FCC TEST REPORT

(Part 15, Subpart C)

Applicant:	Shenzhen Zolon Technology Co., Ltd.
Address:	401, Building 3, Shenzhen Software Park, Maling Community, Yuehai Street, Nanshan District, Shenzhen City, Guangdong Province, P.R.C

Manufacturer or Supplier:	Shenzhen Zolon Technology Co., Ltd.
Address:	401, Building 3, Shenzhen Software Park, Maling Community, Yuehai Street, Nanshan District, Shenzhen City, Guangdong Province, P.R.C
Product:	Integrated Smart Terminal
Brand Name:	ZOLON
Model Name:	K2220, K2160
FCC ID:	2AV5BK2220
Date of tests:	Jul. 14, 2023 ~ Sep. 28, 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 Engineer / Mobile Department	Approved by Luke Lu Manager / Mobile Department
Simon Wang Date: Sep. 28, 2023	Luke Lu Date: Sep. 28, 2023

This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/ and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

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 10

2.2.1 CONFIGURATION OF SYSTEM UNDER TEST 11

2.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL 11

2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS 13

2.4 DESCRIPTION OF SUPPORT UNITS 13

3 TEST TYPES AND RESULTS 14

3.1 CONDUCTED EMISSION MEASUREMENT 14

3.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT 14

3.1.2 TEST INSTRUMENTS 14

3.1.3 TEST PROCEDURES 14

3.1.4 DEVIATION FROM TEST STANDARD 15

3.1.5 TEST SETUP 15

3.1.6 EUT OPERATING CONDITIONS 15

3.1.7 TEST RESULTS 16

3.2 RADIATED EMISSION AND BANDEDGE MEASUREMENT 18

3.2.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT 18

3.2.2 TEST INSTRUMENTS 19

3.2.3 TEST PROCEDURES 20

3.2.4 DEVIATION FROM TEST STANDARD 20

3.2.5 TEST SETUP 21

3.2.6 EUT OPERATING CONDITIONS 22

3.2.7 TEST RESULTS 23

3.3 NUMBER OF HOPPING FREQUENCY USED 29

3.3.1 LIMIT OF HOPPING FREQUENCY USED 29

3.3.2 TEST SETUP 29

3.3.3 TEST INSTRUMENTS 29

3.3.4 TEST PROCEDURES 30

3.3.5 DEVIATION FROM TEST STANDARD 30

3.3.6 TEST RESULTS 30

3.4 DWELL TIME ON EACH CHANNEL 31

3.4.1 LIMIT OF DWELL TIME USED 31
3.4.2 TEST SETUP 31
3.4.3 TEST INSTRUMENTS 31
3.4.4 TEST PROCEDURES 31
3.4.5 DEVIATION FROM TEST STANDARD 32
3.4.6 TEST RESULTS 32
3.5 CHANNEL BANDWIDTH 33
3.5.1 LIMITS OF CHANNEL BANDWIDTH 33
3.5.2 TEST SETUP 33
3.5.3 TEST INSTRUMENTS 33
3.5.4 TEST PROCEDURE 33
3.5.5 DEVIATION FROM TEST STANDARD 33
3.5.6 EUT OPERATING CONDITION 34
3.5.7 TEST RESULTS 34
3.6 HOPPING CHANNEL SEPARATION 35
3.6.1 LIMIT OF HOPPING CHANNEL SEPARATION 35
3.6.2 TEST SETUP 35
3.6.3 TEST INSTRUMENTS 35
3.6.4 TEST PROCEDURES 35
3.6.5 DEVIATION FROM TEST STANDARD 35
3.6.6 TEST RESULTS 36
3.7 MAXIMUM OUTPUT POWER 36
3.7.1 LIMITS OF MAXIMUM OUTPUT POWER MEASUREMENT 36
3.7.2 TEST SETUP 36
3.7.3 TEST INSTRUMENTS 36
3.7.4 TEST PROCEDURES 36
3.7.5 DEVIATION FROM TEST STANDARD 37
3.7.6 EUT OPERATING CONDITION 37
3.7.7 TEST RESULTS 38
3.7.7.1 MAXIMUM PEAK OUTPUT POWER 38
3.7.7.2 AVERAGE OUTPUT POWER (FOR REFERENCE) 39
3.8 OUT OF BAND MEASUREMENT 40
3.8.1 LIMITS OF OUT OF BAND MEASUREMENT 40
3.8.2 TEST INSTRUMENTS 40
3.8.3 TEST PROCEDURE 40
3.8.4 DEVIATION FROM TEST STANDARD 40

3.8.5 EUT OPERATING CONDITION 40
3.8.6 TEST RESULTS 40
4 PHOTOGRAPHS OF THE TEST CONFIGURATION 41
5 MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB.. 42
6 APPENDIX 43

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
W7L-P23070005RF01	Original release	Sep. 28, 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**	**LAB**
15.207	AC Power Conducted Emission	Compliance	A
15.247(a)(1)(iii)	Number of Hopping Frequency Used	Compliance	A
15.247(a)(1)(iii)	Dwell Time on Each Channel	Compliance	A
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	Compliance	A
15.247(b)	Maximum Peak Output Power	Compliance	A
15.247(d)& 15.209	Transmitter Radiated Emissions	Compliance	B
15.247(d)	Out of band Measurement	Compliance	A
15.203	Antenna Requirement	Compliance	A

NOTE:

1. If the Frequency Hopping System operates in 2400-2483.5MHz band and the output power is 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 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:
Lab A

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

Lab B:

Huarui 7Layers High Technology (Suzhou) Co., Ltd.

Lab Address:

Tower N, Innovation Center, 88 Zhuyi Road, High-tech District, Suzhou City, Anhui Province

Accredited Test Lab Cert 6613.01
The FCC Site Registration No. is 434559; The Designation No. is CN1325.

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	Integrated Smart Terminal
BRAND NAME	ZOLON
MODEL NAME	K2220, K2160
NOMINAL VOLTAGE	12.0Vdc
MODULATION TECHNOLOGY	FHSS
MODULATION TYPE	GFSK, 8DPSK, π/4 DQPSK
OPERATING FREQUENCY	2402MHz~2480MHz
NUMBER OF CHANNEL	79
MAX. OUTPUT POWER	4.92mW (Max. Measured)
ANTENNA TYPE	Small Folding Antenna with 1.07dBi gain
HW VERSION	K2220 K2160
SW VERSION	V0.0.0.1
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	AC cable: non-shielded cable, with w/o ferrite core, 1.8 meter

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 (K2220) was shown in the test report. （The test mainly executed by K2220,and K2160 verified the AC Power Conducted Emission and RSE test case, only the data of K2220 has been reported in the report.）

3. The difference of K2220 and K2160 is on below:

Object	K2160	K2220
PMN	K2160	K2220
HVIM	K2160	K2220
Power Rating	Model Name: SLX-PWL27-P4 I/P: 100-240Vac, 2000mA, O/P: 12Vdc, 2.0 A；LCD backlight power supply：28.8 Vdc, 150 mA	Model Name: SLX-PWL27-V13 I/P: 100-240Vac, 2000mA, O/P: 12Vdc, 2.0 A；LCD backlight power supply: 54 Vdc, 240 mA
Screen	Manufacturer: CSOT Model Name: MG1561B01-6 Size: 15.6 inches	Manufacturer: HKC Model Name: PN215CT01-1 Size: 21.5 inches
When the operating voltage changes, It does not affect RF, baseband module.		

List of Accessory:

ACCESSORIES	BRAND	MANUFACTURER	MODEL	SPECIFICATION
AC cable US Plug	N/A	N/A	KE301	1.8 METER
Small folding antenna	N/A	Shenzhen Zhenwei technology co.,LTD	HTX-002	N/A

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 4 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.
☒ The 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	39	FHSS	GFSK	1DH5

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.
☒ The 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	1DH5

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	39	FHSS	GFSK	1DH5

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, 70%RH	AC 120V	Jace Hu
RE≥1G	23deg. C, 70%RH	AC 120V	Jace Hu
PLC	25deg. C, 52%RH	AC 120V	Carl Xie
APCM	25deg. C, 60%RH	AC 120V	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. 14,23	Feb. 13,24
EMC32 test software	Rohde&Schwarz	EMC32	NA	NA	NA
LISN network	Rohde&Schwarz	ENV216	101922	Mar. 03,23	Mar. 02,24

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.

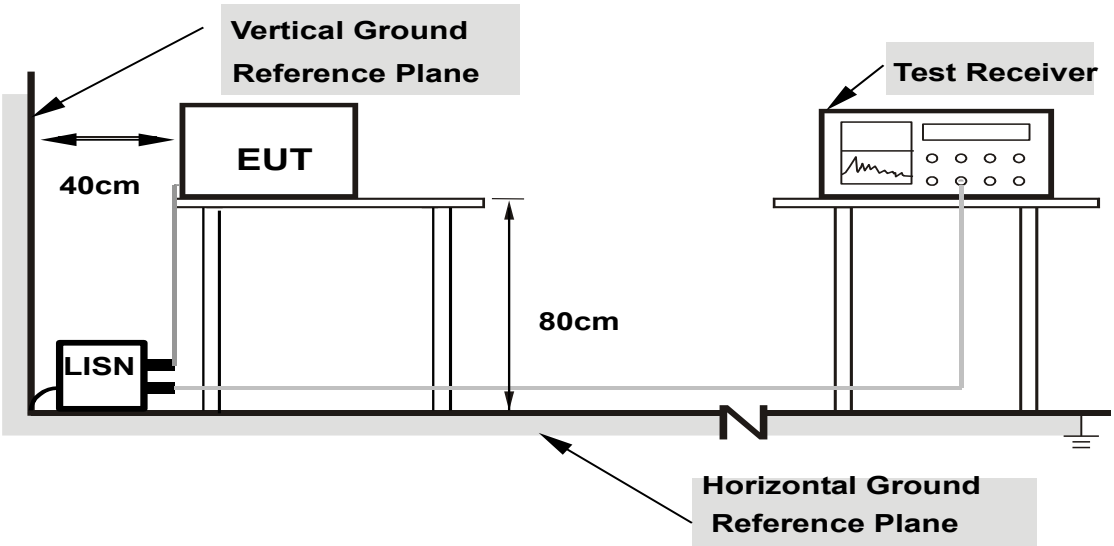
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded.

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 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

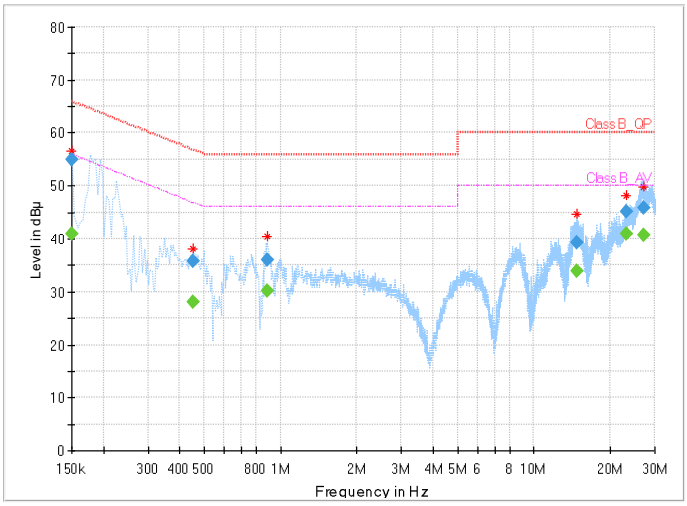
CONDUCTED WORST-CASE DATA:

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	---	40.90	56.00	15.10	L1	ON	9.7
0.150000	54.97	---	66.00	11.03	L1	ON	9.7
0.452000	---	28.09	46.84	18.75	L1	ON	9.7
0.452000	35.72	---	56.84	21.12	L1	ON	9.7
0.892000	---	30.17	46.00	15.83	L1	ON	9.7
0.892000	36.10	---	56.00	19.90	L1	ON	9.7
14.776000	---	33.93	50.00	16.07	L1	ON	9.8
14.776000	39.27	---	60.00	20.73	L1	ON	9.8
23.128000	---	40.94	50.00	9.06	L1	ON	9.8
23.128000	45.06	---	60.00	14.94	L1	ON	9.8
27.260000	---	40.64	50.00	9.36	L1	ON	9.8
27.260000	45.83	---	60.00	14.17	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.

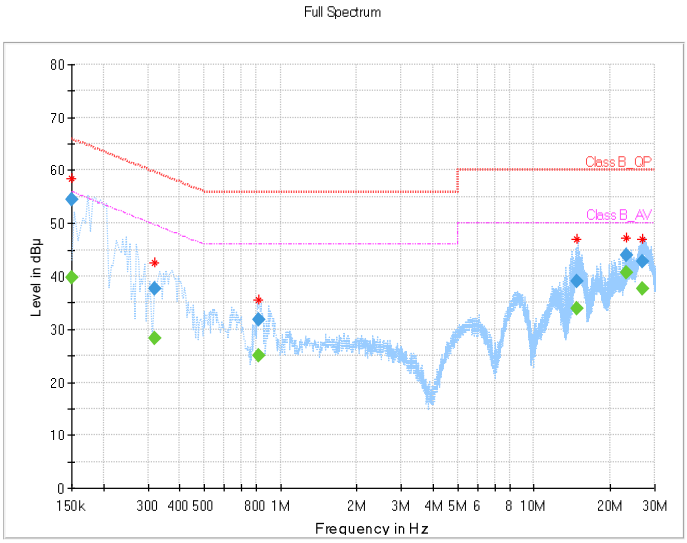
Full Spectrum



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	---	39.85	56.00	16.15	N	ON	9.7
0.150000	54.61	---	66.00	11.39	N	ON	9.7
0.320000	---	28.38	49.71	21.33	N	ON	9.7
0.320000	37.60	---	59.71	22.11	N	ON	9.7
0.820000	---	25.06	46.00	20.94	N	ON	9.7
0.820000	31.90	---	56.00	24.10	N	ON	9.7
14.828000	---	33.88	50.00	16.12	N	ON	9.8
14.828000	39.00	---	60.00	21.00	N	ON	9.8
23.128000	---	40.65	50.00	9.35	N	ON	9.9
23.128000	43.99	---	60.00	16.01	N	ON	9.9
26.708000	---	37.61	50.00	12.39	N	ON	9.9
26.708000	42.79	---	60.00	17.21	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.



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.
Pre-Amplifier	R&S	SCU18F1	100815	Aug.30,22	Aug.29,24
Pre-Amplifier	R&S	SCU08F1	101028	Sep.16,22	Sep.15,24
Signal Generator	R&S	SMB100A	182185	Feb.16,22	Feb.15,24
3m Fully-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-EMC-01Chamber	Nov.25,22	Nov.24,25
3m Semi-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-EMC-02Chamber	Nov.25,22	Nov.24,25
EMI TEST Receiver	R&S	ESW44	101973	Feb.25,22	Feb.24,24
Bilog Antenna	SCHWARZBECK	VULB 9163	1264	Feb.28,22	Feb.27,24
Horn Antenna	ETS-LINDGREN	3117	227836	Aug.22,22	Aug.21,24
Horn Antenna (18GHz-40GHz)	Steatite Q-par Antennas	QMS 00880	23486	Feb.23,22	Feb.22,24
Horn Antenna	Steatite Q-par Antennas	QMS 00208	23485	Aug.22,22	Aug.21,24
Loop Antenna	SCHWARZ	HFH2-Z2/Z2E	100976	Feb.23,22	Feb.22,24
WIDEBANDRADIO COMMUNICATION TESTER	R&S	CMW500	169399	Jun.27,22	Jun.26,24
Test Software	ELEKTRA	ELEKTRA4.32	N/A	N/A	N/A
Open Switch and Control Unit	R&S	OSP220	101964	N/A	N/A
DC Source	HYELEC	HY3010B	551016	Aug.31,22	Aug.30,24
Hygrothermograph	DELI	20210528	SZ014	Sep.06,22	Sep.05,24
6DB attenuator	Tonscend Technology Co., Ltd	N/A	23062787	N/A	N/A
PC	LENOVO	E14	HRSW0024	N/A	N/A
TMC-AMI18843A(CABLE)	R&S	HF290-NMNM-7.00M	N/A	N/A	N/A
TMC-AMI18843A(CABLE)	R&S	HF290-NMNM-4.00M	N/A	N/A	N/A
CABLE	R&S	W13.02	N/A	Apr.28,23	Oct.27,23
CABLE	R&S	W12.14	N/A	Apr.28,23	Oct.27,23

NOTE: 1. The calibration interval of the above test instruments is 6 months or 12 months or 36 months, and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

2. The test was performed in the 3m Chamber.

3. The FCC Site Registration No. is 434559; The Designation No. is CN1325.

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 in the 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 varies 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:

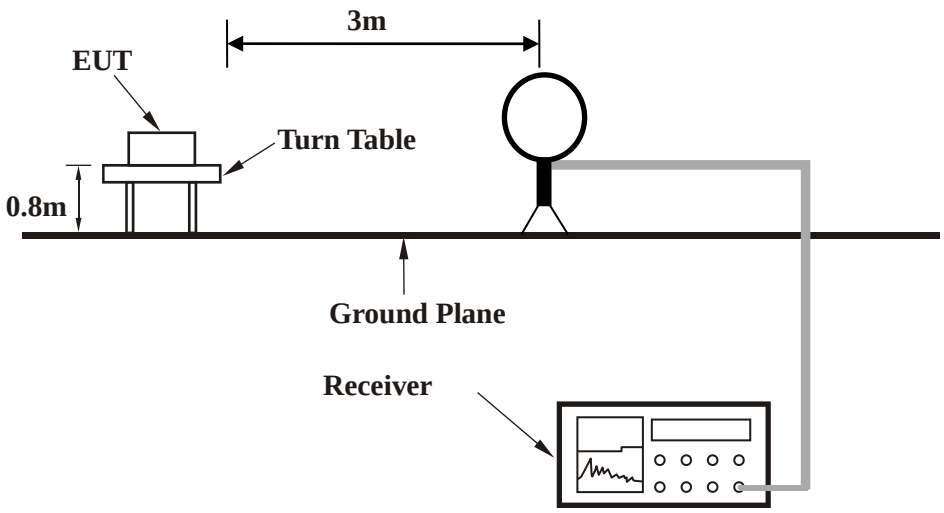
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution 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

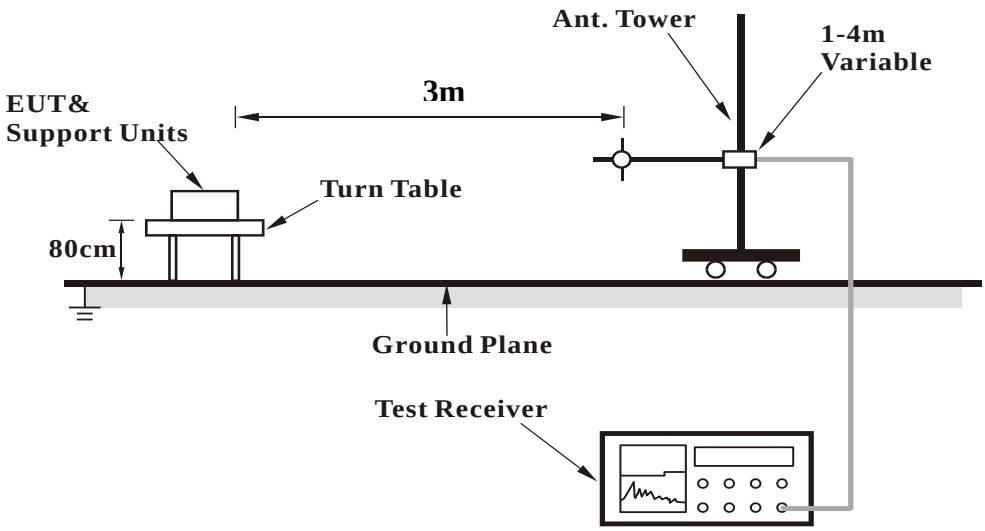
No deviation.

