FCC Test Report

Product Name	Pocket photo printer
Model No.	VS0000Z
FCC ID.	2AAD3B01C0Z

Applicant	ABILITY ENTERPRISE CO., LTD.
Address	No.200, Sec. 3, Zhonghuan Rd., Xinzhuang Dist.,New Taipei City 24242,Taiwan(R.O.C.)

Date of Receipt	Feb. 13, 2019
Issued Date	Mar. 21, 2019
Report No.	1920076R-RFUSP01V00-B
Report Version	V1.0

Testing Laboratory
3023

Test Report

Issued Date: Mar. 21, 2019
Report No.: 1920076R-RFUSP01V00-B

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Applicant	ABILITY ENTERPRISE CO., LTD.
Address	No.200, Sec. 3, Zhonghuan Rd., Xinzhuang Dist.,New Taipei City 24242,Taiwan(R.O.C.)
Manufacturer	ABILITY ENTERPRISE CO., LTD.
Model No.	VS0000Z
FCC ID.	2AAD3B01C0Z
EUT Rated Voltage	DC 7.4V by Battery
EUT Test Voltage	AC 120V/ 60Hz ; DC 7.4V by Battery
Trade Name	ABILITY
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2017 ANSI C63.4: 2014, ANSI C63.10: 2013 KDB 558074 D01 DTS Meas Guidance v05
Test Result	Complied

Documented By : Genie Chang

(Senior Adm. Specialist / Genie Chang)

Tested By : Sam Hsu

(Engineer / Sam Hsu)

Approved By :

(Director / Vincent Lin)

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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Pocket photo printer
Trade Name	ABILITY
Model No.	VS0000Z
FCC ID.	2AAD3B01C0Z
Frequency Range	2402 – 2480MHz
Channel Number	V4.2: 40CH
Type of Modulation	V4.2: GFSK(1Mbps)
Antenna Type	Chip Antenna
Channel Control	Auto
Antenna Gain	Refer to the table “Antenna List”
USB Cable	Non-shielded, 0.32m

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	Unictron	AA055A	Chip Antenna	1.4dBi for 2.4GHz

Note: The antenna of EUT is conforming to FCC 15.203.

Center Frequency of Each Channel: (For V4.2)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 00:	2402 MHz	Channel 01:	2404 MHz	Channel 02:	2406 MHz	Channel 03:	2408 MHz
Channel 04:	2410 MHz	Channel 05:	2412 MHz	Channel 06:	2414 MHz	Channel 07:	2416 MHz
Channel 08:	2418 MHz	Channel 09:	2420 MHz	Channel 10:	2422 MHz	Channel 11:	2424 MHz
Channel 12:	2426 MHz	Channel 13:	2428 MHz	Channel 14:	2430 MHz	Channel 15:	2432 MHz
Channel 16:	2434 MHz	Channel 17:	2436 MHz	Channel 18:	2438 MHz	Channel 19:	2440 MHz
Channel 20:	2442 MHz	Channel 21:	2444 MHz	Channel 22:	2446 MHz	Channel 23:	2448 MHz
Channel 24:	2450 MHz	Channel 25:	2452 MHz	Channel 26:	2454 MHz	Channel 27:	2456 MHz
Channel 28:	2458 MHz	Channel 29:	2460 MHz	Channel 30:	2462 MHz	Channel 31:	2464 MHz
Channel 32:	2466 MHz	Channel 33:	2468 MHz	Channel 34:	2470 MHz	Channel 35:	2472 MHz
Channel 36:	2474 MHz	Channel 37:	2476 MHz	Channel 38:	2478 MHz	Channel 39:	2480 MHz

Note:

1. The EUT is a Pocket photo printer with a built-in Bluetooth V4.2,V3.0, V2.1+EDR transceiver, this report for Bluetooth V4.2.
2. These tests were conducted on a sample for the purpose of demonstrating compliance of Bluetooth transmitter with Part 15 Subpart C Paragraph 15.247 for spread spectrum devices.
3. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
4. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

Test Mode	Mode 1: Transmit - BLE (GFSK)

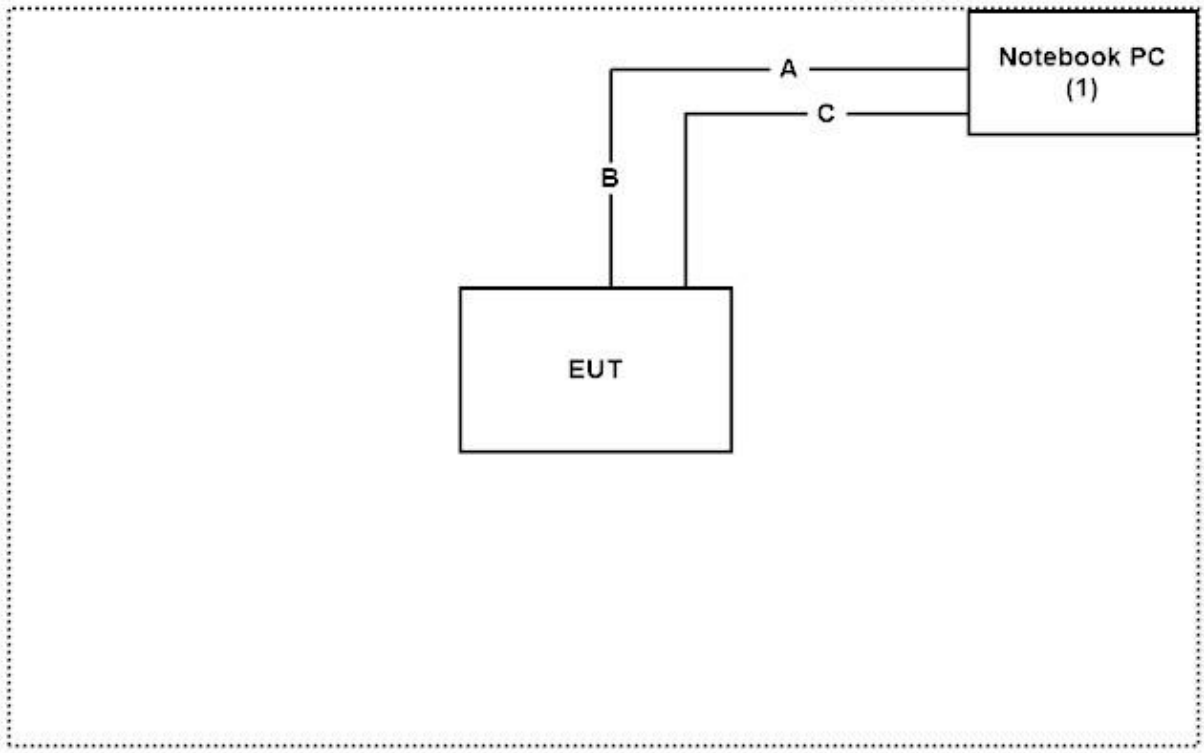
1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	Notebook PC	DELL	Latitude E5440	HG26TZ1	Non-shielded, 0.8m

Signal Cable Type		Signal cable Description
A	USB Cable	Non-shielded, 1.8m
B	USB Cable	Non-shielded, 0.32m
C	Fixture Cable	Non-shielded, 1m

1.4. Configuration of Tested System



1.5. EUT Exercise Software

1. Setup the EUT as shown in Section 1.4.
2. Execute software ” Blue Test v1.9.3.7” on the Notebook PC.
3. Configure the test mode, the test channel, and the data rate.
4. Press “OK” to start the continuous Transmit.
5. Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	30-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:
http://www.dekra.com.tw/english/about/certificates.aspx?bval=5
The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: http://www.dekra.com.tw/index_en.aspx

Site Description: Accredited by TAF
Accredited Number: 3023

Site Name: DEKRA Testing and Certification Co., Ltd
Site Address: No.5-22, Ruishukeng, Linkou Dist., New Taipei City 24451, Taiwan, R.O.C.
TEL : 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : info.tw@dekra.com

FCC Accreditation Number: TW3023

1.7. List of Test Equipment

For Conducted measurements /CB3/SR8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Date	Due. Date
	Temperature Chamber	WIT GROUP	TH-1S-B	EQ-201-00146	2019/02/26	2020/02/25
X	Spectrum Analyzer	Agilent	N9010A	MY48030495	2018/09/27	2019/09/26
X	Power Meter	Anritsu	ML2495A	6K00003357	2018/08/01	2019/07/31
X	Pulse power sensor	Anritsu	MA2411B	0846193	2018/07/25	2019/07/24
X	EMI Test Receiver	R&S	ESCS 30	100369	2018/07/25	2019/07/24
X	LISN	R&S	ESH3-Z5	836679/017	2018/11/19	2019/11/18
X	LISN	R&S	ENV216	100097	2018/03/30	2019/03/29
X	Coaxial Cable	QTK(Arnist)	RG 400	LC018-RG	2018/04/02	2019/04/01

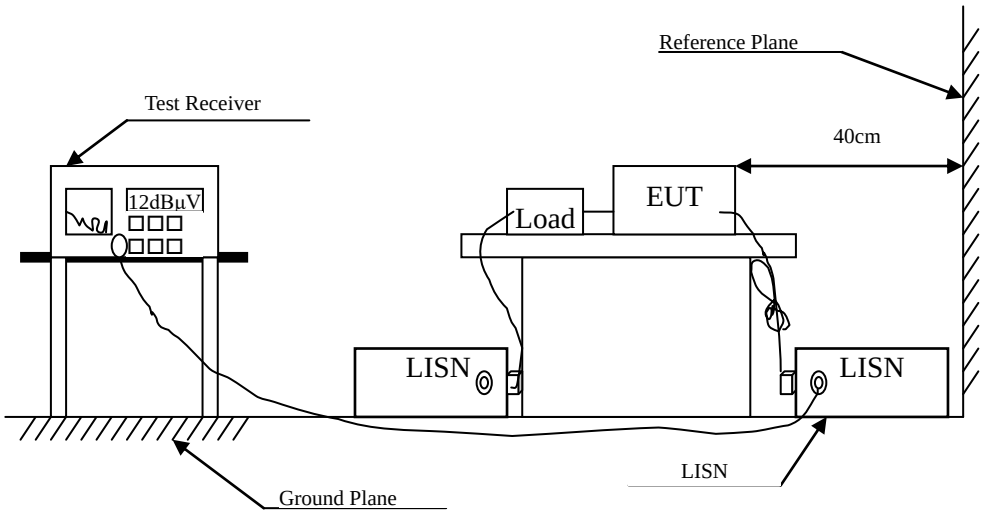
For Radiated measurements /Site3/CB8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Date	Due. Date
X	Spectrum Analyzer	R&S	FSP40	100170	2019/03/12	2020/03/11
X	Loop Antenna	Teseq	HLA6121	37133	2017/10/13	2019/10/12
X	Bilog Antenna	Schaffner Chase	CBL6112B	2707	2018/06/24	2019/06/23
X	Coaxial Cable	DEKRA	RG 214	LC003-RG	2018/06/14	2019/06/13
X	Pre-Amplifier	Jet-Power	JPA-10M1G33	170101000330010	2018/06/14	2019/06/13
X	Horn Antenna	ETS-Lindgren	3117	00135205	2018/05/03	2019/05/02
X	Horn Antenna	SCHWARZBECK	9120D	576	2018/12/18	2019/12/17
X	Pre-Amplifier	EMCI	EMC012630SE	980210	2018/04/10	2019/04/09
X	Horn Antenna	Com-Power	AH-840	101043	2019/01/19	2020/01/18
X	Amplifier + Cable	EMCI	EMC184045SE	980370	2018/03/21	2019/03/20
X	Filter	MICRO-TRONICS	BRM50702	G270	2018/08/06	2019/08/05
X	Filter	MICRO-TRONICS	BRM50716	G196	2018/08/06	2019/08/05

Note:
1. All equipments are calibrated every one year.
2. The test instruments marked with “X” are used to measure the final test results.
3. Test Software version : QuieTek EMI 2.0 V2.1.113

2. Conducted Emission

2.1. Test Setup



2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBμV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

2.3. Test Procedure

The EUT and Peripherals are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

The EUT was setup to ANSI C63.4, 2014; tested to DTS test procedure of FCC KDB-558074 for compliance to FCC 47CFR Subpart C requirements.

