FCC TEST REPORT

(Part 15, Subpart C)

Applicant:	TYCO SAFETY PRODUCTS / KANTECH
Address:	9995L de Chateauneuf Ave, Brossard, J4Z 3V7, Canada

Manufacturer or Supplier:	TYCO SAFETY PRODUCTS / KANTECH
Address:	9995L de Chateauneuf Ave, Brossard, J4Z 3V7, Canada
Product:	KT-4 Ethernet Ready Four Door Controller
Brand Name:	KANTECH
Model Name:	KT-4
FCC ID:	V85KT4
Date of tests:	Nov. 25, 2022 ~ Feb. 22, 2023

The tests have been carried out according to the requirements of the following standard:

☒ **FCC Part 15, Subpart C, Section 15.247**

☒ **ANSI C63.10-2013**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Simon Wang	Approved by Luke Lu
Engineer / Mobile Department	Manager / Mobile Department
Simon Wang	Luke Lu
Date: Feb. 22, 2023	Date: Feb. 22, 2023

TABLE OF CONTENTS

RELEASE CONTROL RECORD 5
1 SUMMARY OF TEST RESULTS 6
1.1 MEASUREMENT UNCERTAINTY 7
2 GENERAL INFORMATION 8
2.1 GENERAL DESCRIPTION OF EUT 8
2.2 DESCRIPTION OF TEST MODES 9
2.2.1 CONFIGURATION OF SYSTEM UNDER TEST 10
2.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL 10
2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS 12
2.4 DESCRIPTION OF SUPPORT UNITS 12
3 TEST TYPES AND RESULTS 13
3.1 CONDUCTED EMISSION MEASUREMENT 13
3.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT 13
3.1.2 TEST INSTRUMENTS 13
3.1.3 TEST PROCEDURES 13
3.1.4 DEVIATION FROM TEST STANDARD 14
3.1.5 TEST SETUP 14
3.1.6 EUT OPERATING CONDITIONS 14
3.1.7 TEST RESULTS 15
3.2 RADIATED EMISSION AND BANDEDGE MEASUREMENT 17
3.2.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT 17
3.2.2 TEST INSTRUMENTS 18
3.2.3 TEST PROCEDURES 19
3.2.4 DEVIATION FROM TEST STANDARD 19
3.2.5 TEST SETUP 20
3.2.6 EUT OPERATING CONDITIONS 21
3.2.7 TEST RESULTS 22
3.3 NUMBER OF HOPPING FREQUENCY USED 31
3.3.1 LIMIT OF HOPPING FREQUENCY USED 31
3.3.2 TEST SETUP 31
3.3.3 TEST INSTRUMENTS 31
3.3.4 TEST PROCEDURES 32
3.3.5 DEVIATION FROM TEST STANDARD 32
3.3.6 TEST RESULTS 32
3.4 DWELL TIME ON EACH CHANNEL 33

3.4.1 LIMIT OF DWELL TIME USED 33
3.4.2 TEST SETUP 33
3.4.3 TEST INSTRUMENTS 33
3.4.4 TEST PROCEDURES 33
3.4.5 DEVIATION FROM TEST STANDARD 34
3.4.6 TEST RESULTS 34
3.5 CHANNEL BANDWIDTH 35
3.5.1 LIMITS OF CHANNEL BANDWIDTH 35
3.5.2 TEST SETUP 35
3.5.3 TEST INSTRUMENTS 35
3.5.4 TEST PROCEDURE 35
3.5.5 DEVIATION FROM TEST STANDARD 35
3.5.6 EUT OPERATING CONDITION 36
3.5.7 TEST RESULTS 36
3.6 HOPPING CHANNEL SEPARATION 37
3.6.1 LIMIT OF HOPPING CHANNEL SEPARATION 37
3.6.2 TEST SETUP 37
3.6.3 TEST INSTRUMENTS 37
3.6.4 TEST PROCEDURES 37
3.6.5 DEVIATION FROM TEST STANDARD 37
3.6.6 TEST RESULTS 38
3.7 MAXIMUM OUTPUT POWER 38
3.7.1 LIMITS OF MAXIMUM OUTPUT POWER MEASUREMENT 38
3.7.2 TEST SETUP 38
3.7.3 TEST INSTRUMENTS 38
3.7.4 TEST PROCEDURES 38
3.7.5 DEVIATION FROM TEST STANDARD 39
3.7.6 EUT OPERATING CONDITION 39
3.7.7 TEST RESULTS 40
3.7.7.1 MAXIMUM PEAK OUTPUT POWER 40
3.7.7.2 AVERAGE OUTPUT POWER (FOR REFERENCE) 41
3.8 OUT OF BAND MEASUREMENT 42
3.8.1 LIMITS OF OUT OF BAND MEASUREMENT 42
3.8.2 TEST INSTRUMENTS 42
3.8.3 TEST PROCEDURE 42
3.8.4 DEVIATION FROM TEST STANDARD 42

3.8.5 EUT OPERATING CONDITION 42
3.8.6 TEST RESULTS 42
4 PHOTOGRAPHS OF THE TEST CONFIGURATION 43
5 MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB 44
6 APPENDIX 45

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
W7L-P22110033RF01	Original release	Feb. 22, 2023

1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C		
STANDARD	**TEST TYPE AND LIMIT**	**RESULT**
15.207	AC Power Conducted Emission	Compliance
15.247(a)(1)(iii)	Number of Hopping Frequency Used	Compliance
15.247(a)(1)(iii)	Dwell Time on Each Channel	Compliance
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	Compliance
15.247(b)	Maximum Peak Output Power	Compliance
15.247(d)& 15.209	Transmitter Radiated Emissions	Compliance
15.247(d)	Out of band Measurement	Compliance
15.203	Antenna Requirement	Compliance

NOTE:

1. If the Frequency Hopping System operating in 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.
2. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Test Lab Information Reference:

BV 7Layers Communications Technology (Shenzhen) Co., Ltd

Lab Address:

No.B102, Dazu Chuangxin Mansion, North of Beihuan Avenue, North Area, Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, China

Accredited Test Lab Cert 3939.01

1.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	UNCERTAINTY
AC Power Conducted emissions	±2.70dB
Radiated emissions (9KHz~30MHz)	±2.68dB
Radiated emissions (30MHz~1GHz)	±4.98dB
Radiated emissions (1GHz ~6GHz)	±4.70dB
Radiated emissions (6GHz ~18GHz)	±4.60dB
Radiated emissions (18GHz ~40GHz)	±4.12dB
Conducted emissions	±4.01dB
Occupied Channel Bandwidth	±43.58KHz
Conducted Output power	±2.06dB
Power Spectral Density	±0.85 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	KT-4 Ethernet Ready Four Door Controller
BRAND NAME	KANTECH
MODEL NAME	KT-4
NOMINAL VOLTAGE	16.0Vdc(Transformer) 12Vdc (Lead Acid) DC24V
MODULATION TECHNOLOGY	FHSS
MODULATION TYPE	GFSK, 8DPSK, π/4 DQPSK
OPERATING FREQUENCY	2402MHz~2480MHz
NUMBER OF CHANNEL	79
MAX. OUTPUT POWER	17.95mW (Max. Measured)
ANTENNA TYPE	Dipole Antenna with 2dBi gain
HW VERSION	UA763
SW VERSION	1.00.07
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	N/A

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

List of Accessory:

ACCESSORIES	BRAND	MODEL	SPECIFICATION
Battery	Power Kingdom	PS7-12	Capacity ：12Vdc, 7000mAh
Transformer	Hammond	BF2F	SECONDARY 16V 75VA

2.2 DESCRIPTION OF TEST MODES

79 channels are provided to this EUT:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

2.2.1 CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photograph of the test configuration for reference.

2.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports.
The worst case was found when positioned on X axis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE<1G	RE≥1G	PLC	APCM	
-	√	√	√	√	-

Where **RE<1G:** Radiated Emission below 1GHz **RE≥1G:** Radiated Emission above 1GHz
PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

RADIATED EMISSION TEST (BELOW 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	78	FHSS	GFSK	DH5

RADIATED EMISSION TEST (ABOVE 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	0, 39, 78	FHSS	GFSK	DH5
	0 to 78	0, 39, 78	FHSS	π/4 DQPSK	2DH5
	0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

POWER LINE CONDUCTED EMISSION TEST:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture) and packet type.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	78	FHSS	GFSK	DH5

ANTENNA PORT CONDUCTED MEASUREMENT:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 to 78	0, 39, 78	FHSS	GFSK	DH1/DH3/DH5
0 to 78	0, 39, 78	FHSS	π/4 DQPSK	2DH1/2DH3/2DH5
0 to 78	0, 39, 78	FHSS	8DPSK	3DH1/3DH3/3DH5

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE (SYSTEM)	TESTED BY
RE<1G	23deg. C, 56%RH	DC 16V By Transformer	Jace Hu
RE≥1G	23deg. C, 56%RH	DC 16V By Transformer	Jace Hu
PLC	25deg. C, 52%RH	DC 16V By Transformer	Carl Xie
APCM	25deg. C, 60%RH	DC 16V By Transformer	James Fu

2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C. Section 15.247
ANSI C63.10-2013

NOTE: 1. All test items have been performed and recorded as per the above standards.

2. The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (Certification). The test report has been issued separately.

2.4 DESCRIPTION OF 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.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Desktop	Lenovo	M73 SFF	PC04GRQV	N/A
2	Desktop	Lenovo	M73 SFF	PC06CS27	N/A
3	Laptop	Lenovo	Thinkpad L440	R90FTFKN	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	AC Line: Unshielded, Detachable 1.5m
2	AC Line: Unshielded, Detachable 1.5m
3	AC Line: Unshielded, Detachable 1.5m

3 TEST TYPES AND RESULTS

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

NOTE: 1.The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

3.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR3	101900	Feb. 15,22	Feb. 14,23
EMI Test Receiver	Rohde&Schwarz	ESR3	101900	Feb. 14,23	Feb. 13,24
EMC32 test software	Rohde&Schwarz	EMC32	NA	NA	NA
LISN network	Rohde&Schwarz	ENV216	101922	Mar. 04,22	Mar. 03,23

NOTE: 1. The test was performed in CE shielded room.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

3.1.3 TEST PROCEDURES

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The frequency range from 150kHz to 30MHz was searched. Emission levels

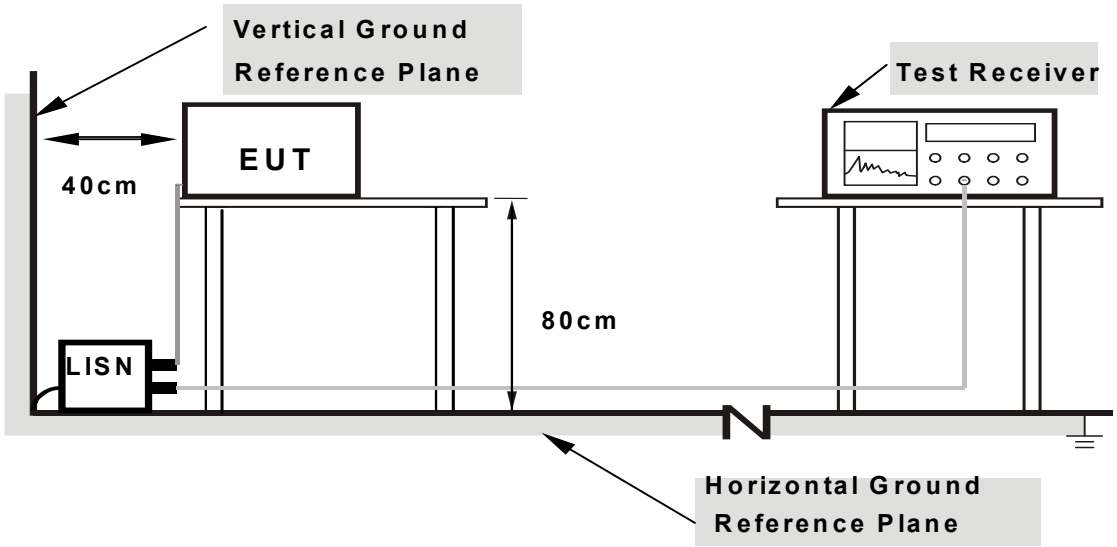
under (Limit - 20dB) was not recorded.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

3.1.4 DEVIATION FROM TEST STANDARD

No deviation.

3.1.5 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

For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.1.6 EUT OPERATING CONDITIONS

a. Turned on the power and connected of all equipment.
b. EUT was operated according to the type used was description in manufacturer's specifications or the User's Manual.

3.1.7 TEST RESULTS

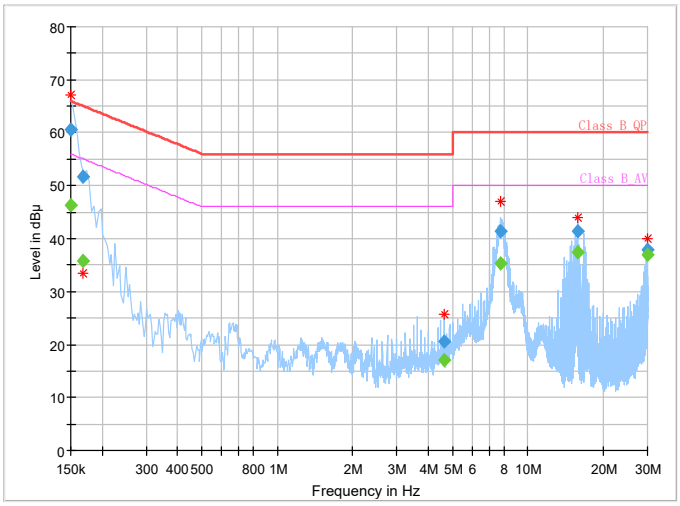
CONDUCTED WORST-CASE DATA:

Frequency Range	150KHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120Vac, 60Hz	**Environmental Conditions**	26deg. C, 51%RH
Tested By	Carl xie		

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.150000	---	46.38	56.00	9.62	L1	ON	9.7
0.150000	60.55	---	66.00	5.45	L1	ON	9.7
0.168000	---	35.80	55.06	19.26	L1	ON	9.7
0.168000	51.76	---	65.06	13.30	L1	ON	9.7
4.624000	---	17.04	46.00	28.96	L1	ON	9.7
4.624000	20.58	---	56.00	35.42	L1	ON	9.7
7.748000	---	35.26	50.00	14.74	L1	ON	9.7
7.748000	41.32	---	60.00	18.68	L1	ON	9.7
15.748000	---	37.39	50.00	12.61	L1	ON	9.8
15.748000	41.46	---	60.00	18.54	L1	ON	9.8
29.996000	---	36.99	50.00	13.01	L1	ON	9.8
29.996000	37.98	---	60.00	22.02	L1	ON	9.8

REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Limit value - Emission level
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.

