SHENZHEN DNS INDUSTRIES CO., LTD

TEST REPORT

SCOPE OF WORK
FCC TESTING – SH-301, SH-301A, GDUTAG25, S6DUTAG25, NAGD-301, 500062, AIR-200

REPORT NUMBER
250507016SZN-001

ISSUE DATE
01 August 2025

[REVISED DATE]
[----------]

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TEST REPORT

Intertek Report No.: 250507016SZN-001

SHENZHEN DNS INDUSTRIES CO., LTD

Application
For
Certification

FCC ID: ZBC-SH301A

Smart Tag

Model: SH-301, SH-301A, GDUTAG25, S6DUTAG25, NAGD-301, 500062, AIR-200

Brand Name: DNS, NOVOO, Energy Sistem, BARMASO

2.4GHz Transceiver

Report No.: 250507016SZN-001

We hereby certify that the sample of the above item is considered to comply with the requirements of FCC Part 15, Subpart C for Intentional Radiator, mention 47 CFR [10-1-23]

Prepared and Checked by:

Molly

Molly Wu
Engineer

Approved by:

Johnny Wang

Johnny Wang
Project Engineer
Date: 01 August 2025

MEASUREMENT/TECHNICAL REPORT

This report concerns (check one:) Original Grant X Class I Change _____

Equipment Type: DTS - Part 15 Digital Transmission System

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes _____ No X

If yes, defer until: _____
date

Company Name agrees to notify the Commission by: _____
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? Yes _____ No X

If no, assumed Part 15, Subpart C for intentional radiator – the new 47 CFR [10-1-23 Edition] provision.

Report prepared by:

Molly Wu
Intertek Testing Services Shenzhen Ltd. Longhua Branch
101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing
Community, GuanHu Subdistrict, LongHua District, Shenzhen.
Tel: (86 755) 8614 0669 Fax: (86 755) 8601 6661

Table of Contents

1.0 Summary of Test Results

Applicant: SHENZHEN DNS INDUSTRIES CO., LTD
Applicant Address: 23/F Building A, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian, Shenzhen, China
Manufacturer 1: HUIZHOU DNS TECHNOLOGY CO., LTD.
Manufacturer Address: 5 Dongshun South Road, Dongjiang Hi-tech Industrial Park, Zhongkai Hi-tech Zone, Huizhou City, Guangdong, China
Manufacturer 2: D AND S INDUSTRIES (PHILIPPINES) CORPORATION
Manufacturer Address 2: 1 to 5 Orient Goldcrest Suntrust Ecotown Building 2, Lot 8 Block 8, Sahud Ulan, Tanza, Region IV-A, Cavite, Philippines

Model: SH-301, SH-301A, GDUTAG25, S6DUTAG25, NAGD-301, 500062, AIR-200

FCC ID: ZBC-SH301A

TEST ITEM	REFERENCE	RESULTS
Max. Output power	15.247(b)(3)	Pass
6 dB Bandwidth	15.247(a)(2)	Pass
Max. Power Density	15.247(e)	Pass
Out of Band Antenna Conducted Emission	15.247(d)	Pass
Transmitter Radiated Emissions in Restricted Bands	15.247(d), 15.209, FCC 15.205	Pass
Antenna Requirement	15.203	Pass (See Notes)

Notes: The EUT uses an Integral Antenna which in accordance to Section 15.203 is considered sufficient to comply with the provisions of this section.

2.0 General Description

2.1 Product Description

The equipment under test (EUT) is a Smart Tag with Bluetooth 5.0 function operating in 2402-2480MHz. The EUT is powered by DC 3V by lithium cell. For more detail information pls. refer to the user manual.

Type of Modulation: GFSK (BLE)
Antenna Type: Internal Antenna
Antenna Gain: -3.23dBi (This information is provided by manufacturer, and the manufacturer is responsible for the authenticity of the provided information.)

Bluetooth Version: 5.0
The models: SH-301A, GDUTAG25, S6DUTAG25, NAGD-301, 500062, AIR-200 are the same as the model: SH-301 in hardware aspect. The difference in model number and trade name serves as marketing strategy.

Production name	Trade name	Model no.
Smart Tag	DNS, NOVOO, Energy Sistem, BARMASO	SH-301, SH-301A, GDUTAG25, S6DUTAG25 SH-301, NAGD-301, 500062, AIR-200

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

2.2 Related Submittal(s) Grants

This is an application for certification of transceiver for the Smart Tag which has Bluetooth function.

2.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). Radiated emission measurement was performed in semi-anechoic chamber. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

2.4 Test Facility

The Semi-anechoic chamber used to collect the radiated data is **Intertek Testing Services Shenzhen Ltd. Longhua Branch** and located at 101, 201, Building B, No. 308

Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, Shenzhen. This test facility and site measurement data have been fully placed on file with File Number: CN1188

3.0 System Test Configuration

3.1 Justification

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, all cables were manipulated to produce worst case emissions. The EUT was powered by DC 3V by lithium cell during the test.

For maximizing emissions, the EUT was rotated through 360°, the EUT was placed on the styrene turntable with 12mm up to 1GHz and 12 mm above 1GHz. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

The rear of unit shall be flushed with the rear of the table.

Radiated emission measurement were performed the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

3.2 EUT Exercising Software

The EUT exercise program (provided by client) used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The worst-case configuration is used in all specified testing.

The parameters of test software setting:
During the test, Channel and power controlling software provided by the applicant was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the application and is going to be fixed on the firmware of the end product.

Test software: AB161x_Airoha_Tool_Kit (ATK)_v2.2.2.0

3.3 Special Accessories

N/A.

3.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

3.5 Equipment Modification

Any modifications installed previous to testing by SHENZHEN DNS INDUSTRIES CO., LTD will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Longhua Branch.

3.6 Support Equipment List and Description

Description	Remark
mobile phone	iPhone 13 Promax (provided by Intertek)

4.0 Test Results

Data is included worst-case configuration (the configuration which resulted in the highest emission levels).

4.1 Radiated Test Results

A sample calculation, configuration photographs and data tables of the emissions are included.

4.1.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD + AV

Where FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB/m
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

Assume a receiver reading of 62.0 dBµV is obtained. The antenna factor of 7.4 dB/m and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dBµV/m. This value in dBµV/m was converted to its corresponding level in µV/m.

RA = 62.0 dBµV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB
AV = -10 dB
FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 dBµV/m
Level in µV/m = Common Antilogarithm [(32 dBµV/m)/20] = 39.8 µV/m

4.1.2 Radiated Emission Configuration Photograph

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

4.1.3 Radiated Emissions- FCC section 15.209

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission

at 952.276000 MHz

Judgement: Passed by 13.9 dB

TEST PERSONNEL:

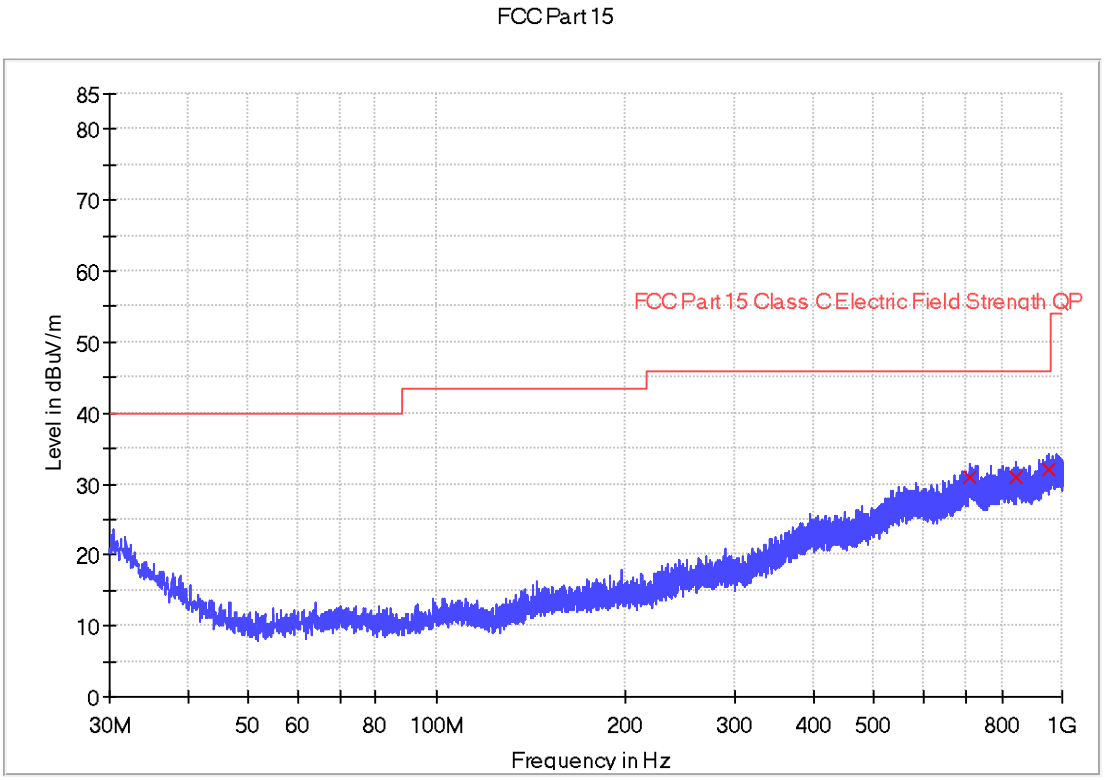
Sign on file

Molly Wu, Engineer
Typed/Printed Name

05 June 2025
Date

Applicant: SHENZHEN DNS INDUSTRIES CO., LTD
Date of Test: 05 June 2025 Model: SH-301
Worst Case Operating Mode: BT link
Modulation type: GFSK

