TEST REPORT

Applicant	Kane USA Inc.
Address	7601 E 88th Place, Indianapolis IN 46256, USA

Manufacturer or Supplier	ePlus Innovation Corp.
Address	3F-West, Litai factory Building C, Luoyang Town, Boluo District, Huizhou, Guangdong Province, China.
Product	Wireless Pipe Clamp
Brand Name	UEi Test Instruments
Model	WPC2
Additional Model & Model Difference	N/A
Date of tests	Dec. 11, 2019 ~ Dec. 31, 2019

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

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

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

Tested by Aaron Liang Project Engineer / EMC Department	Approved by David Huang Supervisor / EMC Department
Aaron Liang	David Huang Date: Jan. 07, 2020

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF200103N044	Original release	Jan. 07, 2020

Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch

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1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)			
STANDARD SECTION	**TEST TYPE AND LIMIT**	**RESULT**	**REMARK**
15.207	AC Power Conducted Emission	N/A	Powered from battery
15.205 15.209	Radiated Emission	PASS	Meet the requirement of limit.
15.247(d)	Out of band Emission Measurement	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted Output power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used

NOTE: Test Lab Information:

Lab: Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch

Test Lab Address: Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao'an District Shenzhen, Guangdong, 518108, People's Republic of China

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	3.74dB
	1GHz ~ 18GHz	4.66dB
	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	Wireless Pipe Clamp
MODEL NO.	WPC2
ADDITIONAL MODELS	N/A
FCC ID	2AKE4WPC2
NOMINAL VOLTAGE	DC 1.5V from Battery
MODULATION TECHNOLOGY	DTS
MODULATION TYPE	BT-LE(GFSK)
OPERATING FREQUENCY	2402-2480MHz
PEAK OUTPUT POWER	13.614 mW (Max. Measured)
ANTENNA TYPE	FPC Antenna, with 3.09 dBi gain
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	N/A

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
3. Please refer to the EUT photo document (Reference No.: 200103N044) for detailed product photo.

3.2 DESCRIPTION OF TEST MODES

40 channels are provided for BT-LE(GFSK):

CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

3.2.1. CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photographs 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 and antenna ports
The worst case was found when positioned on X axis for radiated emission. Following test modes were selected for the final test, and the final worst case is marked in boldface and recorded in the report:

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE<1G	RE≥1G	PLC	APCM	
A	√	√	-	√	DC 1.5V from Battery

Where **RE<1G:** Radiated Emission below 1GHz **RE≥1G:** Radiated Emission above 1GHz
PLC: Power Line Conducted Emission **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 1GHz):

☒ 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 (if EUT with antenna diversity architecture).

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
BT-LE	0 to 39	39	DTS	BT-LE	1

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

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, XYZ axis and antenna ports (if EUT with antenna diversity architecture).

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
BT-LE	0 to 39	0,19, 39	DTS	BT-LE	1

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, data rates and antenna ports (if EUT with antenna diversity architecture).

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
BT-LE	0 to 39	0, 19, 39	DTS	BT-LE	1

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE	TESTED BY
RE<1G	25deg. C, 55%RH	DC 1.5V from Battery	Huang Long
RE≥1G	24deg. C, 58%RH	DC 1.5V from Battery	Huang Long
PLC	N/A	N/A	N/A
APCM	25deg. C, 60%RH	DC 1.5V from Battery	Aaron Liang

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

558074 D01 15.247 Meas Guidance v05r02

ANSI C63.10-2013

Note: 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 a dependent unit together without any other necessary accessories or support units.

4 TEST TYPES AND RESULTS

4.1 RADIATED EMISSION MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION 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).

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

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESL6	1300.5001K06 -100262-eQ	Apr. 04, 19	Apr. 03, 20
Bilog Antenna	Sunol Sciences	JB6	A110712	Apr. 08, 19	Apr. 07, 20
Active Antenna	CMO-POWER	AL-130	121031	Mar. 27, 19	Mar. 26, 20
Signal Amplifier	HP	8447E	443008	Mar. 28, 19	Mar. 27, 20
Spectrum	Agilent	E4446A	MY46180622	May. 08,19	Mar. 07, 20
MXA signal analyzer	Agilent	N9020A	MY49100060	Mar. 28, 19	Mar. 27, 20
Horn Antenna	COM-POWER	HAH-118	71259	Mar. 22, 19	Mar. 21, 20
Horn Antenna	COM-POWER	HAH-118	71283	Mar. 20, 19	Mar. 19, 20
SHF-EHF Horn	Schwarzbeck	BBHA9170	BBHA9170147	Jun. 30, 19	Jun. 29, 20
SHF-EHF Horn	Schwarzbeck	BBHA9170	BBHA9170242	Jun. 30, 19	Jun. 29, 20
AMPLIFIER	EM Electornic Corporation	EM01G26G	60613	Mar. 28, 19	Mar. 27, 20
AMPLIFIER	Emc Instruments Corporation	Emc012645	980077	Jan. 04, 19	Jan. 03,20
3m Semi-anechoic Chamber	SAEMC	9m*6m*6m	N/A	Oct. 18,18	Oct. 17,21
Test Software	EZ-EMC	ICP-03A1	N/A	N/A	N/A

NOTE:

1. The test was performed in 966 Chamber.
2. The calibration interval of the above test instruments is 12 months (Except 3m Semi-anechoic Chamber). And the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
3. The horn antenna is used only for the measurement of emission frequency above1GHz if tested.
4. The FCC Site Registration No. is 749762.

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 place 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 1m 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 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 ≥ 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.

