software	15.2.0.339			
RF Connected Test Equipment					
Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Temperature & Humidity	SW-108	SuWei	N/A	2023.03.03	2024.03.02
Universal Radio communication tester	R&S	CMU200	111058	2022.09.28	2023.09.27
Signal Generator	Agilent	N5182A	MY46240556	2022.09.28	2023.09.27
Signal Analyzer	Agilent	N9020A	MY52440124	2023.03.01	2024.02.29
Intercom comprehensive tester	HP	8920A	348A05658	2023.03.01	2024.02.29
Temperature & Humidity Test Chamber	Safety test	AG80L	171200018	2023.03.01	2024.02.29
Programmable Power Supply	Agilent	E3642A	MY40002025	2022.09.29	2023.09.28
Attenuator	HP	8494B	DC-18G	2023.03.02	2024.03.01
AC Power Source	APC	KDF-11010G	F214050035	N/A	N/A

3. MAXIMUM TRANSMITTER POWER

3.1 LIMITS

Per FCC Part 2.1046 and Part 90.205: Maximum ERP is dependent upon the station's antenna HAAT and required service area.

The output power shall not exceed by more than 20 percent either the output power shown in the Radio Equipment List [available in accordance with §90.203(a)(1)] for transmitters included in this list or when not so listed, the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

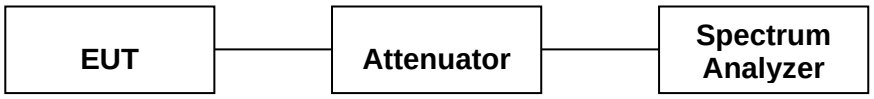
3.2 TEST PROCEDURE

Measurements shall be made to establish the radio frequency power delivered by the transmitter the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted bellow:
If the power output is adjustable, measurements shall be made for the highest and lowest power levels. The EUT connect to the Spectrum Analyzer through 30 dB attenuator.

3.3 DEVIATION FROM TEST STANDARD

No deviation

3.4 TEST SETUP BLOCK DIAGRAM

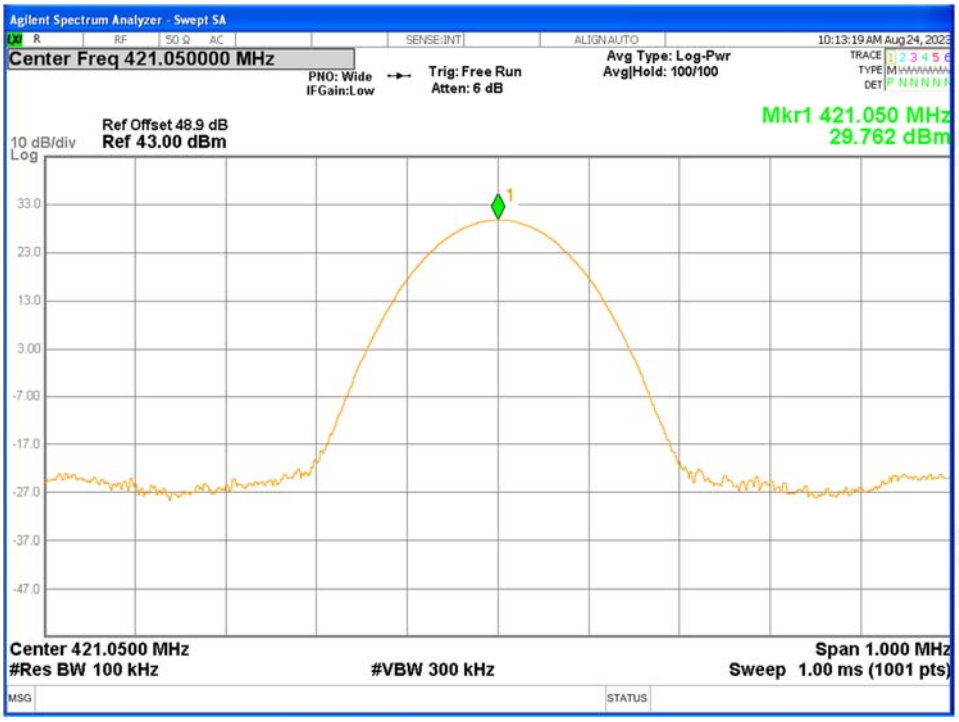


3.5 TEST RESULT

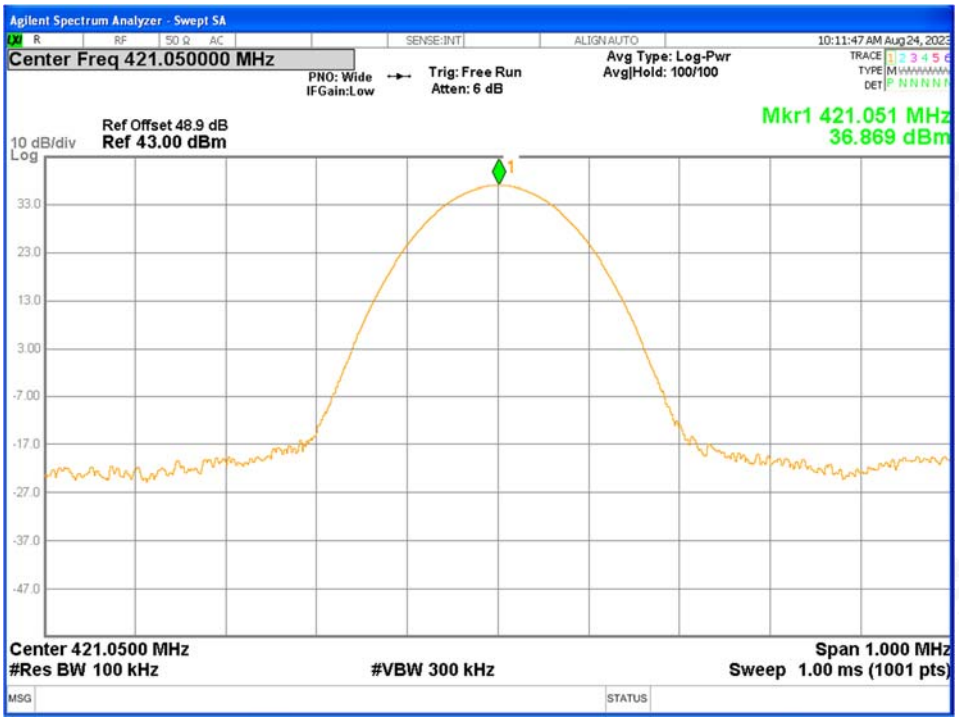
Modulation Type	Channel Sparation	Operation Mode	Test Channel	Test Frequency (MHz)	Test Results (dBm)	Test Results (W)	Limit (W)
4FSK	6.25kHz	Low Power	Lowest	421.0500	29.762	0.95	0.8-1.2
			Middle	445.5000	29.588	0.91	
			Highest	469.9500	29.609	0.91	
		High Power	Lowest	421.0500	36.869	4.86	4-6
			Middle	445.5000	36.902	4.90	
			Highest	469.9500	36.871	4.87	

Note: The rated low power is 1W, the power limits is 0.8W~1.2W.
The rated high power is 5W, the power limits is 4W~6W.