Full Spectrum

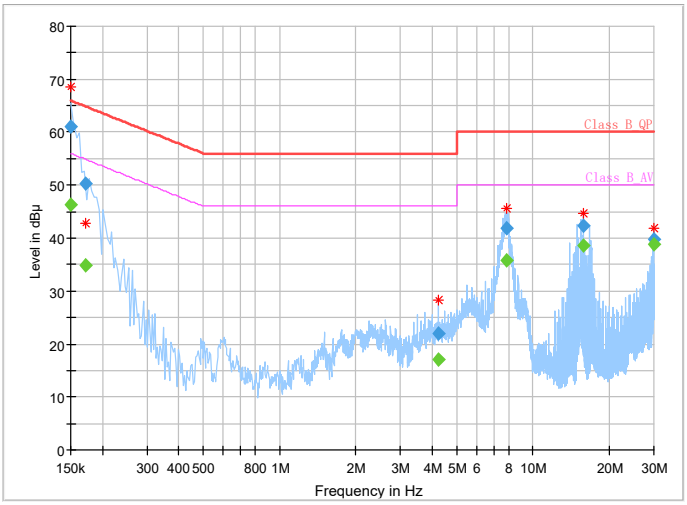


Frequency Range	150KHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120Vac, 60Hz	Environmental Conditions	26deg. C, 51%RH
Tested By	Carl xie		

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.150000	---	46.28	56.00	9.72	N	ON	9.7
0.150000	61.07	---	66.00	4.93	N	ON	9.7
0.172000	---	34.88	54.86	19.98	N	ON	9.7
0.172000	50.20	---	64.86	14.66	N	ON	9.7
4.252000	---	17.06	46.00	28.94	N	ON	9.8
4.252000	21.88	---	56.00	34.12	N	ON	9.8
7.876000	---	35.78	50.00	14.22	N	ON	9.8
7.876000	41.91	---	60.00	18.09	N	ON	9.8
15.752000	---	38.59	50.00	11.41	N	ON	9.8
15.752000	42.31	---	60.00	17.69	N	ON	9.8
29.996000	---	38.80	50.00	11.20	N	ON	9.9
29.996000	39.79	---	60.00	20.21	N	ON	9.9

REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Limit value - Emission level
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.

Full Spectrum



3.2 RADIATED EMISSION AND BANDEDGE MEASUREMENT

3.2.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a). Other emissions shall be at least 20dB below the highest level of the desired power.

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/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

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

3.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	May. 19,20	May. 18,23
Bilog Antenna	ETS-LINDGREN	3143B	00161965	Mar. 06,22	Mar. 05,23
Horn Antenna	ETS-LINDGREN	3117	00168692	Mar. 06,22	Mar. 05,23
Horn Antenna (18GHz-40GHz)	N/A	QWH-SL-18-40-K-SG/QMS-00361	15433	Aug. 27, 22	Aug. 26, 23
Test Software	E3	V 9.160323	N/A	N/A	N/A
Test Software	JS1120-3	3.2.06	N/A	N/A	N/A
10dB Attenuator	JFW/USA	50HF-010-SMA	1505	Jun. 02,22	Jun. 01,23
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Feb. 21,22	Feb. 20,23
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Feb. 20,23	Feb. 19,24
Signal Pre-Amplifier	EMSI	EMC 9135	980249	May.12,22	May.11,23
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	May.12,22	May.11,23
Signal Pre-Amplifier	EMSI	EMC 184045B	980259	Feb. 21,22	Feb.20,23
Signal Pre-Amplifier	EMSI	EMC 184045B	980259	Feb. 20,23	Feb. 19,24
DC Source	Kikusui/JP	PMX18-5A	0000001	Aug. 24,22	Aug. 23,23
Power Meter	Anritsu	ML2495A	1506002	Feb. 22,22	Feb. 21,23
Power Meter	Anritsu	ML2495A	1506002	Feb. 21,23	Feb. 20,24
Power Sensor	Anritsu	MA2411B	1339352	May. 14,22	May. 13,23
Loop Antenna	Schwarzbeck	FMZB 1519B	00173	Sep. 04,22	Sep. 03,23

NOTE: 1. The calibration interval of the above test instruments is 12 months or 36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

2. The test was performed in 3m Chamber.

3. The FCC Site Registration No. is 525120; The Designation No. is CN1171.

3.2.3 TEST PROCEDURES

a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

NOTE:

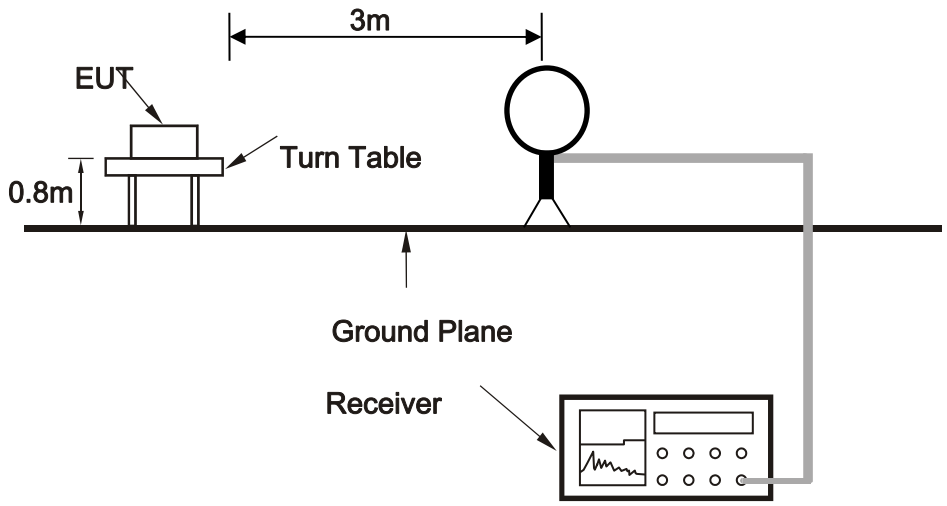
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz for Average detection (AV) at frequency above 1GHz.
4. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit.
5. All modes of operation were investigated and the worst-case emissions are reported.

3.2.4 DEVIATION FROM TEST STANDARD

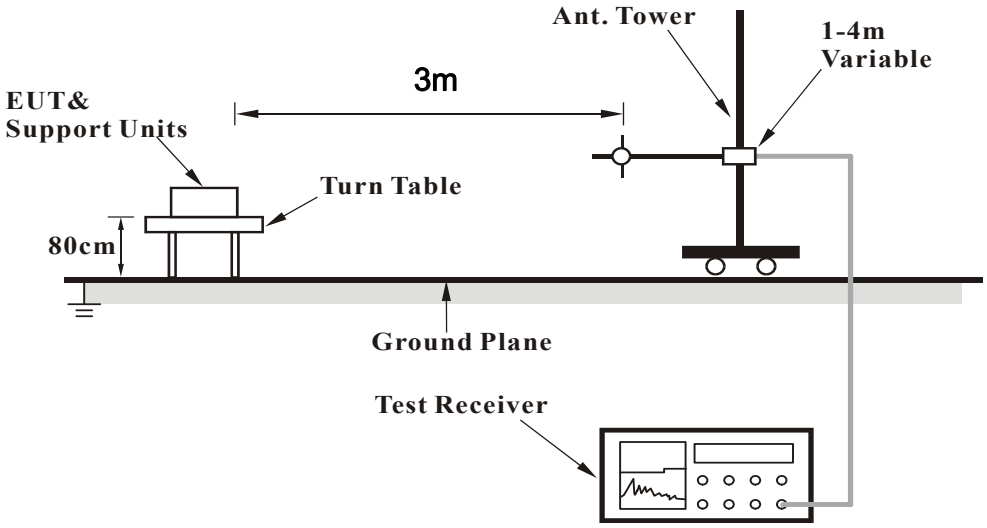
No deviation.

3.2.5 TEST SETUP

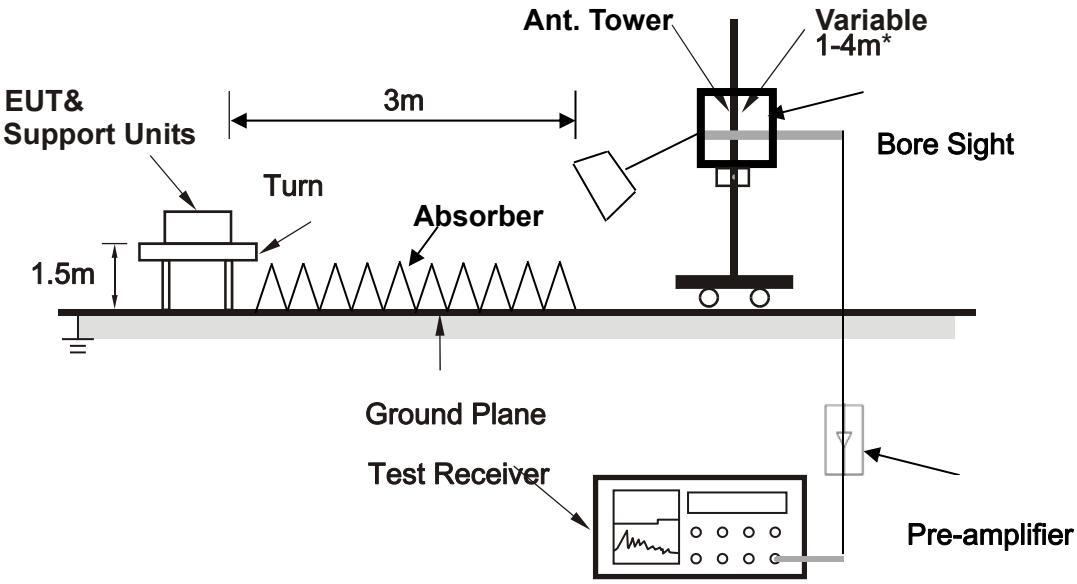
<Frequency Range 9KHz~30MHz >



< Frequency Range 30MHz~1GHz >



<Frequency Range above 1GHz>



Note: Above 1G is a directional antenna

Depends on the EUT height and the antenna 3dB beamwidth both, refer to section 7.3 of CISPR 16-2-3.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.2.6 EUT OPERATING CONDITIONS

a. Set the EUT under full load condition and placed them on a testing table.

b. Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.

c. The necessary accessories enable the EUT in full functions.

3.2.7 TEST RESULTS

Note: 1. For radiated emissions testing, the full testing range of different modes have been scanned, only the worst case harmonic data is reported in the sheet.

2. The 9K~30MHz amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required in the report.

3.Pre-scan 16.0Vdc(Transformer) and 12Vdc (Lead Acid),worse case is 16.0Vdc(Transformer)

BELOW 1GHz WORST-CASE DATA:

30 MHz – 1GHz data:

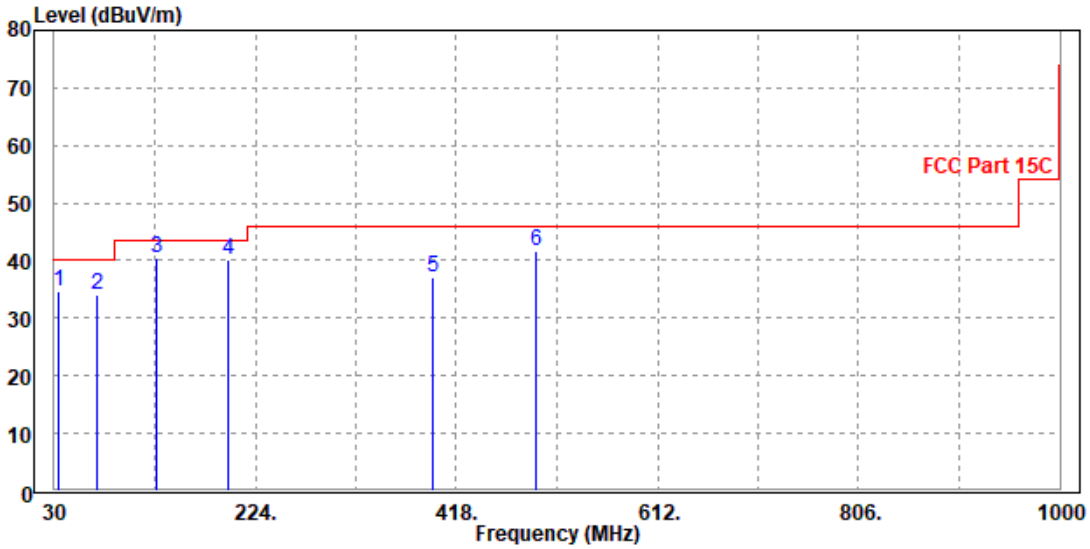
BT_GFSK

CHANNEL	Channel 78	**DETECTOR FUNCTION**	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
33.880	34.74	52.72	40.00	-5.26	19.07	0.33	37.38	131	168	QP
71.710	34.16	62.95	40.00	-5.84	7.70	0.47	36.96	100	99	QP
127.970	40.33	67.65	43.50	-3.17	8.76	0.60	36.68	168	297	QP
197.810	40.27	64.53	43.50	-3.23	11.31	0.73	36.30	119	153	QP
395.690	37.14	56.37	46.00	-8.86	16.11	1.07	36.41	122	237	QP
494.630	41.64	59.04	46.00	-4.36	18.00	1.21	36.61	173	340	QP

REMARKS:

1. Emission Level(dBuV/m) = Read Level(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

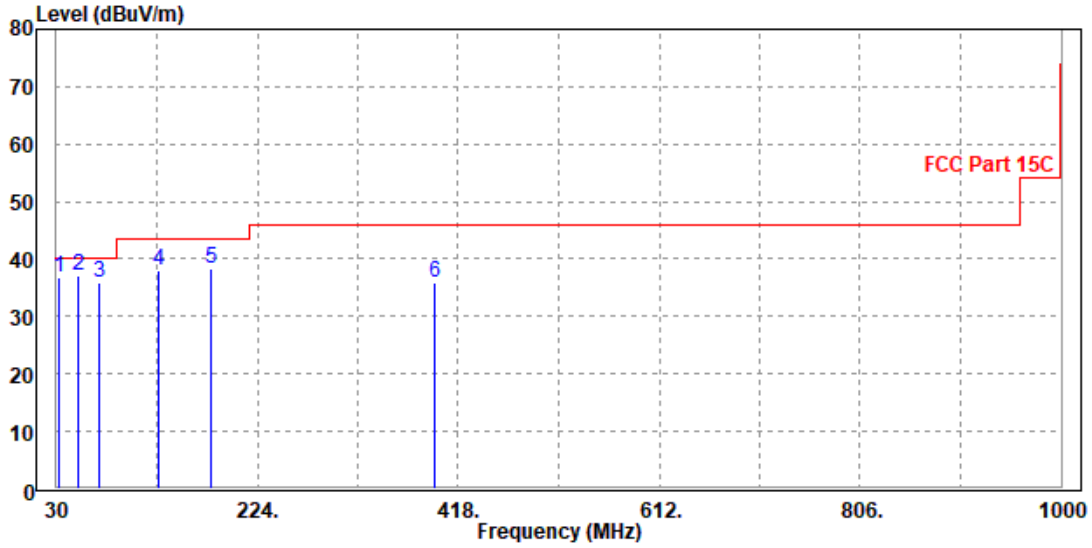

Level (dBuV/m)
80
70
60
50
40
30
20
10
0
30
224.
418.
612.
806.
1000
Frequency (MHz)
FCC Part 15C
1
2
3
4
5
6

CHANNEL	Channel 78	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
32.910	36.74	54.98	40.00	-3.26	18.84	0.32	37.40	155	116	QP
50.370	37.14	64.07	40.00	-2.86	9.66	0.41	37.00	145	197	QP
71.710	35.78	64.26	40.00	-4.22	8.01	0.47	36.96	162	87	QP
127.970	38.14	65.96	43.50	-5.36	8.26	0.60	36.68	104	166	QP
179.380	38.21	62.72	43.50	-5.29	11.19	0.70	36.40	138	282	QP
395.690	35.89	55.03	46.00	-10.11	16.20	1.07	36.41	188	242	QP

REMARKS:

1. Emission Level(dBuV/m) = Read Level(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value



ABOVE 1GHz WORST-CASE DATA:

Note: 1. For radiated emissions testing, the full testing range of different modes have been scanned, only the worst case harmonic data is reported in the sheet.

