FCC RADIO TEST REPORT
FCC ID: 2ADPCX5

Product：	High precision GNSS handset
Trade Name：	SOUTH, SANDING, KOLIDA
Model Name：	Polar X5
Serial Model：	Polar X2, Polar X3, Polar X6, S720, S750, S760, D4, D6, D6-P, K720, K750, K760
Report No.：	STUEMO015121606581RF2

Prepared for

Guangzhou SOUTH Surveying & Mapping Instrument Co.,Ltd.

Room 301 South Building, No.24-26 Keyun Road, Tian He District, Guangzhou, China

Prepared by

BZT Testing Technology Co., Ltd.

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TEST RESULT CERTIFICATION

Applicant's name	:	Guangzhou SOUTH Surveying & Mapping Instrument Co.,Ltd.
Address	:	Room 301 South Building, No.24-26 Keyun Road, Tian He District, Guangzhou, China
Manufacture's Name	:	South Navigation Limited
Address	:	Layer 2-3, N0.52-54 Jian Zhong Road, Tian He District, Guangzhou, China
Product description		
Product name	:	High precision GNSS handset
Model and/or type reference	:	Polar X5
Serial Model：		Polar X2, Polar X3, Polar X6, S720,S750, S760, D4, D6, D6-P, K720, K750, K760
Standards	:	FCC Part15.247:2013
Test procedure		ANSI C63.10-2013, DA 00-705

This device described above has been tested by BZT, and 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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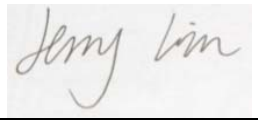
Date of Test	:	
Date (s) of performance of tests	:	10 Feb. 2016 ~20 Apr. 2016
Date of Issue	:	20 Feb. 2016
Test Result	:	**Pass**

Testing Engineer : 

(Jerry Lin)

Technical Manager : 

(Jimmy Yao)

Authorized Signatory : 

(Terry Yang)

Table of Contents

Page

1 . SUMMARY OF TEST RESULTS 5

1.1 TEST FACILITY 6

1.2 MEASUREMENT UNCERTAINTY 6

2 . GENERAL INFORMATION 7

2.1 GENERAL DESCRIPTION OF EUT 7

2.2 DESCRIPTION OF TEST MODES 9

2.3 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING 9

2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED 10

2.5 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE) 11

2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS 12

3 . EMC EMISSION TEST 13

3.1 CONDUCTED EMISSION MEASUREMENT 13

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS 13

3.1.2 TEST PROCEDURE 14

3.1.3 DEVIATION FROM TEST STANDARD 14

3.1.4 TEST SETUP 14

3.1.5 EUT OPERATING CONDITIONS 14

3.1.6 TEST RESULTS 15

3.2 RADIATED EMISSION MEASUREMENT 16

3.2.1 RADIATED EMISSION LIMITS 16

3.2.2 TEST PROCEDURE 17

3.2.3 DEVIATION FROM TEST STANDARD 17

3.2.4 TEST SETUP 18

3.2.5 EUT OPERATING CONDITIONS 19

3.2.6 TEST RESULTS (BELOW 30 MHZ) 20

3.2.7 TEST RESULTS (BETWEEN 30M – 1000 MHZ) 21

3.2.8 TEST RESULTS (ABOVE 1000 MHZ) 23

3.2.9 TEST RESULTS (RESTRICTED BANDS REQUIREMENTS) 24

4 . NUMBER OF HOPPING CHANNEL 26

4.1 APPLIED PROCEDURES / LIMIT 26

4.1.1 TEST PROCEDURE 26

4.1.2 DEVIATION FROM STANDARD 26

4.1.3 TEST SETUP 26

4.1.4 EUT OPERATION CONDITIONS 26

4.1.5 TEST RESULTS 27

5 . AVERAGE TIME OF OCCUPANCY 28

Table of Contents

Page

5.1 APPLIED PROCEDURES / LIMIT 28
5.1.1 TEST PROCEDURE 28
5.1.2 DEVIATION FROM STANDARD 28
5.1.3 TEST SETUP 29
5.1.4 EUT OPERATION CONDITIONS 29
5.1.5 TEST RESULTS 30

6 . HOPPING CHANNEL SEPARATION MEASUREMENT 36

6.1 APPLIED PROCEDURES / LIMIT 36
6.1.1 TEST PROCEDURE 36
6.1.2 DEVIATION FROM STANDARD 36
6.1.3 TEST SETUP 36
6.1.4 EUT OPERATION CONDITIONS 36
6.1.5 TEST RESULTS 37

7 . BANDWIDTH TEST 43

7.1 APPLIED PROCEDURES / LIMIT 43
7.1.1 TEST PROCEDURE 43
7.1.2 DEVIATION FROM STANDARD 43
7.1.3 TEST SETUP 43
7.1.4 EUT OPERATION CONDITIONS 43
7.1.5 TEST RESULTS 44

8 . PEAK OUTPUT POWER TEST 50

8.1 APPLIED PROCEDURES / LIMIT 50
8.1.1 TEST PROCEDURE 50
8.1.2 DEVIATION FROM STANDARD 50
8.1.3 TEST SETUP 50
8.1.4 EUT OPERATION CONDITIONS 50
8.1.5 TEST RESULTS 51

9 . ANTENNA REQUIREMENT 57

9.1 STANDARD REQUIREMENT 57

9.2 EUT ANTENNA 57

APPENDIX-PHOTOGRAPHS OF EUT CONSTRUCTIONAL DETAILS

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15 (15.247) , Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	N/A	
15.247(a)(1)	Hopping Channel Separation	PASS	
15.247(b)(1)	Peak Output Power	PASS	
15.247(c)	Radiated Spurious Emission	PASS	
15.247(d)	Conducted spurious Emission	PASS	
15.247(a)(iii)	Number of Hopping Frequency	PASS	
15.247(a)(iii)	Dwell Time	PASS	
15.247(a)(1)	Bandwidth	PASS	
15.205	Band Edge Emission	PASS	
15.203	Antenna Requirement	PASS	

NOTE:

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

1.1 TEST FACILITY

BZT Testing Technology Co., Ltd.
Add.:1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street, Bao'an District, Shenzhen P.R. China.
FCC Registered No.: 701733

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	Conducted Emission Test	±1.38dB
2	RF power,conducted	±0.16dB
3	Spurious emissions,conducted	±0.21dB
4	All emissions,radiated(<1G)	±4.68dB
5	All emissions,radiated(>1G)	±4.89dB
6	Temperature	±0.5°C
7	Humidity	±2%

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	High precision GNSS handset
Trade Name	SOUTH, SANDING, KOLIDA
Model Name	Polar X5
Serial Model	Polar X2, Polar X3, Polar X6, S720,S750, S760, D4, D6, D6-P, K720, K750, K760
Model Difference	All the same,only model name is different
Product Description	The EUT is a High precision GNSS handset Operation Frequency: 2402~2480 MHz Modulation Type: BT(1Mbps): GFSK BT EDR(2Mbps):∏/4-DQPSK BT EDR(3Mbps): 8-DPSK Bit Rate of Transmitter 1Mbps/2Mbps/3Mbps Number Of Channel 79 CH Antenna Designation: Please see Note 3. Output Power(Conducted): BT(1Mbps): 3.628dBm BT EDR(2Mbps): 3.090dBm BT EDR(3Mbps): 3.191dBm Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.
Channel List	Please refer to the Note 2.
Adapter	Model:DSA-42D-12 Input: AC 100-240V, 50/60Hz, 1.2A Output:DC 12V, 3A
Battery Charger	Model:CH-SA3011 Input: DC 12V, 3A Output:DC 4.2V, 2A
Battery	Model: BTNF-L7412W Rated Voltage: 3.7V capacity :7200mah
Connecting I/O Port(s)	Please refer to the User's Manual

Note:

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

2.

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

3.

Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	N/A	Chip Antenna	NA	1.0	BT Antenna

2.2 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.

Pretest Mode	Description
Mode 1	CH00
Mode 2	CH39
Mode 3	CH78
Mode 4	BT Link

For Conducted Emission	
Final Test Mode	Description
Mode 4	N/A

For Radiated Emission	
Final Test Mode	Description
Mode 1	CH00
Mode 2	CH39
Mode 3	CH78

Note:

(1) The measurements are performed at the highest, middle, lowest available channels.

(2) The EUT use new battery.

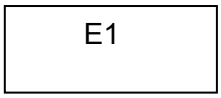
(3)The data rate was set in 1Mbps for radiated emission due to the highest RF output power.

2.3 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS

Test software Version	Test program: BCM20730		
Frequency	2402 MHz	2441 MHz	2480 MHz
Parameters(1/2/3Mbps)	DEF	DEF	DEF

2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



2.5 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

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.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	High precision GNSS handset	SOUTH	Polar X5	N/A	EUT

Item	Shielded Type	Ferrite Core	Length	Note

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.
(3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Spectrum Analyzer	Agilent	E4407B	MY45108040	2015.07.06	2016.07.05	1 year
2	Test Receiver	R&S	ESPI	101318	2015.06.07	2016.06.06	1 year
3	Bilog Antenna	TESEQ	CBL6111D	31216	2015.07.06	2016.07.05	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264416	2015.06.07	2016.06.06	1 year
5	Spectrum Analyzer	ADVANTEST	R3132	150900201	2015.06.07	2016.06.06	1 year
6	Horn Antenna	EM	EM-AH-10180	2011071402	2015.07.06	2016.07.05	1 year
7	Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2015.07.06	2016.07.05	1 year
8	Amplifier	EM	EM-30180	060538	2015.12.22	2016.12.21	1 year
9	Loop Antenna	ARA	PLA-1030/B	1029	2015.06.08	2016.06.07	1 year
10	Power Meter	R&S	NRVS	100696	2015.07.06	2016.07.05	1 year
11	Power Sensor	R&S	URV5-Z4	0395.1619.05	2015.07.06	2016.07.05	1 year
12	Signal Analyzer	Agilent	N9020A	MY49100060	2015.07.06	2016.07.05	1 year

Conduction Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Test Receiver	R&S	ESCI	101160	2015.06.06	2016.06.05	1 year
2	LISN	R&S	ENV216	101313	2015.08.24	2016.08.23	1 year
3	LISN	EMCO	3816/2	00042990	2015.08.24	2016.08.23	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264417	2015.06.07	2016.06.06	1 year
5	Passive Voltage Probe	R&S	ESH2-Z3	100196	2015.06.07	2016.06.06	1 year
6	Absorbing clamp	R&S	MOS-21	100423	2015.06.08	2016.06.07	1 year

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)		Standard
	Quasi-peak	Average	Quasi-peak	Average	
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *	CISPR
0.50 -5.0	73.00	60.00	56.00	46.00	CISPR
5.0 -30.0	73.00	60.00	60.00	50.00	CISPR

0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	73.00	60.00	56.00	46.00	FCC
5.0 -30.0	73.00	60.00	60.00	50.00	FCC

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

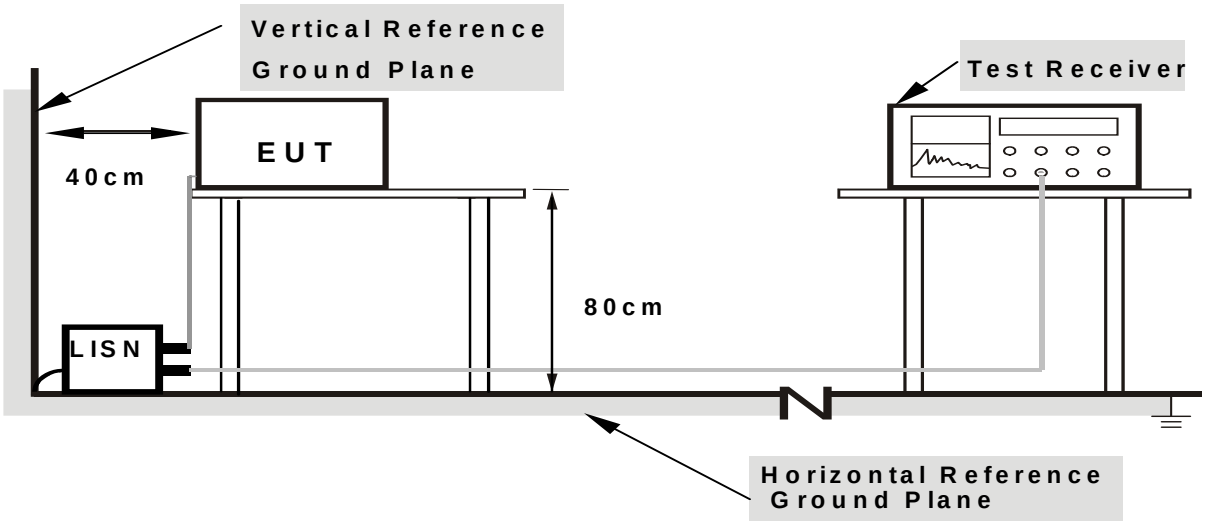
3.1.2 TEST PROCEDURE

a. The EUT was placed 0.4 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 DEVIATION FROM TEST STANDARD

No deviation

3.1.4 TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

3.1.6 TEST RESULTS

EUT：	High precision GNSS handset	Model Name. ：	Polar X5
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	1010hPa	Phase：	L
Test Voltage ：	AC120V/60Hz	Test Mode：	Mode 4

Battery powered, not suitable for conducted emission.

3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS (Frequency Range 9kHz-1000MHz)

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

(2) The tighter limit applies at the band edges.

(3) Emission level (dBuV/m)=20log Emission level (uV/m).

FREQUENCY RANGE OF RADIATED MEASUREMENT (For unintentional radiators)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	Range (MHz)
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5^{th} harmonic of the highest frequency or 40 GHz, whichever is lower

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

3.2.2 TEST PROCEDURE

a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

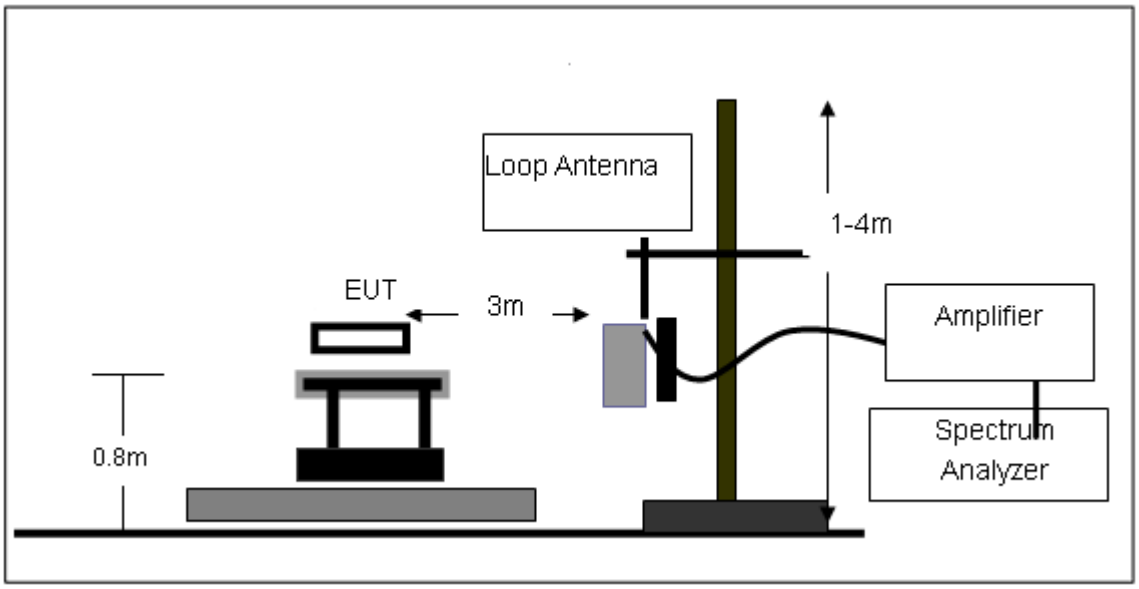
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