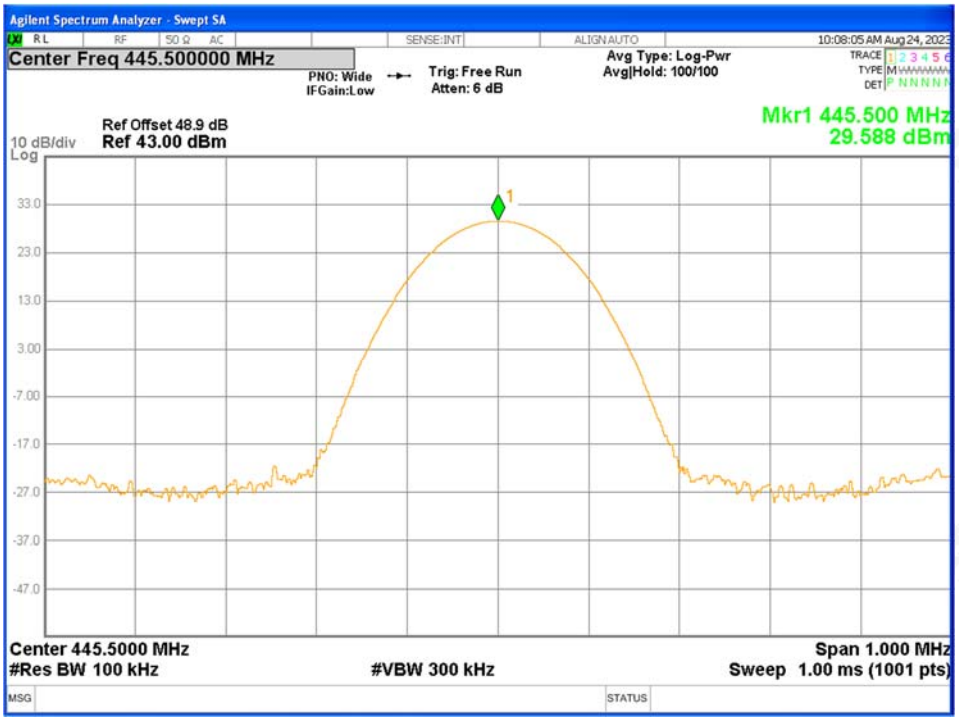
421.050MHz-L



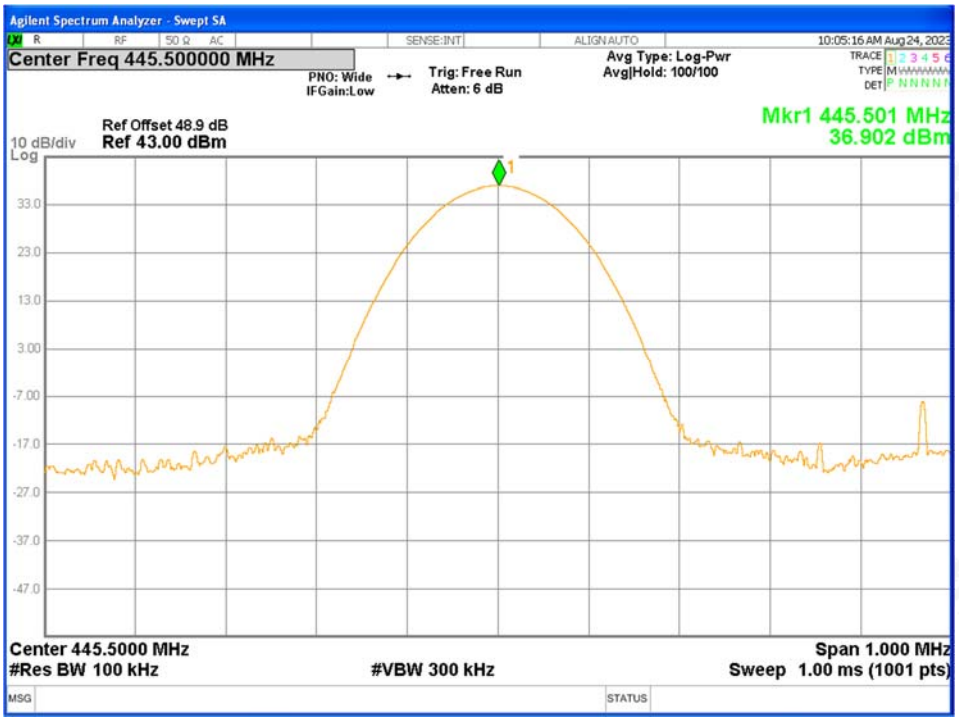
421.050MHz-H



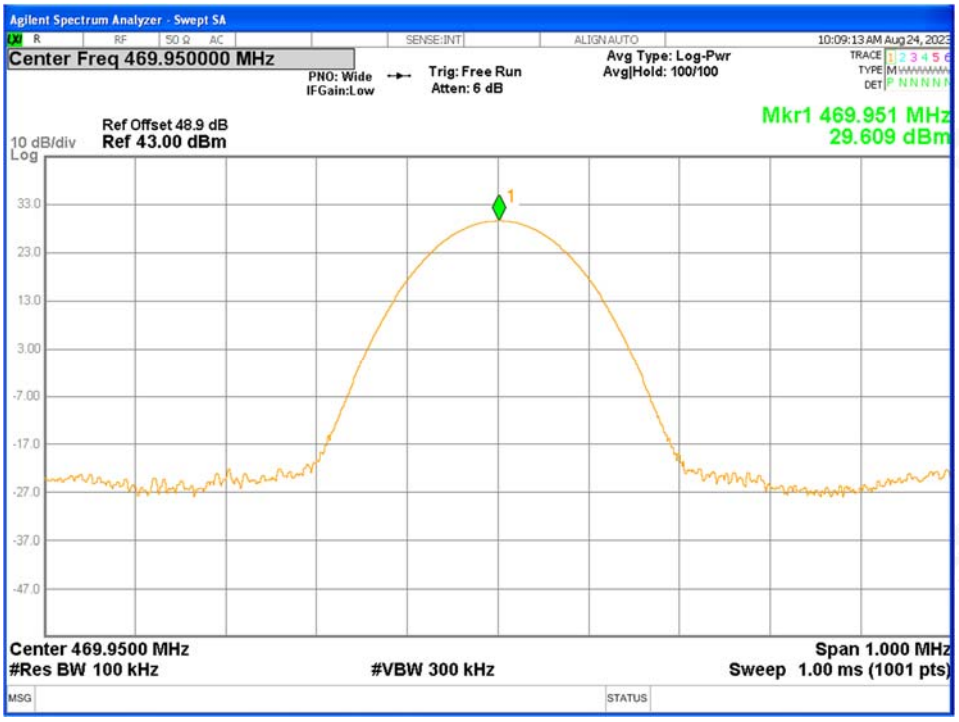
445.50MHz-L



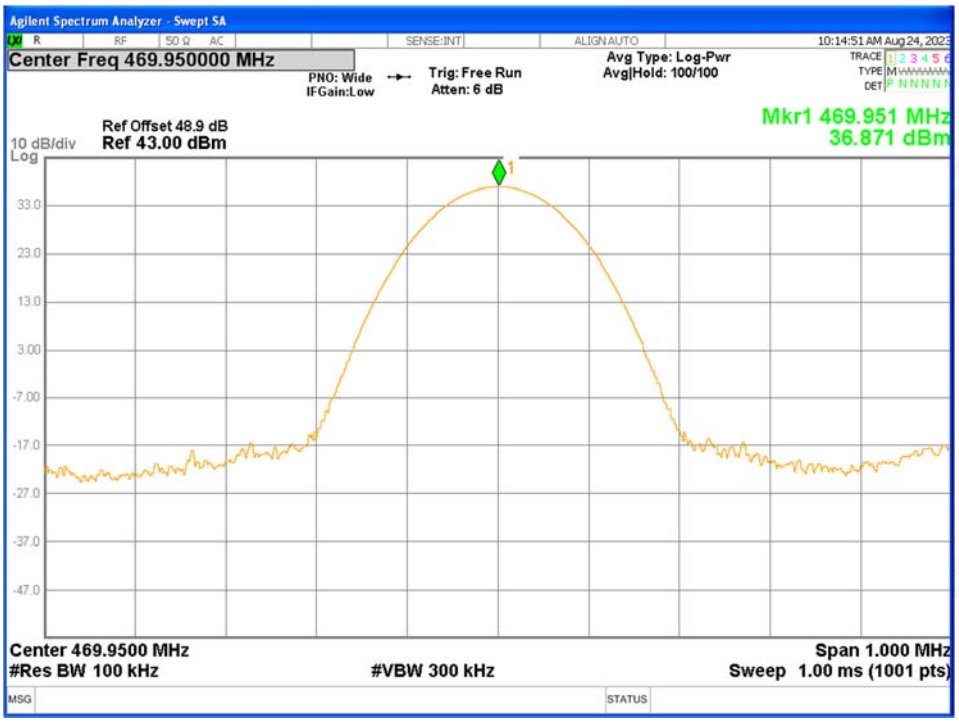
445.50MHz-H



469.950MHz-L



469.950MHz-H



4. OCCUPIED BANDWIDTH

4.1 LIMIT

Occupied Bandwidth: The EUT was connected to the spectrum analyzer via the main RF connector, and through an appropriate attenuator. The EUT was controlled to transmit its maximum power. Then the bandwidth of 99% power can be measured by the spectrum analyzer. The maximum authorized bandwidth shall not be more than that normally authorized for digital data mode.

4.2 MEASUREMENT PROCEDURE

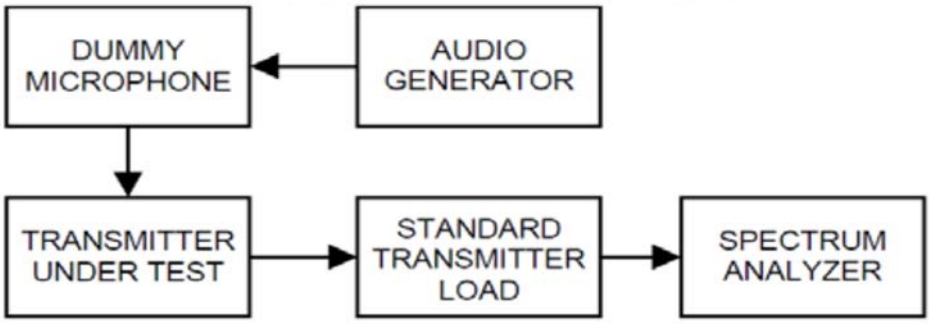
a. The EUT was connected to the spectrum analyzer through sufficent attenuation.

b. Set EUT as digital data mode.

c. Set SPA Center Frequency=fundamental frequency, RBW=100Hz, VBW=1KHz, span =15KHz.

e Set SPA Max hold. Mark peak, Set 99% Occupied Bandwidth.

4.3 TEST SETUP BLOCK DIAGRAM

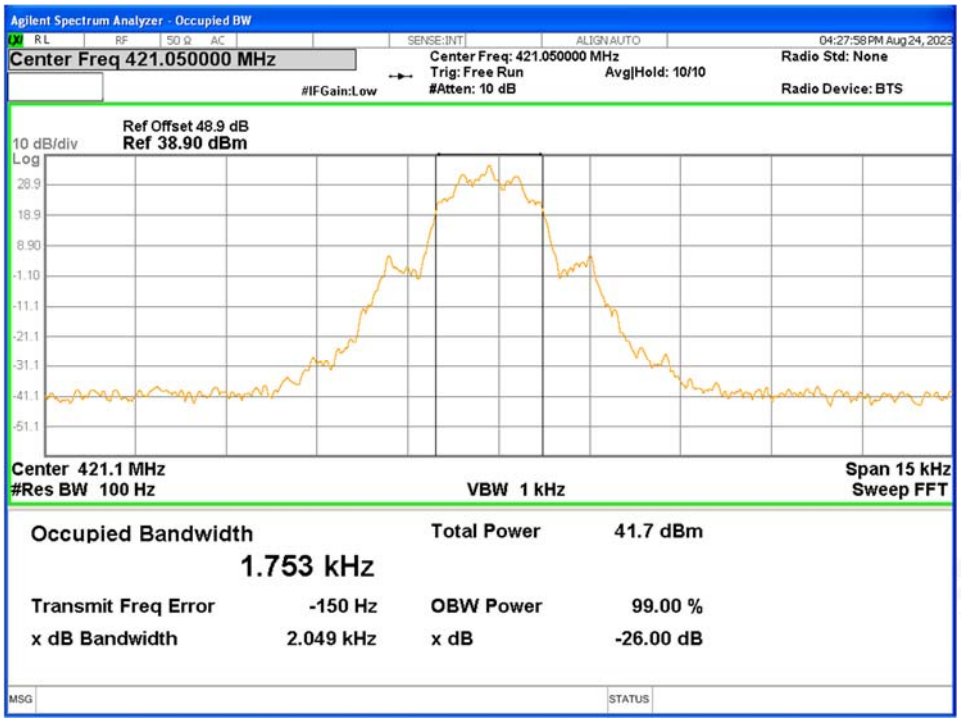


4.4 TEST RESULT

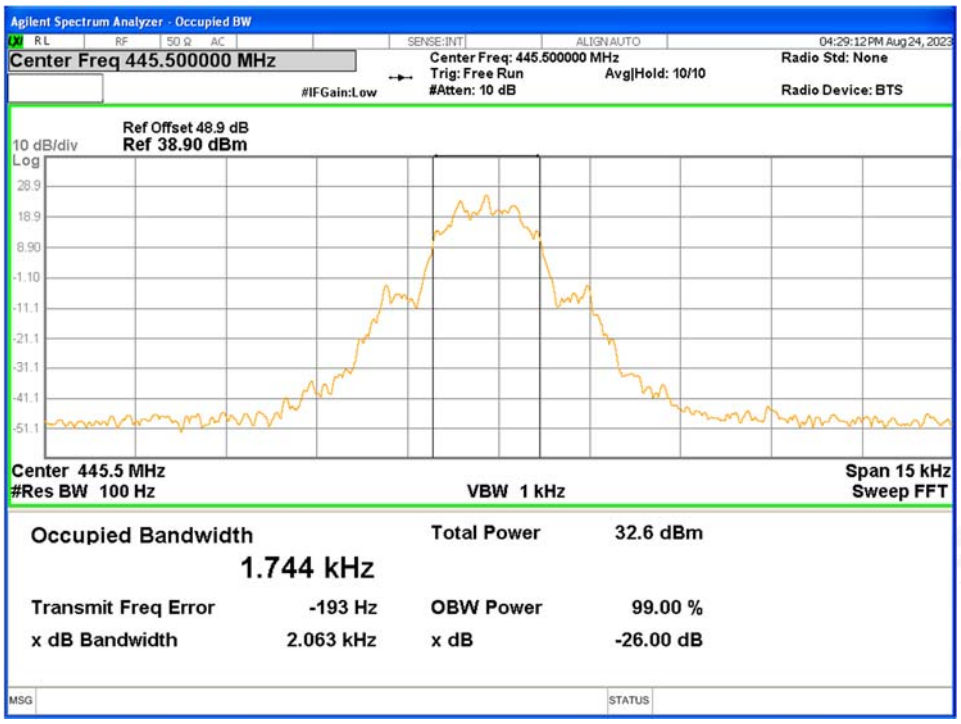
Modulation Type	Channel Bandwidth	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)		Limits （KHz）
					99%	26dB	
4FSK	6.25KHz	Low Power	Lowest	421.0500	1.747	2.092	6
			Middle	445.5000	1.744	2.063	
			Highest	469.9500	1.772	2.061	
		High Power	Lowest	421.0500	1.753	2.049	
			Middle	445.5000	1.761	2.019	
			Highest	469.9500	1.742	2.076	