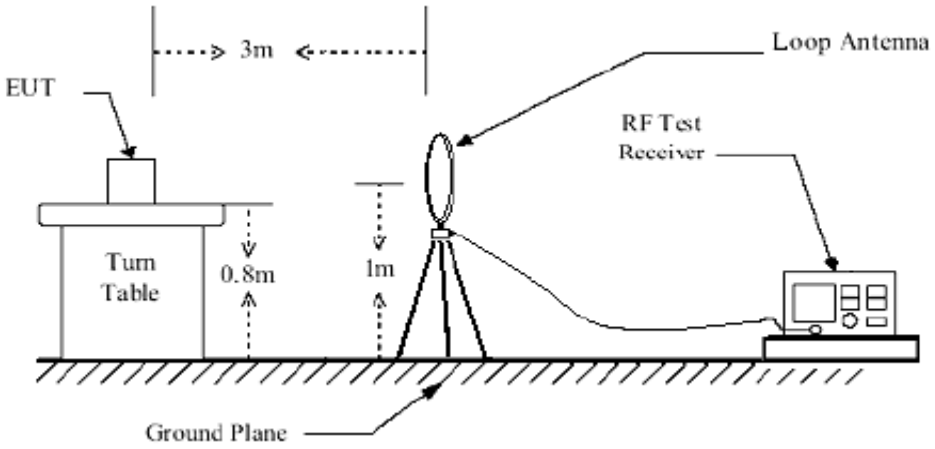
5.The testing of the EUT was performed on all 3 orthogonal axes; the worst-case test configuration was reported on the file test setup photo.

4.1.4 DEVIATION FROM TEST STANDARD

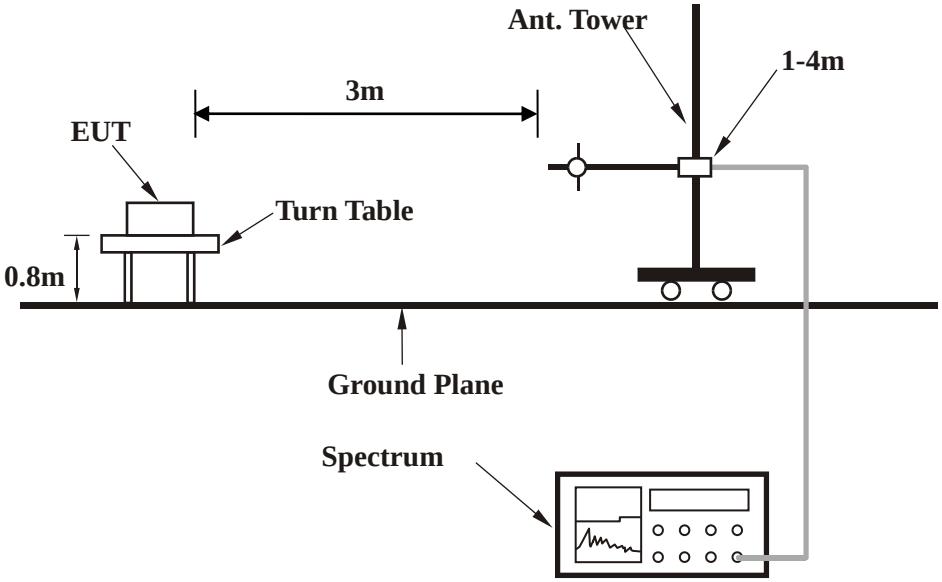
No deviation.

4.1.5 TEST SETUP

Below 30MHz test setup

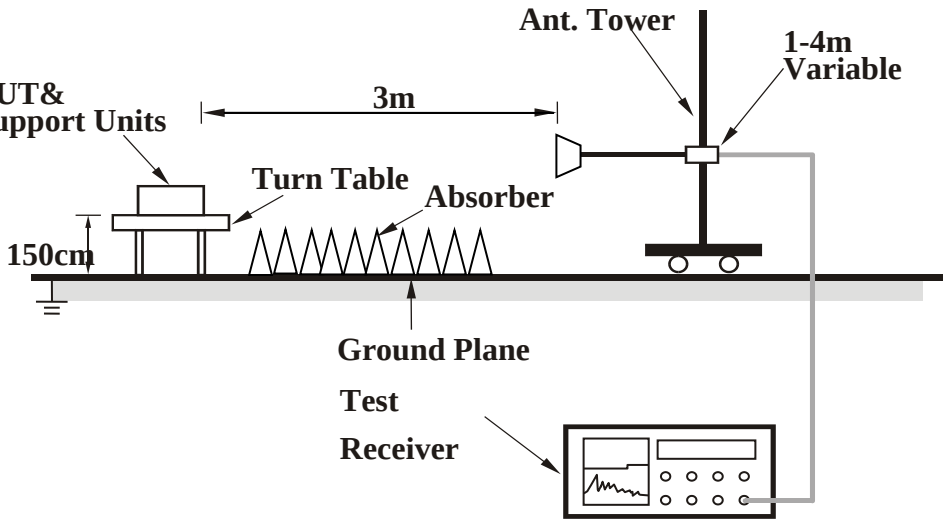


Below 1GHz test setup



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

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

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

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

4.1.7 TEST RESULTS

BELOW 1GHz WORST-CASE DATA:

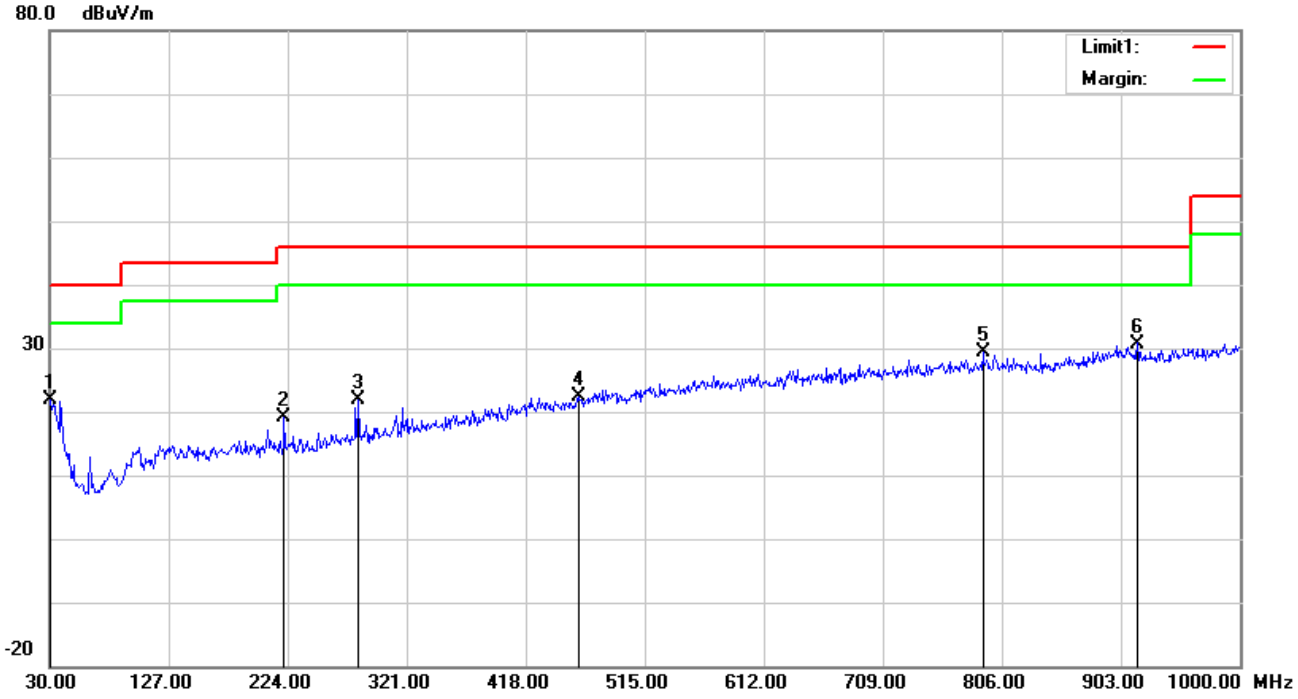
BT-LE (GFSK)

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 m										
No.	Frequency	Reading	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
	(MHz)	(dBuV/m)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	30.9700	24.48	19.48	22.27	0.13	21.82	40.00	-18.18	200	44
2	221.0900	28.55	11.42	22.34	1.58	19.21	46.00	-26.79	100	111
3	281.2300	29.17	13.25	22.29	1.68	21.81	46.00	-24.19	100	260
4	460.6800	24.47	17.66	21.89	2.04	22.28	46.00	-23.72	100	208
5	790.4800	25.79	22.11	21.17	2.54	29.27	46.00	-16.73	100	289
6	916.5800	25.36	23.57	20.85	2.67	30.75	46.00	-15.25	100	70

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 Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

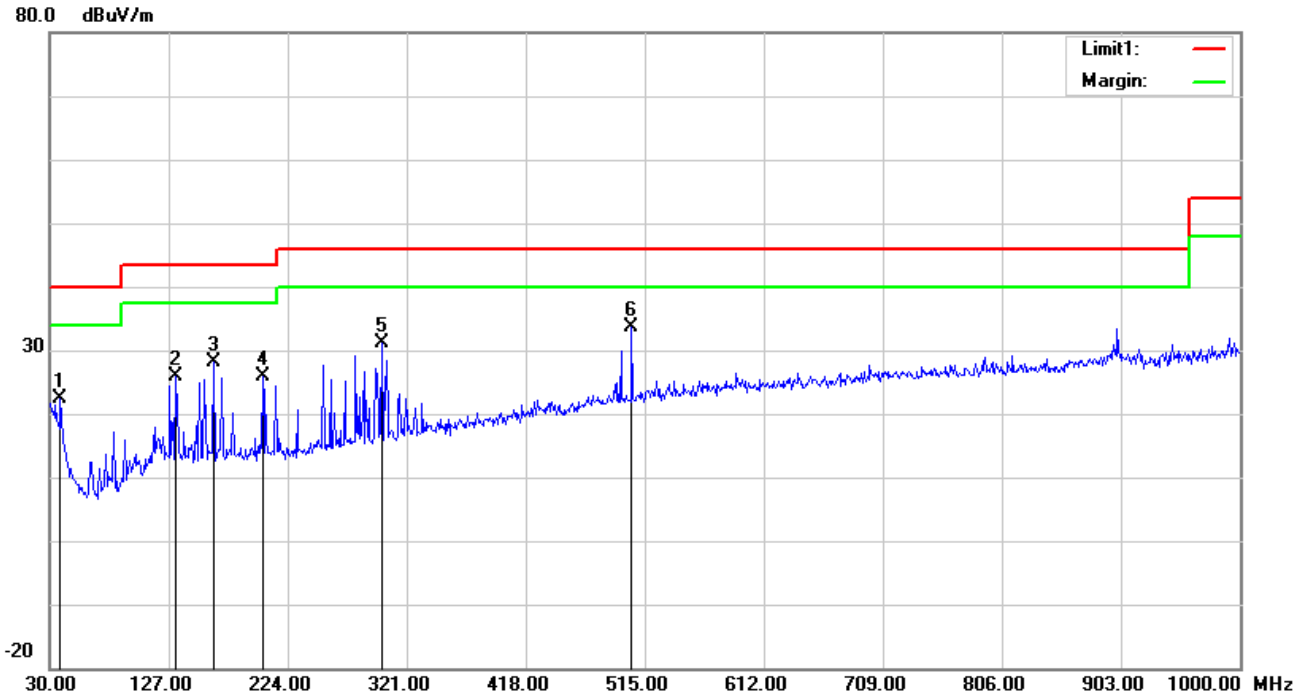


CHANNEL	TX Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 m										
No.	Frequency	Reading	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
	(MHz)	(dBuV/m)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	38.7300	30.60	13.77	22.27	0.17	22.27	40.00	-17.73	100	36
2	132.8200	35.66	11.45	22.39	1.12	25.84	43.50	-17.66	100	57
3	163.8600	37.92	11.07	22.27	1.35	28.07	43.50	-15.43	100	154
4	203.6300	35.28	11.49	22.37	1.55	25.95	43.50	-17.55	100	289
5	300.6300	38.01	13.71	22.29	1.72	31.15	46.00	-14.85	100	106
6	504.3300	34.55	18.79	21.80	2.14	33.68	46.00	-12.32	100	47

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 Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.