3.2.5 TEST SETUP

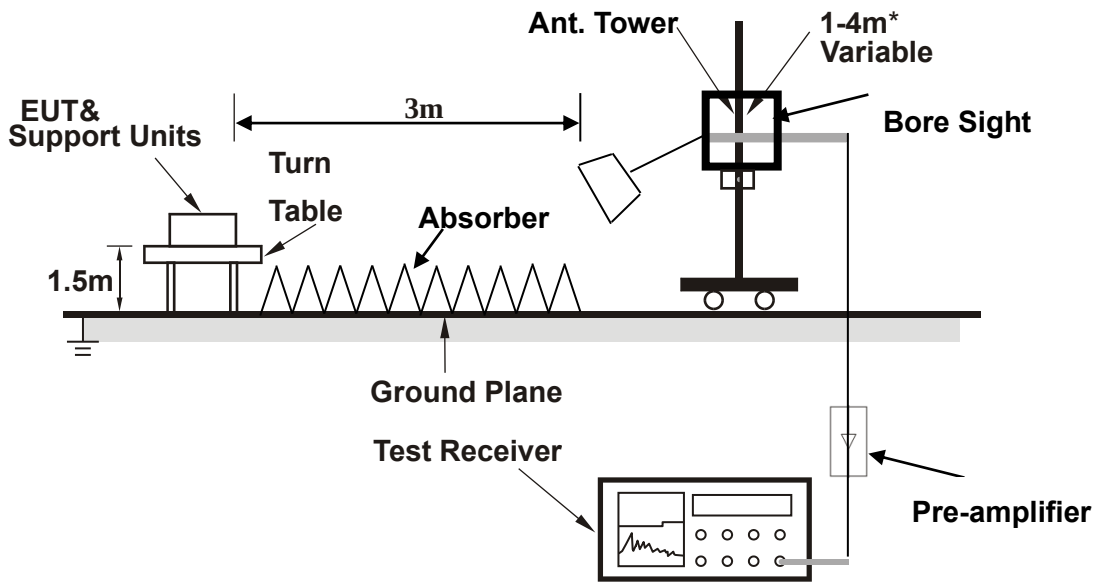
<Frequency Range 9KHz~30MHz >



< Frequency Range 30MHz~1GHz >



<Frequency Range above 1GHz>



Note: Above 1G is a directional antenna

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

BELOW 1GHz WORST-CASE DATA:

30 MHz – 1GHz data:

BT_ GFSK

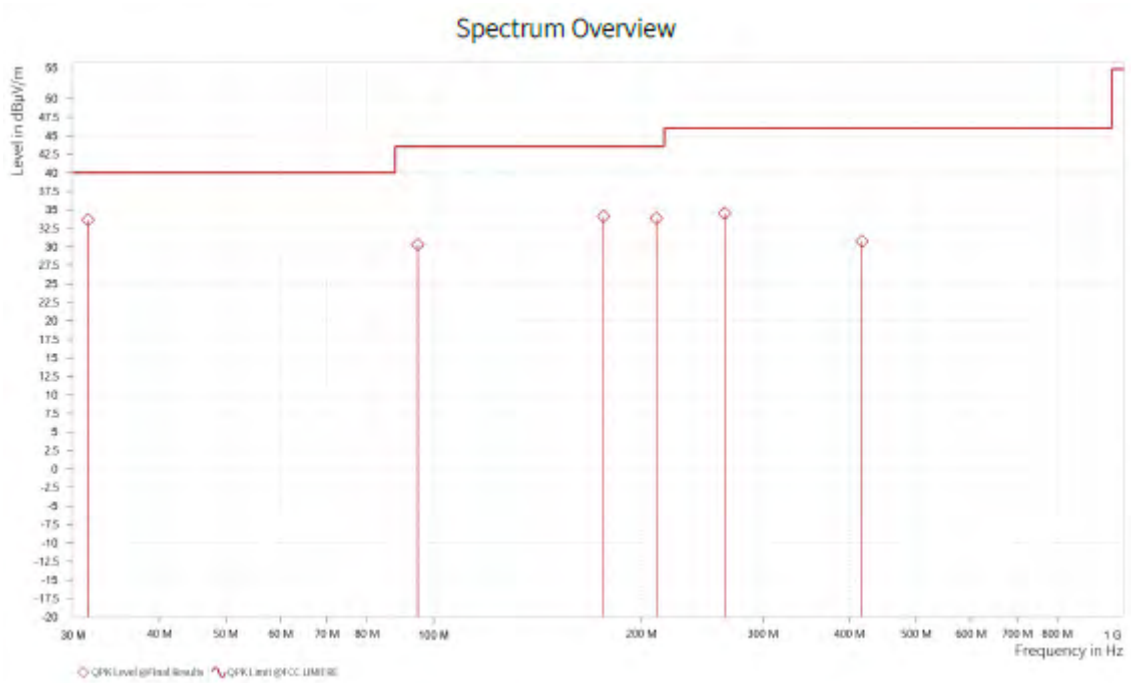
CHANNEL	Channel 39	**DETECTOR FUNCTION**	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY: HORIZONTAL

Rg	Frequency [MHz]	QPK Level [dBμV/m]	QPK Limit [dBμV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]
1	31.552	33.63	40.00	6.37	-13.36	H	1	2	120.000
1	94.845	30.30	43.50	13.20	-13.13	H	83.3	2	120.000
1	176.276	34.09	43.50	9.41	-13.59	H	359	1	120.000
1	210.323	33.84	43.50	9.66	-11.13	H	277.8	1	120.000
1	264.110	34.52	46.00	11.48	-8.55	H	277.8	1	120.000
1	417.273	30.75	46.00	15.25	-4.75	H	223.1	2	120.000

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.



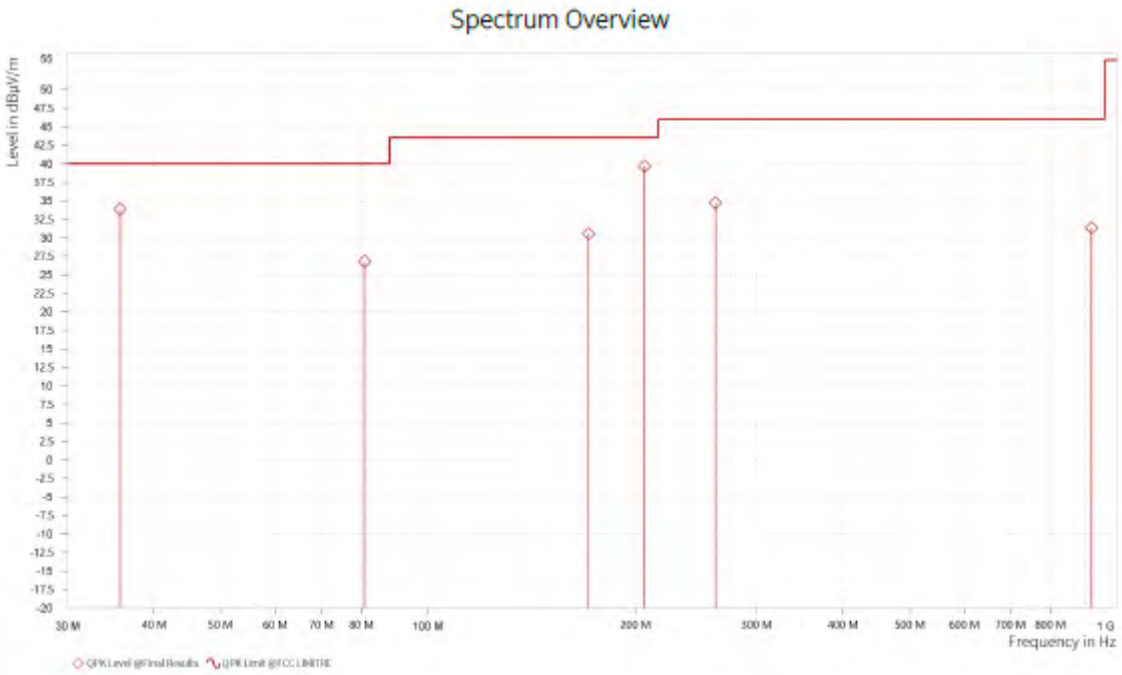
CHANNEL	Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY: VERTICAL

Rg	Frequency [MHz]	QPK Level [dBμV/m]	QPK Limit [dBμV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]
1	35.723	33.86	40.00	6.14	-12.54	V	134.4	1	120.000
1	80.925	26.79	40.00	13.21	-16.43	V	134.4	1	120.000
1	171.087	30.55	43.50	12.95	-13.93	V	224.3	2	120.000
1	206.201	39.66	43.50	3.84	-11.06	V	224.3	2	120.000
1	261.248	34.69	46.00	11.31	-8.61	V	134.4	1	120.000
1	918.132	31.33	46.00	14.67	1.68	V	83.3	2	120.000

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.



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

1GHz – 25GHz: (Scan with GFSK, π/4-DQPSK, 8DPSK mode, the worst case is GFSK Mode)

BT_ GFSK

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
5	2,388.000	32.12	54.00	21.88	7.08	H	1	1
5	2,389.500	32.26	54.00	21.74	7.08	H	266.2	2
5	2,402.000	77.20			7.08	H	355	2

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
5	2,363.000	46.77	74.00	27.23	7.10	H	1	1
5	2,390.000	46.15	74.00	27.85	7.08	H	42.4	1
5	2,402.500	92.41			7.09	H	271.9	1

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
5	2,383.500	32.41	54.00	21.59	7.08	V	217.2	2
5	2,390.000	32.30	54.00	21.70	7.08	V	217.2	2
5	2,402.500	82.80			7.09	V	191.8	1

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
5	2,379.000	47.17	74.00	26.83	7.09	V	219.6	2
5	2,390.000	46.18	74.00	27.82	7.08	V	170.6	2
5	2,402.500	96.89			7.09	V	89	1

REMARKS:

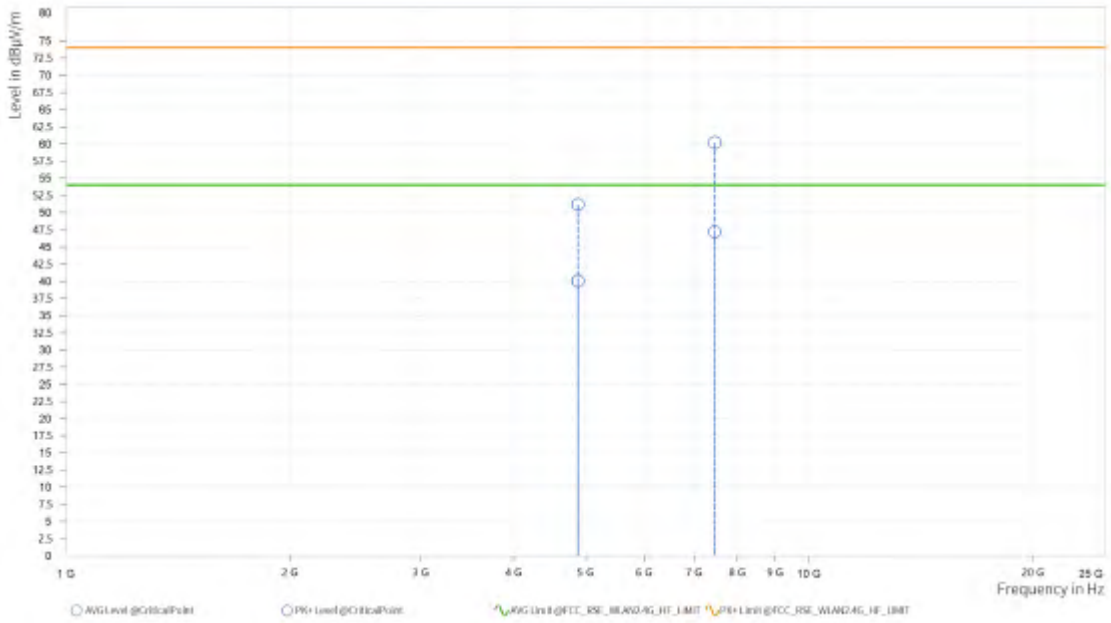
1.Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor

2.2402MHz: Fundamental frequency.

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

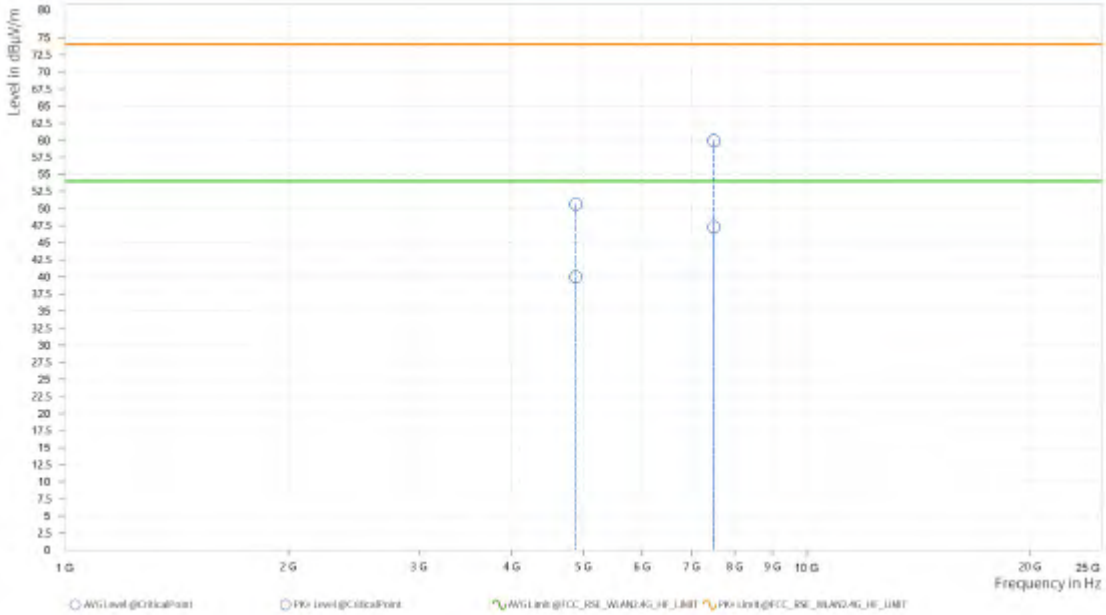
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

Rg	Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
2	4,882.000	51.17	74.00	22.83	40.04	54.00	13.96	15.32	H	29.6	2
2	7,462.000	60.18	74.00	13.82	47.18	54.00	6.82	21.60	H	29.6	2



ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
2	4,882.000	50.65	74.00	23.35	40.00	54.00	14.00	15.32	V	0.9	2
2	7,490.000	59.95	74.00	14.05	47.27	54.00	6.73	21.70	V	29.5	2



REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
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

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
6	2,479.929	80.41			7.36	H	289.8	1
6	2,483.500	32.42	54.00	21.58	7.36	H	340.3	1
6	2,487.500	32.64	54.00	21.36	7.36	H	1	1

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
6	2,480.100	89.27			7.36	H	273.1	1
6	2,483.500	45.28	74.00	28.72	7.36	H	227.8	2
6	2,487.900	47.55	74.00	26.45	7.36	H	165.7	2

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
6	2,479.929	86.32			7.36	V	193	1
6	2,483.500	32.41	54.00	21.59	7.36	V	193	1
6	2,488.071	32.64	54.00	21.36	7.36	V	69	2

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
6	2,479.800	96.72			7.36	V	183.4	1
6	2,483.500	46.00	74.00	28.00	7.36	V	183.4	1
6	2,492.200	47.78	74.00	26.22	7.37	V	359.1	1

REMARKS:

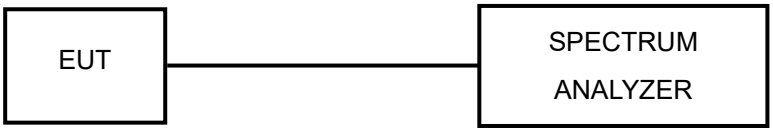
1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
2. 2480MHz: Fundamental frequency.