421.050MHz-L

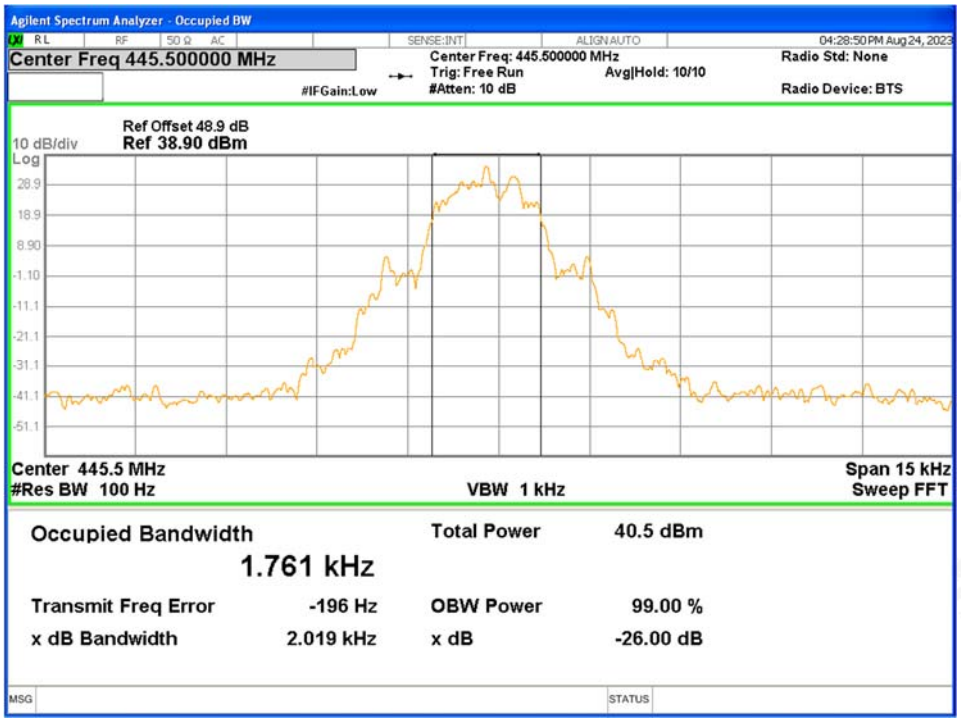
421.050MHz-H



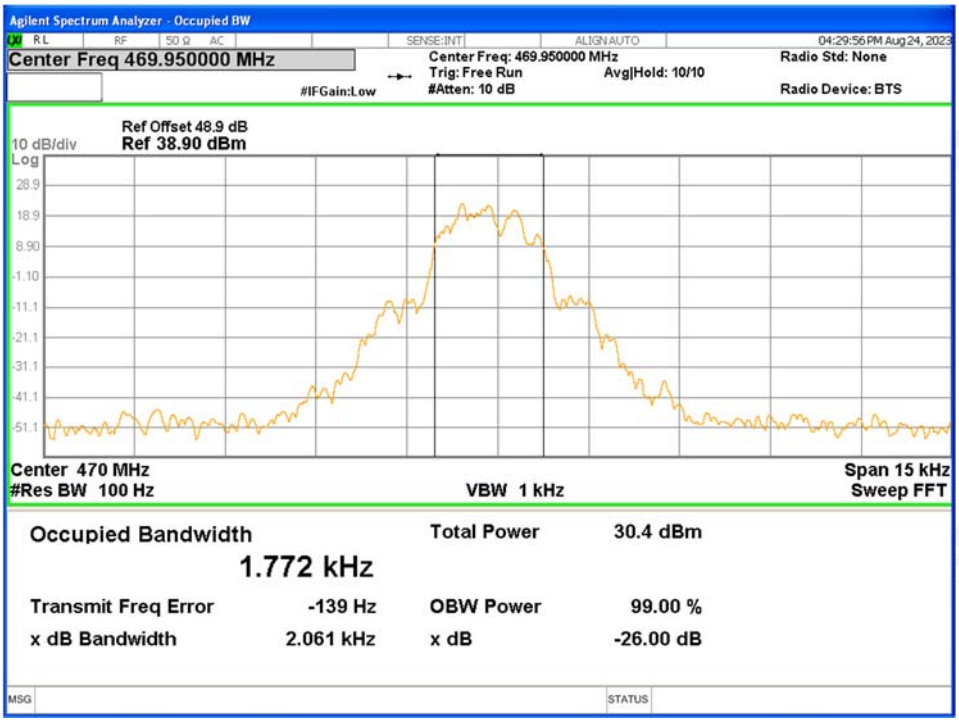
445.50MHz-L



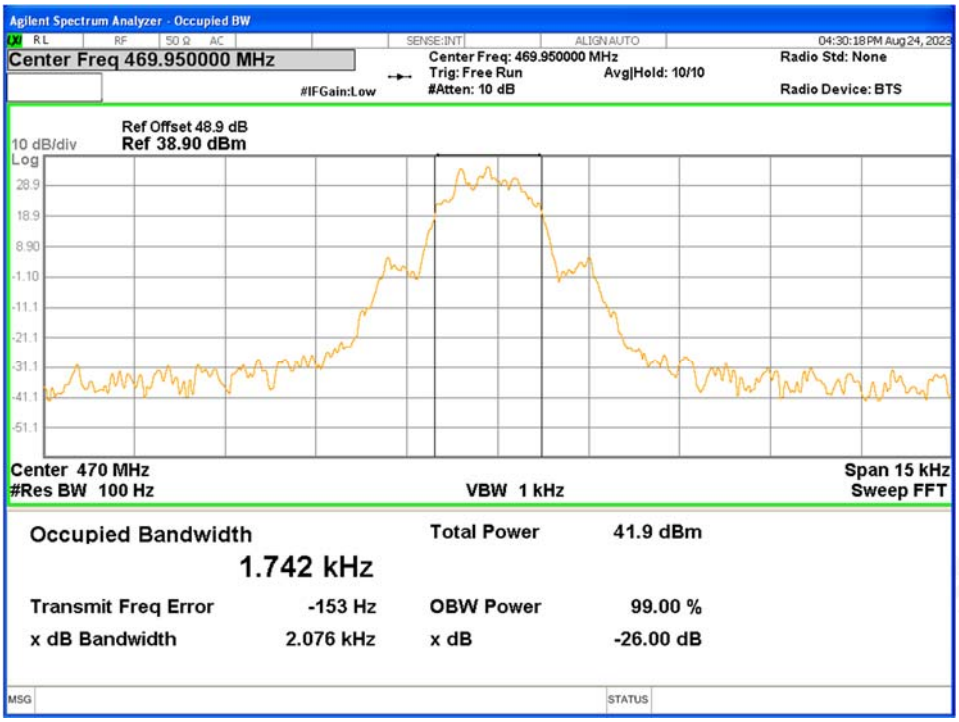
445.50MHz-H



469.950MHz-L



469.950MHz-H



5. EMISSION MASK

5.1 PROVISIONS APPLICABLE

Emission Mask E—6.25 kHz or less channel bandwidth equipment.

For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must beattenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f0 to 3.0 kHz removed from f0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least 30 + 16.67(fd−3 kHz) or 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

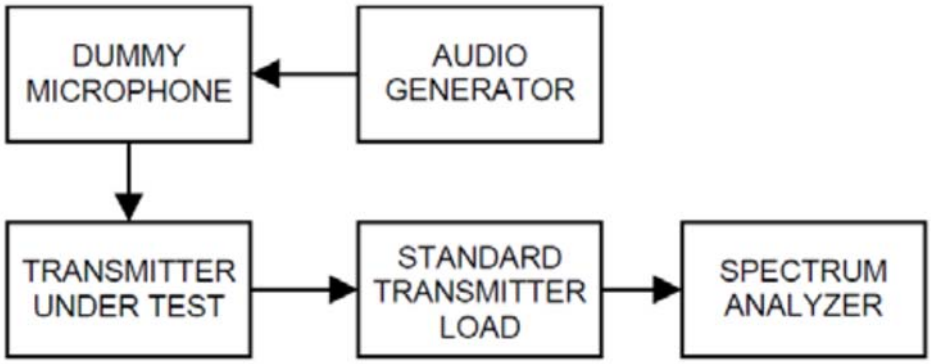
5.2 MEASUREMENT PROCEDURE

a. The EUT was connected to the spectrum analyzer through sufficent attenuation.

b. Set EUT as digital data mode.

c Set SPA Center Frequency=fundamental frequency, RBW=100Hz, VBW=3KHz, span =100KHz.