ABOVE 1GHz TEST DATA:

BT-LE (GFSK)

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**DETECTOR (PK/AV)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	2390	44.93	PK	74	-29.07	167	89	58.58	-13.65
2	2390	33.2	AV	54	-20.8	167	89	46.85	-13.65
3	*2402	94.27	PK			140	275	107.67	-13.97
4	*2402	93.7	AV			140	275	65.05	-13.97
5	4804	51.08	PK	74	-22.92	136	188	54.83	-3.75
6	4804	43.42	AV	54	-10.58	136	188	47.17	-3.75
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**DETECTOR(PK/AV)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	2390	50.77	PK	74	-23.23	133	197	64.42	-13.65
2	2390	41.42	AV	54	-12.58	133	197	55.07	-13.65
3	*2402	105.32	PK			154	293	119.29	-13.97
4	*2402	104.23	AV			154	293	118.2	-13.97
5	4804	57.56	PK	74	-16.44	166	40	61.31	-3.75
6	4804	51.17	AV	54	-2.83	166	40	54.92	-3.75

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 Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 19	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	DETECTOR (PK/AV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2440	94.03	PK			133	345	107.05	-13.02
2	*2440	93.56	AV			133	345	106.58	-13.02
3	4880	50.35	PK	74	-23.65	144	243	54.31	-3.96
4	4880	50.34	AV	54	-3.66	144	243	54.3	-3.96
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	DETECTOR(PK/AV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2440	104.62	PK			141	104	117.64	-13.02
2	*2440	103.51	AV			141	104	116.53	-13.02
3	4880	56.34	PK	74	-17.66	146	241	60.3	-3.96
4	4880	50.13	AV	54	-3.87	146	241	54.09	-3.96

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 Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	DETECTOR (PK/AV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2483.5	48.1	PK	74	-25.9	137	16	61.75	-13.65
2	2483.5	36.1	AV	54	-17.9	137	16	49.75	-13.65
3	*2480	89.1	PK			168	100	103.07	-13.97
4	*2480	88.1	AV			168	100	102.07	-13.97
5	4960	56.85	PK	74	-17.15	167	344	60.6	-3.75
6	4960	48.2	AV	54	-5.8	167	344	51.95	-3.75
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	DETECTOR(PK/AV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2483.5	56.57	PK	74	-17.43	150	15	70.22	-13.65
2	2483.5	44.95	AV	54	-9.05	150	15	58.6	-13.65
3	*2480	99.76	PK			158	178	113.73	-13.97
4	*2480	99.54	AV			158	178	113.51	-13.97
5	4960	63.1	PK	74	-10.9	135	101	66.85	-3.75
6	4960	52.4	AV	54	-1.6	135	101	56.15	-3.75

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 Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

4.2 6dB BANDWIDTH MEASUREMENT

4.2.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Wireless Connectivity Tester	R&S	CMW270	1201.0002K75	Nov. 29, 18	Nov. 28, 19
Wireless Connectivity Tester	R&S	CMW270	1201.0002K75	Dec. 18, 19	Dec. 17, 20
MXA VEXTOR SIGNAL	Agilent	n5182a	MY50140530	Mar. 28,19	Mar. 27,20
MXA signal analyzer	Agilent	n9020a	MY49100060	Mar. 28,19	Mar. 27,20
RF Control Unit	Tonscend	JS0806-2	188060112	Mar. 28,19	Mar. 27,20
Signal Generation	Agilent	E4421B	US40051152	Nov. 29, 18	Nov. 28, 19
Signal Generation	Agilent	E4421B	US40051152	Dec.18,19	Dec.17,20
DC Power Supply	Agilent	E3640A	MY40004013	Mar. 28,19	Mar. 27,20
Programmable Temperature & Humidity Chamber	Hongjin	HYC-TH-225 DH	DG-180746	Mar. 28,19	Mar. 27,20
Test System	Tonscend	JS 1120-3	N/A	N/A	N/A
Power Splitter	Weinschel	1580-1	TL177	Mar. 20,19	Mar. 19,20
Universal Radio Communication	ROHDE&SCHWARZ	CMU200	112012	Mar. 28,19	Mar. 27,20
Universal Radio Communication	ROHDE&SCHWARZ	CMU200	121393	Mar. 28,19	Mar. 27,20
Wireless Communication Test Set	ROHDE&SCHWARZ	CMW500	1201.0002K500-155842-Gd	Nov. 1, 19	Oct. 31, 20

NOTE:

1. The test was performed in RF Oven 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.

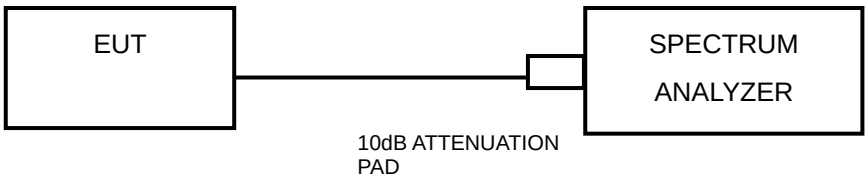
4.2.3 TEST PROCEDURE

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

4.2.5 TEST SETUP



4.2.6 EUT OPERATING CONDITIONS

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

4.2.7 TEST RESULTS

BT-LE (GFSK)

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	0.736	0.5	PASS
19	2440	0.752	0.5	PASS
39	2480	0.752	0.5	PASS