2. All other emissions were greater than 20dB below the limit is not recorded

3.Pre-scan 16.0Vdc(Transformer) and 12Vdc (Lead Acid),worse case is 16.0Vdc(Transformer)

BT_GFSK

CHANNEL	TX Channel 0	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390.000	51.26	59.30	74.00	-22.74	31.75	6.18	45.97	100	275	Peak
2390.000	43.76	51.80	54.00	-10.24	31.75	6.18	45.97	100	275	Average
2402.000	106.16	114.15	/	/	31.79	6.19	45.97	100	275	Peak
2402.000	104.82	112.81	/	/	31.79	6.19	45.97	100	275	Average
2483.500	51.97	59.54	74.00	-22.03	32.05	6.31	45.93	100	275	Peak
2483.500	43.40	50.97	54.00	-10.60	32.05	6.31	45.93	100	275	Average
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390.000	51.93	59.58	74.00	-22.07	32.14	6.18	45.97	100	260	Peak
2390.000	44.71	52.36	54.00	-9.29	32.14	6.18	45.97	100	260	Average
2402.000	112.61	120.23	/	/	32.16	6.19	45.97	100	260	Peak
2402.000	111.64	119.26	/	/	32.16	6.19	45.97	100	260	Average
2483.500	52.17	59.43	74.00	-21.83	32.36	6.31	45.93	100	260	Peak
2483.500	43.44	50.70	54.00	-10.56	32.36	6.31	45.93	100	260	Average

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
   Margin value = Emission level – Limit value.
2. 2402MHz: Fundamental frequency.

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390.000	50.97	59.01	74.00	-23.03	31.75	6.18	45.97	100	275	Peak
2390.000	43.80	51.84	54.00	-10.20	31.75	6.18	45.97	100	275	Average
2441.000	103.13	110.92	/	/	31.91	6.25	45.95	100	275	Peak
2441.000	102.05	109.84	/	/	31.91	6.25	45.95	100	275	Average
2483.500	51.74	59.31	74.00	-22.26	32.05	6.31	45.93	100	275	Peak
2483.500	43.91	51.48	54.00	-10.09	32.05	6.31	45.93	100	275	Average
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390.000	51.95	59.60	74.00	-22.05	32.14	6.18	45.97	100	260	Peak
2390.000	44.48	52.13	54.00	-9.52	32.14	6.18	45.97	100	260	Average
2441.000	112.73	120.17	/	/	32.26	6.25	45.95	100	260	Peak
2441.000	111.97	119.41	/	/	32.26	6.25	45.95	100	260	Average
2483.500	51.48	58.74	74.00	-22.52	32.36	6.31	45.93	100	260	Peak
2483.500	43.58	50.84	54.00	-10.42	32.36	6.31	45.93	100	260	Average

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
   Margin value = Emission level – Limit value.
2. 2441MHz: Fundamental frequency.

CHANNEL	TX Channel 78	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390.000	50.59	58.63	74.00	-23.41	31.75	6.18	45.97	100	200	Peak
2390.000	44.07	52.11	54.00	-9.93	31.75	6.18	45.97	100	200	Average
2480.000	101.75	109.34	/	/	32.04	6.30	45.93	100	200	Peak
2480.000	101.21	108.80	/	/	32.04	6.30	45.93	100	200	Average
2483.500	50.90	58.47	74.00	-23.10	32.05	6.31	45.93	100	200	Peak
2483.500	44.07	51.64	54.00	-9.93	32.05	6.31	45.93	100	200	Average
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390.000	51.39	59.04	74.00	-22.61	32.14	6.18	45.97	100	265	Peak
2390.000	44.40	52.05	54.00	-9.60	32.14	6.18	45.97	100	265	Average
2480.000	113.04	120.32	/	/	32.35	6.30	45.93	100	265	Peak
2480.000	111.98	119.26	/	/	32.35	6.30	45.93	100	265	Average
2483.500	54.59	61.85	74.00	-19.41	32.36	6.31	45.93	100	265	Peak
2483.500	48.09	55.35	54.00	-5.91	32.36	6.31	45.93	100	265	Average

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
   Margin value = Emission level – Limit value.
2. 2480MHz: Fundamental frequency.

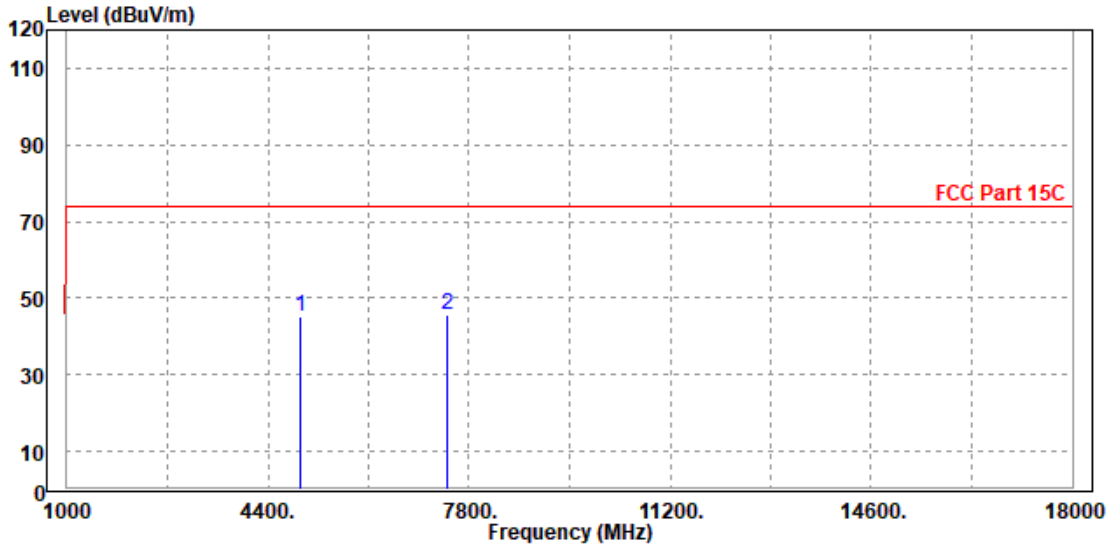
Worst case harmonic:

BT_GFSK

CHANNEL	TX Channel 78	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

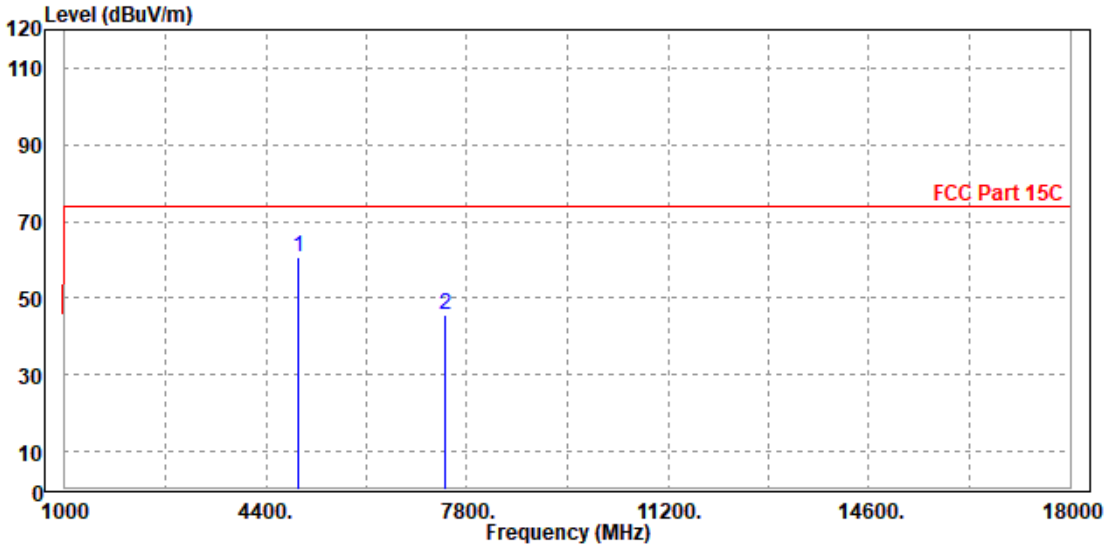
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1	4961.000	45.19	46.38	74.00	-28.81	-1.19	Peak	Horizontal
2 PP	7440.000	45.76	43.78	74.00	-28.24	1.98	Peak	Horizontal



ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1	PP 4961.000	60.69	61.68	74.00	-13.31	-0.99	Peak	Vertical
2	7440.000	45.55	43.54	74.00	-28.45	2.01	Peak	Vertical



REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
   Margin value = Emission level – Limit value.
2. 2480MHz: Fundamental frequency.
3. For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet.

For Harmonic data above, the average level was corrected by the duty cycle factor based on the peak level, according to the chapter 7.5 of C63.10-2013.

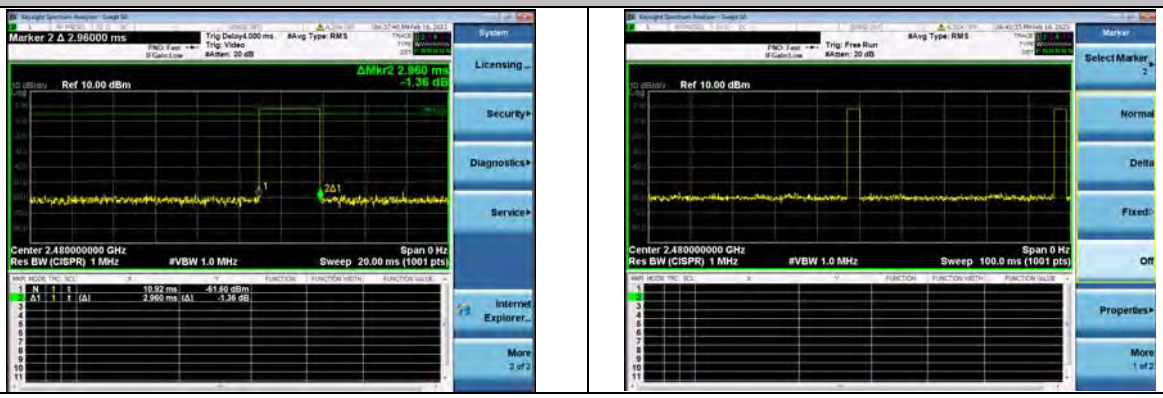
Average Level=Peak Level+ Duty cycle Factor

Duty cycle Factor:

Duty cycle Factor =20*log((Ton*Number of pulses)/100ms)

Ton(ms)	Number of pulses	Duty cycle	Factor
2.960	2	5.92%	-24.55

DH5_2480(Hopping Mode)



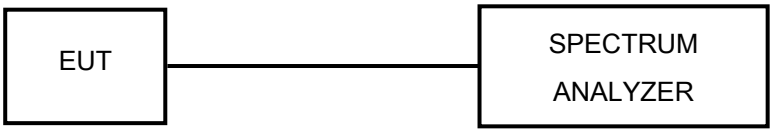
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
4961	20.64	54	33.36	34.34	9.97	45.5	100	360	Average
7440	21.21	54	32.79	35.81	10.86	44.69	100	360	Average
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
4961	36.14	54	17.86	34.54	9.97	45.5	100	260	Average
7440	21	54	33	35.84	10.86	44.69	100	260	Average

3.3 NUMBER OF HOPPING FREQUENCY USED

3.3.1 LIMIT OF HOPPING FREQUENCY USED

At least 15 channels frequencies, and should be equally spaced.

3.3.2 TEST SETUP



3.3.3 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Power Meter	ANRITSU	ML2495A	1506002	Feb. 22,22	Feb. 21,23
Power Meter	ANRITSU	ML2495A	1506002	Feb. 21,23	Feb. 20,24
EXA Signal Analyzer	KEYSIGHT	N9010A-526	MY54510322	Feb. 18,22	Feb. 17,23
EXA Signal Analyzer	KEYSIGHT	N9010A-526	MY54510322	Feb. 17,23	Feb. 16,24
EXA Signal Analyzer	KEYSIGHT	N9010A-544	MY54510355	May.15,22	May.14,23
Power Sensor	ANRITSU	MA2411B	1339352	May. 06,22	May. 05,23

NOTE:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in RF Oven room.

3.3.4 TEST PROCEDURES

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.

c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.

d. Set the SA on View mode and then plot the result on SA screen.

e. Repeat above procedures until all frequencies measured were completed.

3.3.5 DEVIATION FROM TEST STANDARD

No deviation.

3.3.6 TEST RESULTS

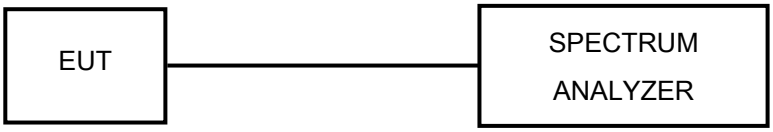
Please Refer to Appendix Of this test report.

3.4 DWELL TIME ON EACH CHANNEL

3.4.1 LIMIT OF DWELL TIME USED

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

3.4.2 TEST SETUP



3.4.3 TEST INSTRUMENTS

Refer to section 3.3.3 to get information of above instrument.

3.4.4 TEST PROCEDURES

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.

c. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.

d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.

e. Repeat above procedures until all different time-slot modes have been completed.

3.4.5 DEVIATION FROM TEST STANDARD

No deviation.

3.4.6 TEST RESULTS

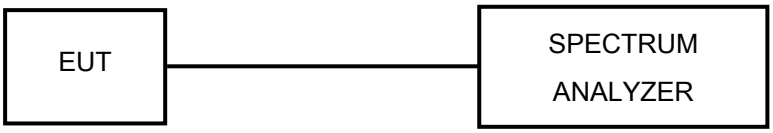
Please Refer to Appendix Of this test report

3.5 CHANNEL BANDWIDTH

3.5.1 LIMITS OF CHANNEL BANDWIDTH

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dBbandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

3.5.2 TEST SETUP



3.5.3 TEST INSTRUMENTS

Refer to section 3.3.3 to get information of above instrument.

3.5.4 TEST PROCEDURE

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.

d. Repeat above procedures until all frequencies measured were complete.

3.5.5 DEVIATION FROM TEST STANDARD

No deviation.

3.5.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

3.5.7 TEST RESULTS

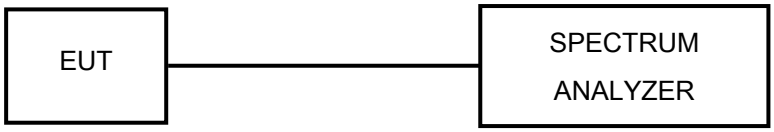
Please Refer to Appendix Of this test report.

3.6 HOPPING CHANNEL SEPARATION

3.6.1 LIMIT OF HOPPING CHANNEL SEPARATION

At least 25kHz or two-third of 20dB hopping channel bandwidth (whichever is greater).

3.6.2 TEST SETUP



3.6.3 TEST INSTRUMENTS

Refer to section 3.3.3 to get information of above instrument.

3.6.4 TEST PROCEDURES

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

3.6.5 DEVIATION FROM TEST STANDARD

No deviation.

3.6.6 TEST RESULTS

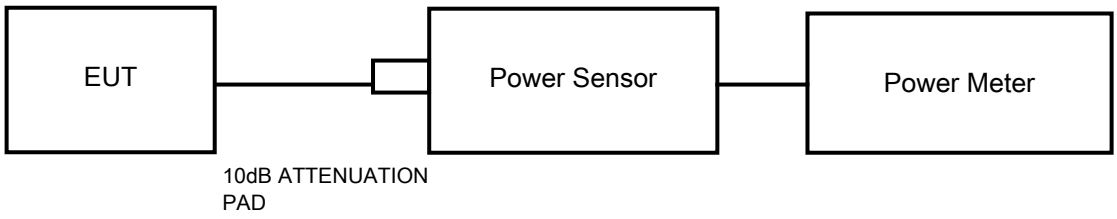
Please Refer to Appendix Of this test report.