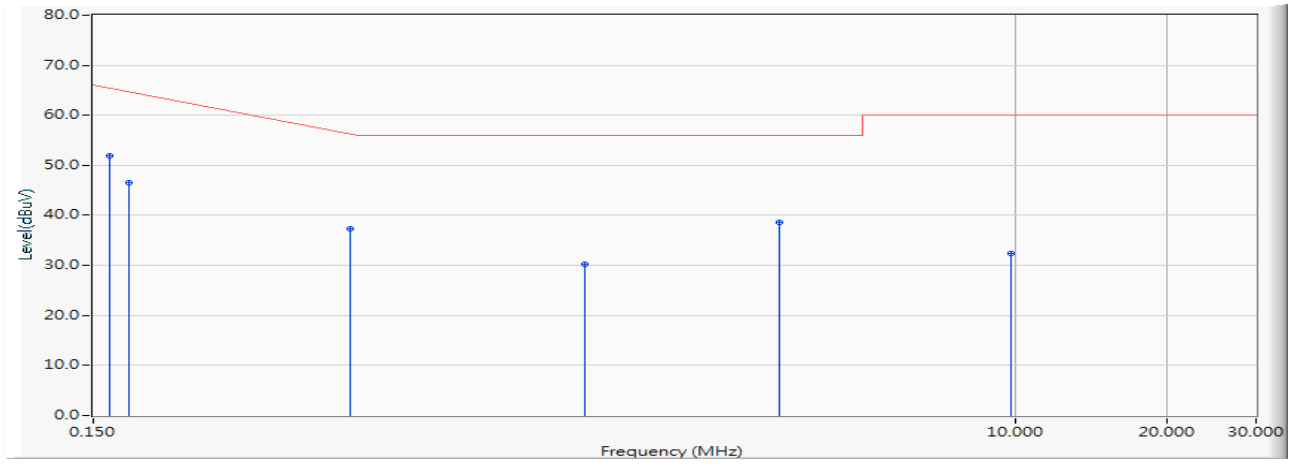
2.4. Uncertainty

± 2.26 dB

2.5. Test Result of Conducted Emission

Product	:	VS0000Z
Test Item	:	Conducted Emission Test
Test date	:	2019/02/15
Test Mode	:	Mode 1: Transmit - BLE (GFSK) (2440MHz)

Line1



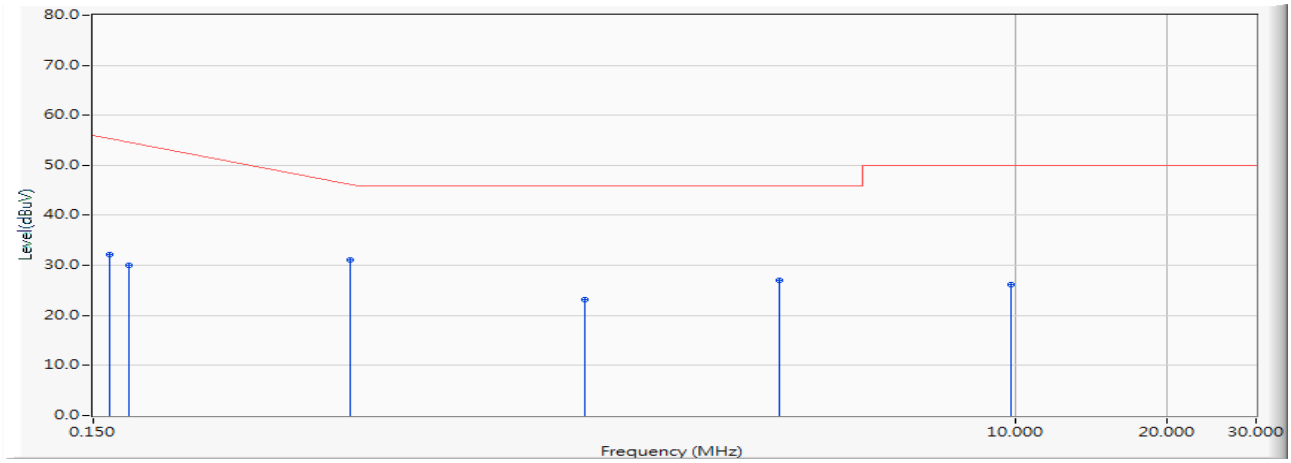
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV)	Margin (dB)	Limit (dBuV)	Detector Type
1	*	0.162	9.745	42.190	51.935	-13.722	65.657	QUASIPEAK
2		0.177	9.741	36.750	46.491	-18.738	65.229	QUASIPEAK
3		0.482	9.749	27.580	37.329	-19.185	56.514	QUASIPEAK
4		1.404	9.797	20.520	30.317	-25.683	56.000	QUASIPEAK
5		3.423	9.868	28.660	38.528	-17.472	56.000	QUASIPEAK
6		9.791	10.068	22.220	32.288	-27.712	60.000	QUASIPEAK

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : VS0000Z
Test Item : Conducted Emission Test
Test date : 2019/02/26
Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Line1



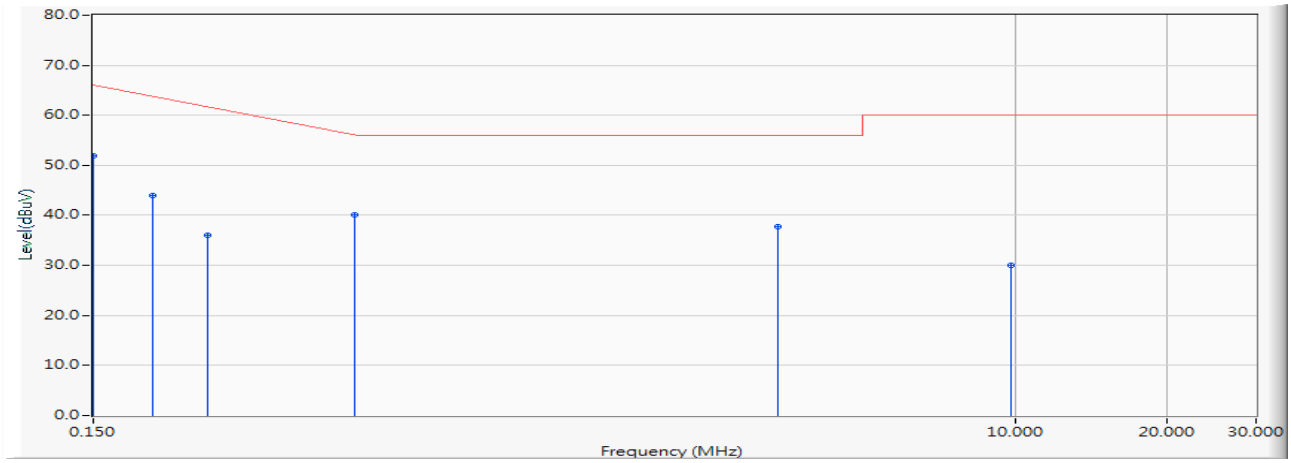
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV)	Margin (dB)	Limit (dBuV)	Detector Type
1		0.162	9.745	22.460	32.205	-23.452	55.657	AVERAGE
2		0.177	9.741	20.380	30.121	-25.108	55.229	AVERAGE
3	*	0.482	9.749	21.270	31.019	-15.495	46.514	AVERAGE
4		1.404	9.797	13.390	23.187	-22.813	46.000	AVERAGE
5		3.423	9.868	17.100	26.968	-19.032	46.000	AVERAGE
6		9.791	10.068	16.090	26.158	-23.842	50.000	AVERAGE

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : VS0000Z
Test Item : Conducted Emission Test
Test date : 2019/02/26
Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Line2



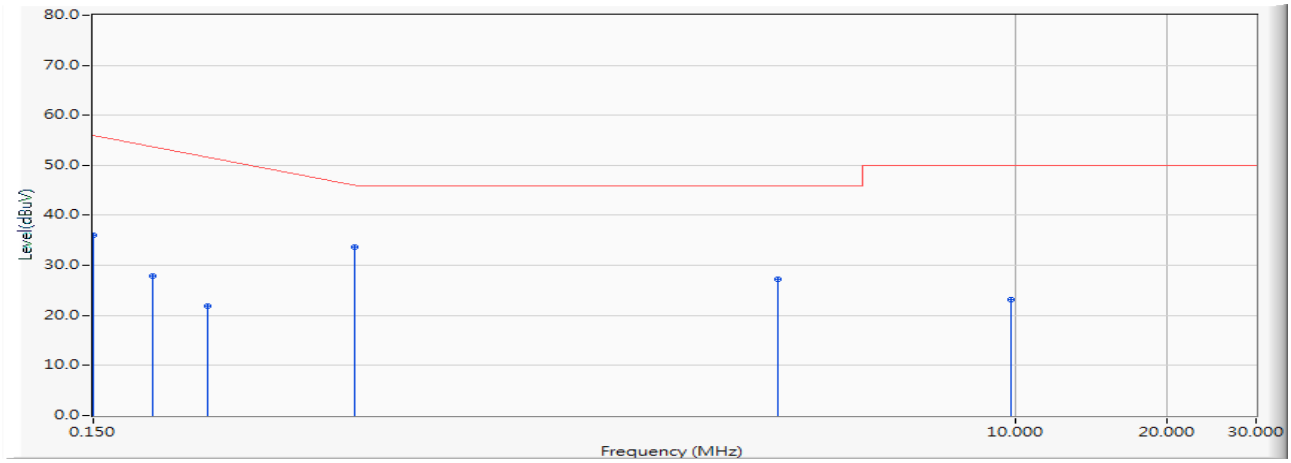
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV)	Margin (dB)	Limit (dBuV)	Detector Type
1	*	0.150	9.739	42.210	51.949	-14.051	66.000	QUASIPEAK
2		0.197	9.738	34.280	44.018	-20.639	64.657	QUASIPEAK
3		0.252	9.740	26.380	36.120	-26.966	63.086	QUASIPEAK
4		0.494	9.740	30.450	40.190	-15.981	56.171	QUASIPEAK
5		3.396	9.867	27.970	37.837	-18.163	56.000	QUASIPEAK
6		9.845	10.089	19.880	29.969	-30.031	60.000	QUASIPEAK

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : VS0000Z
Test Item : Conducted Emission Test
Test date : 2019/02/26
Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Line2



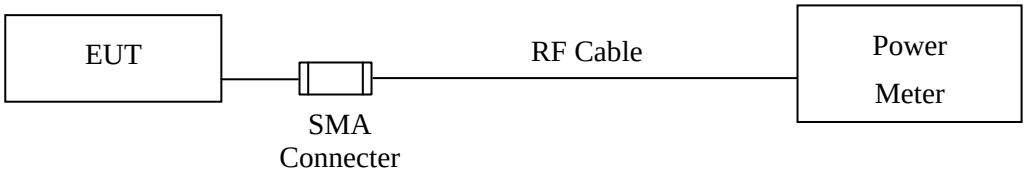
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV)	Margin (dB)	Limit (dBuV)	Detector Type
1		0.150	9.739	26.360	36.099	-19.901	56.000	AVERAGE
2		0.197	9.738	18.210	27.948	-26.709	54.657	AVERAGE
3		0.252	9.740	12.070	21.810	-31.276	53.086	AVERAGE
4	*	0.494	9.740	23.910	33.650	-12.521	46.171	AVERAGE
5		3.396	9.867	17.350	27.217	-18.783	46.000	AVERAGE
6		9.845	10.089	13.090	23.179	-26.821	50.000	AVERAGE

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

3. Peak Power Output

3.1. Test Setup



3.2. Limit

The maximum peak power shall be less 1Watt.

3.3. Test Procedure

Tested according to DTS test procedure of KDB 558074 for compliance to FCC 47CFR 15.247 requirements. The maximum peak conducted output power using KDB 558074 section 9.1.3 PKPM1 Peak power meter method.

