

TEST REPORT

Applicant	Zound Industries International AB
Address	Centralplan 15 SE-111 20 Stockholm Sweden

Manufacturer or Supplier	Zound Industries International AB
Address	Centralplan 15 SE-111 20 Stockholm Sweden
Product	PORTABLE STEREO LOUDSPEAKER
Brand Name	Marshall
Model	EMBERTON BLUETOOTH
Additional Model & Model Difference	N/A
Date of tests	Nov. 13, 2021~ Dec. 08, 2021

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 Eric Fang Project Engineer / EMC Department	Approved by Glyn He Assistant Manager / EMC Department
	 Date: Dec. 21, 2021

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TABLE OF CONTENTS

RELEASE CONTROL RECORD	4
1 SUMMARY OF TEST RESULTS.....	5
2 MEASUREMENT UNCERTAINTY	5
3 GENERAL INFORMATION	6
3.1 GENERAL DESCRIPTION OF EUT	6
3.2 DESCRIPTION OF TEST MODES	7
3.2.1. CONFIGURATION OF SYSTEM UNDER TEST	7
3.2.2. TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL.....	7
3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS	10
3.4 DESCRIPTION OF SUPPORT UNITS	10
4 TEST TYPES AND RESULTS.....	11
4.1 CONDUCTED EMISSION MEASUREMENT	11
4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT	11
4.1.2 TEST INSTRUMENTS.....	11
4.1.3 TEST PROCEDURES	12
4.1.4 DEVIATION FROM TEST STANDARD	12
4.1.5 TEST SETUP	13
4.1.6 EUT OPERATING CONDITIONS	13
4.1.7 TEST RESULTS	14
4.2 RADIATED EMISSION MEASUREMENT	16
4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT	16
4.2.2 TEST INSTRUMENTS.....	17
4.2.3 TEST PROCEDURES	18
4.2.4 DEVIATION FROM TEST STANDARD	19
4.2.5 TEST SETUP	19
4.2.6 EUT OPERATING CONDITIONS	20
4.2.7 TEST RESULTS	21
4.3 6DB BANDWIDTH MEASUREMENT	29
4.3.1 LIMITS OF 6DB BANDWIDTH MEASUREMENT	29
4.3.2 TEST INSTRUMENTS.....	29
4.3.3 TEST PROCEDURE.....	30
4.3.4 DEVIATION FROM TEST STANDARD	30
4.3.5 TEST SETUP	31

4.3.6	EUT OPERATING CONDITIONS	31
4.3.7	TEST RESULTS	32
4.4	CONDUCTED OUTPUT POWER.....	36
4.4.1	LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT	36
4.4.2	TEST SETUP	36
4.4.3	TEST INSTRUMENTS.....	36
4.4.4	TEST PROCEDURES	36
4.4.5	DEVIATION FROM TEST STANDARD	36
4.4.6	EUT OPERATING CONDITIONS	36
4.4.7	TEST RESULTS	37
4.4.7.1	MAXIMUM PEAK OUTPUT POWER	37
4.4.7.2	AVERAGE OUTPUT POWER (FOR REFERENCE)	38
4.5	POWER SPECTRAL DENSITY MEASUREMENT	39
4.5.1	LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT	39
4.5.2	TEST SETUP	39
4.5.3	TEST INSTRUMENTS.....	39
4.5.4	TEST PROCEDURE.....	39
4.5.5	DEVIATION FROM TEST STANDARD	39
4.5.6	EUT OPERATING CONDITION	39
4.5.7	TEST RESULTS	40
4.6	OUT OF BAND EMISSION MEASUREMENT	44
4.6.1	LIMITS OF OUT OF BAND EMISSION MEASUREMENT	44
4.6.2	TEST SETUP	44
4.6.3	TEST INSTRUMENTS.....	44
4.6.4	TEST PROCEDURE.....	44
4.6.5	DEVIATION FROM TEST STANDARD	45
4.6.6	EUT OPERATING CONDITION	45
4.6.7	TEST RESULTS	46
5	PHOTOGRAPHS OF THE TEST CONFIGURATION	50
6	APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB	51



Test Report No.: RF2111WDG0029-2

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF2111WDG0029-2	Original release	Dec. 21, 2021

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	PASS	Meet the requirement of limit.
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

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
Conducted emissions	0.15MHz ~ 30MHz	3.05dB
Radiated emissions	9KHz ~ 30MHz	2.16dB
	30MHz ~ 1GMHz	3.63dB
	1GHz ~ 18GHz	4.96dB
	18GHz ~ 40GHz	4.37dB

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	PORTABLE STEREO LOUDSPEAKER
MODEL NO.	EMBERTON BLUETOOTH
ADDITIONAL MODEL	N/A
FCC ID	2AAGF-EMBERTONB
NOMINAL VOLTAGE	DC 5V From USB or DC 7.2V From Li-ion Battery
MODULATION TECHNOLOGY	DTS
MODULATION TYPE	GFSK
OPERATING FREQUENCY	2402MHz~2480MHz
NUMBER OF CHANNEL	40
PEAK OUTPUT POWER	4.446mW (Max. Measured)
ANTENNA TYPE	FPC Antenna, 3.33dBi Gain
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	USB-A to USB-C Cable: Shielded, Detachable, 1.2m

NOTES:

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.: 2111WDG0029) 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, power supply voltage range 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	√	√	√	√	Bluetooth Low Energy

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

**RADIATED EMISSION TEST (BELOW 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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A	0 to 39	39	DTS	GFSK	1
A	0 to 39	39	DTS	GFSK	2

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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A	0 to 39	0,19, 39	DTS	GFSK	1
A	0 to 39	0,19, 39	DTS	GFSK	2

POWER LINE CONDUCTED EMISSION TEST:

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

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

EUT CONFIGURE MODE	TESTED CONDITION
A	BT Link+Charging

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	DATA RATE (Mbps)
A	0 to 39	0,19, 39	DTS	GFSK	1
A	0 to 39	0,19, 39	DTS	GFSK	2

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER(POE)	TESTED BY
RE<1G	25deg. C, 55%RH	DC5V from adapter	Jelly
RE≥1G	25deg. C, 55%RH	DC7.2V from Battery	Jelly
PLC	20deg. C, 55%RH	DC5V from adapter	Jelly
APCM	25deg. C, 55%RH	DC7.2V from Battery	Jelly

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 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	Adapter	N/A	SJB0501000VE	N/A	N/A
2	Adapter	N/A	ZDC050060US	N/A	N/A

NO.	DESCRIPTION OF THE ABOVE SUPPORT UNITS
1-2	N/A

4 TEST TYPES AND RESULTS

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

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

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

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

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

4.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR7	101494	Mar. 07,22
Artificial Mains Network	Rohde&Schwarz	ENV216	101173	Mar. 07,22
Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	100317	Mar. 07,22
Voltage probe	SCHWARZBECK	TK 9421	TK 9421-176	Aug. 05,22
Coaxial RF Cable	/	CE CABLE	C2310066D G	Jul. 27,22
Test software	ADT	ADT_Cond_V7.3.7	N/A	N/A

NOTES:

1. The test was performed in shielded room 553.
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.

4.1.3 TEST PROCEDURES

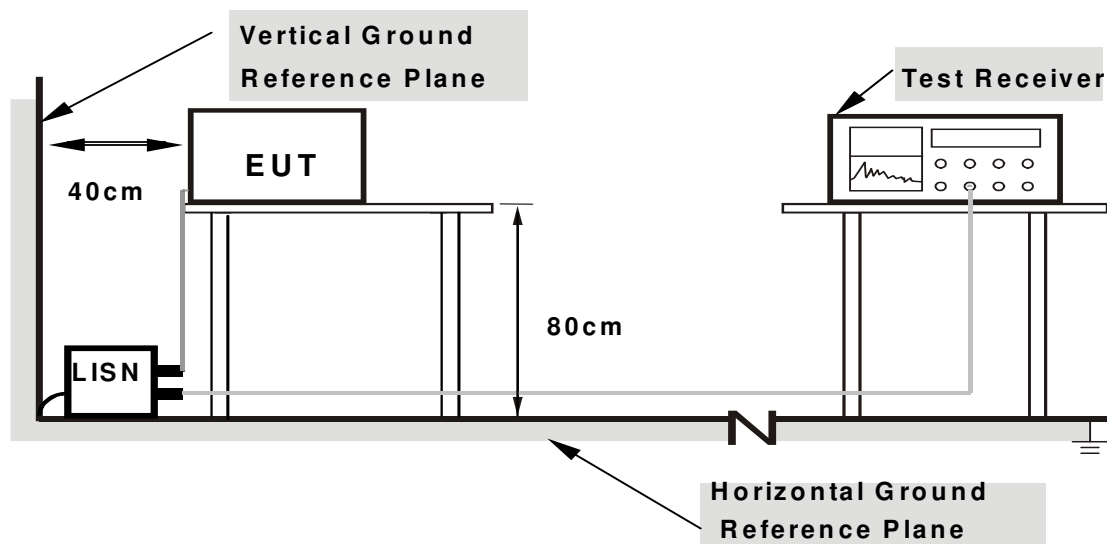
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150KHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