3.7 MAXIMUM OUTPUT POWER

3.7.1 LIMITS OF MAXIMUM OUTPUT POWER MEASUREMENT

The Maximum Output Power Measurement is 125mW.

3.7.2 TEST SETUP



3.7.3 TEST INSTRUMENTS

Refer to section 3.3.3 to get information of above instrument.

3.7.4 TEST PROCEDURES

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

3.7.5 DEVIATION FROM TEST STANDARD

No deviation.

3.7.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

3.7.7 TEST RESULTS

3.7.7.1 MAXIMUM PEAK OUTPUT POWER

Please Refer to Appendix Of this test report.

3.7.7.2 Average Output Power (FOR REFERENCE)

The average power sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

Please Refer to Appendix Of this test report.

3.8 OUT OF BAND MEASUREMENT

3.8.1 LIMITS OF OUT OF BAND MEASUREMENT

Below –20dB of the highest emission level of operating band (in 100KHz RBW).

3.8.2 TEST INSTRUMENTS

Refer to section 3.3.3 to get information of above instrument.

3.8.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low loss cable. Spectrum Analyzer was set RBW to 100 kHz and VBW to 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. Detector = PEAK and Trace mode = Max Hold. The band edges was measured and recorded.

3.8.4 DEVIATION FROM TEST STANDARD

No deviation.

3.8.5 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

3.8.6 TEST RESULTS

The spectrum plots are attached on the following images. D1 line indicates the highest level. D2 line indicates the 20dB offset below D1. It shows compliance to the requirement.

Please Refer to Appendix Of this test report.

4 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).

5 MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

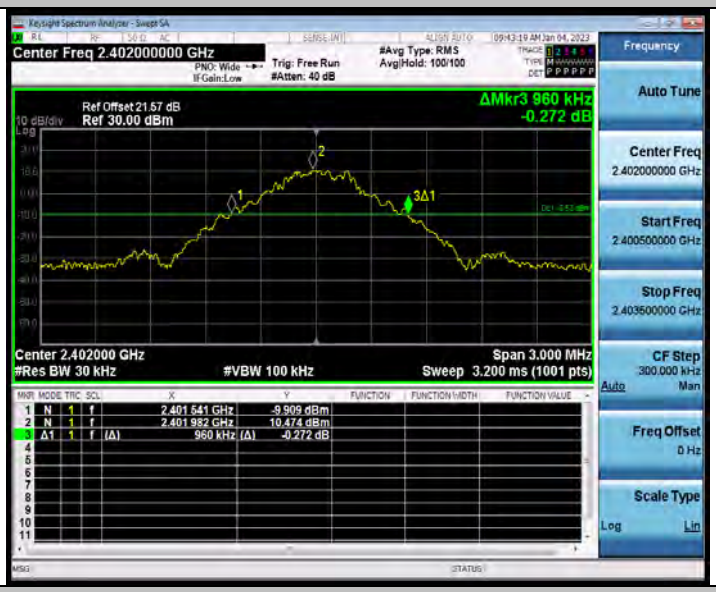
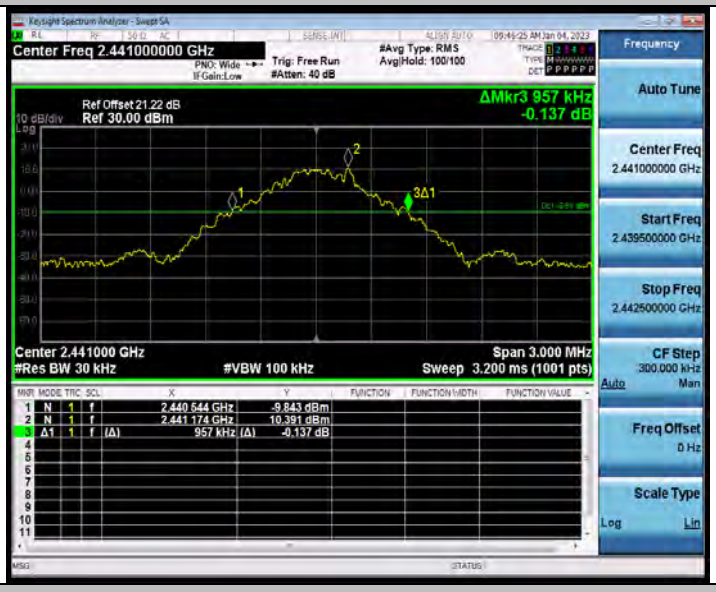
6 APPENDIX

20DB EMISSION BANDWIDTH

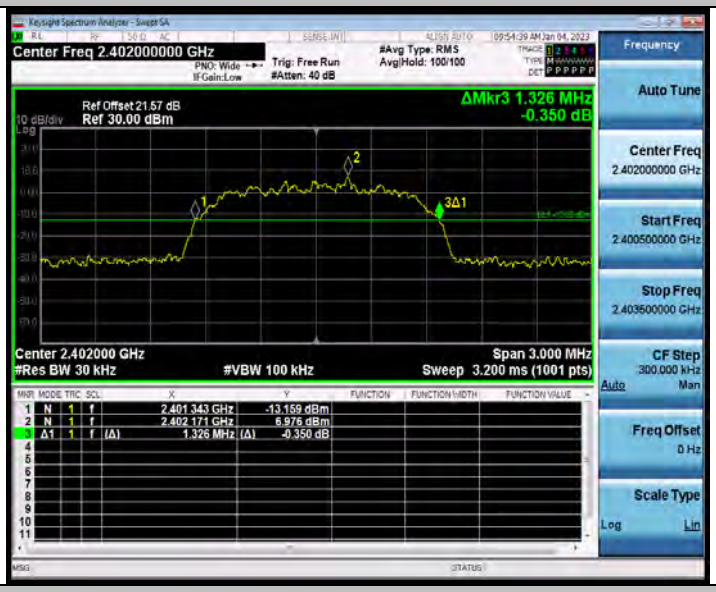
TEST RESULT

TestMode	Antenna	Frequency[MHz]	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.960	2401.541	2402.501	---	---
		2441	0.957	2440.544	2441.501	---	---
		2480	0.942	2479.544	2480.486	---	---
2DH5	Ant1	2402	1.326	2401.343	2402.669	---	---
		2441	1.329	2440.343	2441.672	---	---
		2480	1.323	2479.346	2480.669	---	---
3DH5	Ant1	2402	1.317	2401.355	2402.672	---	---
		2441	1.305	2440.358	2441.663	---	---
		2480	1.317	2479.349	2480.666	---	---

TEST GRAPHS

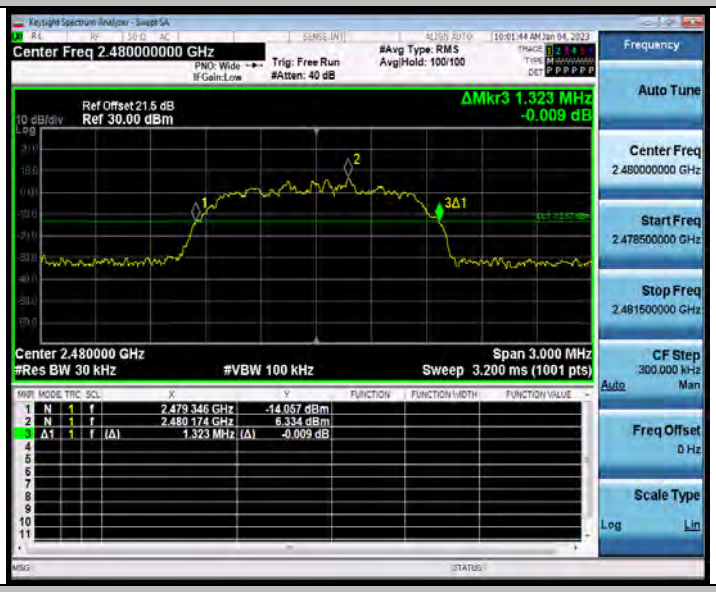
DH5_Ant1_2402

DH5_Ant1_2441

DH5_Ant1_2480

2DH5_Ant1_2402

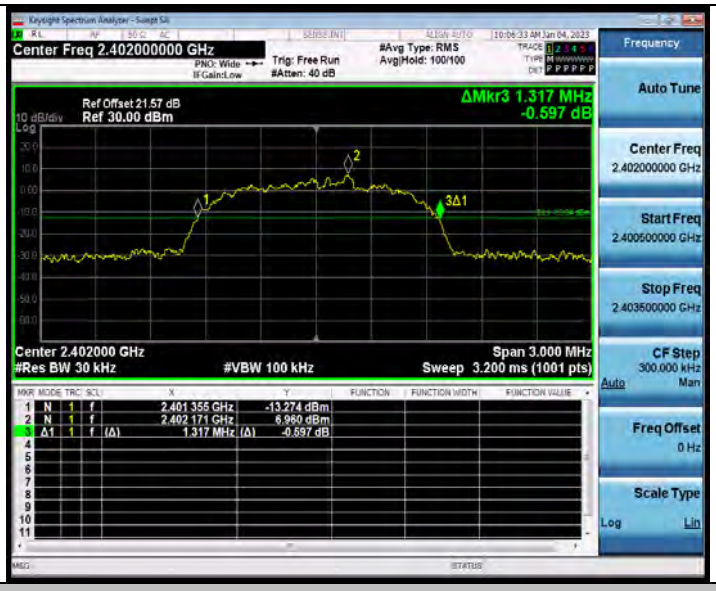


2DH5_Ant1_2441

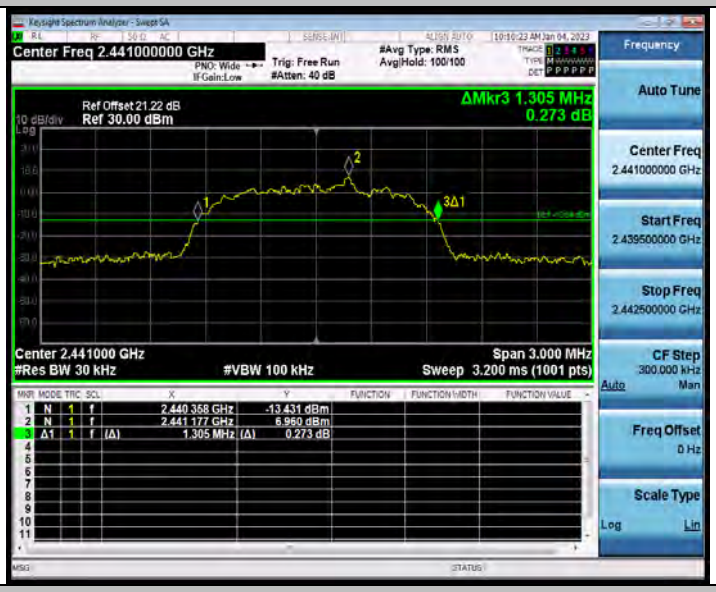
2DH5_Ant1_2480



3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480


Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 100/100
Ref Offset 21.5 dB
10 dB/div
Ref 30.00 dBm
ΔMkr3 1.317 MHz
0.367 dB
Center 2.480000 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3.000 MHz
Sweep 3.200 ms (1001 pts)
1 N 1 f 2.479 349 GHz -14.526 dBm
2 N 1 f 2.480 180 GHz 6.123 dBm
3 Δ1 1 f (Δ) 1.317 MHz (Δ) 0.367 dB
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.478500000 GHz
Stop Freq
2.481500000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

OCCUPIED CHANNEL BANDWIDTH

TEST RESULT

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.86520	2401.5731	2402.4383	---	---
		2441	0.88486	2440.5676	2441.4525	---	---
		2480	0.87969	2479.5714	2480.4511	---	---
2DH5	Ant1	2402	1.1920	2401.4105	2402.6025	---	---
		2441	1.1882	2440.4135	2441.6017	---	---
		2480	1.1844	2479.4134	2480.5978	---	---
3DH5	Ant1	2402	1.1935	2401.4081	2402.6016	---	---
		2441	1.1967	2440.4091	2441.6058	---	---
		2480	1.1838	2479.4186	2480.6024	---	---

TEST GRAPHS

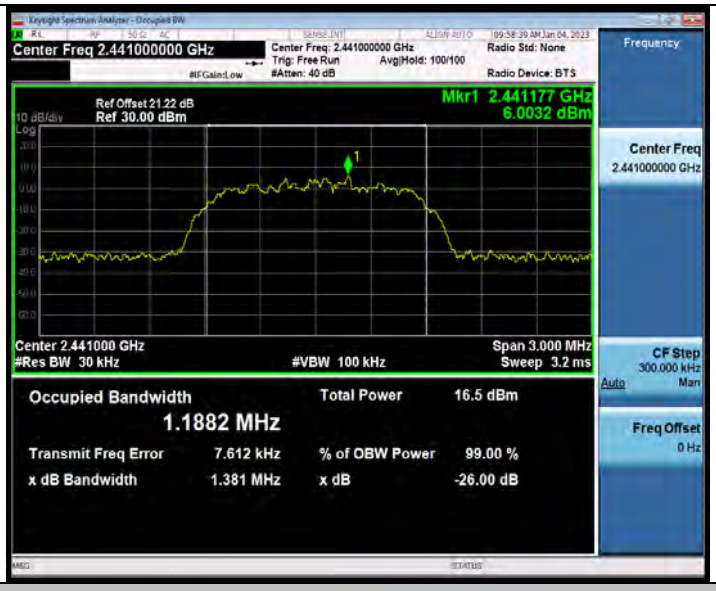
DH5_Ant1_2402

DH5_Ant1_2441

DH5_Ant1_2480

2DH5_Ant1_2402

2DH5_Ant1_2441



2DH5_Ant1_2480

3DH5_Ant1_2402

3DH5_Ant1_2441

3DH5_Ant1_2480


Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 40 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 21.5 dB
10 dB/div
Ref 30.00 dBm
Mkr1 2.480054 GHz
5.2824 dBm
Center Freq
2.480000000 GHz
Center 2.480000 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3.000 MHz
Sweep 3.2 ms
CF Step
300.000 kHz
Auto
Man
Occupied Bandwidth
1.1838 MHz
Total Power 16.4 dBm
Transmit Freq Error 10.467 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.391 MHz
x dB -26.00 dB
Freq Offset
0 Hz

MAXIMUM CONDUCTED OUTPUT POWER

TEST RESULT

TestMode	Frequency [MHz]	Average power [dBm]	Peak Power [dBm]	Peak Power [mw]	Conducted Limit [dBm]	EIRP [dBm]	EIRP [mw]	EIRP Limit [dBm]	Verdict	Power Setting
DH5	2402	12.61	12.54	17.95	≤20.98	14.54	28.44	≤36.00	PASS	Defult
	2441	12.55	12.36	17.22	≤20.98	14.36	27.29	≤36.00	PASS	Defult
	2480	12.23	12.04	16.00	≤20.98	14.04	25.35	≤36.00	PASS	Defult
2DH5	2402	9.44	11.61	14.49	≤20.98	13.61	22.96	≤36.00	PASS	Defult
	2441	9.26	11.47	14.03	≤20.98	13.47	22.23	≤36.00	PASS	Defult
	2480	8.87	11.13	12.97	≤20.98	13.13	20.56	≤36.00	PASS	Defult
3DH5	2402	9.46	11.87	15.38	≤20.98	13.87	24.38	≤36.00	PASS	Defult
	2441	9.29	11.72	14.86	≤20.98	13.72	23.55	≤36.00	PASS	Defult
	2480	8.93	11.39	13.77	≤20.98	13.39	21.83	≤36.00	PASS	Defult