3.4. Uncertainty

± 1.19 dB

3.5. Test Result of Peak Power Output

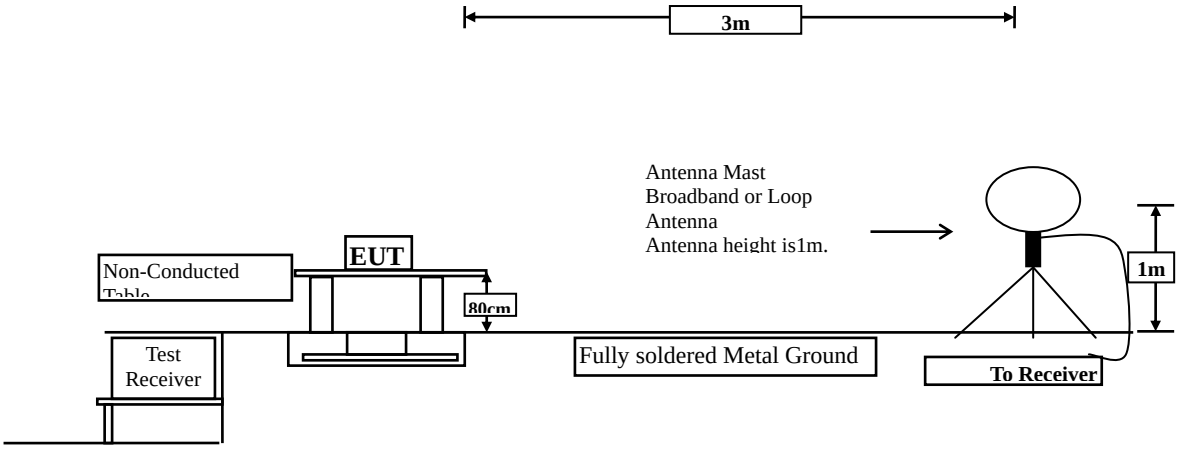
Product : VS0000Z
Test Item : Peak Power Output
Test Site : No.3 OATS
Test date : 2019/03/14
Test Mode : Mode 1: Transmit - BLE (GFSK)

Channel No.	Frequency (MHz)	Average Measurement (dBm)	Peak Measurement (dBm)	Required Limit	Result
Channel 00	2402.00	5.24	7.89	1 Watt= 30 dBm	Pass
Channel 19	2440.00	6.16	7.96	1 Watt= 30 dBm	Pass
Channel 39	2480.00	6.37	8.45	1 Watt= 30 dBm	Pass

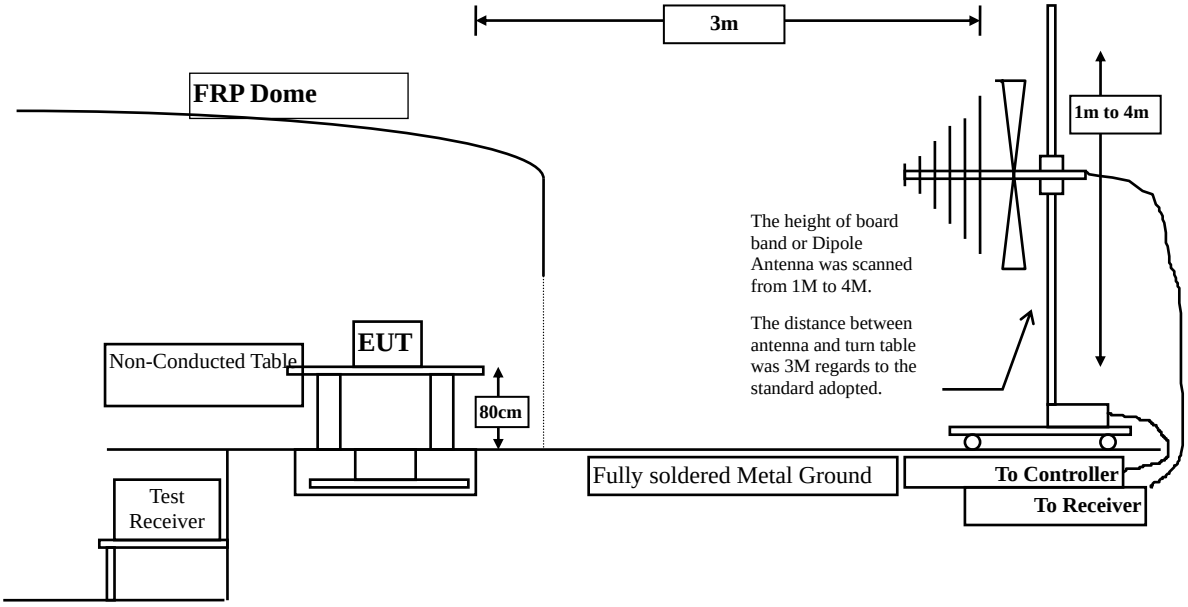
4. Radiated Emission

4.1. Test Setup

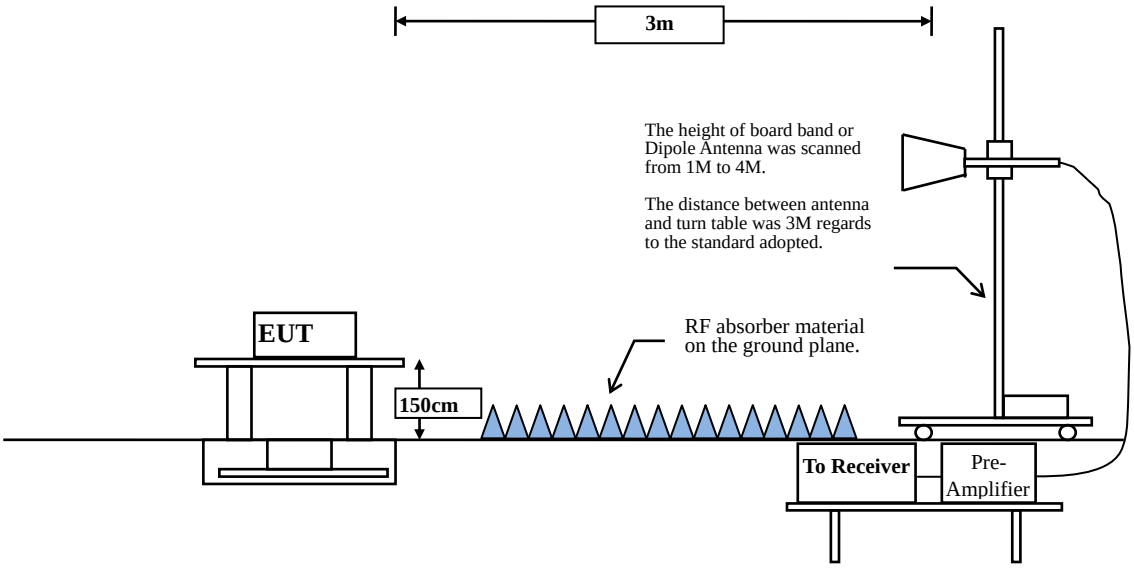
Under 30MHz



Below 1GHz



Above 1GHz


3m
The height of board band or Dipole Antenna was scanned from 1M to 4M.
The distance between antenna and turn table was 3M regards to the standard adopted.
EUT
150cm
RF absorber material on the ground plane.
To Receiver
Pre-Amplifier

4.2. Limits

➢ **General Radiated Emission Limits**

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remarks: 1. RF Voltage (dBμV) = 20 log RF Voltage (uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

4.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Measuring the frequency range below 1GHz, the EUT is placed on a turn table which is 0.8 meter above ground,when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2013 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The worst radiated emission is measured in the Open Area Test Site on the Final Measurement.

The measurement frequency range form 9kHz - 10th Harmonic of fundamental was investigated.

RBW and VBW Parameter setting:

According to KDB 558074 section 12.2.4. Peak power measurement procedure

RBW = as specified in Table 1.

VBW ≥ 3 x RBW.

Table 1 —RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

According to KDB 558074 section 12.2.5. Average power measurement procedure

RBW = 1MHz.

VBW = 10Hz, when duty cycle ≥ 98 %

VBW ≥ 1/T, when duty cycle < 98 %

(T refers to the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.)

2.4GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
BLE	61.88	0.3859	2591	3k

Note: Duty Cycle Refer to Section 9

4.4. Uncertainty

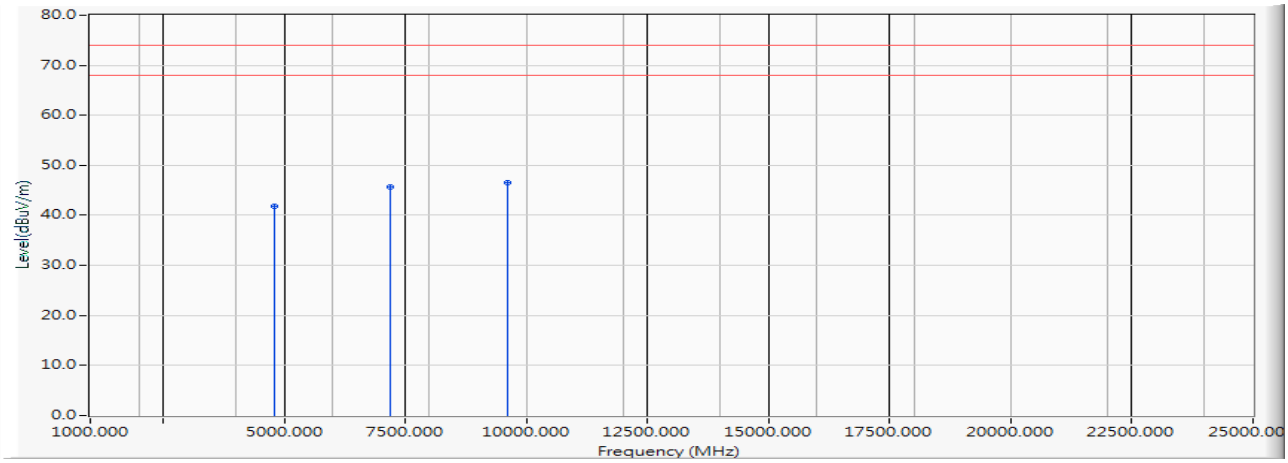
± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

4.5. Test Result of Radiated Emission

Product : VS0000Z
Test Item : Harmonic Radiated Emission
Test Site : No.3 OATS
Test date : 2019/03/15
Test Mode : Mode 1: Transmit - BLE (GFSK)(2402MHz)

Horizontal



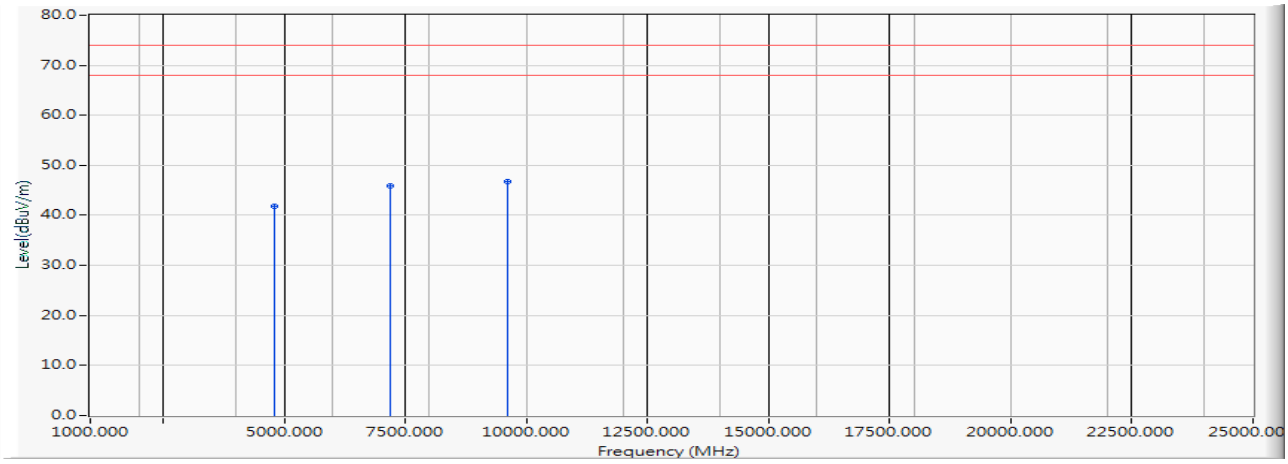
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		4804.000	5.787	36.096	41.883	-32.117	74.000	PEAK
2		7206.000	10.333	35.327	45.660	-28.340	74.000	PEAK
3	*	9608.000	13.713	32.836	46.549	-27.451	74.000	PEAK

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report..

Product : VS0000Z
Test Item : Harmonic Radiated Emission
Test Site : No.3 OATS
Test date : 2019/03/15
Test Mode : Mode 1: Transmit - BLE (GFSK)(2402MHz)

Vertical



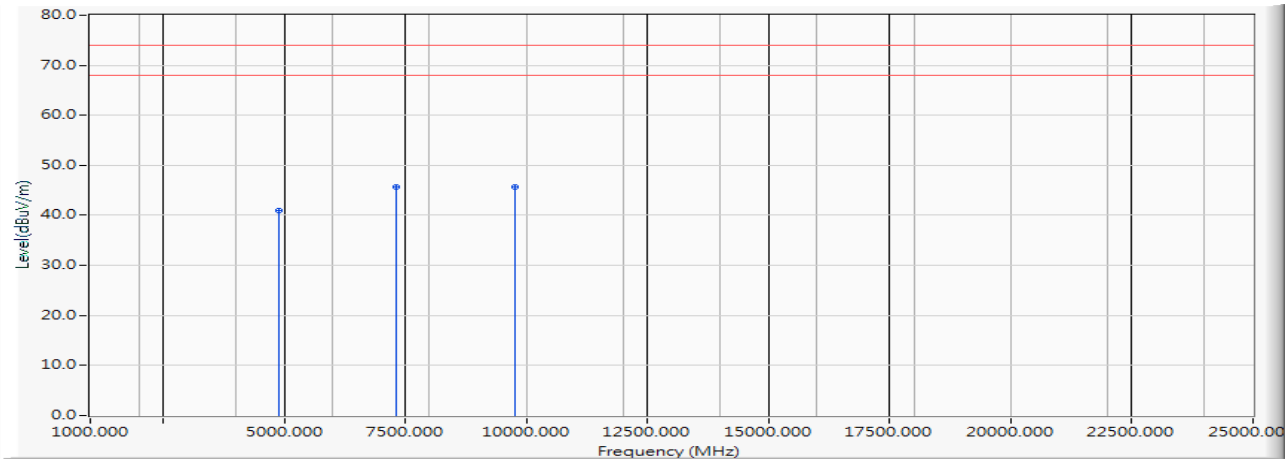
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		4804.000	5.787	36.026	41.813	-32.187	74.000	PEAK
2		7206.000	10.333	35.551	45.884	-28.116	74.000	PEAK
3	*	9608.000	13.713	33.077	46.790	-27.210	74.000	PEAK

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report..

