

FCC Test Report

Report No.: RFBENL-WTW-P21051124-2

FCC ID: RYK-WNFQ261ACNIBT

Test Model: WNFQ-261ACNI(BT)

Received Date: May 28, 2021

Test Date: July 10 to 19, 2021

Issued Date: Aug. 25, 2021

Applicant: SparkLAN Communications, Inc.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Hsin Chu Laboratory

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Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

FCC Registration / 723255 / TW2022

Designation Number:



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Release Control Record

Issue No.	Description	Date Issued
RFBENL-WTW-P21051124-2	Original release.	Aug. 25, 2021

1 Certificate of Conformity

Product: 802.11ac/a/b/g/n 2T2R Industrial-graded Wi-Fi / Bluetooth 4.2 Combo M.2 2230 Module

Brand: Sparklan

Test Model: WNFQ-261ACNI(BT)

Sample Status: R&D SAMPLE

Applicant: SparkLAN Communications, Inc.

Test Date: July 10 to 19, 2021

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : , **Date:** Aug. 25, 2021
Claire Kuan / Specialist

Approved by : , **Date:** Aug. 25, 2021
Clark Lin / Technical Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	N/A	Refer to Note 4 below
15.247(a)(1)(iii)	Number of Hopping Frequency Used	N/A	Refer to Note 4 below
15.247(a)(1)(iii)	Dwell Time on Each Channel	N/A	Refer to Note 4 below
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	N/A	Refer to Note 4 below
15.247(b)	Maximum Peak Output Power	Pass	Meet the requirement of limit.
15.205 & 209 & 15.247(d)	Radiated Emissions & Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -6.9 dB at 46.78 MHz.
15.247(d)	Antenna Port Emission	N/A	Refer to Note 4 below
15.203	Antenna Requirement	Pass	Antenna connector is i-pex(MHF) not a standard connector.

Note:

- For 2.4 GHz band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A.
- Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- If The Frequency Hopping System operating in 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.
- Only Radiated Emissions and Maximum Peak Output Power were performed for this addendum. Other test items data refer to original test report.
- N/A: Not Applicable.

2.1 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	Frequency	Expanded Uncertainty (k=2) (±)
Conducted emissions	-	2.5 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.1 dB
	30MHz ~ 1GHz	5.5 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.1 dB
	18GHz ~ 40GHz	5.3 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	802.11ac/a/b/g/n 2T2R Industrial-graded Wi-Fi / Bluetooth 4.2 Combo M.2 2230 Module
Brand	Sparklan
Test Model	WNFQ-261ACNI(BT)
Status of EUT	R&D SAMPLE
Power Supply Rating	3.3Vdc form host equipment
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	Up to 3 Mbps
Operating Frequency	2.402 ~ 2.480 GHz
Number of Channel	79
Output Power	6.281 mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Cable Supplied	NA

Note:

- This report is prepared for FCC Class II permissive change. The difference compared with the Report No.: RF170816E06H-2 design is as the following information:

◆ Added new antennas as below table:

Original										
Ant. Set.	Transmitter Circuit	Brand	Model	Ant. Type	2.4GHz Gain with cable loss (dBi)	5GHz Gain with cable loss (dBi)	2.4GHz Cable Loss (dBi)	5G Cable Loss (dBi)	Connector Type	Cable Length (mm)
1	Chain (0)	WNC	81-EBJ15.005	PIFA	3.00	Band 1&2: 2.56	1.15	Band 1&2: 1.70	IPEX	300
						Band 3: 4.76		Band 3: 1.74		
						Band 4: 4.76		Band 4: 1.79		
	Chain (1)	WNC	81-EBJ15.005	PIFA	3.62	Band 1&2: 3.08	1.15	Band 1&2: 1.70	IPEX	300
						Band 3: 3.31		Band 3: 1.74		
						Band 4: 2.42		Band 4: 1.79		

Ant. Set.	Transmitter Circuit	Brand	Model	Ant. Type	2.4GHz Gain with cable loss (dBi)	5GHz Gain with cable loss (dBi)	2.4GHz Cable Loss (dBi)	5G Cable Loss (dBi)	Connector Type	Cable Length (mm)
2	Chain (0)	INPAQ	DAM-I6-H-DB-800-10-17	Dipole	1.13	Band 1&2: 1.33	NA	NA	SMA RP Plug	900
						Band 3: -0.63				
						Band 4: -0.97				
	Chain (1)	INPAQ	DAM-I6-H-DB-800-10-17	Dipole	1.29	Band 1&2: 1.94	NA	NA	SMA RP Plug	900
						Band 3: -0.49				
						Band 4: -0.93				
Ant. Set.	Transmitter Circuit	Brand	Model	Ant. Type	2.4GHz Gain with cable loss (dBi)		5GHz Gain with cable loss (dBi)		Connector Type	Cable Length (mm)
3	Chain (0) Chain (1)	Sparklan	AD-301N	Dipole	4.4		Band 1&2: 5.2 Band 3&4: 5.8		IPEX MHF 4 at modular side & RP-SMA (M) at antenna side	150
4	Chain (0) Chain (1)	Sparklan	AD-103AG	Dipole	2.02		Band 1&2: 1.93 Band 3&4: 2.03			150
5	Chain (0) Chain (1)	Sparklan	AD-305N	Dipole	5.0		5.0			150
6	Chain (0) Chain (1)	Sparklan	AD-303N	Dipole	3.0		3.0			150
7	Chain (0) Chain (1)	Sparklan	AD-302N	Dipole	3.0		2.0			150
Newly										
Ant. Set.	Transmitter Circuit	Brand	Model	Ant. Type	2.4GHz Gain with cable loss (dBi)		5GHz Gain with cable loss (dBi)		Connector Type	Cable Length (mm)
8	Chain (0) Chain (1)	SANAV	GEPH-023 401GEPH16-022 G000000032-001	PCB	4.78		4.73		IPEX4L MHF	320