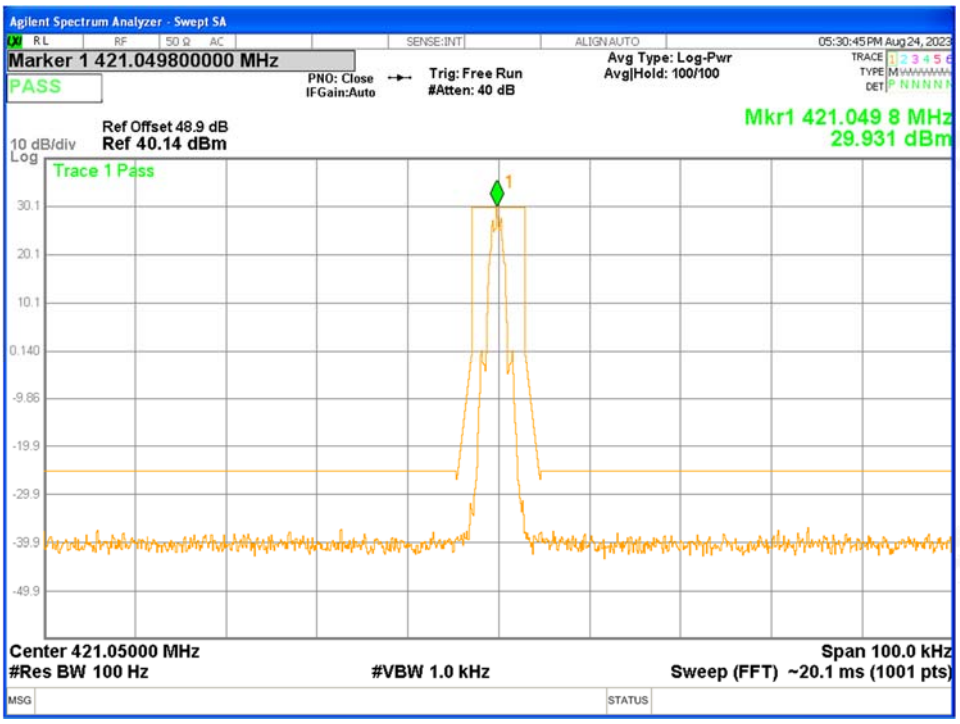
5.3 TEST SETUP BLOCK DIAGRAM



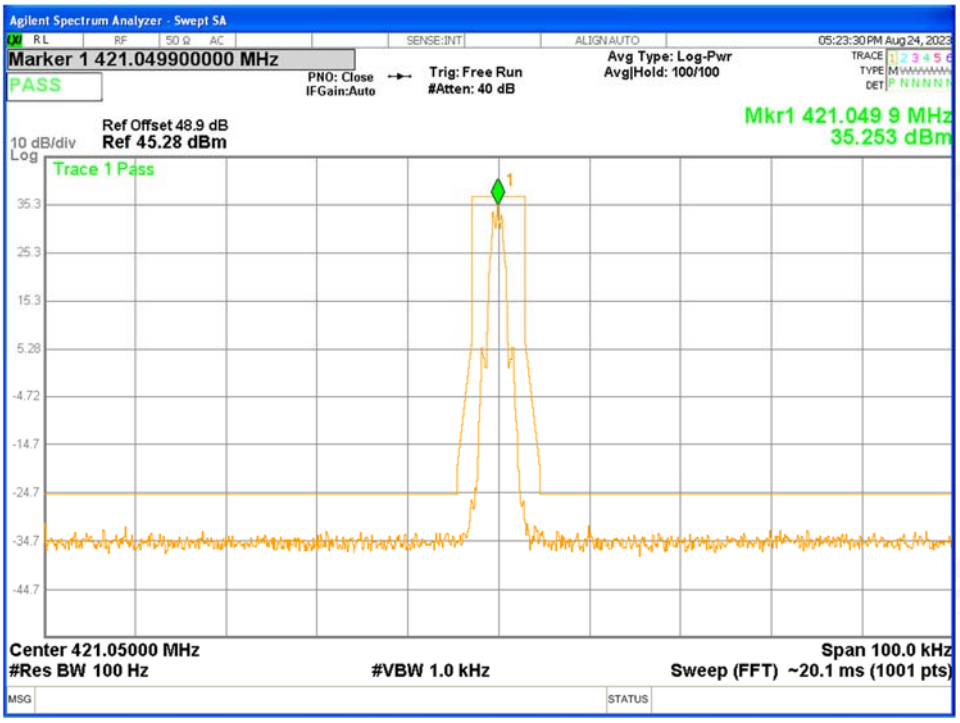
5.4 MEASUREMENT RESULT

Modulation Type	Channel Bandwidth	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	Result
4FSK	6.25KHz	Low Power	Lowest	421.0500	E	PASS
			Middle	445.5000	E	PASS
			Highest	469.9500	E	PASS
		High Power	Lowest	421.0500	E	PASS
			Middle	445.5000	E	PASS
			Highest	469.9500	E	PASS

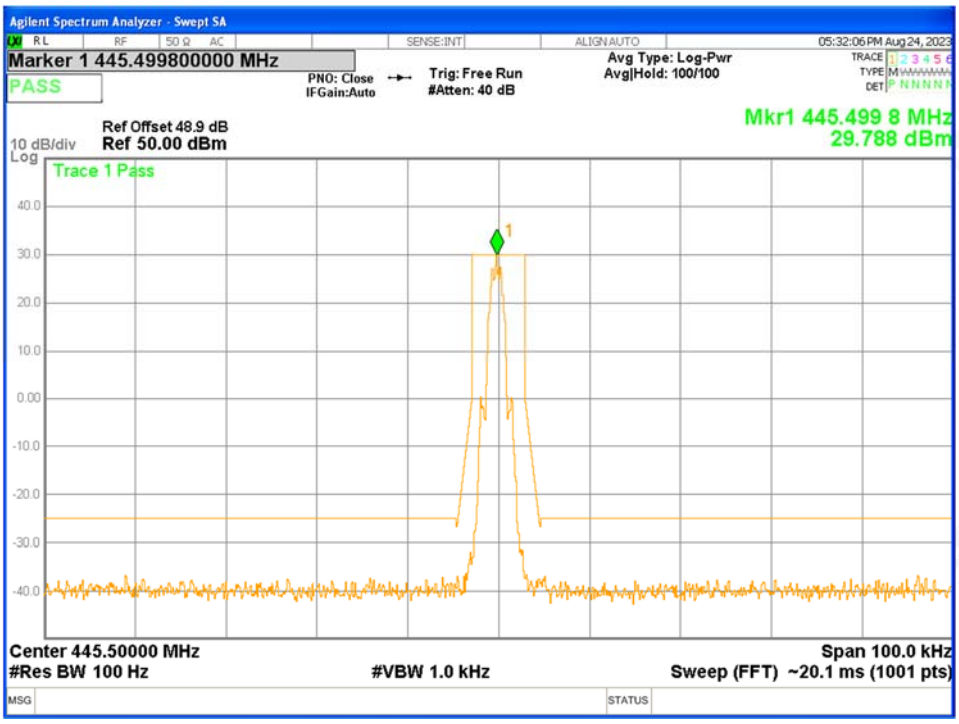
421.050MHz-LOW Power



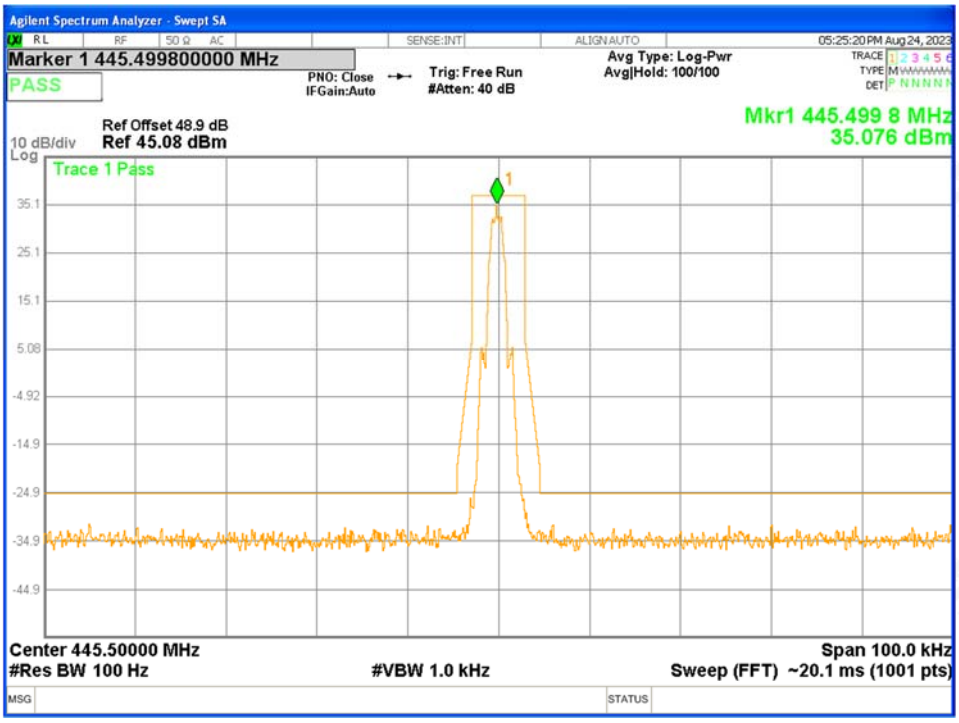
421.050MHz-HIGH Power



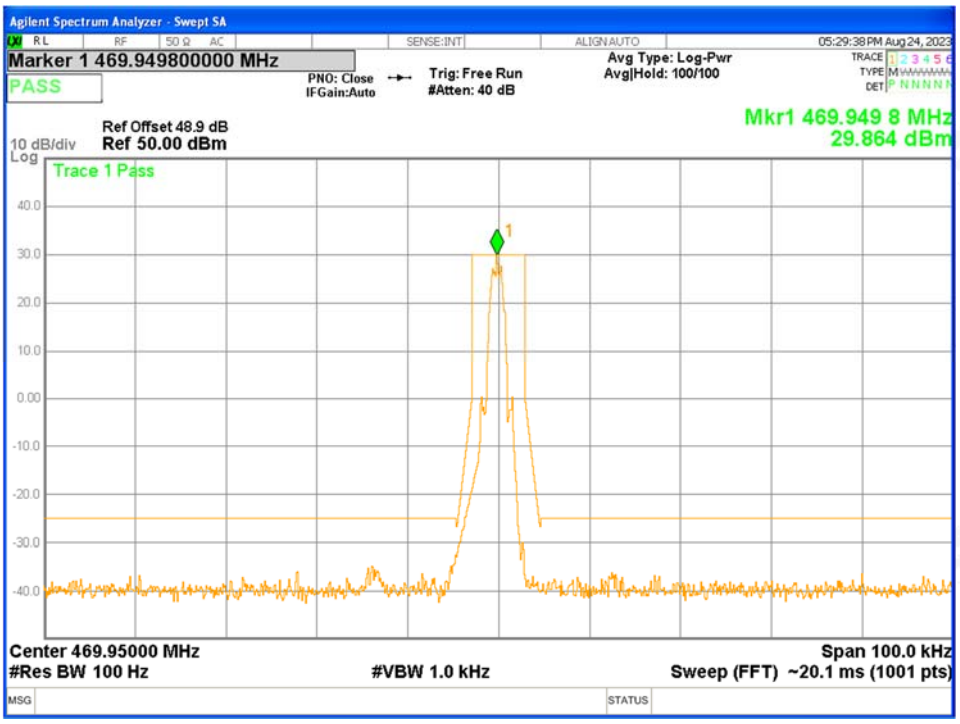
445.500MHz-LOW Power



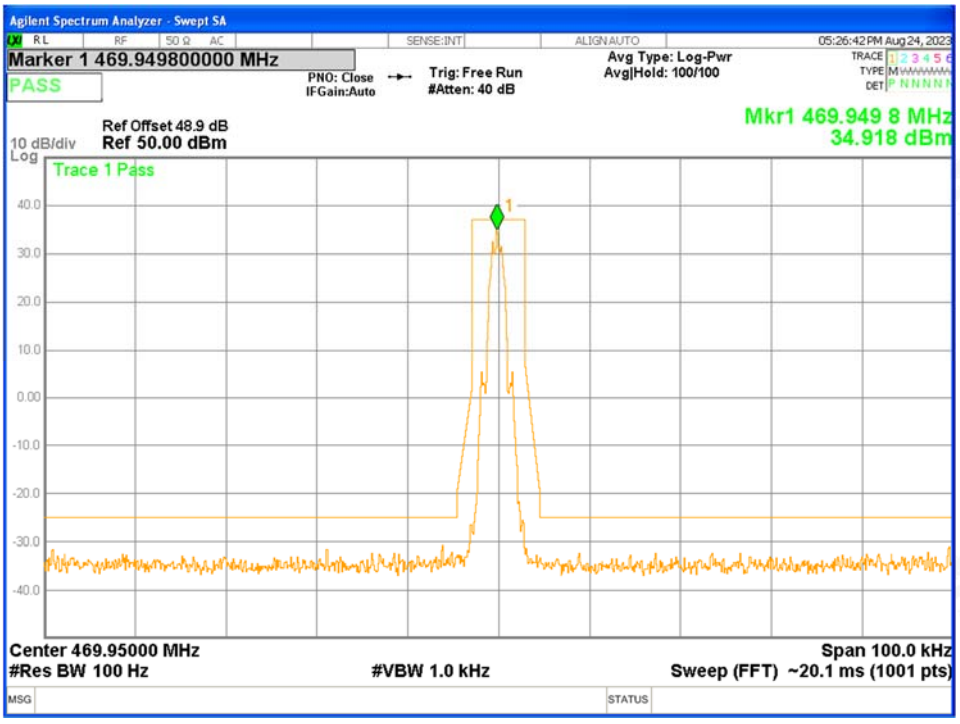
445.500MHz-HIGH Power



469.950MHz-LOW Power



469.950MHz-HIGH Power



6. TRANSMITTER RADIATED SPURIOUS EMSSION

6.1 PROVISIONS APPLICABLE

Emission Mask E—6.25 kHz or less channel bandwidth equipment.

For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must beattenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f0 to 3.0 kHz removed from f0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least 30 + 16.67(fd−3 kHz) or 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

6.2TEST PROCEDURE

a. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT. for emission measurements. The height of receiving antenna is 1.50 m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in six channels were measured with peak detector.