3.2.3 DEVIATION FROM TEST STANDARD

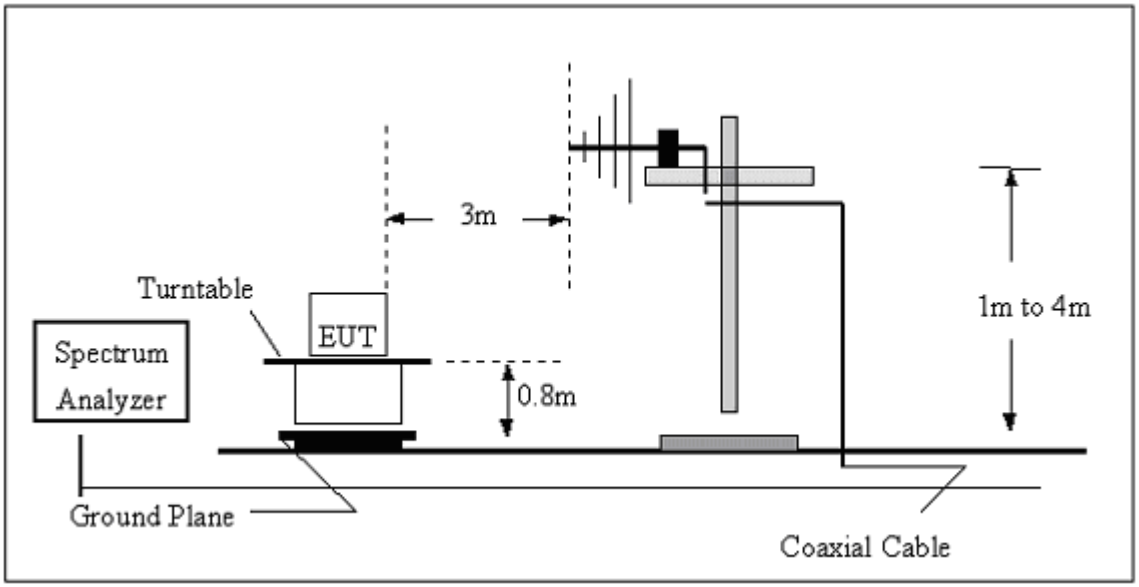
No deviation

3.2.4 TEST SETUP

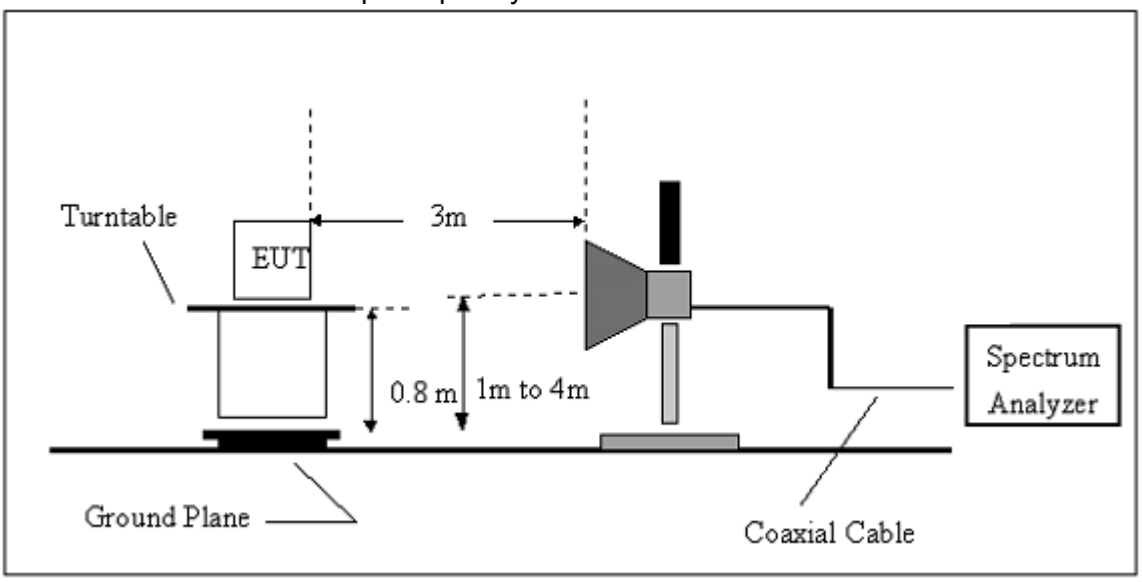
（A）Radiated Emission Test-Up Frequency Below 30MHz



（B）Radiated Emission Test-Up Frequency 30MHz~1GHz



（C）Radiated Emission Test-Up Frequency Above 1GHz



3.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

3.2.6 TEST RESULTS (BELOW 30 MHZ)

EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	TX	Polarization :	---

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

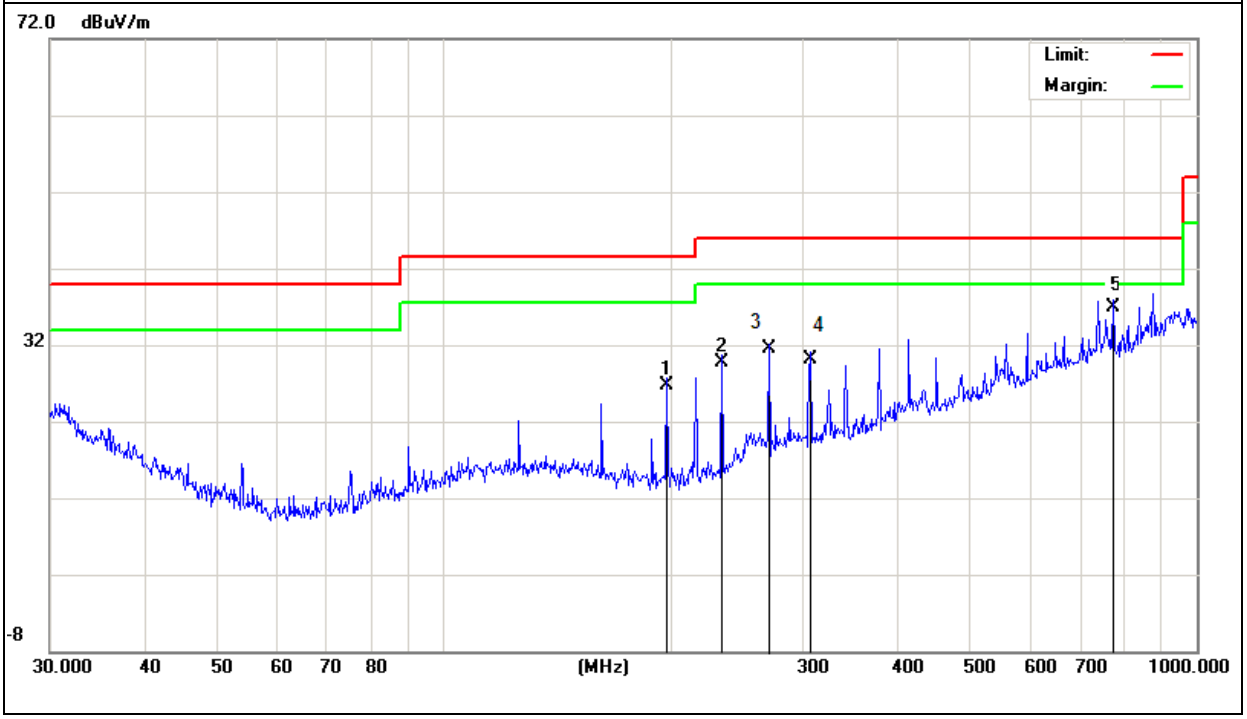
NOTE:
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

3.2.7 TEST RESULTS (BETWEEN 30M – 1000 MHZ)

EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	Model 4	Polarization：	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
197.8926	17.80	8.99	26.79	43.50	-16.71	QP
234.1682	18.76	11.03	29.79	46.00	-16.21	QP
267.2342	19.11	12.13	31.24	46.00	-14.76	QP
309.2531	15.46	14.23	29.69	46.00	-16.31	QP
774.1584	10.69	26.16	36.85	46.00	-9.15	QP

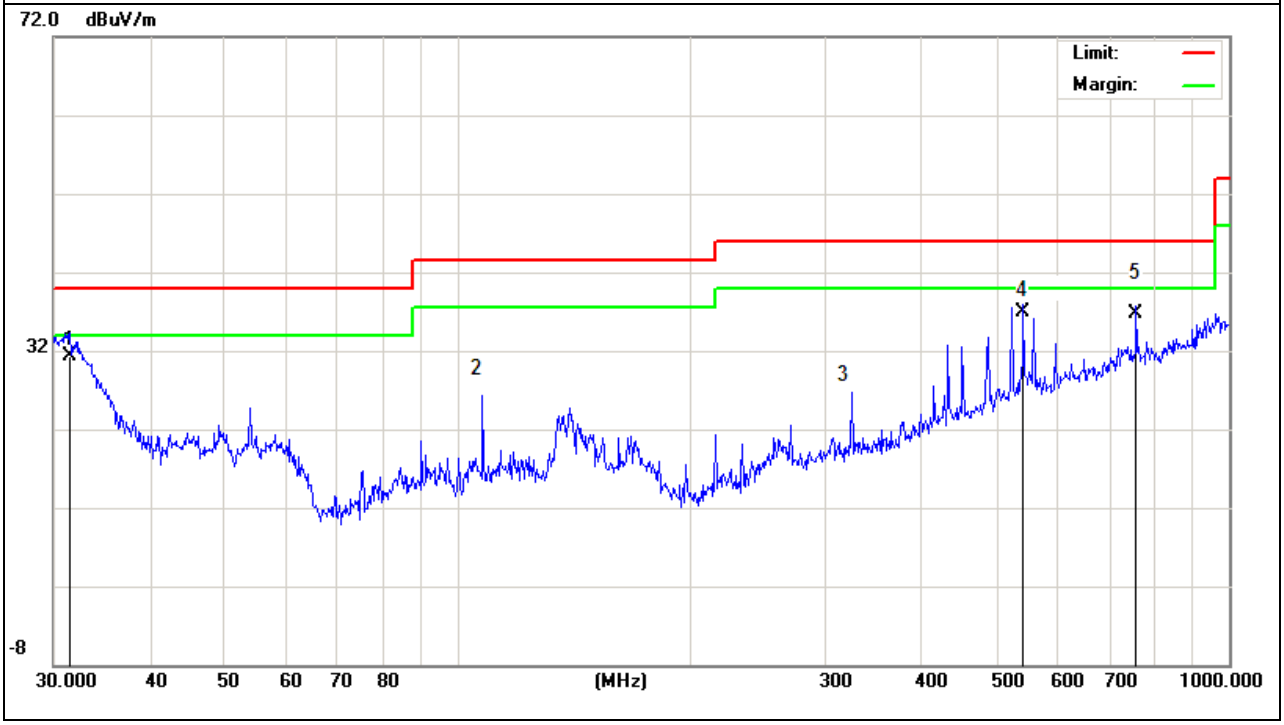
Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.



EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	Mode 4	Polarization：	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
31.5093	13.67	17.66	31.33	40.00	-8.67	QP
119.7651	14.97	12.43	27.42	43.50	-16.08	QP
323.6751	13.15	13.97	27.12	46.00	-18.88	QP
541.3723	14.46	22.44	36.90	46.00	-9.10	QP
758.0407	10.38	26.40	36.78	46.00	-9.22	QP

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.



3.2.8 TEST RESULTS (1G-26GHZ)

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
Low Channel (2402 MHz)							
4804.20	67.42	-3.62	63.80	74	-10.20	PK	Vertical
4804.22	47.25	-3.62	43.63	54	-10.37	AV	Vertical
7206.13	62.96	-0.9	62.06	74	-11.94	PK	Vertical
7206.12	42.25	-0.9	41.35	54	-12.65	AV	Vertical
4804.00	62.77	-3.65	59.12	74	-14.88	PK	Horizontal
4803.99	45.33	-3.65	41.68	54	-12.32	AV	Horizontal
Mid Channel (2441 MHz)							
4882.08	65.60	-3.65	61.95	74	-12.05	PK	Vertical
4882.07	50.21	-3.65	46.56	54	-7.44	AV	Vertical
7323.22	61.48	-0.84	60.64	74	-13.36	PK	Vertical
7323.21	45.09	-0.84	44.25	54	-9.75	AV	Vertical
4882.18	62.12	-3.68	58.44	74	-15.56	PK	Horizontal
4882.14	45.79	-3.68	42.11	54	-11.89	AV	Horizontal
High Channel (2480 MHz)							
4960.26	61.87	-3.59	58.28	74	-15.72	PK	Vertical
4960.31	46.34	-3.59	42.75	54	-11.25	AV	Vertical
7440.33	61.82	-0.83	60.99	74	-13.01	PK	Vertical
7440.31	46.19	-0.83	45.36	54	-8.64	AV	Vertical
4960.33	61.76	-3.59	58.17	74	-15.83	PK	Horizontal
4960.31	46.19	-3.59	42.60	54	-11.40	AV	Horizontal

Note: 1) 1GHz~26GHz:(Scan with GFSK, π/4-DQPSK,8DPSK, the worst case is GFSK Mode)

2) Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Emission Level = Meter Reading + Factor

Margin = Limit - Emission Leve

3.2.9 TEST RESULTS (RESTRICTED BANDS REQUIREMENTS)

EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	TX /2402MHz-1Mbps	Polarization：	Vertical

Band edge

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
GFSK							
2390.0	69.53	-12.99	56.54	74	-17.46	PK	Vertical
2390.0	55.21	-12.99	42.22	54	-11.78	AV	Vertical
2390.0	70.27	-12.99	57.28	74	-16.72	PK	Horizontal
2390.0	54.18	-12.99	41.19	54	-12.81	AV	Horizontal
2483.6	71.16	-12.78	58.38	74	-15.62	PK	Vertical
2483.6	54.19	-12.78	41.41	54	-12.59	AV	Vertical
2483.6	71.34	-12.78	58.56	74	-15.44	PK	Horizontal
2483.6	54.35	-12.78	41.57	54	-12.43	AV	Horizontal
π/4-DQPSK							
2390.0	71.43	-12.99	58.44	74	-15.56	PK	Vertical
2390.0	54.53	-12.99	41.54	54	-12.46	AV	Vertical
2390.0	70.26	-12.99	57.27	74	-16.73	PK	Horizontal
2390.0	55.14	-12.99	42.15	54	-11.85	AV	Horizontal
2483.6	71.46	-12.78	58.68	74	-15.32	PK	Vertical
2483.6	56.21	-12.78	43.43	54	-10.57	AV	Vertical
2483.6	71.20	-12.78	58.42	74	-15.58	PK	Horizontal
2483.6	54.57	-12.78	41.79	54	-12.21	AV	Horizontal
8DPSK							
2390.0	71.49	-12.99	58.50	74	-15.50	PK	Vertical
2390.0	55.36	-12.99	42.37	54	-11.63	AV	Vertical
2390.0	70.49	-12.99	57.50	74	-16.50	PK	Horizontal
2390.0	56.21	-12.99	43.22	54	-10.78	AV	Horizontal
2483.6	71.31	-12.78	58.53	74	-15.47	PK	Vertical
2483.6	55.11	-12.78	42.33	54	-11.67	AV	Vertical
2483.6	71.58	-12.78	58.80	74	-15.20	PK	Horizontal
2483.6	54.51	-12.78	41.73	54	-12.27	AV	Horizontal

Low measurement frequencies is range from 2310 to 2400 MHz, high measurement frequencies is range from 2483.5 to 2500 MHz. Only show the worst point data of the emissions in the frequency 2310-2400 MHz and 2483.5-2500 MHz.

Hopping

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
GFSK							
2390.0	69.15	-12.99	56.16	74	-17.84	PK	Vertical
2390.0	55.20	-12.99	42.21	54	-11.79	AV	Vertical
2390.0	68.41	-12.99	55.42	74	-18.58	PK	Horizontal
2390.0	54.18	-12.99	41.19	54	-12.81	AV	Horizontal
2483.5	67.17	-12.78	54.39	74	-19.61	PK	Vertical
2483.5	55.19	-12.78	42.41	54	-11.59	AV	Vertical
2483.5	68.15	-12.78	55.37	74	-18.63	PK	Horizontal
2483.5	55.19	-12.78	42.41	54	-11.59	AV	Horizontal
π/4-DQPSK							
2390.0	69.07	-12.99	56.08	74	-17.92	PK	Vertical
2390.0	56.28	-12.99	43.29	54	-10.71	AV	Vertical
2390.0	68.08	-12.99	55.09	74	-18.91	PK	Horizontal
2390.0	54.13	-12.99	41.14	54	-12.86	AV	Horizontal
2483.5	68.10	-12.78	55.32	74	-18.68	PK	Vertical
2483.5	54.20	-12.78	41.42	54	-12.58	AV	Vertical
2483.5	69.22	-12.78	56.44	74	-17.56	PK	Horizontal
2483.5	55.16	-12.78	42.38	54	-11.62	AV	Horizontal
8DPSK							
2390.0	69.05	-12.99	56.06	74	-17.94	PK	Vertical
2390.0	55.14	-12.99	42.15	54	-11.85	AV	Vertical
2390.0	68.12	-12.99	55.13	74	-18.87	PK	Horizontal
2390.0	55.15	-12.99	42.16	54	-11.84	AV	Horizontal
2483.5	69.22	-12.78	56.44	74	-17.56	PK	Vertical
2483.5	55.20	-12.78	42.42	54	-11.58	AV	Vertical
2483.5	68.10	-12.78	55.32	74	-18.68	PK	Horizontal
2483.5	55.08	-12.78	42.30	54	-11.70	AV	Horizontal

Low measurement frequencies is range from 2310 to 2400 MHz, high measurement frequencies is range from 2483.5 to 2500 MHz.

Only show the worst point data of the emissions in the frequency 2310-2400 MHz and 2483.5-2500 MHz.

4. NUMBER OF HOPPING CHANNEL

4.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (a)(1)(iii)	Number of Hopping Channel	≥15	2400-2483.5	PASS

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	= the frequency band of operation
RB	RBW ≥ 1% of the span
VB	VBW ≥ RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

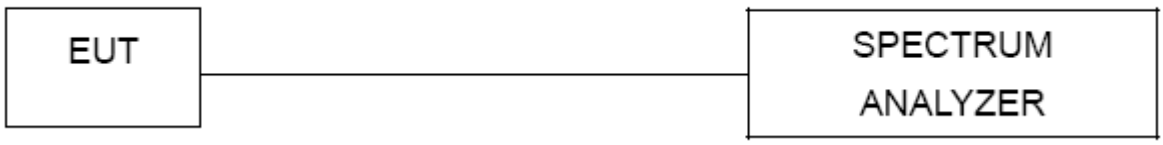
4.1.1 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 1MHz, VBW=3MHz, Sweep time = Auto.

4.1.2 DEVIATION FROM STANDARD

No deviation.