Product	:	VS0000Z
Test Item	:	Harmonic Radiated Emission
Test Site	:	No.3 OATS
Test date	:	2019/03/15
Test Mode	:	Mode 1: Transmit - BLE (GFSK) (2440MHz)

Horizontal



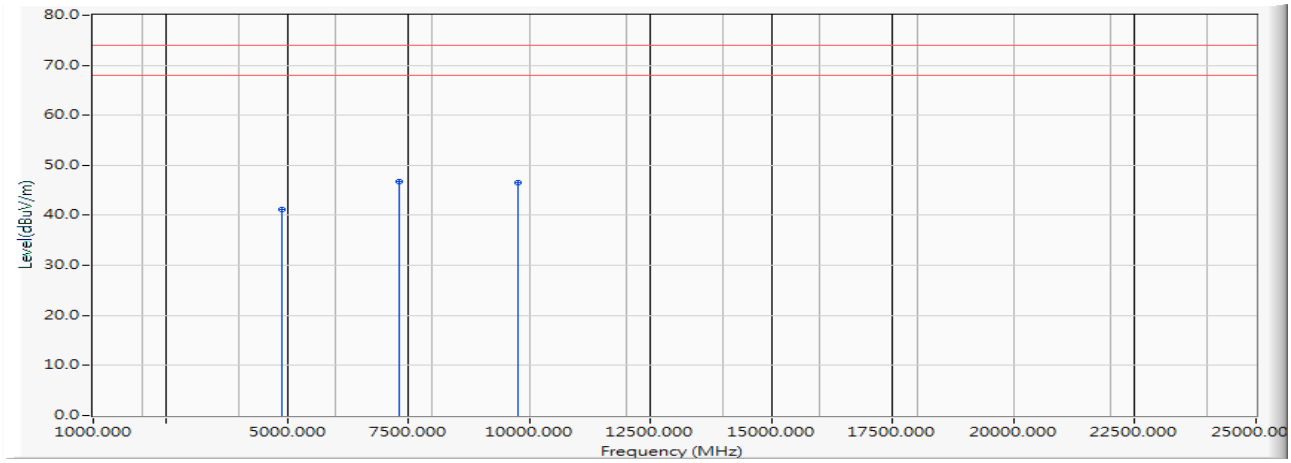
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		4880.000	5.907	34.989	40.897	-33.103	74.000	PEAK
2	*	7320.000	10.400	35.334	45.735	-28.265	74.000	PEAK
3		9760.000	14.113	31.530	45.643	-28.357	74.000	PEAK

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : VS0000Z
Test Item : Harmonic Radiated Emission
Test Site : No.3 OATS
Test date : 2019/03/15
Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Vertical



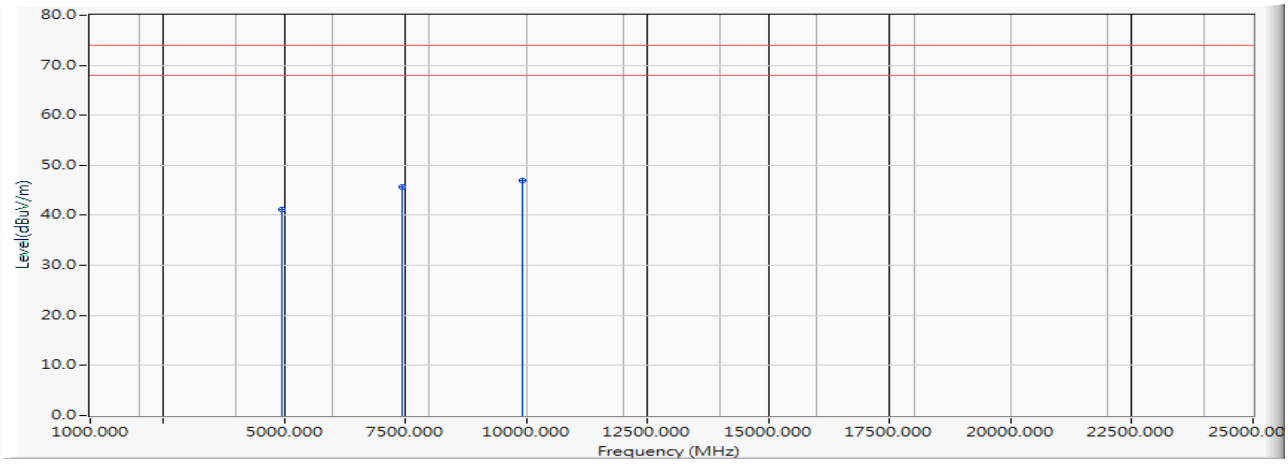
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		4880.000	5.907	35.237	41.145	-32.855	74.000	PEAK
2	*	7320.000	10.400	36.455	46.856	-27.144	74.000	PEAK
3		9760.000	14.113	32.429	46.542	-27.458	74.000	PEAK

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : VS0000Z
Test Item : Harmonic Radiated Emission
Test Site : No.3 OATS
Test date : 2019/03/15
Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

Horizontal



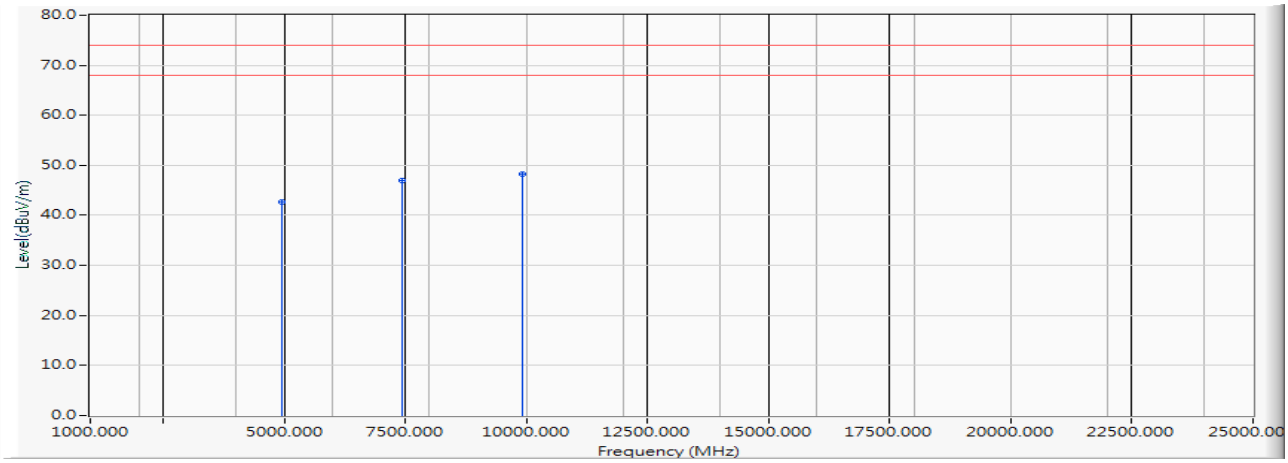
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		4960.000	6.008	35.212	41.220	-32.780	74.000	PEAK
2		7440.000	10.485	35.149	45.634	-28.366	74.000	PEAK
3	*	9920.000	14.146	32.917	47.063	-26.937	74.000	PEAK

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : VS0000Z
Test Item : Harmonic Radiated Emission
Test Site : No.3 OATS
Test date : 2019/03/15
Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

Vertical



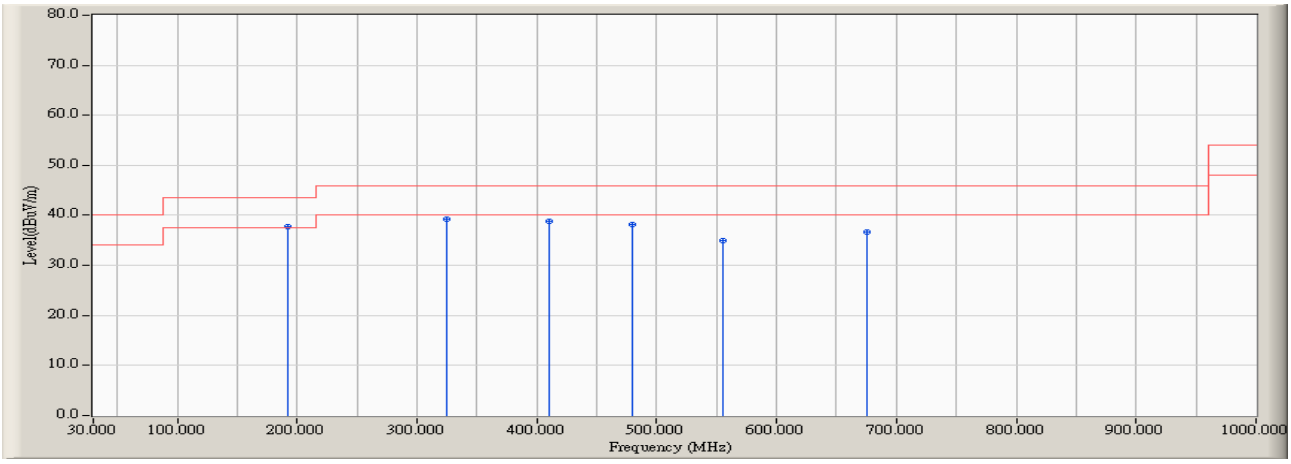
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		4960.000	6.008	36.750	42.758	-31.242	74.000	PEAK
2		7440.000	10.485	36.429	46.914	-27.086	74.000	PEAK
3	*	9920.000	14.146	34.210	48.356	-25.644	74.000	PEAK

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	:	VS0000Z
Test Item	:	General Radiated Emission
Test Site	:	No.3 OATS
Test date	:	2019/02/20
Test Mode	:	Mode 1: Transmit - BLE (GFSK) (2440MHz)

Horizontal



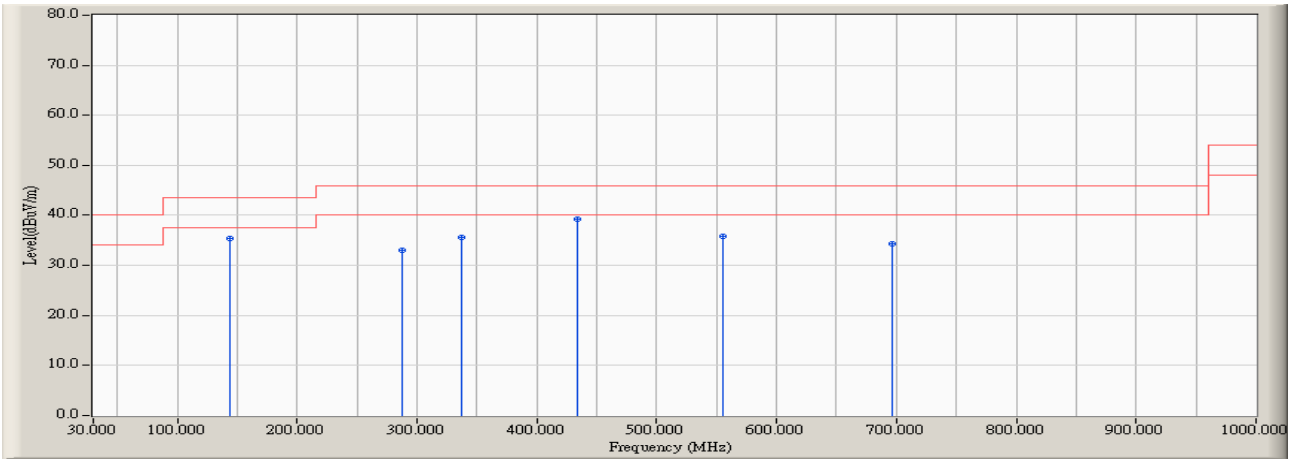
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	191.667	17.183	20.642	37.825	-5.675	43.500	PEAK
2		325.353	22.517	16.660	39.176	-6.824	46.000	PEAK
3		410.849	24.900	13.961	38.861	-7.139	46.000	PEAK
4		479.247	25.941	12.257	38.198	-7.802	46.000	PEAK
5		555.417	27.339	7.666	35.005	-10.995	46.000	PEAK
6		675.112	28.516	8.170	36.686	-9.314	46.000	PEAK

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
4. The emission levels of other frequencies are very lower than the limit and not show in test report.
5. No emission found between lowest internal used/generated frequency to 30MHz.