- According to above conditions, only Antenna Port Conducted test and Radiated Emissions for Dipole antenna test items need to be performed. And all data were verified to meet the requirements.
- There are Bluetooth technology and WLAN technology used for the EUT.
- WLAN/BT coexistence mode:
 - ◆ 2x2 WLAN + BT:
 - 5GHz 802.11a/an (or 11ac) transmit concurrent with BT.
 - 2.4GHz: timely shared coexistence.
- The emission (conducted & radiated emission) of the simultaneous operation (WiFi <5GHz> & Bluetooth) have been evaluated and no non-compliance found. The detail combinations of transmitters / frequencies / modes as below table

Mode	Available Channel	Tested Channel	Modulation Technology
5 GHz (802.11ac (VHT20))	36 to 165	149	OFDM
+ Bluetooth (LE)	0 to 39	0	GFSK

- The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

7. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.2 Description of Test Modes

79 channels are provided for BT-EDR mode:

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 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	-	√	-

Where **RE $\geq$ 1G**: Radiated Emission above 1GHz

RE<1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

APCM: Antenna Port Conducted Measurement

Note: The EUT's PCB antenna had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on Z-plane.

Radiated Emission Test (Above 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ 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	DH5
0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

Radiated Emission Test (Below 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ 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	FHSS	GFSK	DH5

Antenna Port Conducted Measurement:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ 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	DH5
0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

Test Condition:

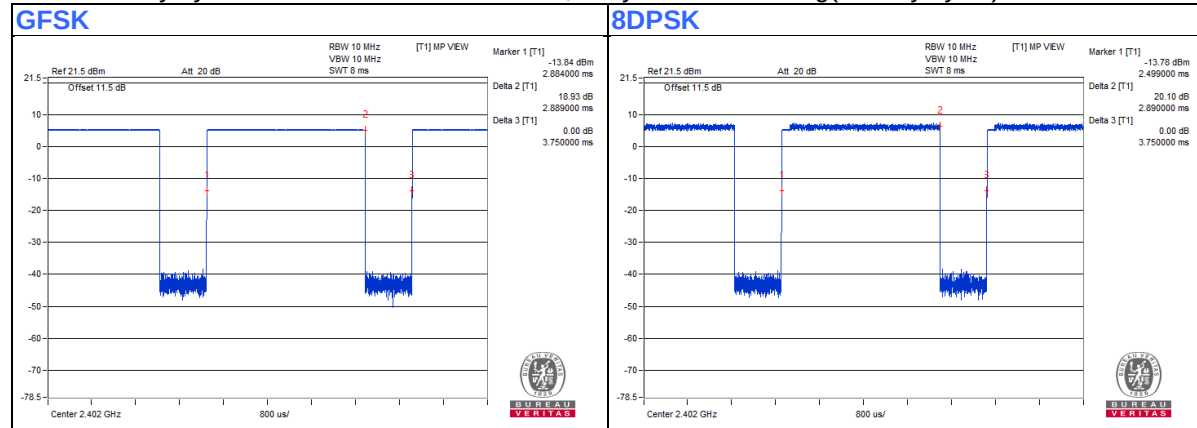
Applicable To	Environmental Conditions	Input Power (System)	Tested By
RE$\geq$1G	25deg. C, 66%RH	120Vac, 60Hz	Carter Lin
	25deg. C, 66%RH		Tom Yang
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Carter Lin
APCM	25deg. C, 60%RH	120Vac, 60Hz	Eric Peng

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %, duty factor shall be considered.

GFSK: Duty cycle = 2.889 ms/3.75 ms = 0.77, Duty factor = $10 * \log(1/\text{Duty cycle}) = 1.13 \text{ dB}$

8DPSK: Duty cycle = 2.89 ms/3.75 ms = 0.771, Duty factor = $10 * \log(1/\text{Duty cycle}) = 1.13 \text{ dB}$



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.