4.1.5 TEST SETUP



- Note:**
1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

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

4.1.6 EUT OPERATING CONDITIONS

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

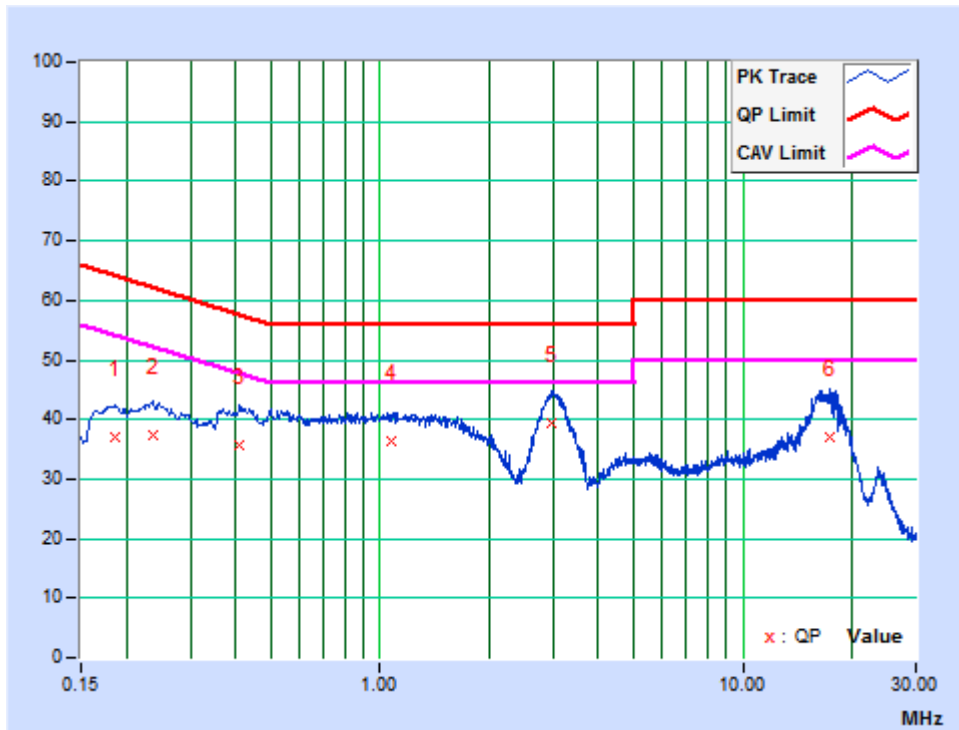
4.1.7 TEST RESULTS

CONDUCTED WORST-CASE DATA:

PHASE	Line	6dB BANDWIDTH	9kHz
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No.	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.18559	10.00	27.08	12.24	37.08	22.24	64.23	54.23	-27.15	-31.99
2	0.23775	10.00	27.31	12.87	37.31	22.87	62.17	52.17	-24.86	-29.30
3	0.40979	9.98	25.79	12.15	35.77	22.13	57.65	47.65	-21.88	-25.52
4	1.06858	10.02	26.22	14.57	36.24	24.59	56.00	46.00	-19.76	-21.41
5	2.95312	10.05	29.22	19.50	39.27	29.55	56.00	46.00	-16.73	-16.45
6	17.37825	10.33	26.78	18.28	37.11	28.61	60.00	50.00	-22.89	-21.39

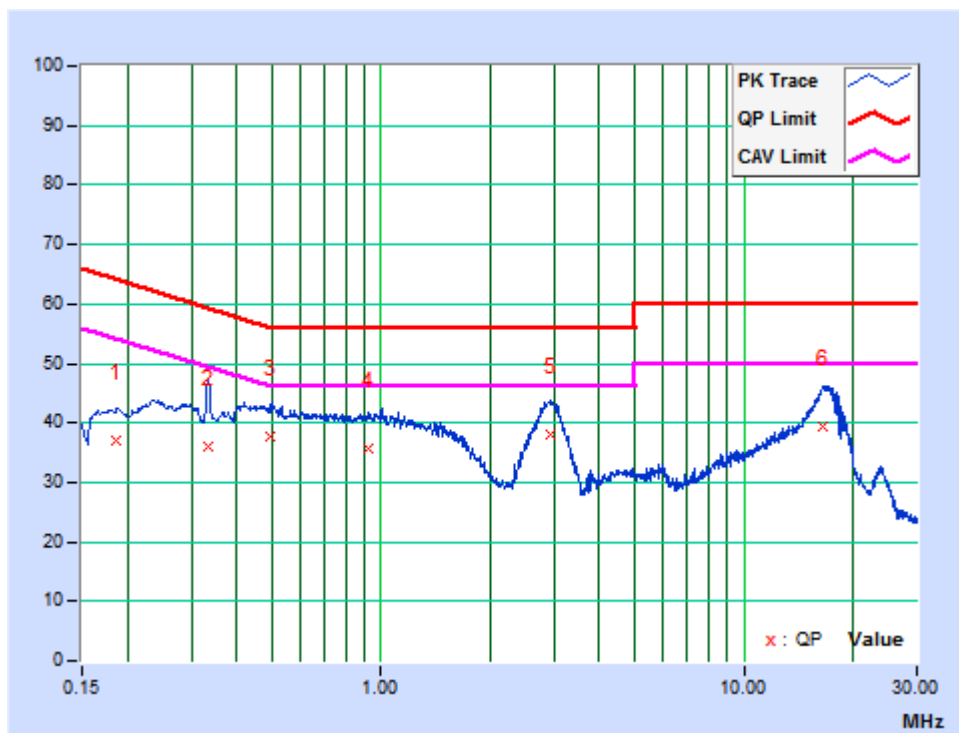
- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value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



PHASE	Neutral	6dB BANDWIDTH	9kHz
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No.	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.18707	9.93	27.11	12.30	37.04	22.23	64.17	54.17	-27.12	-31.93
2	0.33440	9.92	26.00	23.00	35.92	32.92	59.34	49.34	-23.42	-16.42
3	0.49822	9.93	27.92	20.58	37.85	30.51	56.03	46.03	-18.18	-15.52
4	0.91950	9.96	25.65	15.29	35.61	25.25	56.00	46.00	-20.39	-20.75
5	2.92650	9.99	28.17	21.71	38.16	31.70	56.00	46.00	-17.84	-14.30
6	16.48500	10.28	28.99	16.98	39.27	27.26	60.00	50.00	-20.73	-22.74

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





4.2 RADIATED EMISSION MEASUREMENT

4.2.1 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.

4.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESU40	100449	Mar. 07, 22
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV7	102331	May 09, 22
Active Loop Antenna (9KHz -30MHz)	SCHWARZBECK	FMZB 1519B	1519B-045	May 20, 22
Amplifier (9KHz -1GHz)	Burgeon	BPA-530	100210	Mar. 13, 22
Bilog Antenna (20MHz -2GHz)	Teseq	CBL 6111D	30643	May 21, 22
Horn Antenna (1GHz -18GHz)	ETS -Lindgren	3117	00062558	May 21, 22
Horn Antenna (18GHz -40GHz)	SCHWARZBECK	BBHA 9170	BBHA9170147	May 14, 22
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	NSEMC003	May 22, 22
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A
Broadband Preamplifier (1GHz~18GHz)	SCHWARZBECK	BBV9718	305	May 12, 22
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	Mar. 13, 22
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A
BLUETOOTH TESTER	Rohde&Schwarz	CBT32	100811	N/A

NOTES:

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

4.2.3 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. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. 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:

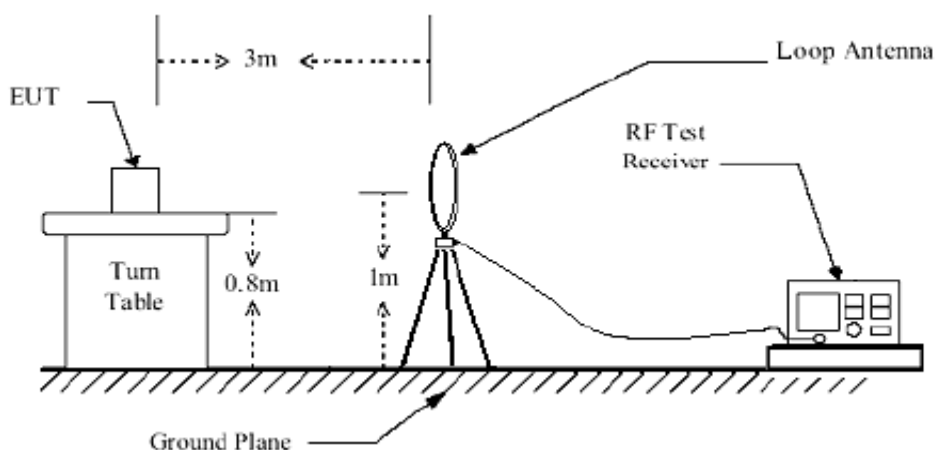
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution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

4.2.4 DEVIATION FROM TEST STANDARD

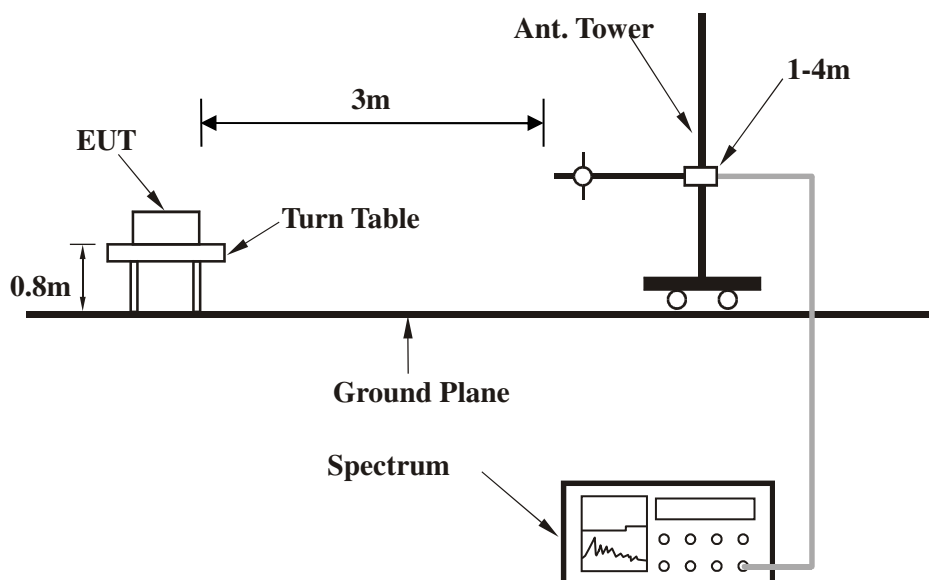
No deviation.

