

TEST REPORT

Applicant	Panasonic Corporation of North America
Address	Product Safety & Compliance Dept.Two Riverfront Plaza,9th floor Newark,NJ 07 102-5490

Manufacturer or Supplier	Dongguan Siyoto Electronics Co., Ltd.
Address	No.10, North 7th Street, Qiaotou Qiaodong Road, Qiaotou Town, Dongguan City, Guangdong Province, P.R.China
Product	Digital Wireless Stereo Earphones
Brand Name	Panasonic
Model	RZ-B110W
Additional Model & Model Difference	N/A
Date of tests	Nov. 11, 2022~ Nov. 23, 2022

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

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

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

Tested by Lucas Chen Project Engineer / EMC Department	Approved by Glyn He Assistant Manager / EMC Department
	 Date: Dec. 19, 2022

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Test Report No.: RF2211WDG0137

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF2211WDG0137	Original release	Dec. 19, 2022

1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	N/A	Power by Battery
15.247(a)(1)(iii)	Number of Hopping Frequency Used	PASS	Meet the requirement of limit.
15.247(a)(1)(iii)	Dwell Time on Each Channel	PASS	Meet the requirement of limit.
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit.
15.247(b)	Conducted Output Power	PASS	Meet the requirement of limit.
15.247(d)&15.209	Transmitter Radiated Emission	PASS	Meet the requirement of limit.
15.247(d)	Out of band Emission Measurement	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

2 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	FREQUENCY	UNCERTAINTY
Radiated emissions	9KHz ~ 30MHz	2.16dB
	30MHz ~ 1GMHz	3.47dB
	1GHz ~ 18GHz	4.84dB
	18GHz ~ 40GHz	4.67dB

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

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Digital Wireless Stereo Earphones
MODEL NO.	RZ-B110W
ADDITIONAL MODELS	N/A
FCC ID	ACJ-RZ-B110W
POWER SUPPLY	Charge case: Input: DC 5V from USB or DC 3.7V, 400mAh, 1.48Wh from battery; Output: DC 5V, 0.5A Each Headphones: Input: DC 5V from Charge case or DC 3.7V, 45mAh, 0.167Wh from battery
MODULATION TECHNOLOGY	FHSS
MODULATION TYPE	GFSK, $\pi/4$ DQPSK, 8DPSK
OPERATING FREQUENCY	2402MHz~2480MHz
NUMBER OF CHANNEL	79
OUTPUT POWER	-1.064dBm(PEAK); -1.438dBm(AVERAGE)
ANTENNA TYPE	Chip Antenna, 2.58dBi Gain
OTHER ACCESSORIES	N/A
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	Type Cable: 20cm, Unshielded, Detachable

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.
3. Please refer to the EUT photo document (Reference No.: 2211WDG0137) for detailed product photo.
4. This product has two Bluetooth Chips (distribute left earbud and right earbud), they are identical in RF circuitry and antenna except the Layout of partial components, all test items are carried out on left earbud and partial test for right earbud test Radiated Emission (Below 1GHz).
5. When the EUT in charging mode that RF function can't working.

3.2 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		

3.2.1. CONFIGURATION OF SYSTEM UNDER TEST

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

3.2.2. 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, power supply voltage range 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	
A	√	√	-	√	DC 3.7V from battery

Where **RE<1G**: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

RE≥1G: Radiated Emission above 1GHz

APCM: Antenna Port Conducted Measurement

NOTE: No need to concern of Conducted Emission due to the EUT is powered by battery.

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
A	0 to 78	39	FHSS	GFSK	DH5

For the test results, only the worst case was shown in test report.

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
A	0 to 78	0, 39, 78	FHSS	GFSK	DH5
	0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
A	0 to 78	0, 39, 78	FHSS	GFSK	DH5
	0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE (Notebook)	TESTED BY
RE<1G	24.5deg. C, 64%RH	DC 3.7V from Fully Battery	Jim
RE≥1G	24.5deg. C, 64%RH	DC 3.7V from Fully Battery	Jim
APCM	24.5deg. C, 64%RH	DC 3.7V from Fully Battery	Jim

3.3 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

KDB 558074 D01 15.247 Meas Guidance v05r02

ANSI C63.10-2013

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

3.4 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	Notebook	DELL	Latitude 5300	00426-OEM-8992662-00006	N/A
2	Notebook	HUAWEI	NbD-WFH9	EUEPM21725002655	N/A

NO.	DESCRIPTCION OF THE ABOVE SUPPORT UNITS
1	USB extension cord 1.0m

4 TEST TYPES AND RESULTS

4.1. RADIATED EMISSION AND BANDEDGE MEASUREMENT

4.1.1 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.

4.1.2 TEST INSTRUMENTS

FREQUENCY RANGE BELOW 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Next Cal. Date
EMI Test Receiver (10kHz~7GHz)	Rohde&Schwarz	ESR 7	100962	2023-01-13
Broadband antenna (25MHz~2500MHz)	Schwarzbeck	VULB 9168	00937	2023-04-15*
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2023-01-13
Signal Amplifier (30MHz~1000MHz)	Com-power	PAM-103	18020051	2023-08-25
Attenuator	R&S	TS2GA-6dB	18101101	N/A
Test software	EZ	EZ EMC V1.1.4.2	N/A	N/A

NOTES: 1. The test was performed in 966 Chamber(Hwa-Hsing (Dongguan) Testing Co., Ltd).
2. The calibration interval of the above test instruments is 12 months / *24 months.
And the calibrations are traceable to CEPREI/CHINA.

FREQUENCY RANGE ABOVE 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Next Cal. Date
Horn Antenna (1GHz-18GHz)	Schwarzbeck	BBHA 9120D	01959	2024-05-04
Broadband Coaxial Preamplifier (1GHz-18GHz)	Schwarzbeck	BBV 9718	25	2023-01-14
Spectrum Analyzer	Rohde&Schwarz	FSV-40N	101783	2023-01-13
Horn Antenna (18GHz-40GHz)	Schwarzbeck	BBHA 9170	BBHA9170242	2023-04-10*
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	2023-01-12
High pass filter	Micro-Tronics	HPM50107	G050	2023-08-25
High pass filter	Micro-Tronics	HPM50117	G007	2023-08-25
Test software	EZ	EZ EMC V1.1.4.2	N/A	N/A
Spectrum (10kHz~26.5GHz)	Keysight	N9020A	MY51240612	2023-08-25

NOTES: 1. The test was performed in 966 Chamber(Hwa-Hsing (Dongguan) Testing Co., Ltd).
2. The calibration interval of the above test instruments is 12 months / *24 months. And
the calibrations are traceable to CEPREI/CHINA.

4.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 1.5 meters (above 1GHz) and 0.8 meters (below 1GHz) above the ground at a 3 meters semi-anechoic chamber. 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. For below 1GHz was used bilog antenna, and above 1GHz was used horn 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. For below 30MHz, a loop antenna with its vertical plane is placed 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1.3m above the ground.
- g. 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 performed using fresh batteries. The turntable was rotated to maximize the emission level.

NOTE:

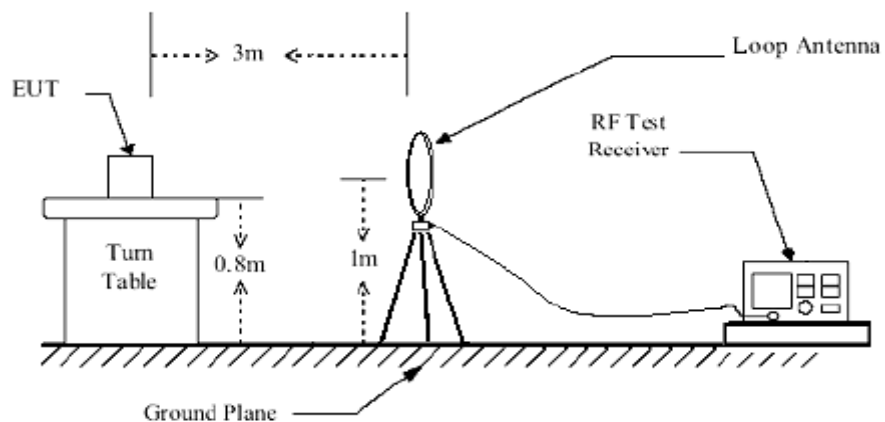
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz (Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The testing of the EUT was performed on all 3 orthogonal axes; the worst-case test configuration was reported on the file test setup photo.

4.1.4 DEVIATION FROM TEST STANDARD

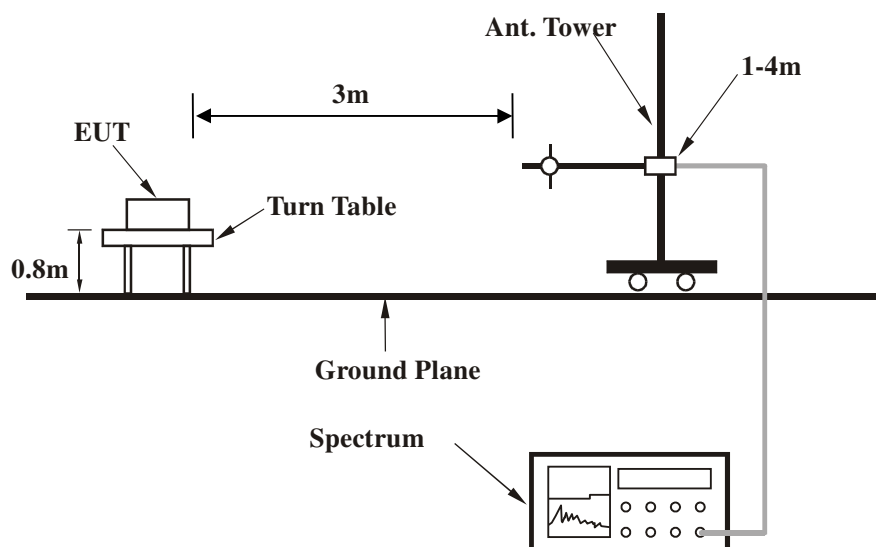
No deviation.

4.1.5 TEST SETUP

Below 30MHz test setup

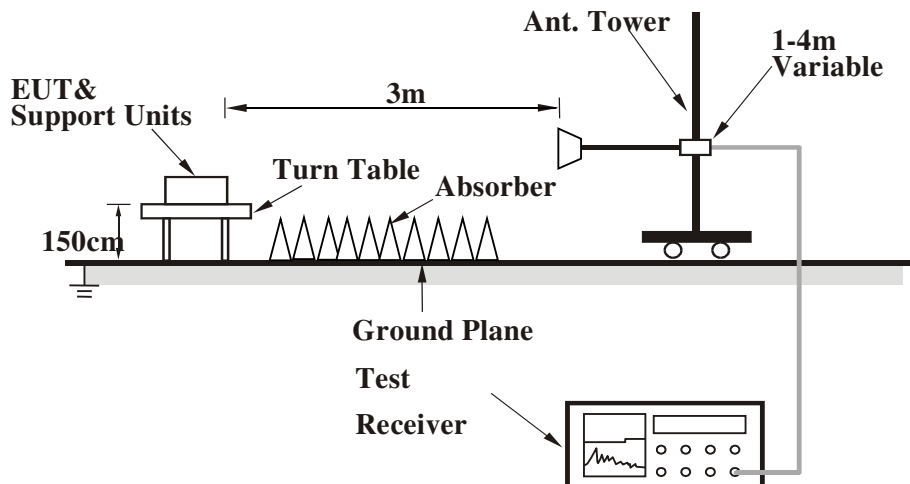


Below 1GHz test setup



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

Above 1GHz test setup



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

4.1.6 EUT OPERATING CONDITIONS

- Set the EUT under full load condition and placed them on a testing table.
- Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the EUT in full functions.