Product	:	VS0000Z
Test Item	:	General Radiated Emission
Test Site	:	No.3 OATS
Test date	:	2019/02/20
Test Mode	:	Mode 1: Transmit - BLE (GFSK) (2440MHz)

Vertical



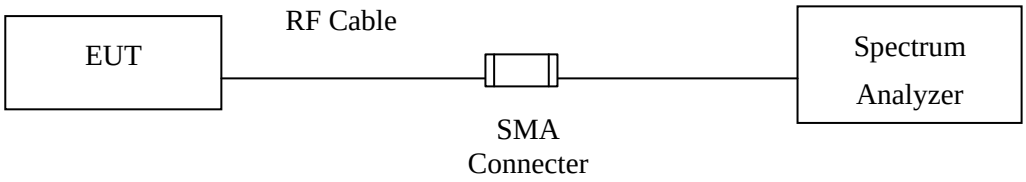
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		143.478	18.933	16.355	35.288	-8.212	43.500	PEAK
2		288.045	21.431	11.557	32.988	-13.012	46.000	PEAK
3		337.788	22.914	12.719	35.633	-10.367	46.000	PEAK
4	*	434.167	25.217	14.106	39.322	-6.678	46.000	PEAK
5		555.417	27.339	8.492	35.831	-10.169	46.000	PEAK
6		696.875	28.562	5.853	34.415	-11.585	46.000	PEAK

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
4. The emission levels of other frequencies are very lower than the limit and not show in test report.
5. No emission found between lowest internal used/generated frequency to 30MHz.

5. RF Antenna Conducted Test

5.1. Test Setup



5.2. Limits

According to FCC Section 15.247(d). In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

5.3. Test Procedure

The EUT was tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

5.4. Uncertainty

± 1.20dB

5.5. Test Result of RF Antenna Conducted Test

Product	:	VS0000Z
Test Item	:	RF Antenna Conducted Test
Test Site	:	No.3 OATS
Test date	:	2019/02/14
Test Mode	:	Mode 1: Transmit - BLE (GFSK)

Figure Channel 00:

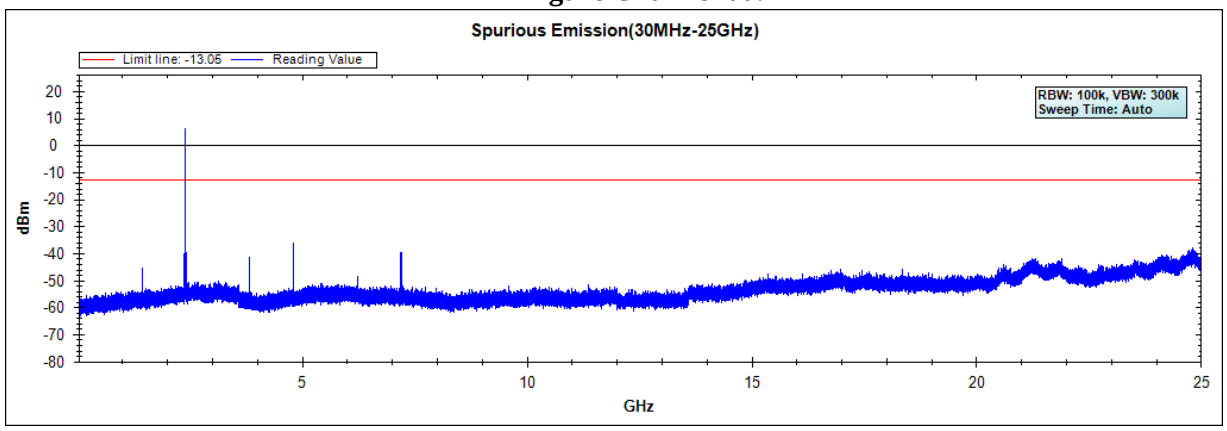


Figure Channel 19:

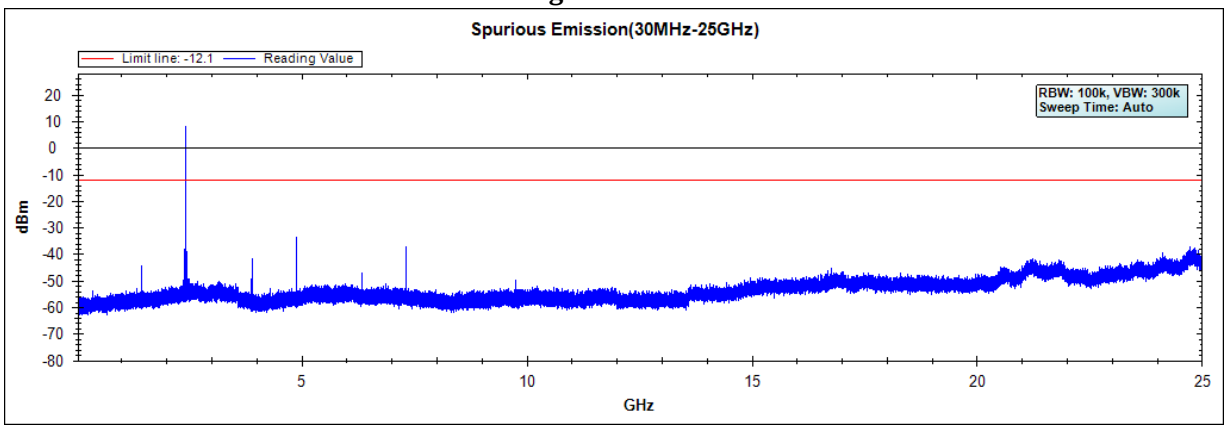
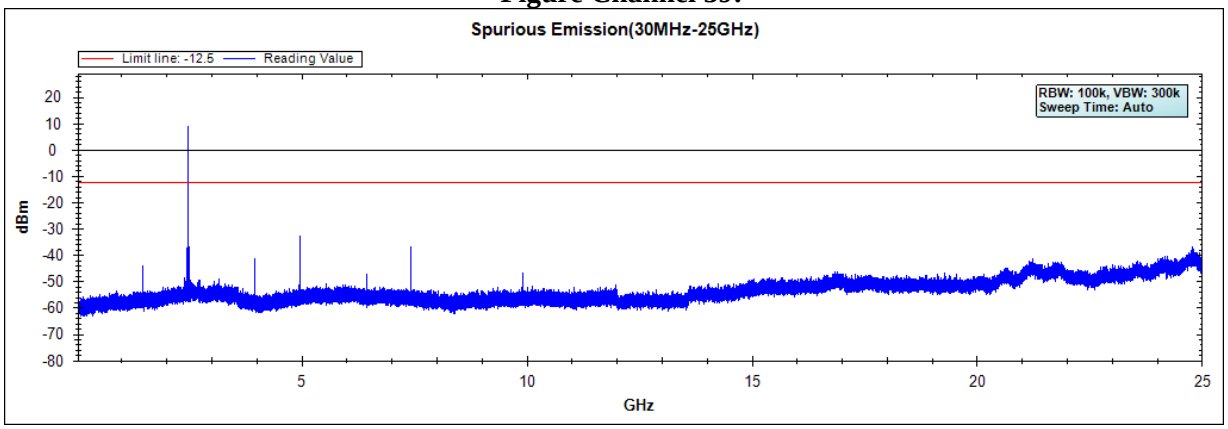


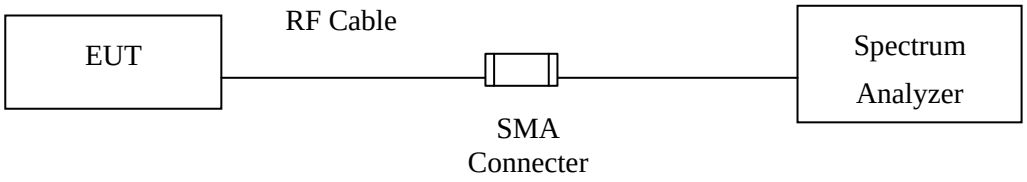
Figure Channel 39:



6. Band Edge

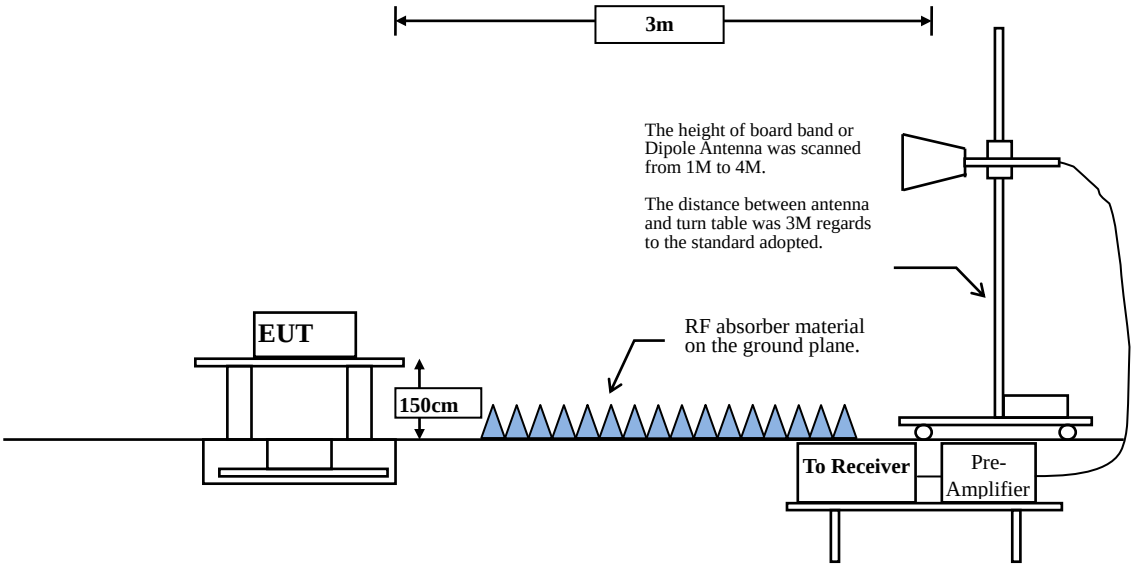
6.1. Test Setup

RF Conducted Measurement



RF Radiated Measurement:

Above 1GHz



6.2. Limit

According to FCC Section 15.247(d). In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, 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) (see Section 15.205(c)).

6.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.
The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.

RBW and VBW Parameter setting:

According to KDB 558074 section 12.2.4. Peak power measurement procedure

RBW = as specified in Table 1.

VBW ≥ 3 x RBW.

Table 1 —RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

According to KDB 558074 section 12.2.5. Average power measurement procedure

RBW = 1MHz.

VBW = 10Hz, when duty cycle ≥ 98 %

VBW ≥ 1/T, when duty cycle < 98 %

(T refers to the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.)

2.4GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
BLE	61.88	0.3859	2591	3k

Note: Duty Cycle Refer to Section 9

6.4. Uncertainty

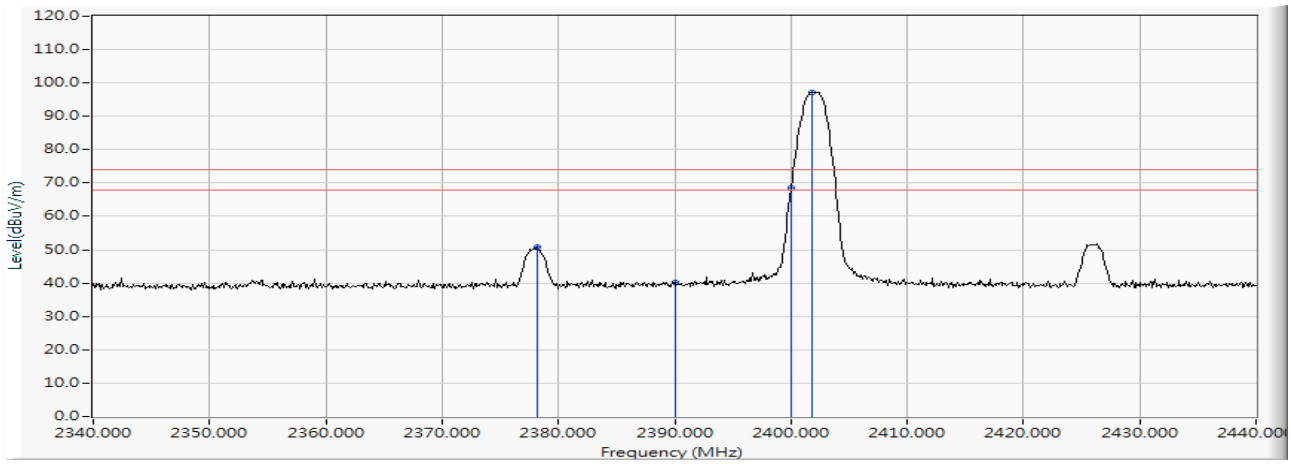
± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

6.5. Test Result of Band Edge

Product : VS0000Z
Test Item : Band Edge
Test Site : No.3 OATS
Test date : 2019/03/12
Test Mode : Mode 1: Transmit - BLE (GFSK)