4.1.3 TEST SETUP



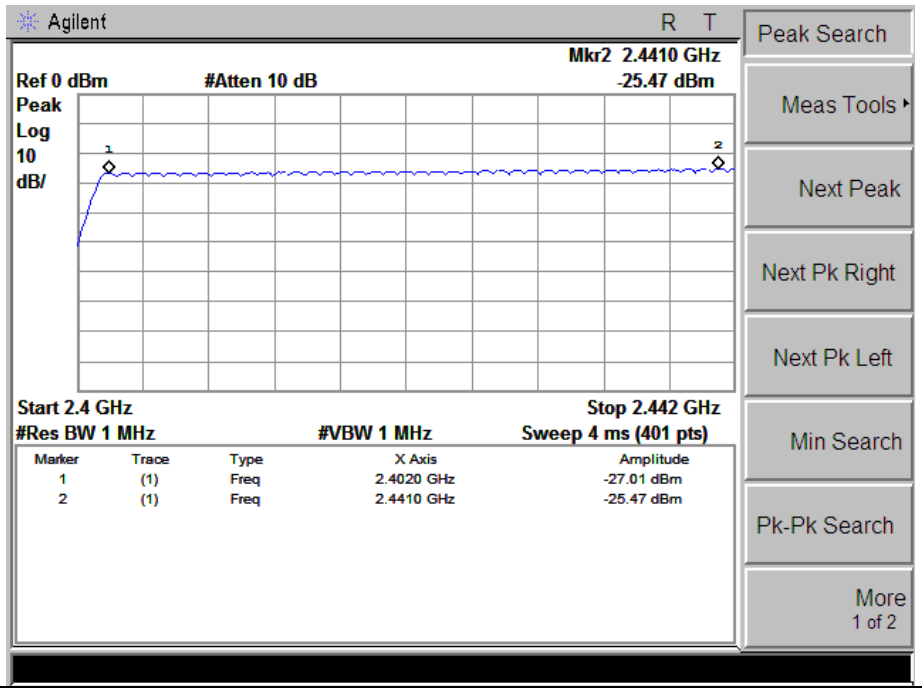
4.1.4 EUT OPERATION CONDITIONS

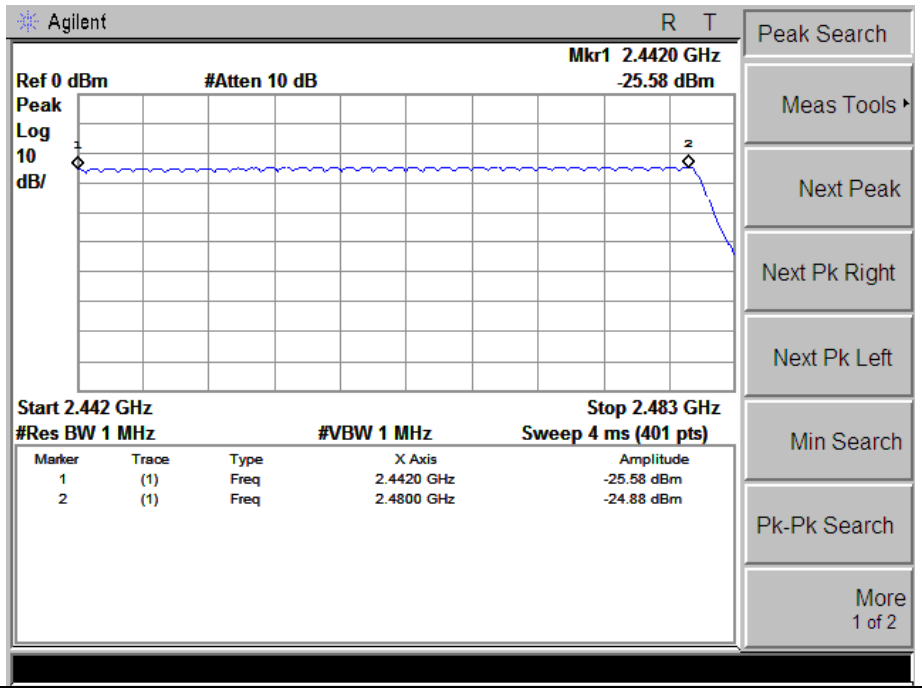
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

4.1.5 TEST RESULTS

EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1015 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	Hopping Mode		

Number of Hopping Channel	79





5. AVERAGE TIME OF OCCUPANCY

5.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (a)(1)(iii)	Average Time of Occupancy	0.4sec	2400-2483.5	PASS

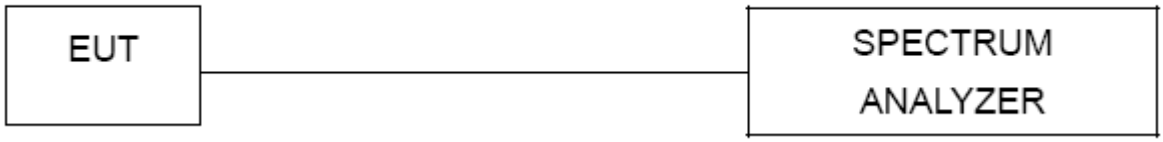
5.1.1 TEST PROCEDURE

a. The transmitter output (antenna port) was connected to the spectrum analyzer
b. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
d. Sweep Time is more than once pulse time.
e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
f. Measure the maximum time duration of one single pulse.
g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
h. Measure the maximum time duration of one single pulse.
i. A Period Time = (channel number)*0.4
DH1 Time Slot: Reading * (1600/2)*31.6/(channel number)
DH3 Time Slot: Reading * (1600/4)*31.6/(channel number)
DH5 Time Slot: Reading * (1600/6)*31.6/(channel number)

5.1.2 DEVIATION FROM STANDARD

No deviation.

5.1.3 TEST SETUP



5.1.4 EUT OPERATION CONDITIONS

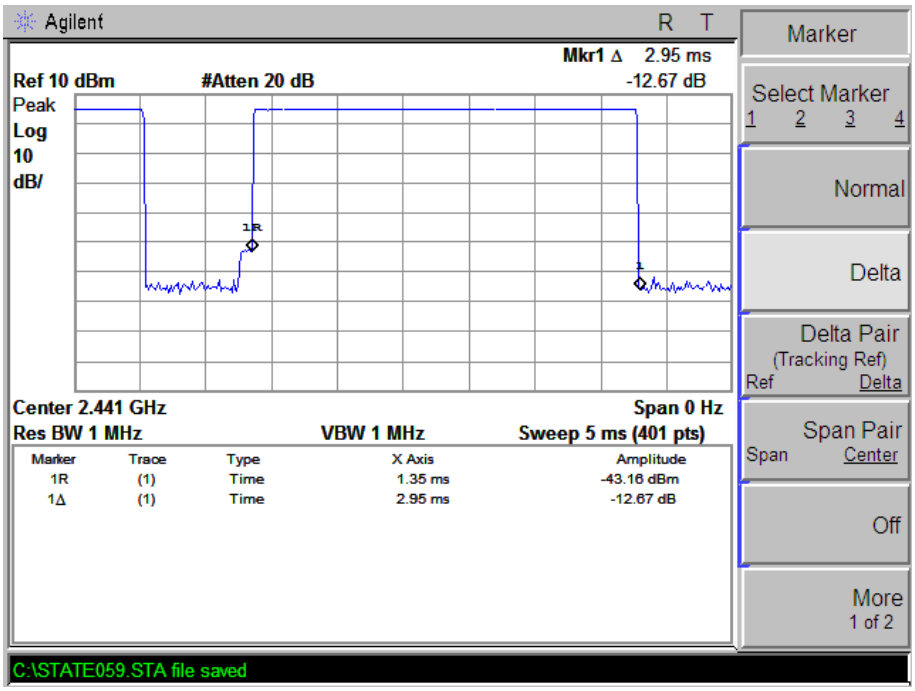
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

5.1.5 TEST RESULTS

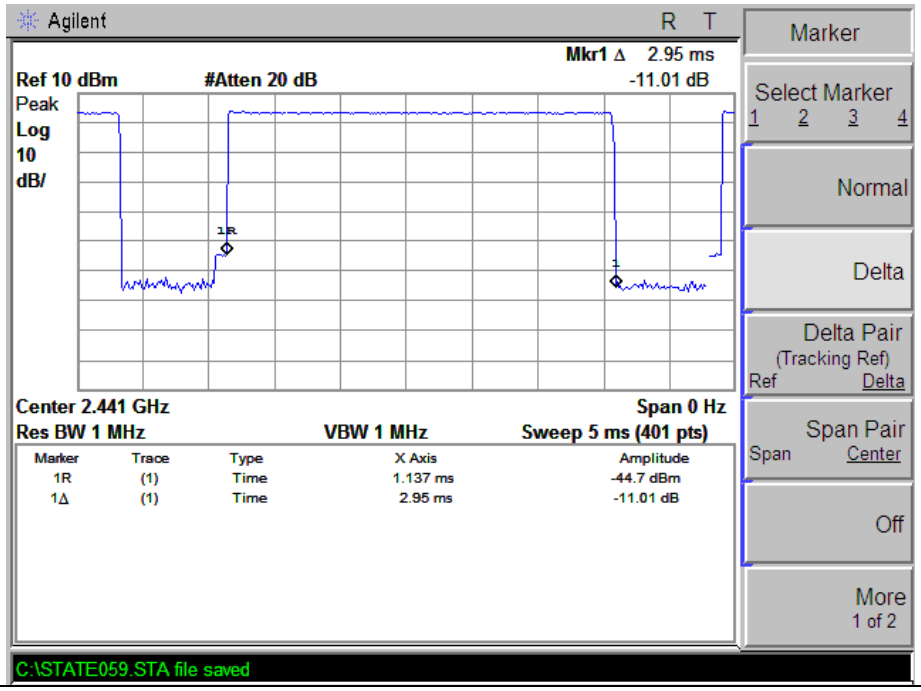
EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	CH39-DH5 ,2DH5,3DH5		

Data Packet	Frequency	Pulse Duration (ms)	Dwell Time (s)	Limits (s)
DH5	2441 MHz	2.95	0.315	0.4
2DH5	2441 MHz	2.95	0.315	0.4
3DH5	2441 MHz	2.96	0.316	0.4

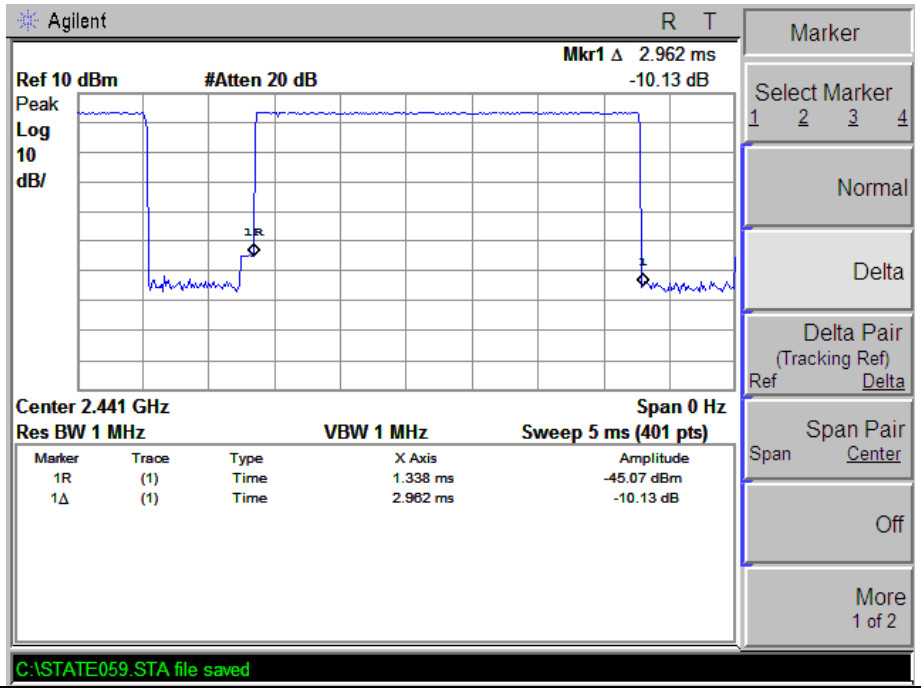
CH39-DH5



CH39-2DH5



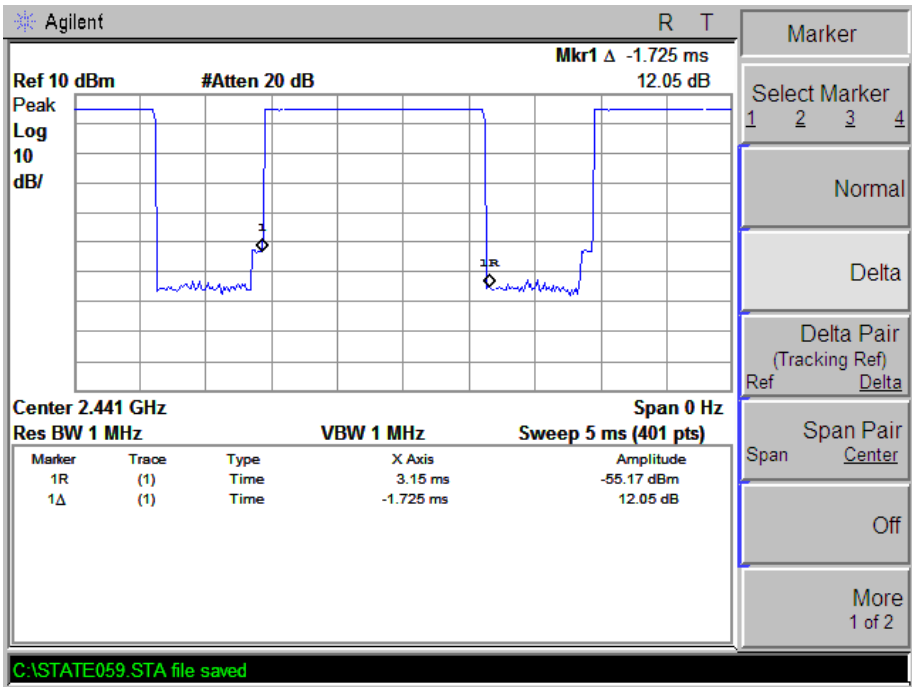
CH39-3DH5



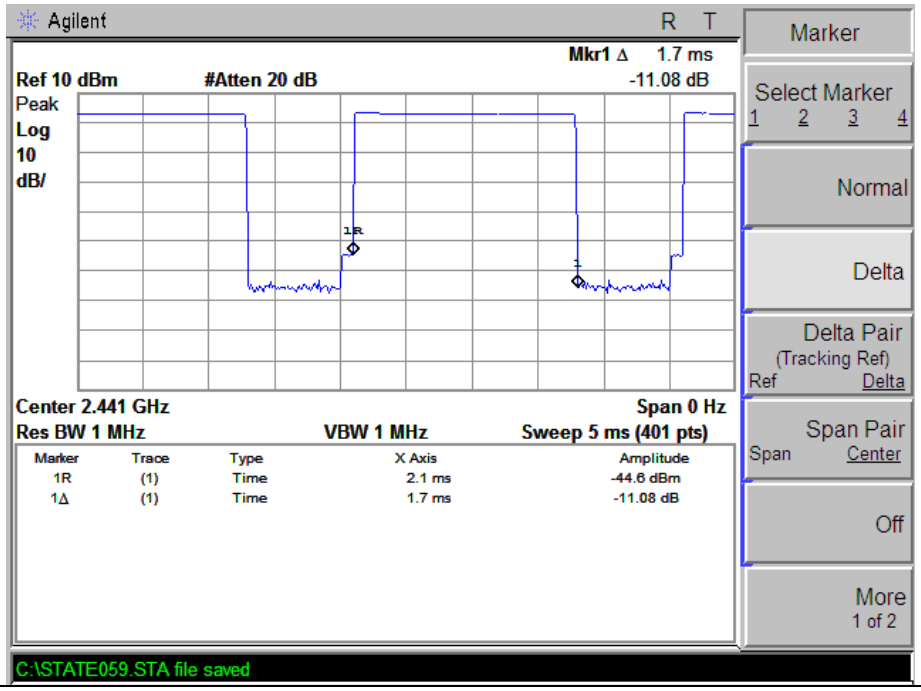
EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	CH39-DH3,2DH3,3DH3		

Data Packet	Frequency	Pulse Duration (ms)	Dwell Time (s)	Limits (s)
DH3	2441 MHz	1.725	0.276	0.4
2DH3	2441 MHz	1.700	0.272	0.4
3DH3	2441 MHz	1.71	0.274	0.4