ANT Polarity: Horizontal

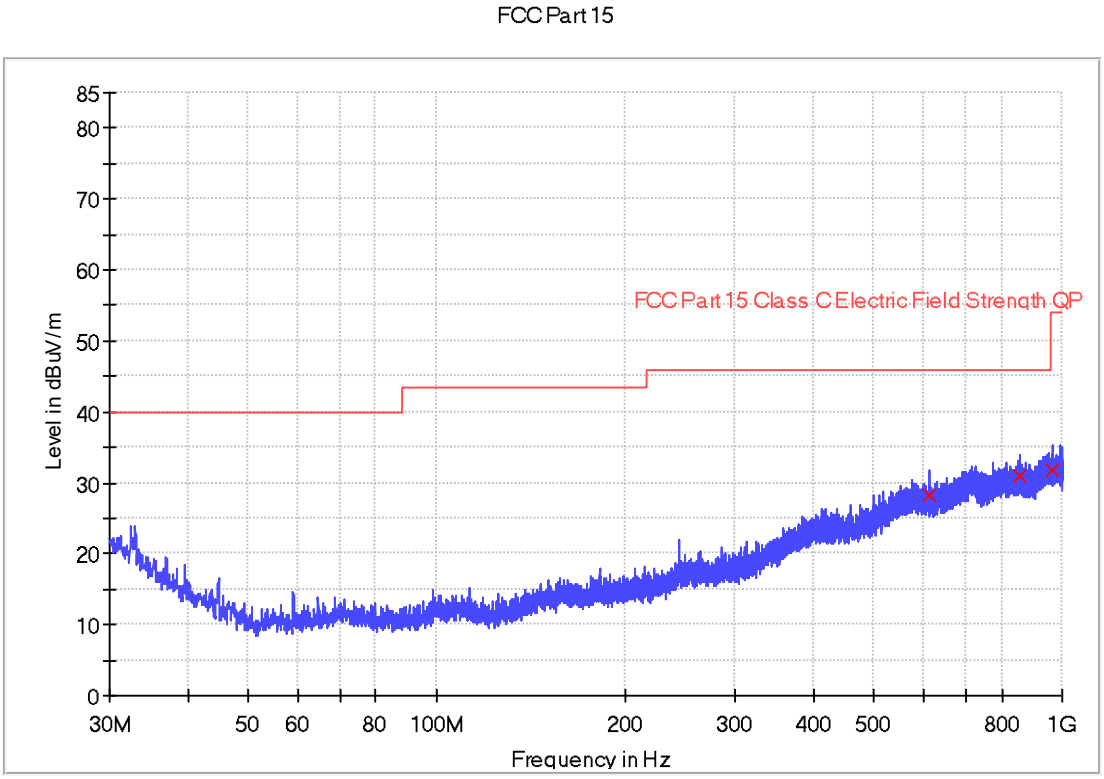


Frequency (MHz)	Quasi Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Corr. (dB/m)	Margin - QPK (dB)	Limit – QPK (dBµV/m)
709.711333	31.0	1000.0	120.000	100.0	H	30.9	15.0	46.0
845.414333	30.9	1000.0	120.000	100.0	H	31.8	15.1	46.0
952.276000	32.1	1000.0	120.000	100.0	H	33.7	13.9	46.0

Remark:
1. Corr. (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)
2. Quasi Peak (dBµV/m) = Corr. (dB/m) + Read Level (dBµV)
3. Margin (dB) = Limit Line (dBµV/m) – Level (dBµV/m)

Applicant: SHENZHEN DNS INDUSTRIES CO., LTD
Date of Test: 05 June 2025 Model: SH-301
Worst Case Operating Mode: BT link
Modulation type: GFSK

ANT Polarity: Vertical



Frequency (MHz)	Quasi Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Corr. (dB/m)	Margin - QPK (dB)	Limit – QPK (dBµV/m)
611.353333	28.3	1000.0	120.000	100.0	V	29.1	17.7	46.0
855.825667	30.9	1000.0	120.000	100.0	V	31.8	15.1	46.0
963.075333	31.8	1000.0	120.000	100.0	V	33.7	22.2	54.0

Remark:
1. Corr. (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)
2. Quasi Peak (dBµV/m) = Corr. (dB/m) + Read Level (dBµV)
3. Margin (dB) = Limit Line (dBµV/m) – Level (dBµV/m)

4.1.4 Transmitter Spurious Emissions (Radiated) - FCC section 15.209

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission

at 2483.500 MHz

Judgement: Passed by 9.7 dB

TEST PERSONNEL:

Sign on file

Molly Wu, Engineer
Typed/Printed Name

05 June 2025
Date

Applicant: SHENZHEN DNS INDUSTRIES CO., LTD
Date of Test: 05 June 2025 Model: SH-301
Worst Case Operating Mode: Transmitting(2402MHz)
Modulation type: GFSK-BW 1MHz

Table 1

Radiated Emissions

(2402MHz)

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	**2390.000	64.5	37.6	27.4	54.3	74.0	-19.7
Horizontal	*4804.000	40.3	37.0	32.8	36.1	74.0	-37.9

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	**2390.000	53.8	37.6	27.4	43.6	54.0	-10.4
Horizontal	*4804.000	34.2	37.0	32.8	30.0	54.0	-24.0

Notes:
1. Peak detector is used for the emission measurement (RBW=1MHz / VBW=3MHz for Peak value, and RBW=1MHz / VBW=10Hz for Average value; RBW=3MHz is used for fundamental emission measurement).

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna is used for the emission over 1000MHz.

Applicant: SHENZHEN DNS INDUSTRIES CO., LTD
Date of Test: 05 June 2025 Model: SH-301
Worst Case Operating Mode: Transmitting(2440MHz)
Modulation type: GFSK-BW 1MHz

Table 2

Radiated Emissions

(2441MHz)

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	*4880.000	50.3	36.9	32.9	46.3	74.0	-27.7
Horizontal	*7320.000	37.6	37.0	37.1	37.7	74.0	-36.3

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	*4880.000	33.8	36.9	32.9	29.5	54.0	-24.5
Horizontal	*7320.000	31.1	37.0	37.1	31.2	54.0	-22.8

Notes:
1. Peak detector is used for the emission measurement (RBW=1MHz / VBW=3MHz for Peak value, and RBW=1MHz / VBW=10Hz for Average value; RBW=3MHz is used for fundamental emission measurement).

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna is used for the emission over 1000MHz.

Applicant: SHENZHEN DNS INDUSTRIES CO., LTD
Date of Test: 05 June 2025 Model: SH-301
Worst Case Operating Mode: Transmitting(2480MHz)
Modulation type: GFSK-BW 1MHz

Table 3

Radiated Emissions

(2480MHz)

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	**2483.500	64.2	37.6	27.8	54.4	74.0	-19.6
Horizontal	*4959.750	55.0	36.9	32.9	51.0	74.0	-23.0
Horizontal	*7440.000	37.0	37.0	37.2	37.2	74.0	-38.8

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB/m)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	**2483.500	54.1	37.6	27.8	44.3	54.0	-9.7
Horizontal	*4959.750	45.9	36.9	32.9	41.9	54.0	-12.1
Horizontal	*7440.000	29.6	37.0	37.2	29.8	54.0	-24.2

Notes:
1. Peak detector is used for the emission measurement (RBW=1MHz / VBW=3MHz for Peak value, and RBW=1MHz / VBW=10Hz for Average value; RBW=3MHz is used for fundamental emission measurement).

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

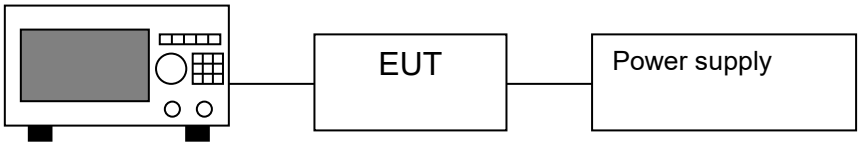
4. Horn antenna is used for the emission over 1000MHz.

4.2 Maximum Conducted Output Power at Antenna Terminals

FCC Rules 15.247(b)(3):

The antenna power of the EUT was connected to the input of a broadband peak RF power meter. The power meter has a video bandwidth that is greater than DTS bandwidth and utilize a fast-responding diode detector. Power was read directly at the EUT antenna terminals with cable loss added.

Block Diagram:



Power meter

For antennas with gains of 6 dBi or less, maximum allowed Transmitter output is 1 watt (+30 dBm).