Horizontal



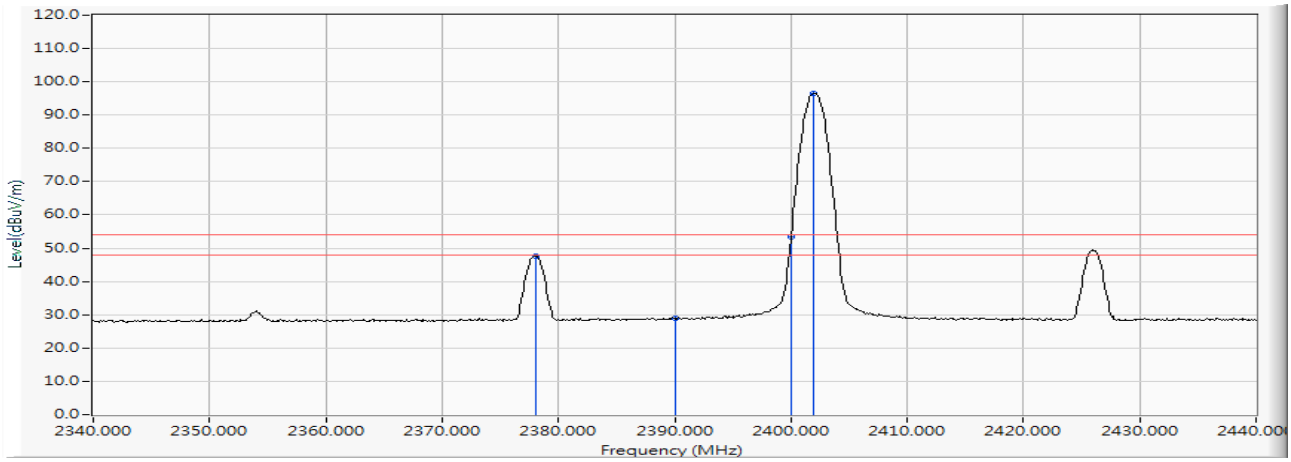
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		2378.200	-2.739	53.508	50.769	-23.231	74.000	PEAK
2		2390.000	-2.687	42.880	40.193	-33.807	74.000	PEAK
3		2400.000	-2.660	71.217	68.557	-5.443	74.000	PEAK
4	*	2401.800	-2.658	99.851	97.193	23.193	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : VS0000Z
Test Item : Band Edge
Test Site : No.3 OATS
Test date : 2019/03/12
Test Mode : Mode 1: Transmit - BLE (GFSK)

Horizontal



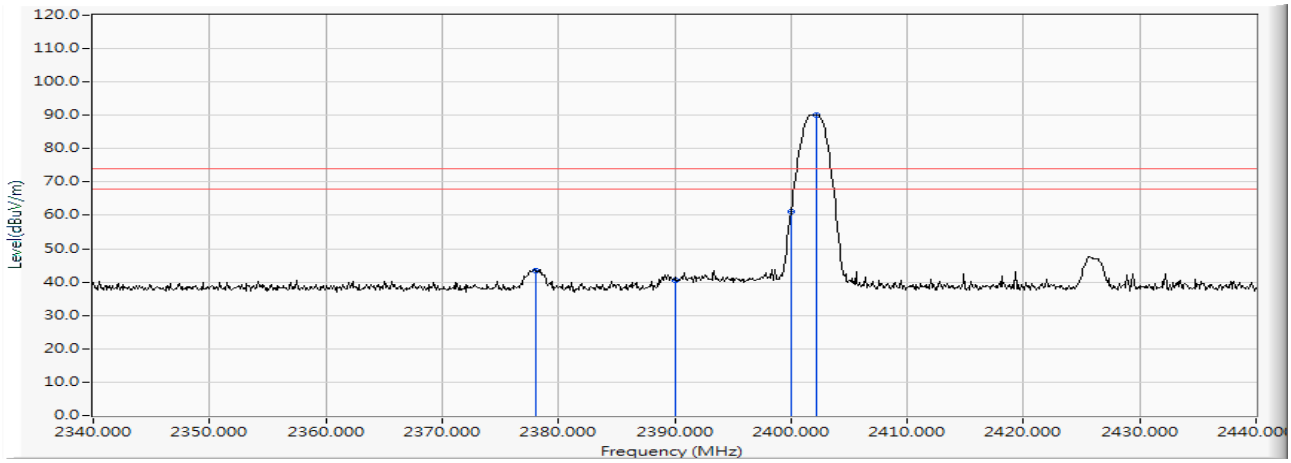
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		2378.000	-2.740	50.507	47.767	-6.233	54.000	AVERAGE
2		2390.000	-2.687	31.556	28.869	-25.131	54.000	AVERAGE
3		2400.000	-2.660	56.021	53.361	-0.639	54.000	AVERAGE
4	*	2402.000	-2.657	99.242	96.585	42.585	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : VS0000Z
Test Item : Band Edge
Test Site : No.3 OATS
Test date : 2019/03/12
Test Mode : Mode 1: Transmit - BLE (GFSK)

Vertical



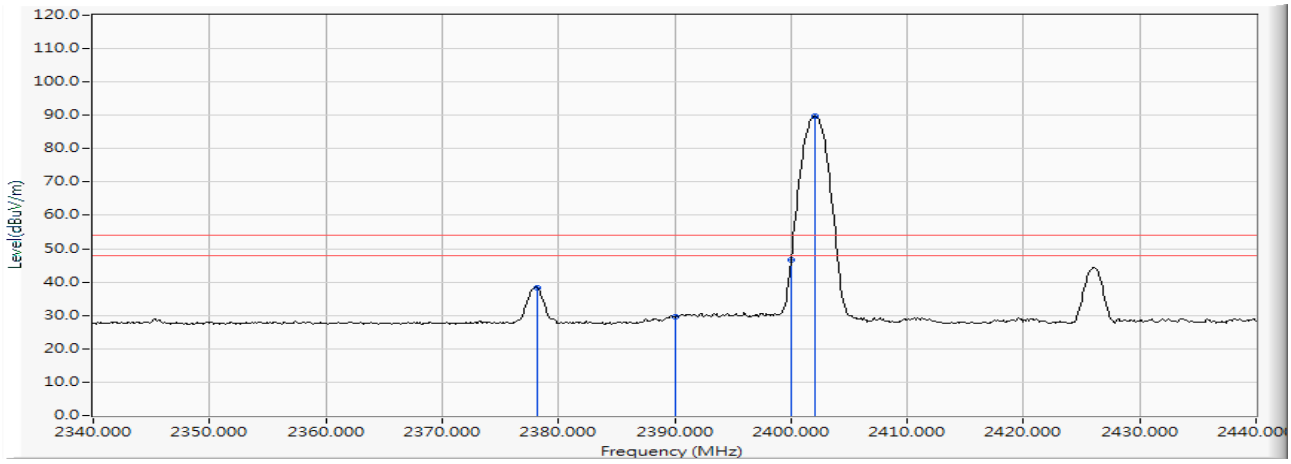
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		2378.000	-4.119	47.536	43.417	-30.583	74.000	PEAK
2		2390.000	-4.159	44.712	40.553	-33.447	74.000	PEAK
3		2400.000	-4.171	65.262	61.091	-12.909	74.000	PEAK
4	*	2402.200	-4.171	94.355	90.184	16.184	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : VS0000Z
Test Item : Band Edge
Test Site : No.3 OATS
Test date : 2019/03/12
Test Mode : Mode 1: Transmit - BLE (GFSK)

Vertical



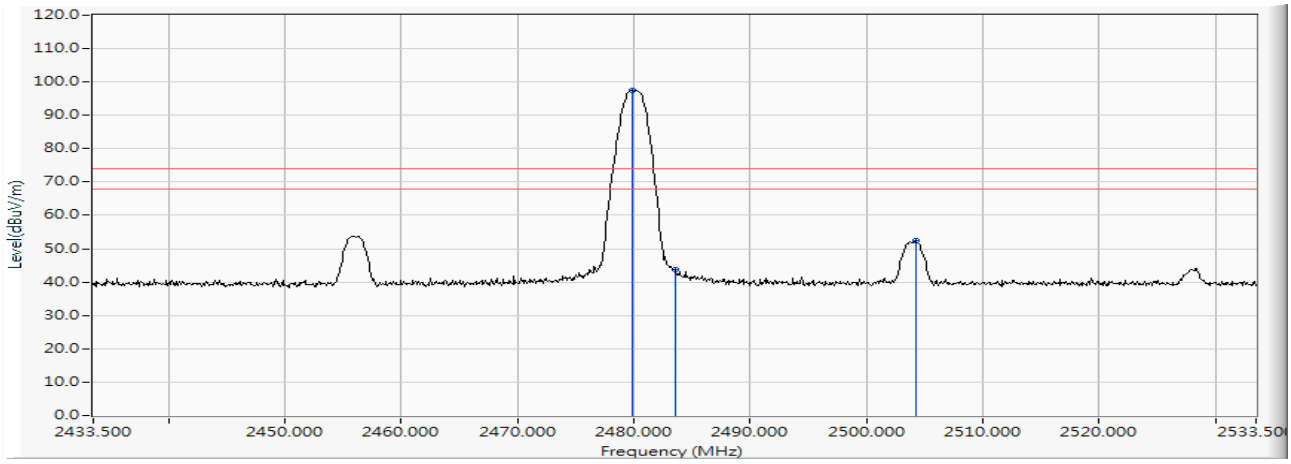
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		2378.200	-4.119	42.527	38.407	-15.593	54.000	AVERAGE
2		2390.000	-4.159	33.801	29.642	-24.358	54.000	AVERAGE
3		2400.000	-4.171	50.920	46.749	-7.251	54.000	AVERAGE
4	*	2402.100	-4.171	93.854	89.683	35.683	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : VS0000Z
Test Item : Band Edge
Test Site : No.3 OATS
Test date : 2019/03/12
Test Mode : Mode 1: Transmit - BLE (GFSK)

Horizontal



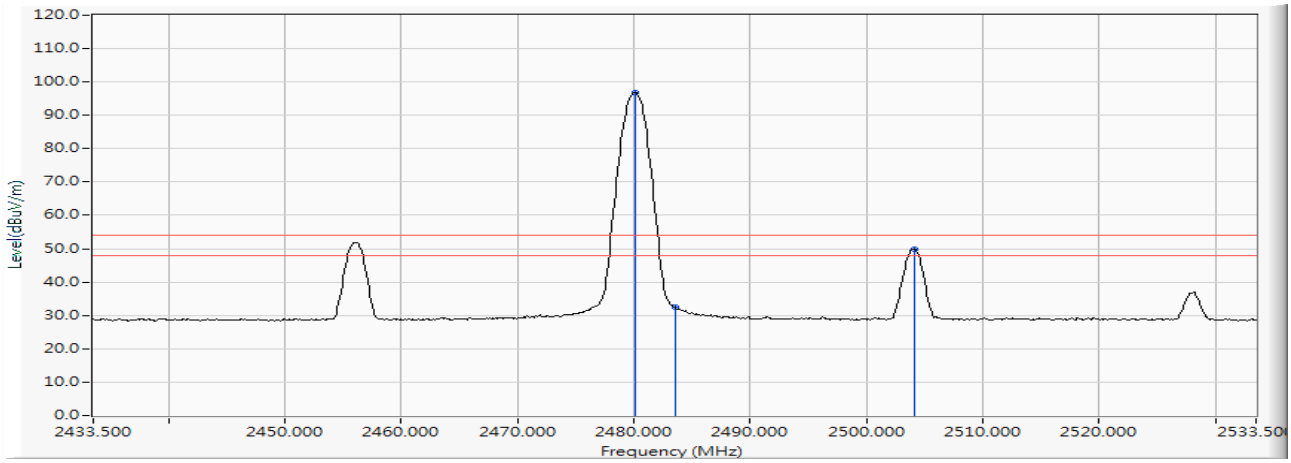
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	2479.800	-2.605	100.038	97.433	23.433	74.000	PEAK
2		2483.500	-2.601	46.207	43.605	-30.395	74.000	PEAK
3		2504.200	-2.633	54.998	52.365	-21.635	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : VS0000Z
Test Item : Band Edge
Test Site : No.3 OATS
Test date : 2019/03/12
Test Mode : Mode 1: Transmit - BLE (GFSK)