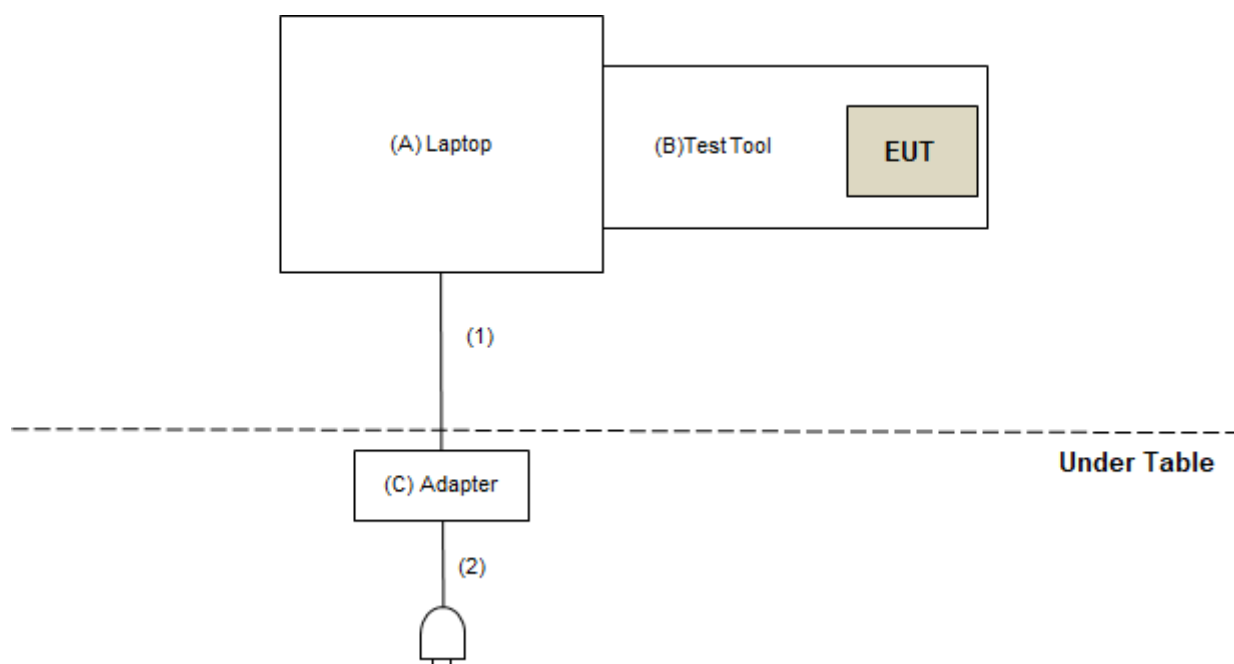
ID	Product	Brand	Model No.	Serial No	FCC ID	Remarks
A.	Laptop	Dell	E5430	NA	NA	Provided by Lab
B.	Test Tool	Qualcomm Atheros	NA	NA	NA	Supplied by client
C.	Adapter	Dell	FA65NE0-00	NA	NA	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	1.8	No	0	Provided by Lab
2.	AC Cable	1	1	No	0	Provided by Lab

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards and References

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

Test standard:

FCC Part 15, Subpart C (15.247)

ANSI C63.10-2013

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

References Test Guidance:

KDB 558074 D01 15.247 Meas Guidance v05r02

All test items have been performed as a reference to the above KDB test guidance.

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 must comply with the radiated emission limits specified as below table. 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. 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

For Radiated Emission test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY51210202	Dec. 01, 2020	Nov. 30, 2021
Pre-Amplifier EMCI	EMC001340	980142	May 24, 2021	May 23, 2022
Loop Antenna Electro-Metrics	EM-6879	264	Mar. 05, 2021	Mar. 04, 2022
RF Cable	5D-FB	LOOPCAB-001	Jan. 07, 2021	Jan. 06, 2022
RF Cable	5D-FB	LOOPCAB-002	Jan. 07, 2021	Jan. 06, 2022
Pre-Amplifier EMCI	EMC330N	980701	Mar. 10, 2021	Mar. 09, 2022
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Nov. 06, 2020	Nov. 05, 2021
RF Cable	8D	966-4-1	Mar. 17, 2021	Mar. 16, 2022
RF Cable	8D	966-4-2	Mar. 17, 2021	Mar. 16, 2022
RF Cable	8D	966-4-3	Mar. 17, 2021	Mar. 16, 2022
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-ATT5-03	Jan. 11, 2021	Jan. 10, 2022
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Nov. 22, 2020	Nov. 21, 2021
Pre-Amplifier EMCI	EMC 12630 SE	980638	Apr. 07, 2021	Apr. 06, 2022
RF Cable	EMC104-SM-SM-1200	160922	Dec. 25, 2020	Dec. 24, 2021
RF Cable	EMC104-SM-SM-2000	180502	Apr. 26, 2021	Apr. 25, 2022
RF Cable	EMC104-SM-SM-6000	180418	Apr. 26, 2021	Apr. 25, 2022
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 11, 2021	Jan. 10, 2022
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 22, 2020	Nov. 21, 2021
RF Cable	EMC102-KM-KM-1200	160924	Jan. 11, 2021	Jan. 10, 2022
RF Cable	EMC-KM-KM-4000	200214	Mar. 10, 2021	Mar. 09, 2022
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	NA	NA

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 4.
3. Tested Date: July 10 to 16, 2021

For other test

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Power meter Anritsu	ML2495A	1529002	June 21, 2021	June 20, 2022
Power sensor Anritsu	MA2411B	1339443	May 31, 2021	May 30, 2022
10dB Attenuator Woken	MDCS18N-10	MDCS18N-10-01	Apr. 13, 2021	Apr. 12, 2022
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA