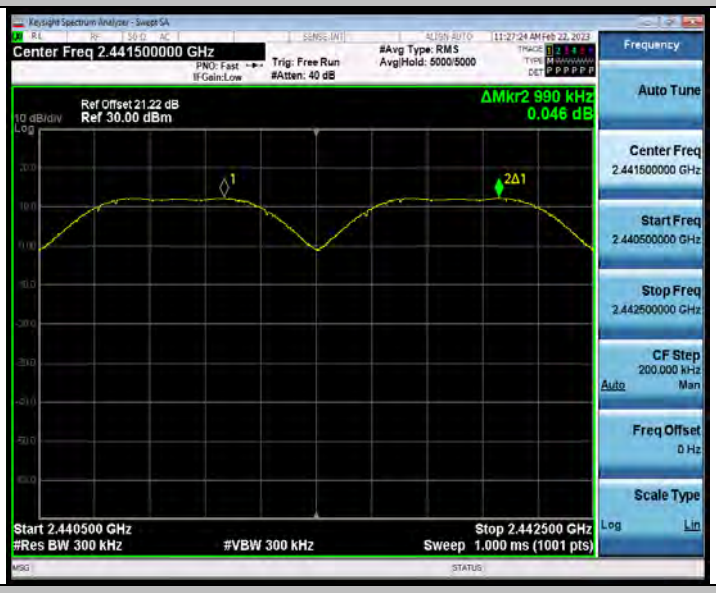
CARRIER FREQUENCY SEPARATION

TEST RESULT

TestMode	Antenna	Frequency[MHz]	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Hop	0.99	≥0.960	PASS
2DH5	Ant1	Hop	1.174	≥0.886	PASS
3DH5	Ant1	Hop	1.05	≥0.878	PASS

TEST GRAPHS

DH5_Ant1_Hop



2DH5_Ant1_Hop

3DH5_Ant1_Hop


Center Freq 2.441500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 5000/5000
Ref Offset 21.22 dB
10 dB/div
Ref 30.00 dBm
Log
ΔMkr2 1.050 MHz
0.075 dB
1
2Δ1
Start 2.440500 GHz
#Res BW 300 kHz
#VBW 300 kHz
Stop 2.442500 GHz
Sweep 1.000 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.441500000 GHz
Start Freq
2.440500000 GHz
Stop Freq
2.442500000 GHz
CF Step
200.000 kHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

TIME OF OCCUPANCY

TEST RESULT

TestMode	Antenna	Frequency[MHz]	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.385	320	0.123	≤0.4	PASS
DH3	Ant1	Hop	1.640	160	0.262	≤0.4	PASS
DH5	Ant1	Hop	2.888	106.67	0.308	≤0.4	PASS
2DH1	Ant1	Hop	0.386	320	0.124	≤0.4	PASS
2DH3	Ant1	Hop	1.639	160	0.262	≤0.4	PASS
2DH5	Ant1	Hop	2.885	106.67	0.308	≤0.4	PASS
3DH1	Ant1	Hop	0.385	320	0.123	≤0.4	PASS
3DH3	Ant1	Hop	1.637	160	0.262	≤0.4	PASS
3DH5	Ant1	Hop	2.887	106.67	0.308	≤0.4	PASS

NOTE:

TotalHops =[1600/(Send and receive Number*79)]*0.4*79;

Send and receive Number : DH1/2DH1/3DH1=2; DH3/2DH3/3DH3=4; DH5/2DH5/3DH5=6

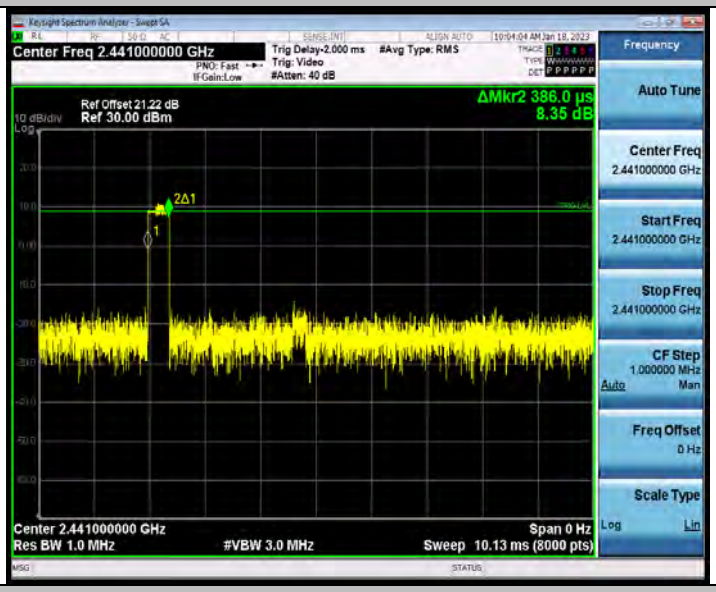
TEST GRAPHS

DH1_Ant1_Hop

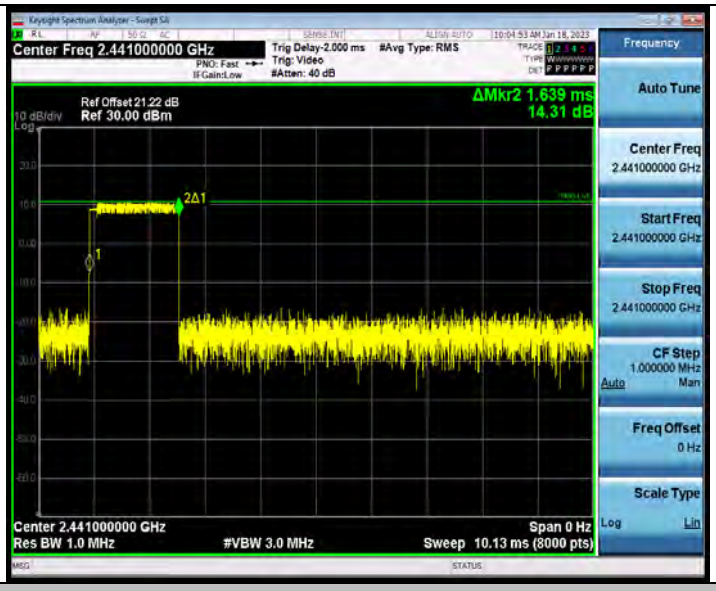
DH3_Ant1_Hop

DH5_Ant1_Hop

2DH1_Ant1_Hop



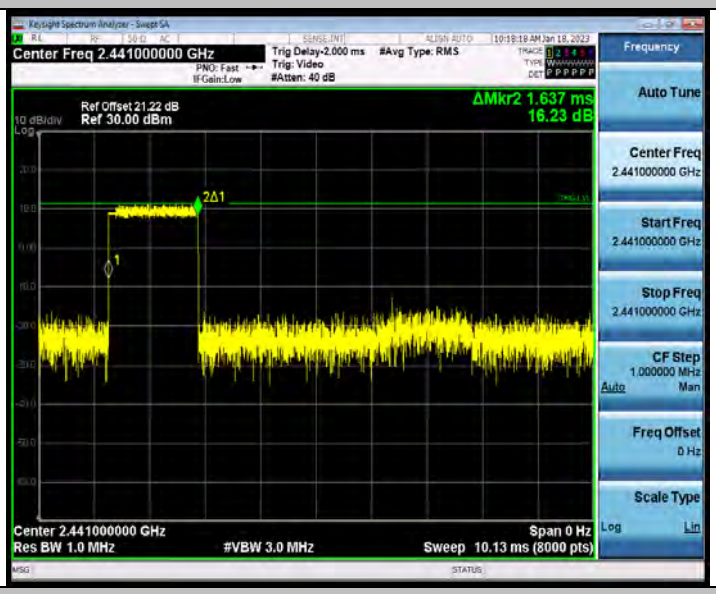
2DH3_Ant1_Hop



2DH5_Ant1_Hop

3DH1_Ant1_Hop

3DH3_Ant1_Hop



3DH5_Ant1_Hop


Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig Delay-2.000 ms
Trig: Video
#Avg Type: RMS
#Atten: 40 dB
Ref Offset 21.22 dB
10 dB/div
Ref 30.00 dBm
ΔMkr2 2.887 ms
6.54 dB
2Δ1
1
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 10.13 ms (8000 pts)
Frequency
Auto Tune
Center Freq
2.441000000 GHz
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

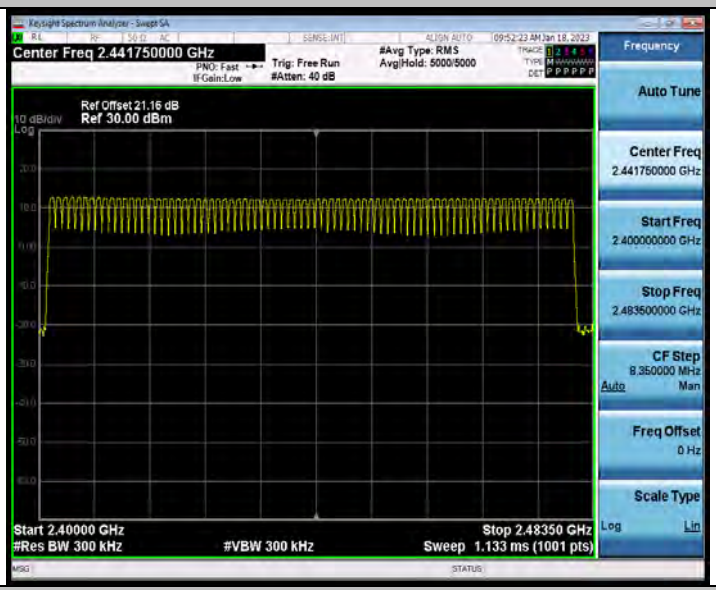
NUMBER OF HOPPING CHANNELS

TEST RESULT

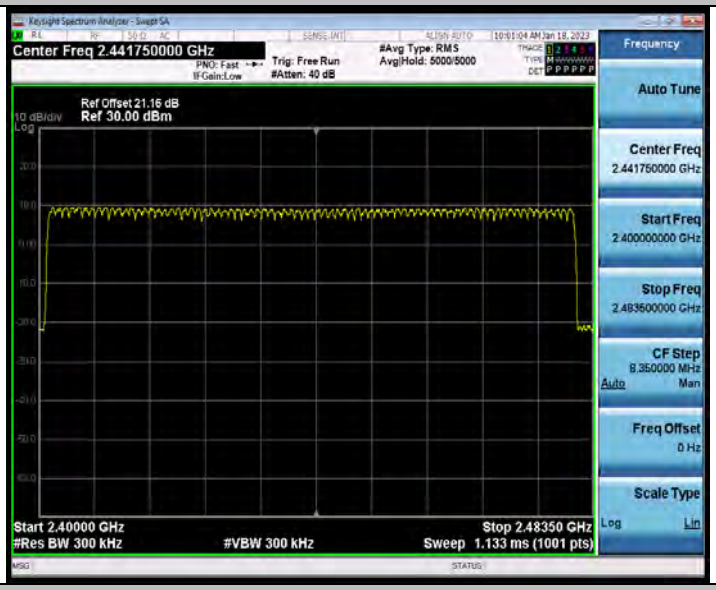
TestMode	Antenna	Frequency[MHz]	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Hop	79	≥15	PASS
2DH5	Ant1	Hop	79	≥15	PASS
3DH5	Ant1	Hop	79	≥15	PASS

TEST GRAPHS

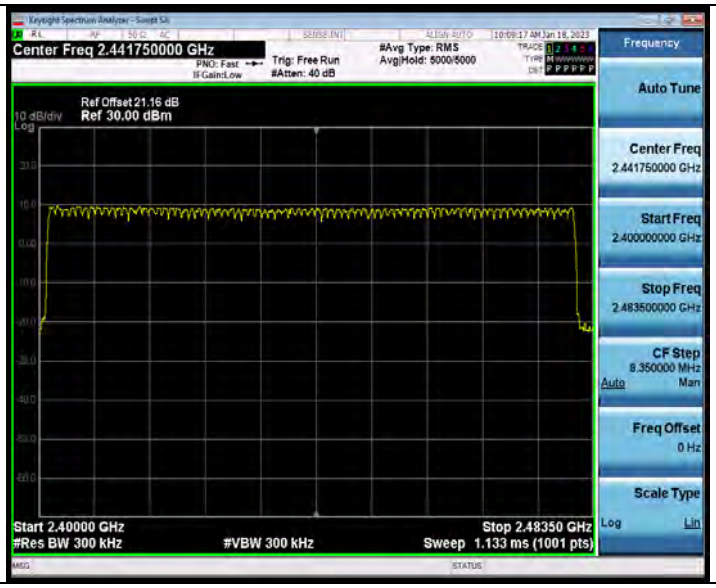
DH5_Ant1_Hop



2DH5_Ant1_Hop



3DH5_Ant1_Hop


Center Freq 2.441750000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 5000/5000
Ref Offset 21.16 dB
10 dB/div
Ref 30.00 dBm
Log
Start 2.40000 GHz
#Res BW 300 kHz
#VBW 300 kHz
Stop 2.48350 GHz
Sweep 1.133 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.441750000 GHz
Start Freq
2.400000000 GHz
Stop Freq
2.483500000 GHz
CF Step
8.350000 MHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

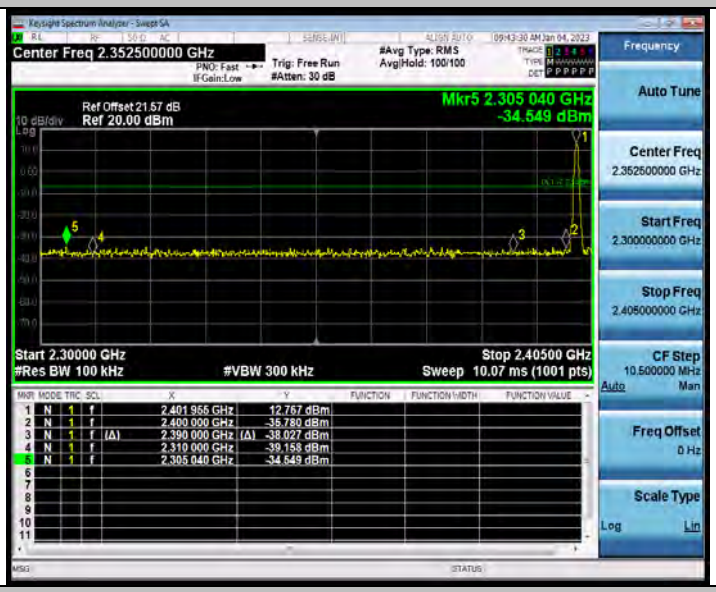
BAND EDGE MEASUREMENTS

TEST RESULT

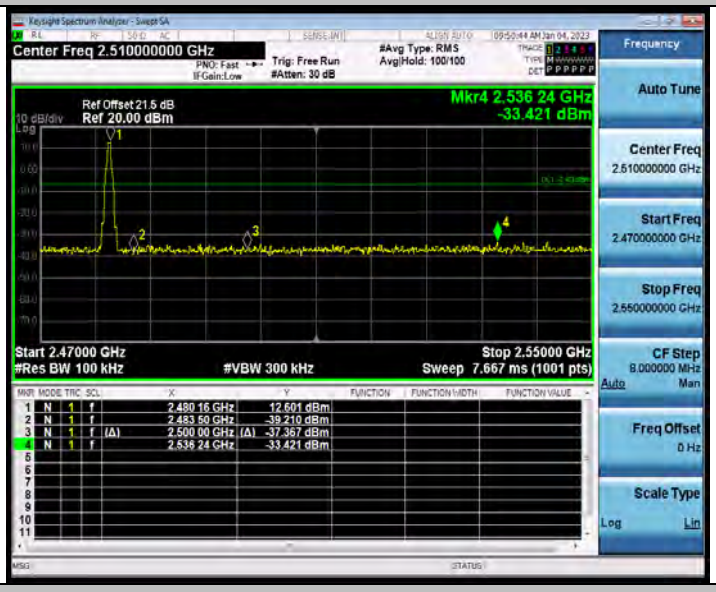
TestMode	Antenna	ChName	Frequency[MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	Low	2402	12.77	-34.55	≤-7.23	PASS
		High	2480	12.60	-33.42	≤-7.4	PASS
		Low	Hop_2402	10.14	-35.16	≤-9.86	PASS
		High	Hop_2480	12.14	-34.1	≤-7.86	PASS
2DH5	Ant1	Low	2402	9.02	-35.06	≤-10.98	PASS
		High	2480	9.45	-34.14	≤-10.55	PASS
		Low	Hop_2402	5.13	-35.58	≤-14.87	PASS
		High	Hop_2480	6.32	-34.14	≤-13.68	PASS
3DH5	Ant1	Low	2402	9.38	-34.26	≤-10.62	PASS
		High	2480	8.85	-34.37	≤-11.16	PASS
		Low	Hop_2402	7.49	-33.9	≤-12.51	PASS
		High	Hop_2480	6.55	-33.79	≤-13.46	PASS