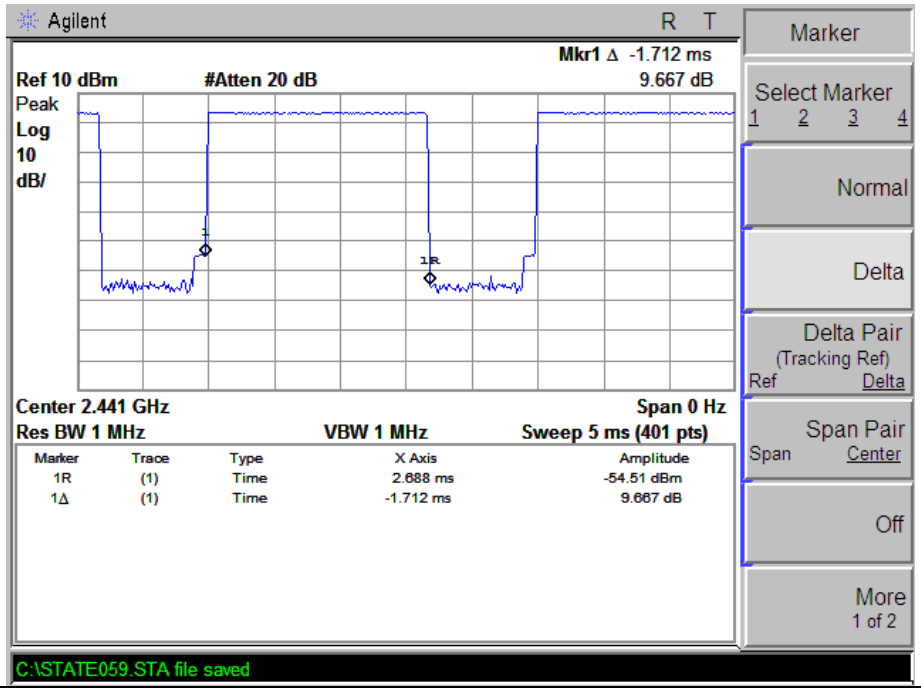
CH39-DH3



CH39-2DH3



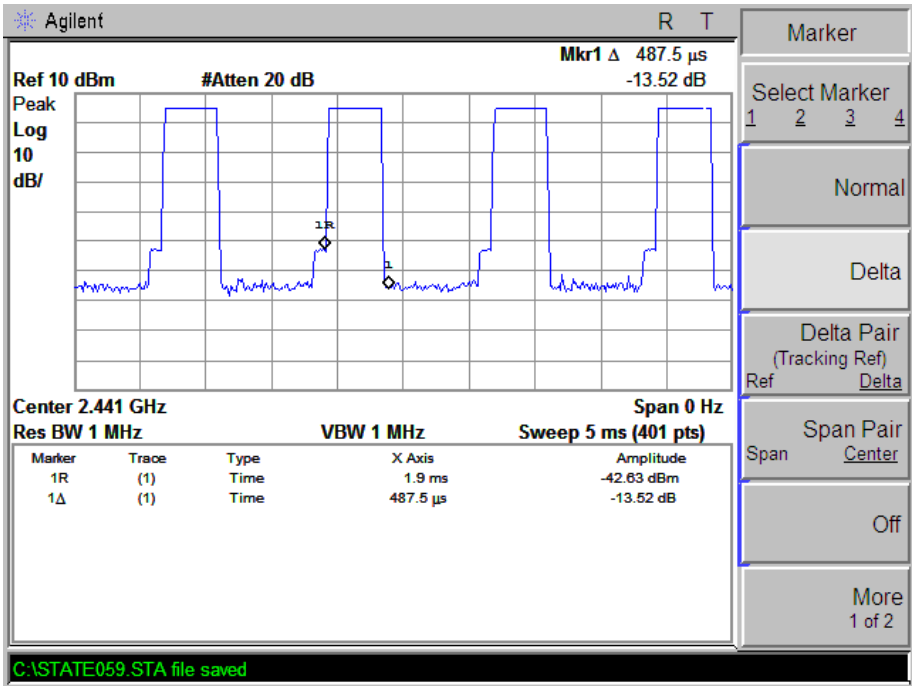
CH39-3DH3



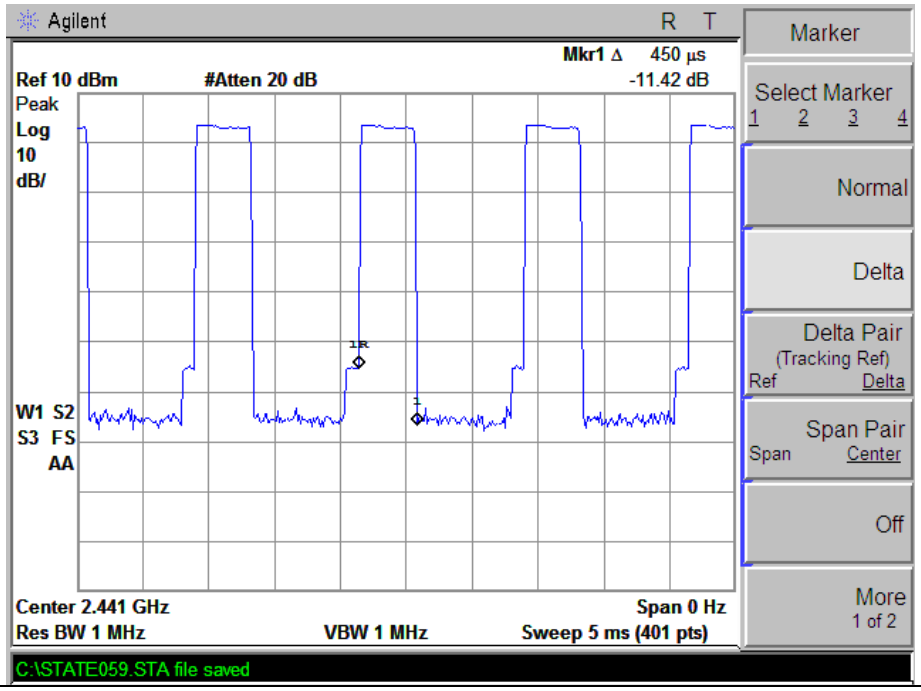
EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	CH39-DH1,2DH1,3DH1		

Data Packet	Frequency	Pulse Duration (ms)	Dwell Time (s)	Limits (s)
DH1	2441 MHz	0.4875	0.16	0.4
2DH1	2441 MHz	0.4500	0.14	0.4
3DH1	2441 MHz	0.4625	0.15	0.4

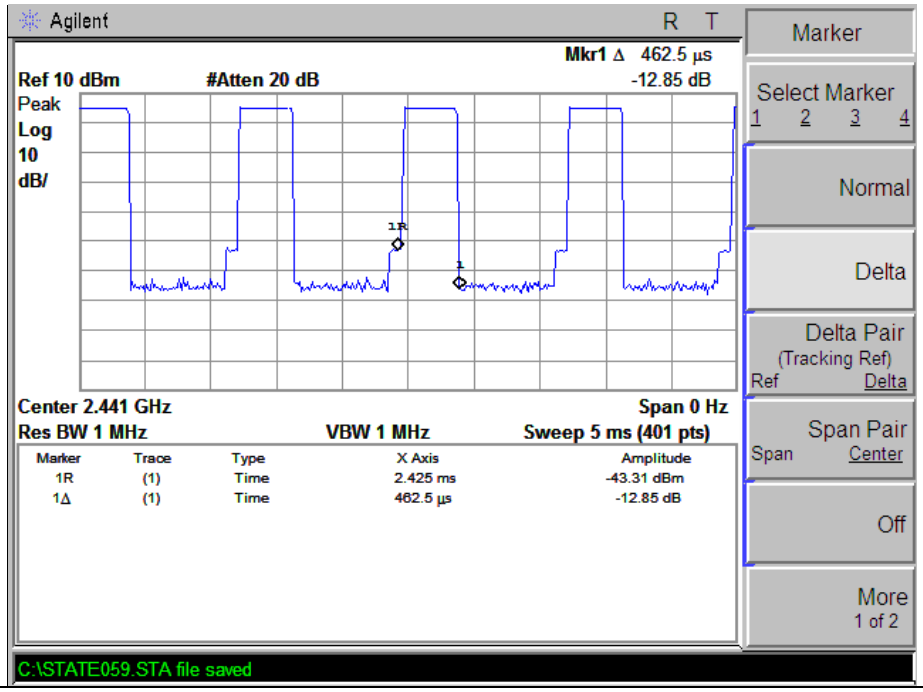
CH39-DH1



CH39-2DH1



CH39-3DH1



6. HOPPING CHANNEL SEPARATION MEASUREMENT

6.1 APPLIED PROCEDURES / LIMIT

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	wide enough to capture the peaks of two adjacent channels
RB	≥ 1% of the span
VB	≥ RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

6.1.1 TEST PROCEDURE

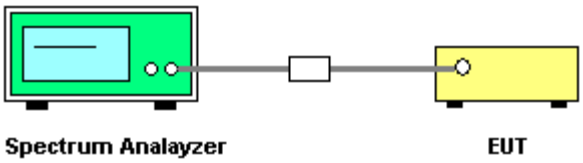
a. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.

b. The resolution bandwidth of 30 kHz and the video bandwidth of 30 kHz were utilised for channel separation measurement.

6.1.2 DEVIATION FROM STANDARD

No deviation.

6.1.3 TEST SETUP



6.1.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

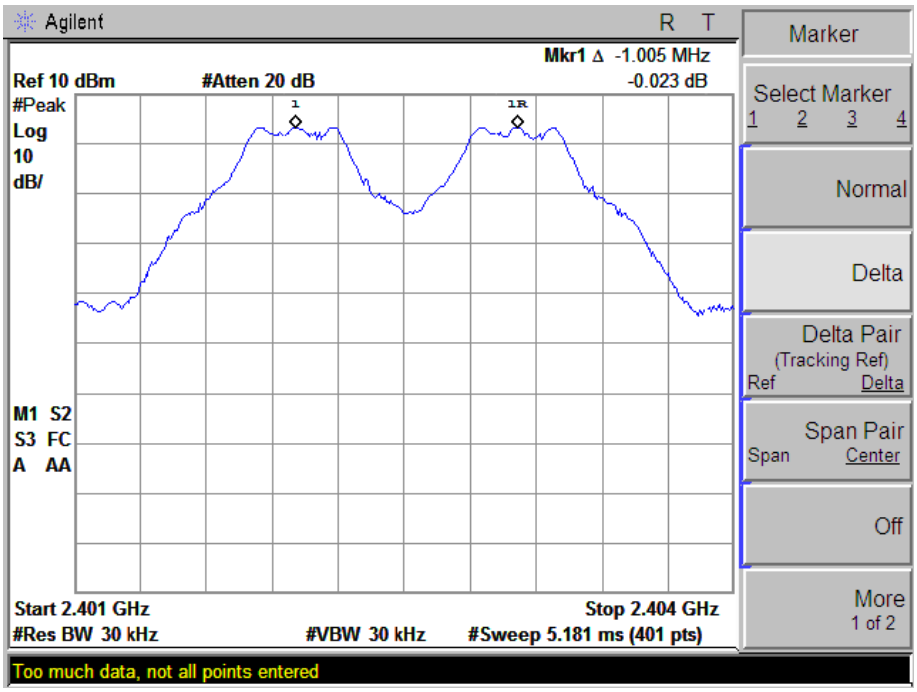
6.1.5 TEST RESULTS

EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	CH00 / CH39 /CH78 (1Mbps Mode)		

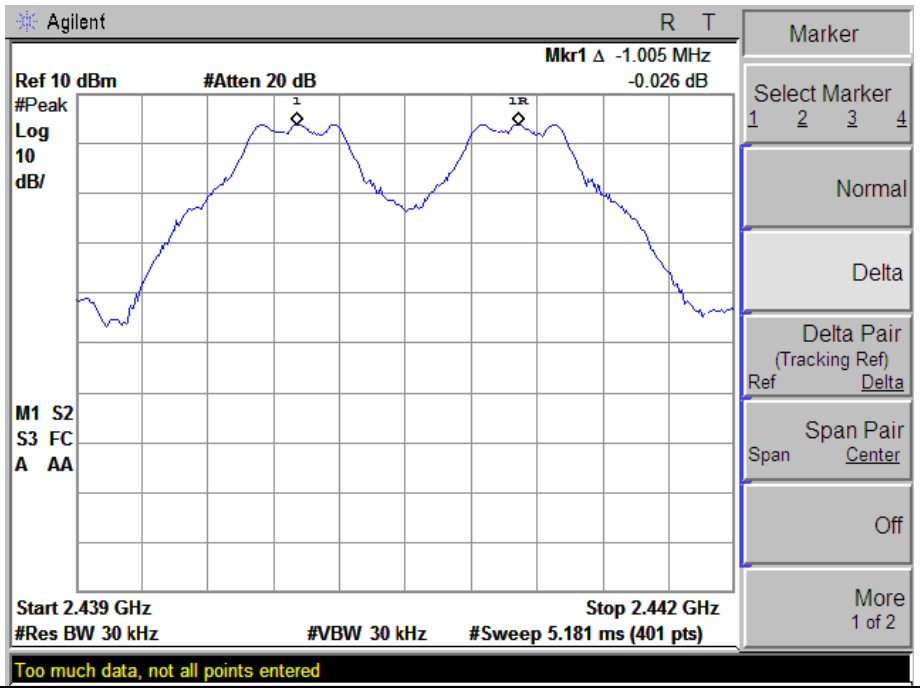
Frequency	Ch. Separation(MHz)	Result
2402 MHz	1.005	**PASS**
2441 MHz	1.005	**PASS**
2480 MHz	1.005	**PASS**

Ch. Separation Limits: >20dB bandwidth

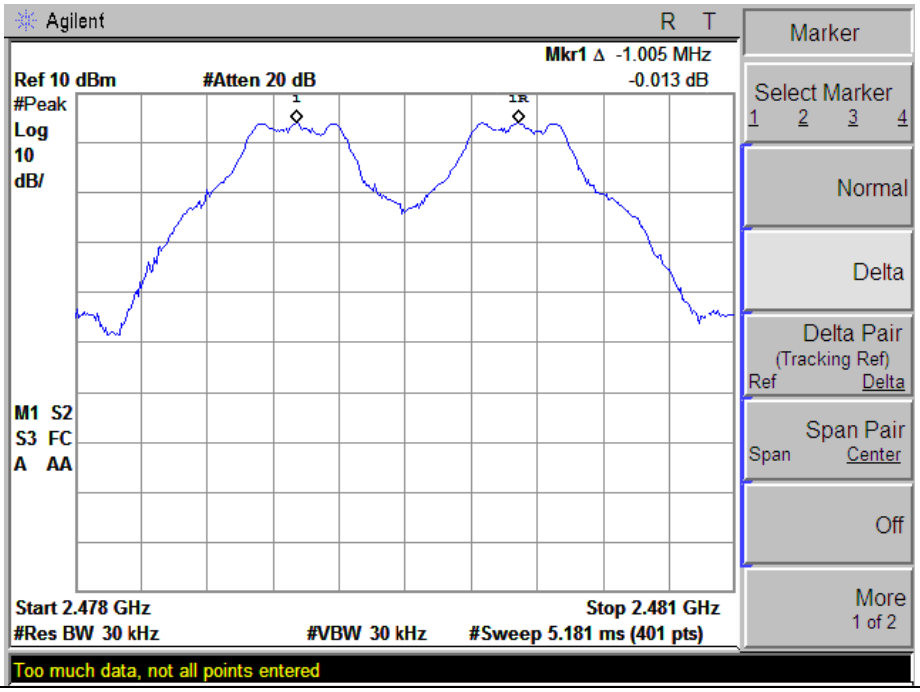
CH00 -1Mbps



CH39 -1Mbps



CH78 -1Mbps

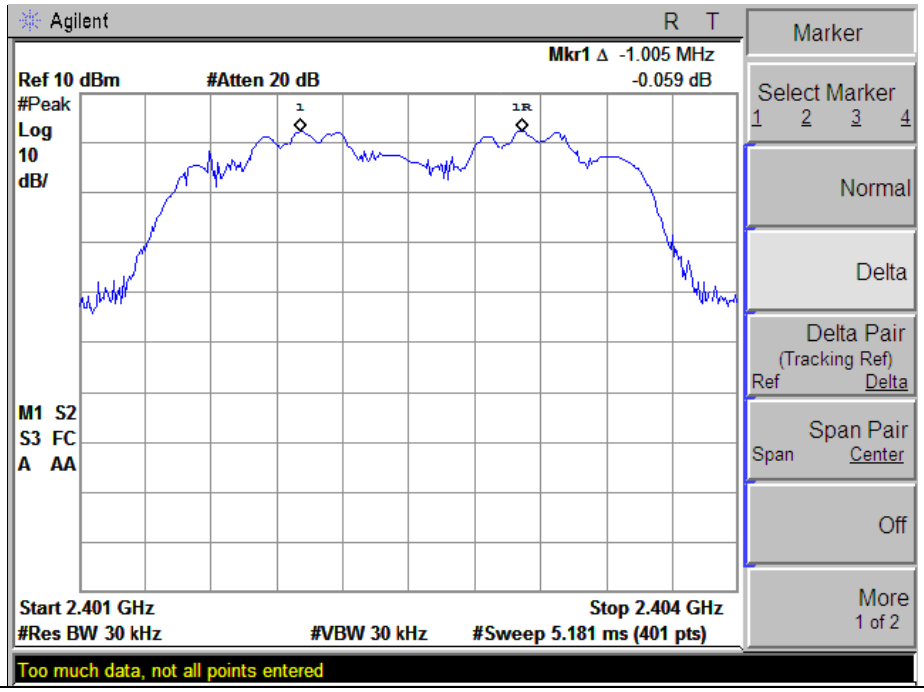


EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	CH00 / CH39 /CH78 (2Mbps Mode)		

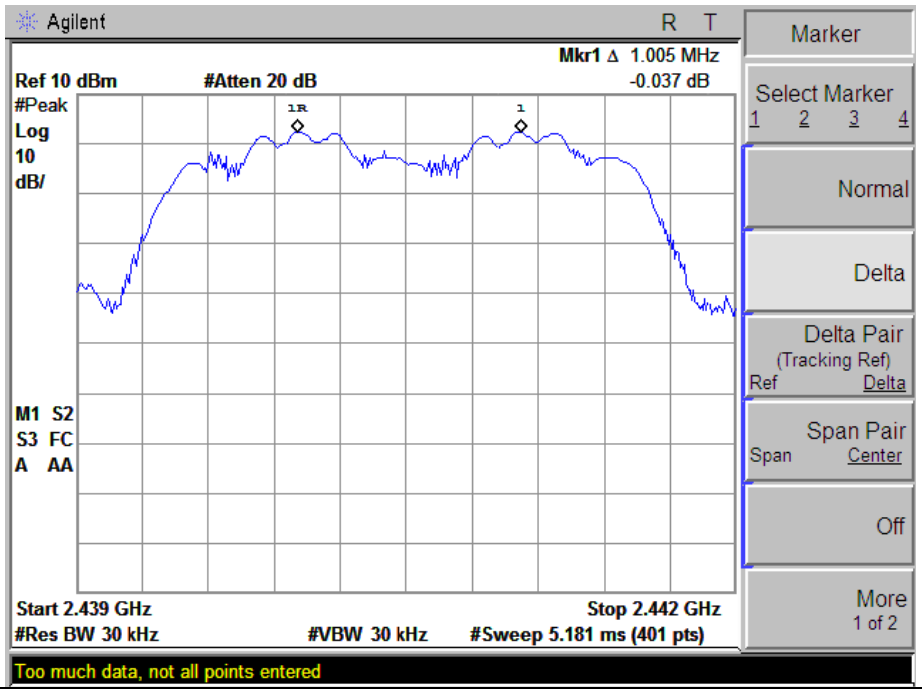
Frequency	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	1.005	1.152*2/3	**PASS**
2441 MHz	1.005	1.157*2/3	**PASS**
2480 MHz	1.005	1.149*2/3	**PASS**