4.1.7 TEST RESULTS

Left

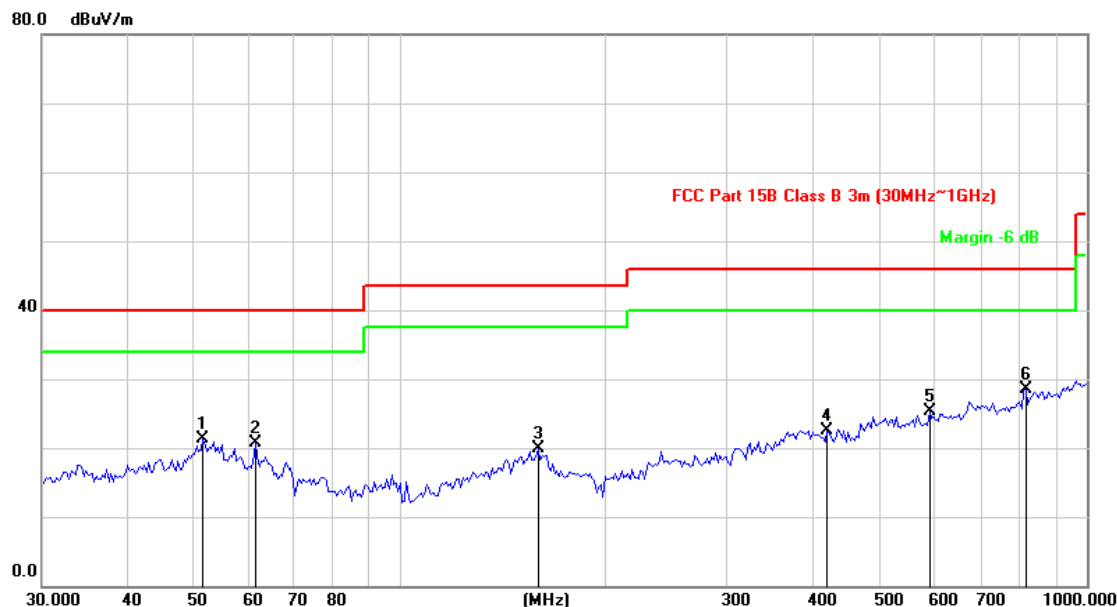
BELOW 1GHz WORST-CASE DATA:

CHANNEL	Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)
1	51.5363	42.33	-21.12	21.21	40.00	-18.79	peak	100	165
2	61.4343	42.95	-22.20	20.75	40.00	-19.25	peak	200	210
3	158.6400	39.96	-19.99	19.97	43.50	-23.53	peak	300	188
4	418.3783	37.77	-15.21	22.56	46.00	-23.44	peak	200	233
5	590.3509	36.52	-11.12	25.40	46.00	-20.60	peak	300	165
6 *	815.6352	36.34	-7.84	28.50	46.00	-17.50	peak	200	125

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. 9KHz~30MHz have been test and test data more than 20dB margin.
5. Margin value = Emission level – Limit value

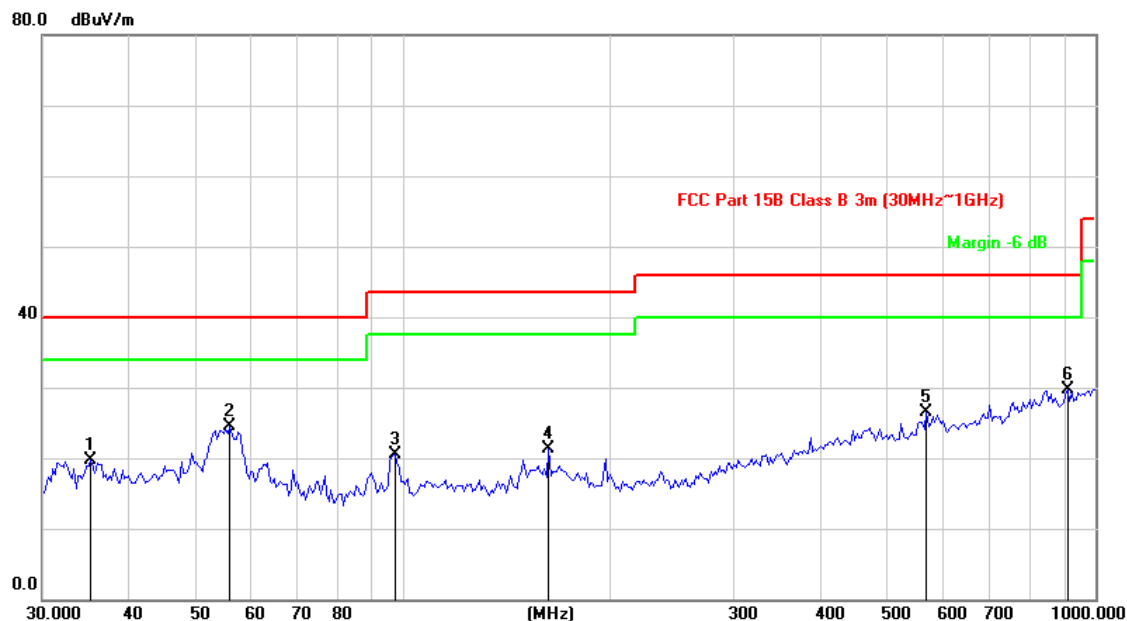


CHANNEL	Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)
1	35.2625	41.14	-21.34	19.80	40.00	-20.20	peak	100	136
2 *	56.0707	46.16	-21.61	24.55	40.00	-15.45	peak	100	255
3	97.0023	44.92	-24.33	20.59	43.50	-22.91	peak	200	108
4	162.0197	41.35	-20.12	21.23	43.50	-22.27	peak	100	22
5	569.9687	37.90	-11.42	26.48	46.00	-19.52	peak	200	51
6	912.6951	36.11	-6.48	29.63	46.00	-16.37	peak	300	232

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. 9KHz~30MHz have been test and test data more than 20dB margin.
5. Margin value = Emission level – Limit value



Right

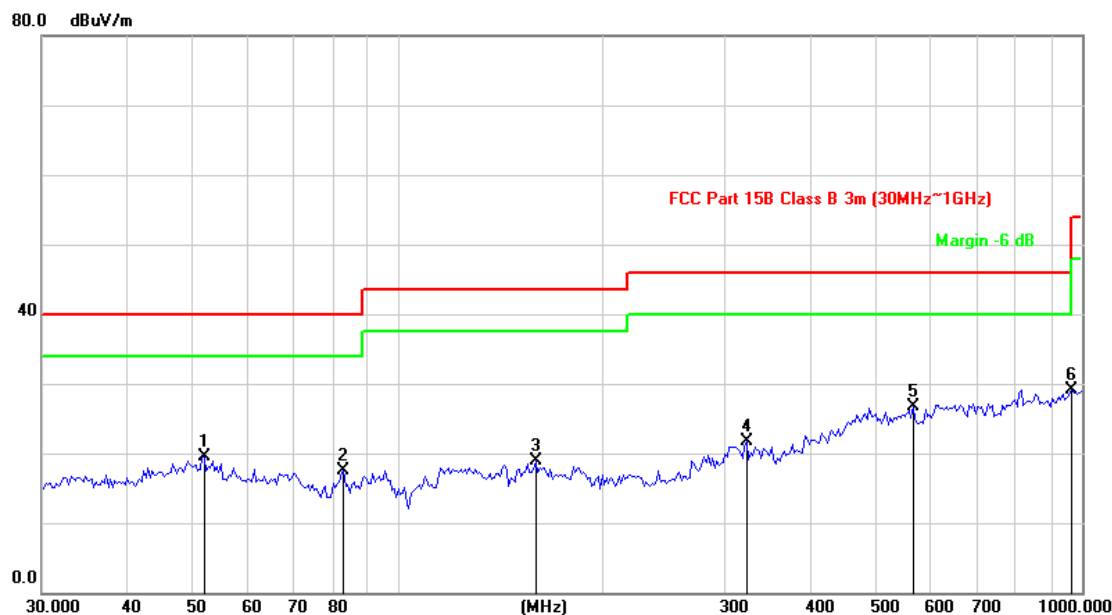
BELOW 1GHz WORST-CASE DATA:

CHANNEL	Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)
1	51.9000	40.69	-21.16	19.53	40.00	-20.47	peak	300	254
2	83.1076	42.60	-25.17	17.43	40.00	-22.57	peak	200	125
3	158.6400	38.96	-19.99	18.97	43.50	-24.53	peak	200	198
4	322.5896	39.88	-18.19	21.69	46.00	-24.31	peak	100	332
5 *	565.9776	38.18	-11.48	26.70	46.00	-19.30	peak	100	55
6	965.4741	34.54	-5.42	29.12	54.00	-24.88	peak	200	210

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. 9KHz~30MHz have been test and test data more than 20dB margin.
5. Margin value = Emission level – Limit value

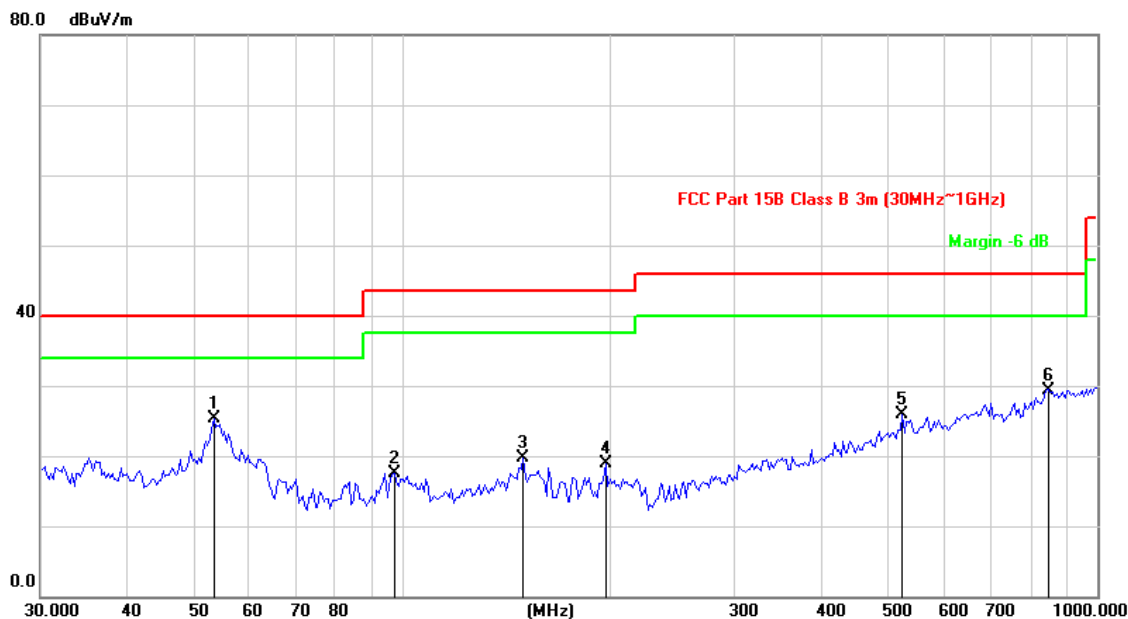


CHANNEL	Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)
1 *	53.3793	46.63	-21.32	25.31	40.00	-14.69	peak	100	185
2	97.0023	41.92	-24.33	17.59	43.50	-25.91	peak	300	132
3	148.9173	40.06	-20.38	19.68	43.50	-23.82	peak	200	321
4	195.8701	41.66	-22.80	18.86	43.50	-24.64	peak	200	221
5	523.8763	38.13	-12.14	25.99	46.00	-20.01	peak	100	65
6	850.7603	36.78	-7.38	29.40	46.00	-16.60	peak	100	158

REMARKS:

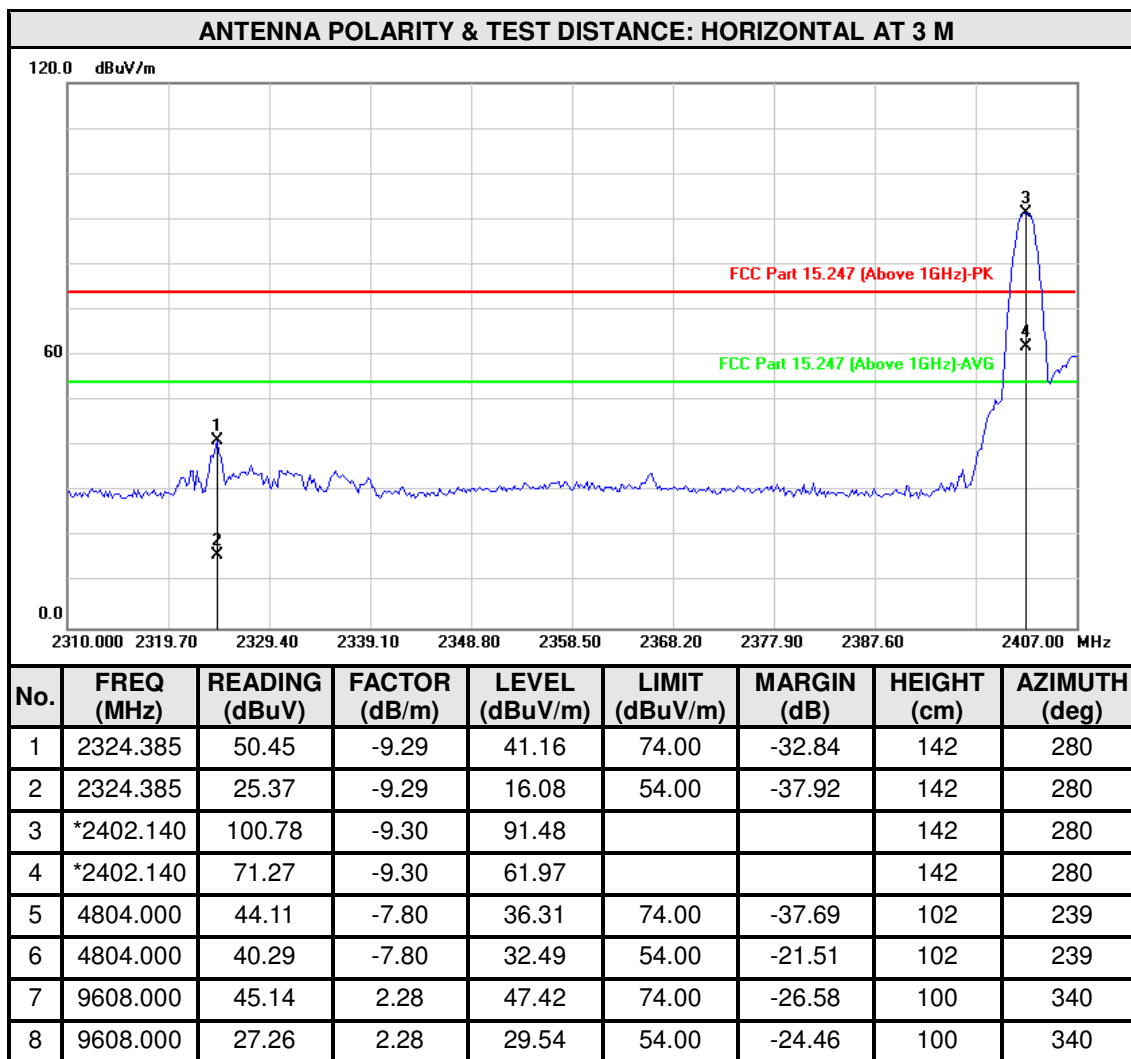
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. 9KHz~30MHz have been test and test data more than 20dB margin.
5. Margin value = Emission level – Limit value



ABOVE 1GHz DATA

BT_GFSK

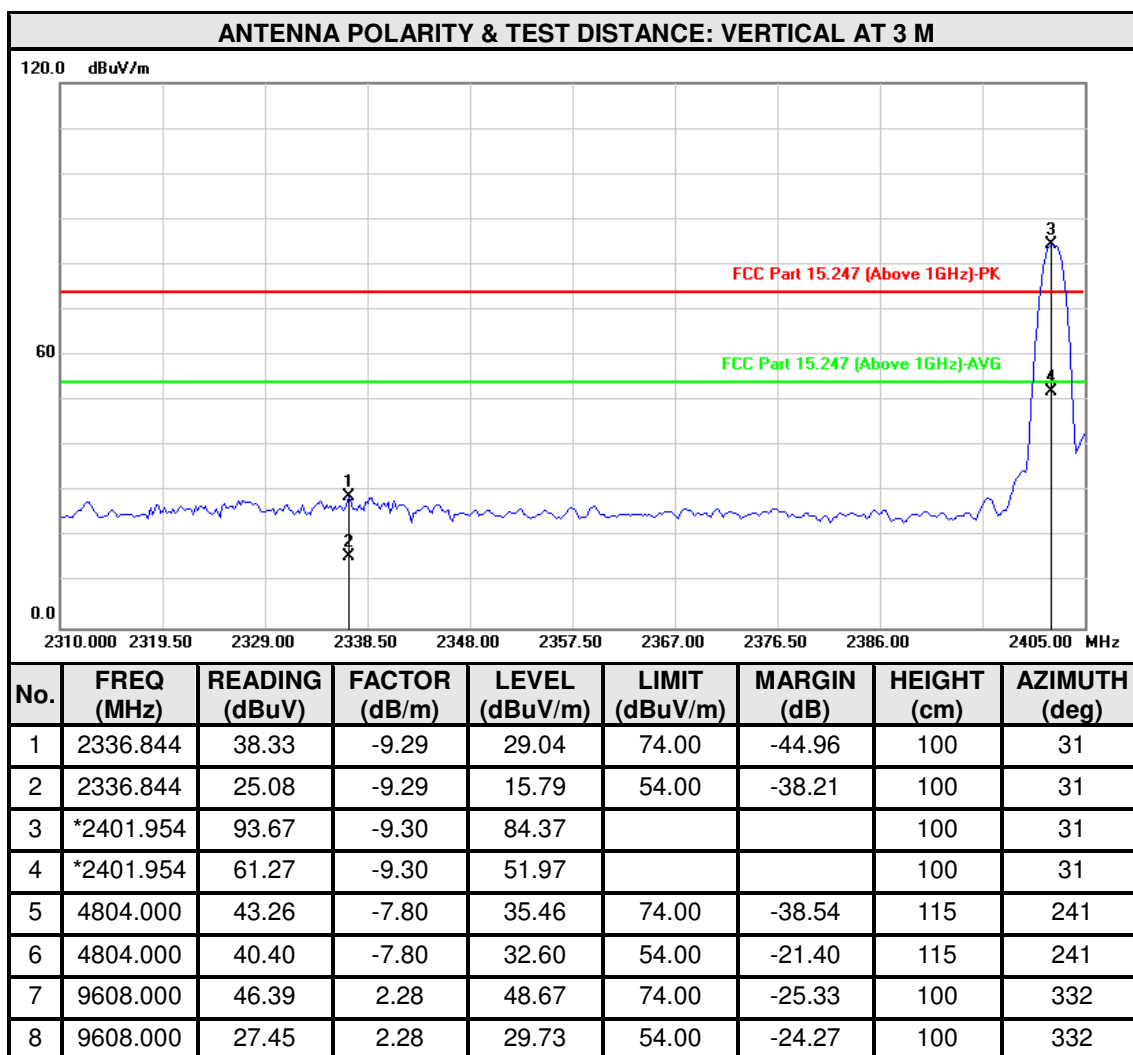
CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)



REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * " : Fundamental frequency.

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



REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

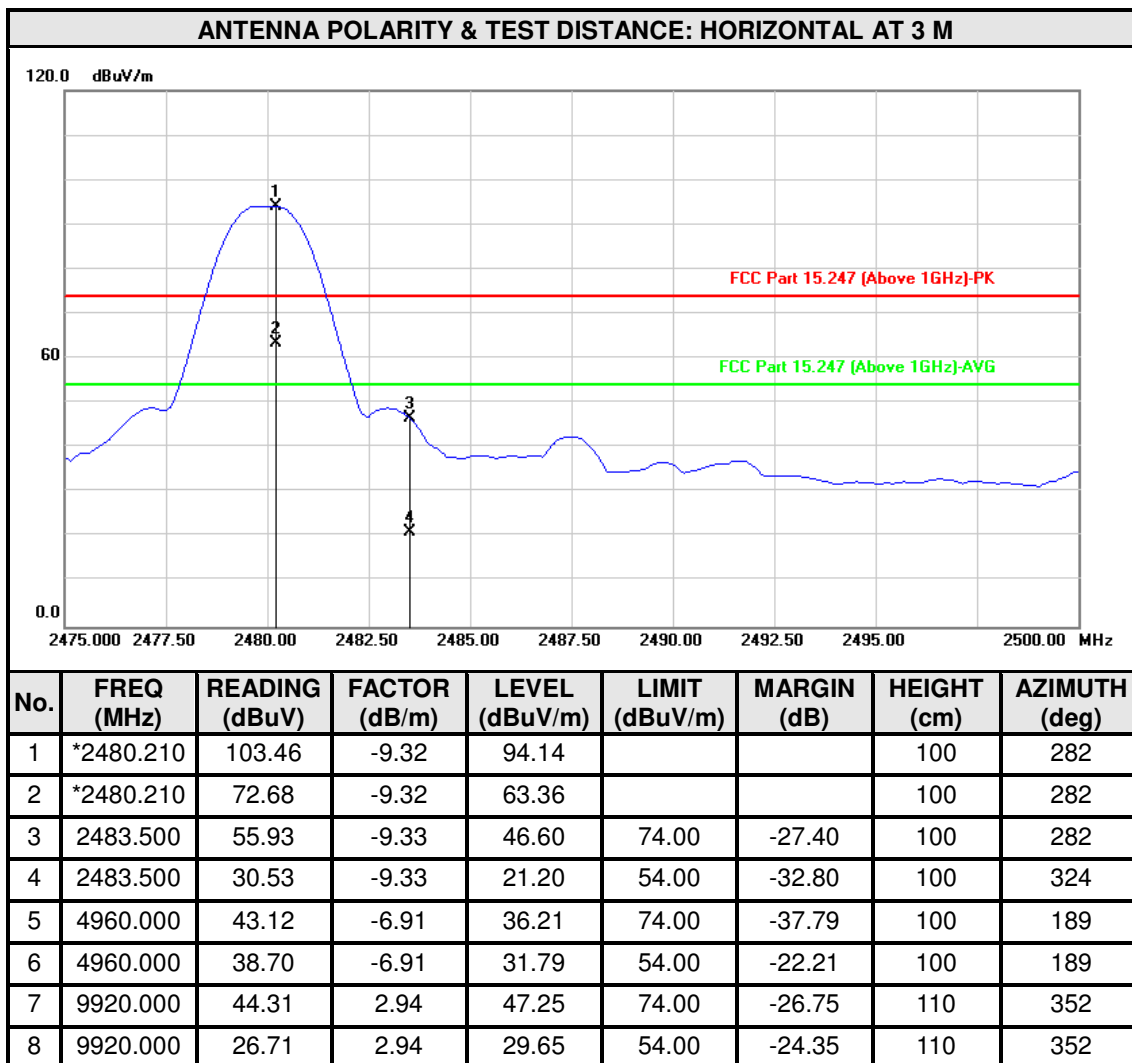
CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	FREQ (MHz)	READING (dBuV)	FACTOR (dB/m)	LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	HEIGHT (cm)	AZIMUTH (deg)
1	*2441.000	104.66	-12.11	92.55			100	200
2	*2441.000	73.96	-12.11	61.85			100	200
3	4882.000	42.83	-6.81	36.02	74.00	-37.98	110	233
4	4882.000	38.36	-6.81	31.55	54.00	-22.45	110	233
5	9764.000	44.39	2.60	46.99	74.00	-27.01	100	320
6	9764.000	36.42	2.60	39.02	54.00	-14.98	100	320
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	FREQ (MHz)	READING (dBuV)	FACTOR (dB/m)	LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	HEIGHT (cm)	AZIMUTH (deg)
1	*2441.000	98.33	-12.11	86.22			100	130
2	*2441.000	61.34	-12.11	49.23			100	130
3	4882.000	42.47	-6.81	35.66	74.00	-38.34	100	258
4	4882.000	38.91	-6.81	32.10	54.00	-21.90	100	258
5	9764.000	46.06	2.60	48.66	74.00	-25.34	100	199
6	9764.000	27.06	2.60	29.66	54.00	-24.34	100	199