TEST GRAPHS

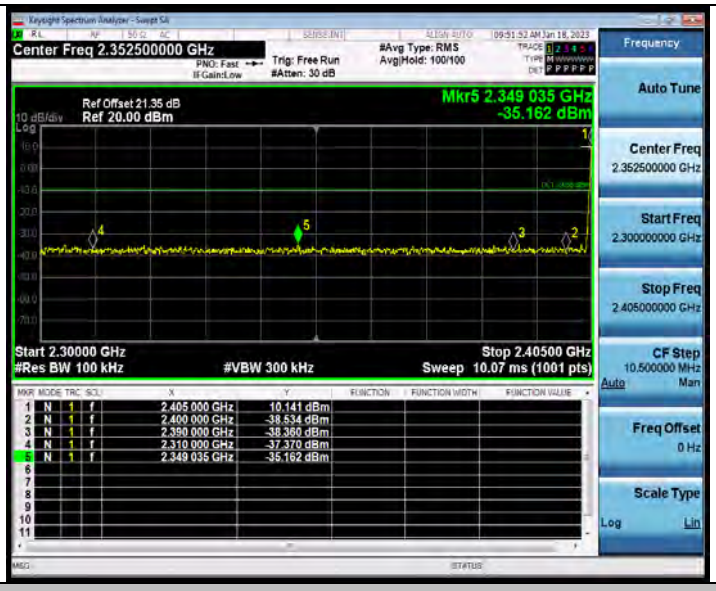
DH5_Ant1_Low_2402



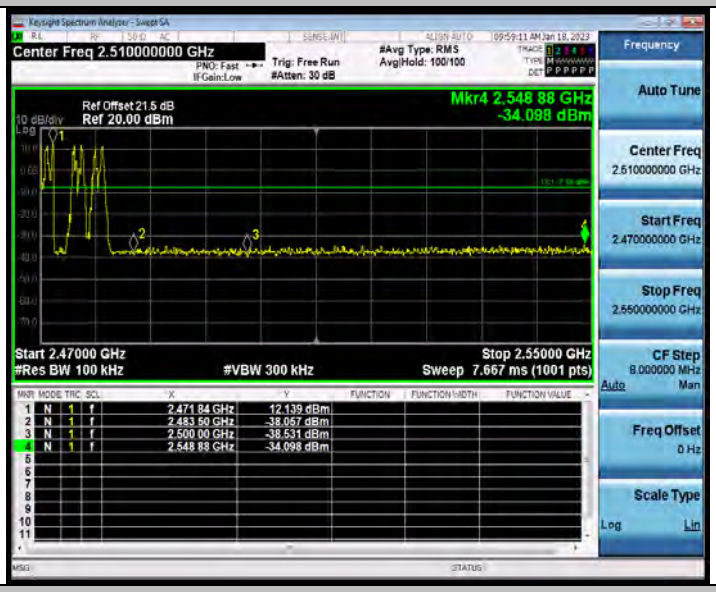
DH5_Ant1_High_2480



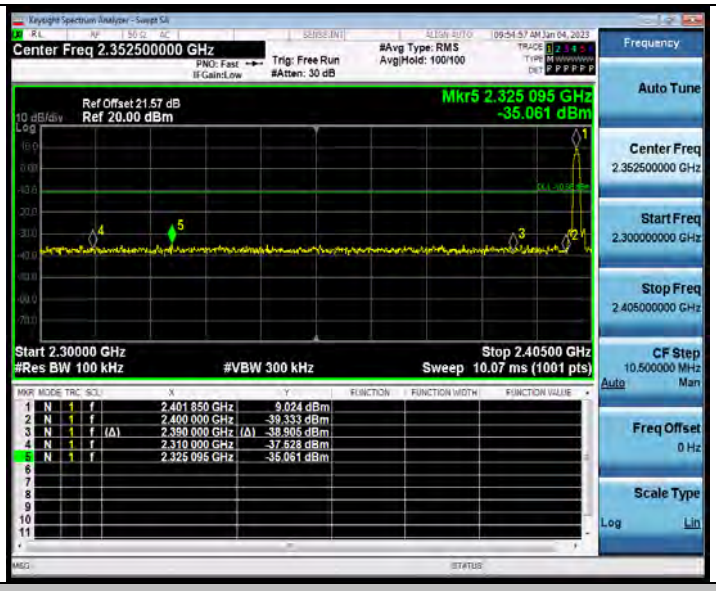
DH5_Ant1_Low_Hop_2402



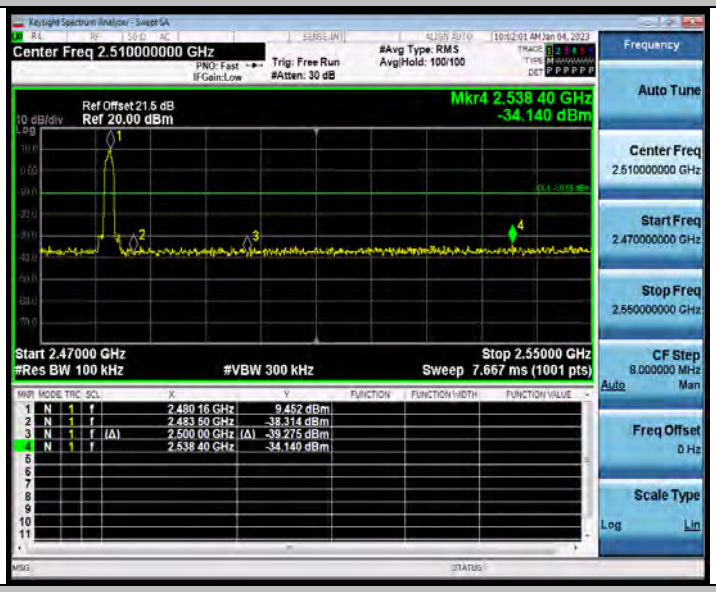
DH5_Ant1_High_Hop_2480



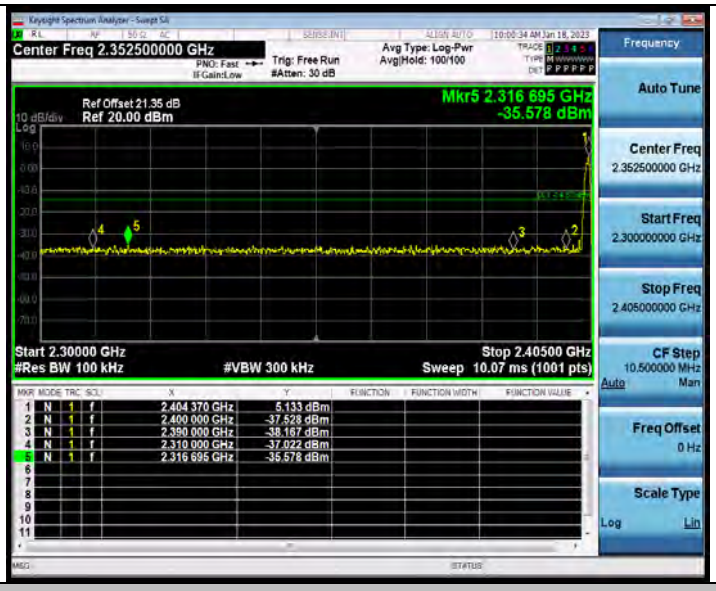
2DH5_Ant1_Low_2402



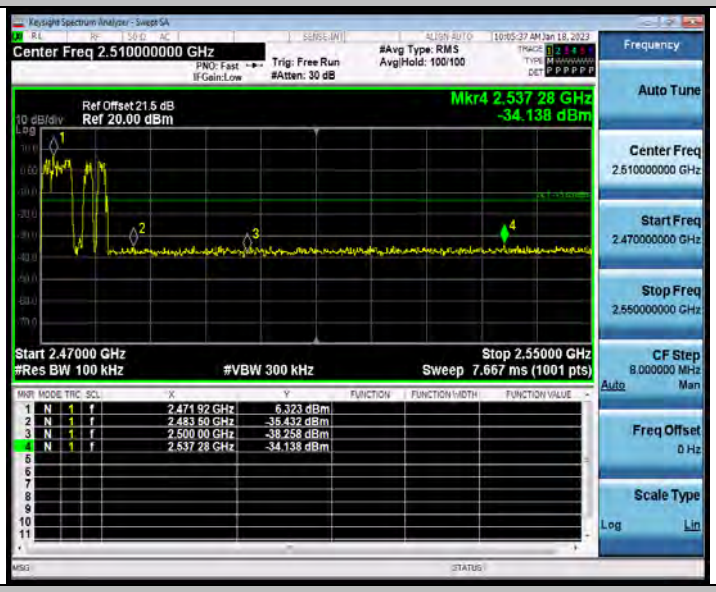
2DH5_Ant1_High_2480



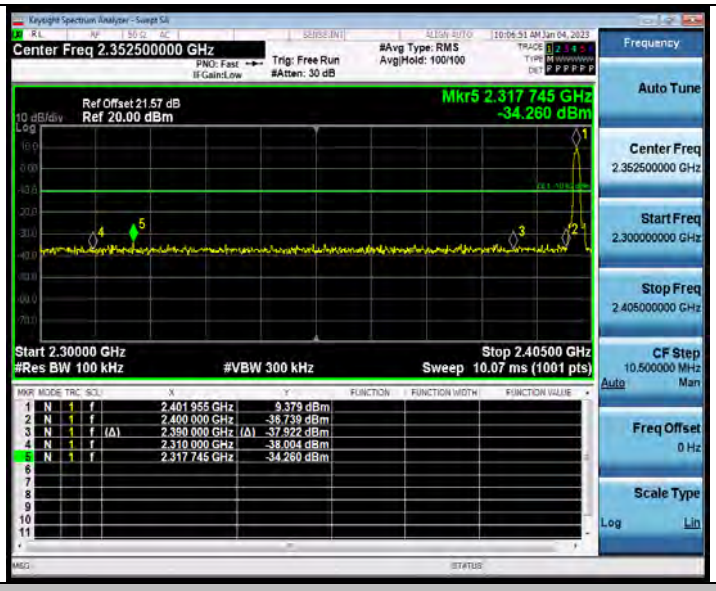
2DH5_Ant1_Low_Hop_2402



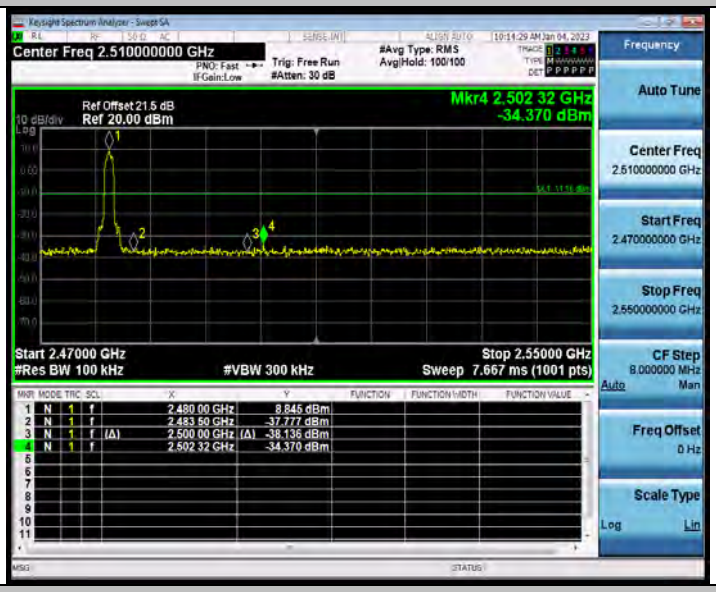
2DH5_Ant1_High_Hop_2480



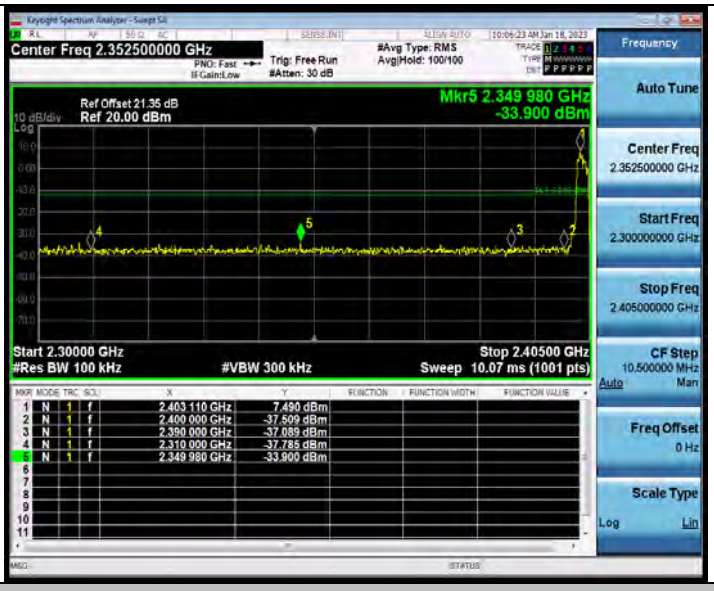
3DH5_Ant1_Low_2402



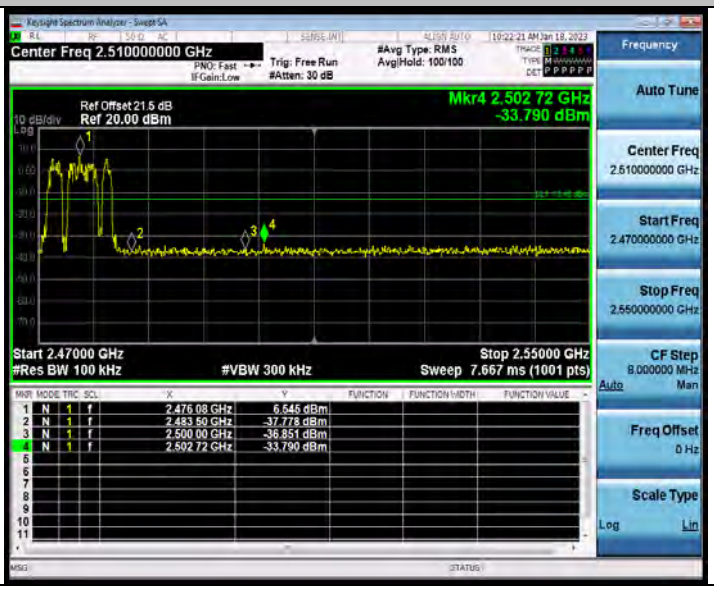
3DH5_Ant1_High_2480



3DH5_Ant1_Low_Hop_2402



3DH5_Ant1_High_Hop_2480



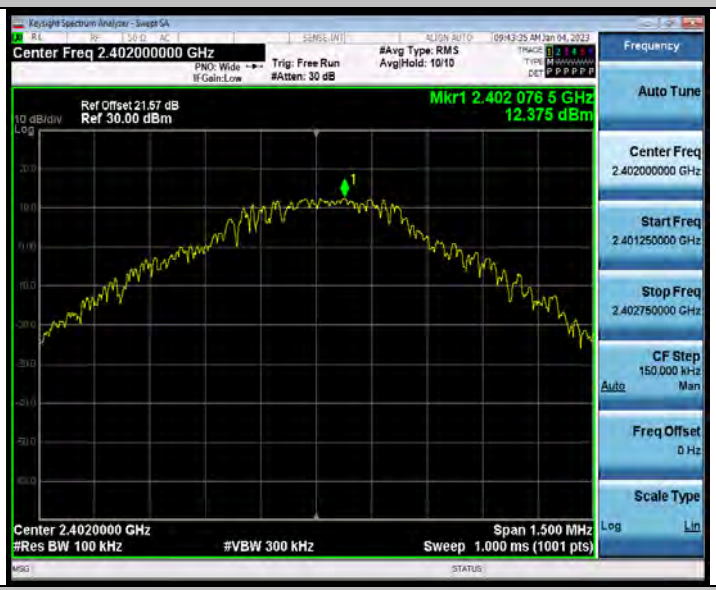
CONDUCTED SPURIOUS EMISSION

TEST RESULT

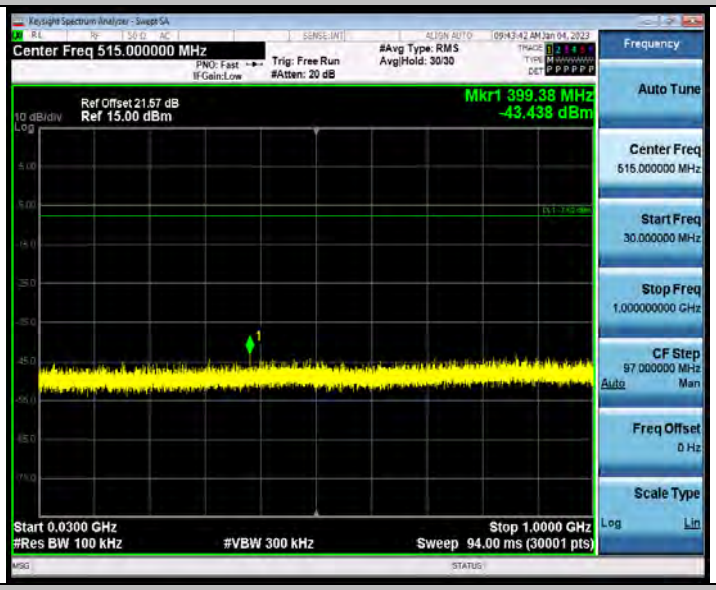
TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	Reference	12.38	12.38	---	PASS
			30~1000	12.38	-43.44	≤-7.62	PASS
			1000~26500	12.38	-24.37	≤-7.62	PASS
		2441	Reference	11.62	11.62	---	PASS
			30~1000	11.62	-43.46	≤-8.38	PASS
			1000~26500	11.62	-24.52	≤-8.38	PASS
		2480	Reference	12.09	12.09	---	PASS
			30~1000	12.09	-43.48	≤-7.91	PASS
			1000~26500	12.09	-24.78	≤-7.91	PASS
2DH5	Ant1	2402	Reference	7.85	7.85	---	PASS
			30~1000	7.85	-43.7	≤-12.15	PASS
			1000~26500	7.85	-24.76	≤-12.15	PASS
		2441	Reference	7.58	7.58	---	PASS
			30~1000	7.58	-43.56	≤-12.42	PASS
			1000~26500	7.58	-23.84	≤-12.42	PASS
		2480	Reference	7.35	7.35	---	PASS
			30~1000	7.35	-43.57	≤-12.65	PASS
			1000~26500	7.35	-24.95	≤-12.65	PASS
3DH5	Ant1	2402	Reference	7.89	7.89	---	PASS
			30~1000	7.89	-43.79	≤-12.11	PASS
			1000~26500	7.89	-24.94	≤-12.11	PASS
		2441	Reference	6.91	6.91	---	PASS
			30~1000	6.91	-44.25	≤-13.09	PASS
			1000~26500	6.91	-24.4	≤-13.09	PASS
		2480	Reference	9.08	9.08	---	PASS
			30~1000	9.08	-43.75	≤-10.92	PASS
			1000~26500	9.08	-24.99	≤-10.92	PASS