4.2.5 TEST SETUP

Below 30MHz test setup

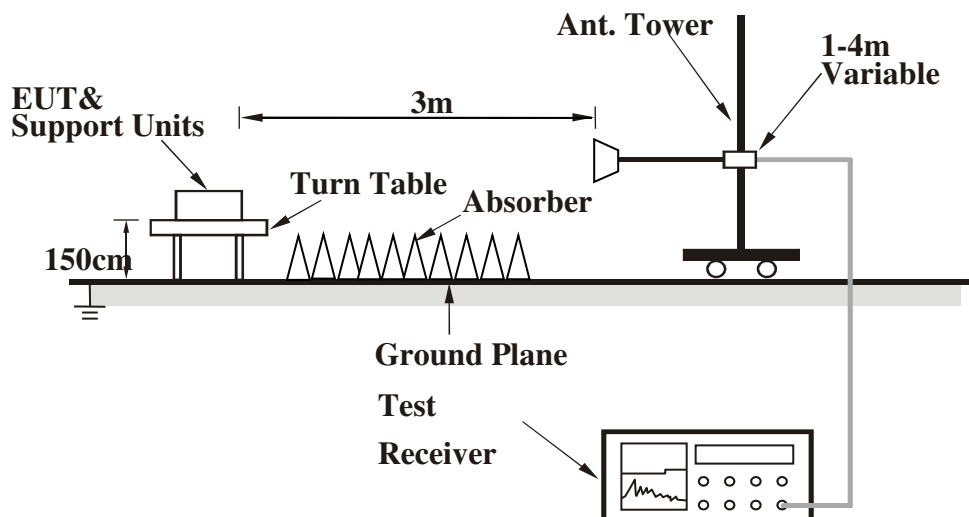


Below 1GHz test setup



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).

4.2.6

CONDITIONS

EUT OPERATING

- 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.

4.2.7 TEST RESULTS

BELOW 1GHz WORST-CASE DATA

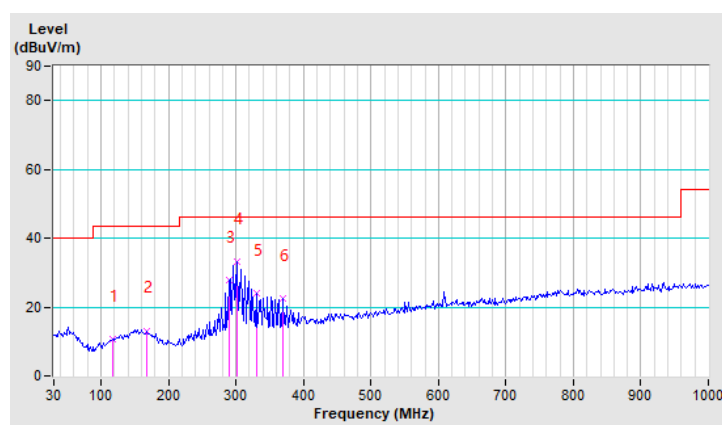
BT_LE-GFSK 1M

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	117.05	10.54 QP	43.50	-32.96	1.00 H	100	26.97	-16.43
2	168.35	13.13 QP	43.50	-30.37	1.00 H	213	27.31	-14.18
3	289.60	27.78 QP	46.00	-18.22	1.00 H	156	41.69	-13.91
4	302.04	32.99 QP	46.00	-13.01	1.00 H	234	46.46	-13.47
5	330.02	24.09 QP	46.00	-21.91	1.00 H	243	36.85	-12.76
6	368.88	22.60 QP	46.00	-23.40	1.00 H	302	34.67	-12.07

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 other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value 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.

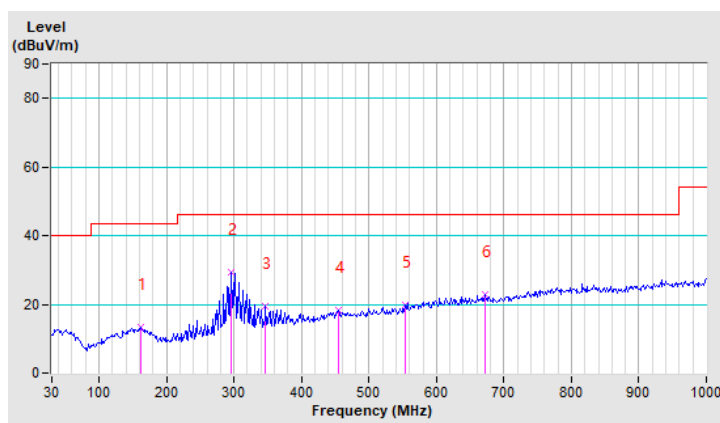


CHANNEL	TX Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	162.13	13.38 QP	43.50	-30.12	1.00 V	256	27.43	-14.05
2	295.82	29.47 QP	46.00	-16.53	1.00 V	145	43.16	-13.69
3	347.12	19.29 QP	46.00	-26.71	1.00 V	203	31.76	-12.47
4	454.37	18.20 QP	46.00	-27.80	1.00 V	243	28.54	-10.34
5	553.86	19.68 QP	46.00	-26.32	1.00 V	214	28.24	-8.56
6	672.00	22.88 QP	46.00	-23.12	1.00 V	135	28.90	-6.02

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 other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value 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.



ABOVE 1GHz DATA

BT_LE-GFSK 1M

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	42.58 PK	74.00	-31.42	1.38 H	110	40.61	1.97
2	2390.00	30.97 AV	54.00	-23.03	1.38 H	110	29.00	1.97
3	*2402.00	92.74 PK			1.38 H	110	90.76	1.98
4	*2402.00	91.68 AV			1.38 H	110	89.70	1.98
5	4804.00	45.57 PK	74.00	-28.43	1.76 H	306	40.68	4.89
6	4804.00	37.88 AV	54.00	-16.12	1.76 H	306	32.99	4.89
7	#7206.00	53.10 PK	74.00	-20.90	1.64 H	237	43.54	9.56
8	#7206.00	42.37 AV	54.00	-11.63	1.64 H	237	32.81	9.56
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	43.36 PK	74.00	-30.64	1.79 V	96	41.39	1.97
2	2390.00	31.09 AV	54.00	-22.91	1.79 V	96	29.12	1.97
3	*2402.00	96.74 PK			1.79 V	96	94.76	1.98
4	*2402.00	96.10 AV			1.79 V	96	94.12	1.98
5	4804.00	47.20 PK	74.00	-26.80	1.35 V	127	42.31	4.89
6	4804.00	38.55 AV	54.00	-15.45	1.35 V	127	33.66	4.89
7	#7206.00	54.15 PK	74.00	-19.85	1.25 V	303	44.59	9.56
8	#7206.00	43.39 AV	54.00	-10.61	1.25 V	303	33.83	9.56

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 other emission levels were very low 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)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2440.00	92.25 PK			1.77 H	57	90.25	2.00
2	*2440.00	91.74 AV			1.77 H	57	89.74	2.00
3	4880.00	42.69 PK	74.00	-31.31	1.26 H	223	37.51	5.18
4	4880.00	34.39 AV	54.00	-19.61	1.26 H	223	29.21	5.18
5	7320.00	50.47 PK	74.00	-23.53	1.83 H	106	40.44	10.03
6	7320.00	38.59 AV	54.00	-15.41	1.83 H	106	28.56	10.03
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2440.00	95.69 PK			1.94 V	101	93.69	2.00
2	*2440.00	94.71 AV			1.94 V	101	92.71	2.00
3	4880.00	43.36 PK	74.00	-30.64	1.37 V	113	38.18	5.18
4	4880.00	35.85 AV	54.00	-18.15	1.37 V	113	30.67	5.18
5	7320.00	51.26 PK	74.00	-22.74	1.22 V	154	41.23	10.03
6	7320.00	39.66 AV	54.00	-14.34	1.22 V	154	29.63	10.03

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 other emission levels were very low against the limit.
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)	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	93.26 PK			1.33 H	256	91.24	2.02
2	*2480.00	92.51 AV			1.33 H	256	90.49	2.02
3	2483.50	49.62 PK	74.00	-24.38	1.76 H	256	47.59	2.03
4	2483.50	37.48 AV	54.00	-16.52	1.76 H	256	35.45	2.03
5	4960.00	48.25 PK	74.00	-25.75	1.24 H	224	42.76	5.49
6	4960.00	39.62 AV	54.00	-14.38	1.24 H	224	34.13	5.49
7	7440.00	52.26 PK	74.00	-21.74	1.93 H	139	41.75	10.51
8	7440.00	43.74 AV	54.00	-10.26	1.93 H	139	33.23	10.51
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (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	96.74 PK			1.73 V	47	94.72	2.02
2	*2480.00	95.03 AV			1.73 V	47	93.01	2.02
3	2483.50	50.26 PK	74.00	-23.74	1.73 V	47	48.23	2.03
4	2483.50	38.69 AV	54.00	-15.31	1.73 V	47	36.66	2.03
5	4960.00	49.55 PK	74.00	-24.45	1.27 V	224	44.06	5.49
6	4960.00	40.10 AV	54.00	-13.90	1.27 V	224	34.61	5.49
7	7440.00	53.37 PK	74.00	-20.63	1.48 V	302	42.86	10.51
8	7440.00	44.45 AV	54.00	-9.55	1.48 V	302	33.94	10.51

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 other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