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

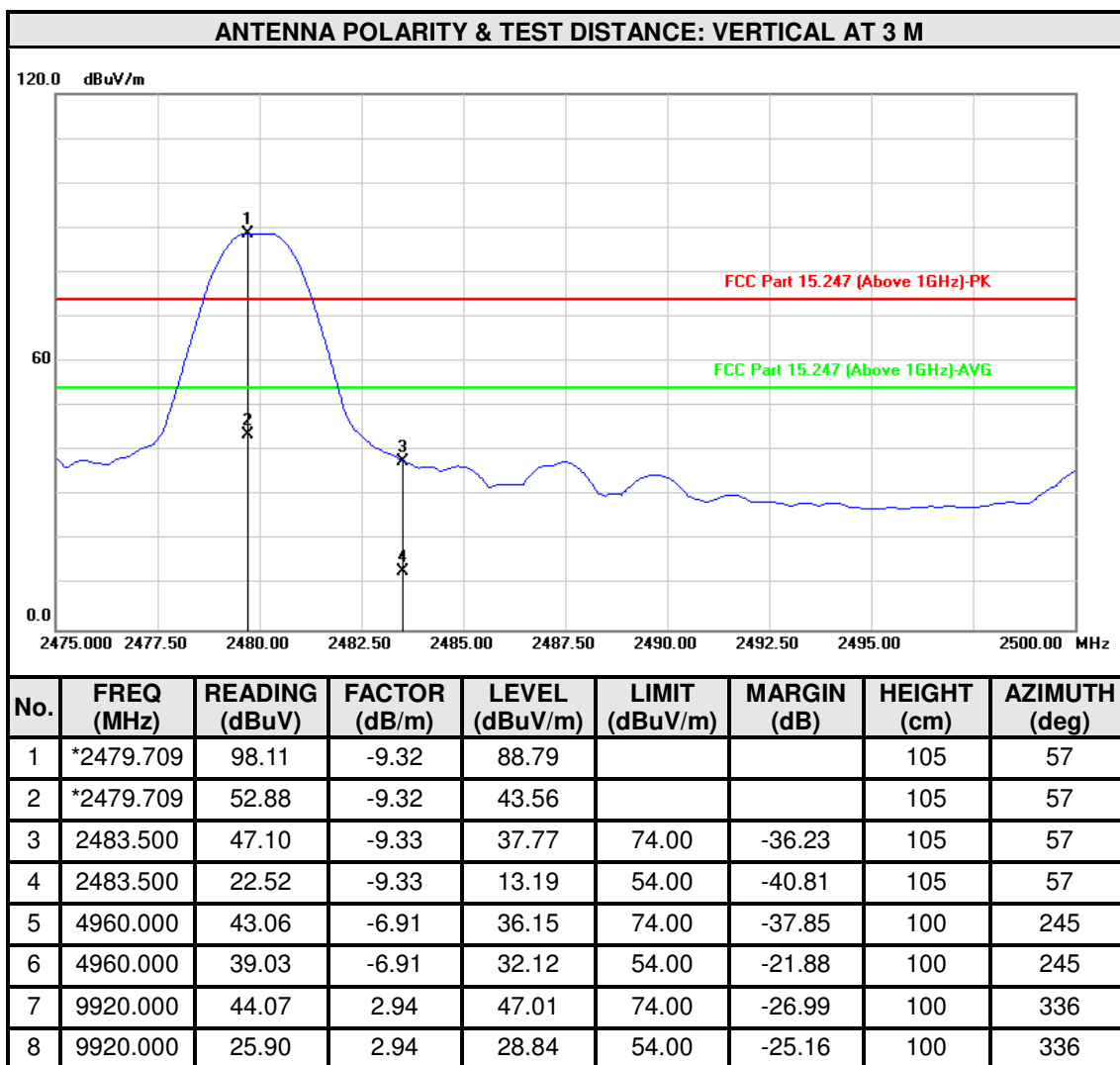
CHANNEL	TX Channel 78	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)



REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

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



REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

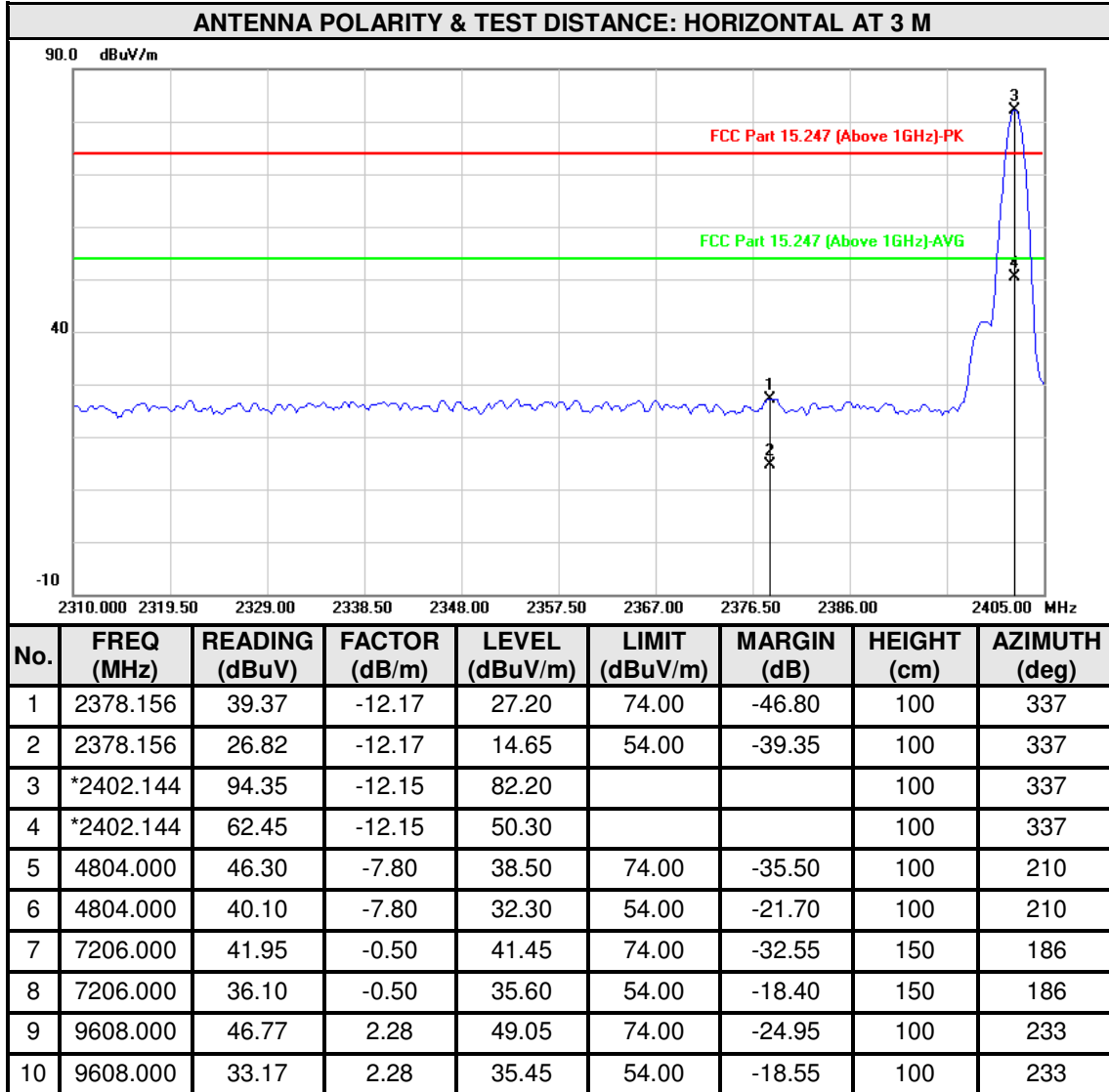


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VERITAS**

Test Report No.: RF2211WDG0137

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



REMARKS:

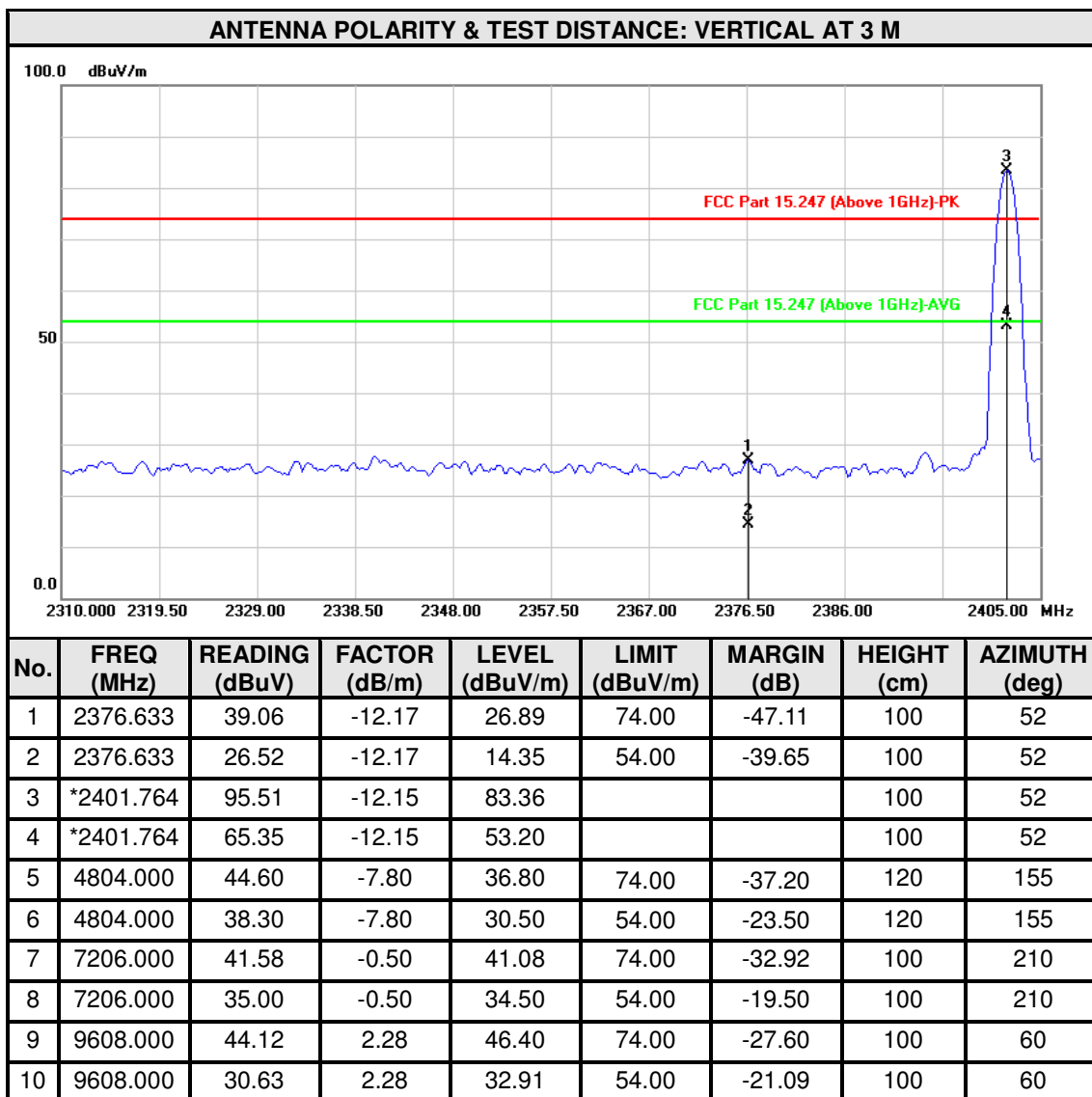
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