BW-1MHz

Frequency (MHz)	Output in dBm (Peak Reading)	Output in mWatt
Low Channel: 2402	5.04	3.20
Middle Channel: 2440	5.57	3.60
High Channel: 2480	5.79	3.80

BW-2MHz

Frequency (MHz)	Output in dBm (Peak Reading)	Output in mWatt
Low Channel: 2402	5.08	3.22
Middle Channel: 2440	5.56	3.60
High Channel: 2480	5.78	3.80

Cable loss: 0.5 dB External Attenuation: 0 dB

Cable loss, external attenuation has been included in OFFSET function

EUT max. E.I.R.P = 5.79dBm = 3.80Mw

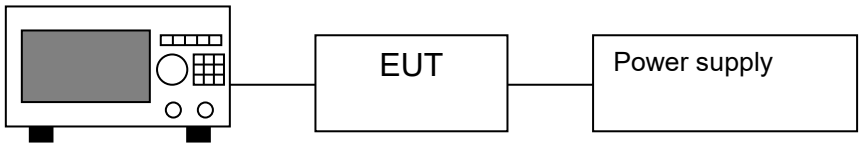
For RF Exposure, the information is saved with filename: RF exposure.pdf.

Applicant: SHENZHEN DNS INDUSTRIES CO., LTD
Date of Test: 09 June 2025 Model: SH-301

4.3 Minimum 6 dB RF Bandwidth, FCC Rule 15.247(a) (2):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 KHz according to FCC KDB 558074 D01 v05r02. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6dB bandwidth was determined from where the channel output spectrum intersected the display line.

Block Diagram:



Spectrum Analyzer

Limit: The 6 dB Bandwidth is at least 500 kHz.

BW-1MHz

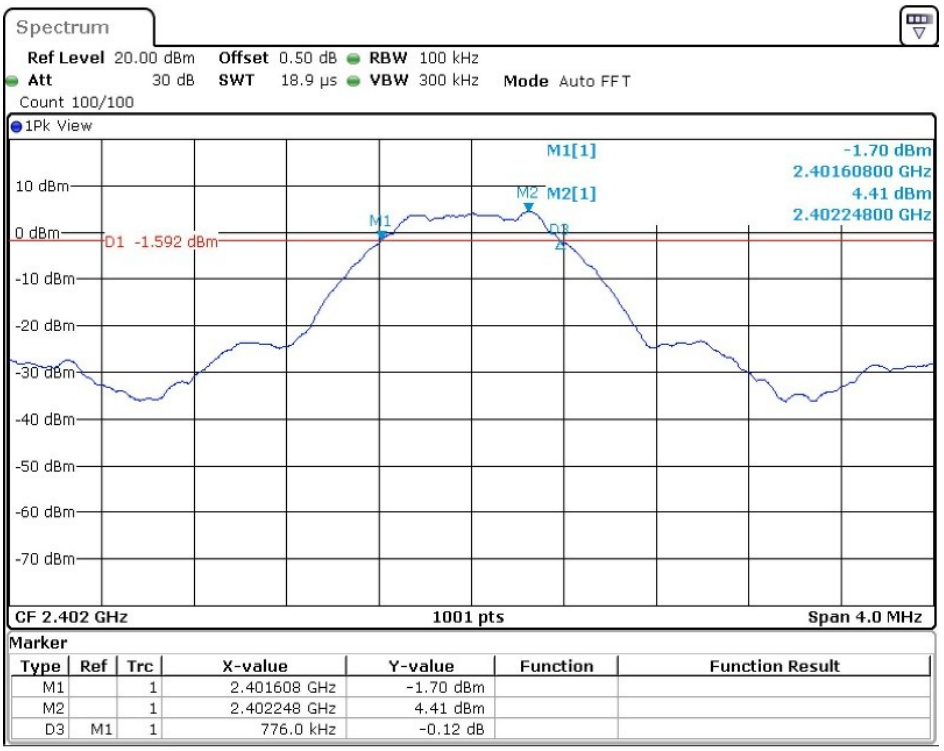
Frequency (MHz)	6 dB Bandwidth (MHz)
2402	0.776
2440	0.768
2480	0.788

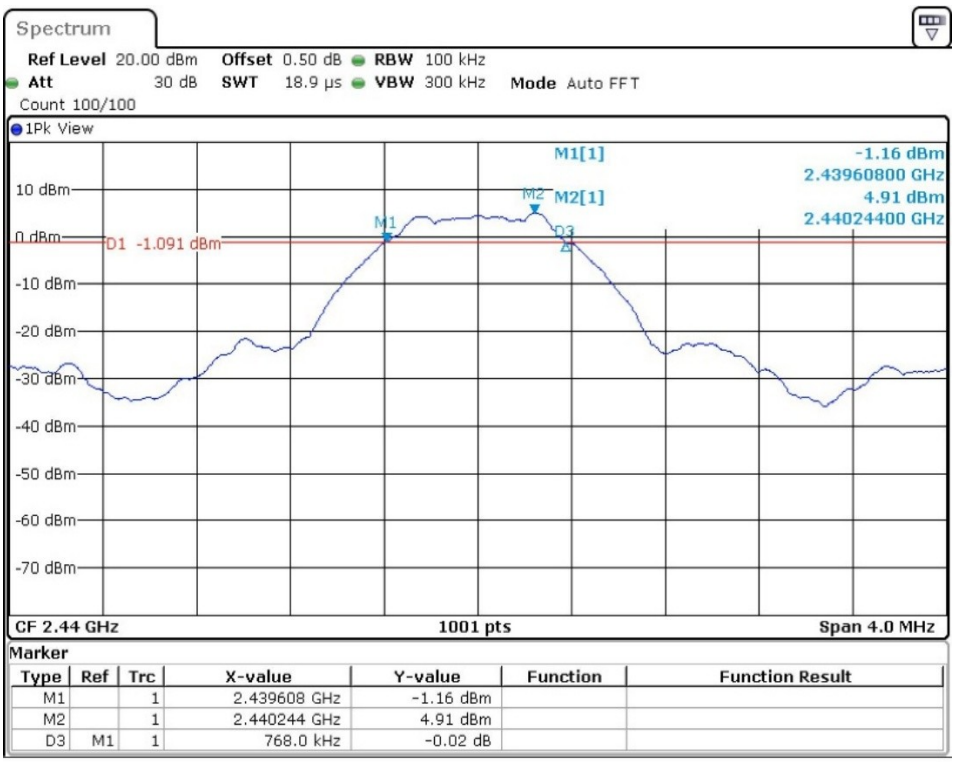
BW-2MHz

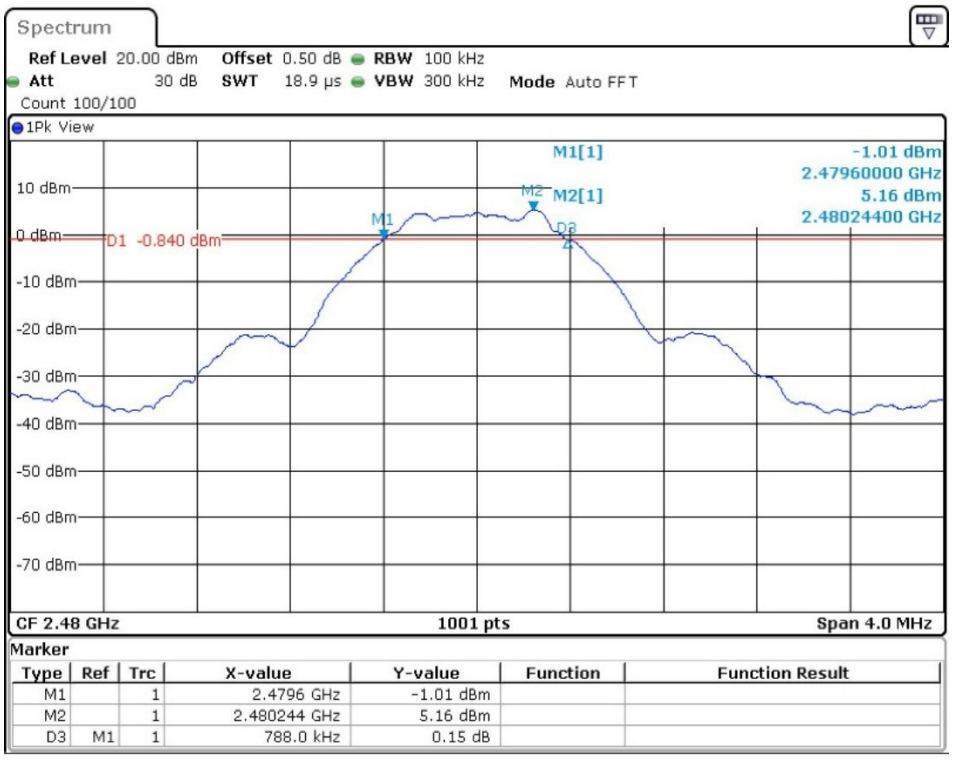
Frequency (MHz)	6 dB Bandwidth (MHz)
2402	1.340
2440	1.364
2480	1.616

The test plots are attached as below.