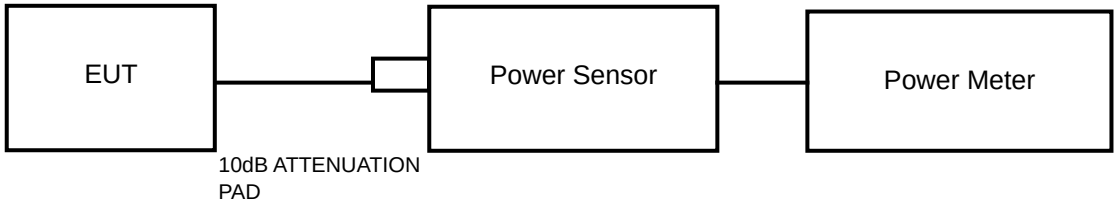
WORSE PLOT

4.3 CONDUCTED OUTPUT POWER

4.3.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 2400–2483.5 MHz band: 1 Watt (30dBm)

4.3.2 TEST SETUP



4.3.3 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Wireless Connectivity Tester	R&S	CMW270	1201.0002K75	Nov. 29, 18	Nov. 28, 19
Wireless Connectivity Tester	R&S	CMW270	1201.0002K75	Dec. 18, 19	Dec. 17, 20
MXA VEXTOR SIGNAL	Agilent	n5182a	MY50140530	Mar. 28,19	Mar. 27,20
MXA signal analyzer	Agilent	n9020a	MY49100060	Mar. 28,19	Mar. 27,20
RF Control Unit	Tonscend	JS0806-2	188060112	Mar. 28,19	Mar. 27,20
Signal Generation	Agilent	E4421B	US40051152	Nov. 29, 18	Nov. 28, 19
Signal Generation	Agilent	E4421B	US40051152	Nov. 29, 18	Nov. 28, 19
DC Power Supply	Agilent	E3640A	MY40004013	Mar. 28,19	Mar. 27,20
Programmable Temperature & Humidity Chamber	Hongjin	HYC-TH-225 DH	DG-180746	Mar. 28,19	Mar. 27,20
Test System	Tonscend	JS 1120-3	N/A	N/A	N/A
Power Splitter	Weinschel	1580-1	TL177	Mar. 20,19	Mar. 19,20
Universal Radio Communication	ROHDE&SCHWARZ	CMU200	112012	Mar. 28,19	Mar. 27,20
Universal Radio Communication	ROHDE&SCHWARZ	CMU200	121393	Mar. 28,19	Mar. 27,20
Wireless Communication Test Set	ROHDE&SCHWARZ	CMW500	1201.0002K50 0-155842-Gd	Nov. 1, 19	Oct. 31, 20

NOTE:1. The test was performed in RF Oven 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.

4.3.4 TEST PROCEDURES

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

4.3.5 DEVIATION FROM TEST STANDARD

No deviation.

4.3.6 EUT OPERATING CONDITIONS

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

4.3.7 TEST RESULTS

4.3.7.1 MAXIMUM PEAK OUTPUT POWER

BT-LE (GFSK)

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
0	2402	11.34	13.614	1	PASS
19	2440	10.62	11.535	1	PASS
39	2480	9.36	8.63	1	PASS

4.3.7.2 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.

BT-LE (GFSK)

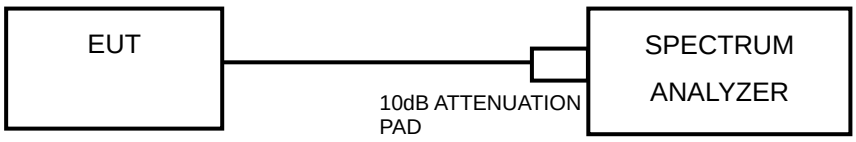
CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)
0	2402	11.14
19	2440	10.21
39	2480	9.15

4.4 POWER SPECTRAL DENSITY MEASUREMENT

4.4.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm/3KHz.

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

1. Set the span to 1.5 times the DTS bandwidth
2. Set the RBW = 3 kHz, VBW ≥ 3 x RBW, Detector = peak.
3. Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

4.4.6 EUT OPERATING CONDITION

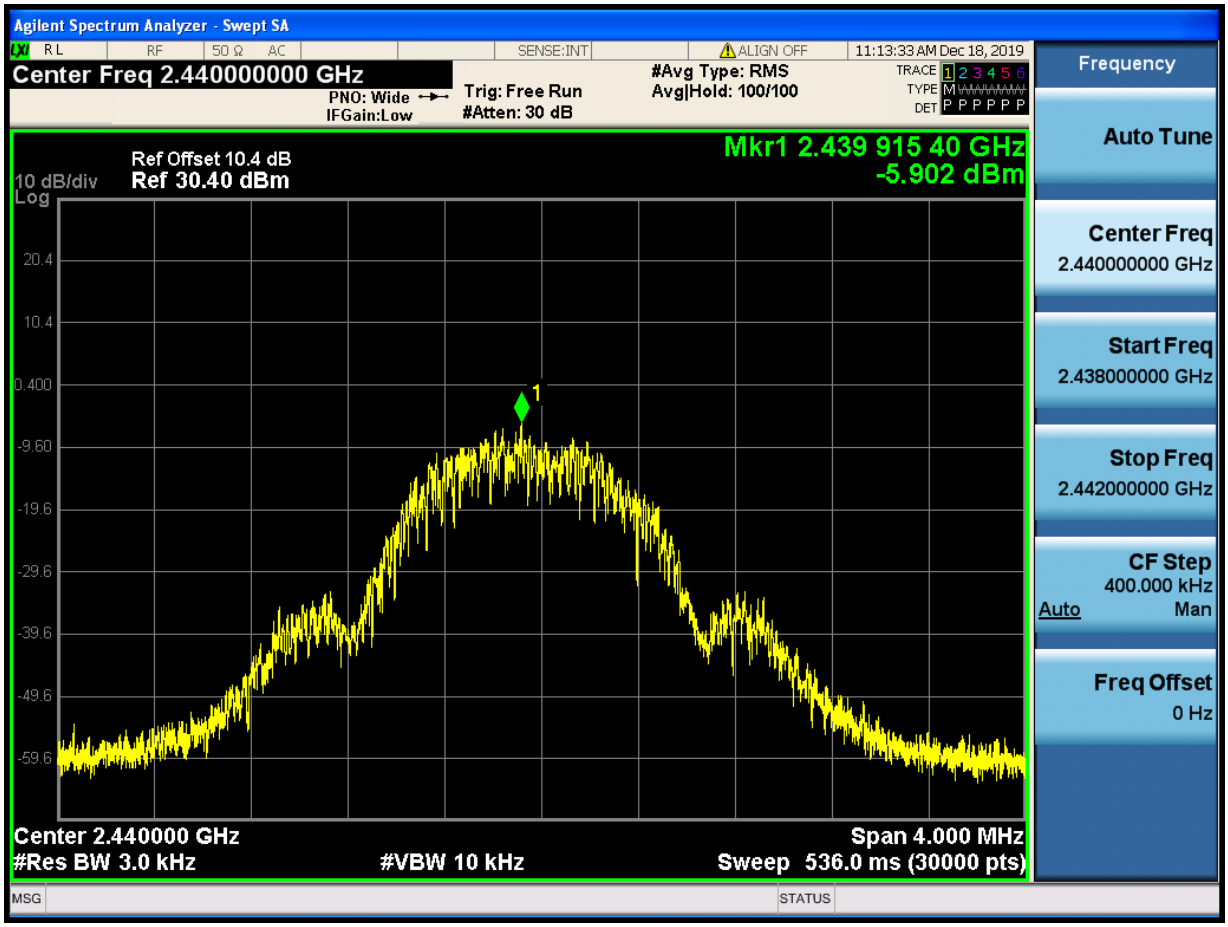
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.4.7 TEST RESULTS