BT_LE-GFSK 2M

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	44.20 PK	74.00	-29.80	1.46 H	90	42.23	1.97
2	2390.00	32.08 AV	54.00	-21.92	1.46 H	90	30.11	1.97
3	*2402.00	93.74 PK			1.46 H	90	91.76	1.98
4	*2402.00	93.04 AV			1.46 H	90	91.06	1.98
5	4804.00	45.28 PK	74.00	-28.72	1.35 H	114	40.39	4.89
6	4804.00	36.74 AV	54.00	-17.26	1.35 H	114	31.85	4.89
7	#7206.00	50.15 PK	74.00	-23.85	1.43 H	237	40.59	9.56
8	#7206.00	39.84 AV	54.00	-14.16	1.43 H	237	30.28	9.56
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	45.26 PK	74.00	-28.74	1.22 V	155	43.29	1.97
2	2390.00	33.48 AV	54.00	-20.52	1.22 V	155	31.51	1.97
3	*2402.00	96.41 PK			1.22 V	155	94.43	1.98
4	*2402.00	95.62 AV			1.22 V	155	93.64	1.98
5	4804.00	46.25 PK	74.00	-27.75	1.39 V	227	41.36	4.89
6	4804.00	37.12 AV	54.00	-16.88	1.39 V	227	32.23	4.89
7	#7206.00	51.26 PK	74.00	-22.74	1.27 V	345	41.70	9.56
8	#7206.00	40.71 AV	54.00	-13.29	1.27 V	345	31.15	9.56

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 other emission levels were very low 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)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2440.00	92.27 PK			1.22 H	51	90.27	2.00
2	*2440.00	91.74 AV			1.22 H	51	89.74	2.00
3	4880.00	44.25 PK	74.00	-29.75	1.87 H	51	39.07	5.18
4	4880.00	36.13 AV	54.00	-17.87	1.87 H	51	30.95	5.18
5	7320.00	49.66 PK	74.00	-24.34	1.26 H	257	39.63	10.03
6	7320.00	39.75 AV	54.00	-14.25	1.26 H	257	29.72	10.03
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2440.00	96.74 PK			1.75 V	106	94.74	2.00
2	*2440.00	95.49 AV			1.75 V	106	93.49	2.00
3	4880.00	42.88 PK	74.00	-31.12	1.87 V	238	37.70	5.18
4	4880.00	35.96 AV	54.00	-18.04	1.87 V	238	30.78	5.18
5	7320.00	48.74 PK	74.00	-25.26	1.28 V	221	38.71	10.03
6	7320.00	38.05 AV	54.00	-15.95	1.28 V	221	28.02	10.03

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 other emission levels were very low against the limit.
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)	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	93.51 PK			1.47 H	90	91.49	2.02
2	*2480.00	92.74 AV			1.47 H	90	90.72	2.02
3	2483.50	48.62 PK	74.00	-25.38	1.47 H	90	46.59	2.03
4	2483.50	37.20 AV	54.00	-16.80	1.47 H	90	35.17	2.03
5	4960.00	46.22 PK	74.00	-27.78	1.38 H	113	40.73	5.49
6	4960.00	36.48 AV	54.00	-17.52	1.38 H	113	30.99	5.49
7	7440.00	51.72 PK	74.00	-22.28	1.49 H	201	41.21	10.51
8	7440.00	41.69 AV	54.00	-12.31	1.49 H	201	31.18	10.51
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (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	97.40 PK			1.23 V	154	95.38	2.02
2	*2480.00	96.59 AV			1.23 V	154	94.57	2.02
3	2483.50	50.41 PK	74.00	-23.59	1.23 V	154	48.38	2.03
4	2483.50	38.96 AV	54.00	-15.04	1.23 V	154	36.93	2.03
5	4960.00	47.62 PK	74.00	-26.38	1.74 V	220	42.13	5.49
6	4960.00	38.69 AV	54.00	-15.31	1.74 V	220	33.20	5.49
7	7440.00	52.74 PK	74.00	-21.26	1.28 V	134	42.23	10.51
8	7440.00	43.10 AV	54.00	-10.90	1.28 V	134	32.59	10.51

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 other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.

4.3 6dB BANDWIDTH MEASUREMENT

4.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.3.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
Power Sensor	Keysight	U2021XA	MY55060016	N/A
Power Sensor	Keysight	U2021XA	MY55060018	May 09,22
Power Meter	Anritsu	ML2495A	1139001	Feb. 24,22
Power Sensor	Anritsu	MA2411B	1531155	Feb. 24,22
Digital Multimeter	FLUKE	15B	A1220010DG	N/A
Humid & Temp Programmable Tester	Haida	HD-225T	110807201	Nov. 03,22
Oscilloscope	Agilent	DSO9254A	MY51260160	Aug. 11,22
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV40	101094	Feb. 24,22
Signal Generator	Agilent	N5183A	MY50140980	Mar 23.22
MXG-B RF Vector Signal Generator	Keysight	N5182B	MY56200288	Sep. 14,22
BLUETOOTH TESTER	Rohde&Schwarz	CBT32	100811	N/A
Attenuator	MINI	BW-S10W2+	S130129FGE2	N/A
DC Source	Keysight	E3642A	MY56146098	N/A

NOTES:

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.

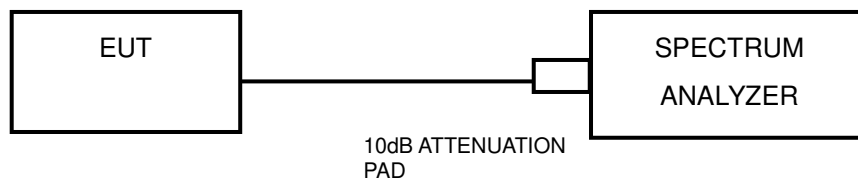
4.3.3 TEST PROCEDURE

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.

4.3.4 DEVIATION FROM TEST STANDARD

No deviation.

4.3.5 TEST SETUP



4.3.6 EUT OPERATING CONDITIONS

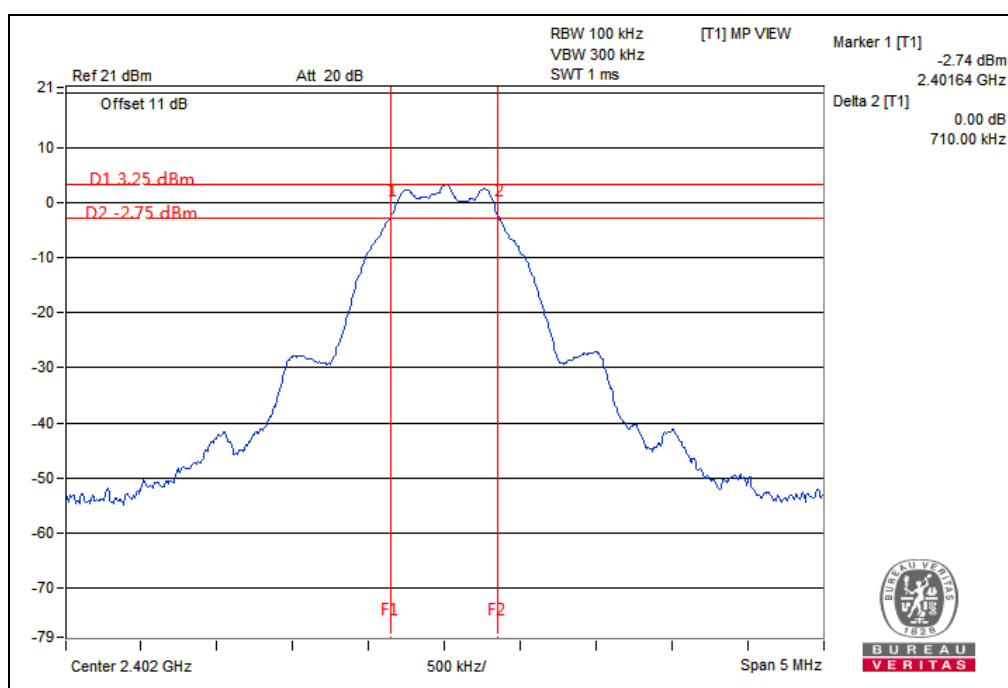
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.3.7 TEST RESULTS

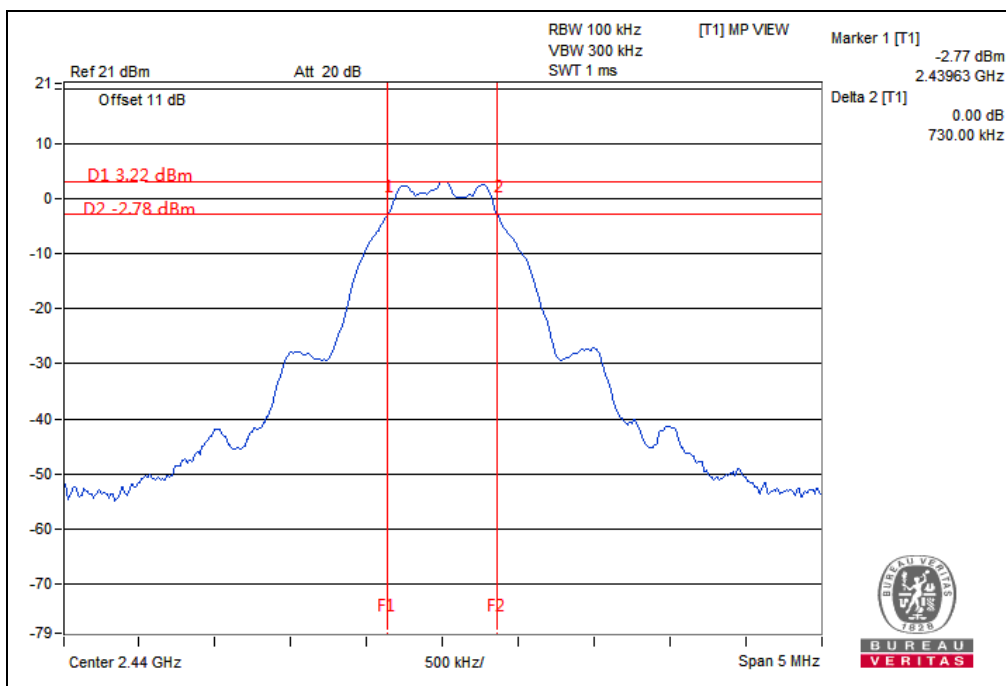
BT-LE (GFSK) 1M

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	0.71	0.5	PASS
19	2440	0.73	0.5	PASS
39	2480	0.71	0.5	PASS