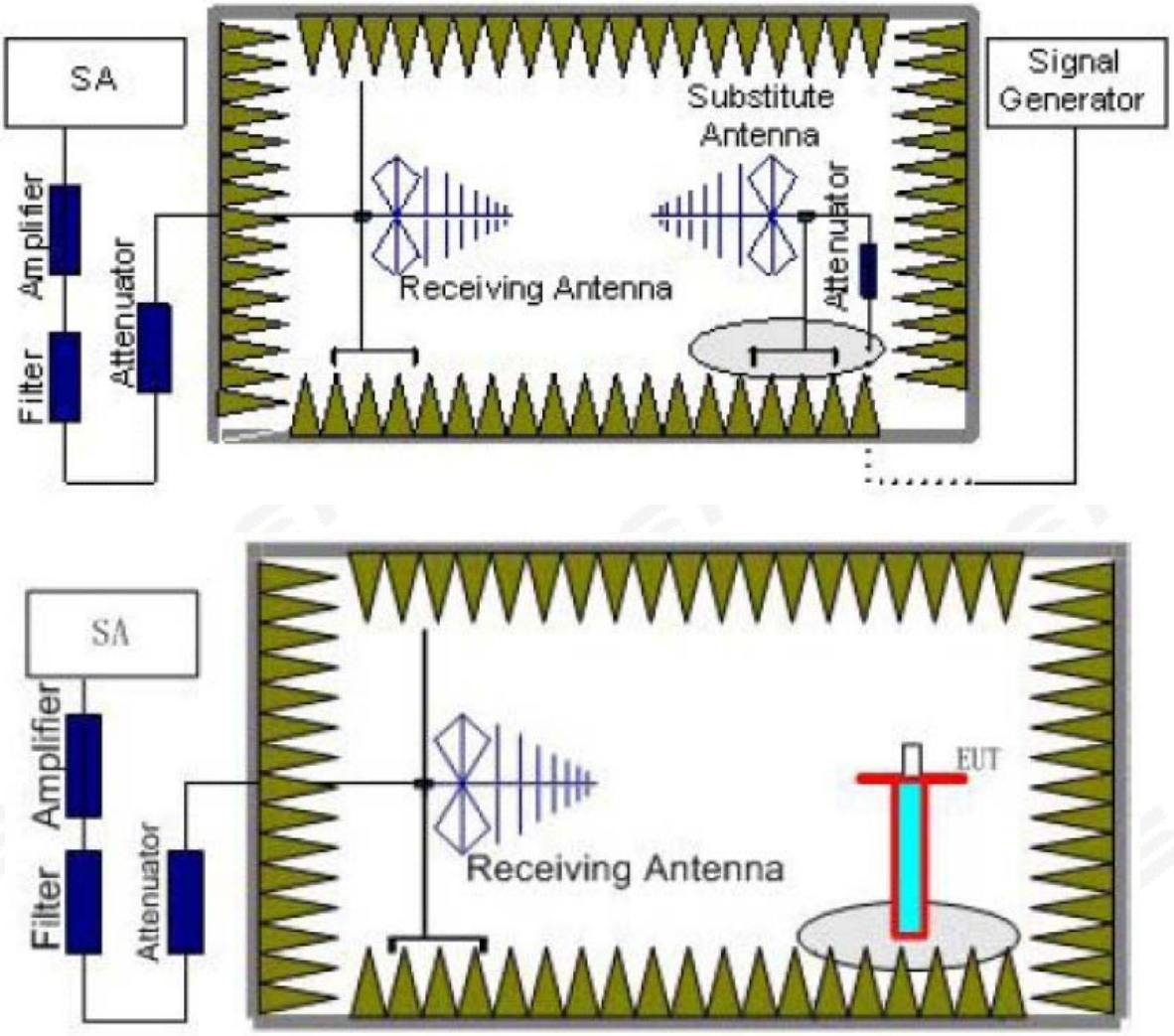
b. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.

c. The EUT is then put into continuously transmitting mode at its maximum power level during the test.Set Test Receiver or Spectrum RBW=1MHz,VBW=3MHz for above 1GHz and RBW=100KHz,VBW=300KHz for 30MHz to 1GHz, And the maximum value of the receiver should be recorded as (P_r).

d. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

e. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}) ,the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test. The measurement results are obtained as described below:
Amplifier for substituation test; The measurement results are amend as described below:
Power(EIRP)=P_{Mea}- P_{cl}+ G_a

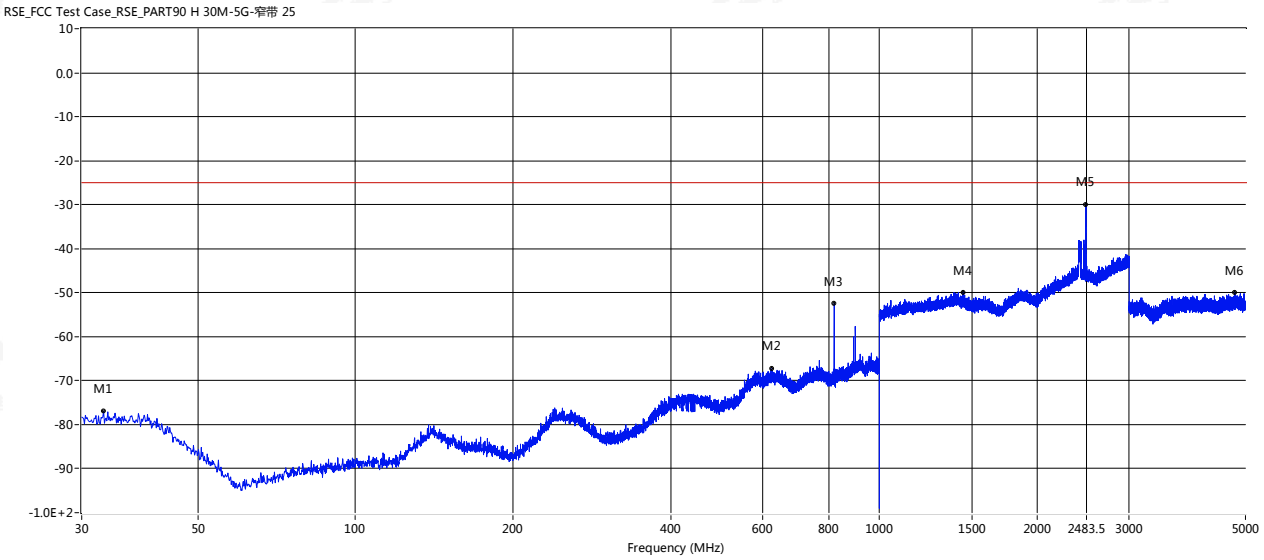
6.3 TEST CONFIGURATION



6.4 TEST RESULT

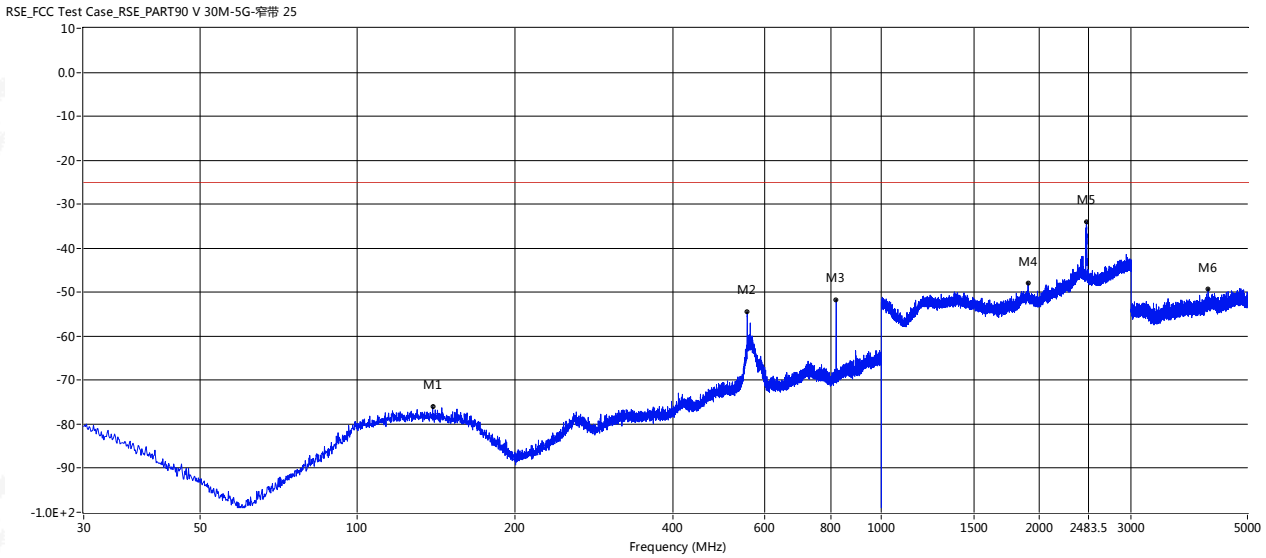
421.05MHz

Horizontal



Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	Table (o)	ANT	EUT	Verdict
33.031	-76.97	-1.89	-25.0	-51.97	197.70	Horizontal	Vertical	Pass
621.821	-67.27	7.28	-25.0	-42.27	345.40	Horizontal	Vertical	Pass
820.186	-52.44	6.26	-25.0	-27.44	150.50	Horizontal	Vertical	Pass
1446.750	-49.84	13.48	-25.0	-24.84	305.20	Horizontal	Vertical	Pass
2480.500	-30.07	18.97	-25.0	-5.07	350.70	Horizontal	Vertical	Pass
4776.000	-50.03	4.72	-25.0	-25.03	34.40	Horizontal	Vertical	Pass

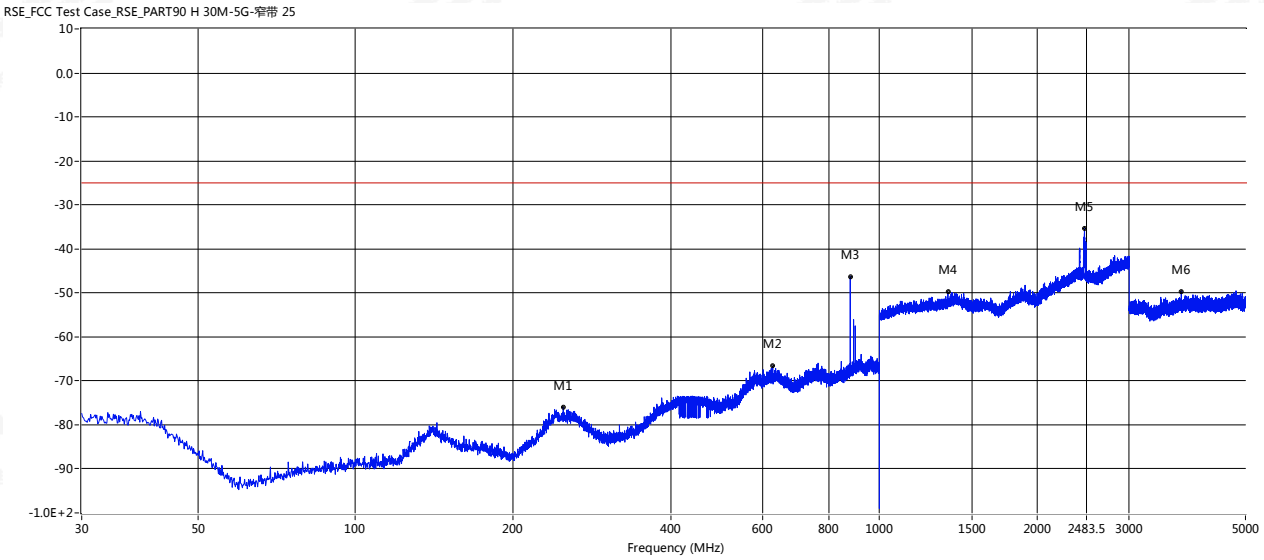
Vertical



Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	Table (o)	ANT	EUT	Verdict
139.125	-76.02	-1.17	-25.0	-51.02	213.50	Vertical	Vertical	Pass
554.649	-54.53	6.34	-25.0	-29.53	12.10	Vertical	Vertical	Pass
820.186	-51.68	6.75	-25.0	-26.68	360.00	Vertical	Vertical	Pass
1907.000	-47.95	14.19	-25.0	-22.95	235.40	Vertical	Vertical	Pass
2464.750	-34.03	18.67	-25.0	-9.03	176.80	Vertical	Vertical	Pass
4207.250	-49.34	4.35	-25.0	-24.34	360.00	Vertical	Vertical	Pass