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. 14,23	Feb. 13,24
EXA Signal Analyzer	KEYSIGHT	N9010A-526	MY54510523	Feb. 14,23	Feb. 13,24
EXA Signal Analyzer	KEYSIGHT	N9010A-544	MY54510355	May.10,23	May.09,24
Power Sensor	ANRITSU	MA2411B	1339352	Feb. 14,23	Feb. 13,24

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 the 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 the above procedures until all frequencies measured are completed.

3.3.5 DEVIATION FROM TEST STANDARD

No deviation.

3.3.6 TEST RESULTS

There are 79 hopping frequencies in the hopping mode. Please refer to the Appendix for the test result. On the plots, it shows that the hopping frequencies are equally spaced.

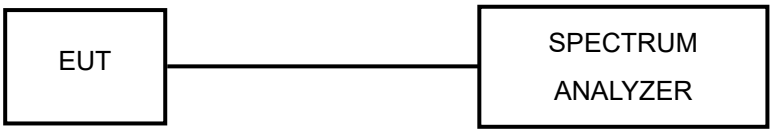
Please Refer to Appendix Of this test report.

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 about the 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 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 the 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

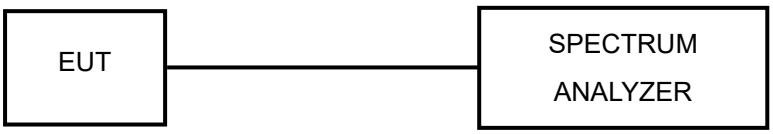
Please Refer to Appendix Of this test report

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 about the 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 the 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

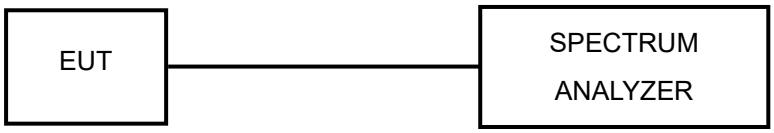
Please Refer to Appendix Of this test report.

3.6 HOPPING CHANNEL SEPARATION

3.6.1 LIMIT OF HOPPING CHANNEL SEPARATION

At least 25kHz or two-thirds 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 about the 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 the 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

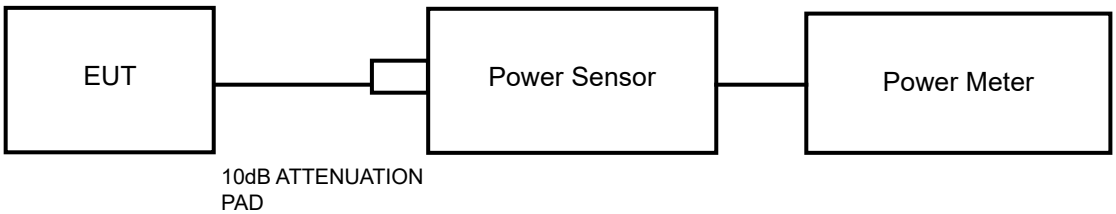
Please Refer to Appendix Of this test report.

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 about the 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 about the 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 were 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

For Band Edge :The spectrum plots are attached in the Appendix. Mark1 value indicates the reference Level. DL line indicates the 20dB offset below reference Level. It shows compliance with the requirement.

For CSE :The spectrum plots are attached in the Appendix. 100KHZ PSD value indicates the reference Level. DL line indicates the 20dB offset below Mark1 value. It shows compliance with the requirement.

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

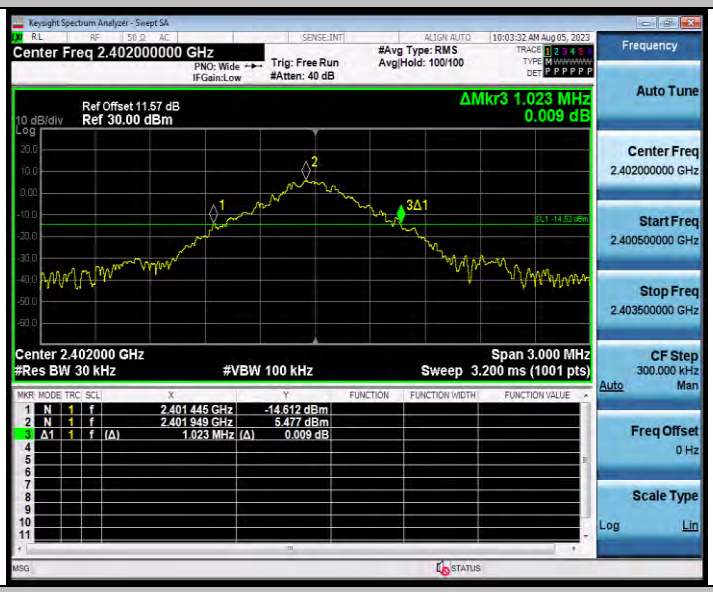
20DB EMISSION BANDWIDTH

TEST RESULT

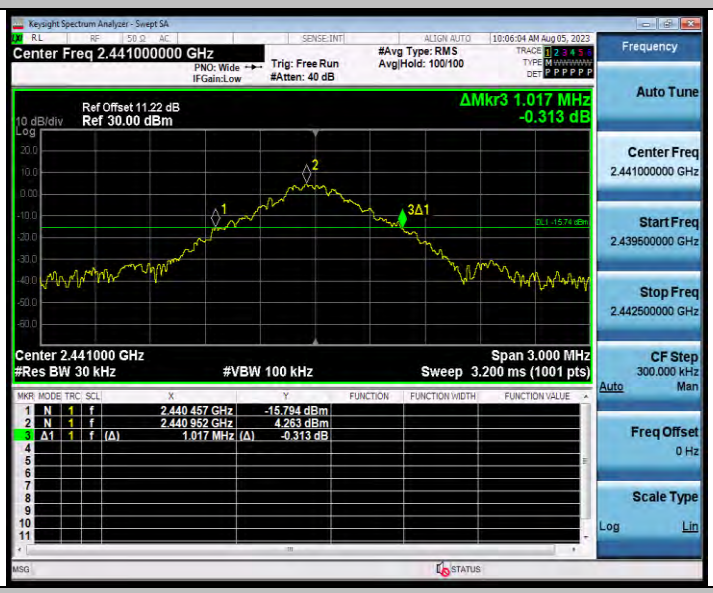
TestMode	Antenna	Frequency[MHz]	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	1.023	2401.445	2402.468	---	---
		2441	1.017	2440.457	2441.474	---	---
		2480	1.032	2479.451	2480.483	---	---
2DH5	Ant1	2402	1.392	2401.289	2402.681	---	---
		2441	1.410	2440.277	2441.687	---	---
		2480	1.428	2479.280	2480.708	---	---
3DH5	Ant1	2402	1.401	2401.271	2402.672	---	---
		2441	1.398	2440.277	2441.675	---	---
		2480	1.410	2479.277	2480.687	---	---

TEST GRAPHS

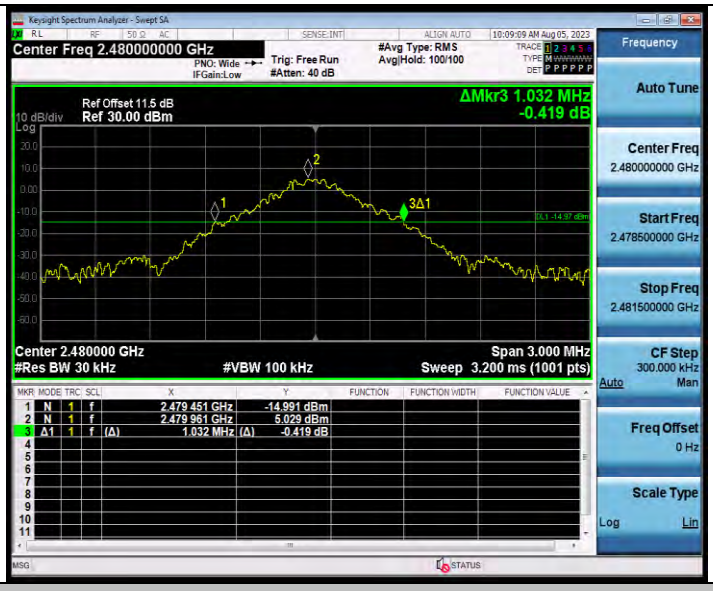
DH5_Ant1_2402



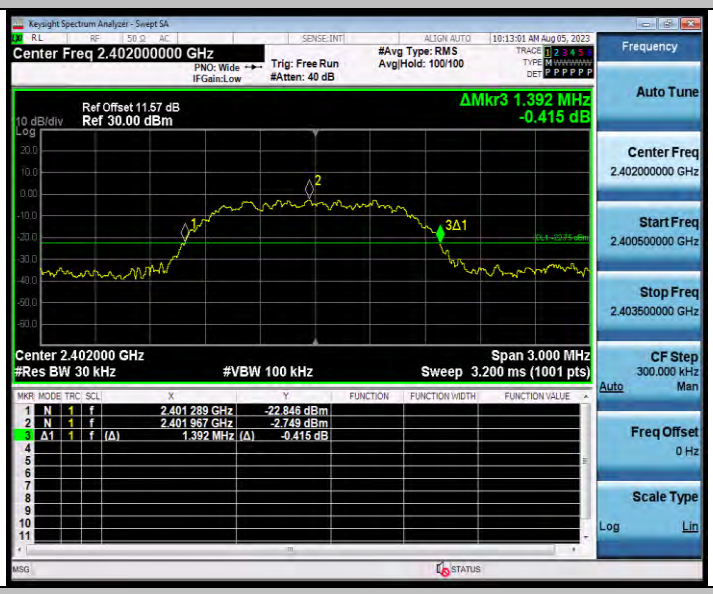
DH5_Ant1_2441



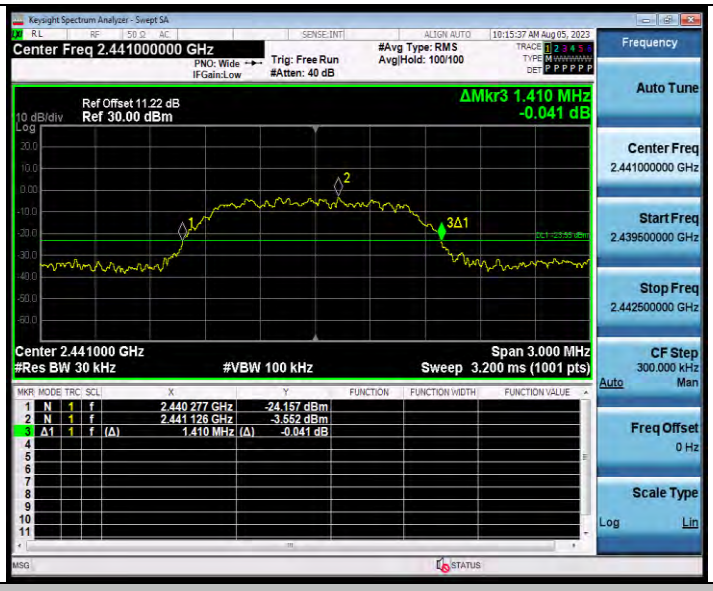
DH5_Ant1_2480



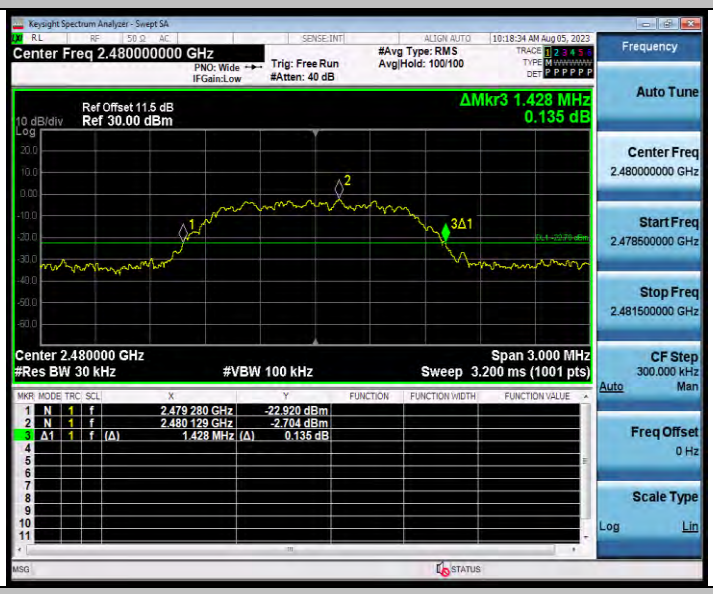
2DH5_Ant1_2402



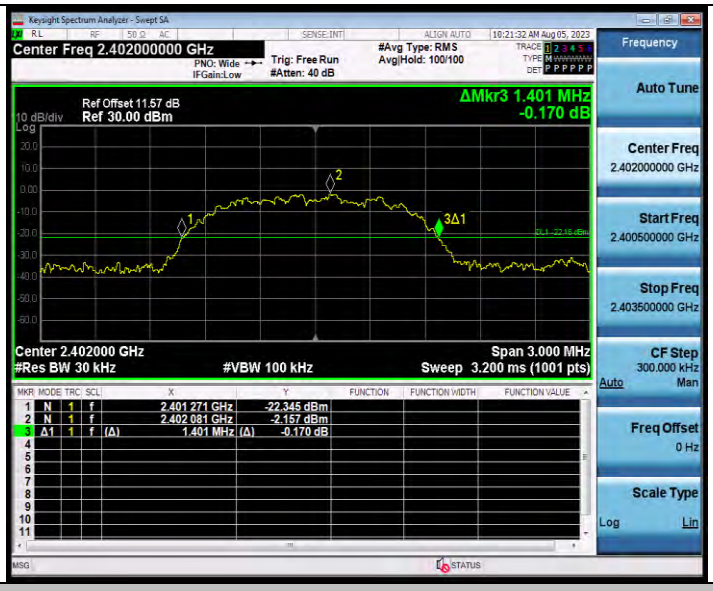
2DH5_Ant1_2441



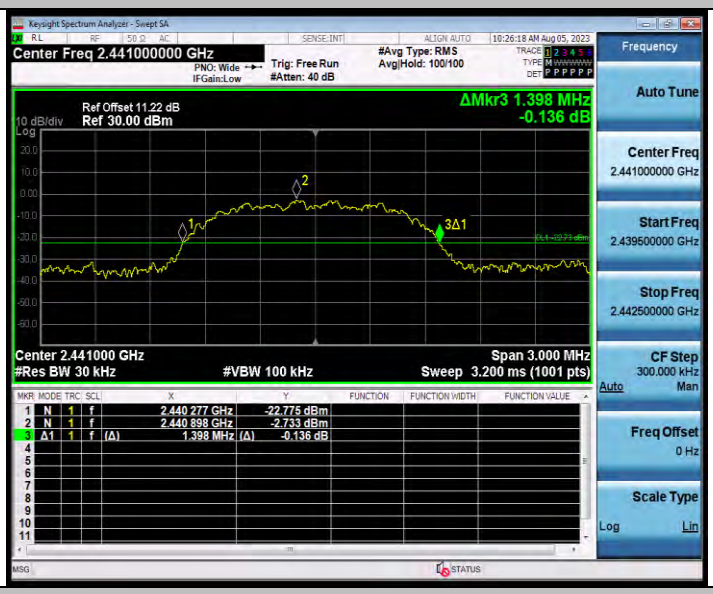
2DH5_Ant1_2480



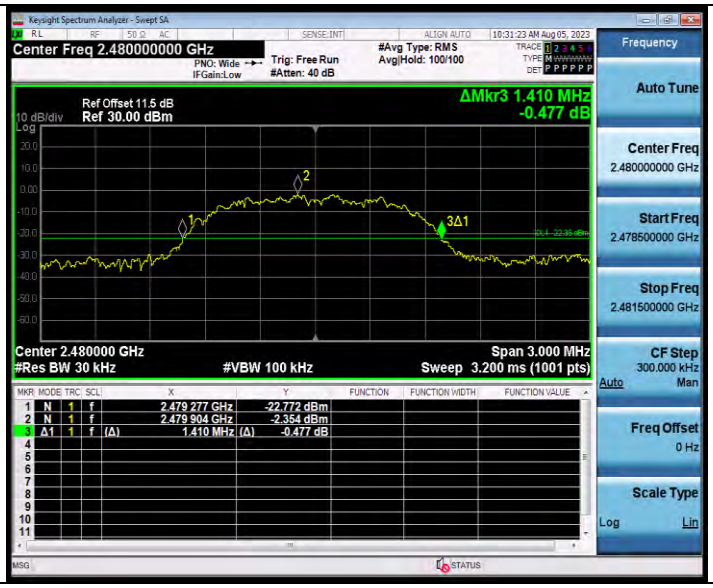
3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 100/100
10:31:23 AM Aug 05, 2023
Ref Offset 11.5 dB
10 dB/div Ref 30.00 dBm
ΔMkr3 1.410 MHz
-0.477 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 2.479 277 GHz -22.772 dBm
2 N 1 f 2.479 904 GHz -2.354 dBm
3 Δ1 1 f (Δ) 1.410 MHz (Δ) -0.477 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