Horizontal



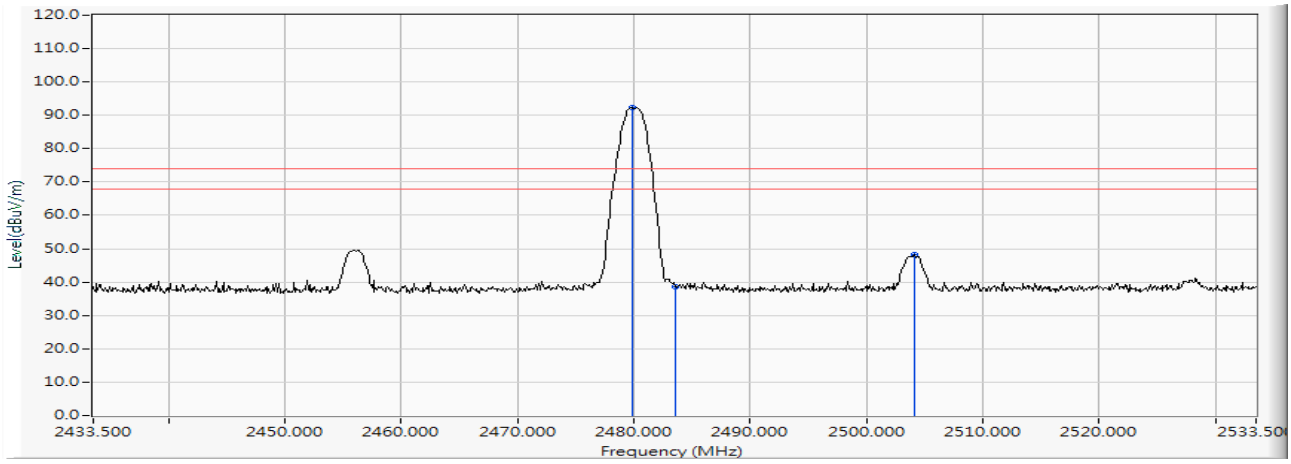
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	2480.100	-2.605	99.499	96.894	42.894	54.000	AVERAGE
2		2483.500	-2.601	35.109	32.507	-21.493	54.000	AVERAGE
3		2504.100	-2.633	52.505	49.872	-4.128	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product	:	VS0000Z
Test Item	:	Band Edge
Test Site	:	No.3 OATS
Test date	:	2019/03/12
Test Mode	:	Mode 1: Transmit - BLE (GFSK)

Vertical



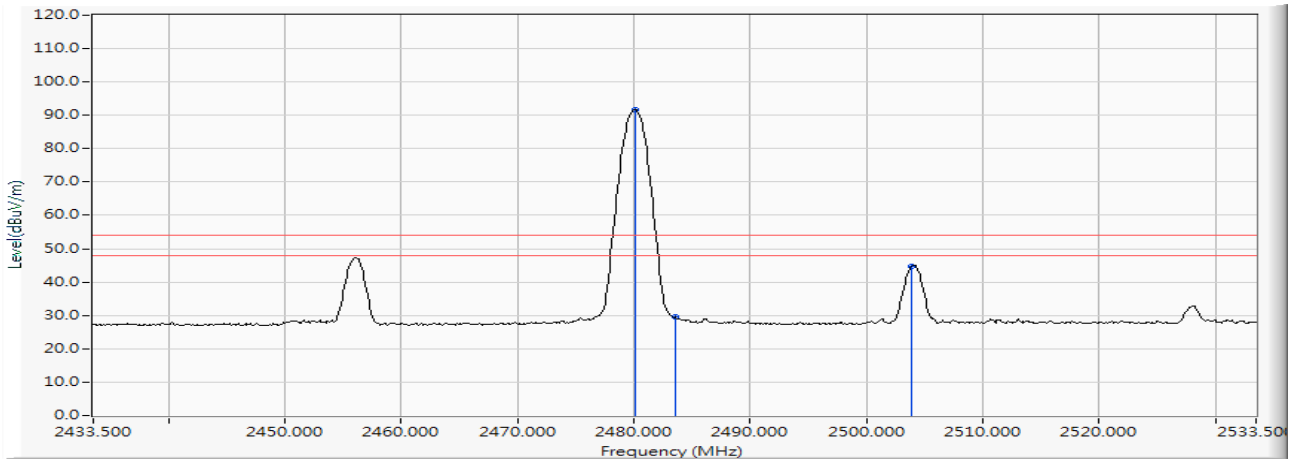
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	2479.800	-3.978	96.189	92.211	18.211	74.000	PEAK
2		2483.500	-3.966	42.635	38.668	-35.332	74.000	PEAK
3		2504.100	-3.891	52.087	48.197	-25.803	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : VS0000Z
Test Item : Band Edge
Test Site : No.3 OATS
Test date : 2019/03/12
Test Mode : Mode 1: Transmit - BLE (GFSK)

Vertical



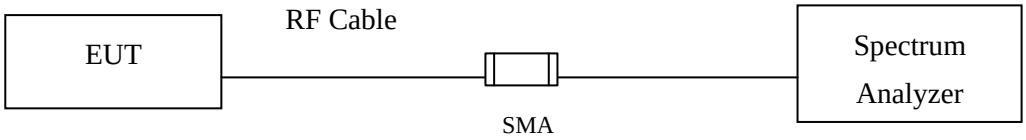
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	2480.100	-3.977	95.634	91.657	37.657	54.000	AVERAGE
2		2483.500	-3.966	33.411	29.444	-24.556	54.000	AVERAGE
3		2503.900	-3.891	48.683	44.792	-9.208	54.000	AVERAGE

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

7. 6dB Bandwidth

7.1. Test Setup



7.2. Limits

The minimum bandwidth shall be at least 500 kHz.

7.3. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 1-5% of the emission bandwidth, VBW≥3*RBW

7.4. Uncertainty

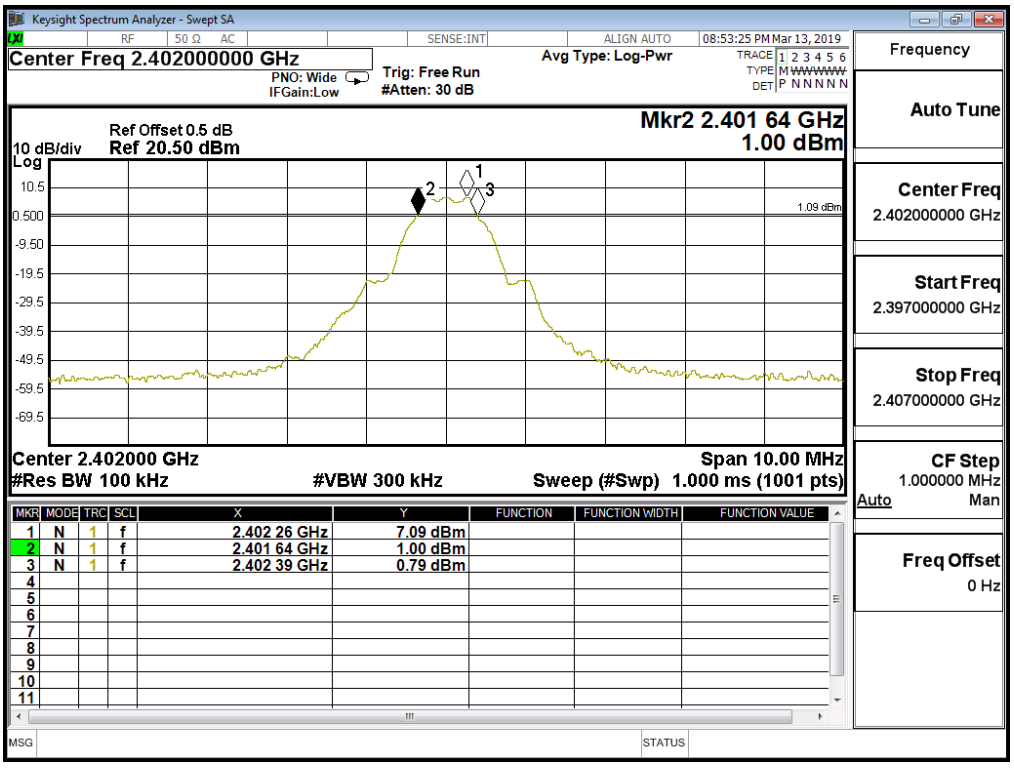
± 283Hz

7.5. Test Result of 6dB Bandwidth

Product : VS0000Z
Test Item : 6dB Bandwidth Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2402MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	750	>500	Pass

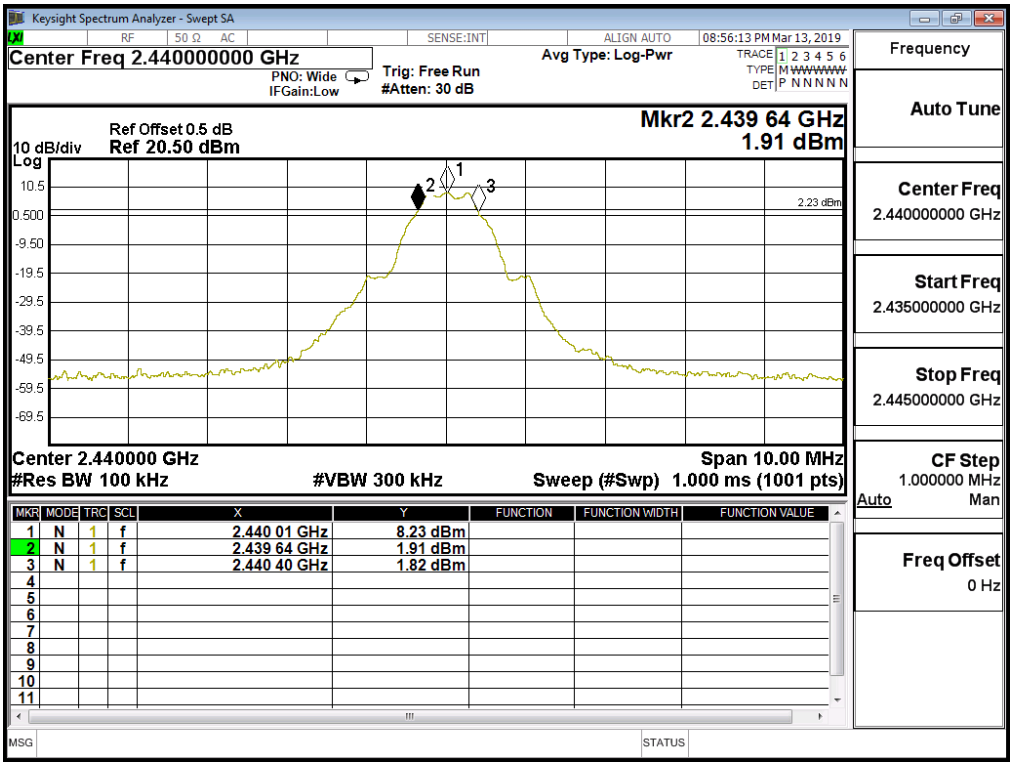
Figure Channel 00:



Product : VS0000Z
Test Item : 6dB Bandwidth Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
19	2440	760	>500	Pass

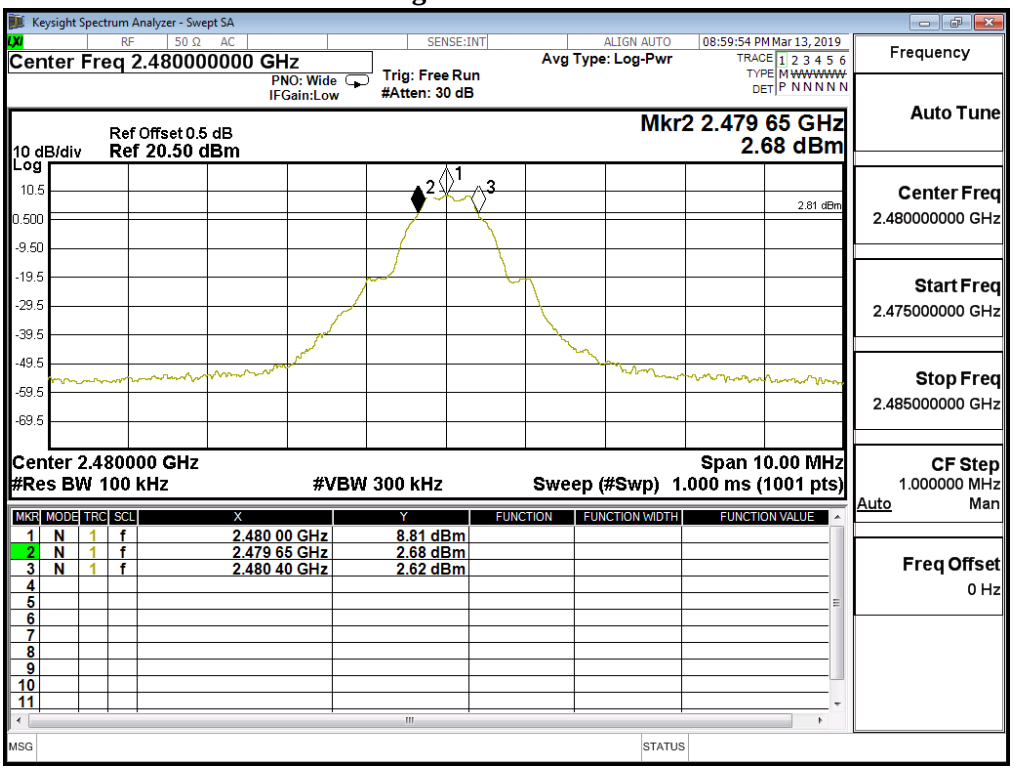
Figure Channel 19:



Product : VS0000Z
Test Item : 6dB Bandwidth Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

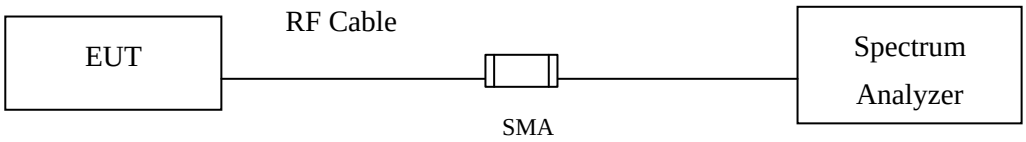
Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
39	2480	750	>500	Pass

Figure Channel 39:



8. Power Density

8.1. Test Setup



8.2. Limits

The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3kHz bandwidth.