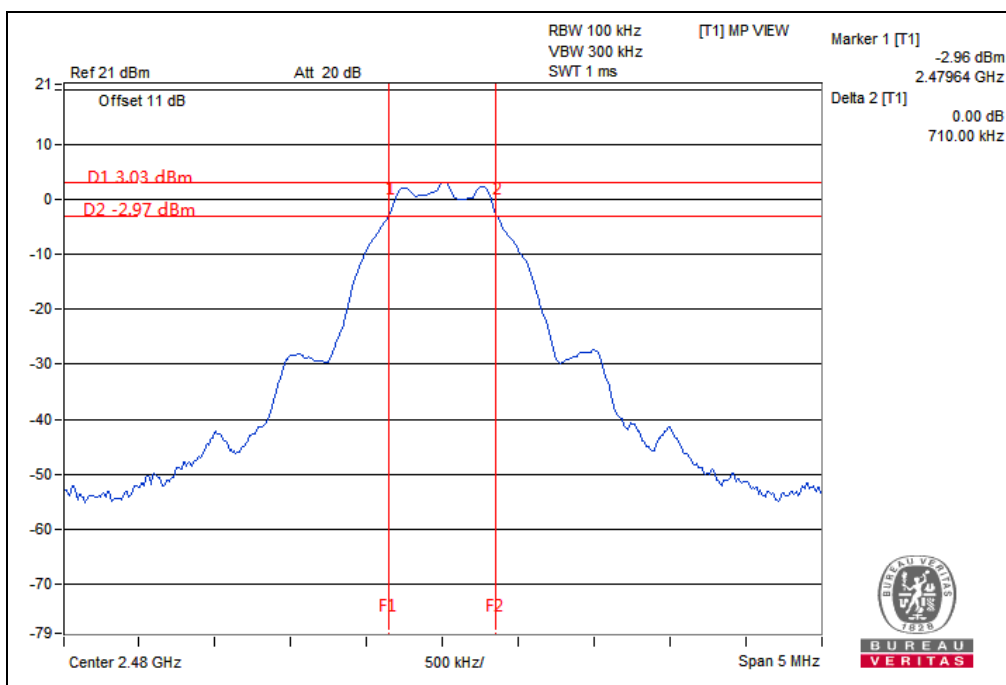
CH0



CH19



CH39





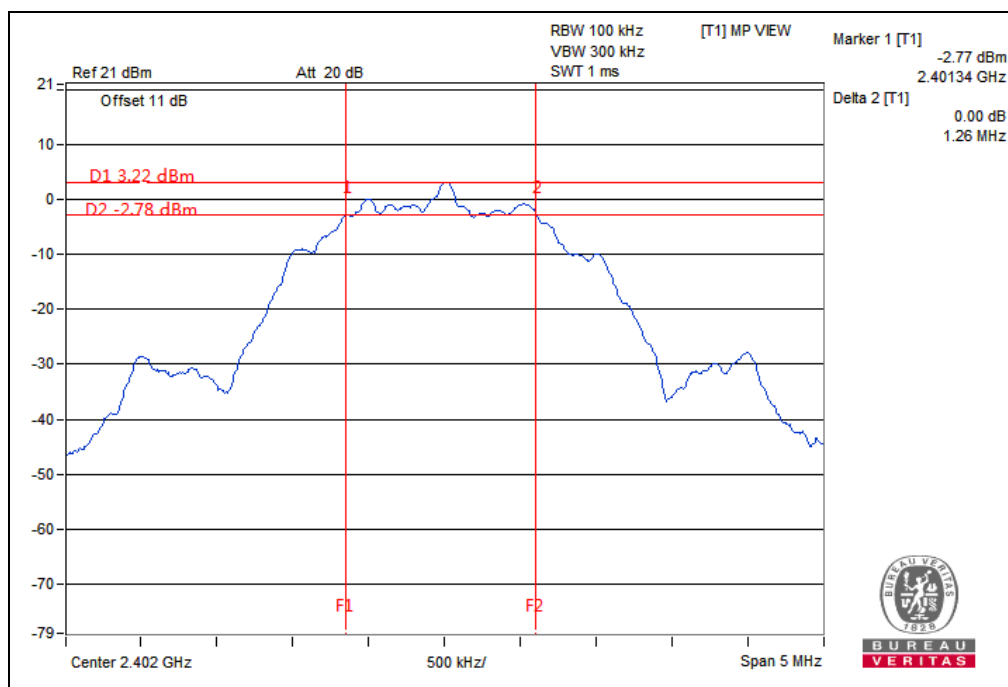
BUREAU
VERITAS

Test Report No.: RF2111WDG0029-2

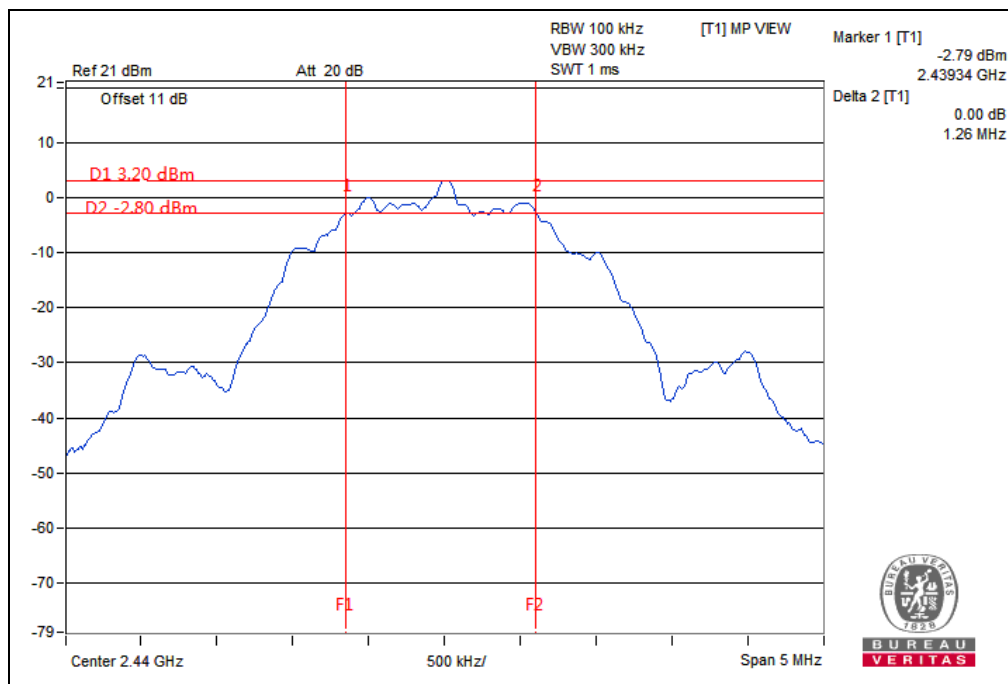
BT-LE (GFSK) 2M

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	1.26	0.5	PASS
19	2440	1.26	0.5	PASS
39	2480	1.26	0.5	PASS

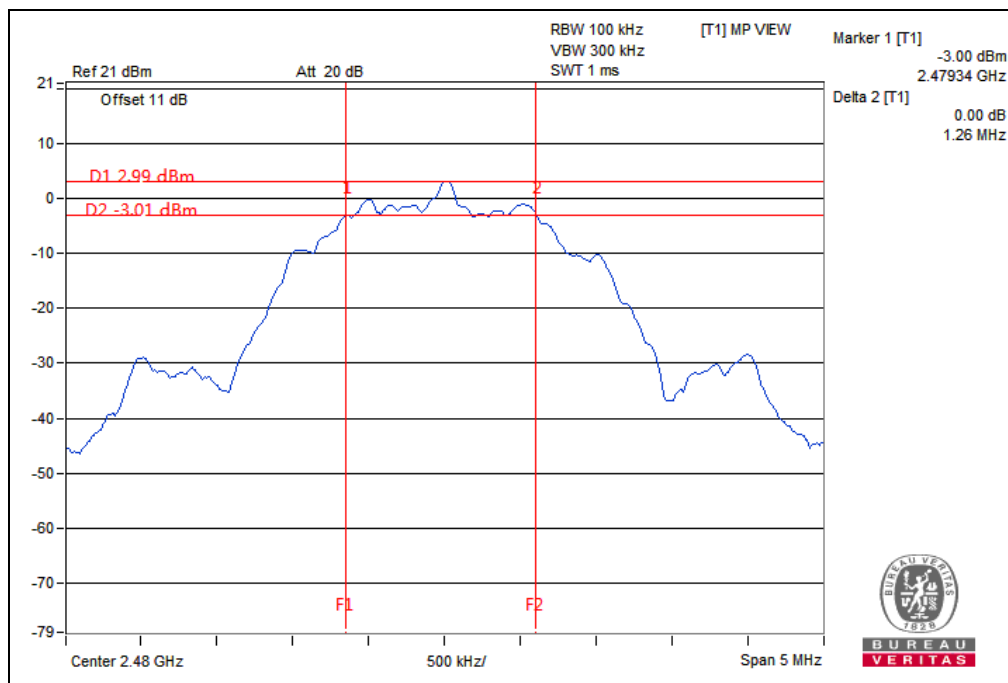
CH0



CH19



CH39

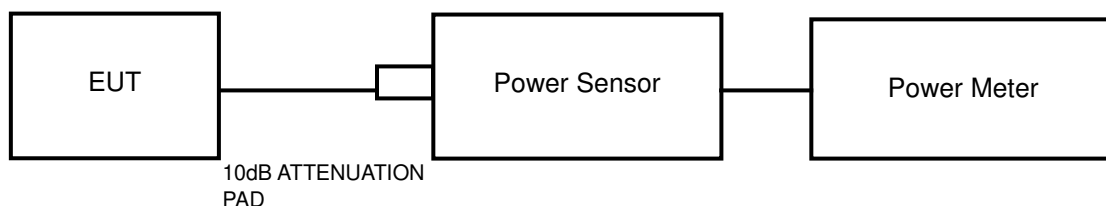


4.4 CONDUCTED OUTPUT POWER

4.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

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

4.4.2 TEST SETUP



4.4.3 TEST INSTRUMENTS

Refer to section 4.3.2 to get information of above instrument.