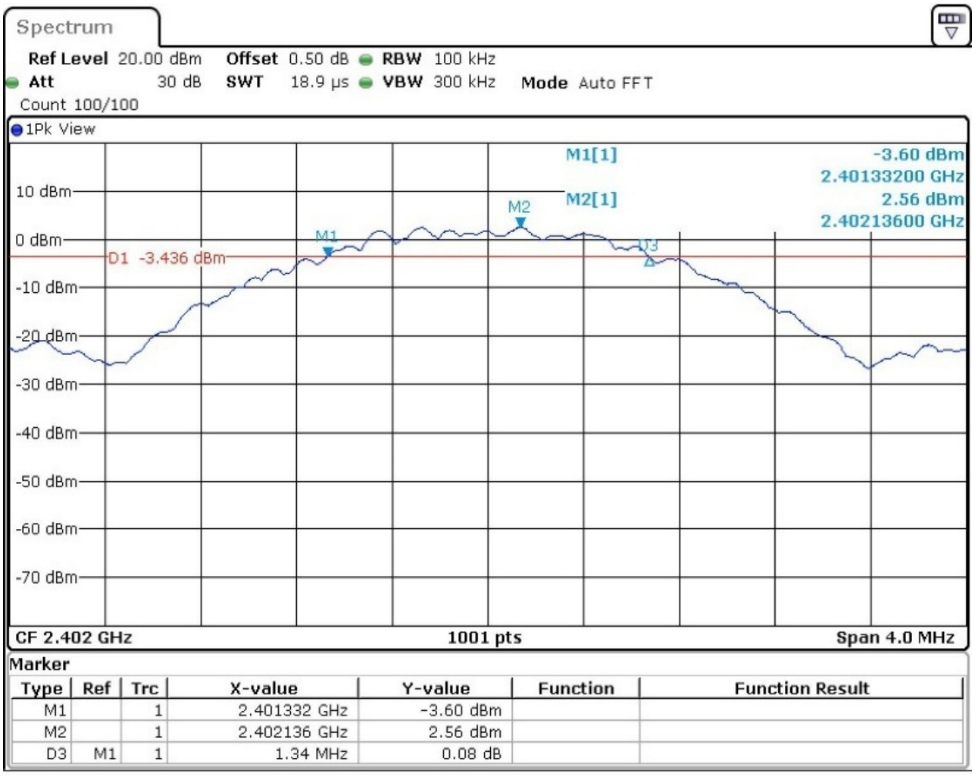
BW-1MHz

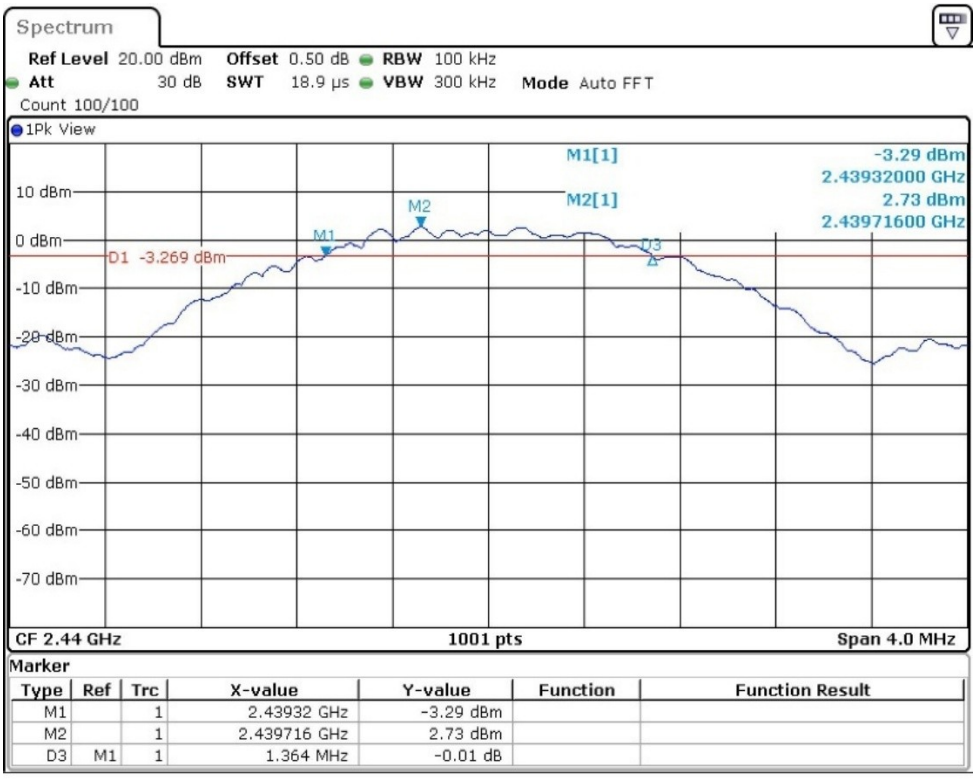

Spectrum
Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz
Att 30 dB SWT 18.9 µs VBW 300 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -1.70 dBm
2.40160800 GHz
M2[1] 4.41 dBm
2.40224800 GHz
D1 -1.592 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.402 GHz
1001 pts
Span 4.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.401608 GHz -1.70 dBm
M2 1 2.402248 GHz 4.41 dBm
D3 M1 1 776.0 kHz -0.12 dB


Spectrum
Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz
Att 30 dB SWT 18.9 µs VBW 300 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -1.16 dBm
2.43960800 GHz
M2[1] 4.91 dBm
2.44024400 GHz
D1 -1.091 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.44 GHz
1001 pts
Span 4.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.439608 GHz -1.16 dBm
M2 1 2.440244 GHz 4.91 dBm
D3 M1 1 768.0 kHz -0.02 dB


Spectrum
Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz
Att 30 dB SWT 18.9 µs VBW 300 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -1.01 dBm
2.47960000 GHz
M2[1] 5.16 dBm
2.48024400 GHz
D1 -0.840 dBm
CF 2.48 GHz
1001 pts
Span 4.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.4796 GHz -1.01 dBm
M2 1 2.480244 GHz 5.16 dBm
D3 M1 1 788.0 kHz 0.15 dB

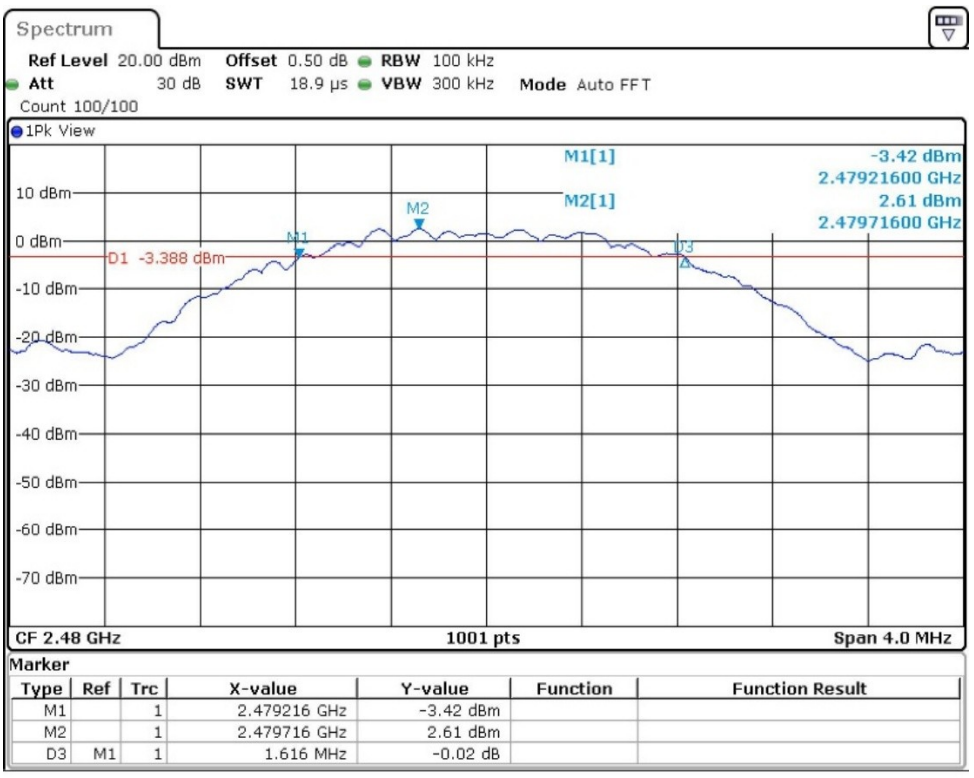
BW-2MHz


Spectrum
Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz
Att 30 dB SWT 18.9 µs VBW 300 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -3.60 dBm
2.40133200 GHz
M2[1] 2.56 dBm
2.40213600 GHz
D1 -3.436 dBm
CF 2.402 GHz
1001 pts
Span 4.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.401332 GHz -3.60 dBm
M2 1 2.402136 GHz 2.56 dBm
D3 M1 1 1.34 MHz 0.08 dB



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.43932 GHz	-3.29 dBm		
M2		1	2.439716 GHz	2.73 dBm		
D3	M1	1	1.364 MHz	-0.01 dB		



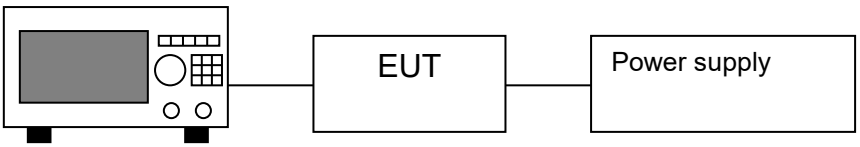
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479216 GHz	-3.42 dBm		
M2		1	2.479716 GHz	2.61 dBm		
D3	M1	1	1.616 MHz	-0.02 dB		

4.4 Maximum Power Density Reading, FCC Rule 15.247(e):

The Measurement Procedure PKPSD was set according to the FCC KDB 558074 D01 v05r02.

Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.
Block Diagram:



Spectrum Analyzer

Limit: The Power Density does not exceed 8dBm/3 kHz.

BW-1MHz

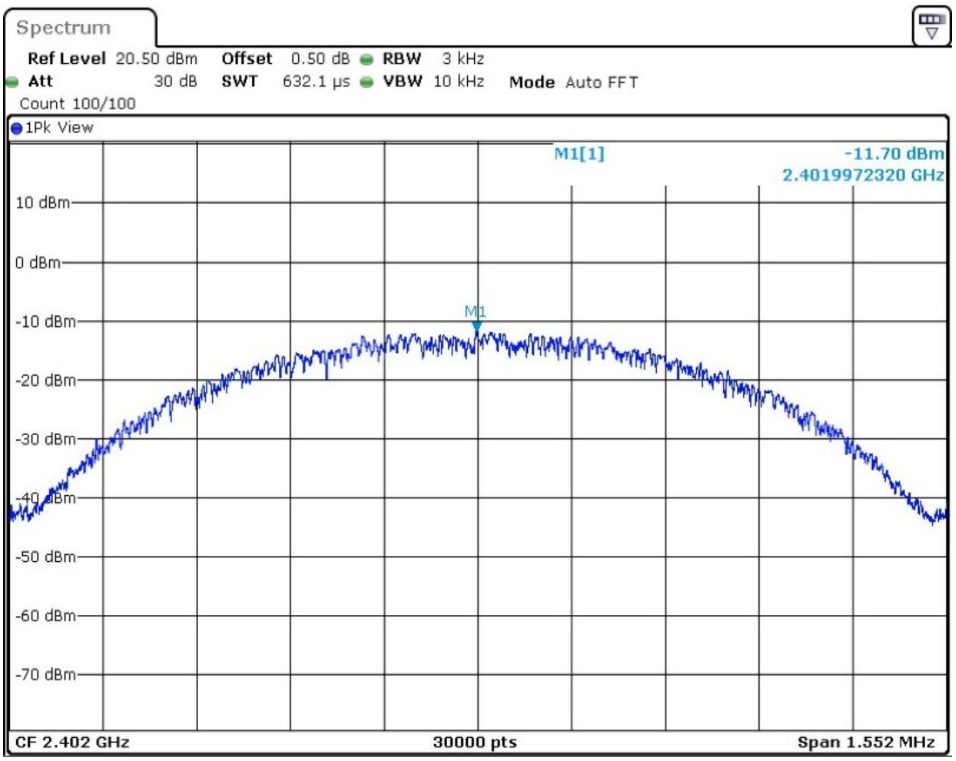
Frequency (MHz)	Power Density with RBW 3KHz
2402	-11.7
2440	-11.16
2480	-11.17

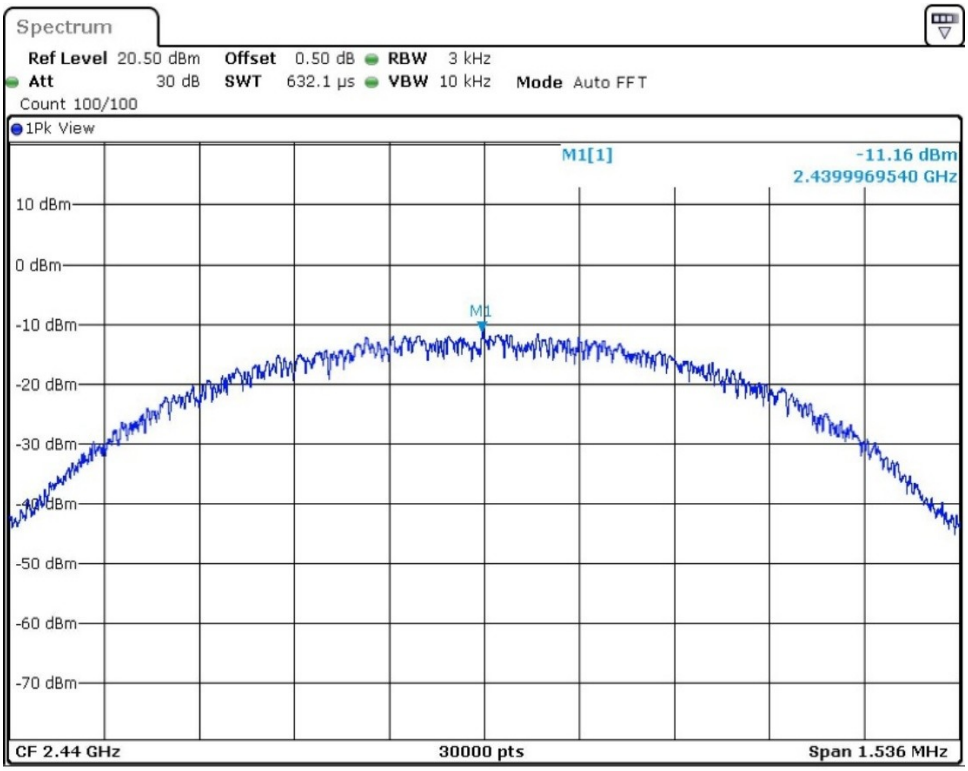
BW-2MHz

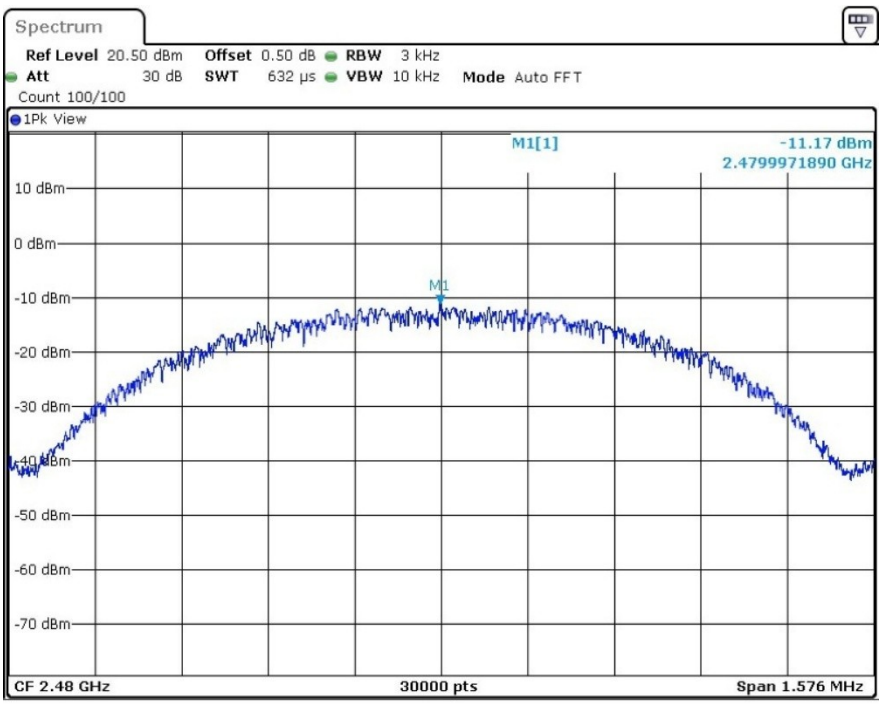
Frequency (MHz)	Power Density with RBW 3KHz
2402	-12.00
2440	-11.06
2480	-11.72

The test plots are attached as below.