BT-LE (GFSK)

Channel	FREQ. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	2402	-6.905	8	PASS
19	2440	-5.902	8	PASS
39	2480	-6.666	8	PASS

WORSE PLOT

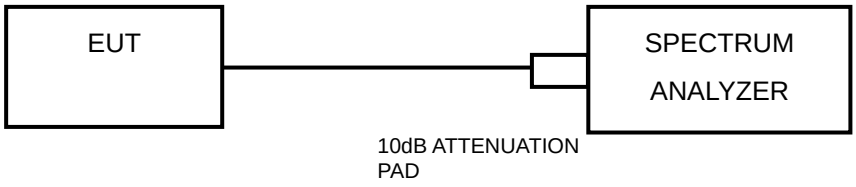


4.5 OUT OF BAND EMISSION MEASUREMENT

4.5.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

Below –20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

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 PROCEDURE

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOBE

1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Set span to encompass the spectrum to be examined
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

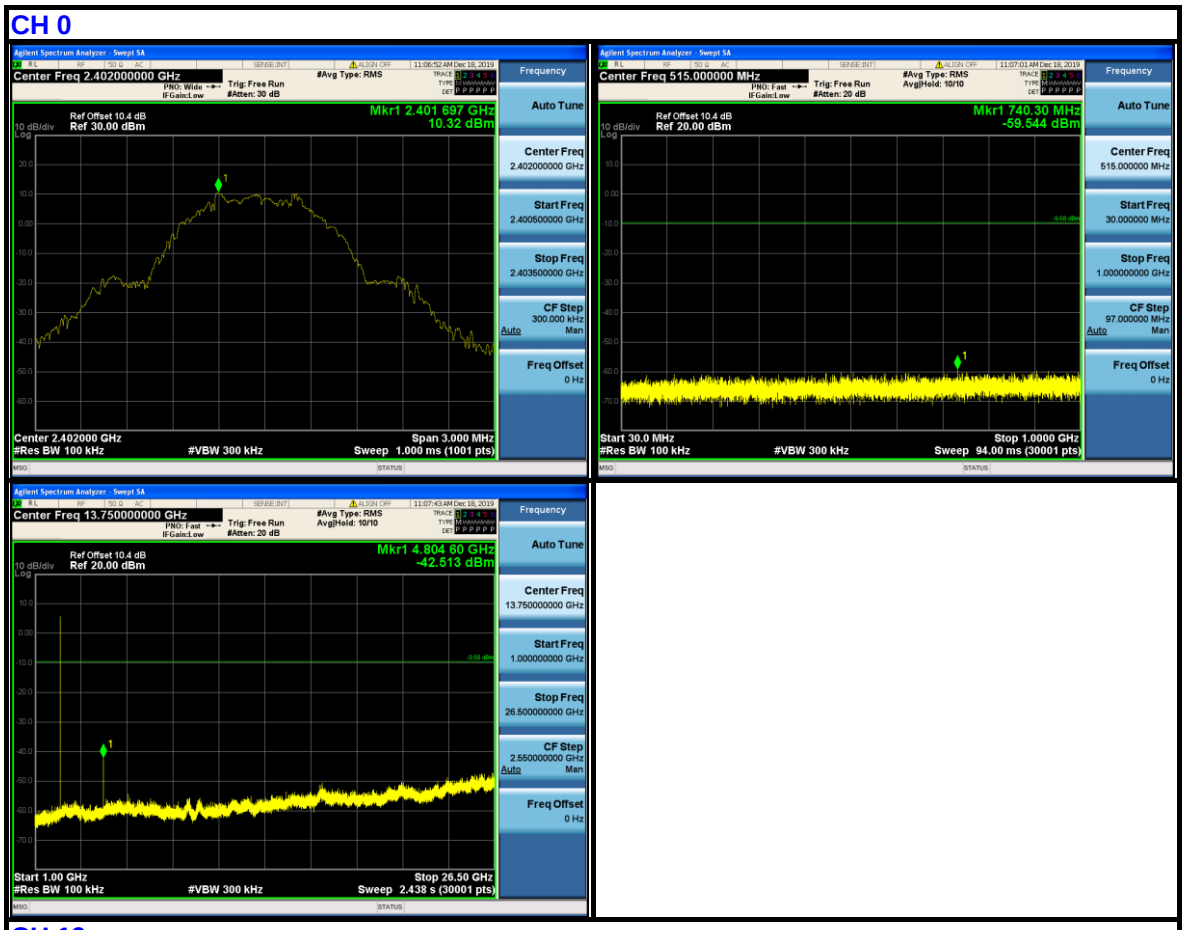
4.5.6 EUT OPERATING CONDITION

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

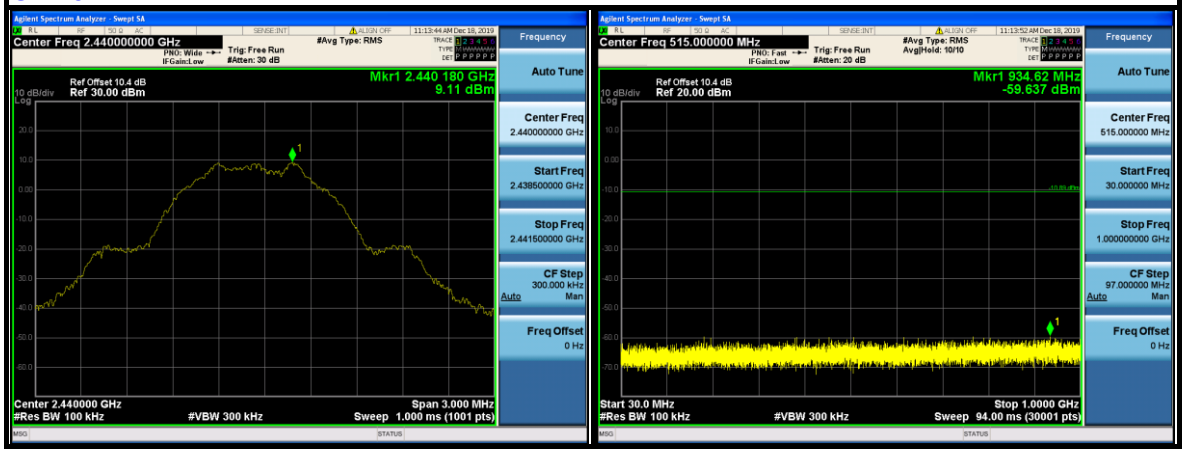
4.5.7 TEST RESULTS

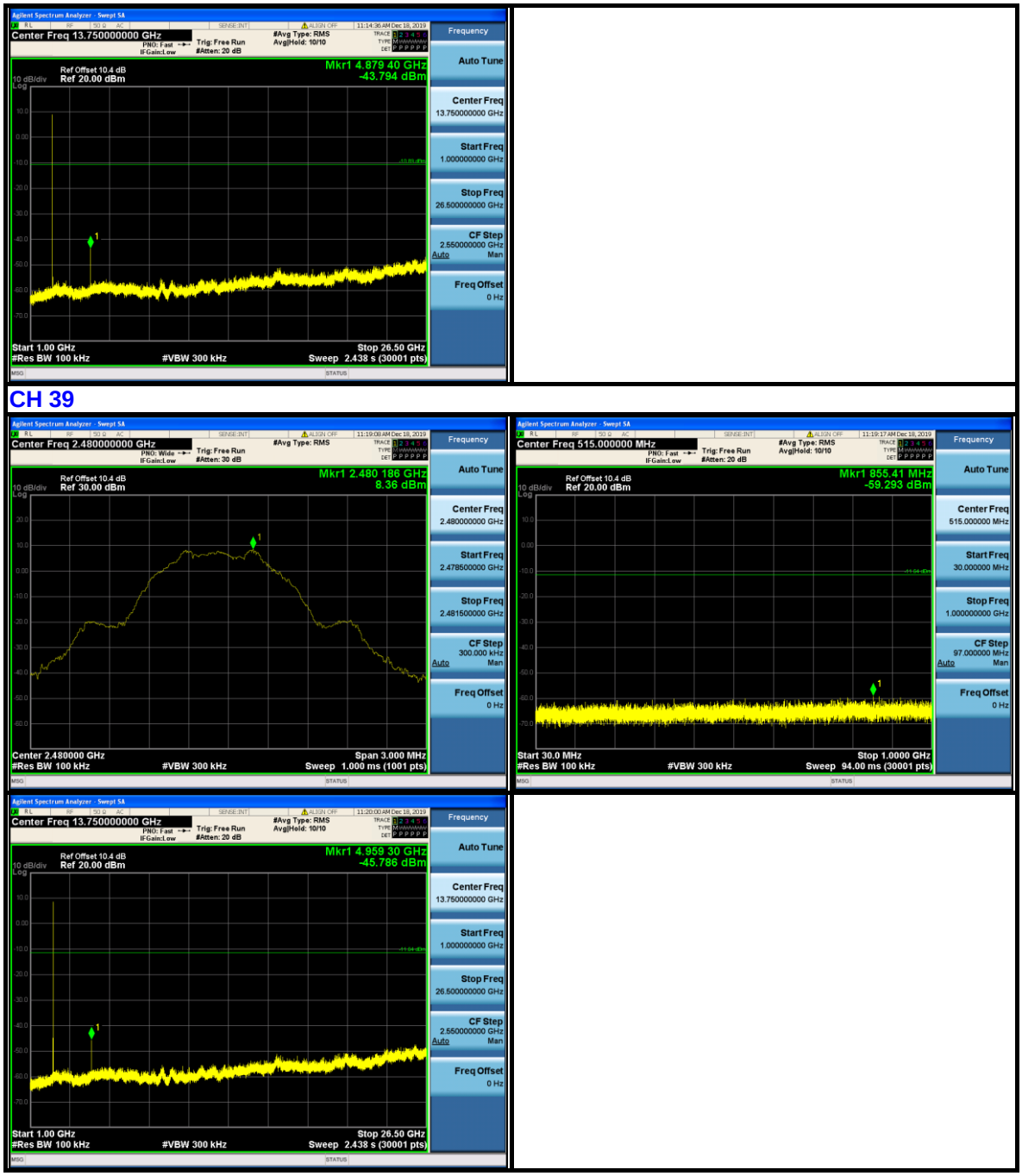
BT-LE (GFSK)