4.4.4 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.

4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

4.4.6 EUT OPERATING CONDITIONS

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

4.4.7 TEST RESULTS

4.4.7.1 MAXIMUM PEAK OUTPUT POWER

BT-LE (GFSK) 1M

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
0	2402	5.23	3.334	1	PASS
19	2440	5.32	3.404	1	PASS
39	2480	5.15	3.73	1	PASS

BT-LE (GFSK) 2M

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
0	2402	6.31	4.276	1	PASS
19	2440	6.48	4.446	1	PASS
39	2480	6.30	4.266	1	PASS

4.4.7.2 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) 1M

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)
0	2402	3.46
19	2440	3.52
39	2480	3.35

BT-LE (GFSK) 2M

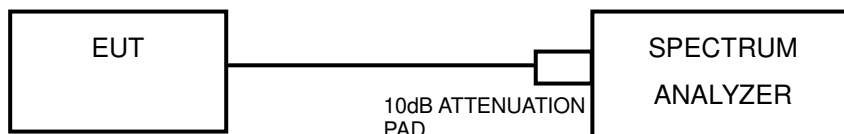
CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)
0	2402	3.32
19	2440	3.52
39	2480	3.32

4.5 POWER SPECTRAL DENSITY MEASUREMENT

4.5.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

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

4.5.2 TEST SETUP



4.5.3 TEST INSTRUMENTS

Refer to section 4.3.2 to get information of above instrument.

4.5.4 TEST PROCEDURE

1. Set the span to 1.5 times the DTS bandwidth
2. Set the RBW = 3 kHz, VBW $\geq 3 \times$ 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.

4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

4.5.6 EUT OPERATING CONDITION

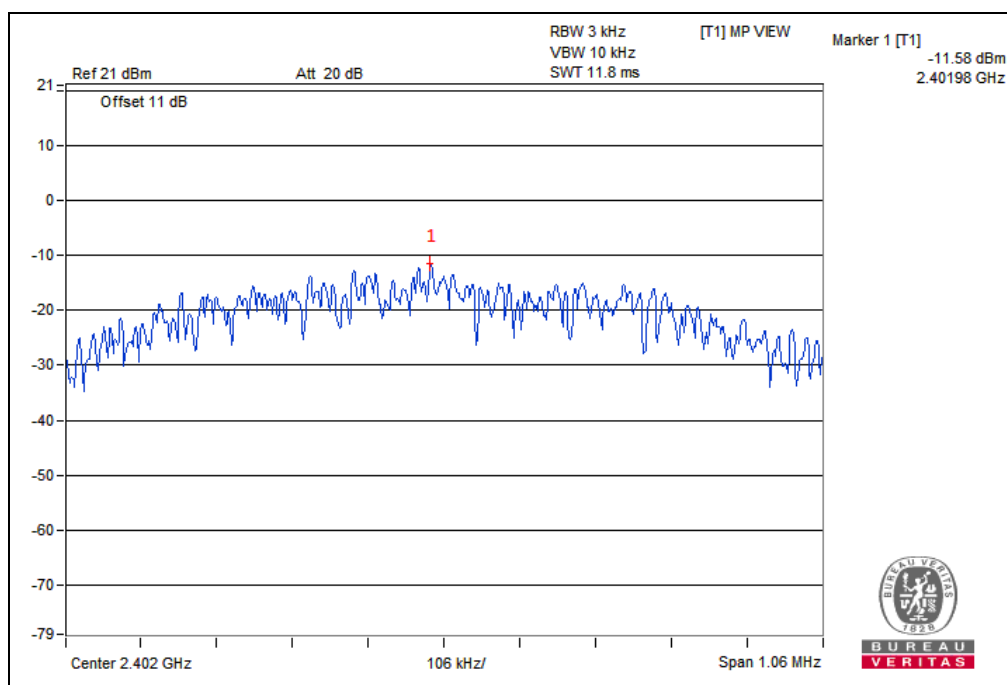
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.5.7 TEST RESULTS

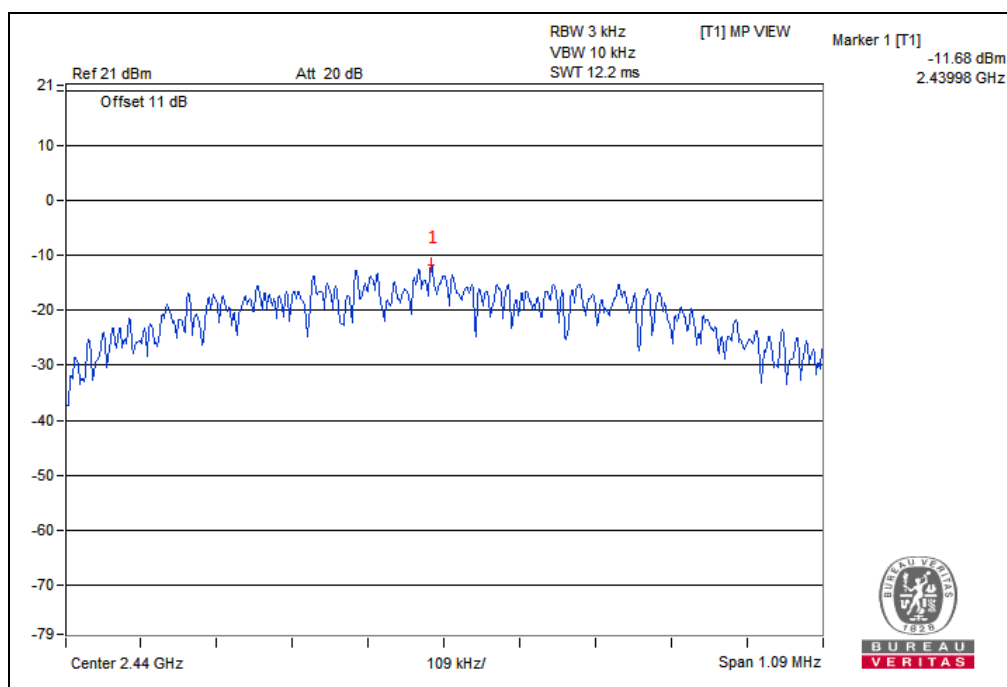
BT-LE (GFSK) 1M

Channel	FREQ. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	2402	-11.58	8	PASS
19	2440	-11.68	8	PASS
39	2480	-12.03	8	PASS