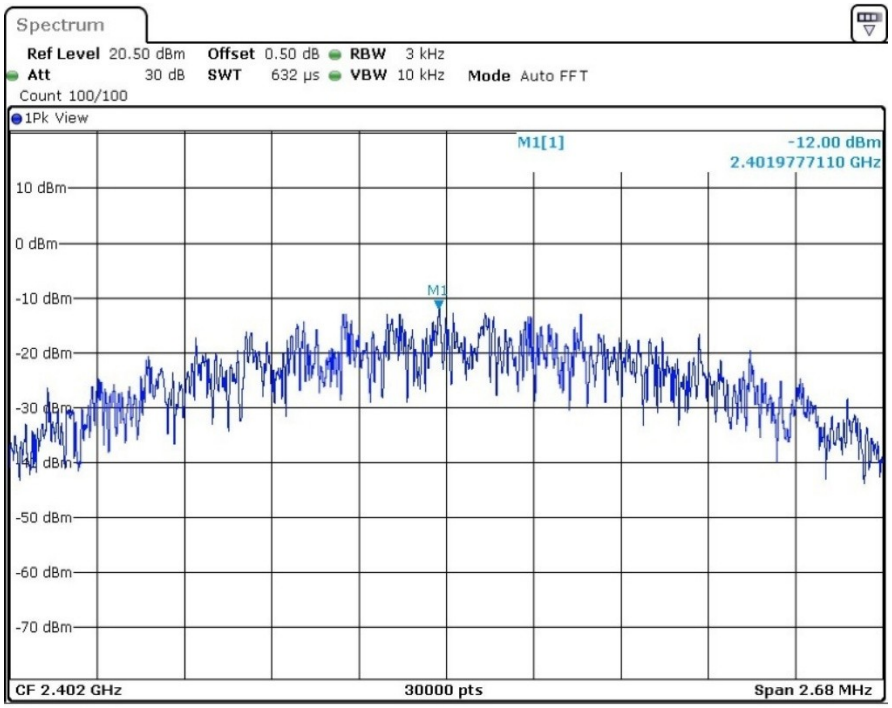
BW-1MHz

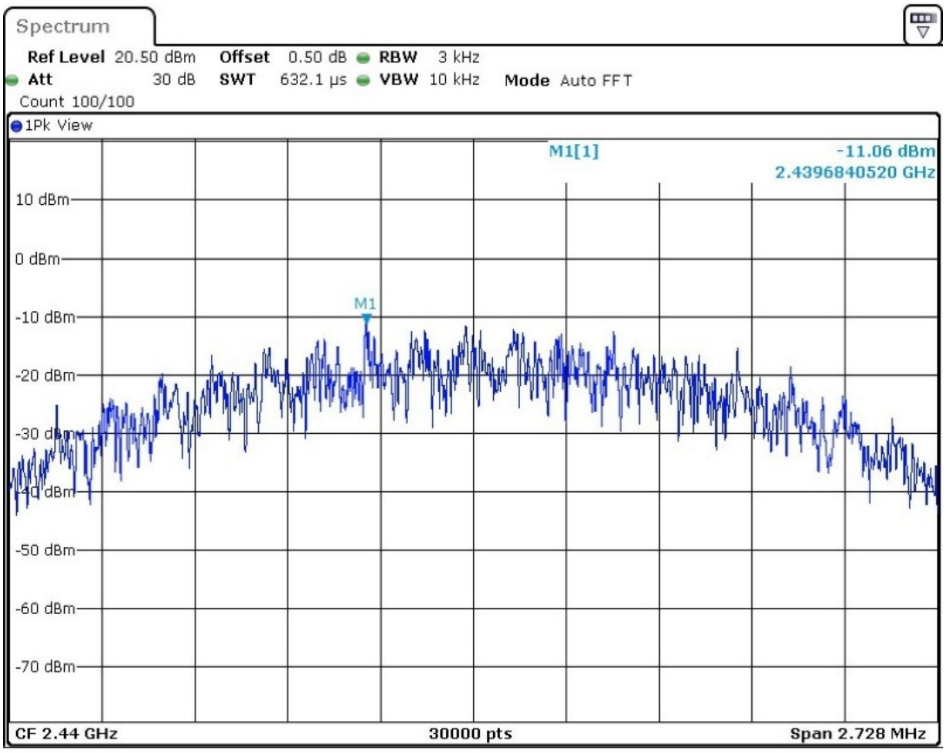

Spectrum
Ref Level 20.50 dBm Offset 0.50 dB RBW 3 kHz
Att 30 dB SWT 632.1 µs VBW 10 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -11.70 dBm
2.4019972320 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
CF 2.402 GHz
30000 pts
Span 1.552 MHz

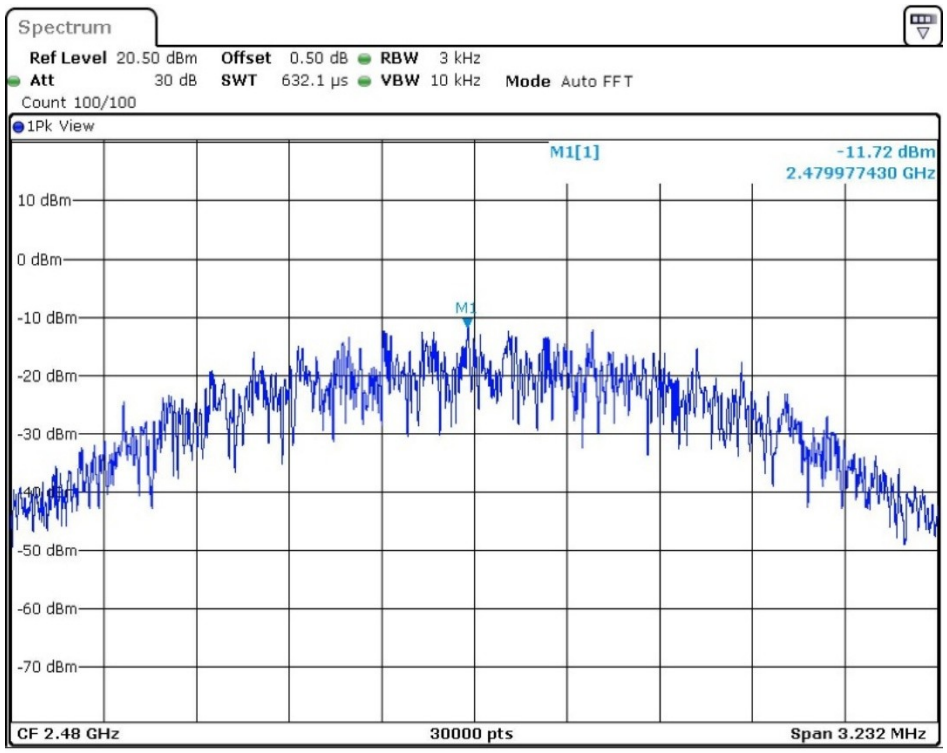

Spectrum
Ref Level 20.50 dBm Offset 0.50 dB RBW 3 kHz
Att 30 dB SWT 632.1 µs VBW 10 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -11.16 dBm
2.4399969540 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
CF 2.44 GHz
30000 pts
Span 1.536 MHz


Spectrum
Ref Level 20.50 dBm Offset 0.50 dB RBW 3 kHz
Att 30 dB SWT 632 µs VBW 10 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -11.17 dBm
2.4799971890 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
CF 2.48 GHz
30000 pts
Span 1.576 MHz

BW-2MHz


Spectrum
Ref Level 20.50 dBm Offset 0.50 dB RBW 3 kHz
Att 30 dB SWT 632 µs VBW 10 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -12.00 dBm
2.4019777110 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
CF 2.402 GHz
30000 pts
Span 2.68 MHz


Spectrum
Ref Level 20.50 dBm Offset 0.50 dB RBW 3 kHz
Att 30 dB SWT 632.1 µs VBW 10 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -11.06 dBm
2.4396840520 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
CF 2.44 GHz
30000 pts
Span 2.728 MHz


Spectrum
Ref Level 20.50 dBm Offset 0.50 dB RBW 3 kHz
Att 30 dB SWT 632.1 µs VBW 10 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -11.72 dBm
2.479977430 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
CF 2.48 GHz
30000 pts
Span 3.232 MHz

4.5 Out of Band Conducted Emissions, FCC Rule 15.247(d):

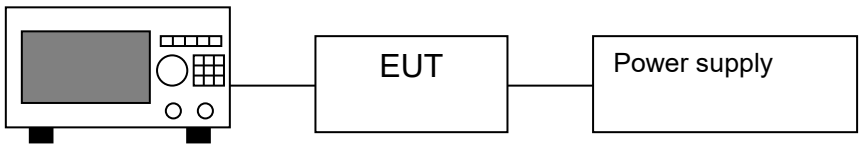
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. The Measurement Procedure was set according to the FCC KDB 558074 D01 v05r02.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the passband.

Refer to the attached test plots for out of band conducted emissions data with rate of 1Mbps &2Mbps for BLE.

The test plots showed all spurious emission up to the tenth harmonic were measured and they were found to be at least 20 dB below the highest level of the desired power in the passband.