Ch. Separation Limits: >2/3 of 20dB bandwidth

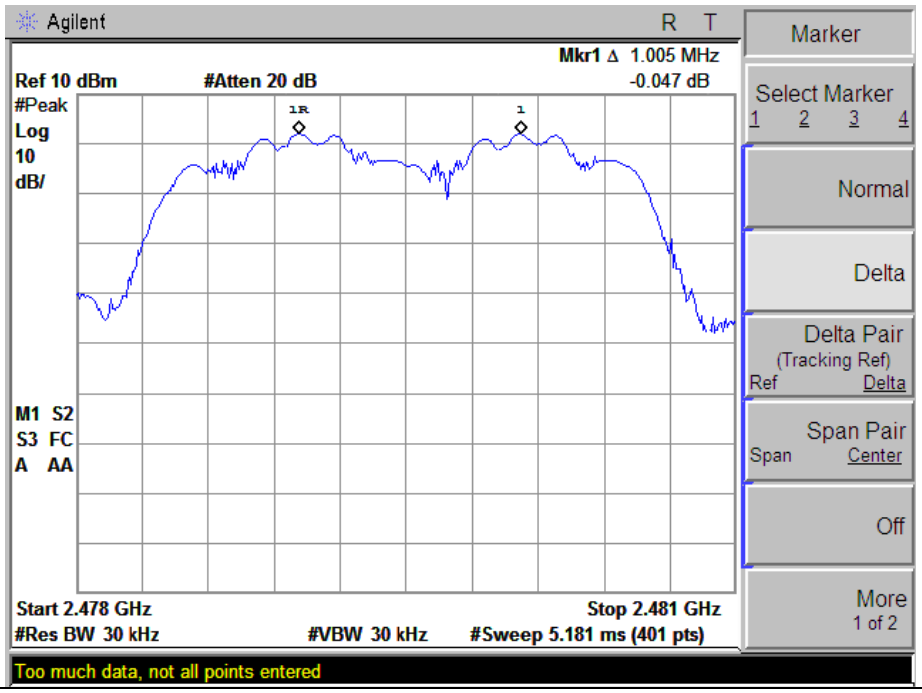
CH00 -2Mbps



CH39 -2Mbps



CH78 -2Mbps

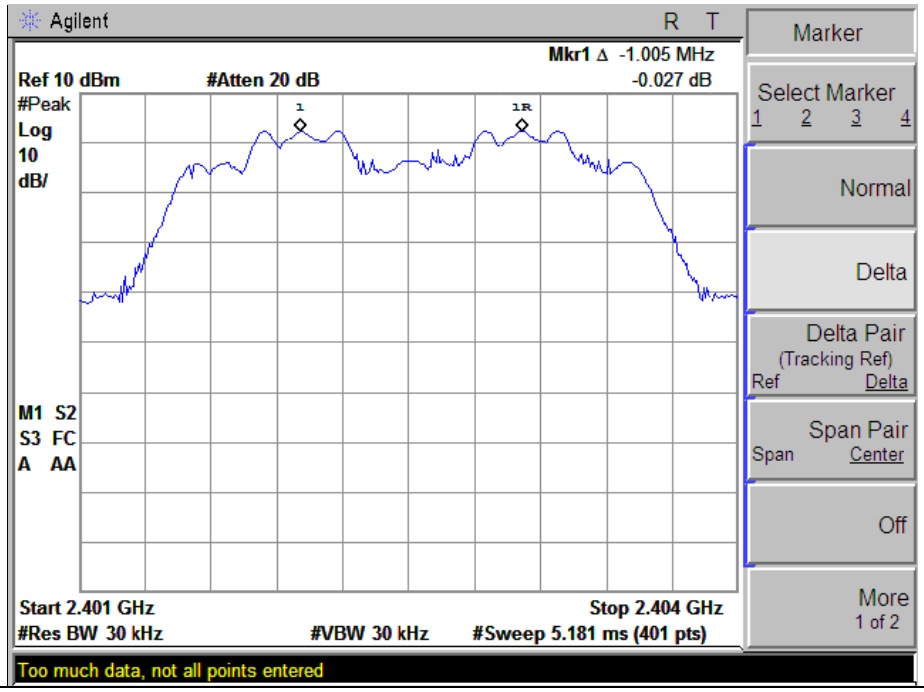


EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	CH00 / CH39 /CH78 (3Mbps Mode)		

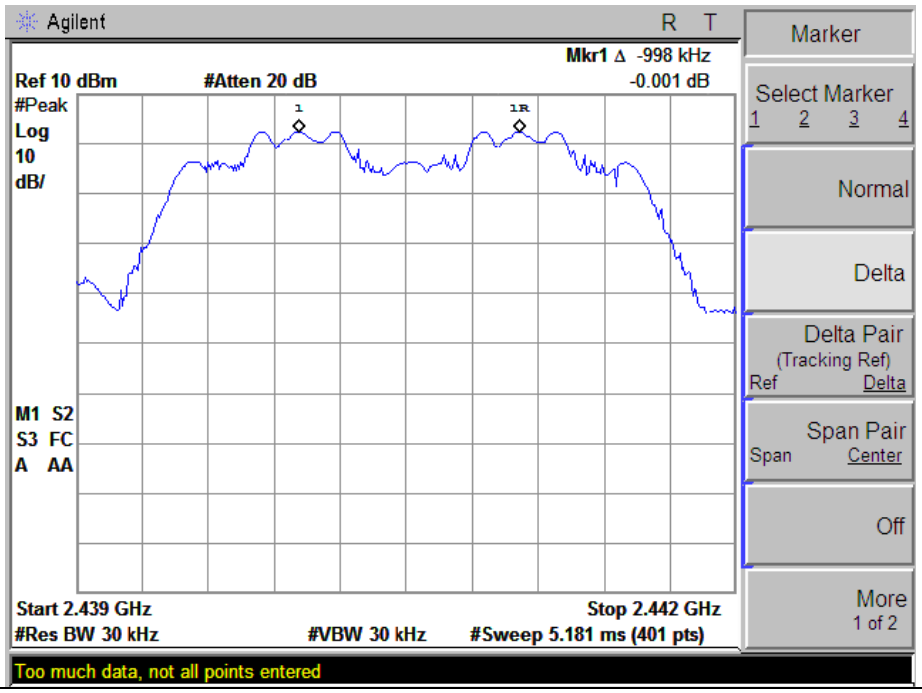
Frequency	Ch. Separation (MHz)	LIMIT (MHz)	Result
2402 MHz	1.005	1.164*2/3	**PASS**
2441 MHz	0.998	1.167*2/3	**PASS**
2480 MHz	1.005	1.161*2/3	**PASS**

Ch. Separation Limits: >2/3 of 20dB bandwidth

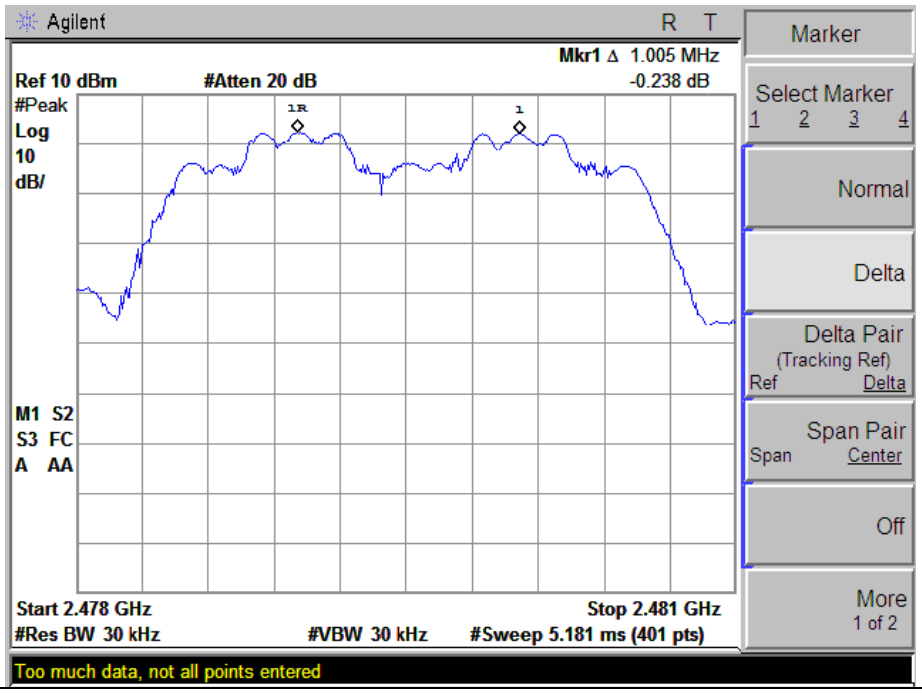
CH00 -3Mbps



CH39 -3Mbps



CH78 -3Mbps



7. BANDWIDTH TEST

7.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (a)(1)	Bandwidth	(20dB bandwidth)	2400-2483.5	PASS

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RB	30 kHz
VB	100 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

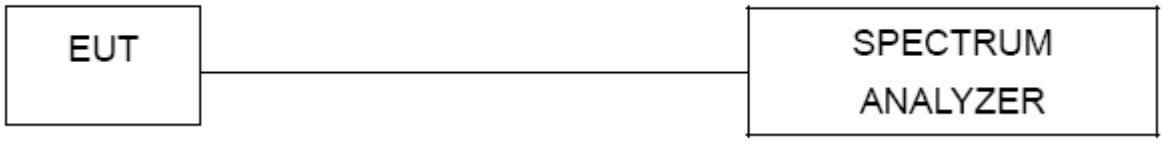
7.1.1 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 30KHz, VBW=100KHz, Sweep time = Auto.

7.1.2 DEVIATION FROM STANDARD

No deviation.

7.1.3 TEST SETUP



7.1.4 EUT OPERATION CONDITIONS

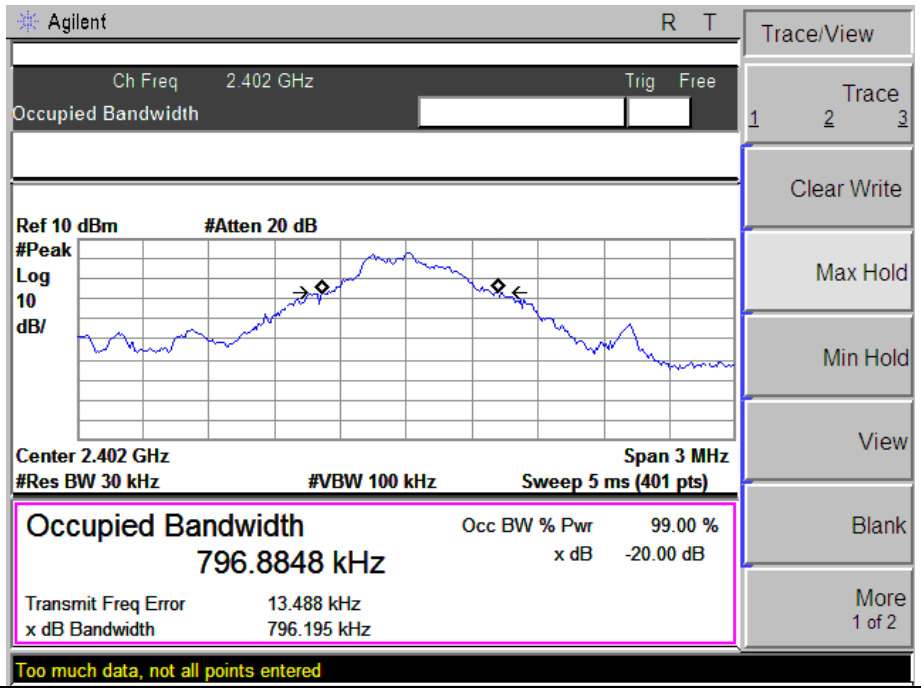
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

7.1.5 TEST RESULTS

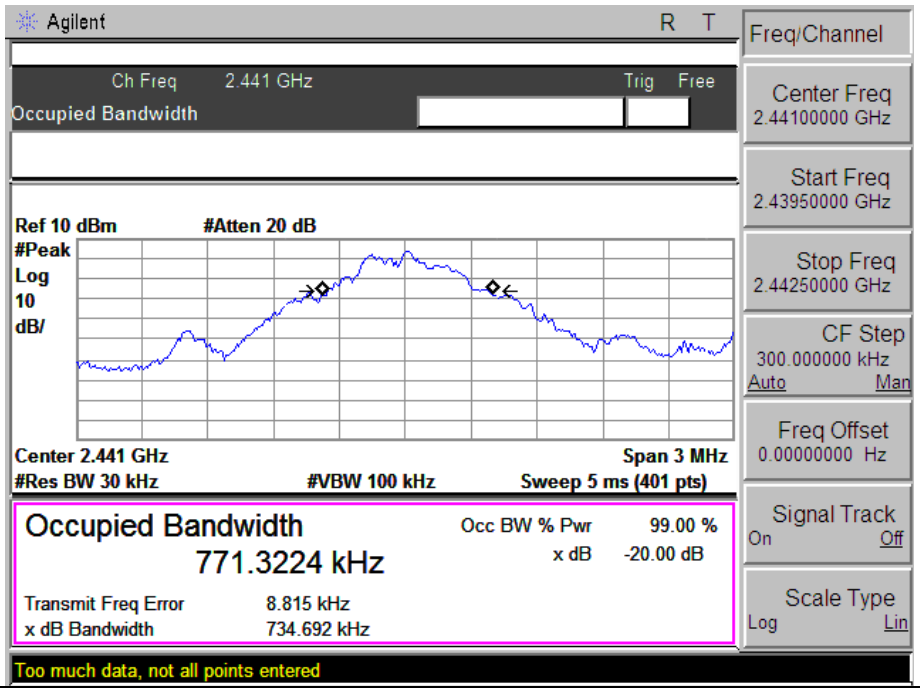
EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	CH00 / CH39 /C78**(1Mbps)**		

Frequency	20dB Bandwidth (kHz)	Result
2402 MHz	796.195	**PASS**
2441 MHz	734.692	**PASS**
2480 MHz	801.635	**PASS**