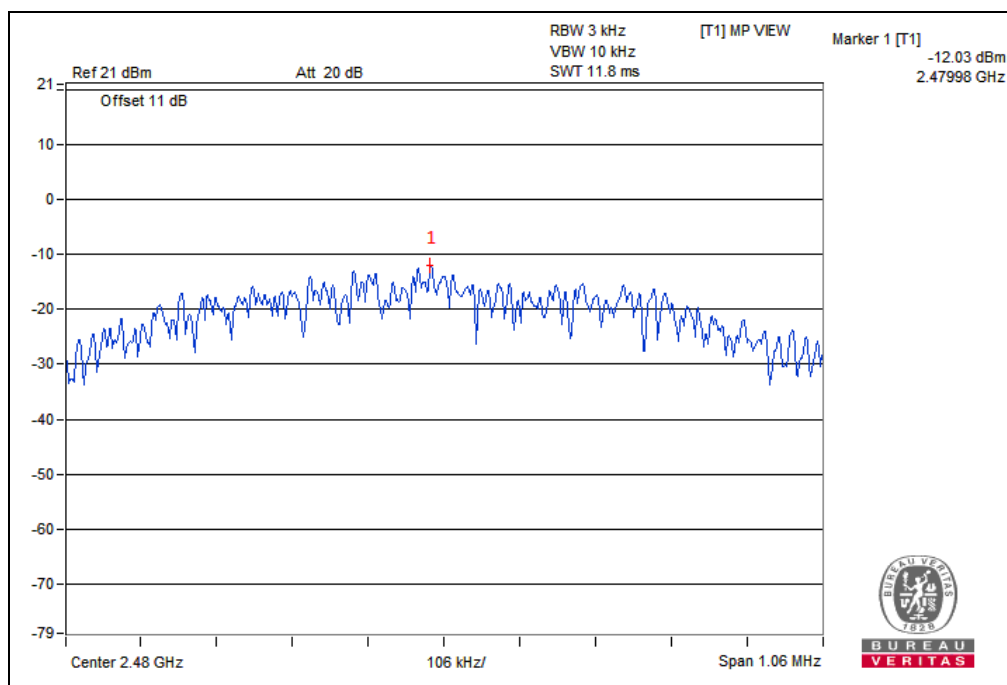
CH0



CH19



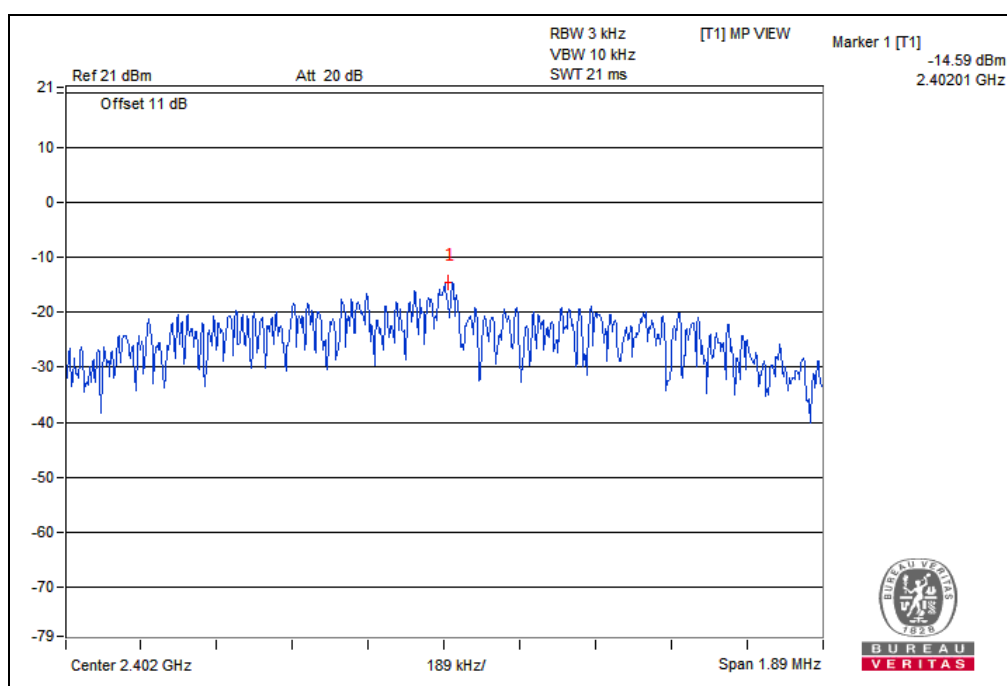
CH39



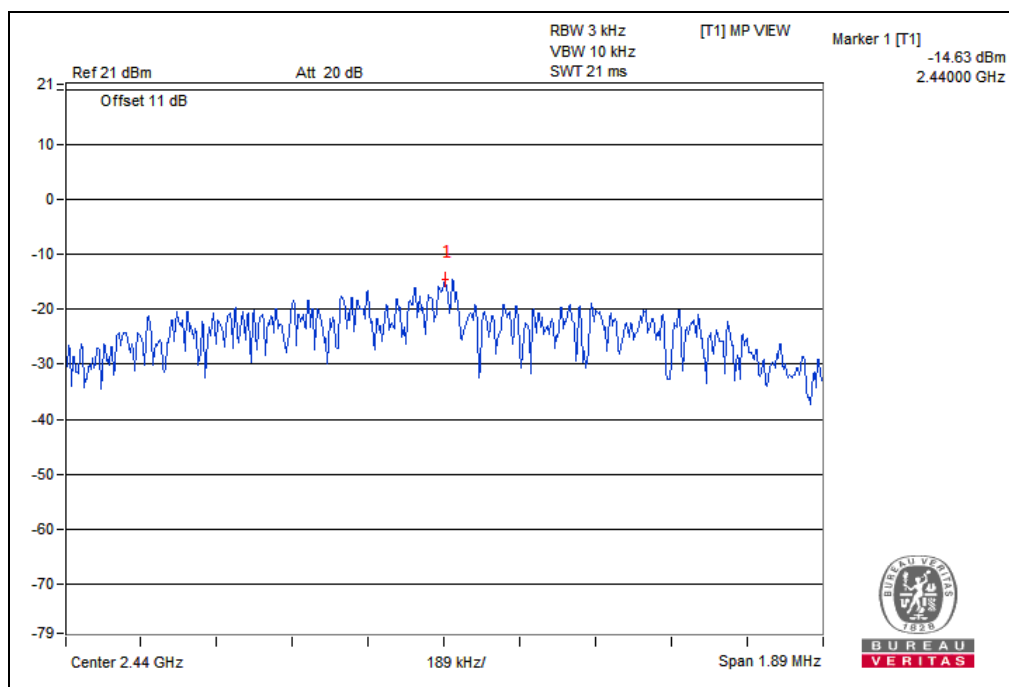
BT-LE (GFSK) 2M

Channel	FREQ. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	2402	-14.59	8	PASS
19	2440	-14.63	8	PASS
39	2480	-14.67	8	PASS

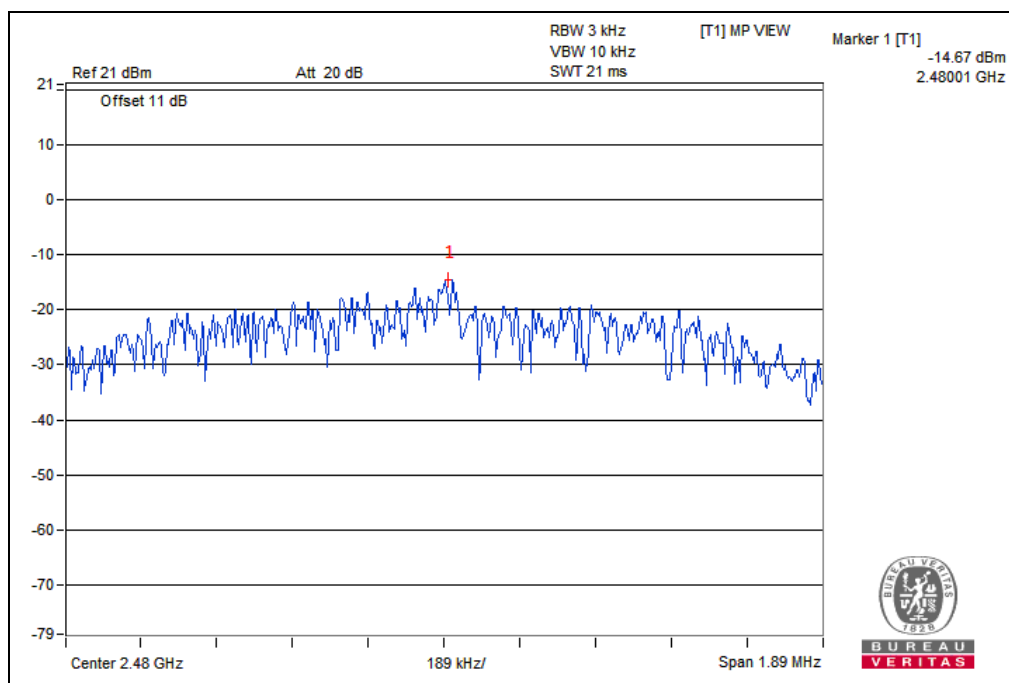
CH0



CH19



CH39

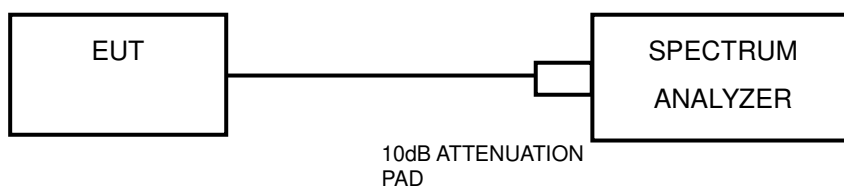


4.6 OUT OF BAND EMISSION MEASUREMENT

4.6.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

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

4.6.2 TEST SETUP



4.6.3 TEST INSTRUMENTS

Refer to section 4.3.2 to get information of above instrument.

4.6.4 TEST PROCEDURE

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 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 OOB

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

4.6.5 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.