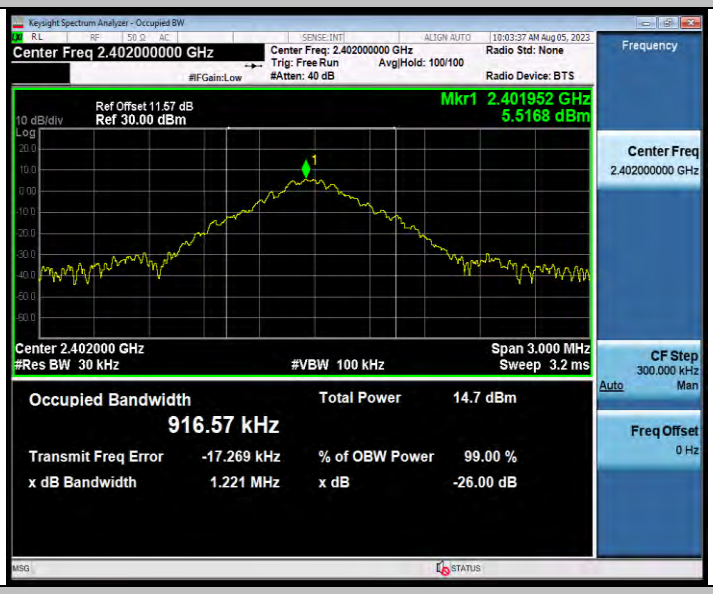
OCCUPIED CHANNEL BANDWIDTH

TEST RESULT

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.91657	2401.5244	2402.4410	---	---
		2441	0.91550	2440.5289	2441.4444	---	---
		2480	0.92545	2479.5269	2480.4523	---	---
2DH5	Ant1	2402	1.2553	2401.3566	2402.6119	---	---
		2441	1.2706	2440.3538	2441.6244	---	---
		2480	1.2809	2479.3552	2480.6361	---	---
3DH5	Ant1	2402	1.2463	2401.3602	2402.6065	---	---
		2441	1.2617	2440.3545	2441.6162	---	---
		2480	1.2777	2479.3520	2480.6297	---	---

TEST GRAPHS

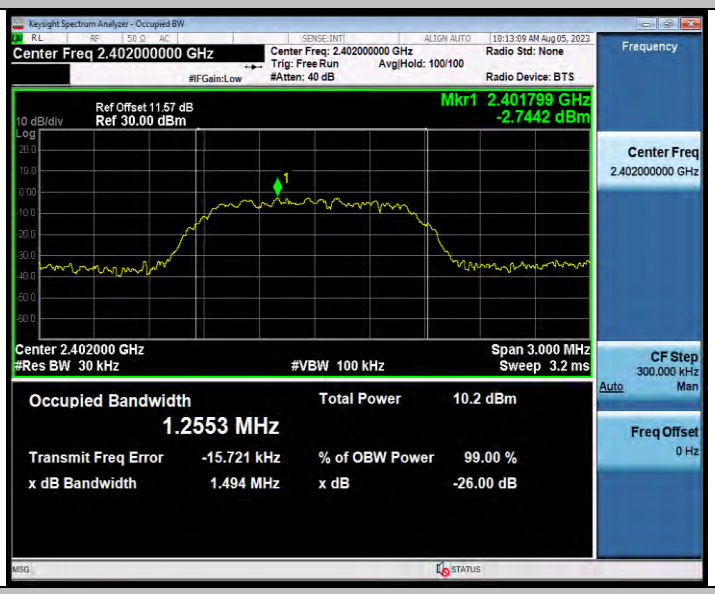
DH5_Ant1_2402



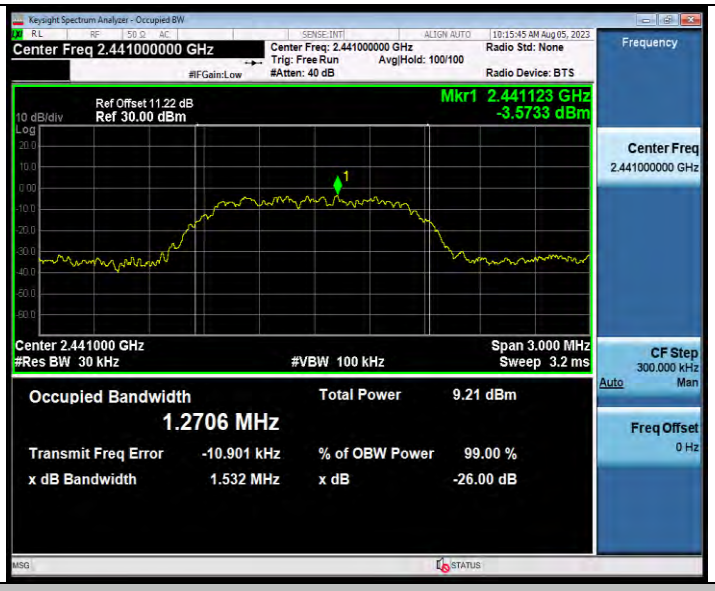
DH5_Ant1_2441

DH5_Ant1_2480

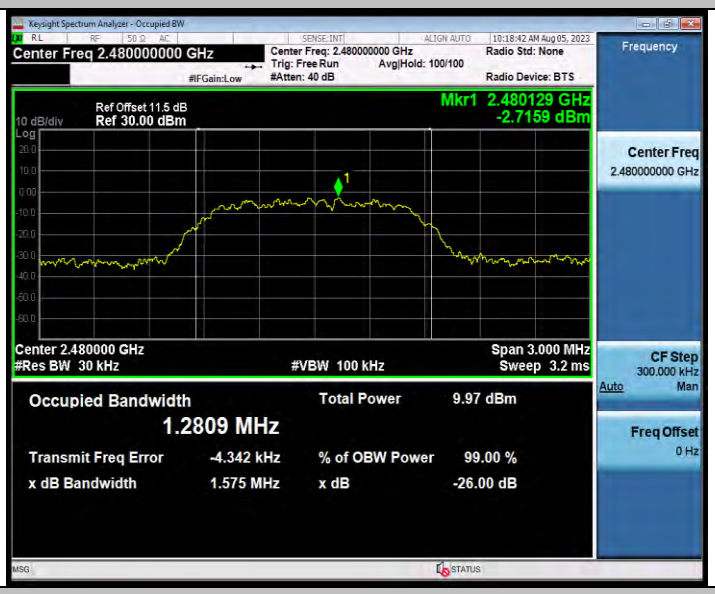
2DH5_Ant1_2402



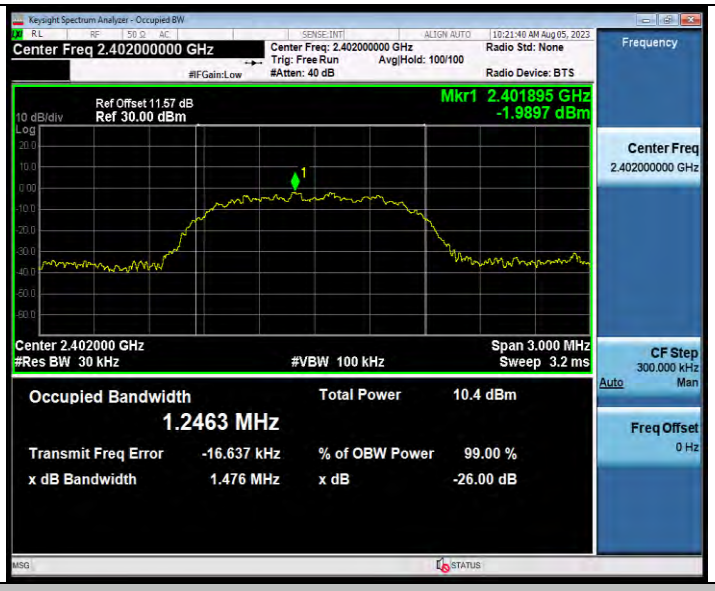
2DH5_Ant1_2441



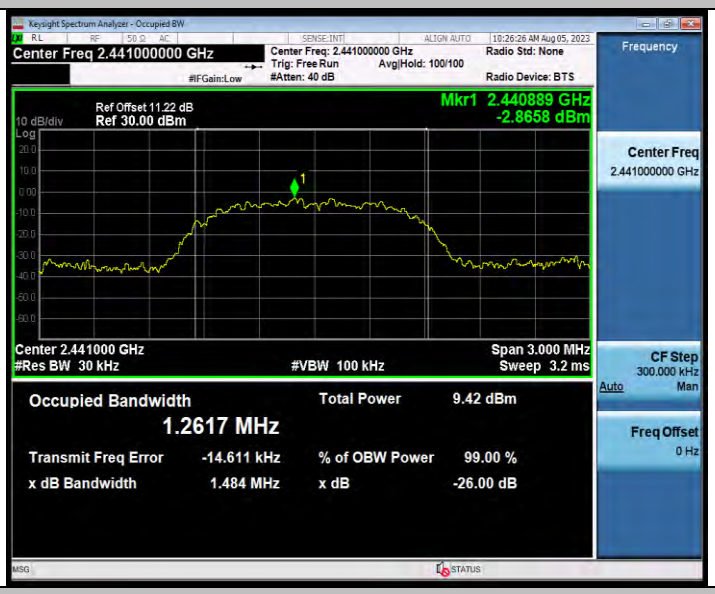
2DH5_Ant1_2480



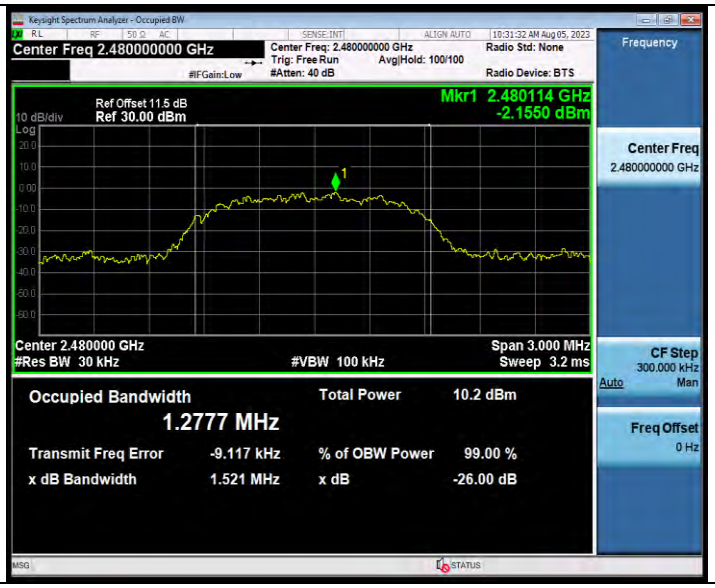
3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480


Keysight Spectrum Analyzer - Occupied BW
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 11.5 dB
10 dB/div
Ref 30.00 dBm
Mkr1 2.480114 GHz
-2.1550 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
1.2777 MHz
Total Power
10.2 dBm
Transmit Freq Error
-9.117 kHz
% of OBW Power
99.00 %
x dB Bandwidth
1.521 MHz
x dB
-26.00 dB
Freq Offset
0 Hz

MAXIMUM CONDUCTED OUTPUT POWER

TEST RESULT

TestMode	Antenna	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	Ant1	2402	6.11	6.67	4.65	≤20.97	7.74	5.94	≤36.00	PASS	Default
		2441	6.18	6.83	4.82	≤20.97	7.9	6.17	≤36.00	PASS	Default
		2480	6.29	6.92	4.92	≤20.97	7.99	6.30	≤36.00	PASS	Default
2DH5	Ant1	2402	2.35	4.36	2.73	≤20.97	5.43	3.49	≤36.00	PASS	Default
		2441	2.49	4.42	2.77	≤20.97	5.49	3.54	≤36.00	PASS	Default
		2480	2.49	4.48	2.81	≤20.97	5.55	3.59	≤36.00	PASS	Default
3DH5	Ant1	2402	2.3	4.39	2.75	≤20.97	5.46	3.52	≤36.00	PASS	Default
		2441	2.43	4.49	2.81	≤20.97	5.56	3.60	≤36.00	PASS	Default
		2480	2.57	4.55	2.85	≤20.97	5.62	3.65	≤36.00	PASS	Default
Note:EIRP=Peak Power+Gain											

CARRIER FREQUENCY SEPARATION

TEST RESULT

TestMode	Antenna	Frequency[MHz]	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Hop	1.004	≥0.688	PASS
2DH5	Ant1	Hop	0.98	≥0.952	PASS
3DH5	Ant1	Hop	1.134	≥0.940	PASS

TEST GRAPHS

DH5_Ant1_Hop

2DH5_Ant1_Hop

3DH5_Ant1_Hop

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 5000/5000
11:17:25 AM Aug 05, 2023
Ref Offset 11.22 dB
10 dB/div
Ref 30.00 dBm
ΔMkr2 1.134 MHz
0.044 dB
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

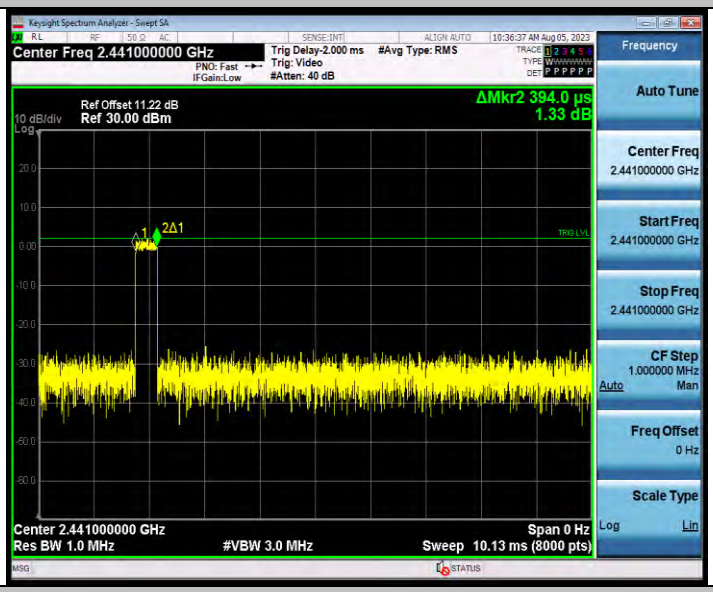
TestMode	Antenna	Frequency[MHz]	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.394	320	0.126	≤0.4	PASS
DH3	Ant1	Hop	1.650	160	0.264	≤0.4	PASS
DH5	Ant1	Hop	2.898	106.67	0.309	≤0.4	PASS
2DH1	Ant1	Hop	0.400	320	0.128	≤0.4	PASS
2DH3	Ant1	Hop	1.653	160	0.264	≤0.4	PASS
2DH5	Ant1	Hop	2.901	106.67	0.309	≤0.4	PASS
3DH1	Ant1	Hop	0.400	320	0.128	≤0.4	PASS
3DH3	Ant1	Hop	1.650	160	0.264	≤0.4	PASS
3DH5	Ant1	Hop	2.903	106.67	0.31	≤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

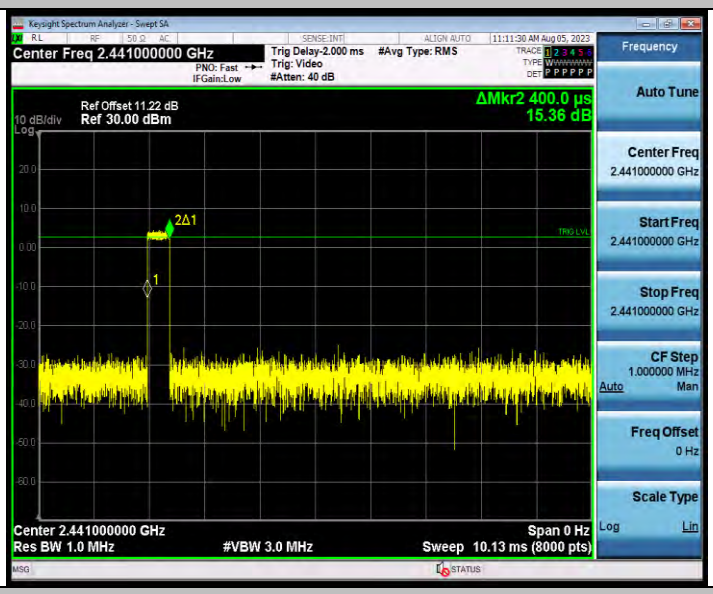
DH1_Ant1_Hop



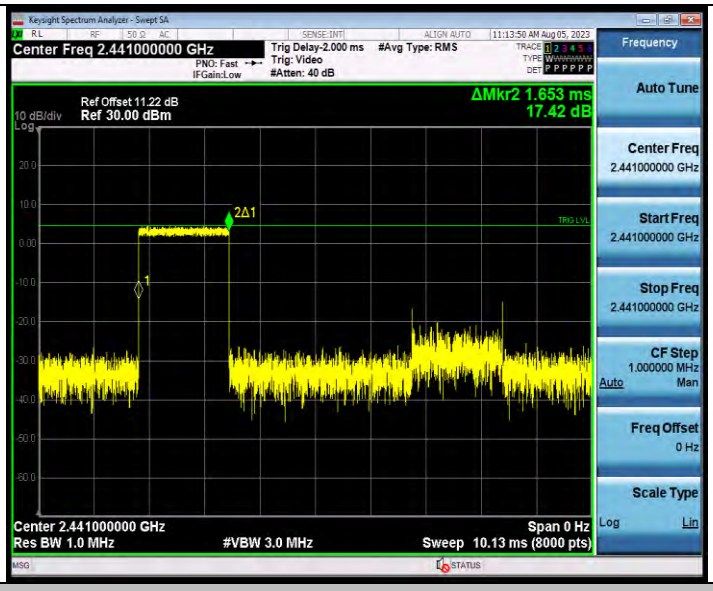
DH3_Ant1_Hop

DH5_Ant1_Hop

2DH1_Ant1_Hop

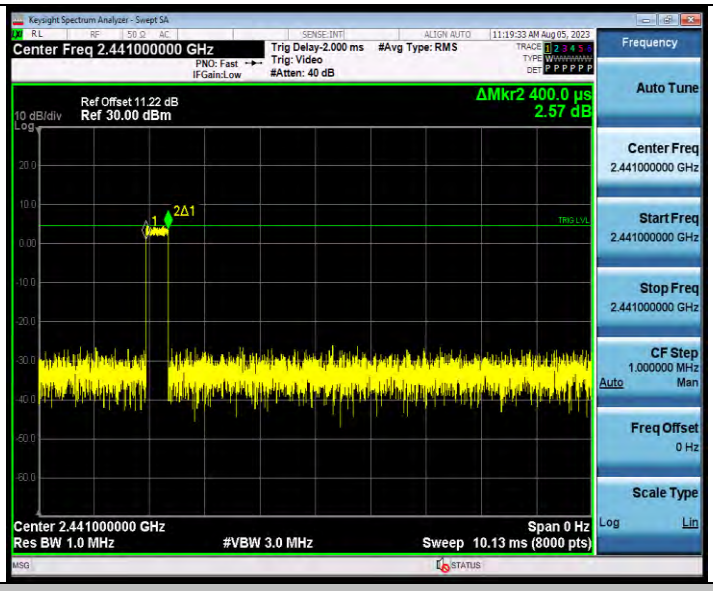


2DH3_Ant1_Hop



2DH5_Ant1_Hop

3DH1_Ant1_Hop



3DH3_Ant1_Hop

3DH5_Ant1_Hop

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
Trig Delay-2.000 ms
#Avg Type: RMS
Trig: Video
#Atten: 40 dB
11:18:11 AM Aug 05, 2023
Ref Offset 11.22 dB
10 dB/div
Ref 30.00 dBm
ΔMkr2 2.903 ms
21.25 dB
2Δ1
1
Center 2.441000000 GHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 3.0 MHz
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