- NOTE:**
1. The test was performed in Oven room 2.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: July 19, 2021

4.1.3 Test Procedures

For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. 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. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case 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 Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna 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 quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

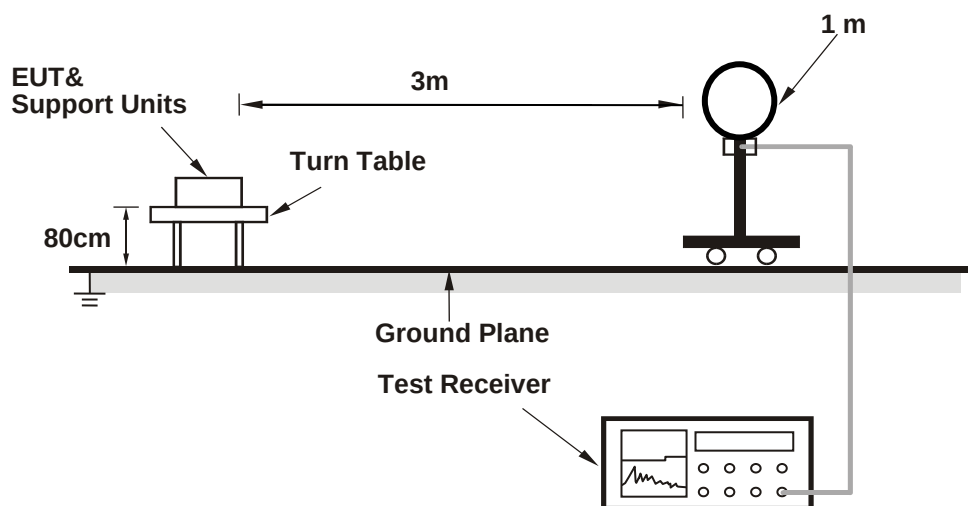
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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 $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

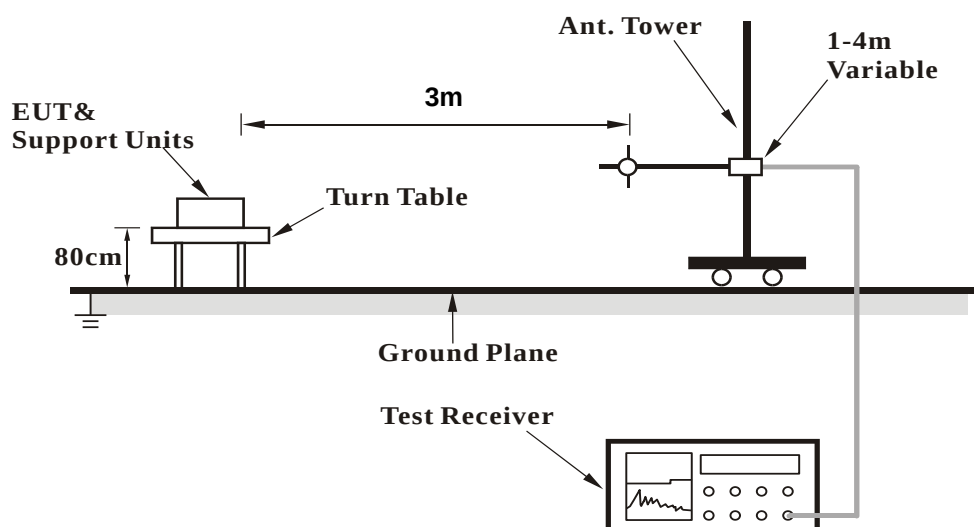
No deviation.

4.1.5 Test Setup

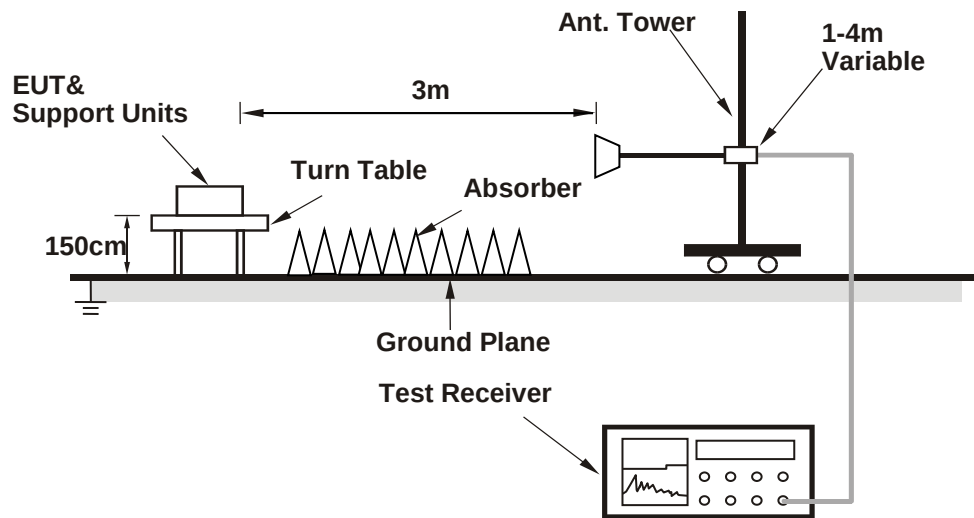
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