TEST GRAPHS

DH5_Ant1_2402_0~Reference

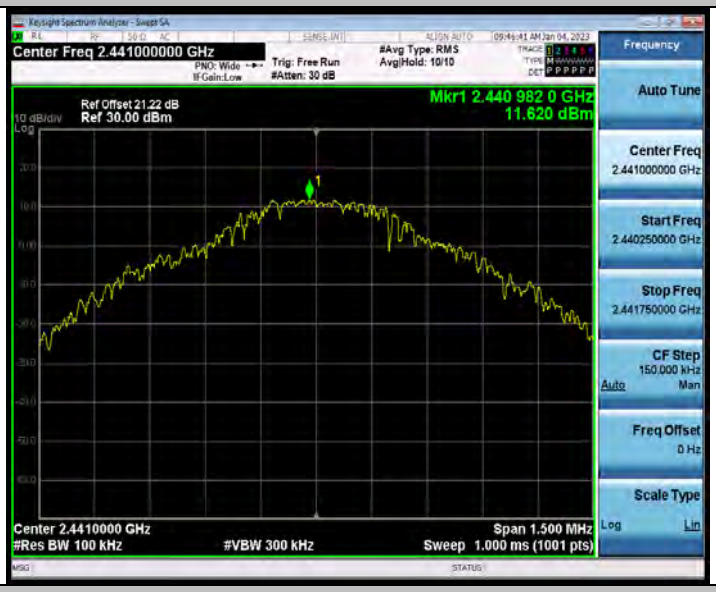


DH5_Ant1_2402_30~1000

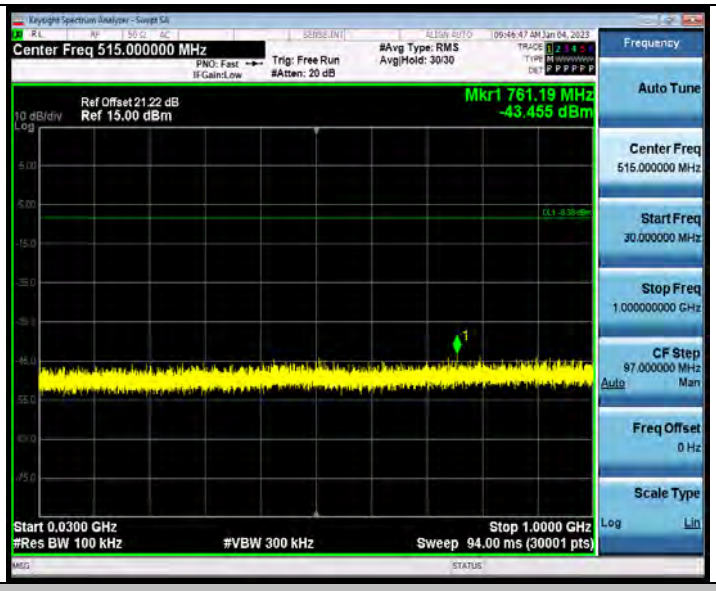


DH5_Ant1_2402_1000~26500

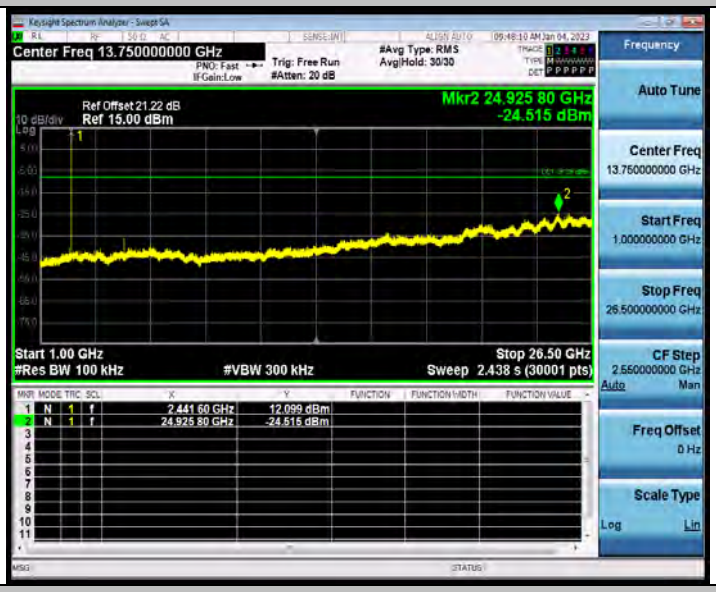
DH5_Ant1_2441_0~Reference



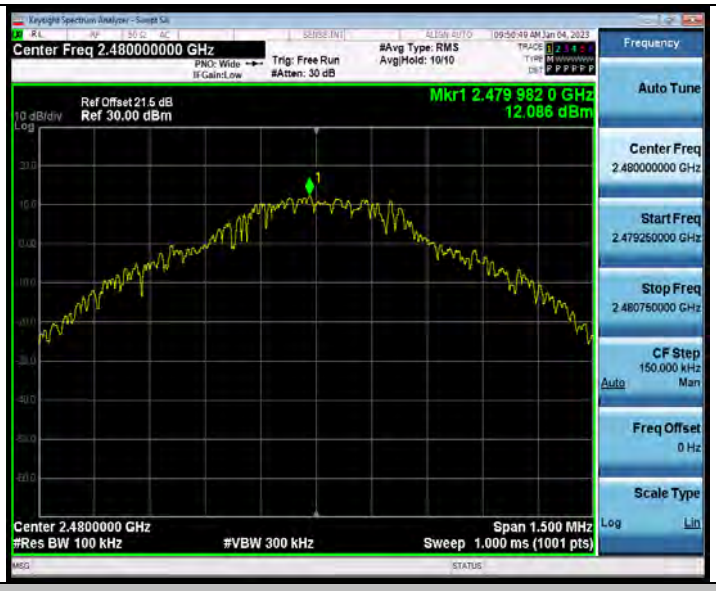
DH5_Ant1_2441_30~1000



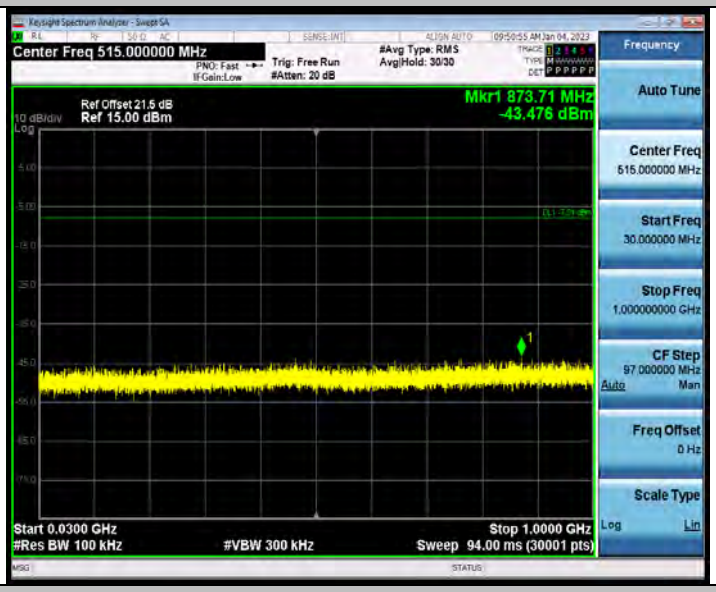
DH5_Ant1_2441_1000~26500



DH5_Ant1_2480_0~Reference

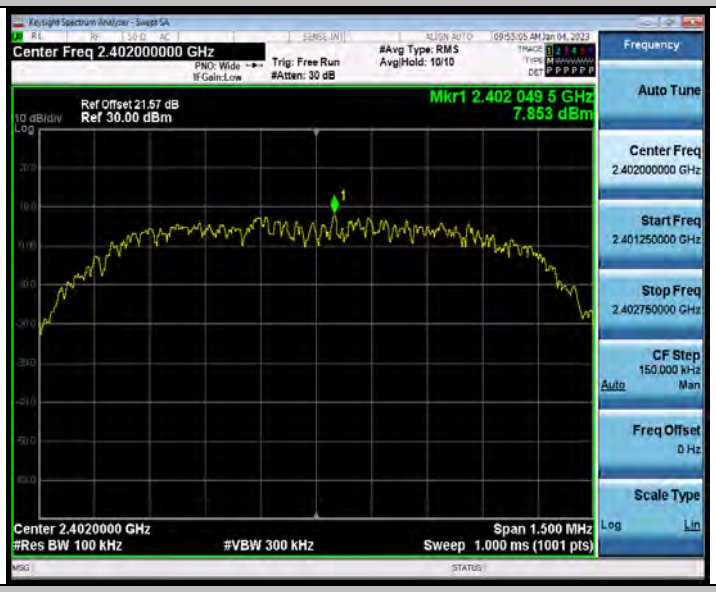


DH5_Ant1_2480_30~1000

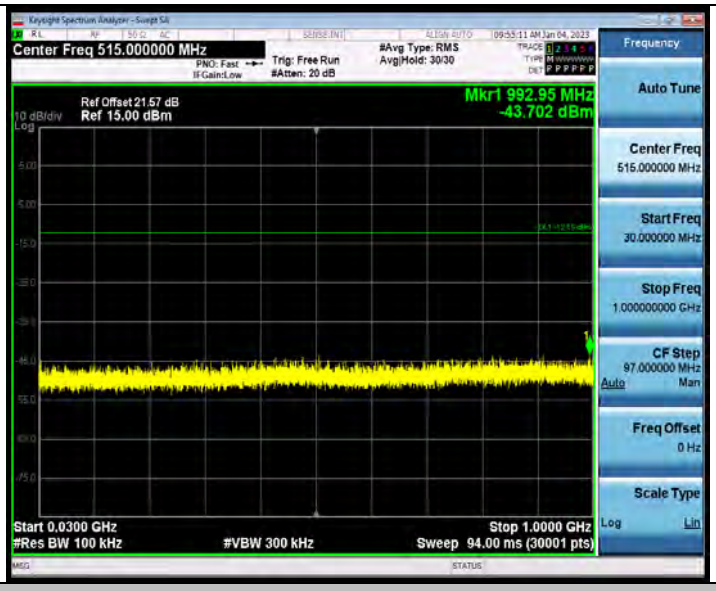


DH5_Ant1_2480_1000~26500

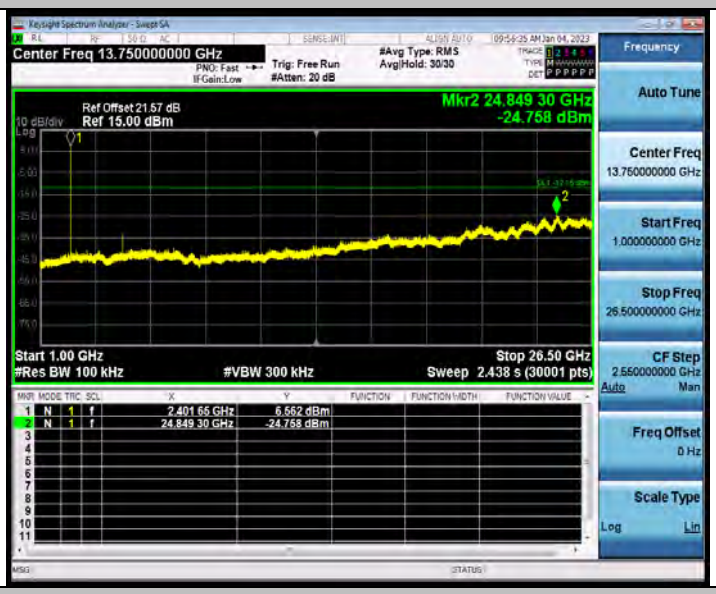
2DH5_Ant1_2402_0~Reference



2DH5_Ant1_2402_30~1000

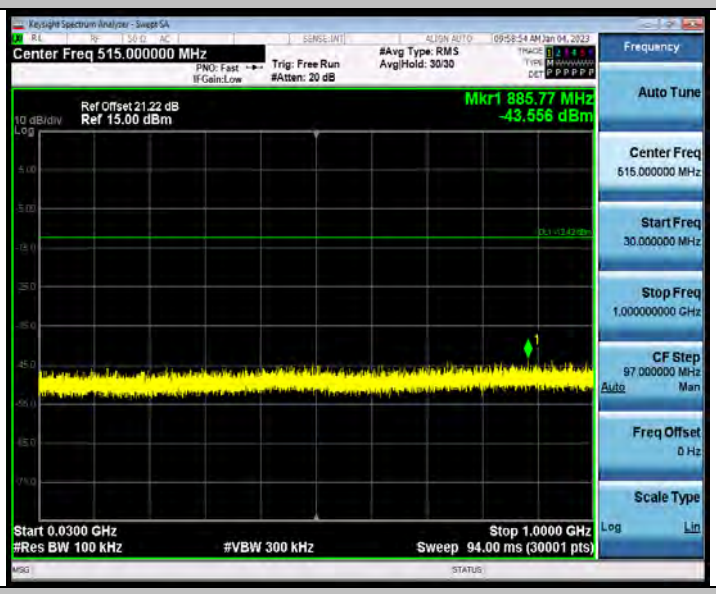


2DH5_Ant1_2402_1000~26500



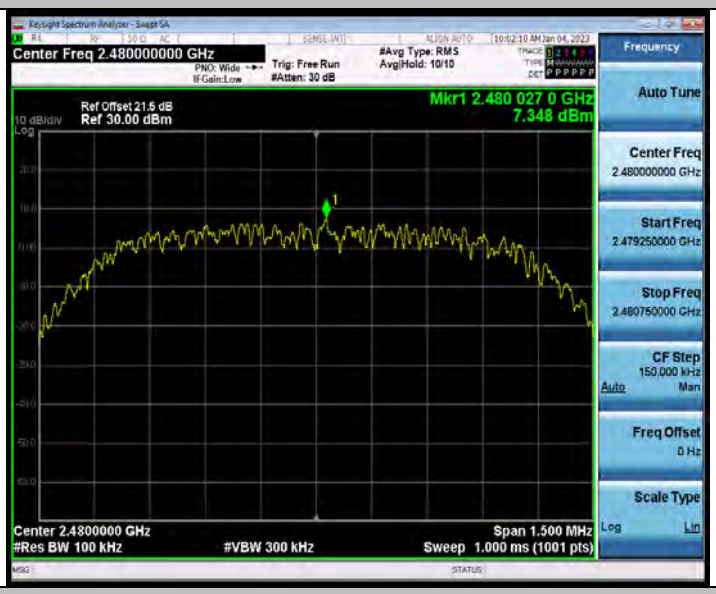
2DH5_Ant1_2441_0~Reference

2DH5_Ant1_2441_30~1000

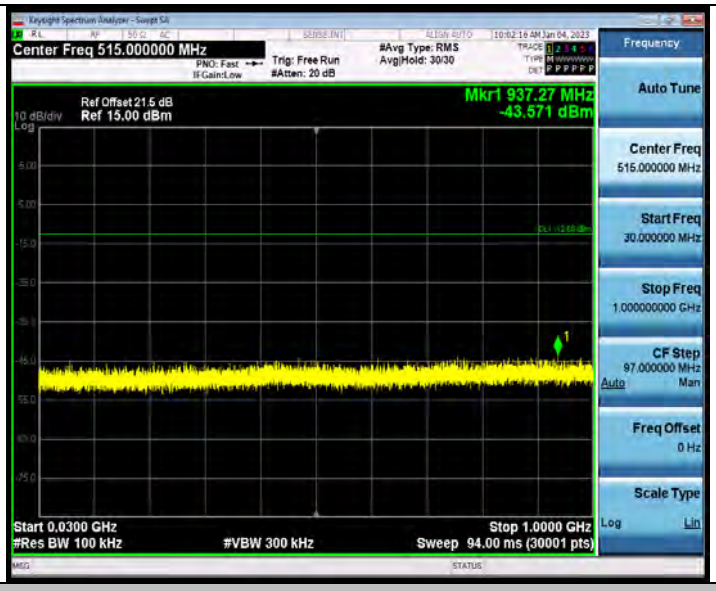


2DH5_Ant1_2441_1000~26500

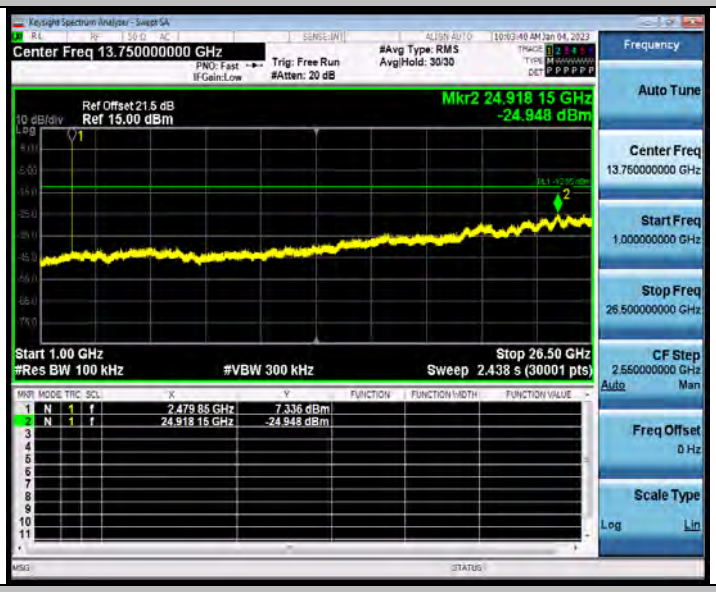
2DH5_Ant1_2480_0~Reference



2DH5_Ant1_2480_30~1000