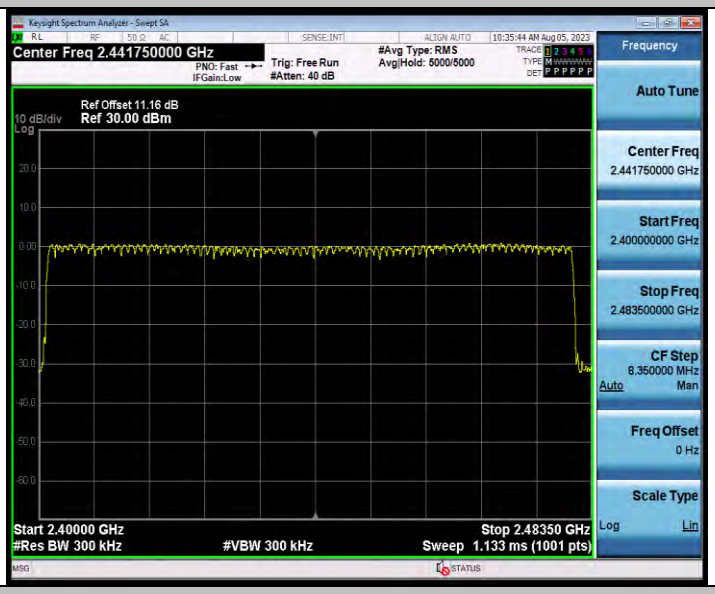
NUMBER OF HOPPING CHANNELS

TEST RESULT

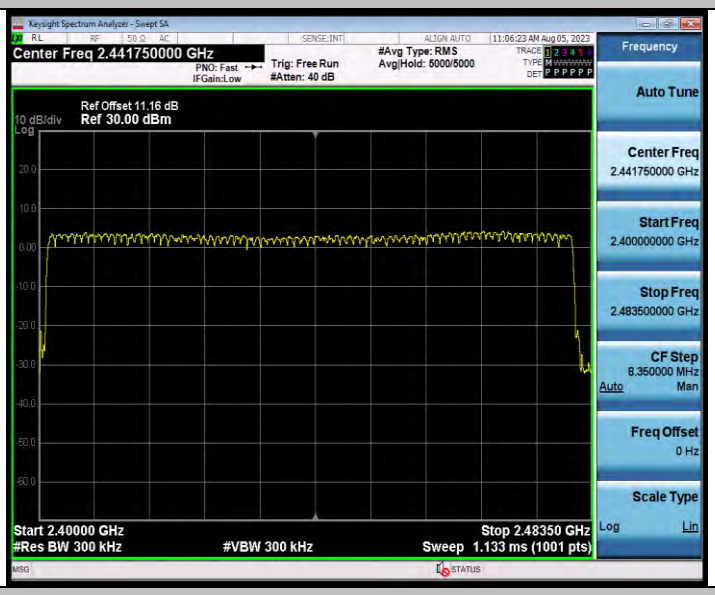
TestMode	Antenna	Frequency[MHz]	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Hop	79	≥15	PASS
2DH5	Ant1	Hop	79	≥15	PASS
3DH5	Ant1	Hop	79	≥15	PASS

TEST GRAPHS

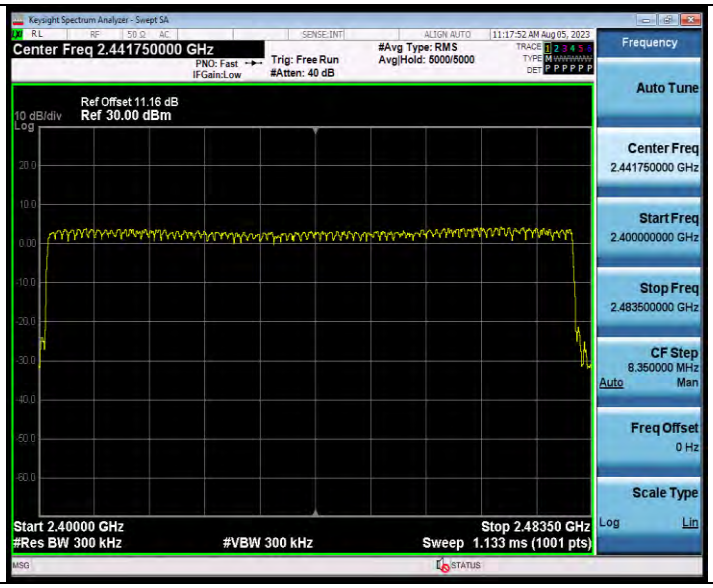
DH5_Ant1_Hop



2DH5_Ant1_Hop



3DH5_Ant1_Hop


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441750000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 5000/5000
11:17:52 AM Aug 05, 2023
Ref Offset 11.16 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

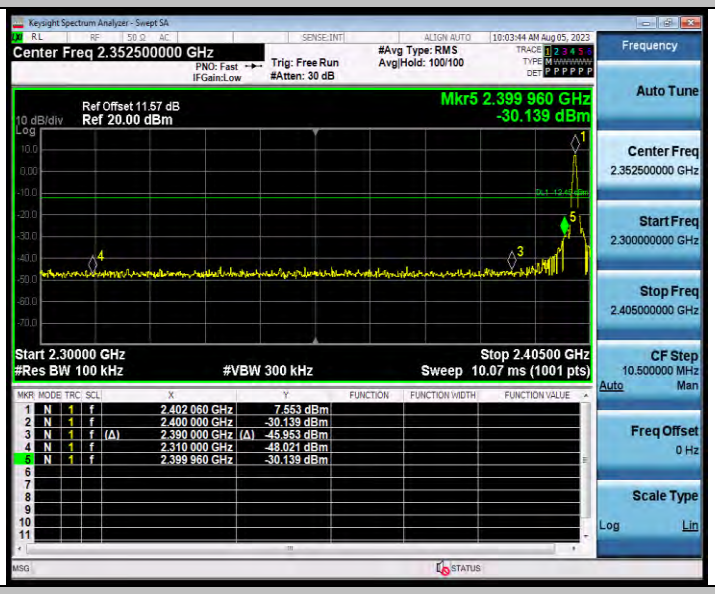
BAND EDGE MEASUREMENTS

TEST RESULT

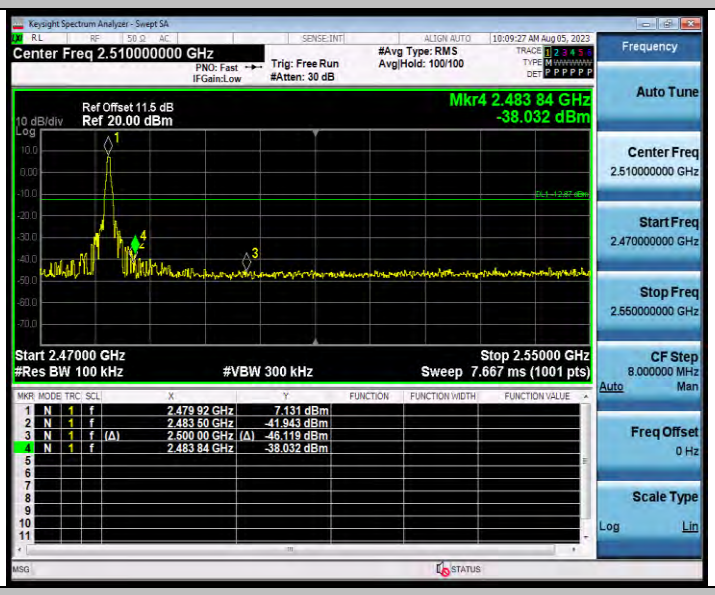
TestMode	Antenna	ChName	Frequency[MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	Low	2402	7.55	-30.14	≤-12.45	PASS
		High	2480	7.13	-38.03	≤-12.87	PASS
		Low	Hop_2402	-1.28	-43.76	≤-21.28	PASS
		High	Hop_2480	-1.79	-43.72	≤-21.79	PASS
2DH5	Ant1	Low	2402	1.46	-33.99	≤-18.54	PASS
		High	2480	1.98	-40.01	≤-18.02	PASS
		Low	Hop_2402	-0.02	-44.59	≤-20.02	PASS
		High	Hop_2480	2.25	-43.41	≤-17.75	PASS
3DH5	Ant1	Low	2402	1.84	-33.29	≤-18.16	PASS
		High	2480	1.65	-39.11	≤-18.35	PASS
		Low	Hop_2402	2.09	-44.36	≤-17.91	PASS
		High	Hop_2480	1.73	-43.84	≤-18.27	PASS