- a. Placed the EUT on the testing table.
- b. Controlling software (QDART 1.0.38) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data:

RF Mode	TX BT_GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2325.40	54.4 PK	74.0	-19.6	2.17 H	48	58.7	-4.3
2	2325.40	42.0 AV	54.0	-12.0	2.17 H	48	46.3	-4.3
3	*2402.00	92.4 PK			2.17 H	48	96.8	-4.4
4	*2402.00	90.7 AV			2.17 H	48	95.1	-4.4
5	4804.00	46.3 PK	74.0	-27.7	3.43 H	246	46.3	0.0
6	4804.00	44.2 AV	54.0	-9.8	3.43 H	246	44.2	0.0
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2324.90	55.6 PK	74.0	-18.4	3.09 V	59	59.9	-4.3
2	2324.90	42.4 AV	54.0	-11.6	3.09 V	59	46.7	-4.3
3	*2402.00	92.5 PK			3.09 V	59	96.9	-4.4
4	*2402.00	91.0 AV			3.09 V	59	95.4	-4.4
5	4804.00	46.3 PK	74.0	-27.7	2.78 V	187	46.3	0.0
6	4804.00	44.3 AV	54.0	-9.7	2.78 V	187	44.3	0.0

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX BT_GFSK	Channel	CH 39 : 2441 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2441.00	94.6 PK			2.13 H	46	99.0	-4.4
2	*2441.00	92.4 AV			2.13 H	46	96.8	-4.4
3	4882.00	46.6 PK	74.0	-27.4	3.44 H	231	46.5	0.1
4	4882.00	44.4 AV	54.0	-9.6	3.44 H	231	44.3	0.1
5	7323.00	42.2 PK	74.0	-31.8	1.67 H	241	35.9	6.3
6	7323.00	29.8 AV	54.0	-24.2	1.67 H	241	23.5	6.3
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2441.00	95.2 PK			3.05 V	43	99.6	-4.4
2	*2441.00	93.4 AV			3.05 V	43	97.8	-4.4
3	4882.00	46.3 PK	74.0	-27.7	2.80 V	201	46.2	0.1
4	4882.00	44.2 AV	54.0	-9.8	2.80 V	201	44.1	0.1
5	7323.00	42.0 PK	74.0	-32.0	1.41 V	327	35.7	6.3
6	7323.00	29.8 AV	54.0	-24.2	1.41 V	327	23.5	6.3

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX BT_GFSK	Channel	CH 78 : 2480 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	95.2 PK			2.15 H	49	99.7	-4.5
2	*2480.00	93.8 AV			2.15 H	49	98.3	-4.5
3	2491.50	54.7 PK	74.0	-19.3	2.15 H	49	59.2	-4.5
4	2491.50	41.7 AV	54.0	-12.3	2.15 H	49	46.2	-4.5
5	4960.00	47.0 PK	74.0	-27.0	3.46 H	238	46.4	0.6
6	4960.00	44.6 AV	54.0	-9.4	3.46 H	238	44.0	0.6
7	7440.00	41.9 PK	74.0	-32.1	1.67 H	254	35.2	6.7
8	7440.00	29.5 AV	54.0	-24.5	1.67 H	254	22.8	6.7
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	97.8 PK			2.78 V	58	102.3	-4.5
2	*2480.00	96.4 AV			2.78 V	58	100.9	-4.5
3	2496.60	53.6 PK	74.0	-20.4	2.78 V	58	58.1	-4.5
4	2496.60	42.0 AV	54.0	-12.0	2.78 V	58	46.5	-4.5
5	4960.00	46.5 PK	74.0	-27.5	2.84 V	211	45.9	0.6
6	4960.00	44.4 AV	54.0	-9.6	2.84 V	211	43.8	0.6
7	7440.00	41.6 PK	74.0	-32.4	1.39 V	317	34.9	6.7
8	7440.00	29.7 AV	54.0	-24.3	1.39 V	317	23.0	6.7

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX BT_8DPSK	Channel	CH 0 : 2402 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2382.80	54.4 PK	74.0	-19.6	2.10 H	50	58.8	-4.4
2	2382.80	41.8 AV	54.0	-12.2	2.10 H	50	46.2	-4.4
3	*2402.00	93.9 PK			2.10 H	50	98.3	-4.4
4	*2402.00	88.8 AV			2.10 H	50	93.2	-4.4
5	4804.00	46.9 PK	74.0	-27.1	3.52 H	245	46.9	0.0
6	4804.00	44.3 AV	54.0	-9.7	3.52 H	245	44.3	0.0
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2313.60	54.9 PK	74.0	-19.1	3.06 V	54	59.2	-4.3
2	2313.60	42.2 AV	54.0	-11.8	3.06 V	54	46.5	-4.3
3	*2402.00	94.6 PK			3.06 V	54	99.0	-4.4
4	*2402.00	89.6 AV			3.06 V	54	94.0	-4.4
5	4804.00	46.5 PK	74.0	-27.5	2.89 V	191	46.5	0.0
6	4804.00	44.7 AV	54.0	-9.3	2.89 V	191	44.7	0.0

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * " : Fundamental frequency.