CH 0



CH 19

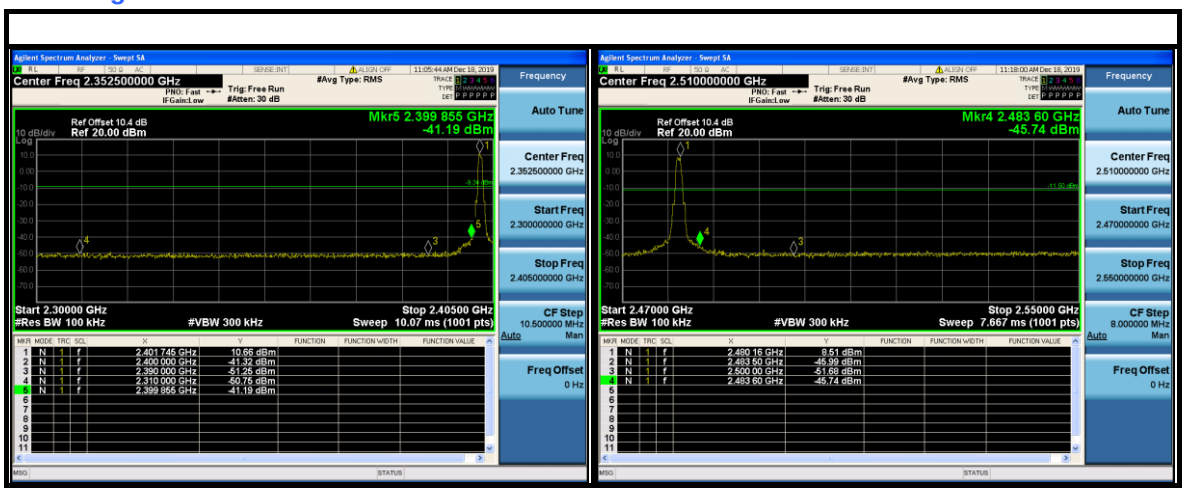



Agilent Spectrum Analyzer - Swept SA
Center Freq 13.750000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 10/10
11:14:36 AM Dec 18, 2019
Frequency
Mkr1 4.879 40 GHz
-43.794 dBm
Ref Offset 10.4 dB
10 dB/div
Ref 20.00 dBm
Log
Auto Tune
Center Freq
13.750000000 GHz
Start Freq
1.000000000 GHz
Stop Freq
26.500000000 GHz
CF Step
2.550000000 GHz
Auto
Man
Freq Offset
0 Hz
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.438 s (30001 pts)
MSG
STATUS

CH 39

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
11:19:08 AM Dec 18, 2019
Frequency
Mkr1 2.480 186 GHz
8.36 dBm
Ref Offset 10.4 dB
10 dB/div
Ref 30.00 dBm
Log
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
Center 2.480000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3.000 MHz
Sweep 1.000 ms (1001 pts)
MSG
STATUS
Agilent Spectrum Analyzer - Swept SA
Center Freq 515.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 10/10
11:19:17 AM Dec 18, 2019
Frequency
Mkr1 855.41 MHz
-59.293 dBm
Ref Offset 10.4 dB
10 dB/div
Ref 20.00 dBm
Log
Auto Tune
Center Freq
515.000000 MHz
Start Freq
30.000000 MHz
Stop Freq
1.000000000 GHz
CF Step
97.000000 MHz
Auto
Man
Freq Offset
0 Hz
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 94.00 ms (30001 pts)
MSG
STATUS
Agilent Spectrum Analyzer - Swept SA
Center Freq 13.750000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Avg|Hold: 10/10
11:20:00 AM Dec 18, 2019
Frequency
Mkr1 4.959 30 GHz
-45.786 dBm
Ref Offset 10.4 dB
10 dB/div
Ref 20.00 dBm
Log
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
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.438 s (30001 pts)
MSG
STATUS

Band Edge:


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.352500000 GHz
#Avg Type: RMS
Trig: Free Run
#Atten: 30 dB
Ref Offset 10.4 dB
10 dB/div
Ref 20.00 dBm
Mkr5 2.399 855 GHz
-41.19 dBm
Start 2.30000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.40500 GHz
Sweep 10.07 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.352500000 GHz
Start Freq
2.300000000 GHz
Stop Freq
2.405000000 GHz
CF Step
10.500000 MHz
Auto
Man
Freq Offset
0 Hz
1 N 1 f 2.401 745 GHz 10.66 dBm
2 N 1 f 2.400 000 GHz -41.32 dBm
3 N 1 f 2.390 000 GHz -51.25 dBm
4 N 1 f 2.310 000 GHz -50.75 dBm
5 N 1 f 2.399 855 GHz -41.19 dBm
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.510000000 GHz
#Avg Type: RMS
Trig: Free Run
#Atten: 30 dB
Ref Offset 10.4 dB
10 dB/div
Ref 20.00 dBm
Mkr4 2.483 60 GHz
-45.74 dBm
Start 2.47000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.55000 GHz
Sweep 7.667 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.510000000 GHz
Start Freq
2.470000000 GHz
Stop Freq
2.550000000 GHz
CF Step
8.000000 MHz
Auto
Man
Freq Offset
0 Hz
1 N 1 f 2.480 16 GHz 9.51 dBm
2 N 1 f 2.483 50 GHz -45.99 dBm
3 N 1 f 2.500 00 GHz -51.68 dBm
4 N 1 f 2.483 60 GHz -45.74 dBm

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---