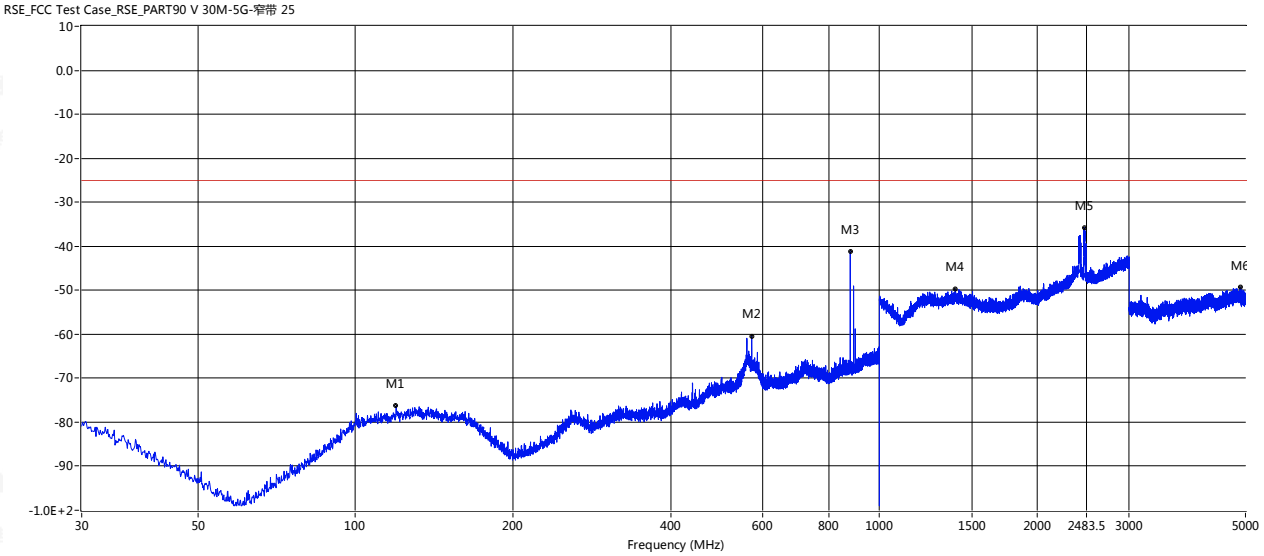
445.5MHz

Horizontal



Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	Table (o)	ANT	EUT	Verdict
249.220	-76.05	-1.12	-25.0	-51.05	0.70	Horizontal	Vertical	Pass
626.065	-66.66	7.27	-25.0	-41.66	194.30	Horizontal	Vertical	Pass
880.084	-46.30	8.09	-25.0	-21.30	32.70	Horizontal	Vertical	Pass
1351.500	-49.80	13.51	-25.0	-24.80	346.00	Horizontal	Vertical	Pass
2464.500	-35.42	19.18	-25.0	-10.42	271.00	Horizontal	Vertical	Pass
3770.750	-49.66	3.79	-25.0	-24.66	11.80	Horizontal	Vertical	Pass

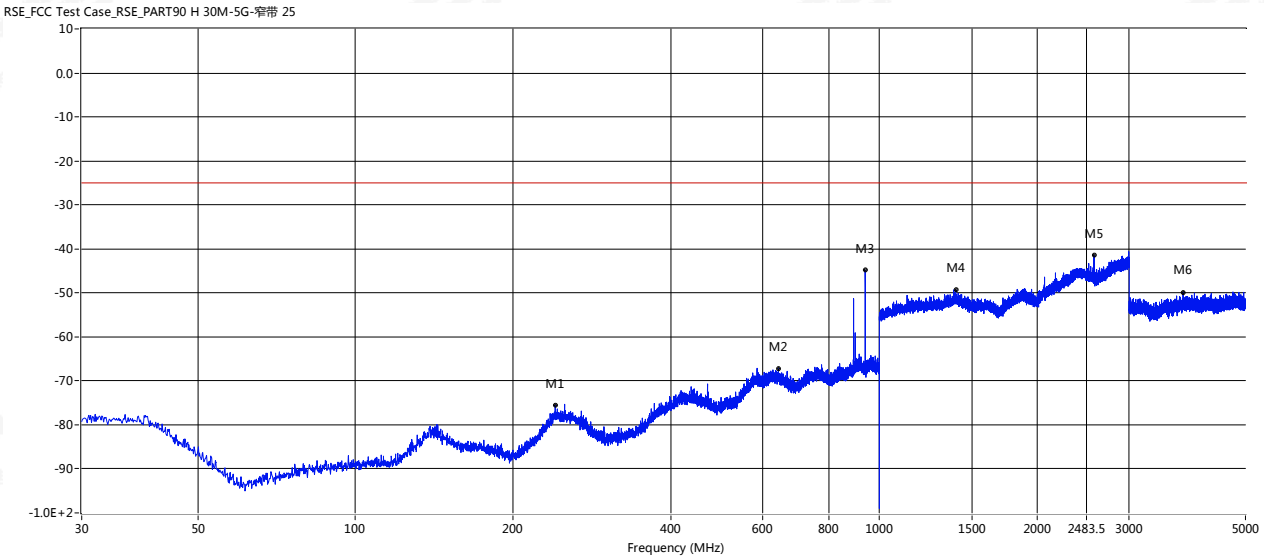
Vertical



Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	Table (o)	ANT	EUT	Verdict
119.482	-76.27	-1.93	-25.0	-51.27	3.50	Vertical	Vertical	Pass
570.532	-60.51	5.96	-25.0	-35.51	43.30	Vertical	Vertical	Pass
880.084	-41.25	8.24	-25.0	-16.25	356.00	Vertical	Vertical	Pass
1396.000	-49.68	13.80	-25.0	-24.68	313.50	Vertical	Vertical	Pass
2463.000	-35.75	18.71	-25.0	-10.75	45.50	Vertical	Vertical	Pass
4887.000	-49.36	5.67	-25.0	-24.36	130.80	Vertical	Vertical	Pass

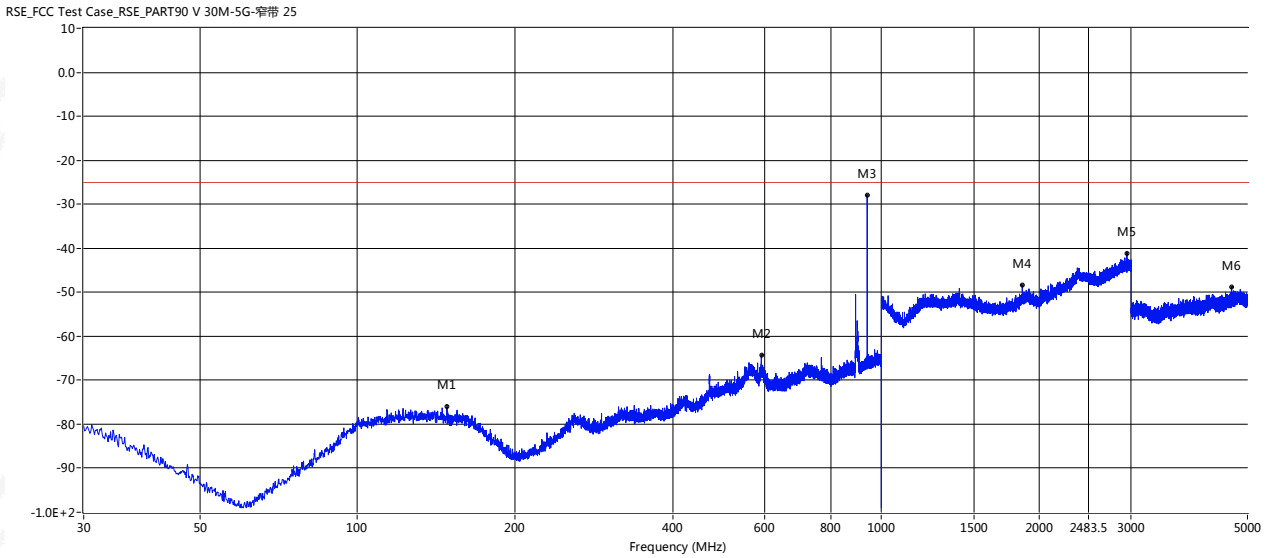
469.95MHz

Horizontal



Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	Table (o)	ANT	EUT	Verdict
240.490	-75.58	-0.79	-25.0	-50.58	31.30	Horizontal	Vertical	Pass
641.949	-67.11	7.13	-25.0	-42.11	225.20	Horizontal	Vertical	Pass
939.981	-44.80	8.19	-25.0	-19.80	46.10	Horizontal	Vertical	Pass
1399.250	-49.29	14.15	-25.0	-24.29	313.00	Horizontal	Vertical	Pass
2570.750	-41.51	18.38	-25.0	-16.51	259.20	Horizontal	Vertical	Pass
3802.750	-49.89	3.85	-25.0	-24.89	196.50	Horizontal	Vertical	Pass

Vertical



Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	Table (o)	ANT	EUT	Verdict
148.098	-76.08	-1.50	-25.0	-51.08	26.90	Vertical	Vertical	Pass
590.054	-64.36	5.12	-25.0	-39.36	259.40	Vertical	Vertical	Pass
939.981	-28.02	10.17	-25.0	-3.02	62.70	Vertical	Vertical	Pass
1858.500	-48.45	13.77	-25.0	-23.45	257.10	Vertical	Vertical	Pass
2945.000	-41.14	20.33	-25.0	-16.14	28.50	Vertical	Vertical	Pass
4664.750	-48.75	5.00	-25.0	-23.75	247.60	Vertical	Vertical	Pass

Note: EIRP=P_{Mea}(dBm)-P_{cl}(dB) +G_a(dBi)

We were not recorded other points as values lower than limits

7. SPURIOUS EMSSION ON ANTENNA PORT

7.1 PROVISIONS APPLICABLE

Emission Mask E—6.25 kHz or less channel bandwidth equipment.

For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must beattenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f0 to 3.0 kHz removed from f0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least 30 + 16.67(fd−3 kHz) or 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

7.2 MEASUREMENT PROCEDURE

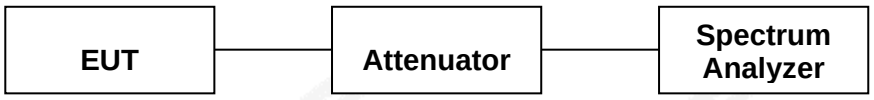
a. The EUT was connected to the spectrum analyzer through sufficent attenuation.

b. Sufficient scans were taken to show any out of band emission up to 10th. Harmonic for the lower and the highest frequency range.

c. Set EUT as digital data mode.

d Set RBW 100kHz, VBW 300 kHz in the frequency band 30MHz to 1GHz, while set RBW=1MHz. VBW=3MHz from the 1GHz to 10th Harmonic.