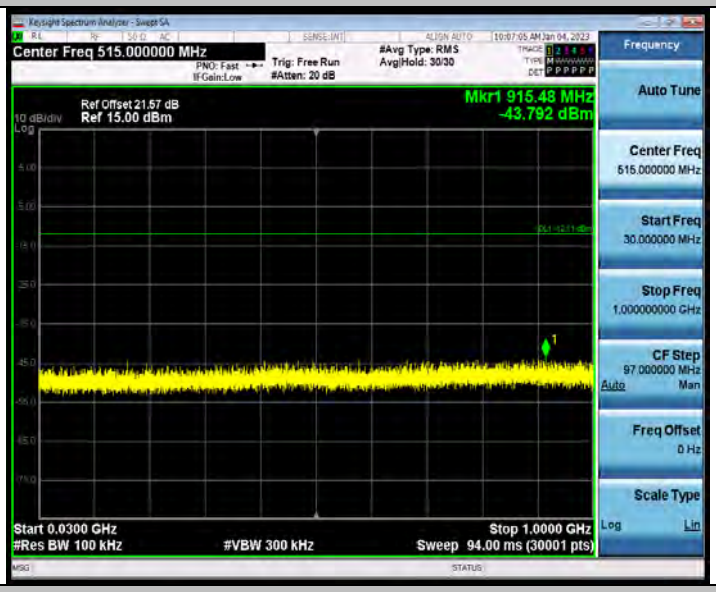


2DH5_Ant1_2480_1000~26500



3DH5_Ant1_2402_0~Reference

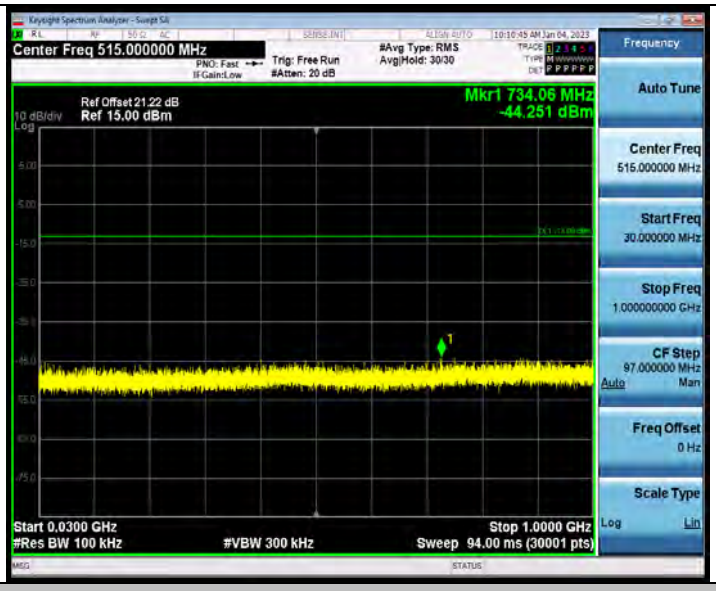
3DH5_Ant1_2402_30~1000



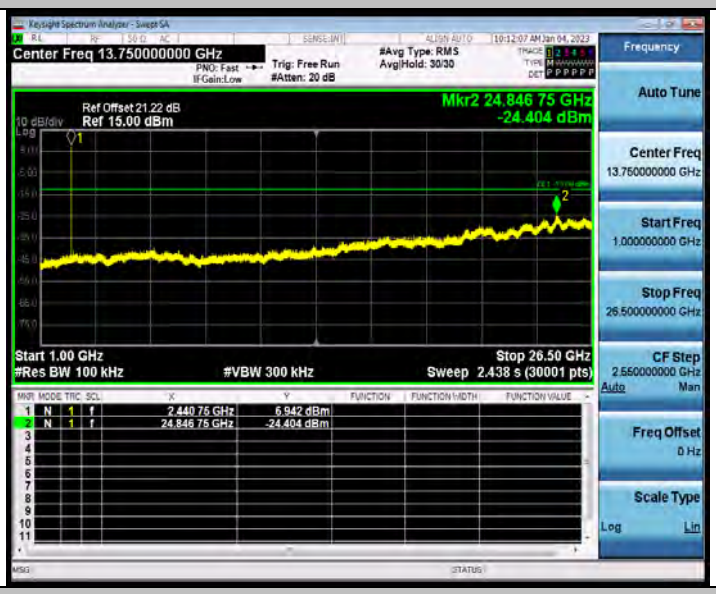
3DH5_Ant1_2402_1000~26500

3DH5_Ant1_2441_0~Reference

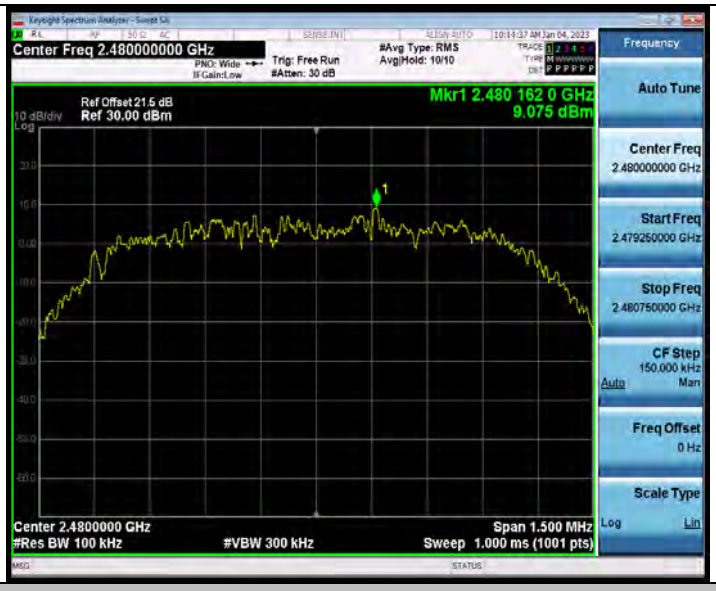
3DH5_Ant1_2441_30~1000



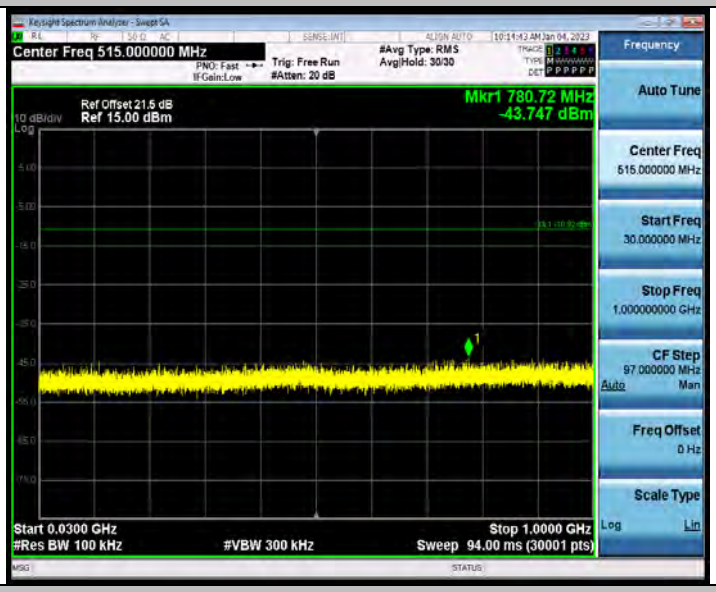
3DH5_Ant1_2441_1000~26500



3DH5_Ant1_2480_0~Reference



3DH5_Ant1_2480_30~1000



3DH5_Ant1_2480_1000~26500


Center Freq 13.750000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 30/30
Ref Offset 21.5 dB
10 dB/div
Ref 15.00 dBm
Mkr2 26.104 75 GHz
-24.991 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.438 s (30001 pts)
1 N 1 f 2.479 85 GHz 6.309 dBm
2 N 1 f 26.104 75 GHz -24.991 dBm
Frequency
Auto Tune
Center Freq
13.750000000 GHz
Start Freq
1.000000000 GHz
Stop Freq
26.500000000 GHz
CF Step
2.550000000 GHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

---END---