TEST GRAPHS

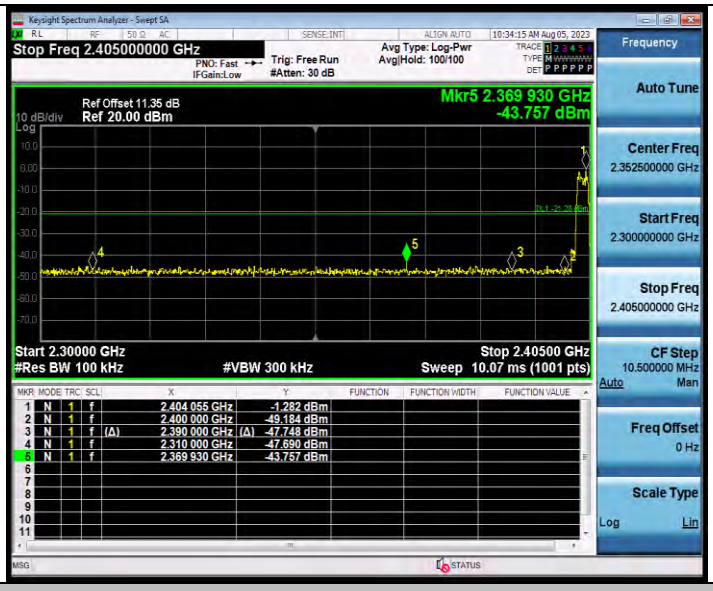
DH5_Ant1_Low_2402



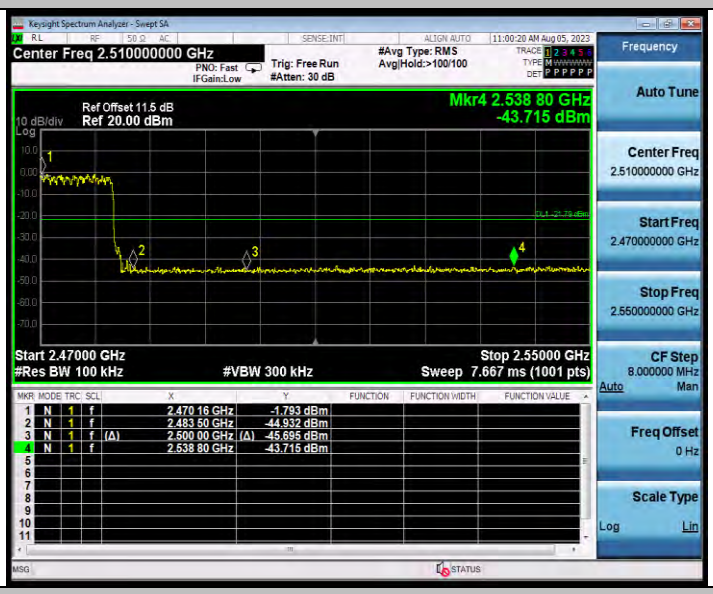
DH5_Ant1_High_2480



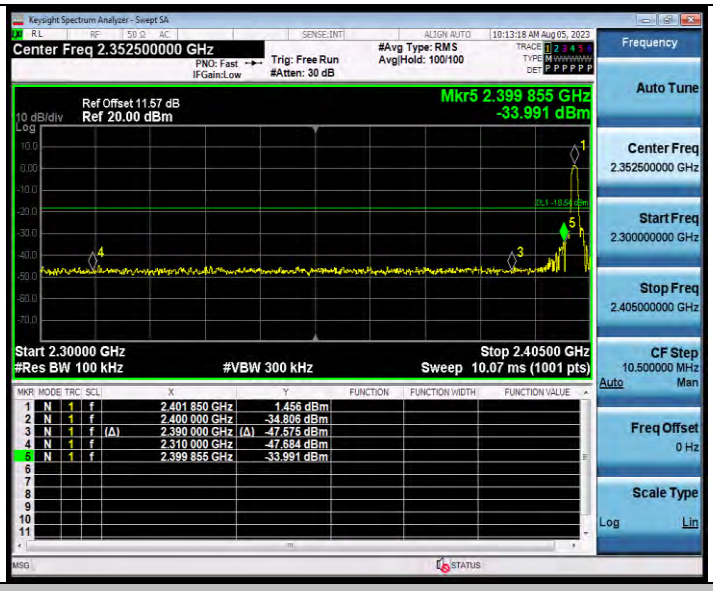
DH5_Ant1_Low_Hop_2402



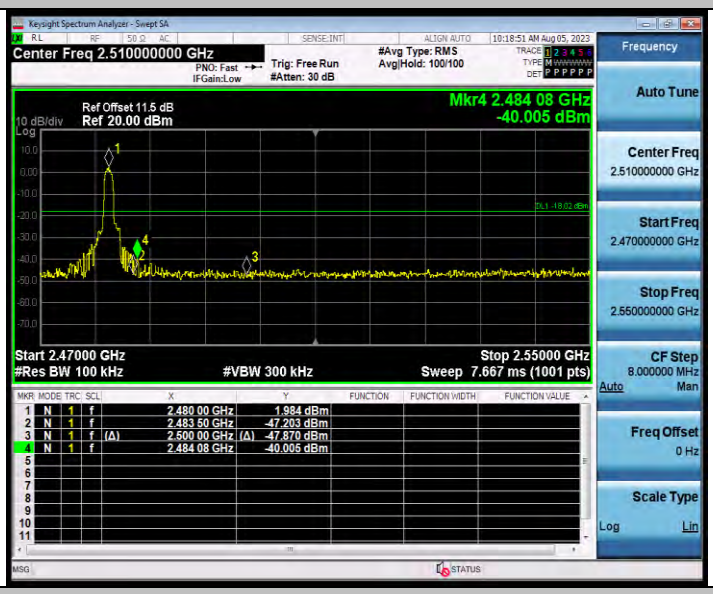
DH5_Ant1_High_Hop_2480



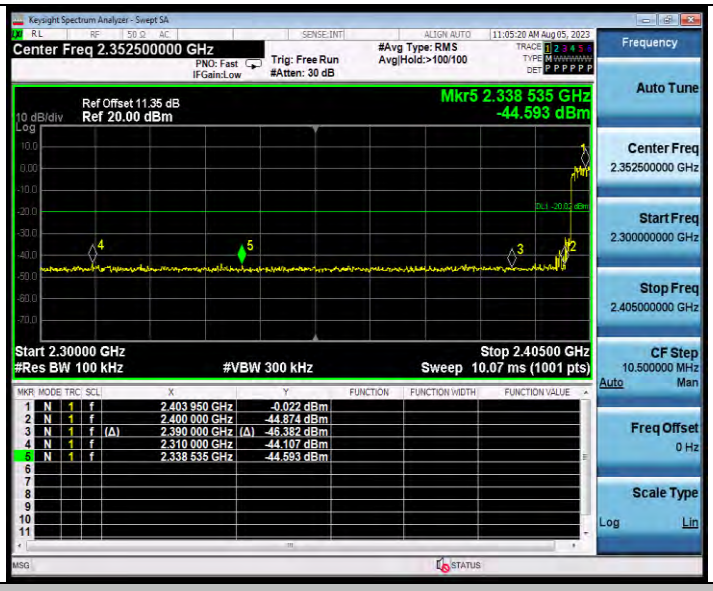
2DH5_Ant1_Low_2402



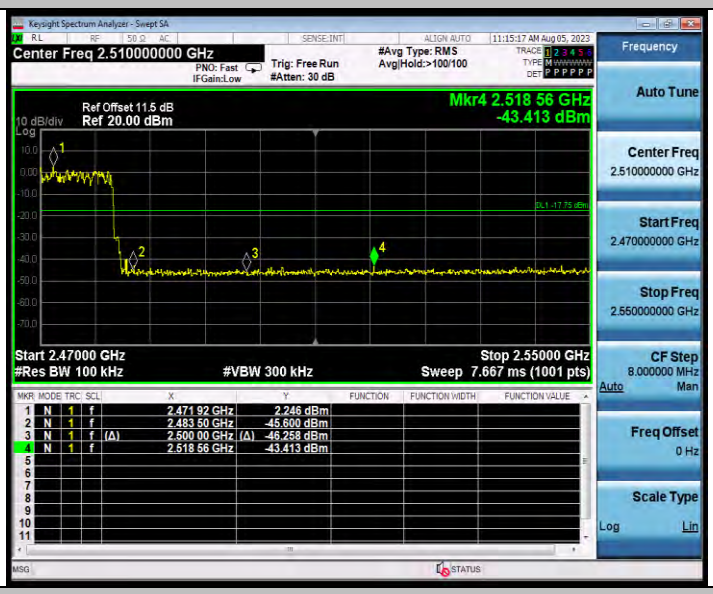
2DH5_Ant1_High_2480



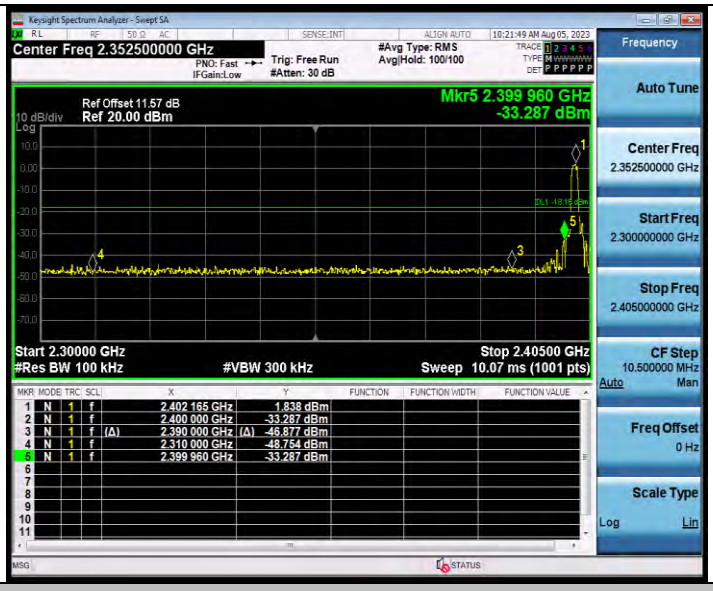
2DH5_Ant1_Low_Hop_2402



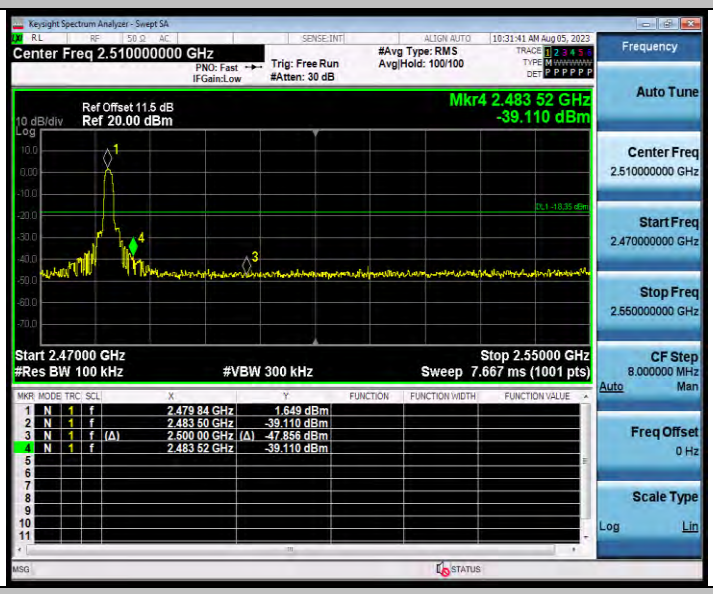
2DH5_Ant1_High_Hop_2480



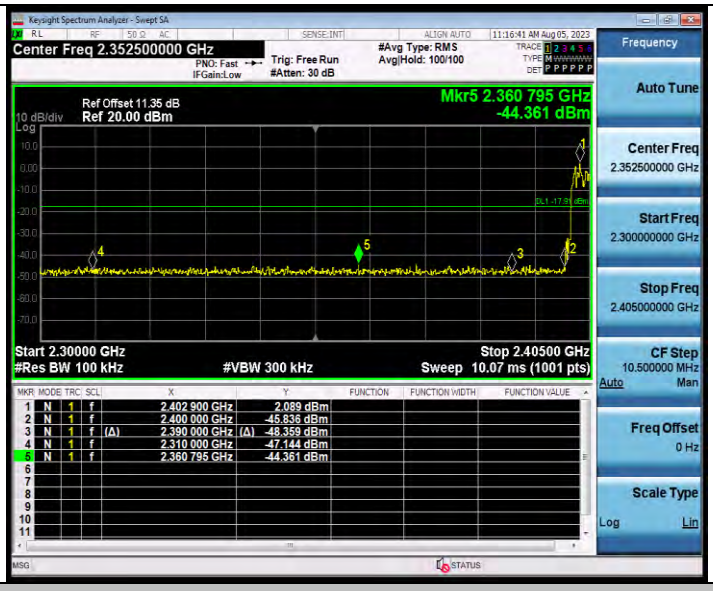
3DH5_Ant1_Low_2402



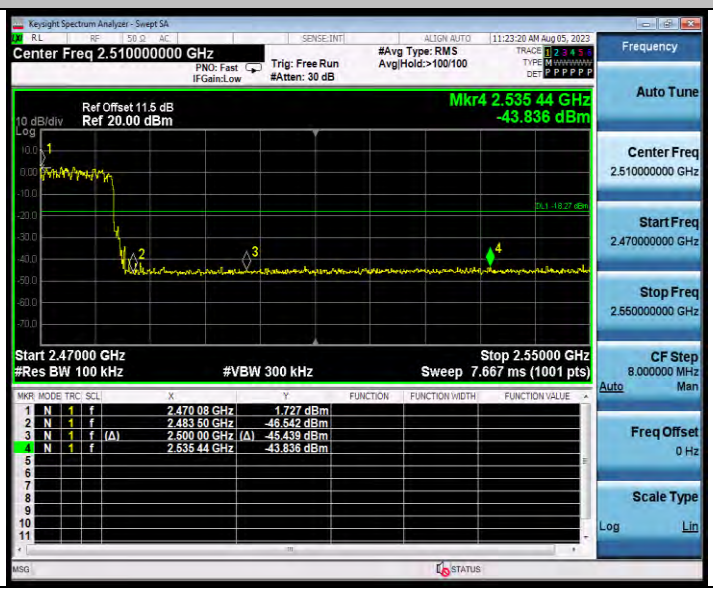
3DH5_Ant1_High_2480



3DH5_Ant1_Low_Hop_2402



3DH5_Ant1_High_Hop_2480



CONDUCTED SPURIOUS EMISSION

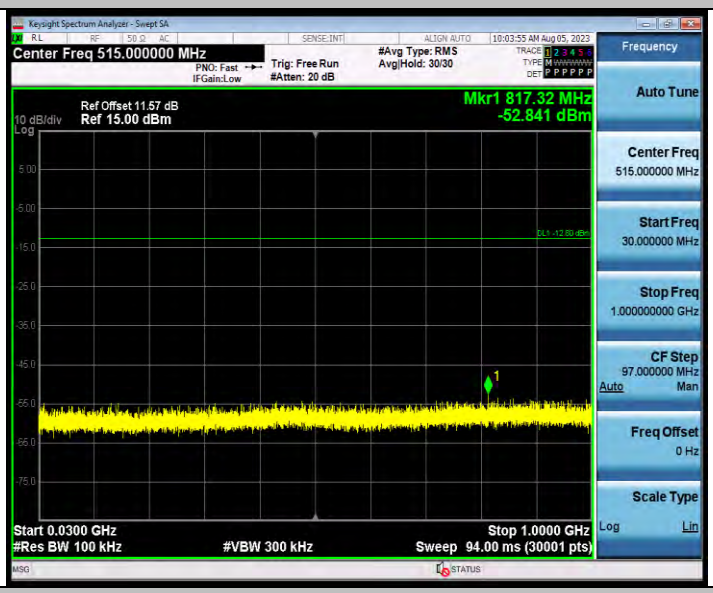
TEST RESULT

TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	Reference	7.20	7.20	---	PASS
			30~1000	7.20	-52.84	≤-12.8	PASS
			1000~26500	7.20	-33.62	≤-12.8	PASS
		2441	Reference	6.07	6.07	---	PASS
			30~1000	6.07	-53.77	≤-13.93	PASS
			1000~26500	6.07	-33.77	≤-13.93	PASS
		2480	Reference	6.62	6.62	---	PASS
			30~1000	6.62	-52.88	≤-13.38	PASS
			1000~26500	6.62	-34.25	≤-13.38	PASS
2DH5	Ant1	2402	Reference	0.53	0.53	---	PASS
			30~1000	0.53	-53.53	≤-19.47	PASS
			1000~26500	0.53	-34.51	≤-19.47	PASS
		2441	Reference	0.51	0.51	---	PASS
			30~1000	0.51	-53.93	≤-19.49	PASS
			1000~26500	0.51	-33.51	≤-19.49	PASS
		2480	Reference	0.76	0.76	---	PASS
			30~1000	0.76	-52.89	≤-19.24	PASS
			1000~26500	0.76	-33.69	≤-19.24	PASS
3DH5	Ant1	2402	Reference	1.90	1.90	---	PASS
			30~1000	1.90	-53.25	≤-18.1	PASS
			1000~26500	1.90	-32.19	≤-18.1	PASS
		2441	Reference	0.82	0.82	---	PASS
			30~1000	0.82	-51.7	≤-19.18	PASS
			1000~26500	0.82	-34.7	≤-19.18	PASS
		2480	Reference	1.43	1.43	---	PASS
			30~1000	1.43	-52.99	≤-18.57	PASS
			1000~26500	1.43	-33.42	≤-18.57	PASS