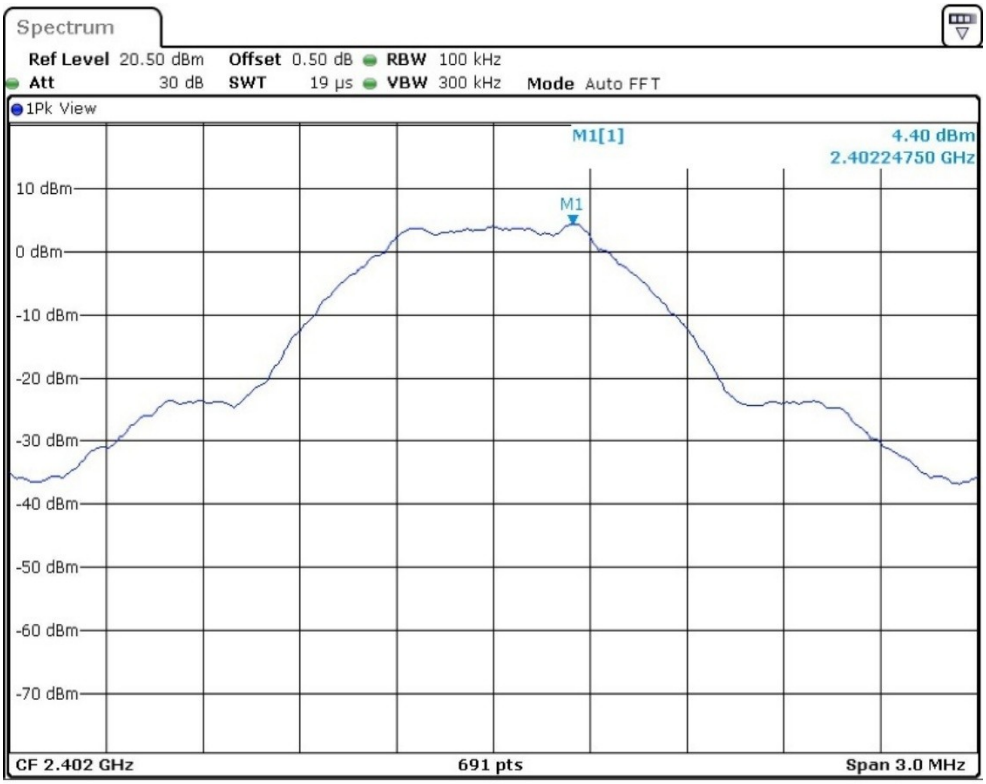
Block Diagram:

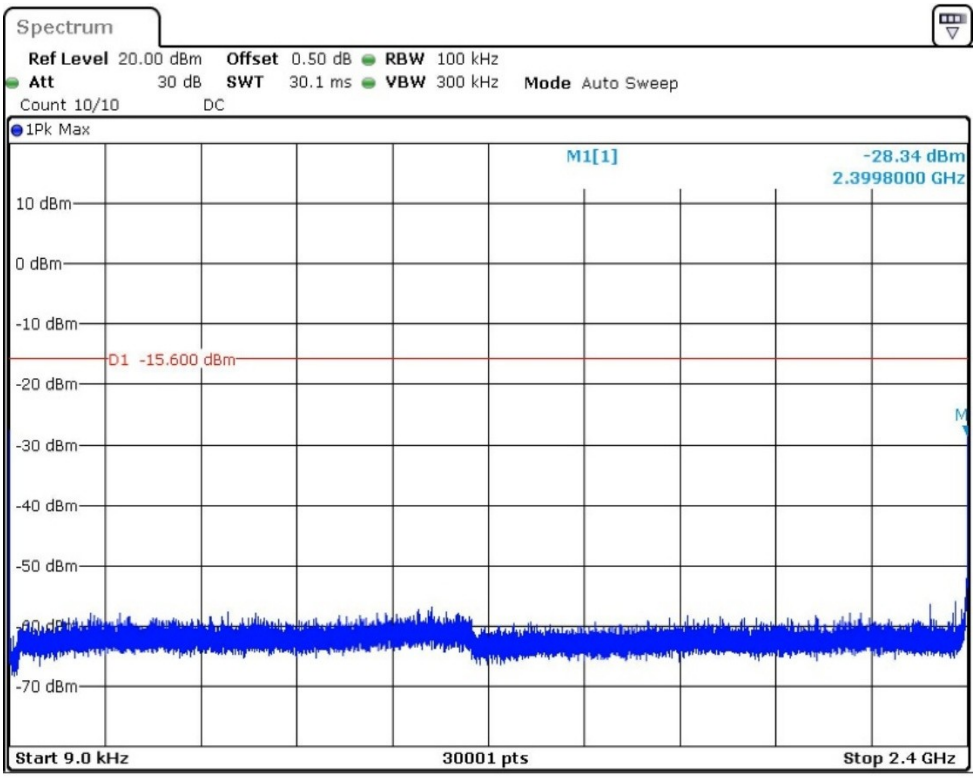


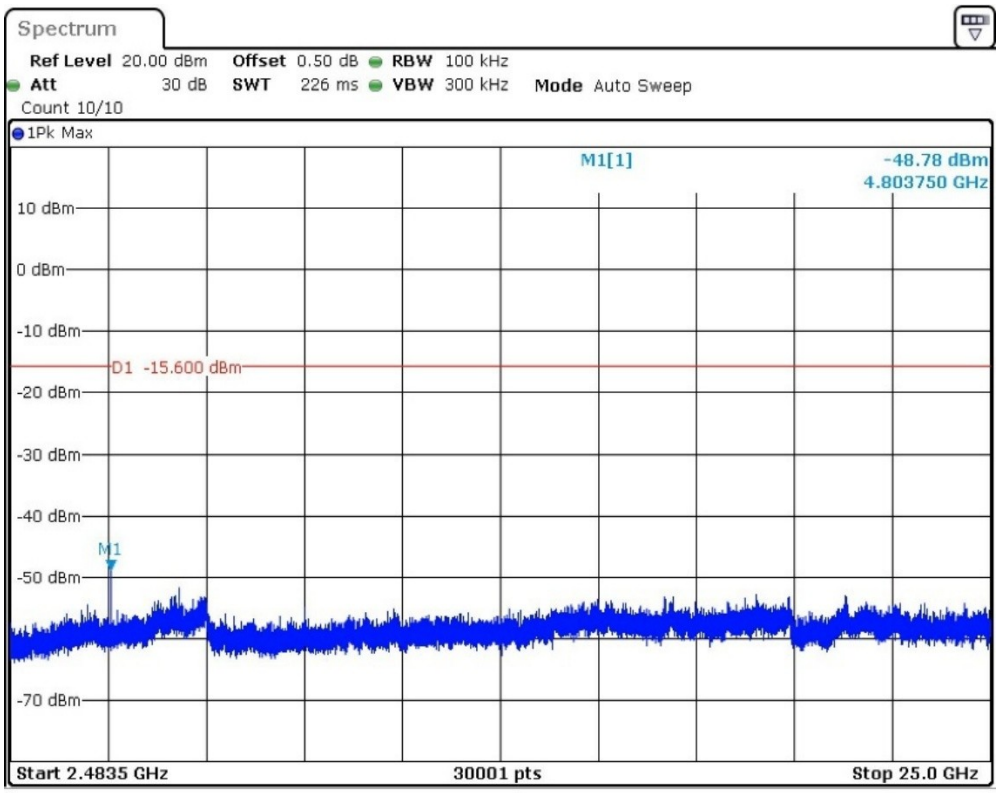
Spectrum Analyzer

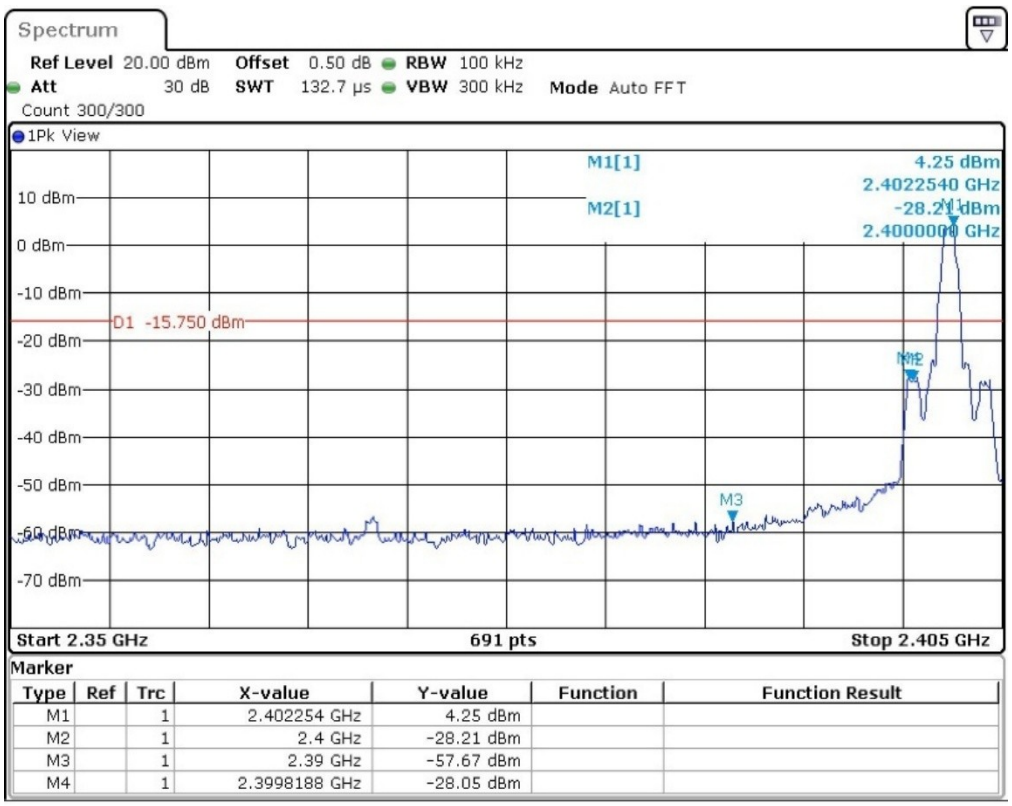
The test plots are attached as below.