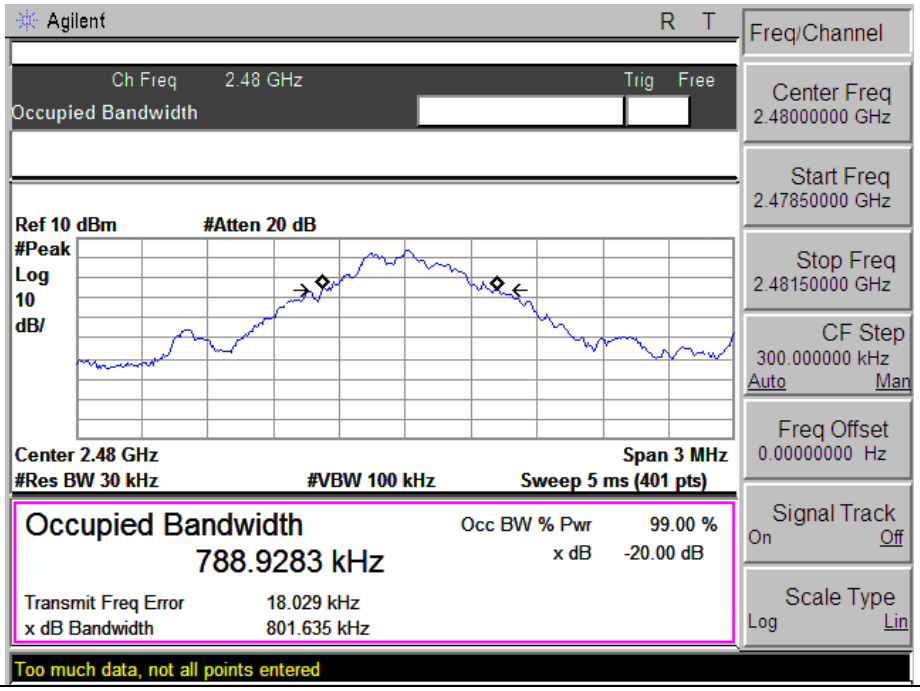
CH00 -1Mbps



CH39 -1Mbps



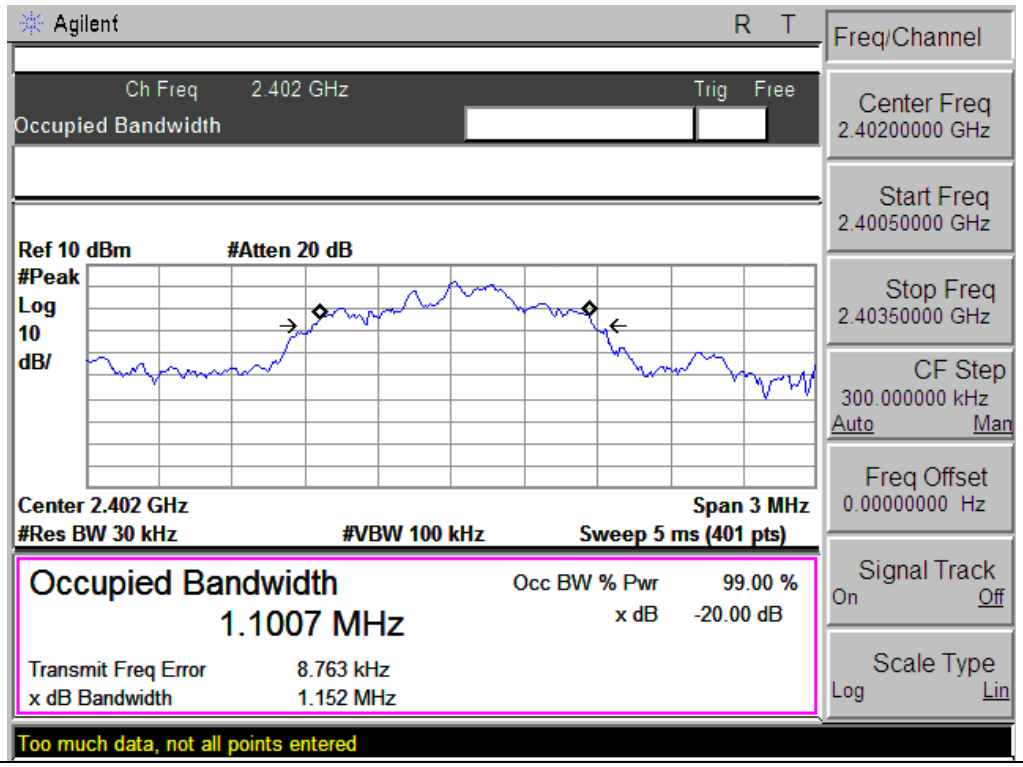
CH78 -1Mbps



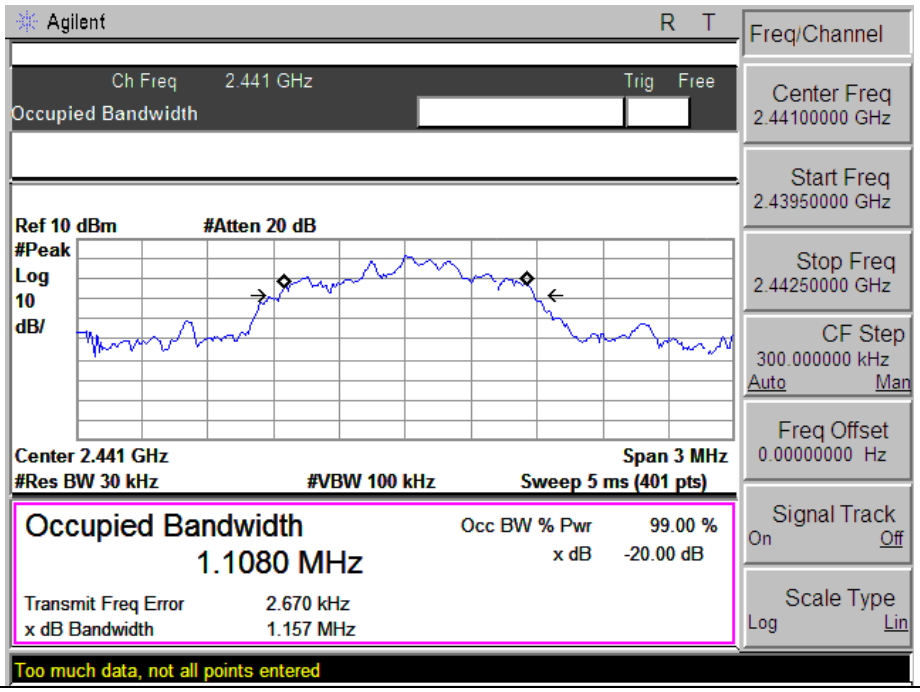
EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	CH00 / CH39 /C78**(2Mbps)**		

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.152	**PASS**
2441 MHz	1.157	**PASS**
2480 MHz	1.149	**PASS**

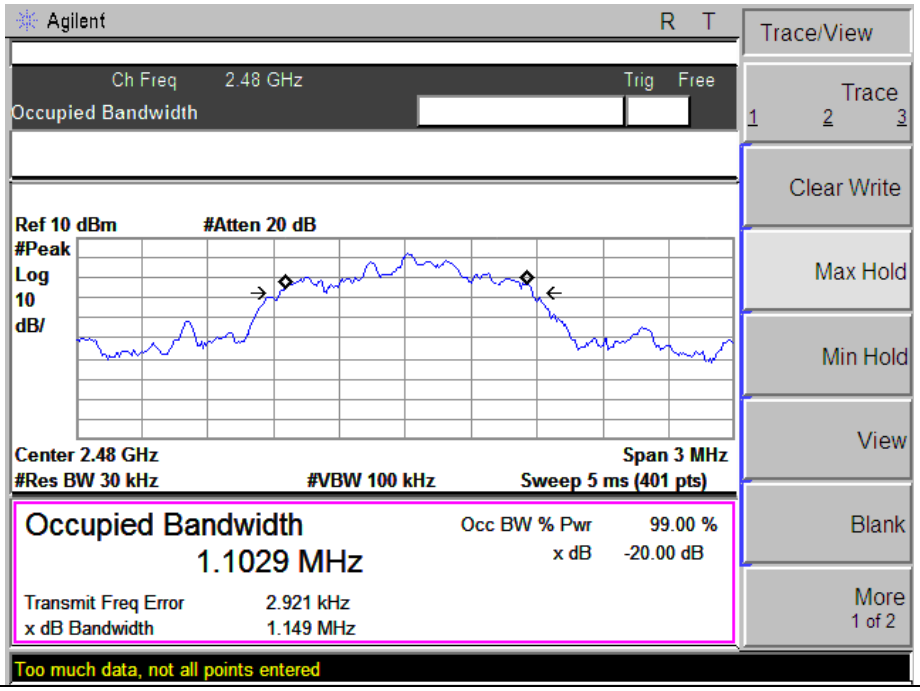
CH00 -2Mbps



CH39 -2Mbps



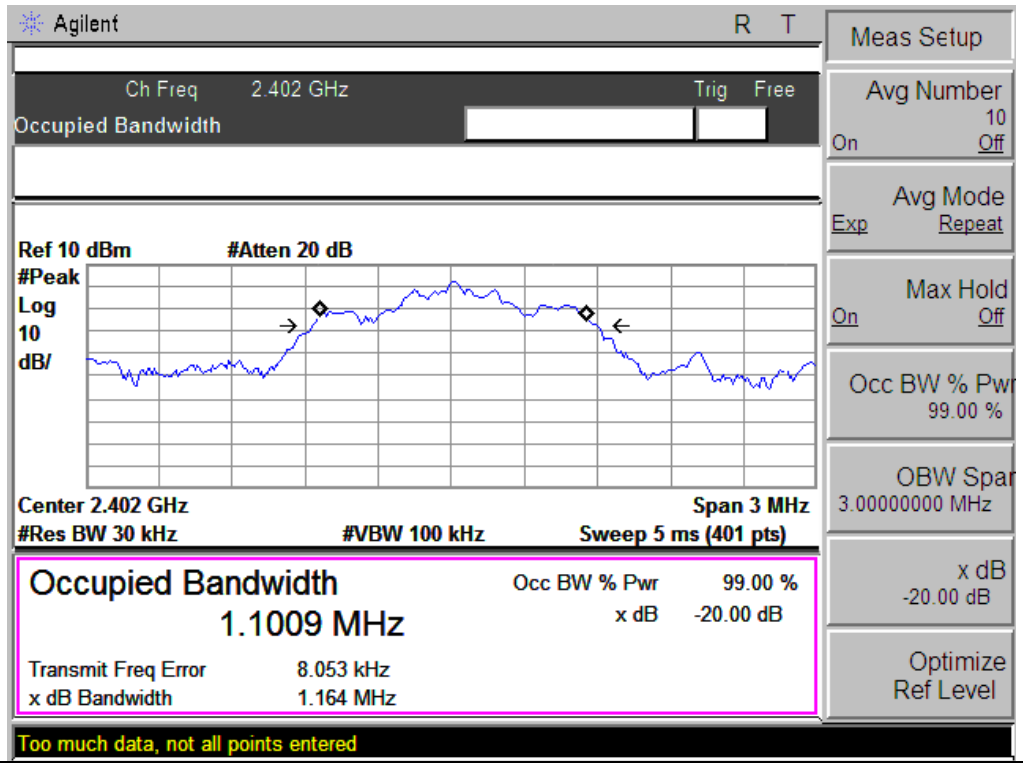
CH78 -2Mbps



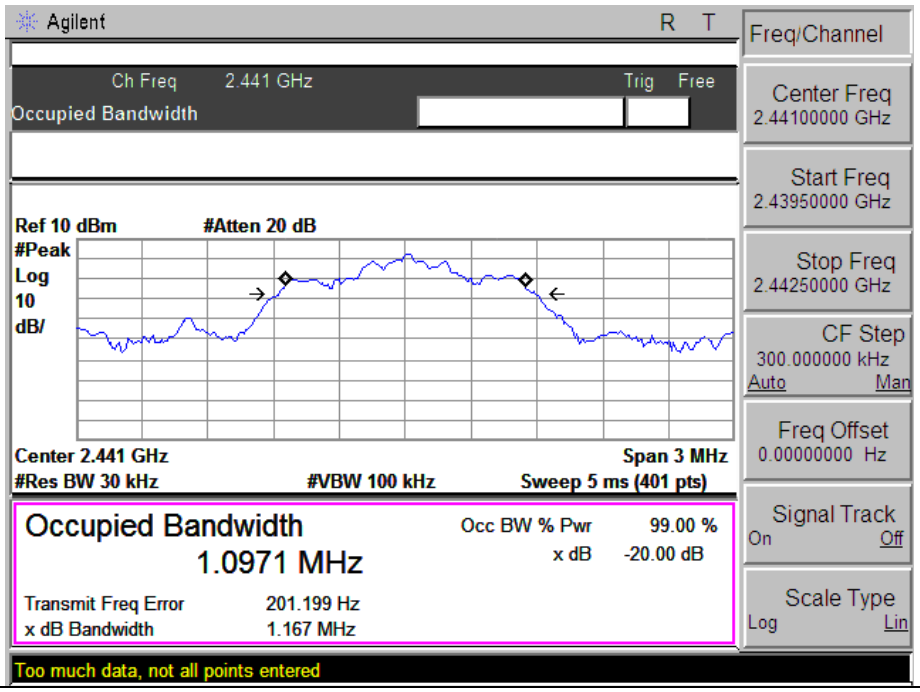
EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	CH00 / CH39 /C78**(3Mbps)**		

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.164	**PASS**
2441 MHz	1.167	**PASS**
2480 MHz	1.161	**PASS**

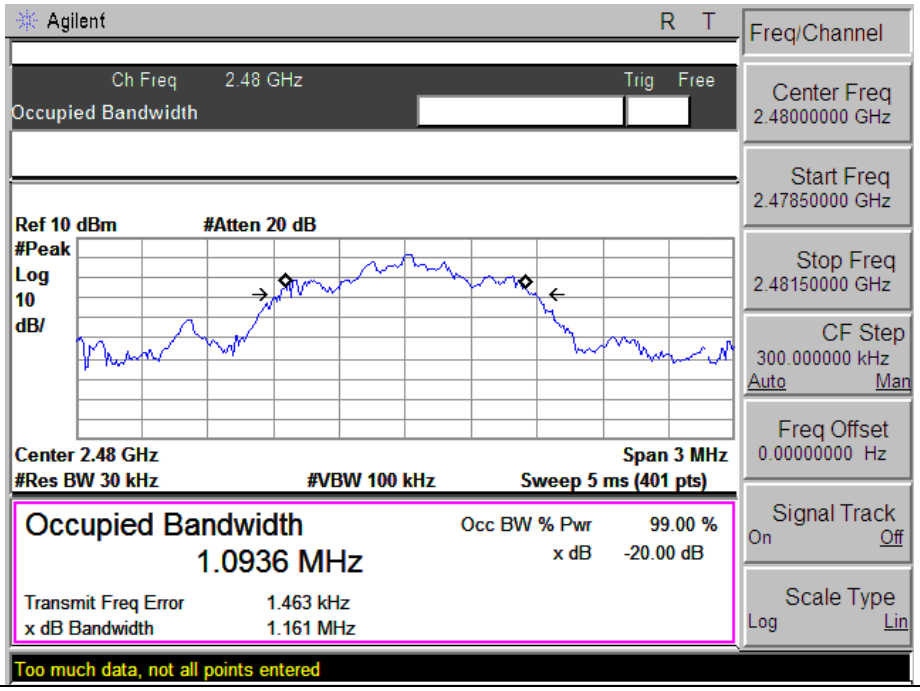
CH00 -3Mbps



CH39 -3Mbps



CH78 -3Mbps



8. PEAK OUTPUT POWER TEST

8.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (b)(i)	Peak Output Power	30dbm or 20.96dBm	2400-2483.5	PASS

8.1.1 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,

b. Spectrum Setting : RBW > the 20 dB bandwidth of the emission being measured

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

VBW ≥ RBW

Sweep = auto

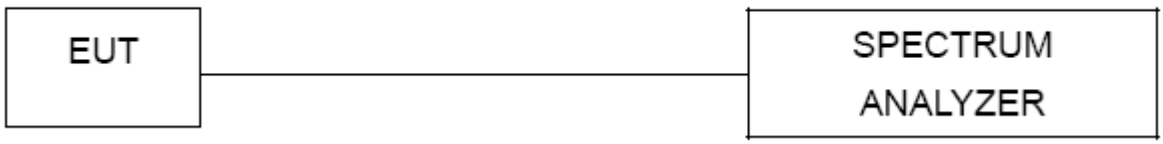
Detector function = peak

Trace = max hold

8.1.2 DEVIATION FROM STANDARD

No deviation.

8.1.3 TEST SETUP



8.1.4 EUT OPERATION CONDITIONS

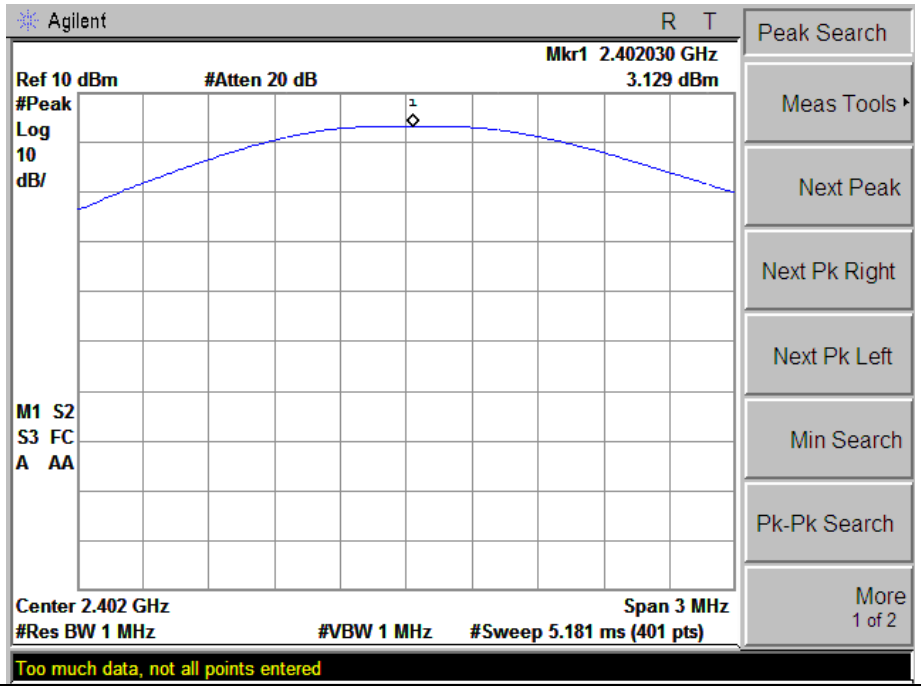
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

8.1.5 TEST RESULTS

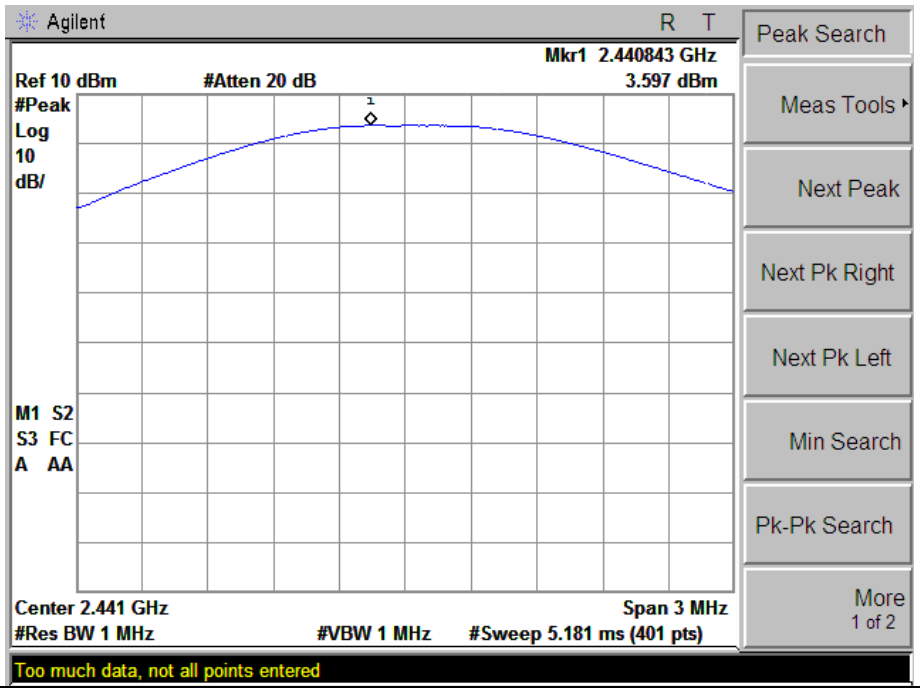
EUT：	High precision GNSS handset	Model Name ：	Polar X5
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	CH00/ CH39 /CH78 (1M/2M/3Mbps Mode)		

1Mbps			
Test Channel	Frequency (MHz)	Peak Output Power (dBm)	LIMIT (dBm)
CH00	2402	3.129	30
CH39	2441	3.597	30
CH78	2480	3.628	30
2Mbps			
CH00	2402	2.653	20.96
CH39	2441	3.090	20.96
CH78	2480	2.787	20.96
3Mbps			
CH00	2402	2.661	20.96
CH39	2441	3.191	20.96
CH78	2480	2.997	20.96