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



REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

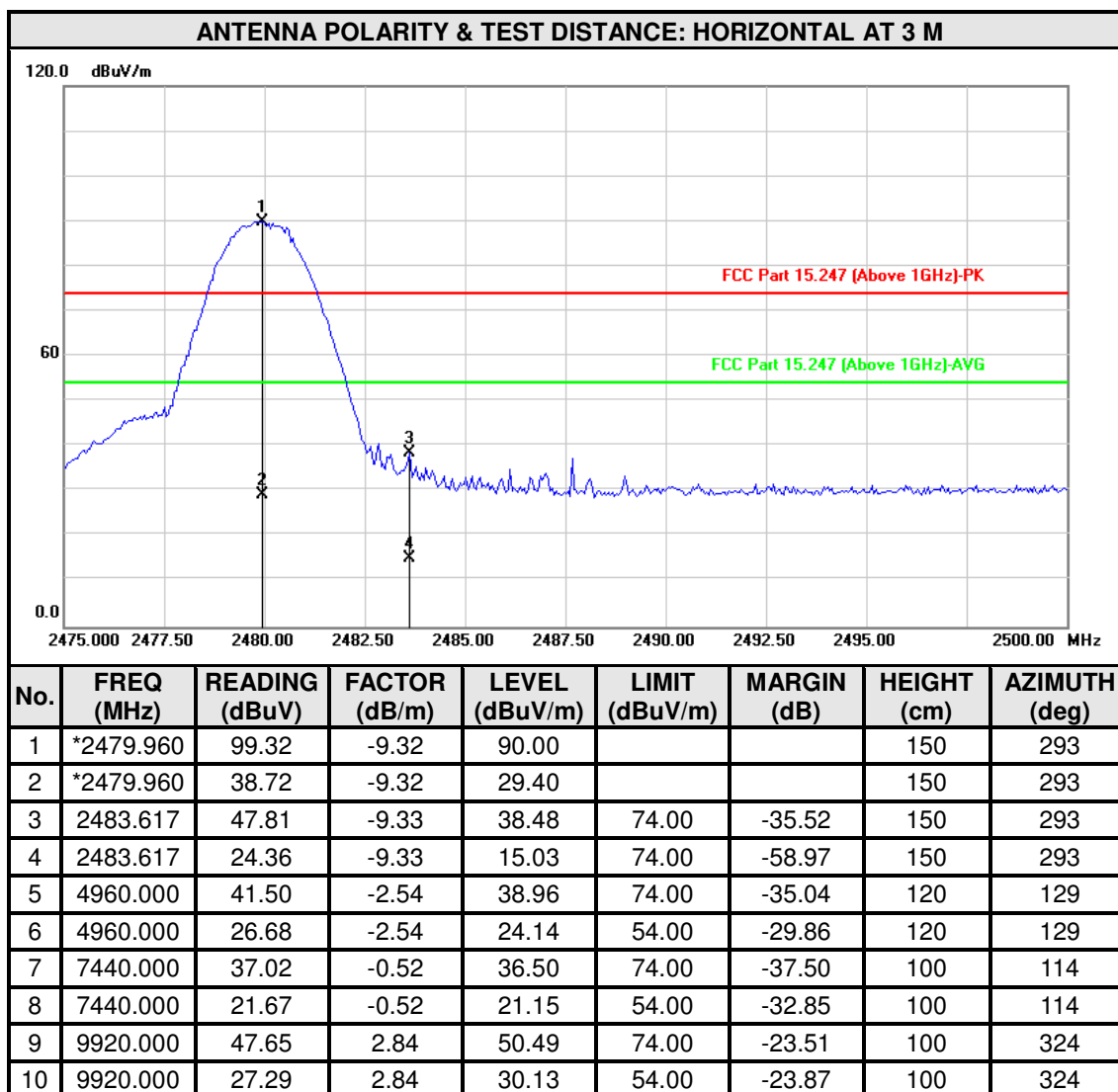
CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	FREQ (MHz)	READING (dBuV)	FACTOR (dB/m)	LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	HEIGHT (cm)	AZIMUTH (deg)
1	*2441.000	98.44	-12.11	86.33			150	199
2	*2441.000	55.99	-12.11	43.88			150	199
5	7323.000	38.64	-0.28	38.36	74.00	-35.64	120	180
6	7323.000	31.50	-0.28	31.22	54.00	-22.78	120	180
7	9764.000	46.62	2.60	49.22	74.00	-24.78	100	130
8	9764.000	30.60	2.60	33.20	54.00	-20.80	100	130
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	FREQ (MHz)	READING (dBuV)	FACTOR (dB/m)	LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	HEIGHT (cm)	AZIMUTH (deg)
1	*2441.000	100.77	-12.11	88.66			100	230
2	*2441.000	60.64	-12.11	48.53			100	230
5	7323.000	36.16	-0.28	35.88	74.00	-38.12	100	133
6	7323.000	29.83	-0.28	29.55	54.00	-24.45	100	133
7	9764.000	43.72	2.60	46.32	74.00	-27.68	100	30
8	9764.000	28.06	2.60	30.66	54.00	-23.34	100	30

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

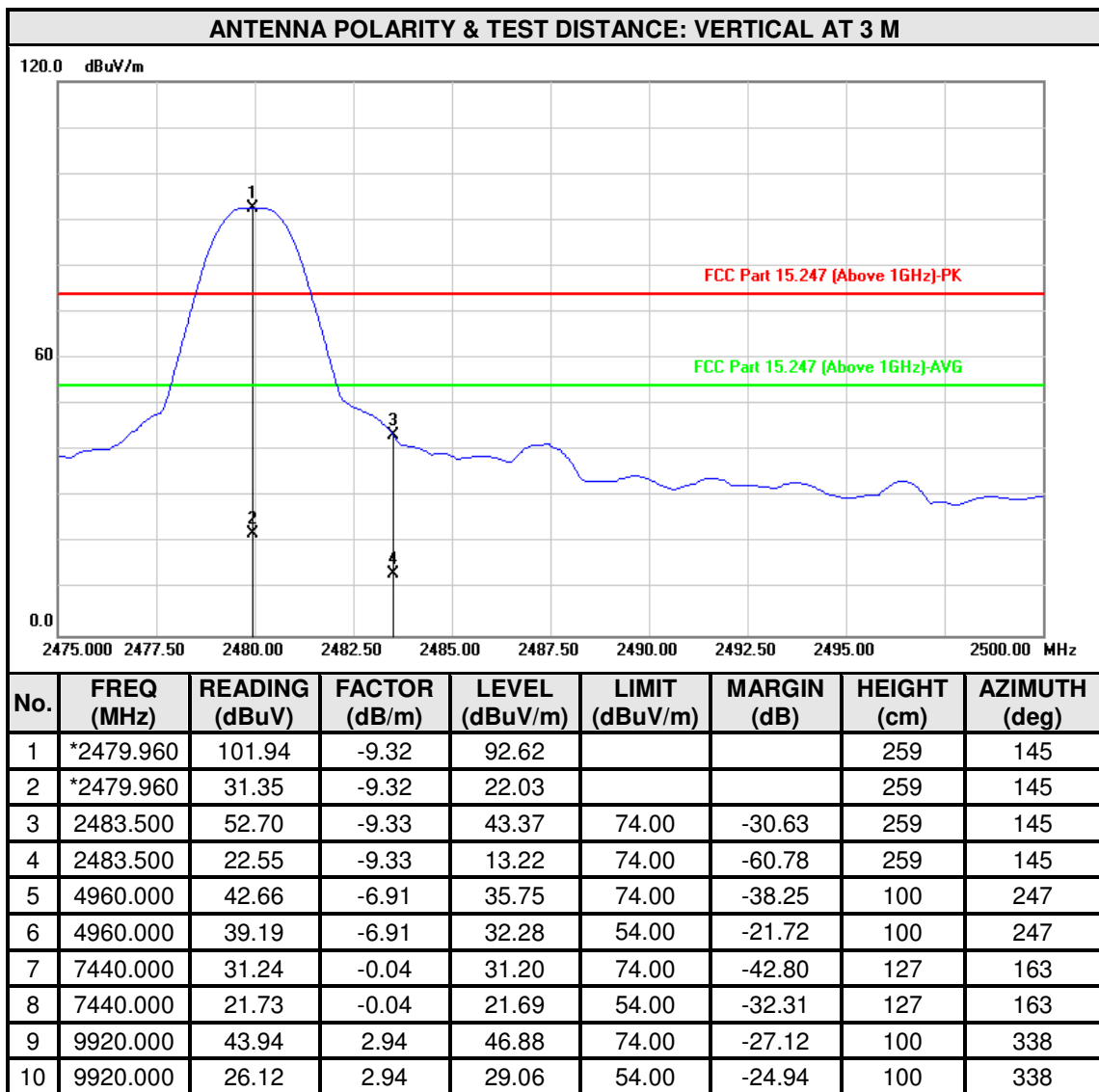
CHANNEL	TX Channel 78	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)



REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * " : Fundamental frequency.

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



REMARKS:

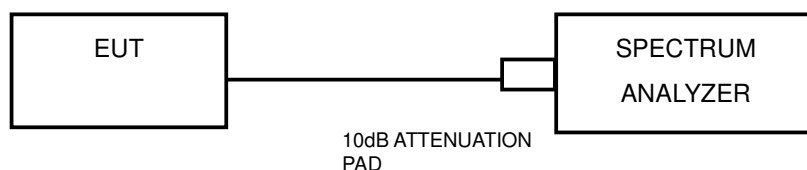
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were greater than 20dB margin.
4. Margin value = Emission level – Limit value.
5. " * " : Fundamental frequency.

4.2 NUMBER OF HOPPING FREQUENCY USED

4.2.1 LIMIT OF HOPPING FREQUENCY USED

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

4.2.2 TEST SETUP



4.2.3 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Due Date of Calibration
Spectrum Keysight	N9020A	MY51240612	2023-08-25
Spectrum Analyzer Rohde&Schwarz	FSV-40N	101783	2023-01-13
Power Meter 10Hz~18GHz Tonscend	JS0806-2	188060126	2023-08-25
Signal generator Keysight	E4421B	GB40051020	2023-08-25
Signal generator Keysight	N5182A	MY47420944	2023-08-25
Test Software Tonscend	JS0806-2	NA	NA
Hygrothermograph Yuhuaze	HTC-1	NA	2023-08-25

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.
2. The test was performed in Chamber 1 of hwa-hsing DongGuan.

4.2.4 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.

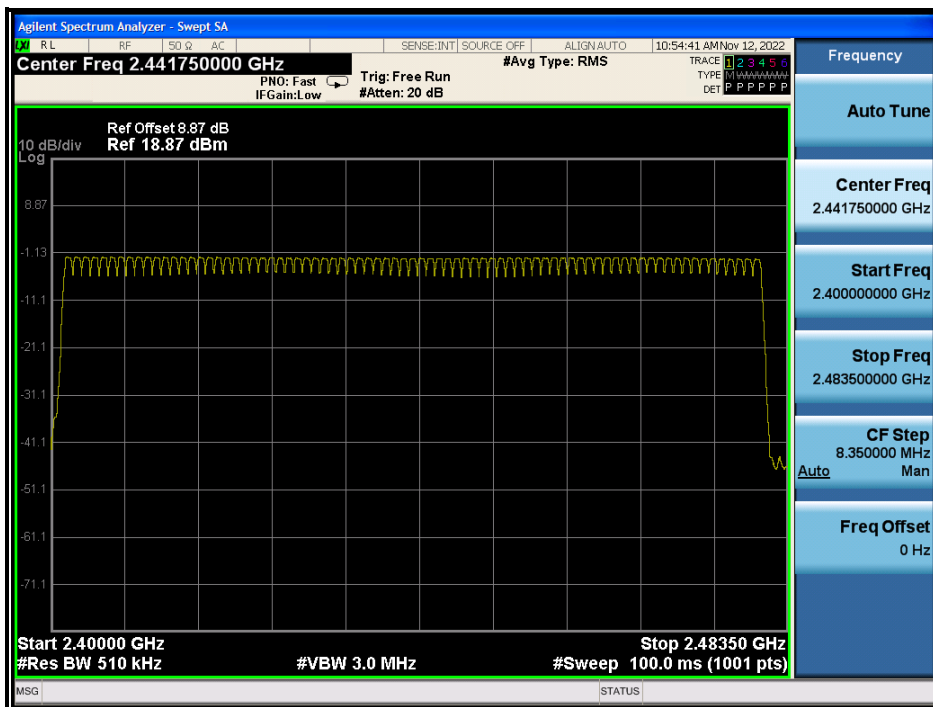
4.2.5 DEVIATION FROM TEST STANDARD

No deviation.