RF Mode	TX BT_8DPSK	Channel	CH 39 : 2441 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2441.00	94.5 PK			2.11 H	56	98.9	-4.4
2	*2441.00	89.4 AV			2.11 H	56	93.8	-4.4
3	4882.00	46.1 PK	74.0	-27.9	3.43 H	235	46.0	0.1
4	4882.00	44.0 AV	54.0	-10.0	3.43 H	235	43.9	0.1
5	7323.00	42.4 PK	74.0	-31.6	1.71 H	240	36.1	6.3
6	7323.00	29.9 AV	54.0	-24.1	1.71 H	240	23.6	6.3
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2441.00	95.4 PK			2.96 V	61	99.8	-4.4
2	*2441.00	90.7 AV			2.96 V	61	95.1	-4.4
3	4882.00	46.8 PK	74.0	-27.2	2.79 V	209	46.7	0.1
4	4882.00	44.6 AV	54.0	-9.4	2.79 V	209	44.5	0.1
5	7323.00	41.8 PK	74.0	-32.2	1.38 V	315	35.5	6.3
6	7323.00	29.6 AV	54.0	-24.4	1.38 V	315	23.3	6.3

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX BT_8DPSK	Channel	CH 78 : 2480 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	95.2 PK			1.97 H	53	99.7	-4.5
2	*2480.00	90.1 AV			1.97 H	53	94.6	-4.5
3	2483.90	54.0 PK	74.0	-20.0	1.97 H	53	58.5	-4.5
4	2483.90	41.4 AV	54.0	-12.6	1.97 H	53	45.9	-4.5
5	4960.00	47.2 PK	74.0	-26.8	3.48 H	229	46.6	0.6
6	4960.00	44.8 AV	54.0	-9.2	3.48 H	229	44.2	0.6
7	7440.00	42.5 PK	74.0	-31.5	1.71 H	256	35.8	6.7
8	7440.00	29.9 AV	54.0	-24.1	1.71 H	256	23.2	6.7

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	96.2 PK			3.01 V	50	100.7	-4.5
2	*2480.00	91.3 AV			3.01 V	50	95.8	-4.5
3	2488.90	53.4 PK	74.0	-20.6	3.01 V	50	57.9	-4.5
4	2488.90	41.9 AV	54.0	-12.1	3.01 V	50	46.4	-4.5
5	4960.00	46.7 PK	74.0	-27.3	2.86 V	207	46.1	0.6
6	4960.00	44.9 AV	54.0	-9.1	2.86 V	207	44.3	0.6
7	7440.00	41.3 PK	74.0	-32.7	1.43 V	330	34.6	6.7
8	7440.00	29.4 AV	54.0	-24.6	1.43 V	330	22.7	6.7

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

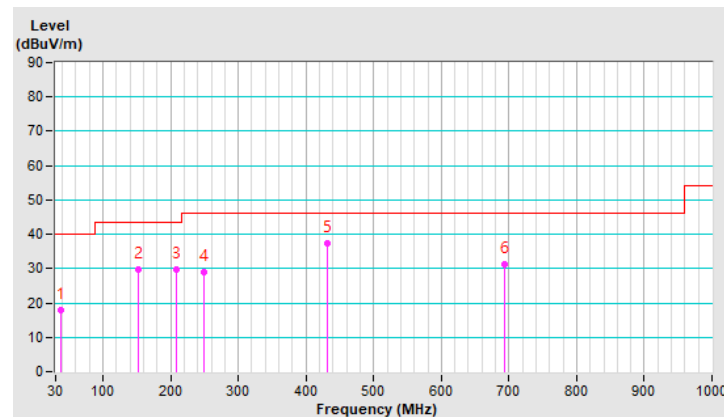
Below 1GHz Data:

RF Mode	TX BT_GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	37.83	17.9 QP	40.0	-22.1	1.00 H	299	31.0	-13.1
2	152.22	29.6 QP	43.5	-13.9	1.00 H	55	41.6	-12.0
3	207.58	29.6 QP	43.5	-13.9	1.50 H	27	44.7	-15.1
4	248.69	28.9 QP	46.0	-17.1	1.00 H	73	41.6	-12.7
5	431.99	37.3 QP	46.0	-8.7	1.00 H	183	43.9	-6.6
6	693.31	31.4 QP	46.0	-14.6	1.50 H	68	32.0	-0.6