7.3 TEST SETUP BLOCK DIAGRAM

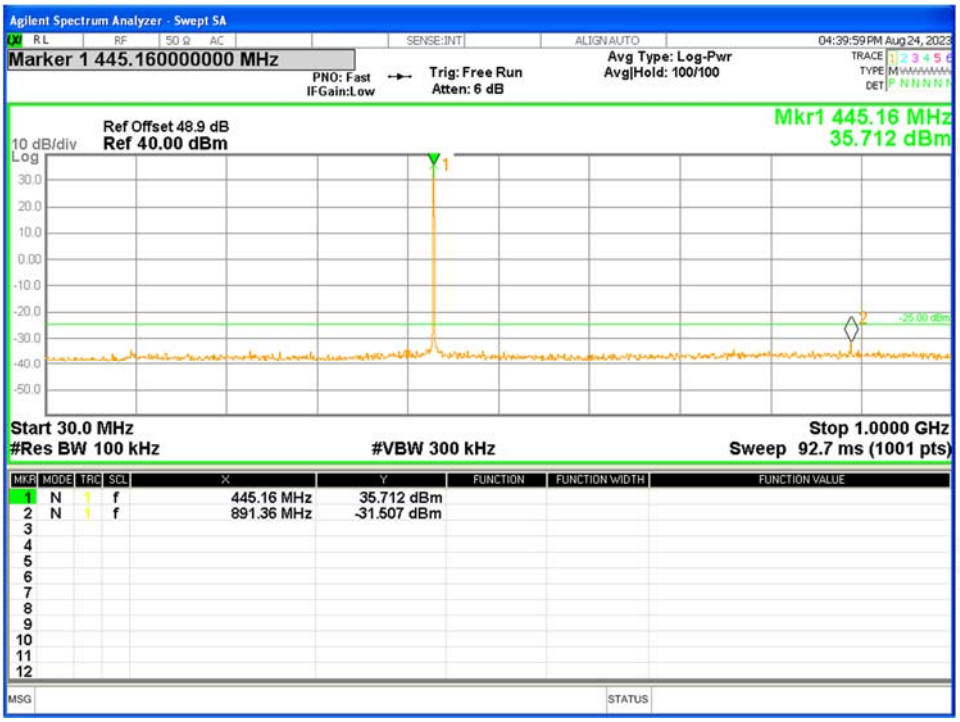


7.4 TEST RESULT

421.050MHz-H 30M-1G

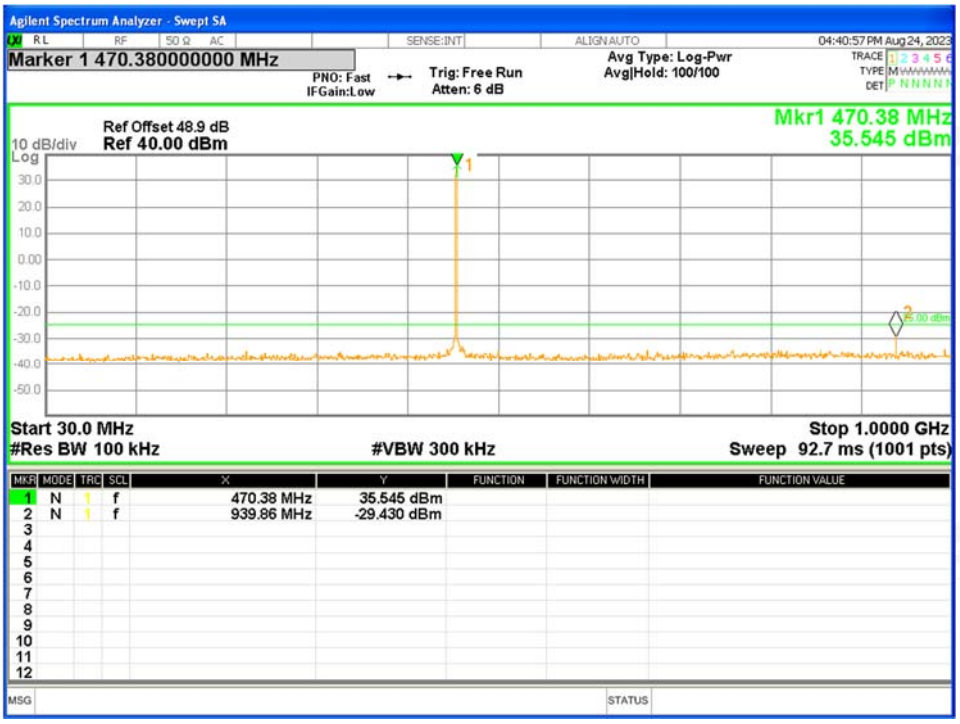
421.050MHz-H 1G-5G

445.500MHz-H 30M-1G



445.500MHz-H 1G-5G

469.950MHz-H 30M-1G



469.950MHz-H 1G-5G

8. FREQUENCY STABILITY

8.1 PROVISIONS APPLICABLE

1) According to FCC Part 2 Section 2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30℃ to +50℃ centigrade.
2) According to FCC Part 2 Section 2.1055 (a) (2), for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacture.
3) Vary primary supply voltage from 85 to 115 percent of the nominal value.
4)

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	[1 2 3]100	100	200
25-50	20	20	50
72-76	5		50
150-174	[5 11]5	[6]5	[4 6]50
216-220	1.0		1.0
220-222[12]	0.1	1.5	1.5
421-512	[7 11 14]2.5	[8]5	[8]5
806-809	[14]1.0	1.5	1.5
809-824	[14]1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	[14]0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928[13]	2.5	2.5	2.5
929-930	1.5		
935-940	0.1	1.5	1.5
1427-1435	[9]300	300	300
Above 2450[10]			

1 Fixed and base stations with over 200 watts transmitter power must have a frequency stability of 50 ppm except for equipment used in the Public Safety Pool where the frequency stability is 100 ppm.

2 For single sideband operations below 25 MHz, the carrier frequency must be maintained within 50 Hz of the authorized carrier frequency.

3 Travelers information station transmitters operating from 530–1700 kHz and transmitters exceeding 200 watts peak envelope power used for disaster communications and long distance circuit operations pursuant to §§ 90.242 and 90.264 must maintain the carrier frequency to within 20 Hz of the authorized frequency.

4 Stations operating in the 154.45 to 154.49 MHz or the 173.2 to 173.4 MHz bands must have a frequency stability of 5 ppm.

5 In the 150–174 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

6 In the 150–174 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth or designed to operate on a frequency specifically designated for itinerant use or designed for low-power operation of two watts or less, must have a frequency stability of 5.0 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 2.0 ppm.

7 In the 421–512 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 1.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 0.5 ppm.

8 In the 421–512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

9 Fixed stations with output powers above 120 watts and necessary bandwidth less than 3 kHz must operate with a frequency stability of 100 ppm. Fixed stations with output powers less than 120 watts and using time-division multiplex, must operate with a frequency stability of 500 ppm.

10 Frequency stability for DSRCS equipment in the 5895–5925 MHz band is specified in subpart M of this part. For all other equipment, frequency stability is to be specified in the station authorization.

11 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.

12 Mobile units may utilize synchronizing signals from associated base stations to achieve the specified carrier stability.

13 Fixed non-multilateration transmitters with an authorized bandwidth that is more than 40 kHz from the band edge, intermittently operated hand-held readers, and mobile transponders are not subject to frequency tolerance restrictions.

14 Control stations may operate with the frequency tolerance specified for associated mobile frequencies.

8.2 MEASUREMENT PROCEDURE

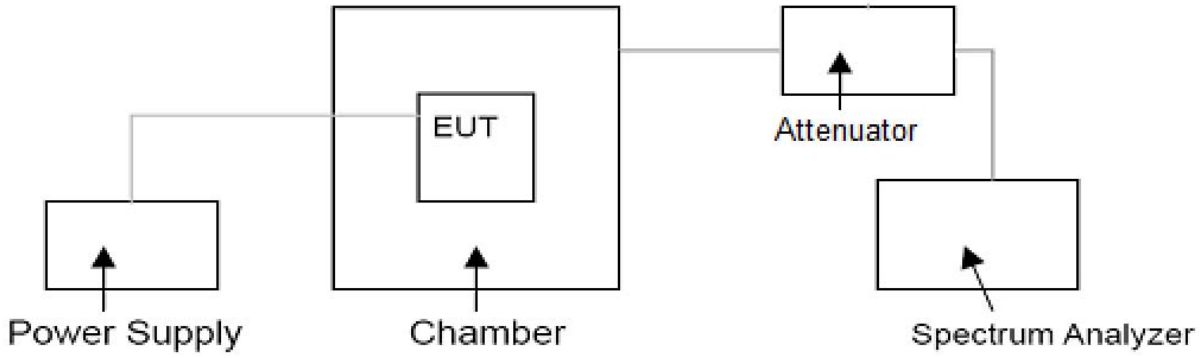
a. The EUT was connected to the spectrum analyzer through sufficent attenuation.

b. The EUT was set in the climate chamber and connected to an external DC power supply

c. After temperature stabilization (approx. 20 min for each stage), the frequency for the lower, the middle and the highest frequency range was recorded.

d For Frequency stability Vs. Voltage the EUT was connected to a DC power supply and the voltage was adjusted in the required ranges. The result was recorded.

8.3 TEST SETUP BLOCK DIAGRAM



8.4 TEST RESULT

Low Power

Low Channel							
Operation Mode	Temperature (°C)	Voltage (V)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency Deviation (ppm)	Limits	Result
Mode 1	30	Normal Voltage	421.0500	421.04973	-0.641	1ppm	PASS
	-20		421.0500	421.04998	-0.048		
	-10		421.0500	421.04998	-0.048		
	0		421.0500	421.05033	0.784		
	10		421.0500	421.05025	0.594		
	20		421.0500	421.05027	0.641		
	30		421.0500	421.04992	-0.190		
	40		421.0500	421.05015	0.356		
	50		421.0500	421.04992	-0.190		
	20	Maximum Voltage	421.0500	421.04975	-0.594		
	20	BEP	421.0500	421.05035	0.831		

Middle Channel							
Operation Mode	Temperature (°C)	Voltage (V)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency Deviation (ppm)	Limits	Result
Mode 1	30	Normal Voltage	445.5000	445.50018	0.404	1ppm	PASS
	-20		445.5000	445.49981	-0.426		
	-10		445.5000	445.50027	0.606		
	0		445.5000	445.50002	0.045		
	10		445.5000	445.49963	-0.831		
	20		445.5000	445.49970	-0.673		
	30		445.5000	445.49977	-0.516		
	40		445.5000	445.49987	-0.292		
	50		445.5000	445.49986	-0.314		
	20	Maximum Voltage	445.5000	445.50020	0.449		
	20	BEP	445.5000	445.50020	0.449		

High Channel							
Operation Mode	Temperature (°C)	Voltage (V)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency Deviation (ppm)	Limits	Result
Mode 1	30	Normal Voltage	469.9500	469.94984	-0.340	1ppm	PASS
	-20		469.9500	469.95007	0.149		
	-10		469.9500	469.95010	0.213		
	0		469.9500	469.95007	0.149		
	10		469.9500	469.95019	0.404		
	20		469.9500	469.95004	0.085		
	30		469.9500	469.94994	-0.128		
	40		469.9500	469.95005	0.106		
	50		469.9500	469.94983	-0.362		
	20	Maximum Voltage	469.9500	469.94978	-0.468		
	20	BEP	469.9500	469.95003	0.064		