8.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013, the maximum power spectral density using KDB 558074 section 10.2 PKPSD (peak PSD) method.

8.4. Uncertainty

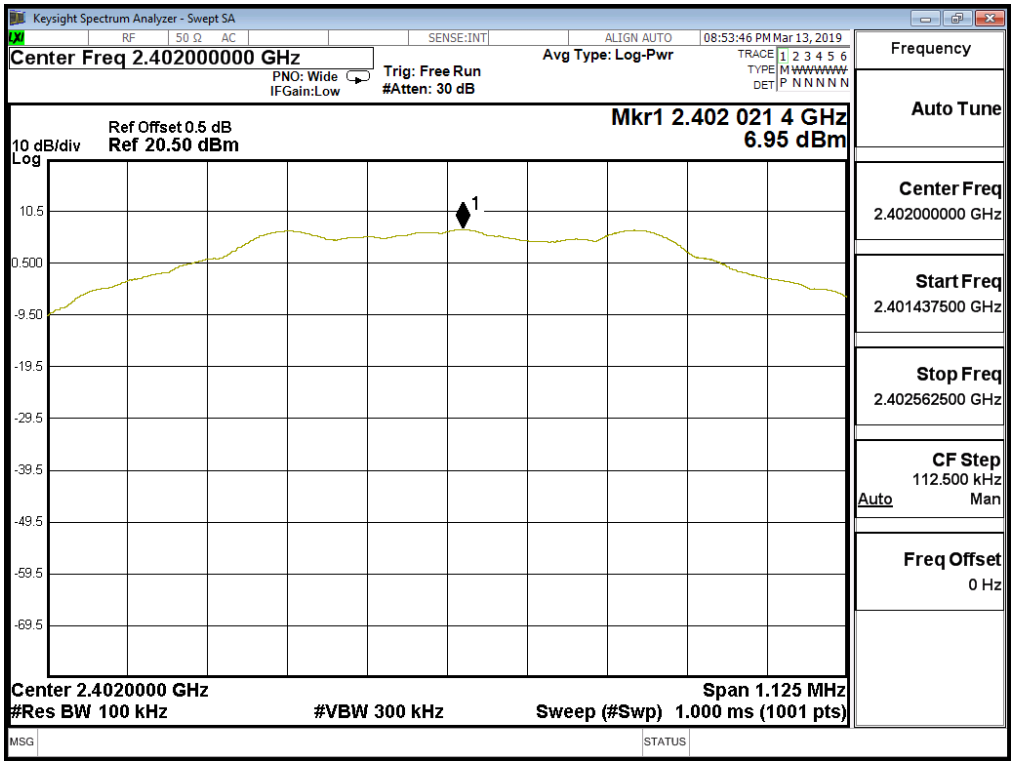
± 1.20 dB

8.5. Test Result of Power Density

Product : VS0000Z
Test Item : Power Density Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2402MHz)

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
00	2402	6.95	≦8dBm	Pass

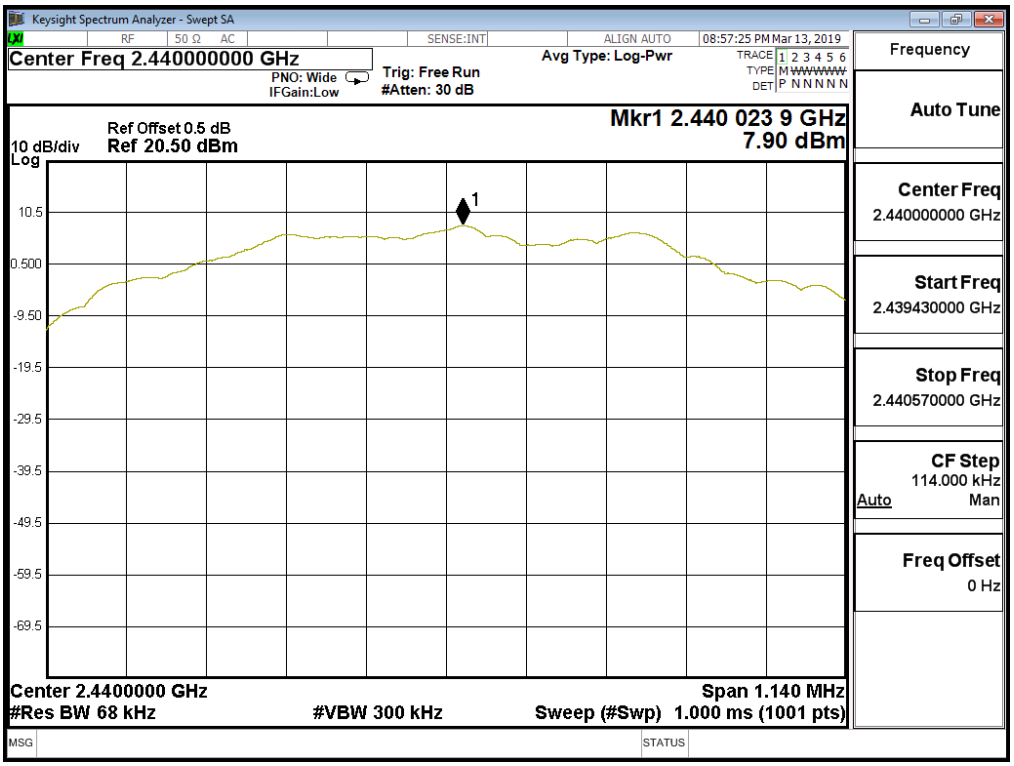
Figure Channel 00:



Product : VS0000Z
Test Item : Power Density Data
Test Site : No.3OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
19	2440	7.9	≦8dBm	Pass

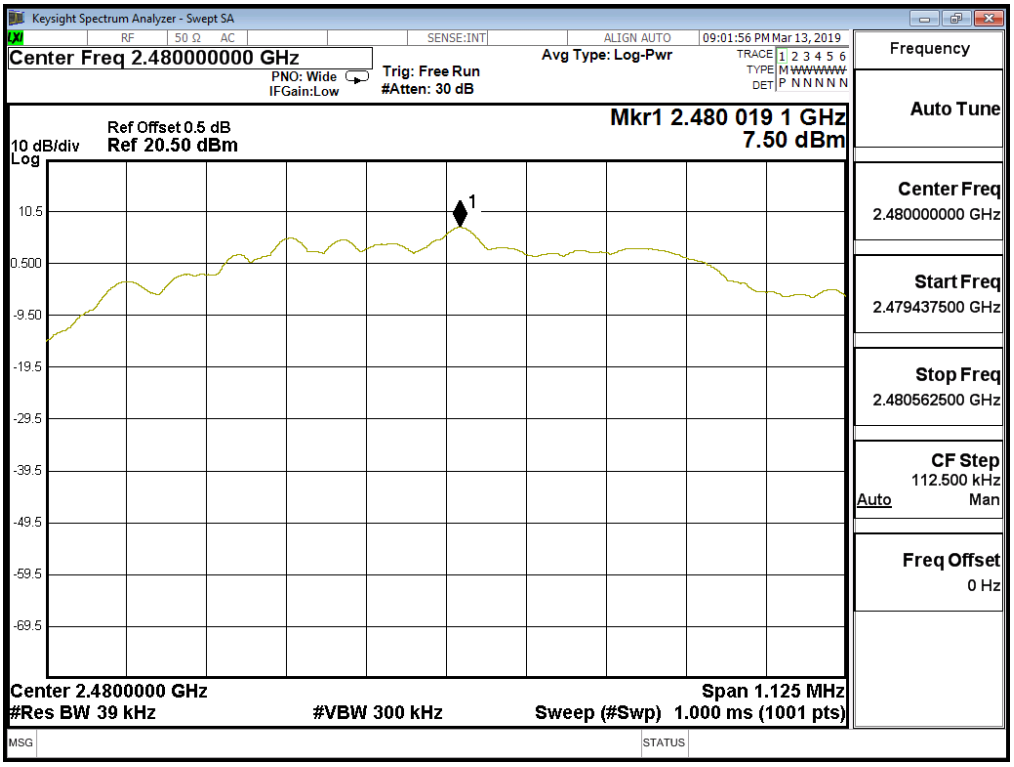
Figure Channel 19:



Product : VS0000Z
Test Item : Power Density Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

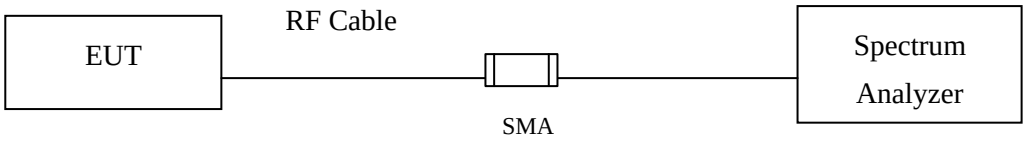
Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
39	2480	7.5	≦8dBm	Pass

Figure Channel 39:



9. Duty Cycle

9.1. Test Setup



9.2. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

9.3. Uncertainty

± 2.31msec

9.4. Test Result of Duty Cycle

Product : VS0000Z
Test Item : Duty Cycle
Test Mode : Mode 1: Transmit - BLE (GFSK)

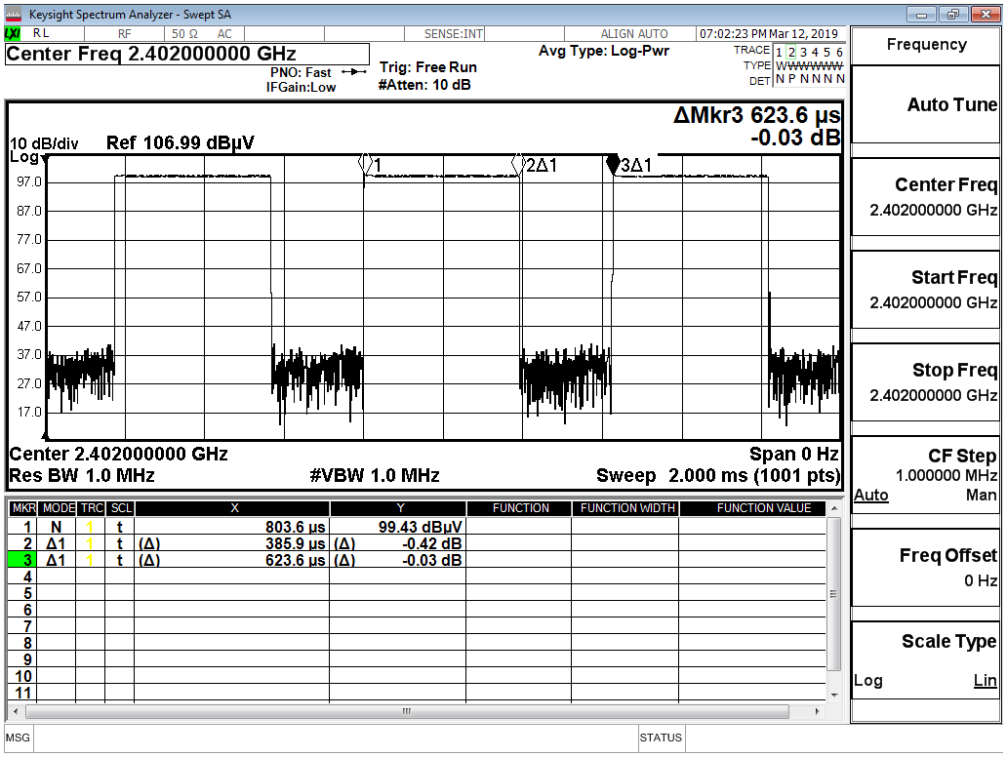
Duty Cycle Formula:

Duty Cycle = Ton / (Ton + Toff)

Duty Factor = 10 Log (1/Duty Cycle)

Results:

2.4GHz band	Ton (ms)	Ton + Toff (ms)	Duty Cycle (%)	Duty Factor (dB)
BLE	0.3859	0.6236	61.88	2.08



10. EMI Reduction Method During Compliance Testing

No modification was made during testing.