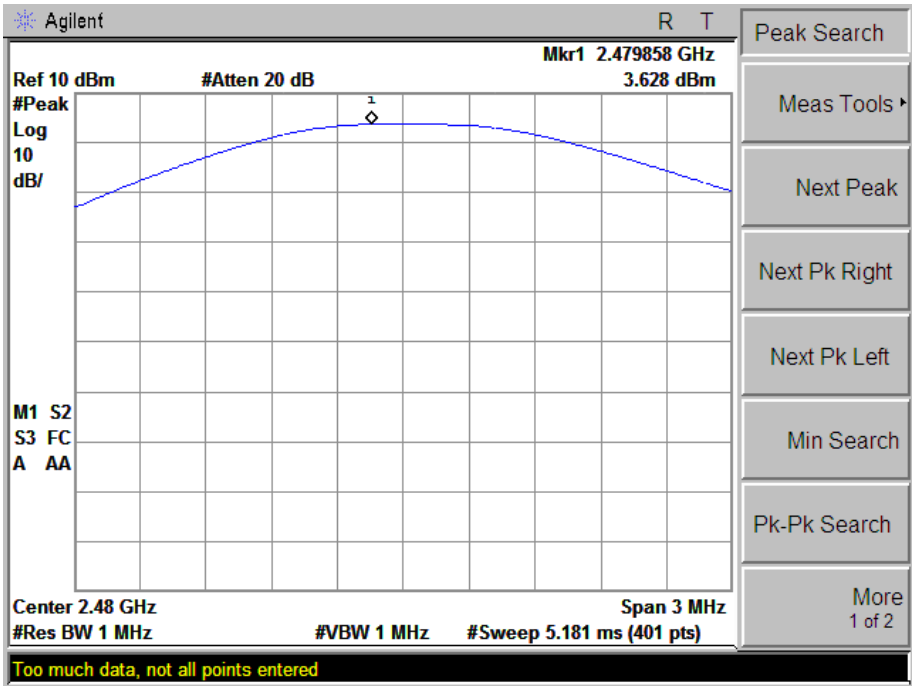
CH00 -1Mbps



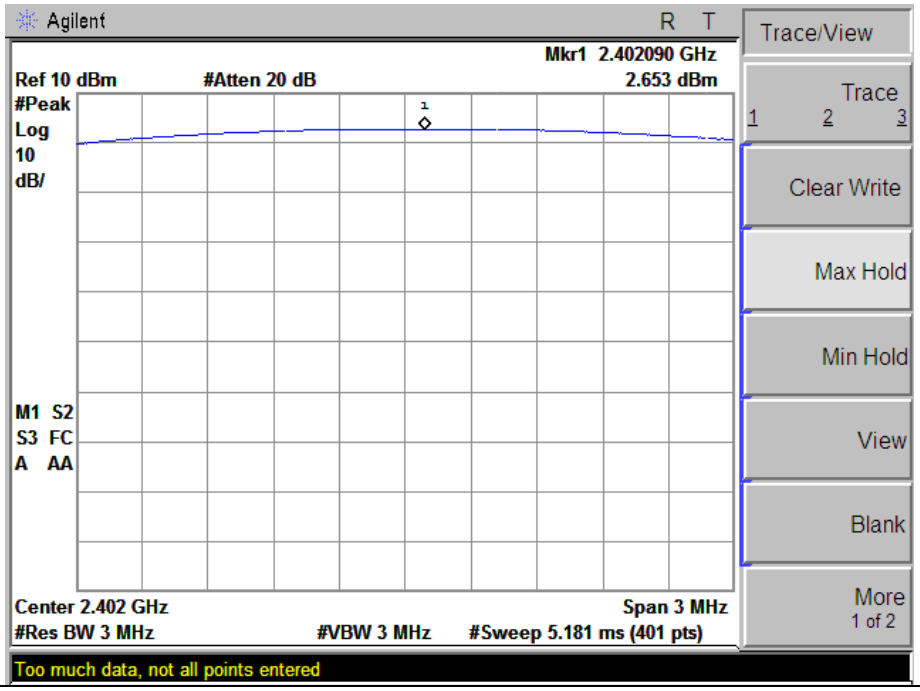
CH39 -1Mbps



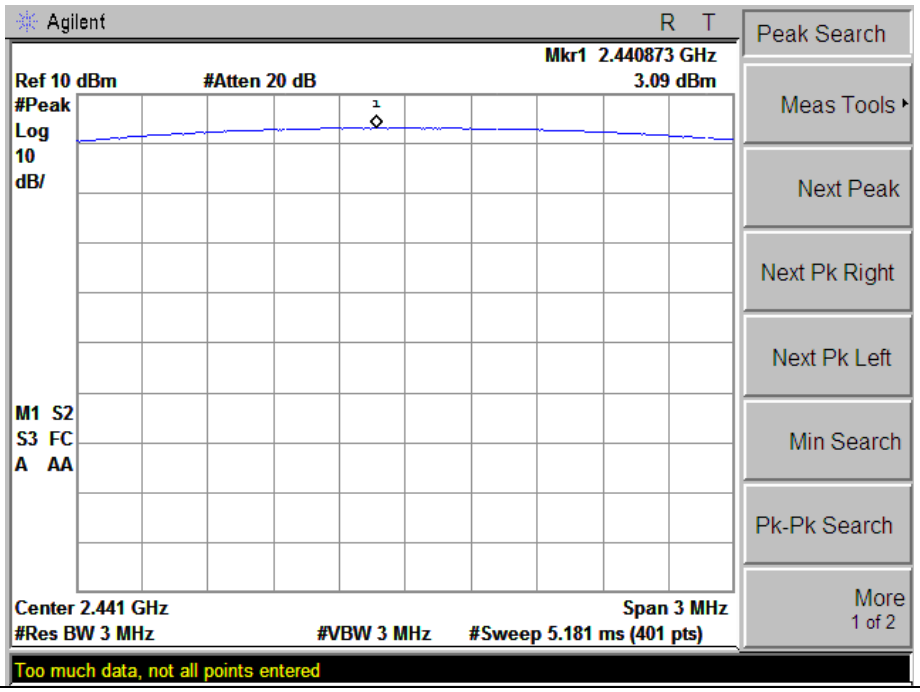
CH78 -1Mbps



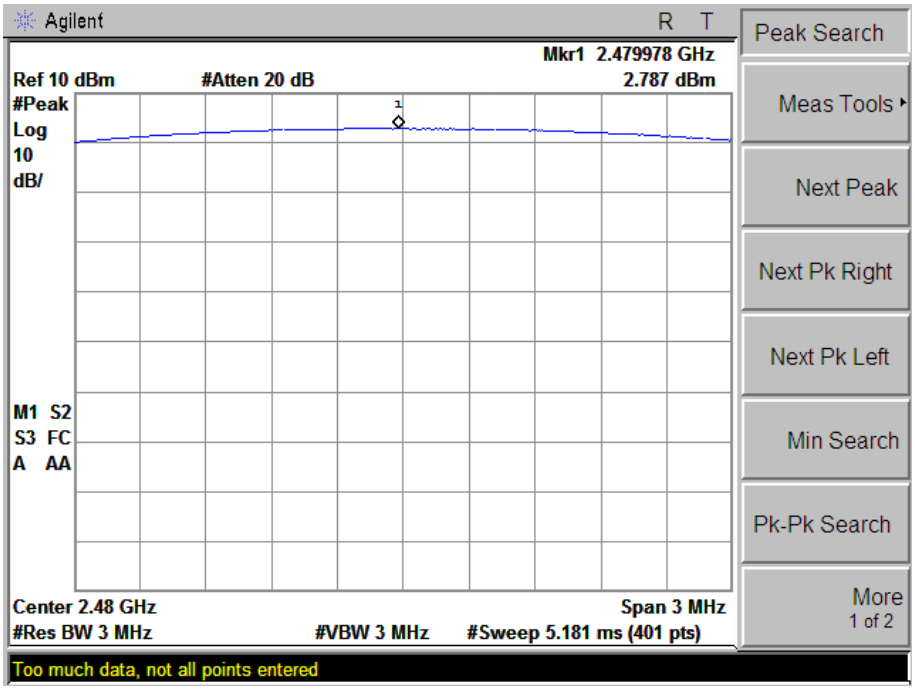
CH00 -2Mbps


Agilent
R T
Mkr1 2.402090 GHz
Ref 10 dBm
#Atten 20 dB
2.653 dBm
#Peak
Log
10
dB/
M1 S2
S3 FC
A AA
Center 2.402 GHz
#Res BW 3 MHz
#VBW 3 MHz
Span 3 MHz
#Sweep 5.181 ms (401 pts)
Too much data, not all points entered
Trace/View
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

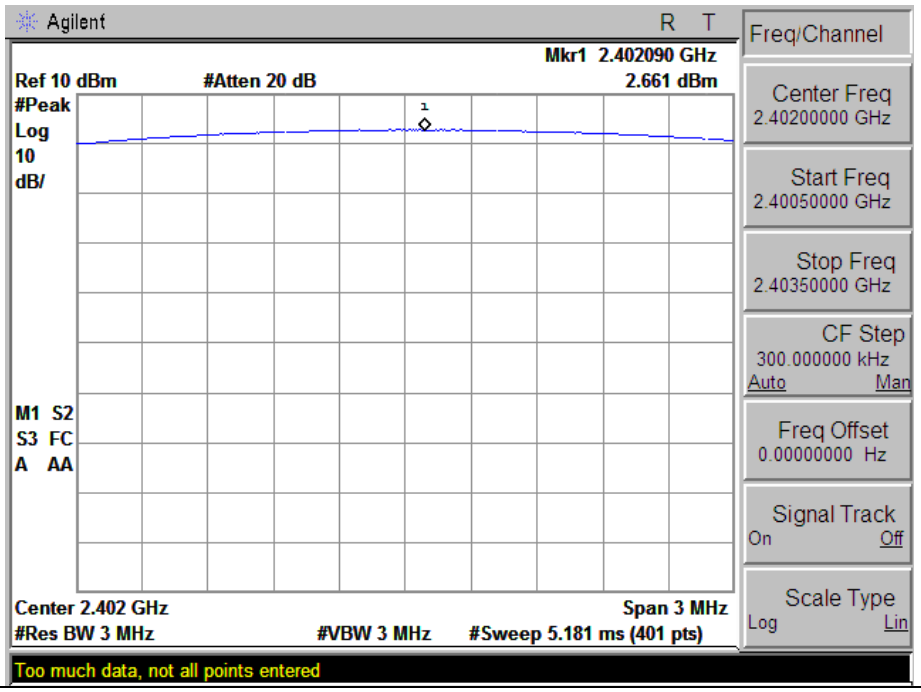
CH39 -2Mbps



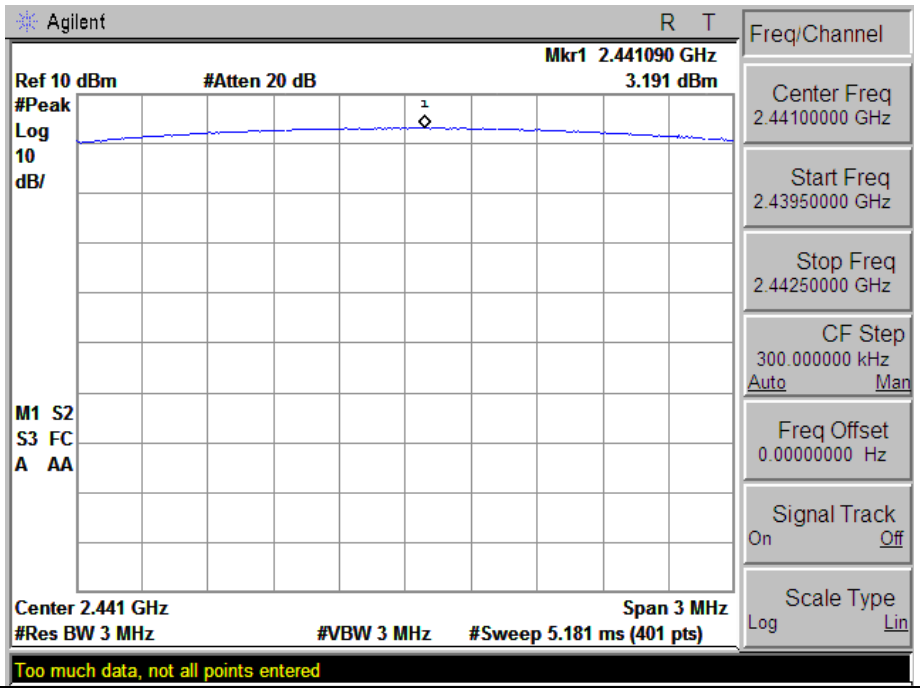
CH78 -2Mbps



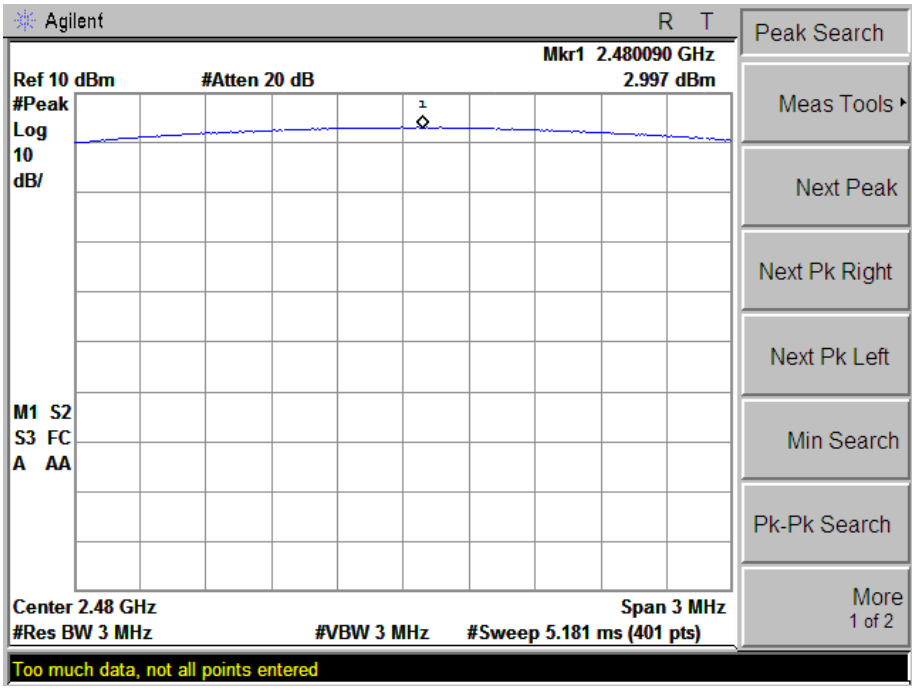
CH00 -3Mbps


Agilent
R T
Mkr1 2.402090 GHz
Ref 10 dBm
#Atten 20 dB
2.661 dBm
#Peak
Log
10
dB/
M1 S2
S3 FC
A AA
Center 2.402 GHz
#Res BW 3 MHz
#VBW 3 MHz
Span 3 MHz
#Sweep 5.181 ms (401 pts)
Too much data, not all points entered
Freq/Channel
Center Freq
2.40200000 GHz
Start Freq
2.40050000 GHz
Stop Freq
2.40350000 GHz
CF Step
300.000000 kHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off
Scale Type
Log
Lin

CH39 -3Mbps



CH78 -3Mbps



9. ANTENNA REQUIREMENT

9.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

9.2 EUT ANTENNA

The EUT antenna is Integrated(Chip) antenna. It comply with the standard requirement.