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

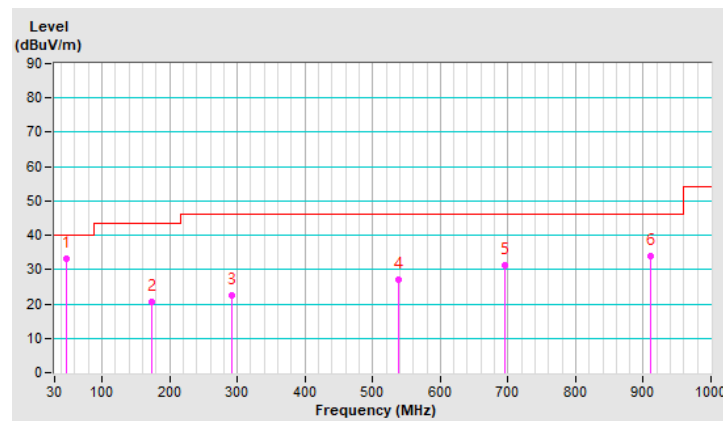


RF Mode	TX BT_GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	46.78	33.1 QP	40.0	-6.9	1.50 V	118	45.6	-12.5
2	173.61	20.6 QP	43.5	-22.9	1.00 V	71	33.4	-12.8
3	291.80	22.5 QP	46.0	-23.5	1.00 V	0	33.5	-11.0
4	537.84	26.9 QP	46.0	-19.1	1.50 V	128	31.1	-4.2
5	695.27	31.4 QP	46.0	-14.6	1.00 V	138	31.9	-0.5
6	911.56	34.0 QP	46.0	-12.0	1.00 V	0	30.2	3.8

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) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

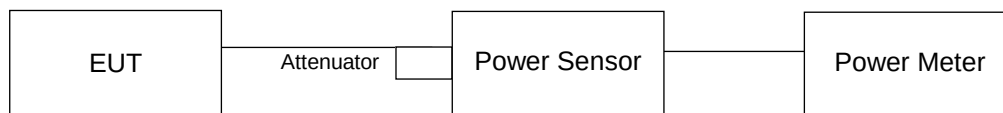


4.2 Maximum Output Power

4.2.1 Limits of Maximum Output Power Measurement

The Maximum Output Power Measurement is 125mW.

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedure

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.

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

4.2.5 Deviation from Test Standard

No deviation.

4.2.6 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.2.7 Test Results

FOR PEAK POWER

GFSK

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
0	2402	3.155	4.99	21	Pass
39	2441	3.873	5.88	21	Pass
78	2480	4.188	6.22	21	Pass

8DPSK

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
0	2402	4.732	6.75	21	Pass
39	2441	5.649	7.52	21	Pass
78	2480	6.281	7.98	21	Pass

FOR AVERAGE POWER

GFSK

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	3.006	4.78
39	2441	3.776	5.77
78	2480	4.093	6.12