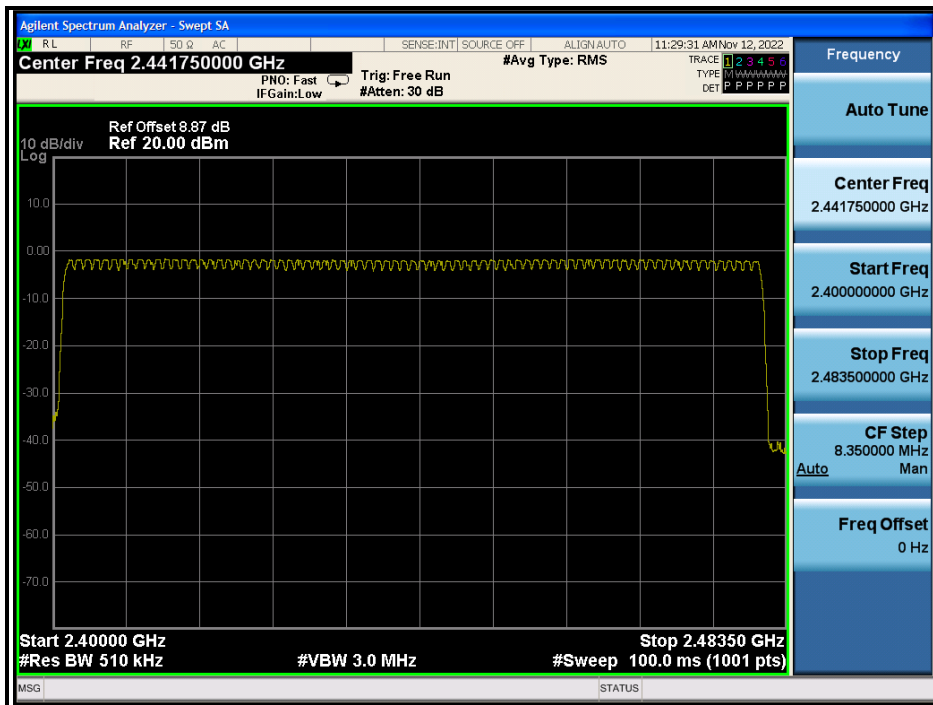
4.2.6 TEST RESULTS

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

GFSK



8DPSK

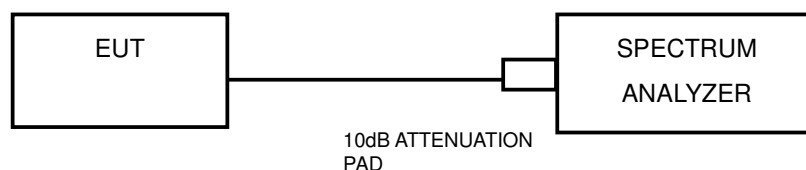


4.3 DWELL TIME ON EACH CHANNEL

4.3.1 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.

4.3.2 TEST SETUP



4.3.3 TEST INSTRUMENTS

Refer to section 4.3.3 to get information of above instrument.

4.3.4 TEST PROCEDURES

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- 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.
- 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.
- Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- Repeat above procedures until all different time-slot modes have been completed.

4.3.5 DEVIATION FROM TEST STANDARD

No deviation.

**4.3.6 TEST RESULTS****GFSK**

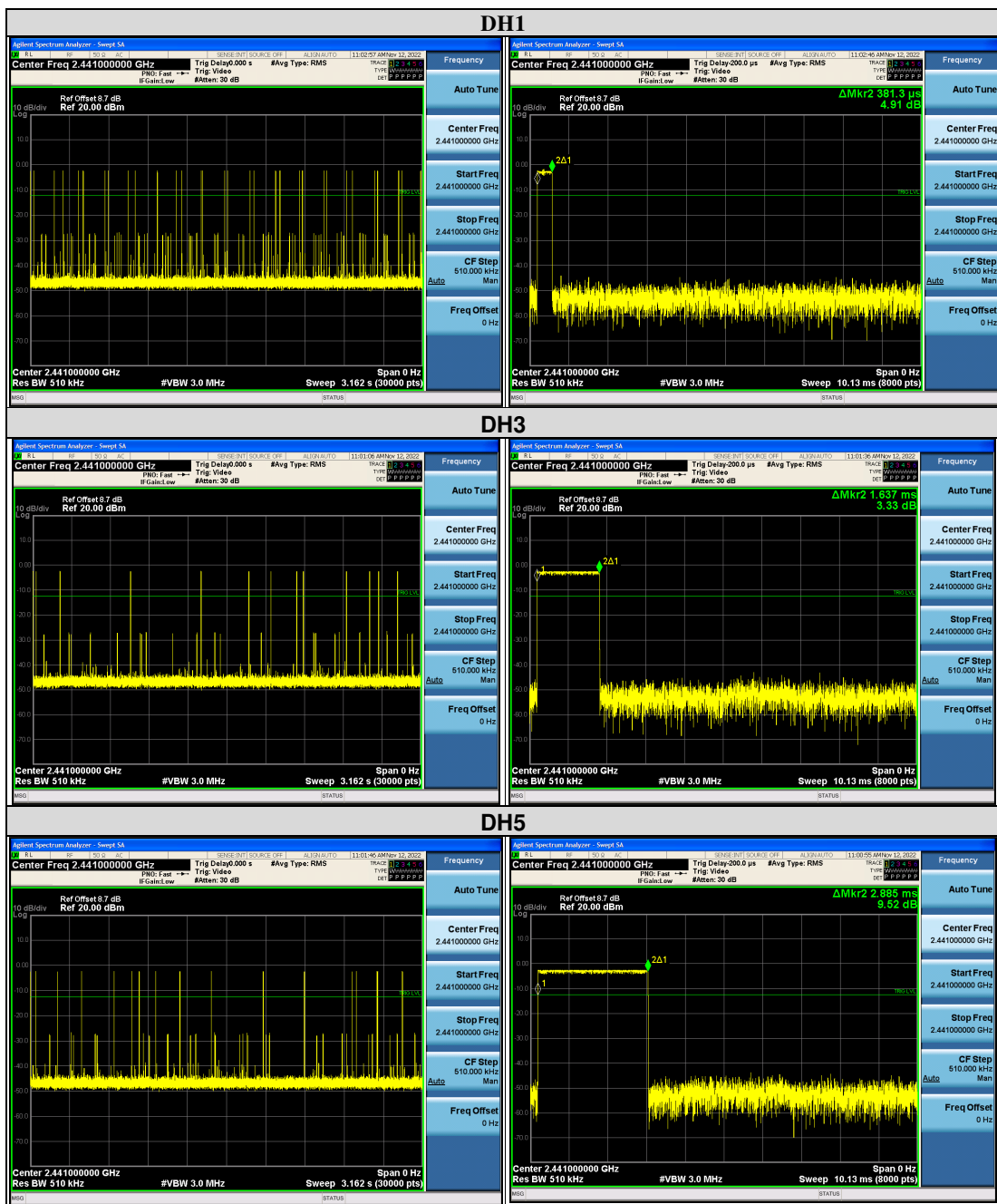
Mode	Number of Hopping Channel	Number of transmission in a period(channel number*0.4 sec)				Length of transmission time (msec)	Result (msec)	Limit (msec)	PASS / FAIL
		period (sec)	sweep time (sec)	times in a sweep	times in a period				
DH1	79	31.6	3.16	31	310	0.381	118.110	400	PASS
DH3	79	31.6	3.16	16	160	1.638	262.080	400	PASS
DH5	79	31.6	3.16	10	100	2.886	288.600	400	PASS

8DPSK

Mode	Number of Hopping Channel	Number of transmission in a period(channel number*0.4 sec)				Length of transmission time (msec)	Result (msec)	Limit (msec)	PASS / FAIL
		period (sec)	sweep time (sec)	times in a sweep	times in a period				
3DH1	79	31.6	3.16	5	50	6.664	333.200	400	PASS
3DH3	79	31.6	3.16	16	160	0.649	103.840	400	PASS
3DH5	79	31.6	3.16	9	90	0.894	80.460	400	PASS

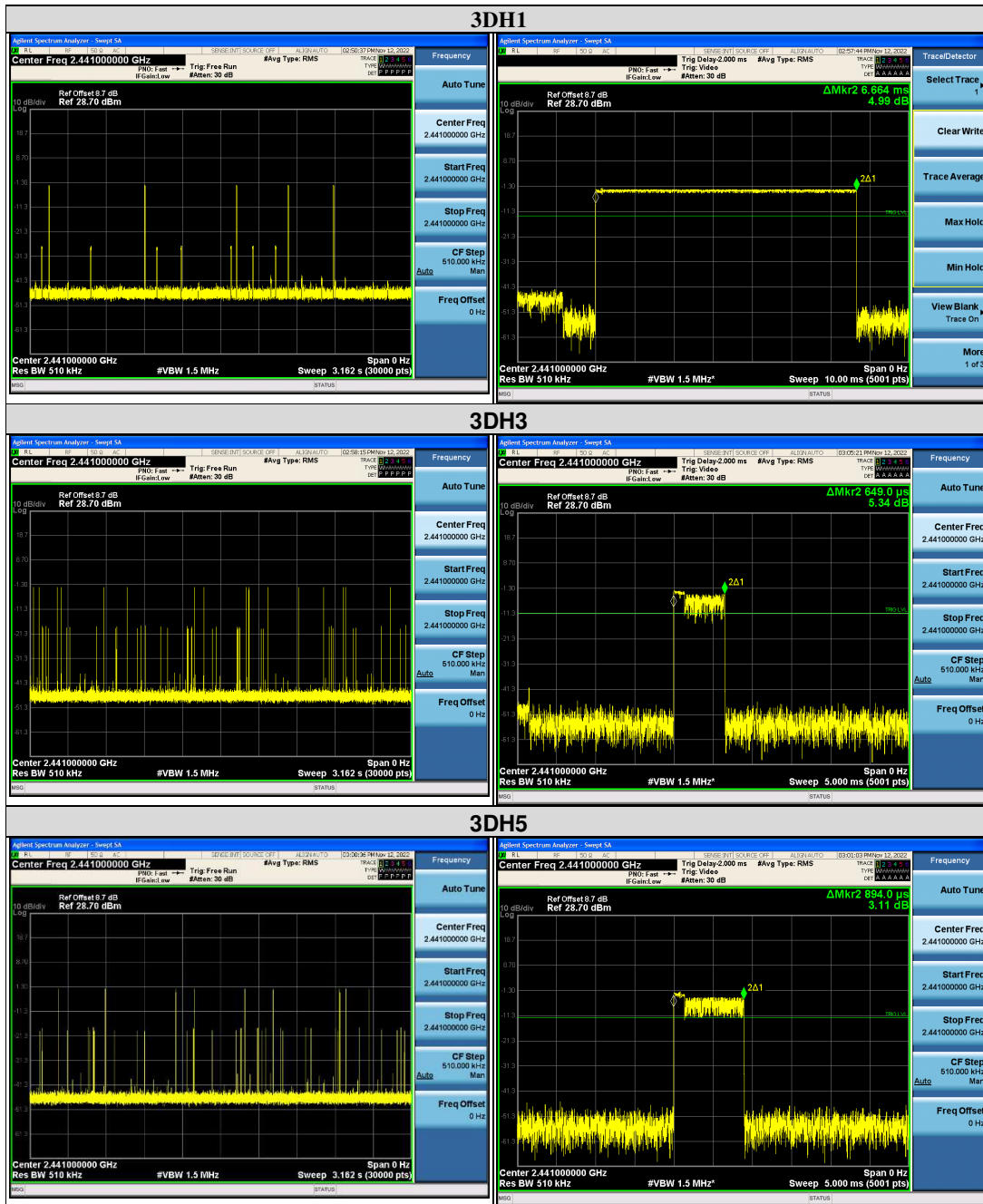
NOTE: Test plots of the transmitting time slot are shown on next page.

GFSK





8DPSK

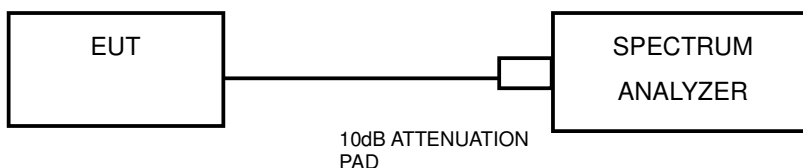


4.4 CHANNEL BANDWIDTH

4.4.1 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 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

4.4.2 TEST SETUP



4.4.3 TEST INSTRUMENTS

Refer to section 4.3.3 to get information of above instrument.

4.4.4 TEST PROCEDURE

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 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.
- Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.