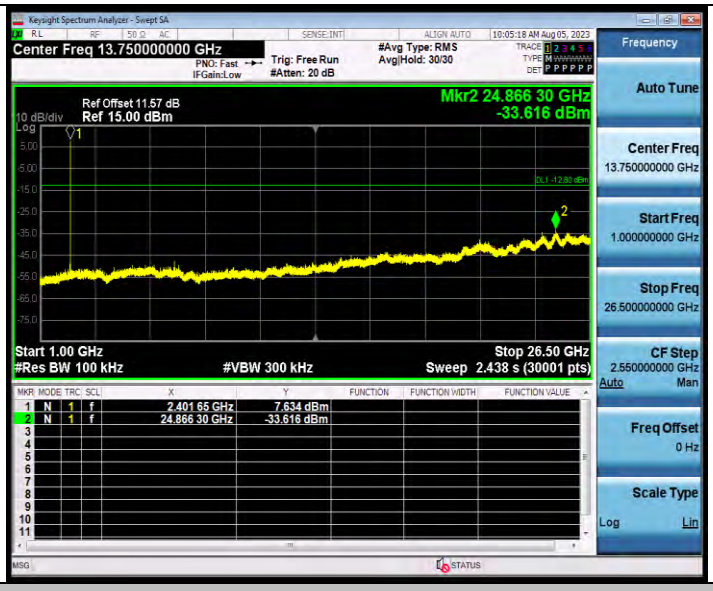
TEST GRAPHS

DH5_Ant1_2402_0~Reference

DH5_Ant1_2402_30~1000

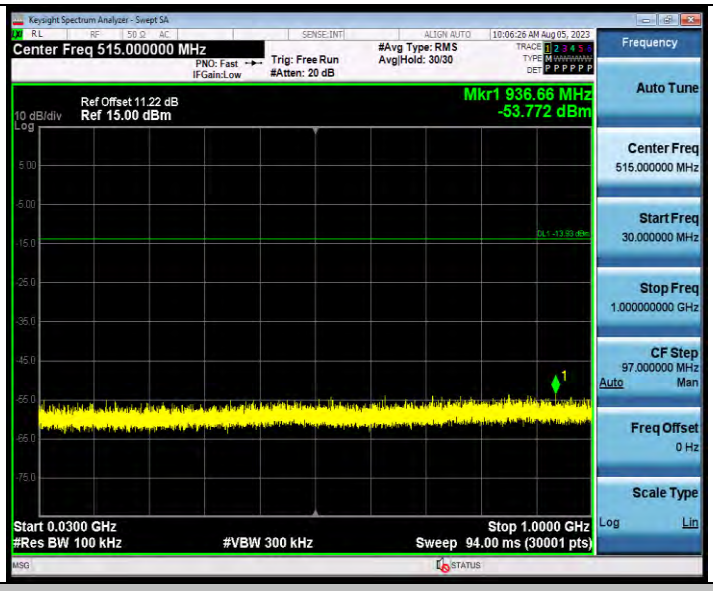


DH5_Ant1_2402_1000~26500

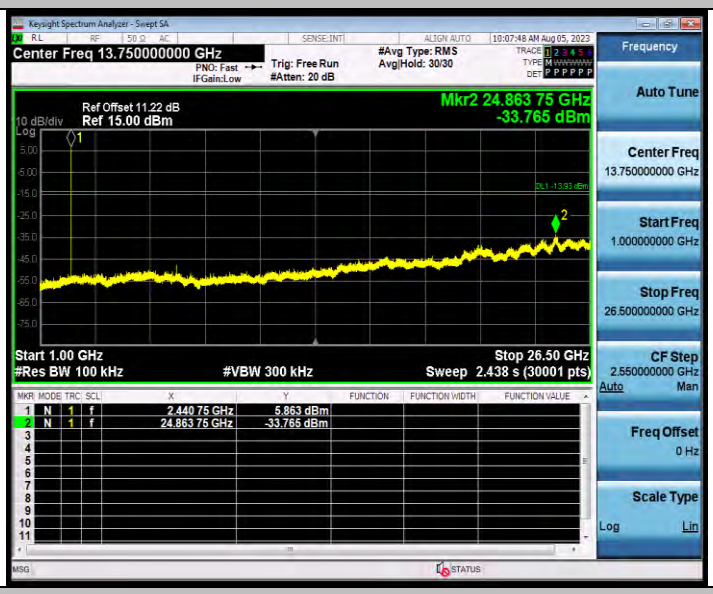


DH5_Ant1_2441_0~Reference

DH5_Ant1_2441_30~1000

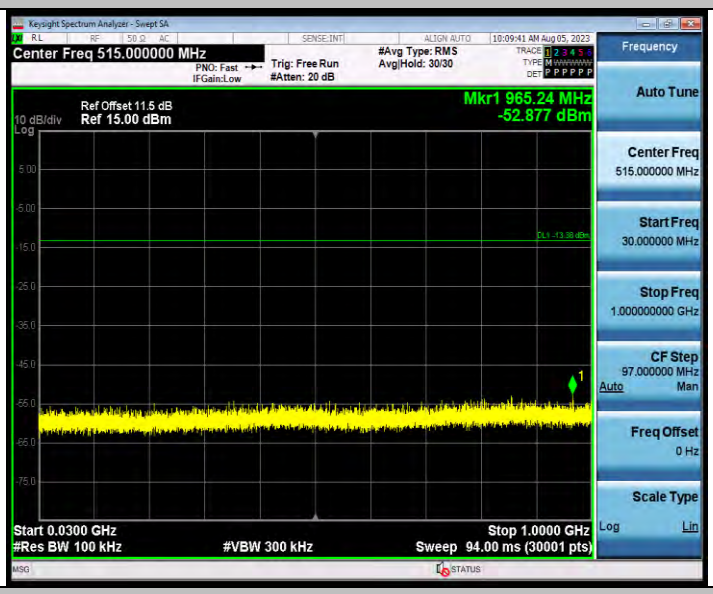


DH5_Ant1_2441_1000~26500

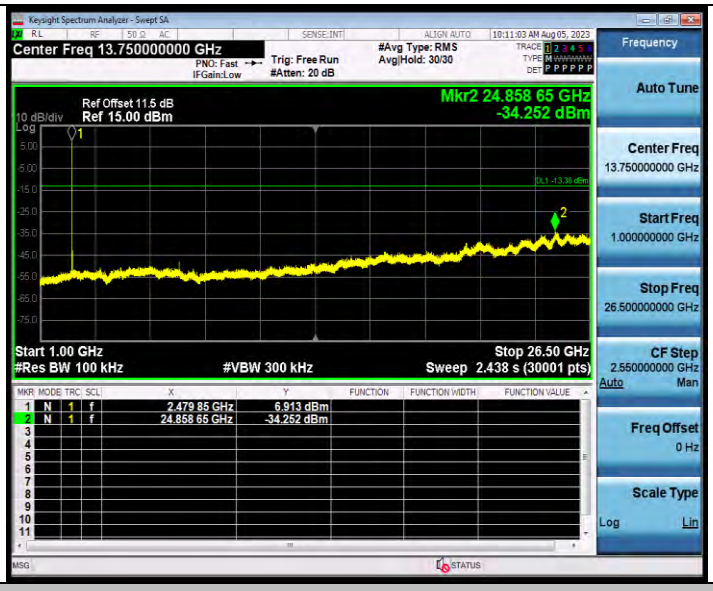


DH5_Ant1_2480_0~Reference

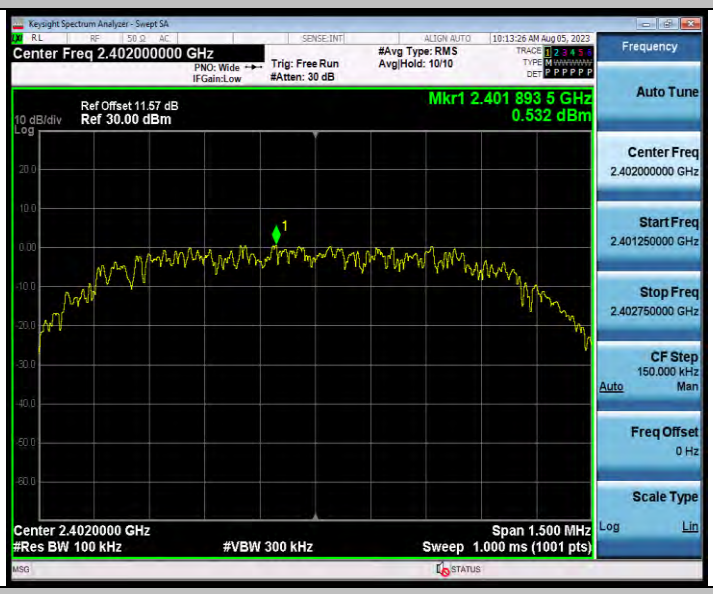
DH5_Ant1_2480_30~1000



DH5_Ant1_2480_1000~26500

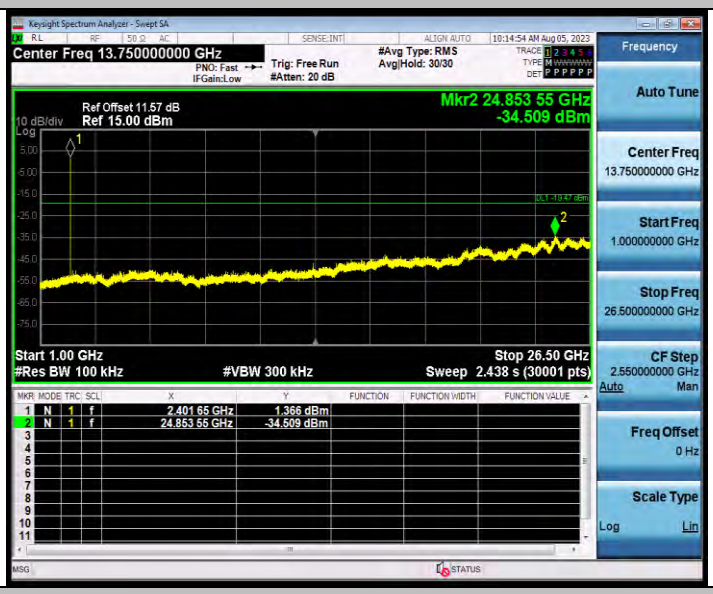


2DH5_Ant1_2402_0~Reference

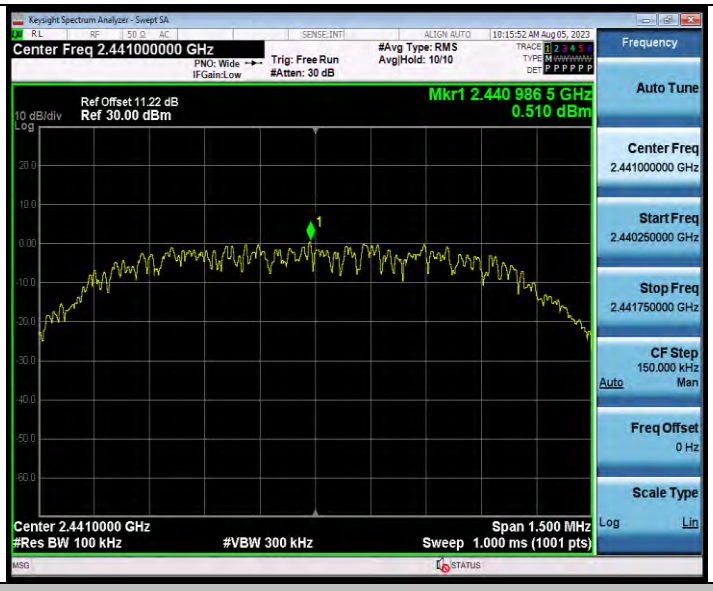


2DH5_Ant1_2402_30~1000

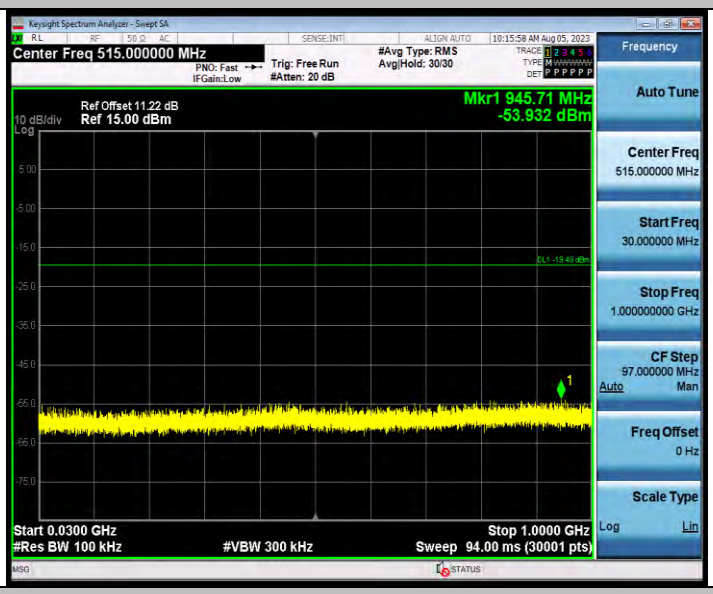
2DH5_Ant1_2402_1000~26500



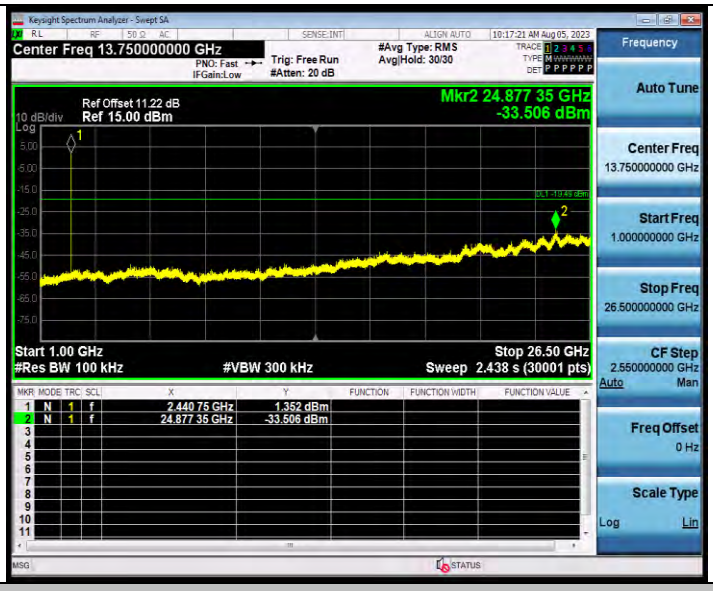
2DH5_Ant1_2441_0~Reference



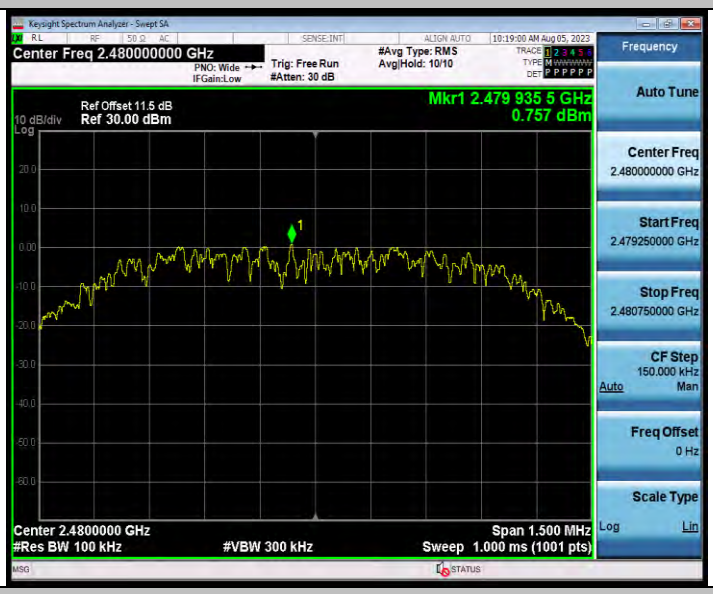
2DH5_Ant1_2441_30~1000



2DH5_Ant1_2441_1000~26500

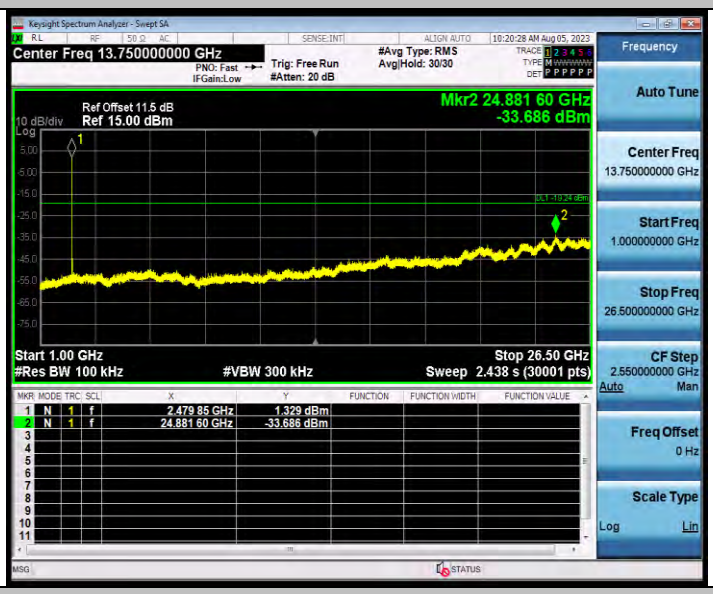


2DH5_Ant1_2480_0~Reference

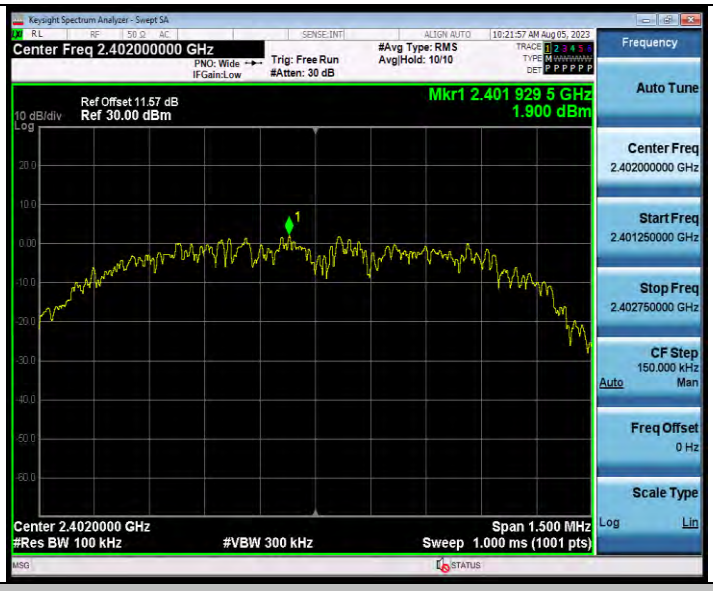


2DH5_Ant1_2480_30~1000

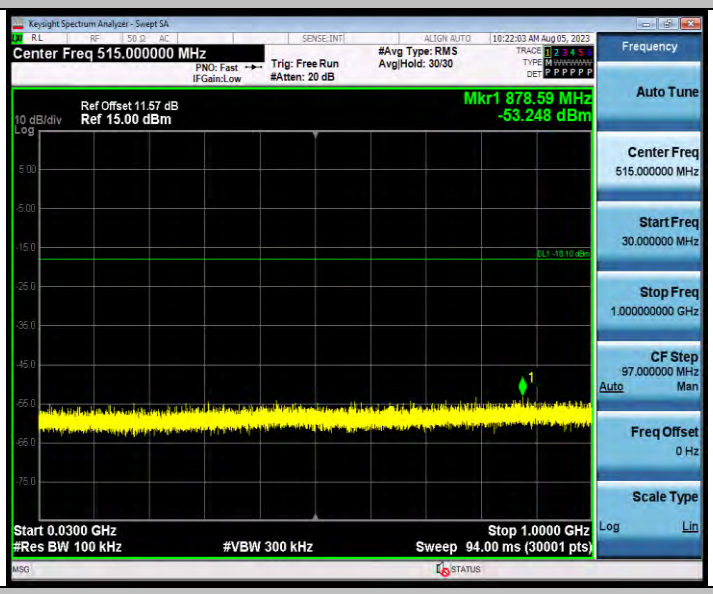
2DH5_Ant1_2480_1000~26500



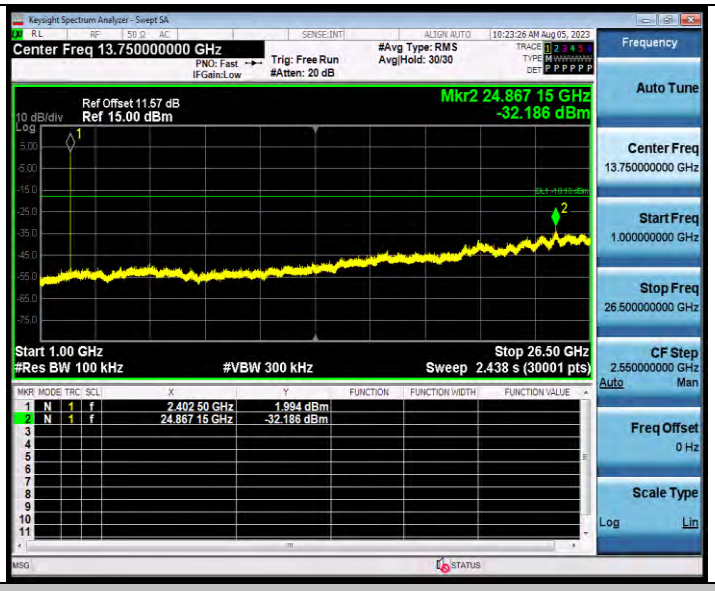
3DH5_Ant1_2402_0~Reference



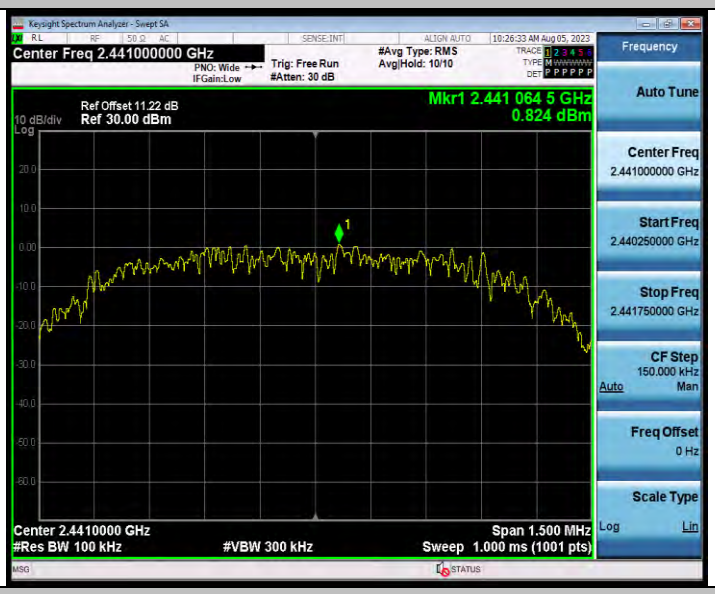
3DH5_Ant1_2402_30~1000



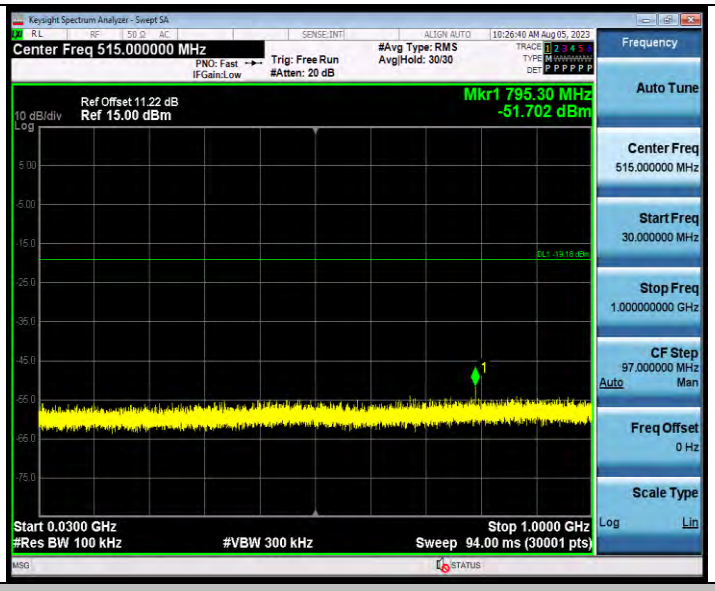
3DH5_Ant1_2402_1000~26500



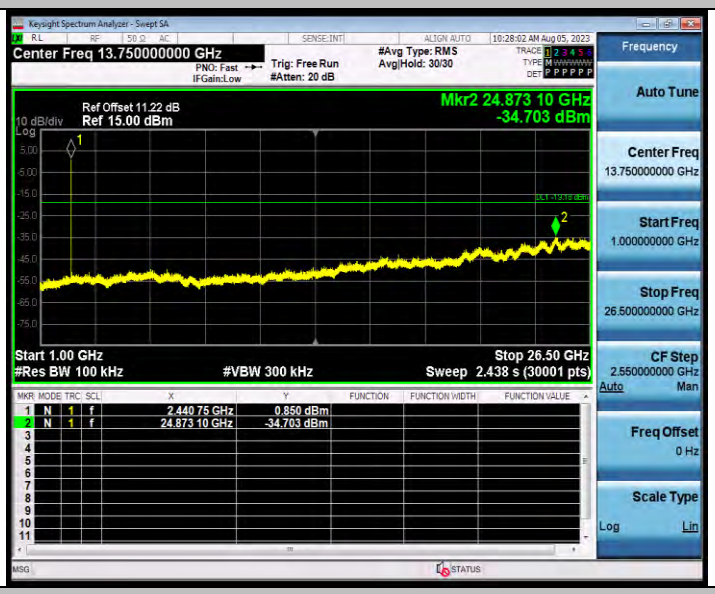
3DH5_Ant1_2441_0~Reference



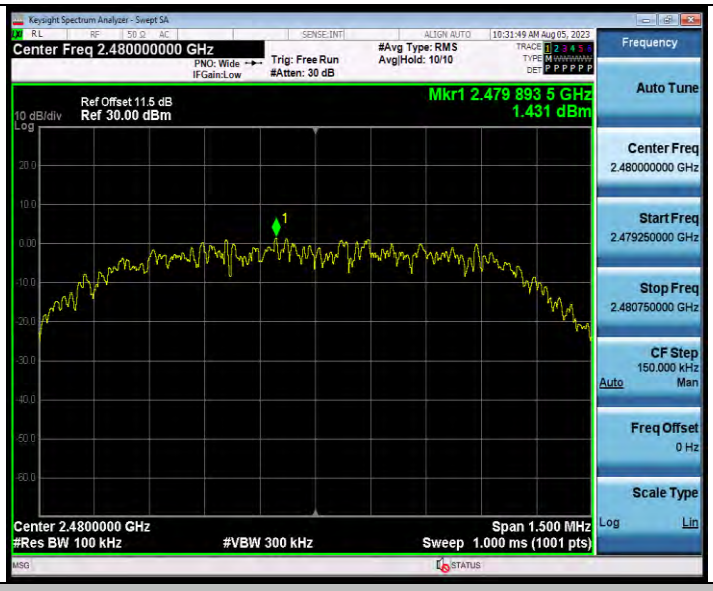
3DH5_Ant1_2441_30~1000



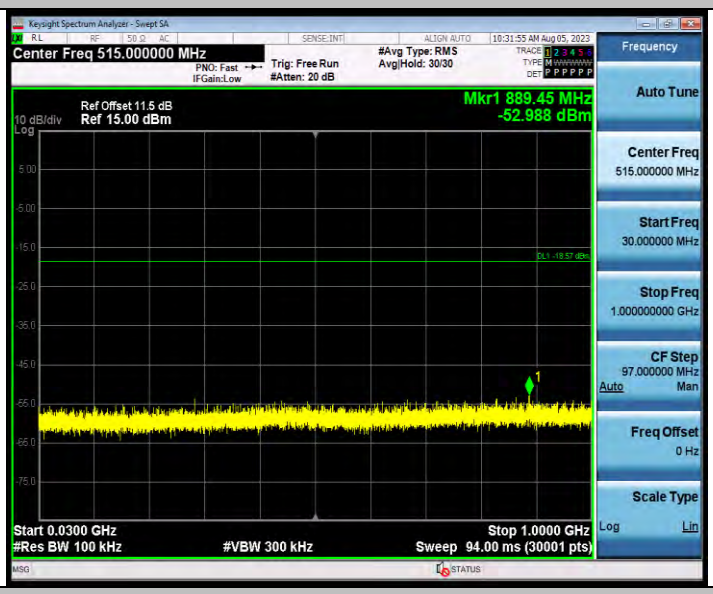
3DH5_Ant1_2441_1000~26500



3DH5_Ant1_2480_0~Reference



3DH5_Ant1_2480_30~1000



3DH5_Ant1_2480_1000~26500

Keysight Spectrum Analyzer - Swept SA
Center Freq 13.750000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 30/30