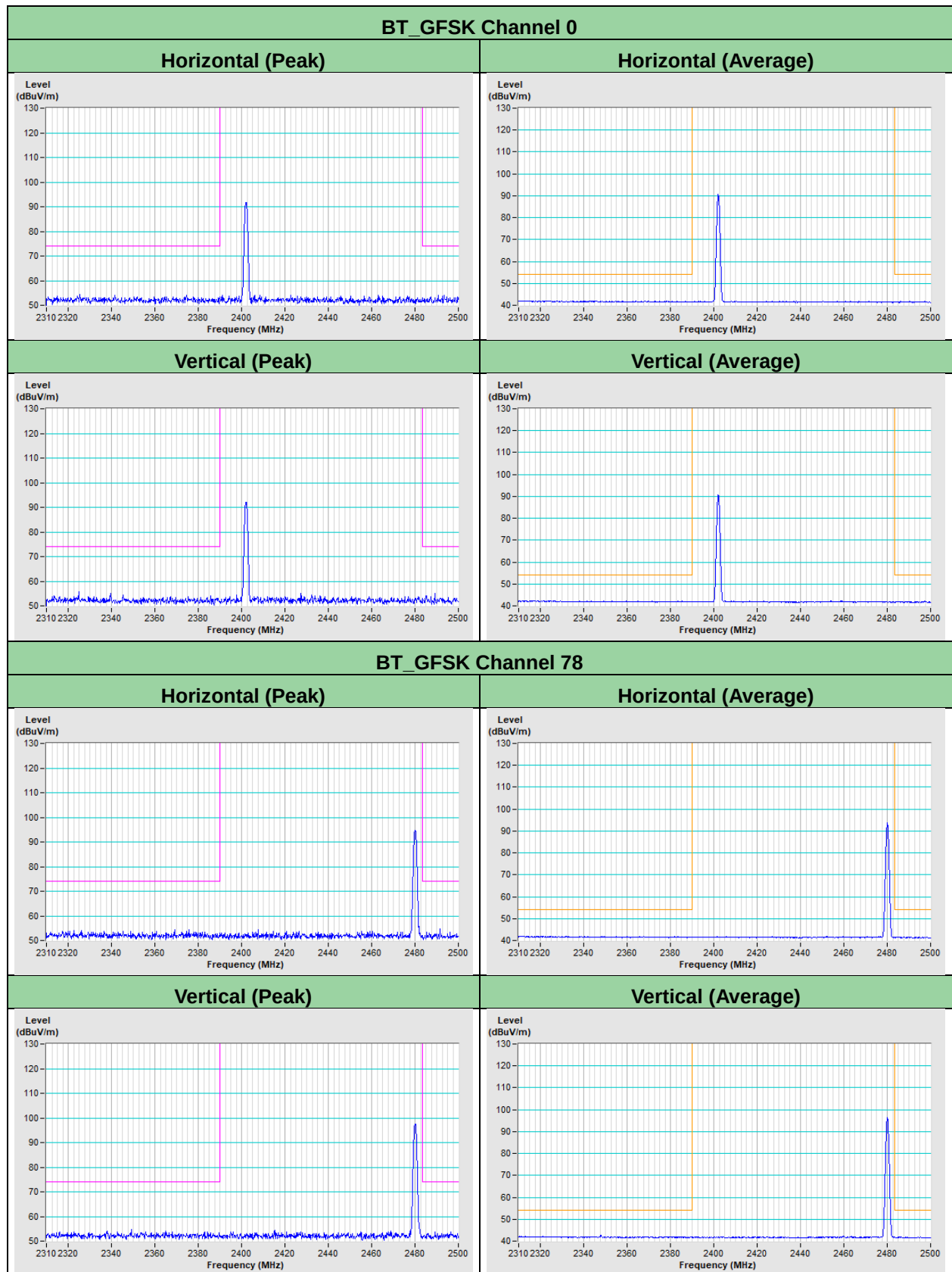
8DPSK

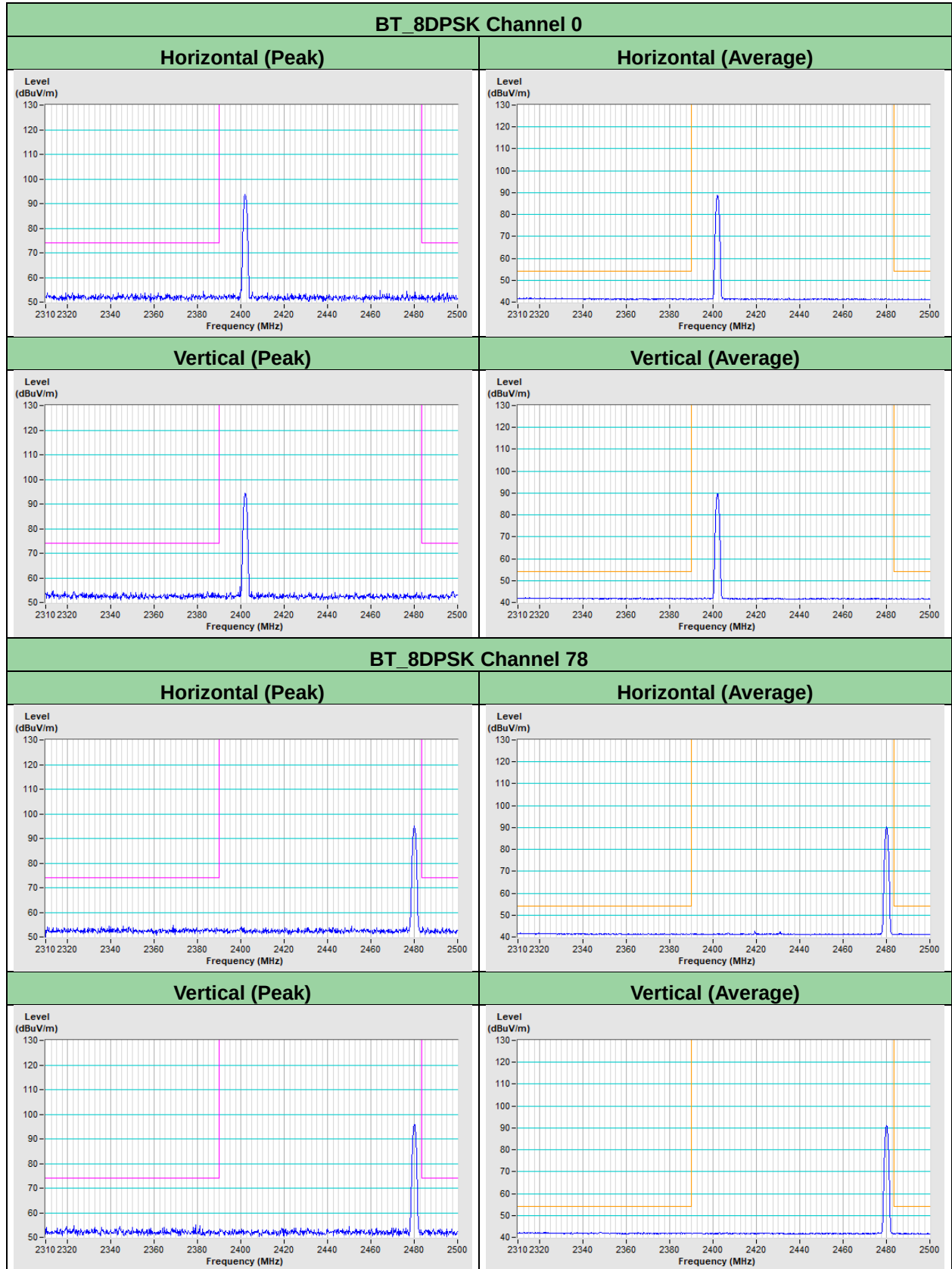
Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	2.673	4.27
39	2441	3.327	5.22
78	2480	3.707	5.69

5 Pictures of Test Arrangements

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

Annex A - Band-Edge Measurement





Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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