High Power

Low Channel							
Operation Mode	Temperature (°C)	Voltage (V)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency Deviation (ppm)	Limits	Result
Mode 2	30	Normal Voltage	421.0500	421.05041	0.974	1ppm	PASS
	-20		421.0500	421.04975	-0.594		
	-10		421.0500	421.05014	0.333		
	0		421.0500	421.05004	0.095		
	10		421.0500	421.05025	0.594		
	20		421.0500	421.04963	-0.879		
	30		421.0500	421.05008	0.190		
	40		421.0500	421.04975	-0.594		
	50		421.0500	421.05020	0.475		
	20	Maximum Voltage	421.0500	421.04995	-0.119		
	20	BEP	421.0500	421.04989	-0.261		

Middle Channel							
Operation Mode	Temperature (°C)	Voltage (V)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency Deviation (ppm)	Limits	Result
Mode 2	30	Normal Voltage	445.5000	445.49992	-0.180	1ppm	PASS
	-20		445.5000	445.49970	-0.673		
	-10		445.5000	445.49967	-0.741		
	0		445.5000	445.50010	0.224		
	10		445.5000	445.50006	0.135		
	20		445.5000	445.50000	0.000		
	30		445.5000	445.50011	0.247		
	40		445.5000	445.50029	0.651		
	50		445.5000	445.49969	-0.696		
	20	Maximum Voltage	445.5000	445.49983	-0.382		
	20	BEP	445.5000	445.49981	-0.426		

High Channel							
Operation Mode	Temperature (°C)	Voltage (V)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency Deviation (ppm)	Limits	Result
Mode 2	30	Normal Voltage	469.9500	469.95011	0.234	1ppm	PASS
	-20		469.9500	469.94975	-0.532		
	-10		469.9500	469.94972	-0.596		
	0		469.9500	469.95002	0.043		
	10		469.9500	469.94982	-0.383		
	20		469.9500	469.94991	-0.192		
	30		469.9500	469.95015	0.319		
	40		469.9500	469.95031	0.660		
	50		469.9500	469.95011	0.234		
	20	Maximum Voltage	469.9500	469.95026	0.553		
	20	BEP	469.9500	469.95023	0.489		

9. TRANSIENT FREQUENCY BEHAVIOR

9.1 PROVISIONS APPLICABLE

Section 90.214

Transient frequencies must be within the maximum frequency difference limits during the time intervals indicated:

Time intervals [1, 2]	Maximum frequency difference [3]	All equipment	
		150 to 174 MHz	421 to 512MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 KHz Channels			
t_1 [4]	± 25.0 KHz	5.0 ms	10.0 ms
t_2	± 12.5 KHz	20.0 ms	25.0 ms
t_3 [4]	± 25.0 KHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 KHz Channels			
t_1 [4]	± 12.5 KHz	5.0 ms	10.0 ms
t_2	± 6.25 KHz	20.0 ms	25.0 ms
t_3 [4]	± 12.5 KHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 KHz Channels			
t_1 [4]	±6.25 KHz	5.0 ms	10.0 ms
t_2	±3.125 KHz	20.0 ms	25.0 ms
t_3 [4]	±6.25 KHz	5.0 ms	10.0 ms

1. t_{on} is the instant when a 1 KHz test signal is completely suppressed, including any capture time due to phasing.
   t_1 is the time period immediately following t_{on}.
   t_2 is the time period immediately following t_1.
   t_3 is the time period from the instant when the transmitter is turned off until t_{off}.
   t_{off} is the instant when the 1 KHz test signal starts to rise.
2. During the time from the end of t_2 to the beginning of t_3, the frequency difference must not exceed the limits specified in § 90.213.
3. Difference between the actual transmitter frequency and the assigned transmitter frequency.
4. If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

9.2 MEASUREMENT PROCEDURE

Use Digital portable radio which manufactured by VictelGlobal Communications Corporation

a. Limited which uses same protocol as the DUT connect to RX antenna by 20Att in order to avoid damaging DUT;

b. Connect DUT into Test discriminator and Storage Oscilloscope and keep DUT stats ON;

c. Inut 1KHz signal into digital portable radio;

d Set the modulation domain analyzer to trigger on the rising edge of the waveform in order to capture a single-shot turn-on of the transmitter signals;

e Keep the digital protable radio in OFF state and Key the PTT of digital portable radio;

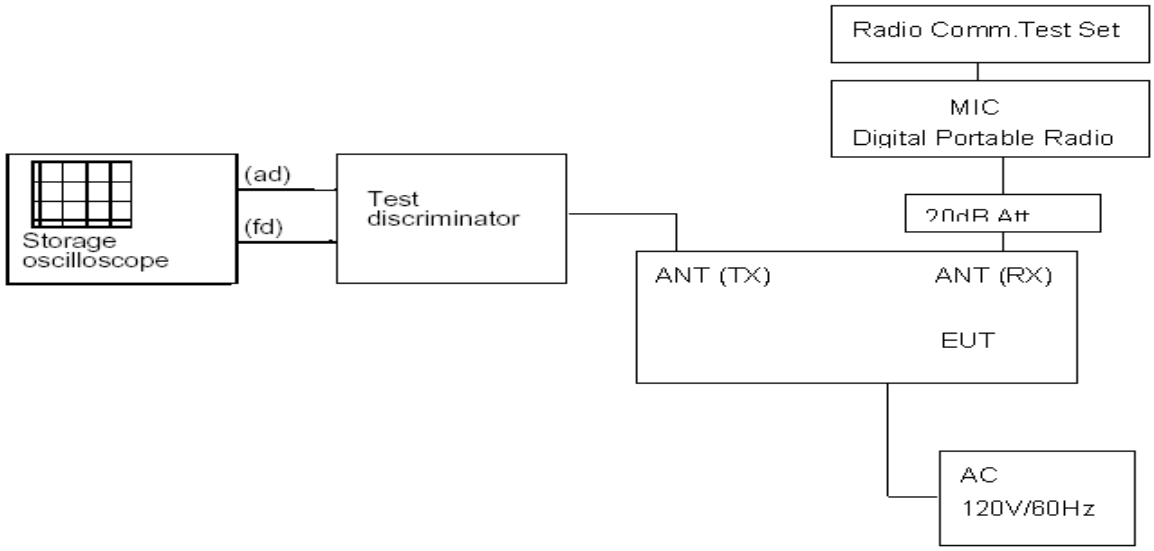
f Observe the stored oscilloscope of modulation domain analyzer.The signal trace shall be maintained within the allowable limits during the periods t_1 and t_2,and shall also remain within limits following t_2;

g Adjust the modulation domain anzlyzer to trigger on the falling edge of the transmitter waveform in order to capture a single-shot turn-off transmitter of the transmitter signal.

h Keep the digital portable radio in ON state and Unkey the PTT of digital portable radio;

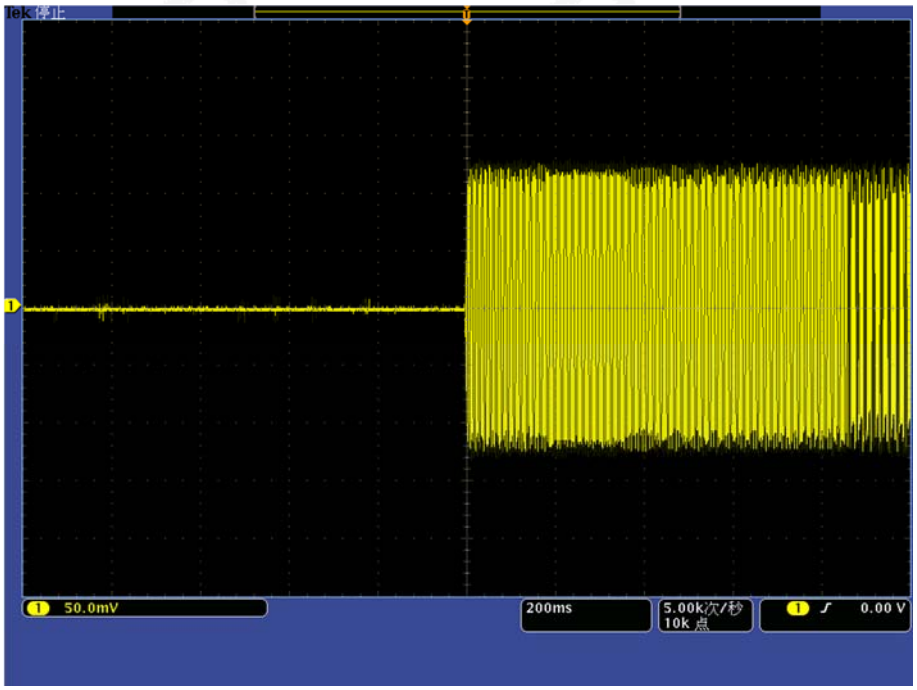
f Observe the stored oscilloscope of modulation domain analyzer.The signal trace shall be maintained within the allowable limits during the period t_3

9.3 TEST SETUP BLOCK DIAGRAM

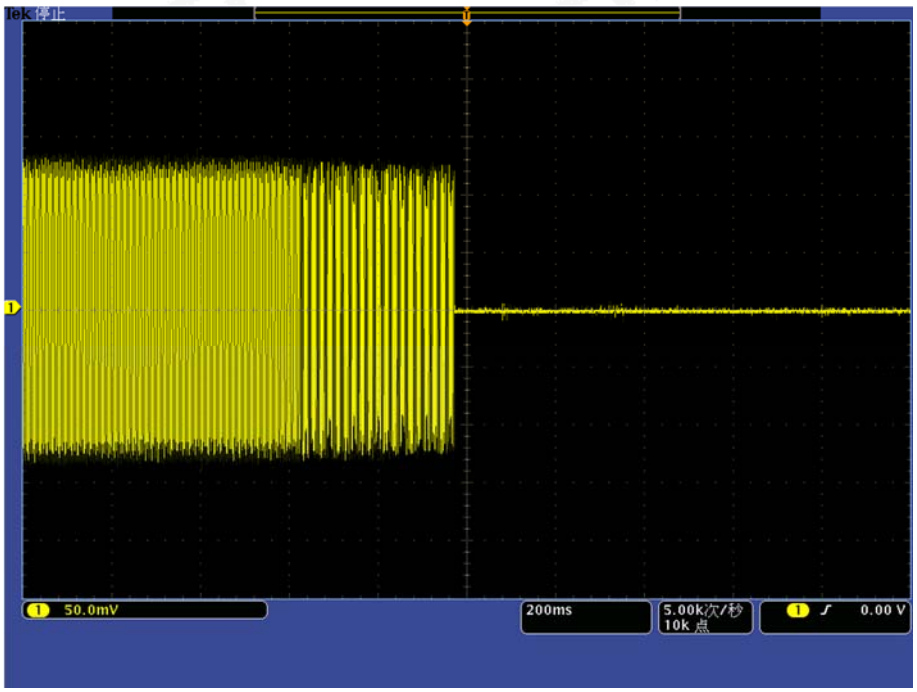


9.4 TEST RESULT

Transmitter Frequency Behaviour @ 6.25 KHz Channel Separation------Off – On



Transmitter Frequency Behaviour @ 12.5 KHz Channel Separation------On – Off



10. PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※END OF THE REPORT※※※※※