4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

4.4.6 EUT OPERATING CONDITION

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

4.4.7 TEST RESULTS

GFSK

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	0.945
39	2441	0.954
78	2480	0.960

CH 0



[illegible]

Agilent Spectrum Analyzer - Swept SA

RL RF 50.0 AC SENSE:INT SOURCE:OFF ALIGN:AUTO 10:37:18 AM Nov 12, 2022

Center Freq 2.480000000 GHz **#Avg Type: RMS** **#Att: 20 dB** **Trig: Free Run** **Avg/Hold: 100/100**

PNO: Wide IFGain: Low

TRACE 1 2 3 4 5 6
TYPE M A A A A A A A A A
DET P P P P P P P

Ref Offset 8.7 dB
Ref 18.70 dBm

ΔMkr3 960 kHz
0.147 dB

10 dB/div
Log

Center 2.480000 GHz
#Res BW 30 kHz

Span 3.000 MHz
Sweep 3.200 ms (1001 pts)

MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.479 547 GHz	-25.844 dBm			
2	N	1	f	2.479 988 GHz	-5.349 dBm			
3	Δ1	1	f (Δ)	960 kHz (Δ)	0.147 dB			

Auto

Frequency

Auto Tune

Center Freq
2.480000000 GHz

Start Freq
2.478500000 GHz

Stop Freq
2.481500000 GHz

CF Step
300.000 kHz
Man

Frequency Offset
0 Hz

STATUS

Tel: +86 769 8998 2098
Fax: +86 769 8593 1080
Email: customerservice.dg@bureauveritas.com

8DPSK

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	1.302
39	2441	1.329
78	2480	1.299

CH 0



CH 39



CH 78

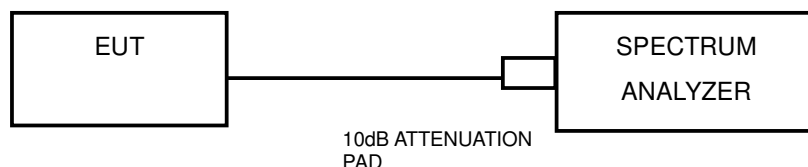


4.5 HOPPING CHANNEL SEPARATION

4.5.1 LIMIT OF HOPPING CHANNEL SEPARATION

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

4.5.2 TEST SETUP



4.5.3 TEST INSTRUMENTS

Refer to section 4.3.3 to get information of above instrument.

4.5.4 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.

4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

4.5.6 TEST RESULTS

GFSK

CHANNEL	FREQUENCY (MHz)	ADJACENT CHANNEL SEPARATION (MHz)	20dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	0.984	0.945	0.630	PASS
39	2441	1.005	0.954	0.636	PASS
78	2480	1.026	0.960	0.640	PASS

NOTE: The minimum limit is two-third 20dB bandwidth.

CH 0



CH 39



CH 78



8DPSK

CHANNEL	FREQUENCY (MHz)	ADJACENT CHANNEL SEPARATION (MHz)	20dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	0.996	1.302	0.868	PASS
39	2441	1.002	1.329	0.886	PASS
78	2480	0.999	1.299	0.866	PASS

NOTE: The minimum limit is two-third 20dB bandwidth.

CH 0



CH 39



CH 78

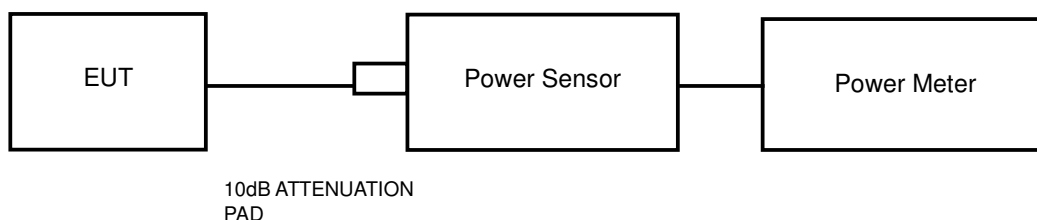


4.6 CONDUCTED OUTPUT POWER

4.6.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

The Maximum Output Power Measurement is 0.125W.

4.6.2 TEST SETUP



4.6.3 TEST INSTRUMENTS

Refer to section 4.3.3 to get information of above instrument.

4.6.4 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 and set the detector to PEAK. Record the power level.

An average power sensor was used on the output port of the EUT. A power meter was used to read the response of the average power sensor and set the detector to AVERAGE. Record the power level.

4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

4.6.6 EUT OPERATING CONDITION

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

4.6.7 TEST RESULTS

MAXIMUM PEAK OUTPUT POWER

PEAK POWER:

GFSK

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
0	2402	-1.952	0.638	0.125	PASS
39	2441	-2.591	0.551	0.125	PASS
78	2480	-2.839	0.520	0.125	PASS

8DPSK

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
0	2402	-1.064	0.783	0.125	PASS
39	2441	-1.633	0.687	0.125	PASS
78	2480	-1.767	0.666	0.125	PASS

AVERAGE POWER:

GFSK

CHANNEL	CHANNEL FREQUENCY (MHz)	Average POWER (dBm)	Average POWER (mW)	Average POWER (W)	PASS/FAIL
0	2402	-6.057	0.248	0.125	PASS
39	2441	-6.708	0.213	0.125	PASS
78	2480	-6.912	0.204	0.125	PASS

8DPSK

CHANNEL	CHANNEL FREQUENCY (MHz)	Average POWER (dBm)	Average POWER (mW)	Average POWER (W)	PASS/FAIL
0	2402	-1.438	0.718	0.125	PASS
39	2441	-1.875	0.649	0.125	PASS
78	2480	-2.028	0.627	0.125	PASS

4.7 OUT OF BAND EMISSION MEASUREMENT

4.7.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

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

4.7.2 TEST INSTRUMENTS

Refer to section 4.3.3 to get information of above instrument.

4.7.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low loss cable. of 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.

4.7.4 DEVIATION FROM TEST STANDARD

No deviation.

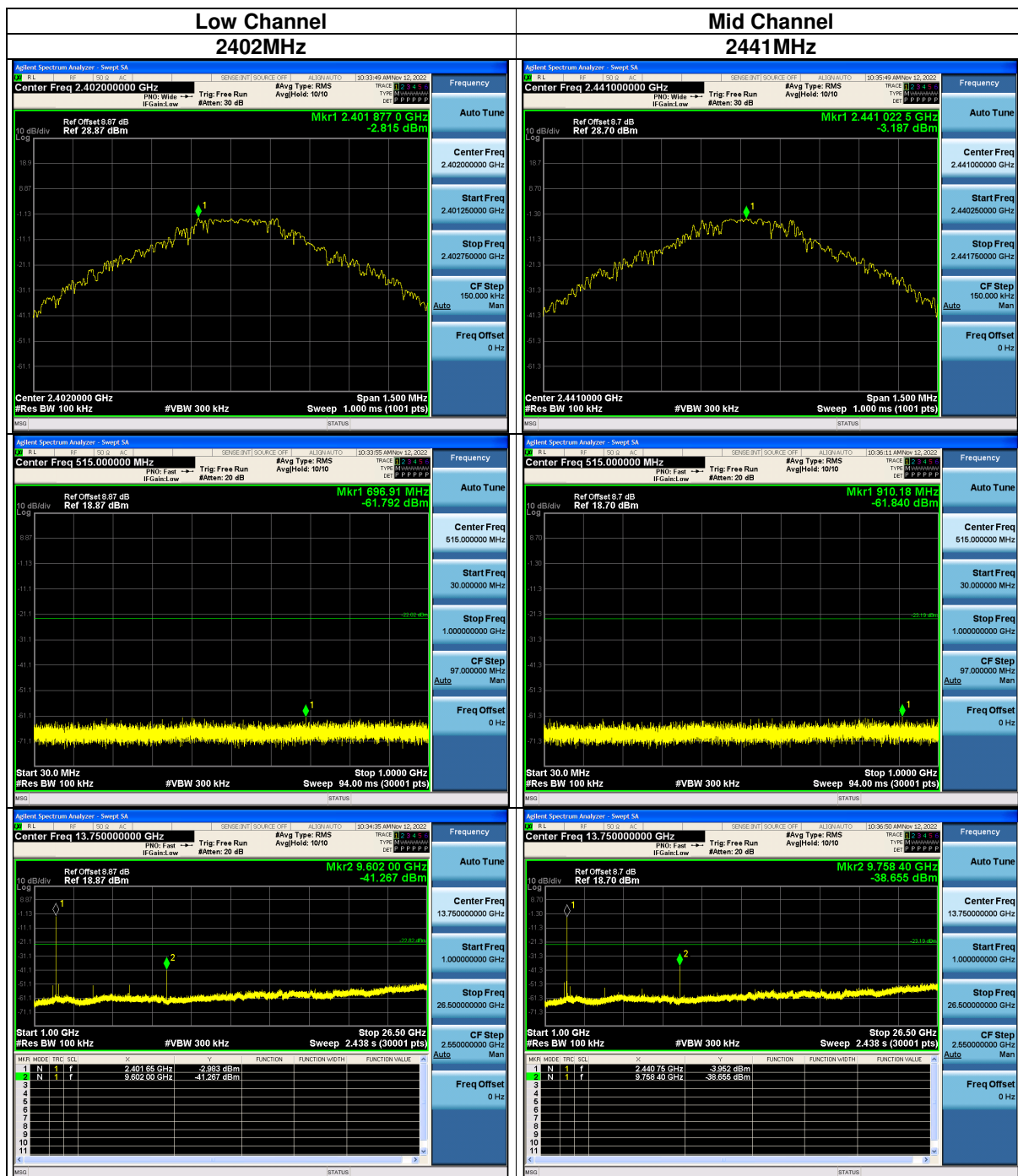
4.7.5 EUT OPERATING CONDITION

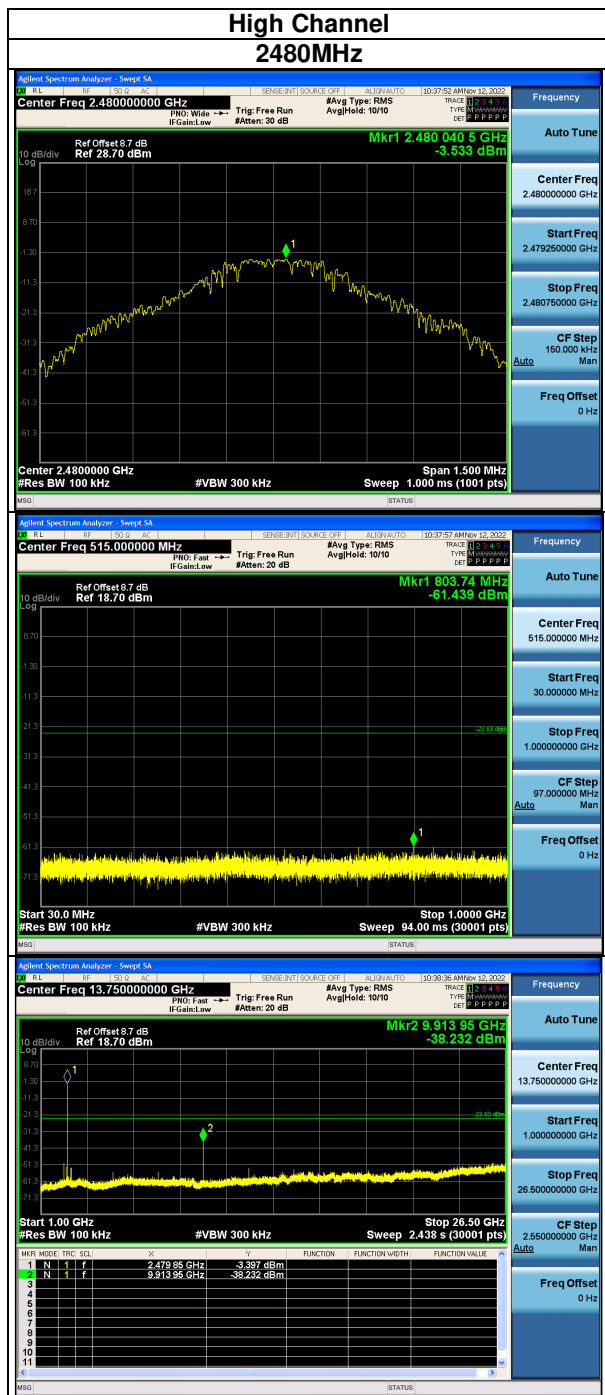
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.7.6 TEST RESULTS