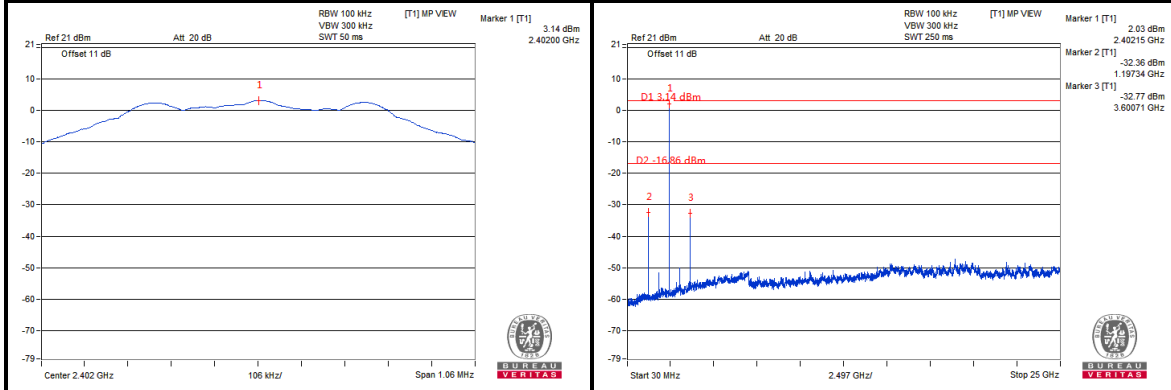
BUREAU
VERITAS

Test Report No.: RF2111WDG0029-2

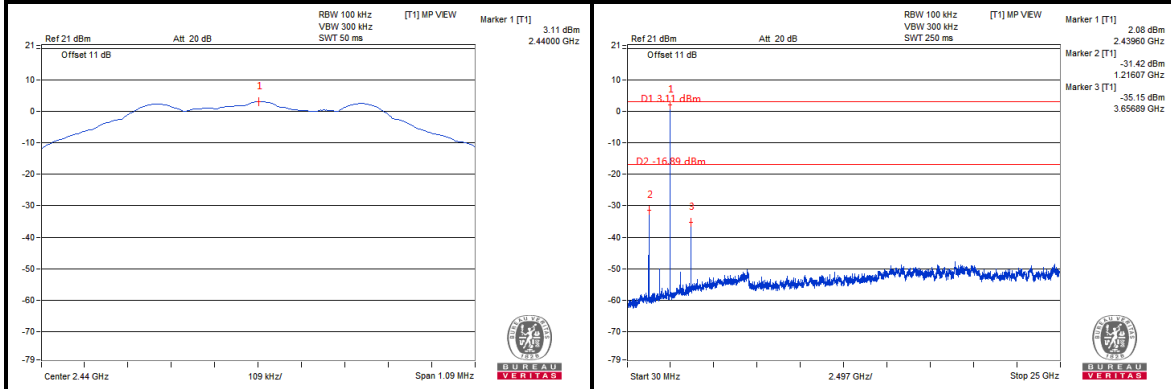
4.6.7 TEST RESULTS

BT-LE (GFSK) 1M

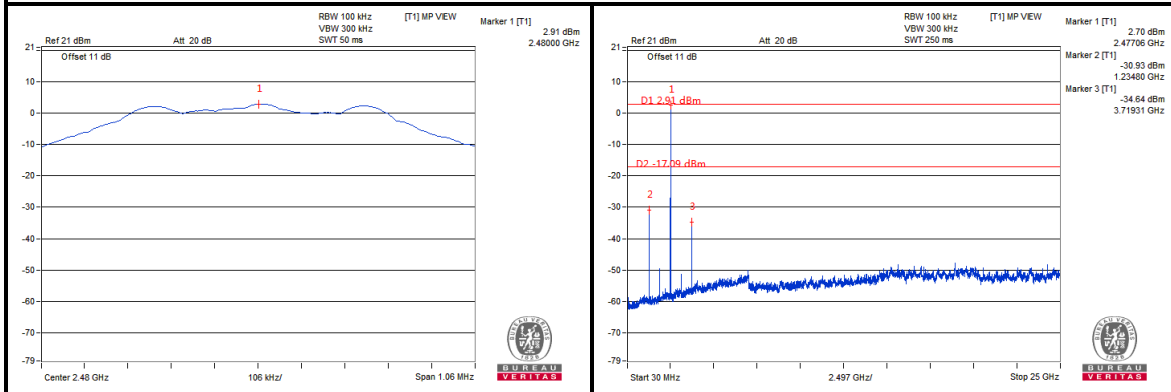
CH 0



CH 19



CH 39

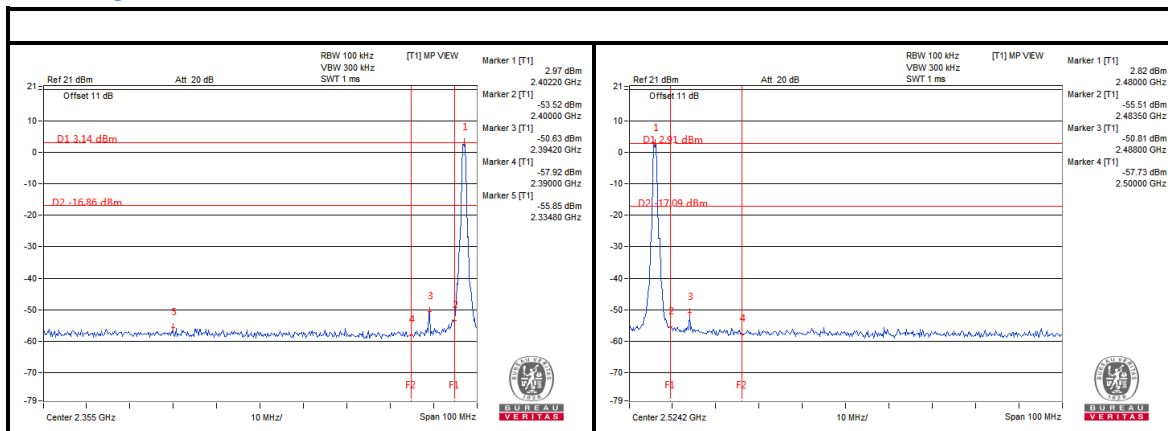


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Band Edge:



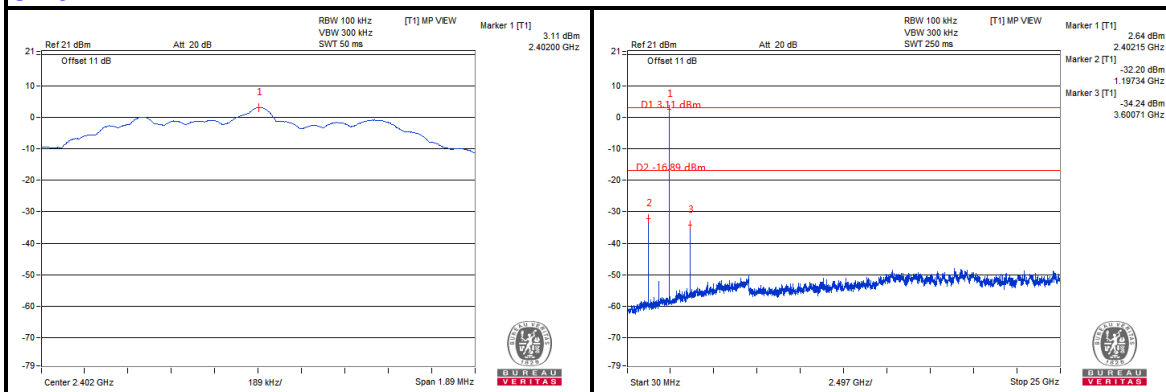


BUREAU
VERITAS

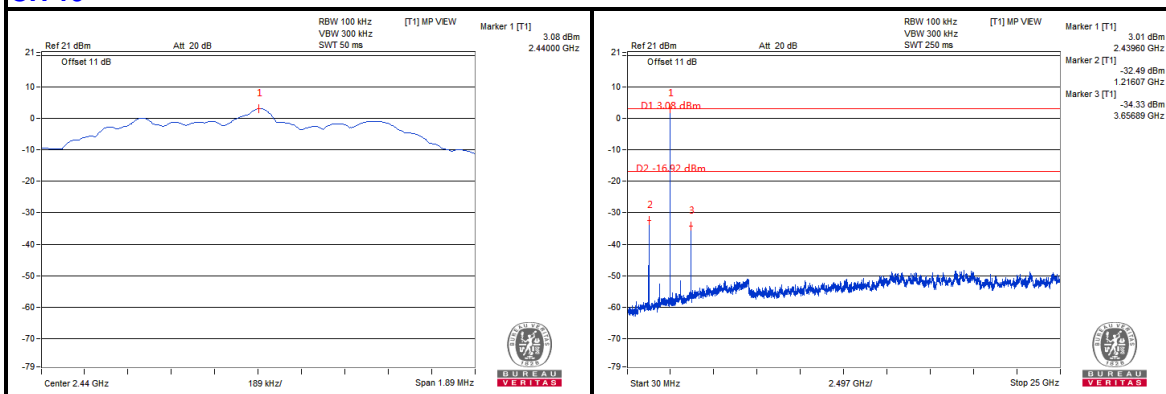
Test Report No.: RF2111WDG0029-2

BT-LE (GFSK) 2M

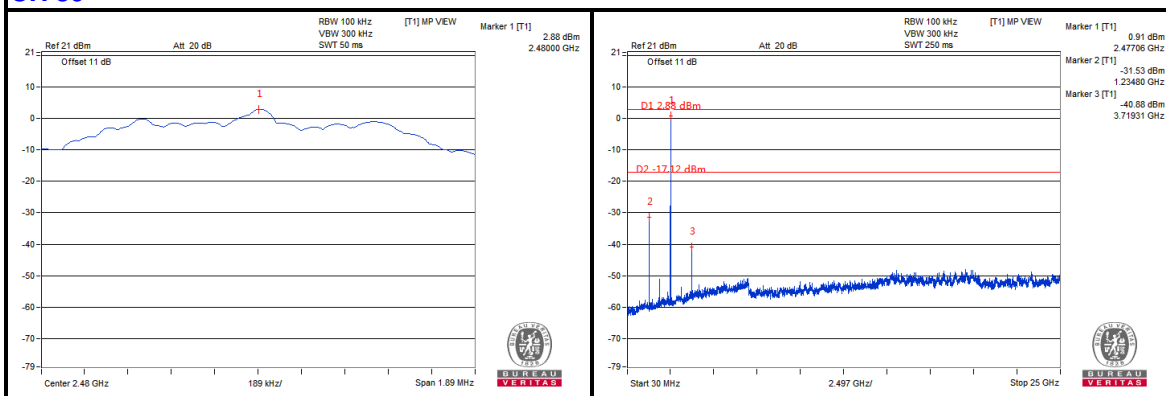
CH 0



CH 19



CH 39

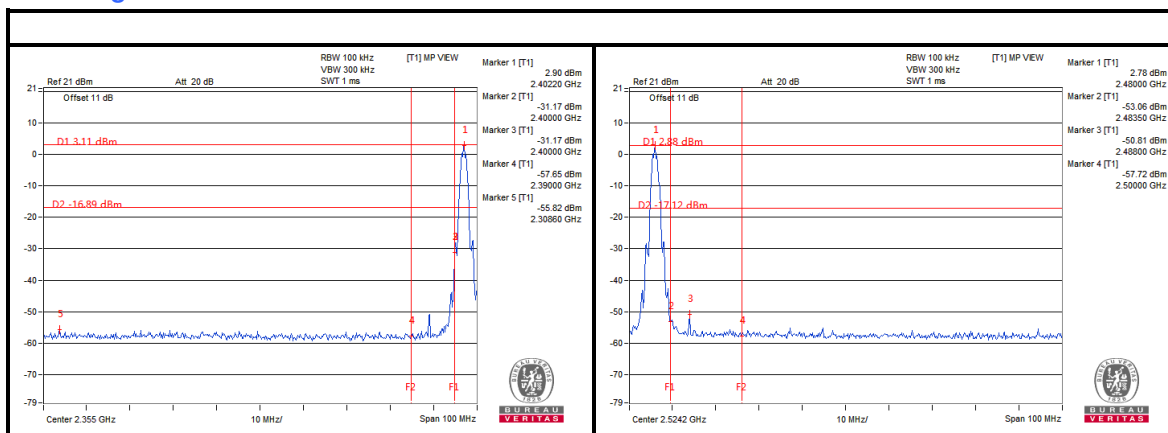


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Band Edge:





Test Report No.: RF2111WDG0029-2

5 PHOTOGRAPHS OF THE TEST CONFIGURATION

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



Test Report No.: RF2111WDG0029-2

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---