10.CONDUCTED SPURIOUS EMISSIONS

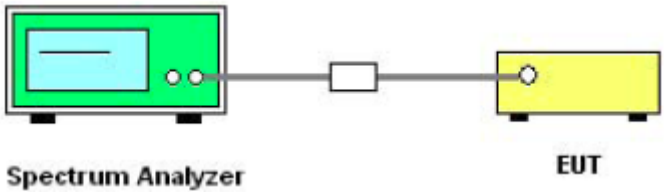
10.1 REQUIREMENT

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

10.2 TEST PROCEDURE

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

10.3 TEST SETUP



The EUT which is powered by the Battery, is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. Make the measurement with the spectrum analyzer's resolution bandwidth(RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

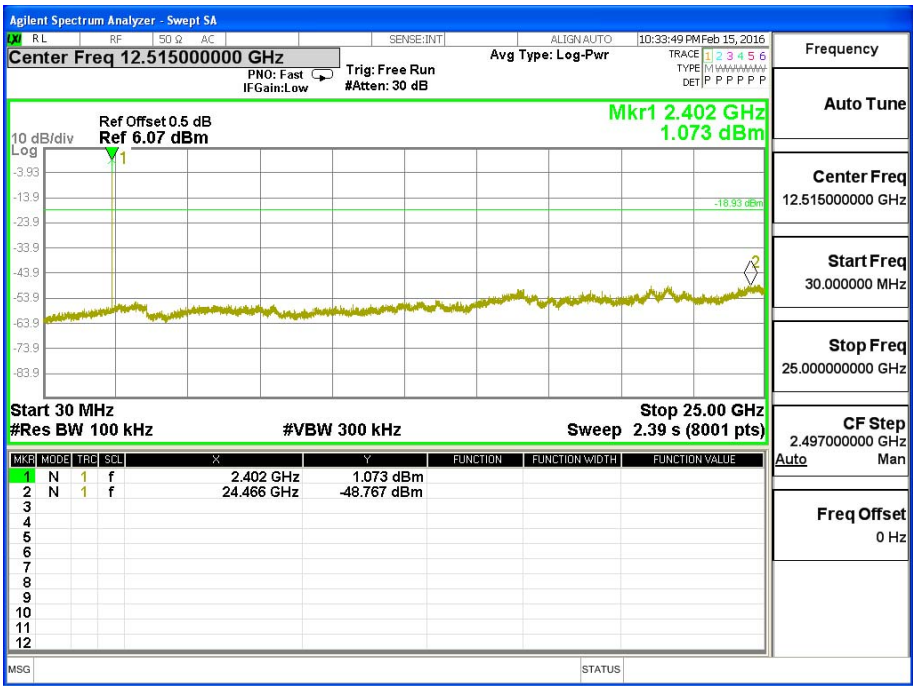
10.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

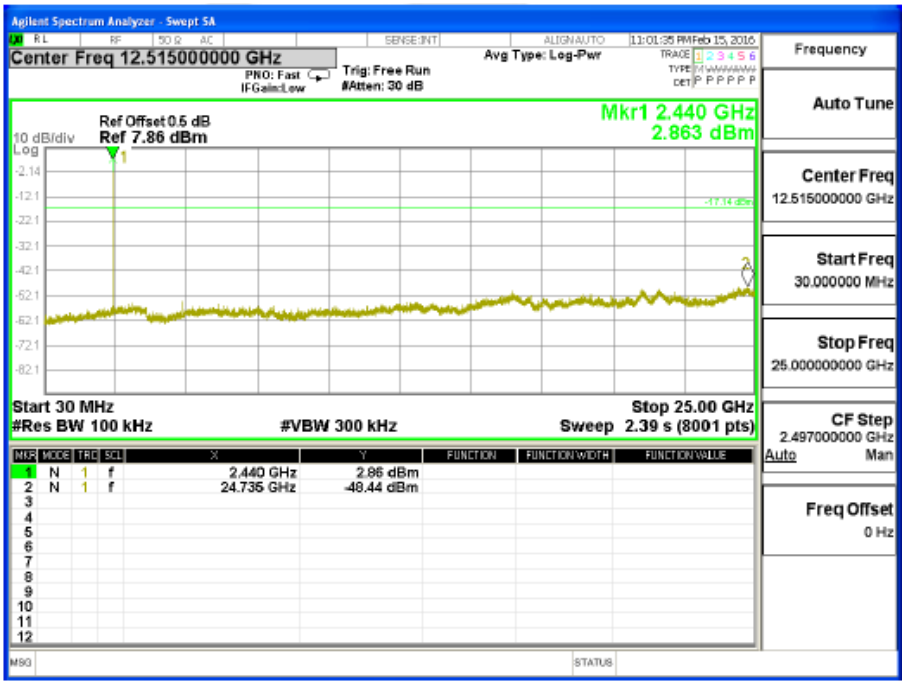
10.5 TEST RESULTS

1Mbps:

CH0



CH 39

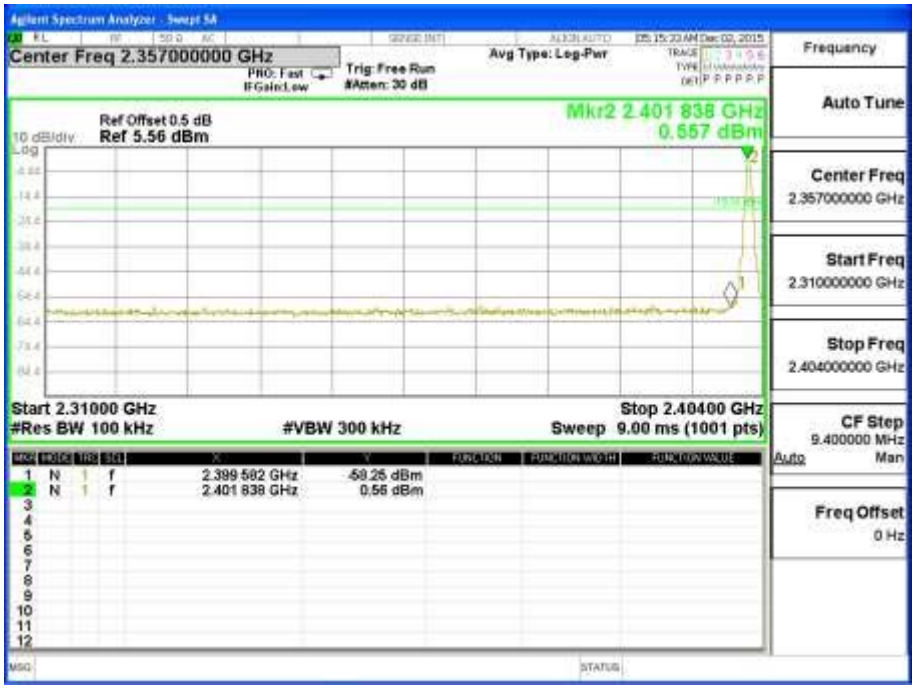


CH78

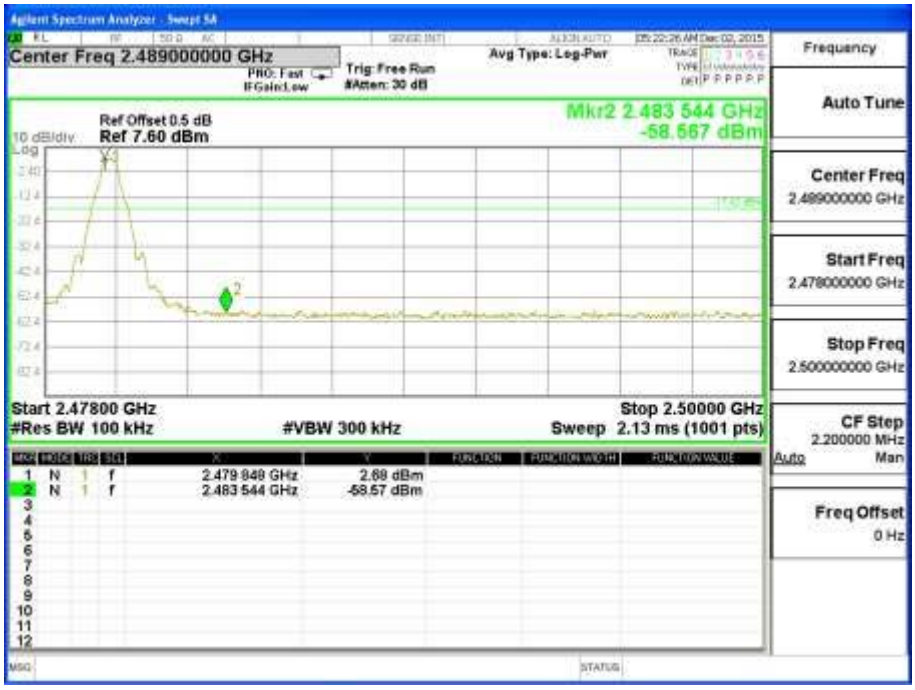

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Frequency
Auto Tune
Ref Offset 0.5 dB
10 dB/div
Ref 7.56 dBm
Mkr1 2.480 GHz
2.555 dBm
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.39 s (8001 pts)
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz
1 N 1 f 2.480 GHz 2.555 dBm
2 N 1 f 24.675 GHz -48.534 dBm

For Band Edge:

CH0

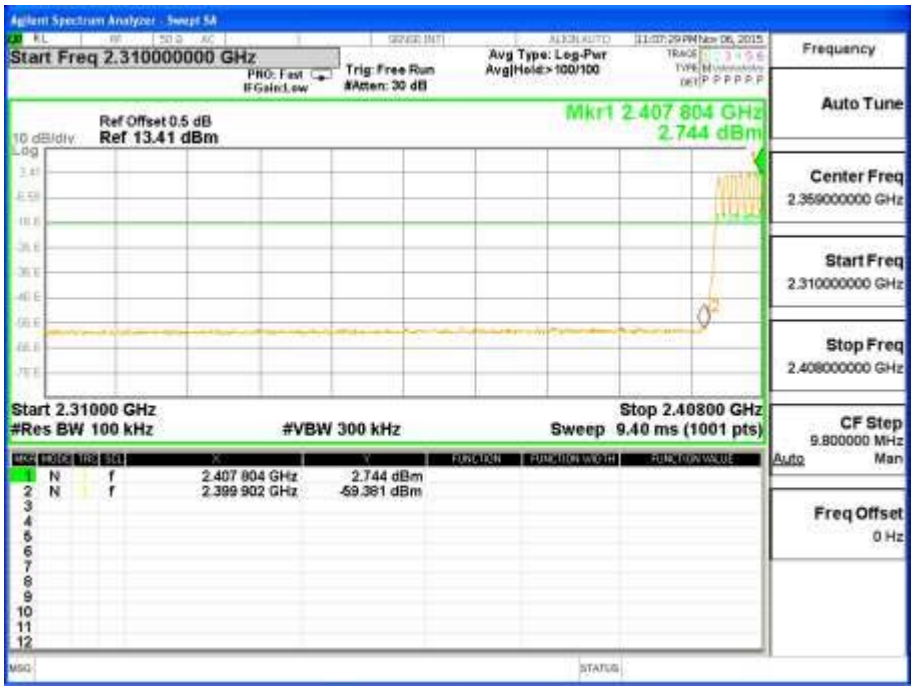


CH78



For hopping Band edge

CH0



CH78

2Mbps:

CH0

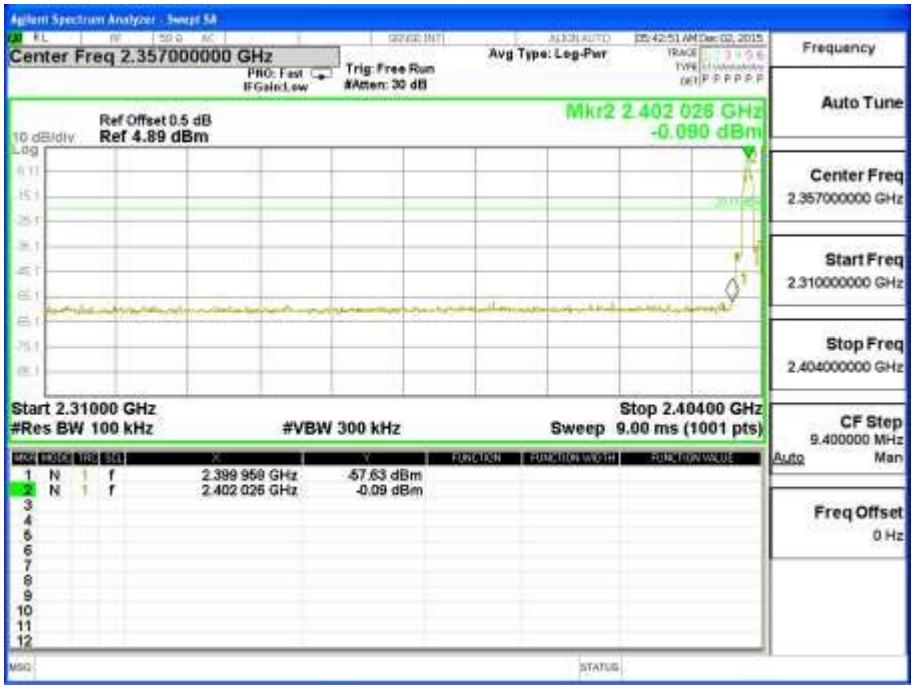
Ch39

Ch78


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Frequency
Auto Tune
Ref Offset 0.5 dB
10 dB/div
Ref 5.19 dBm
Mkr1 2.480 GHz
0.189 dBm
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.39 s (8001 pts)
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz
1 N 1 f 2.480 GHz 0.189 dBm
2 N 1 f 24.975 GHz -48.730 dBm

For Band Edge:

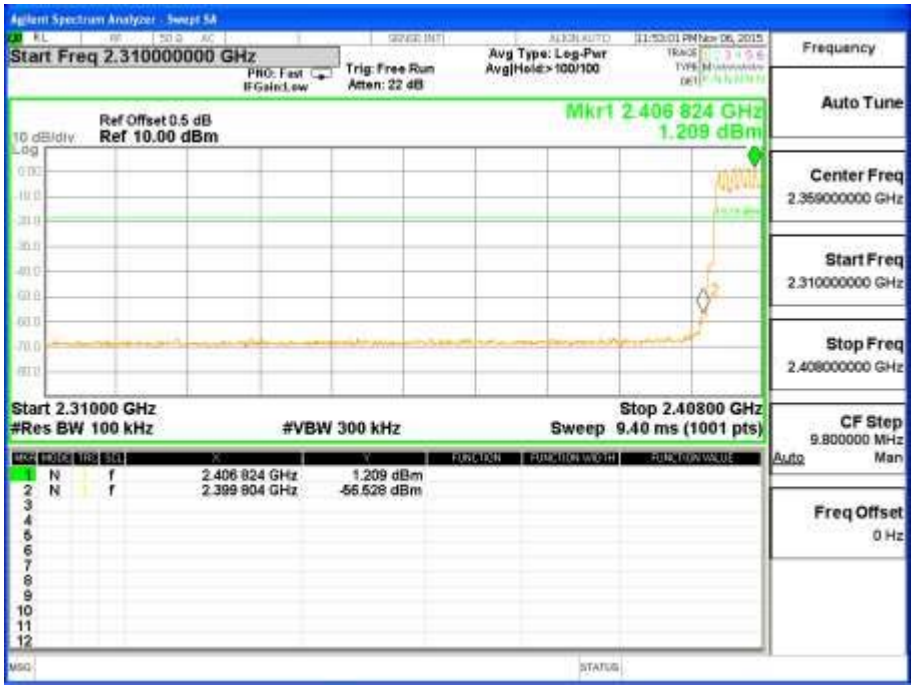
CH0



CH78

Hopping Mode:

CH0



CH78

3Mbps:

CH0

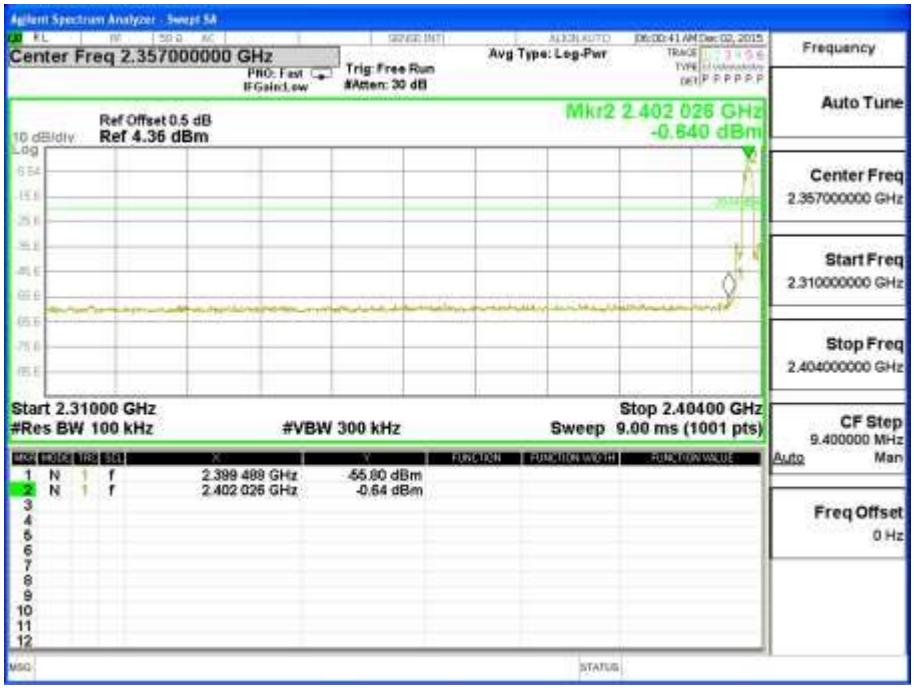
CH39

CH78


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Ref Offset 0.5 dB
10 dB/div
Ref 5.18 dBm
Log
Mkr1 2.480 GHz
0.177 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.39 s (8001 pts)
1 N 1 f 2.480 GHz 0.177 dBm
2 N 1 f 24.529 GHz -48.954 dBm
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz

For Band Edge

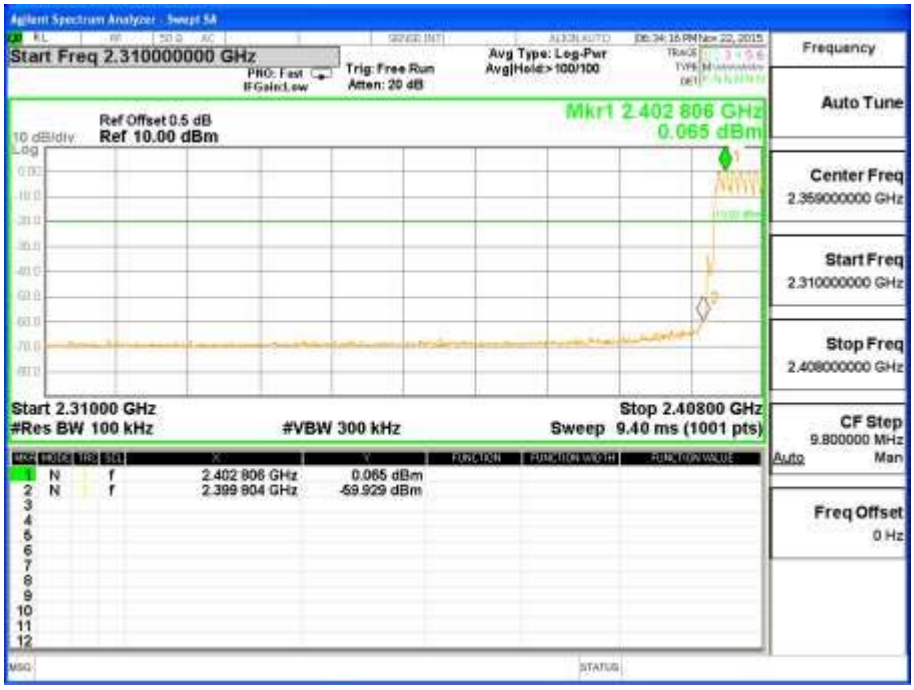
CH0



CH78

Hopping Mode

CH0



CH78