10:33:17 AM Aug 05, 2023
Ref Offset 11.5 dB
10 dB/div
Ref 15.00 dBm
Mkr2 24.869 70 GHz
-33.416 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 1.451 dBm
2 N 1 f 24.869 70 GHz -33.416 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

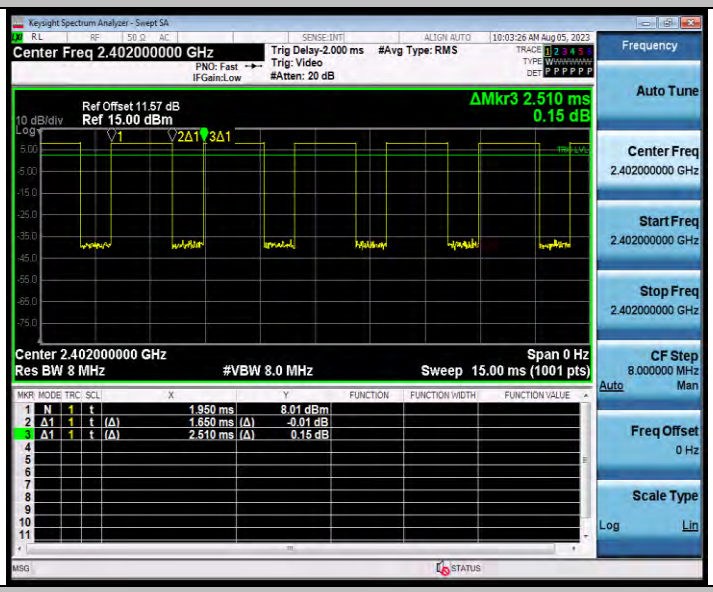
DUTY CYCLE

TEST RESULT

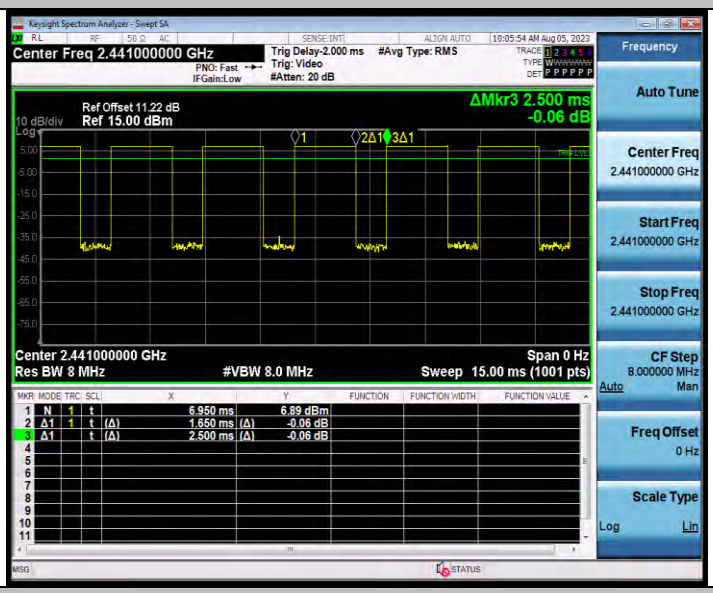
TestMode	Antenna	Frequency[MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor[dB]
DH5	Ant1	2402	1.65	2.51	65.74	1.82
		2441	1.65	2.50	66.00	1.80
		2480	1.65	2.51	65.74	1.82
2DH5	Ant1	2402	1.65	2.51	65.74	1.82
		2441	1.65	2.50	66.00	1.80
		2480	1.65	2.50	66.00	1.80
3DH5	Ant1	2402	1.65	2.50	66.00	1.80
		2441	1.65	2.51	65.74	1.82
		2480	1.65	2.51	65.74	1.82

TEST GRAPHS

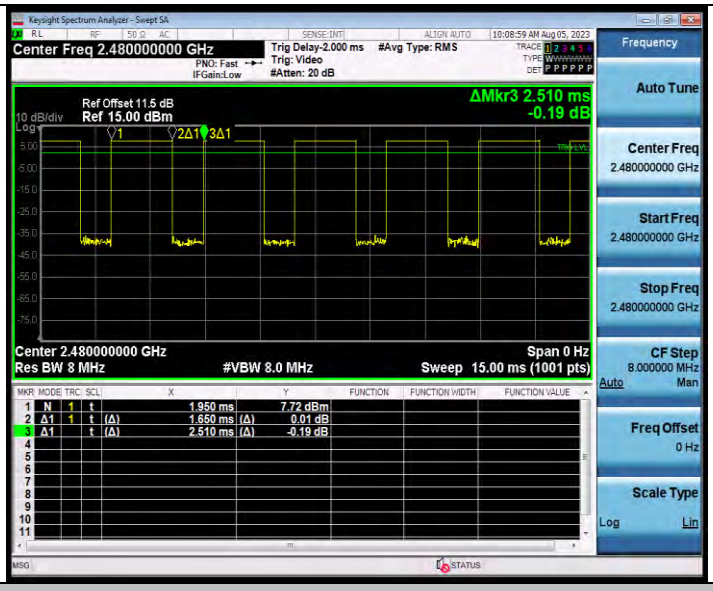
DH5_Ant1_2402



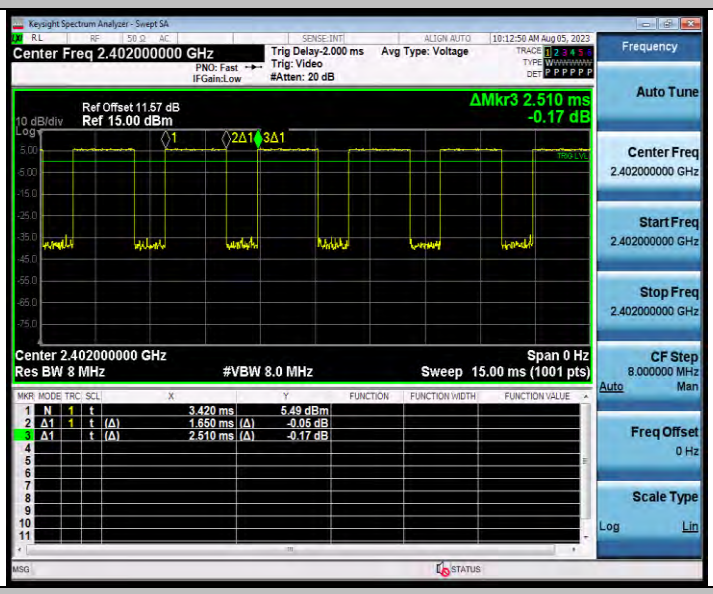
DH5_Ant1_2441



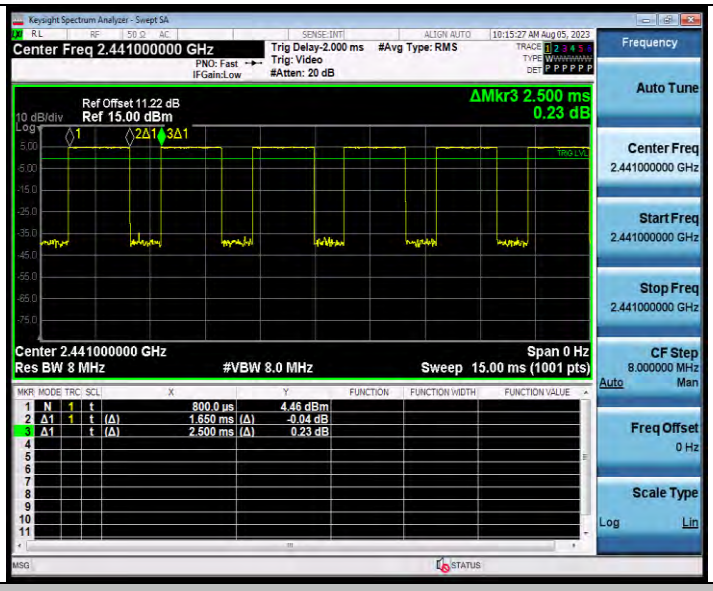
DH5_Ant1_2480



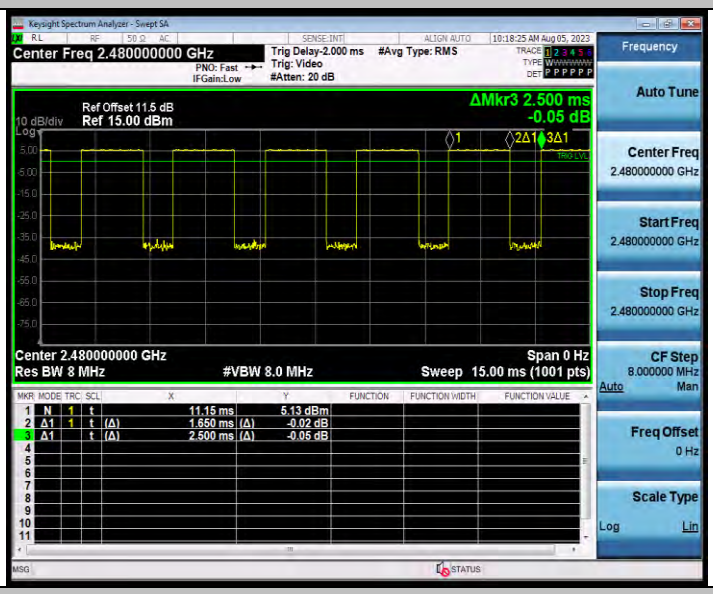
2DH5_Ant1_2402



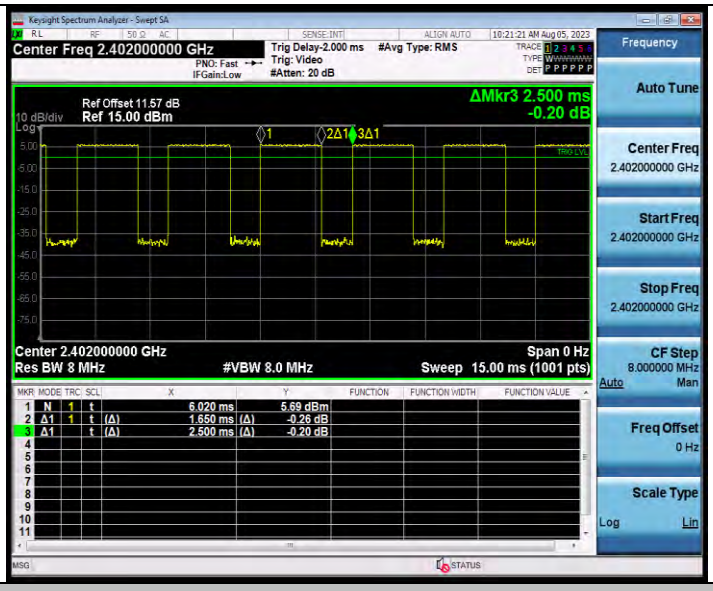
2DH5_Ant1_2441



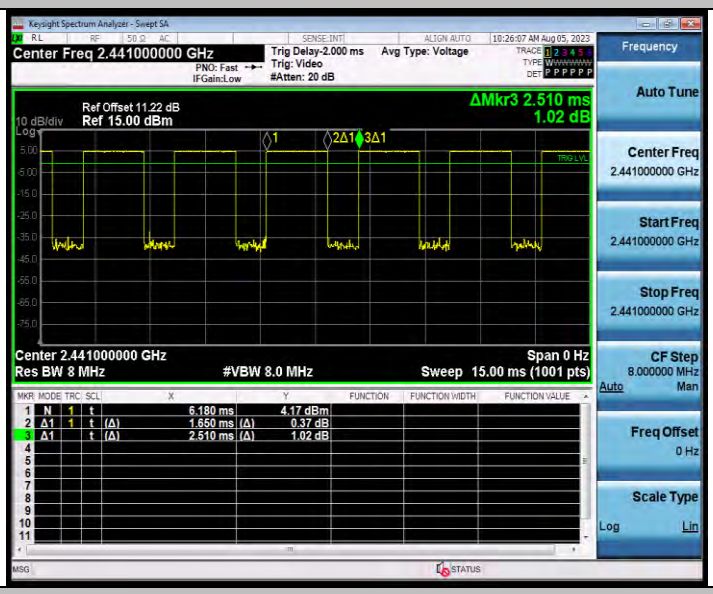
2DH5_Ant1_2480



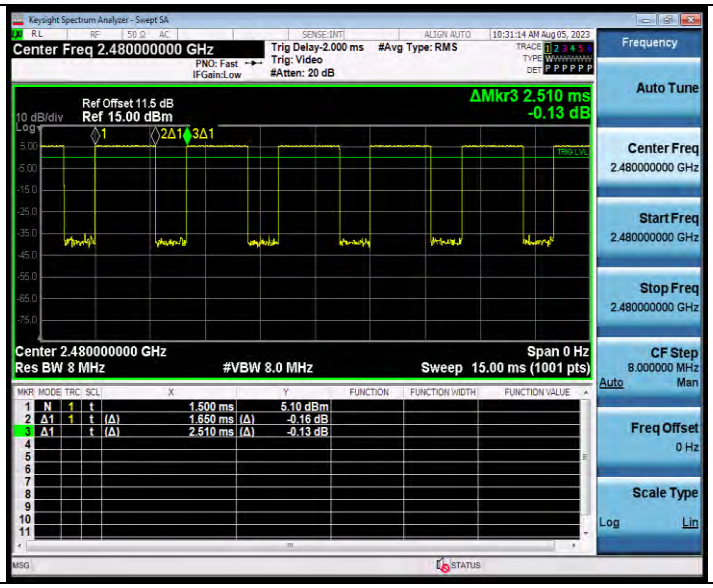
3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
Trig Delay-2.000 ms
#Avg Type: RMS
Trig: Video
#Atten: 20 dB
Ref Offset 11.5 dB
10 dB/div
Ref 15.00 dBm
ΔMkr3 2.510 ms
-0.13 dB
Center 2.480000000 GHz
Span 0 Hz
Res BW 8 MHz
#VBW 8.0 MHz
Sweep 15.00 ms (1001 pts)
1 N 1 t 1.500 ms 5.10 dBm
2 Δ1 1 t (Δ) 1.650 ms (Δ) -0.16 dB
3 Δ1 t (Δ) 2.510 ms (Δ) -0.13 dB
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.480000000 GHz
Stop Freq
2.480000000 GHz
CF Step
8.000000 MHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

--END--