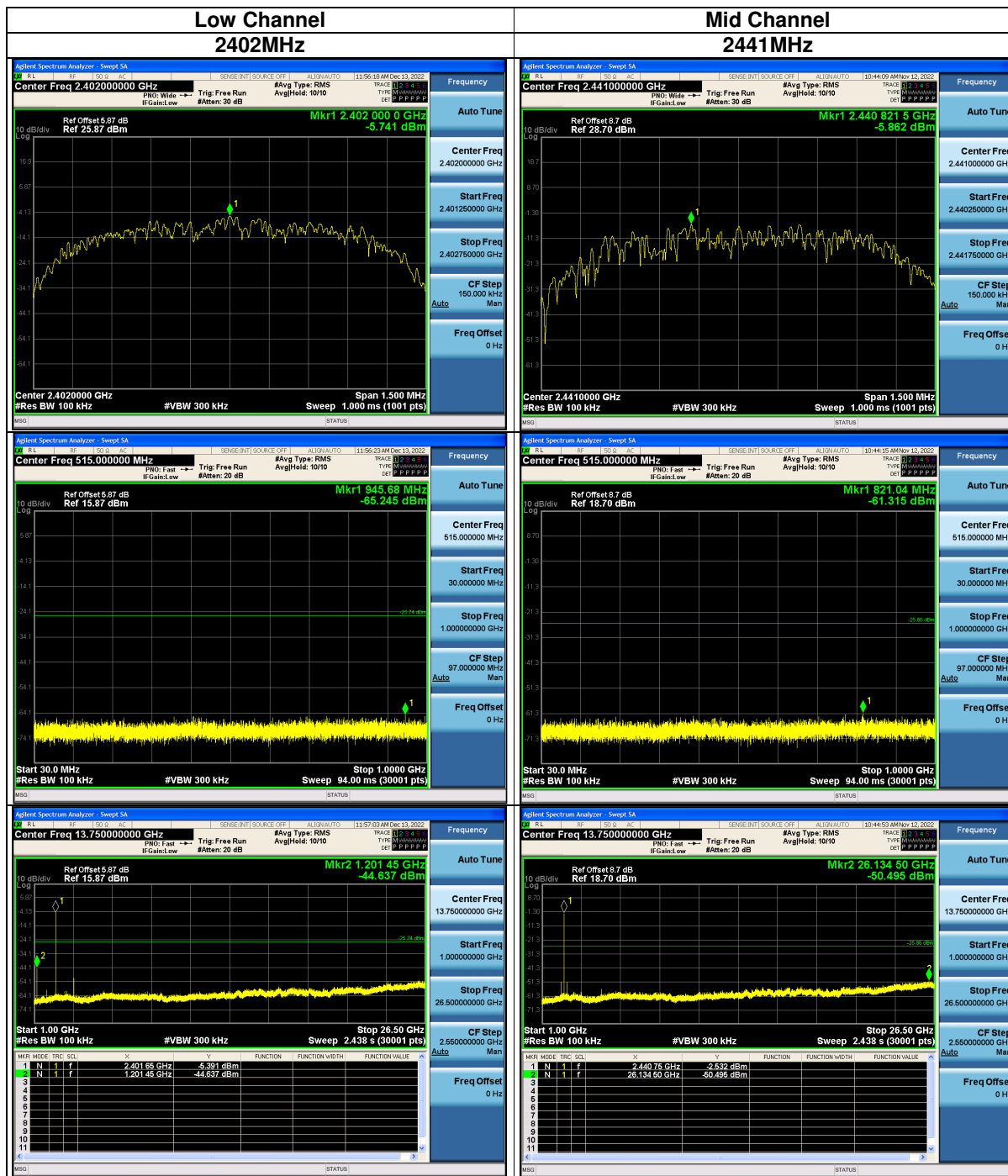
The spectrum plots are attached on the following images. D1 line indicates the highest level. D2 line indicates the 20dB offset below D1. It shows compliance to the requirement.

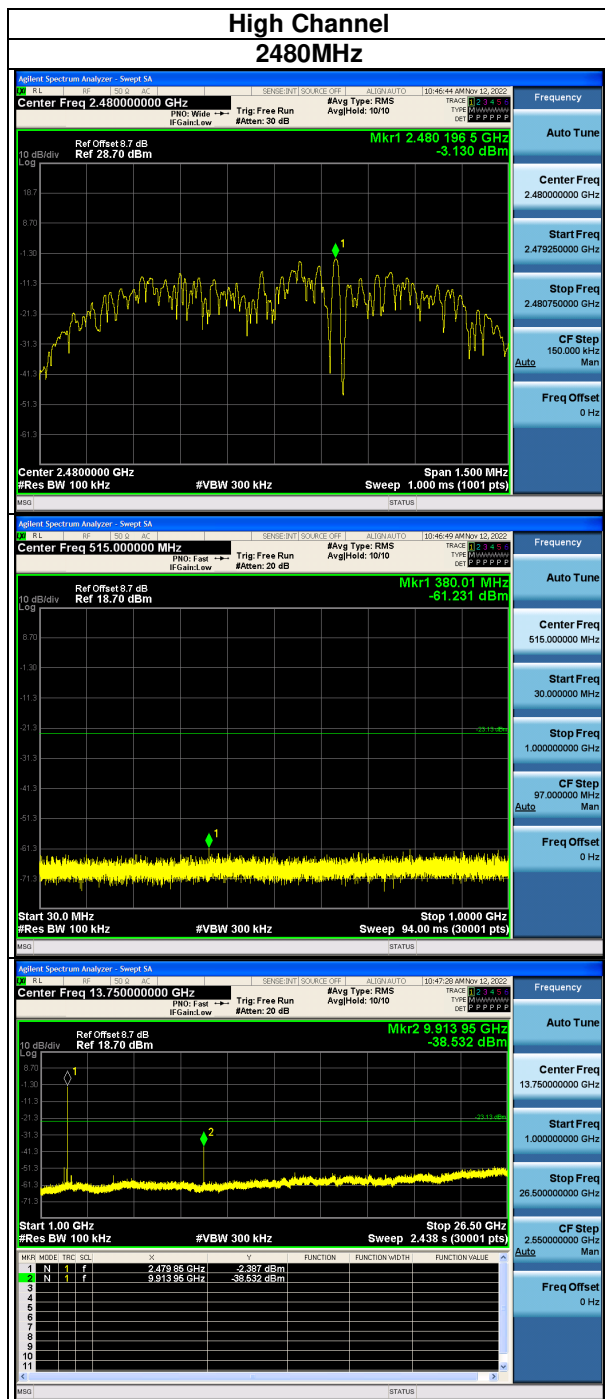
GFSK





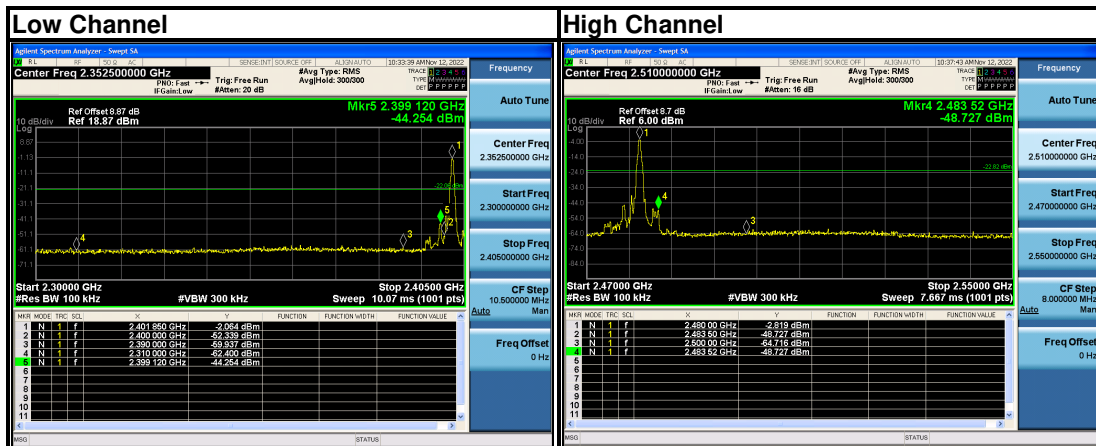
8DPSK



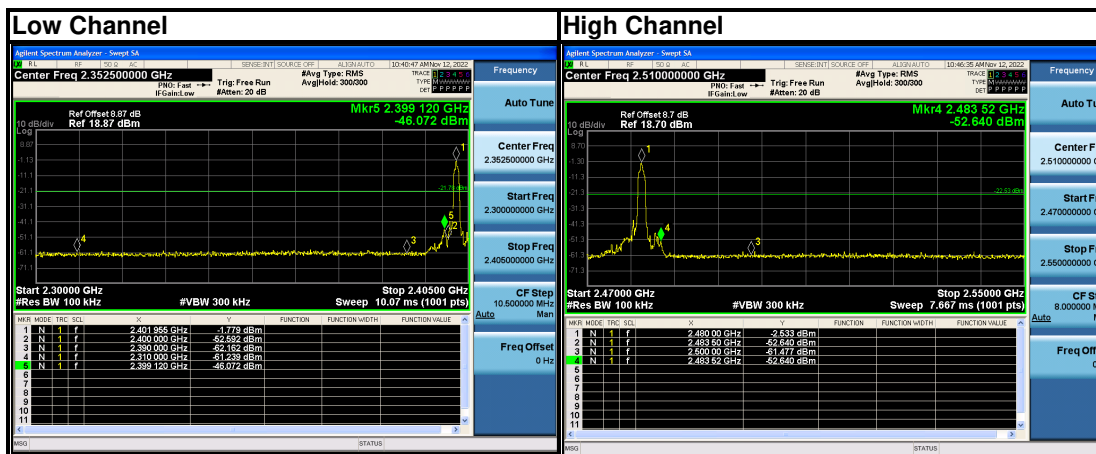


Bandedge(FHSS Disable):

GFSK

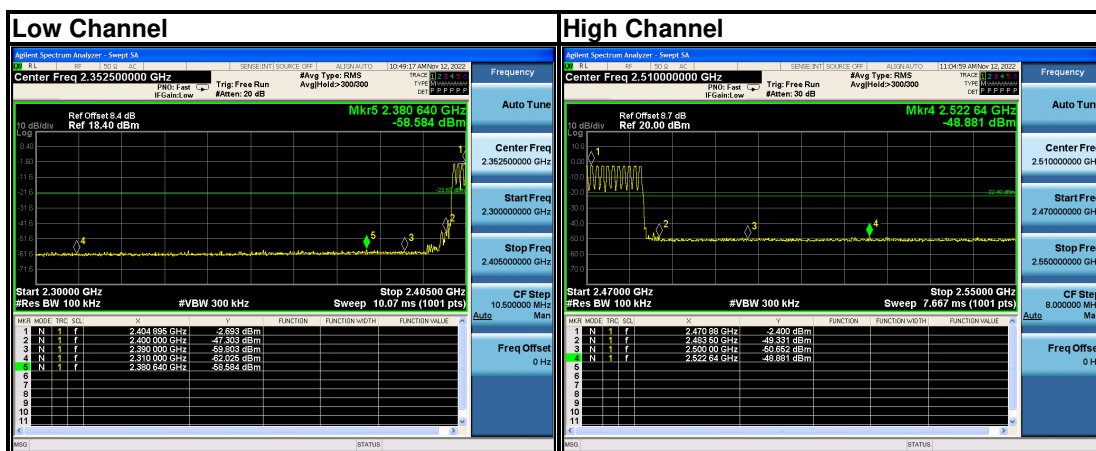


8DPSK

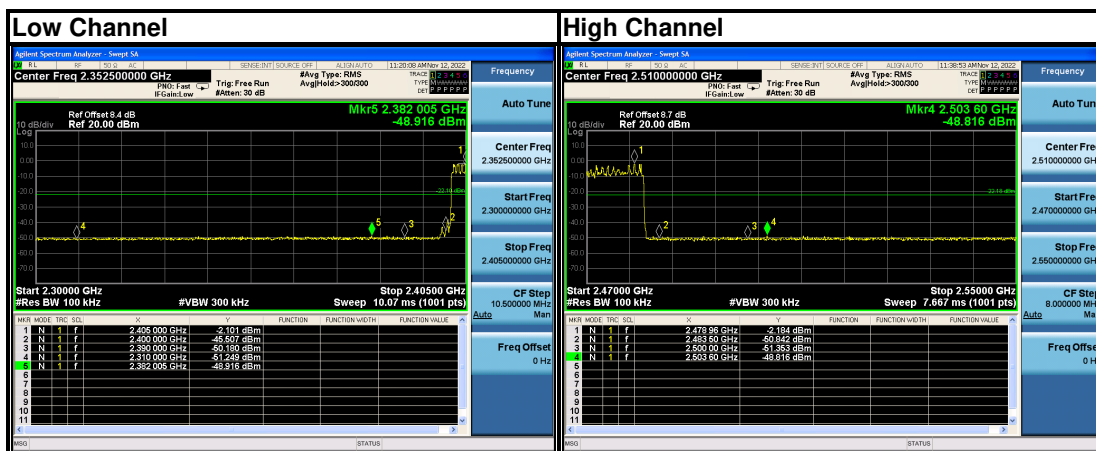


Bandedge(FHSS Enabled):

GFSK



8DPSK





Test Report No.: RF2211WDG0137

5 PHOTOGRAPHS OF THE TEST CONFIGURATION

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



6 APPENDIX A - 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.

---END---