BW-1MHz
Channel 00 (2402MHz) Reference Level: 4.40dBm





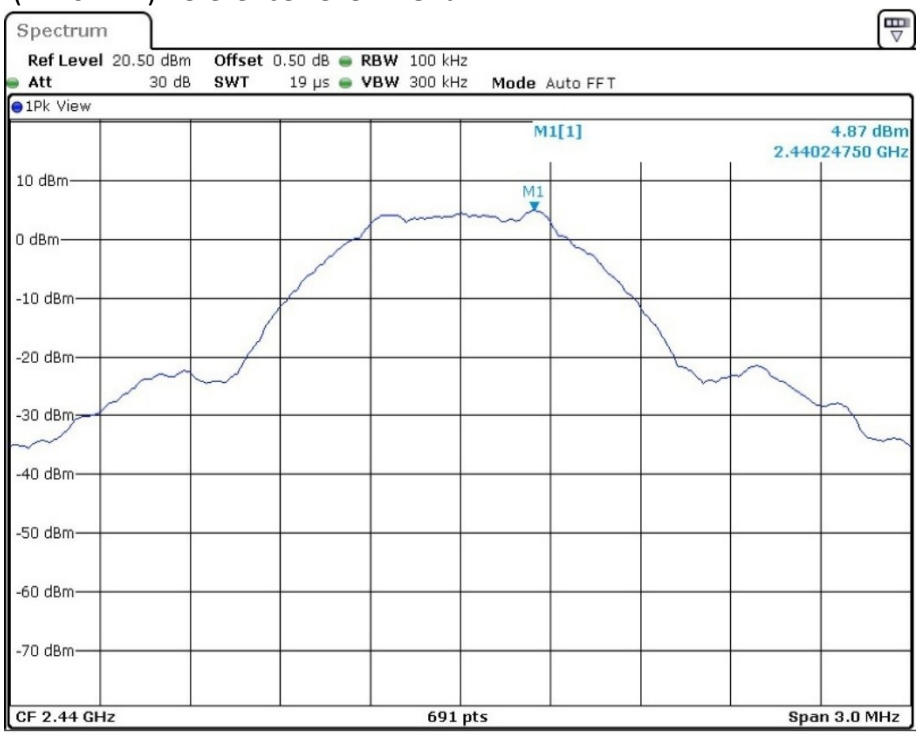


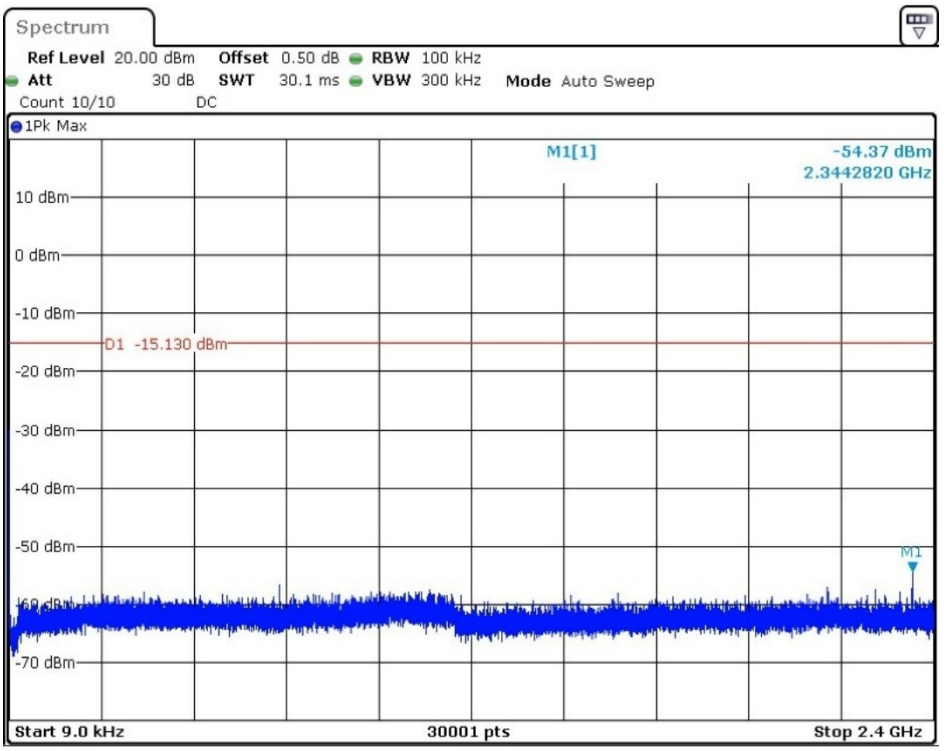


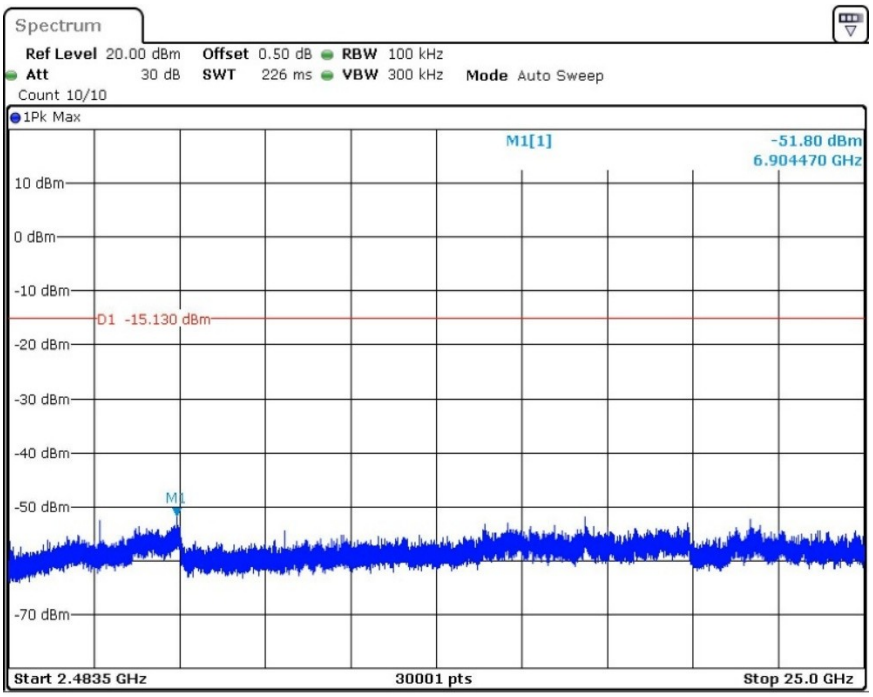
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.402254 GHz	4.25 dBm		
M2		1	2.4 GHz	-28.21 dBm		
M3		1	2.39 GHz	-57.67 dBm		
M4		1	2.3998188 GHz	-28.05 dBm		

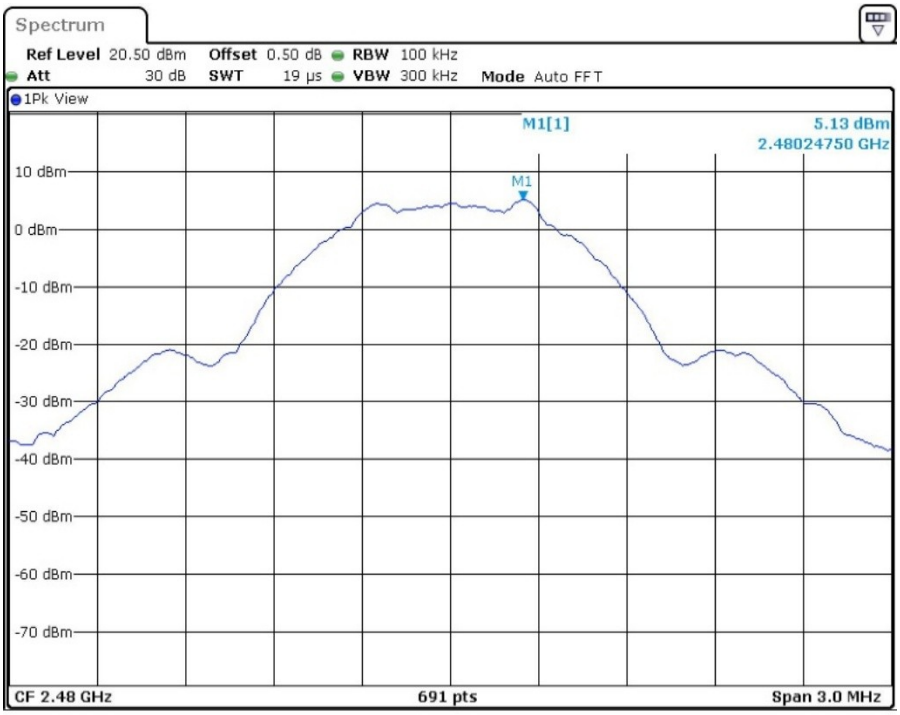
Channel 19 (2440MHz) Reference Level: 4.87dBm

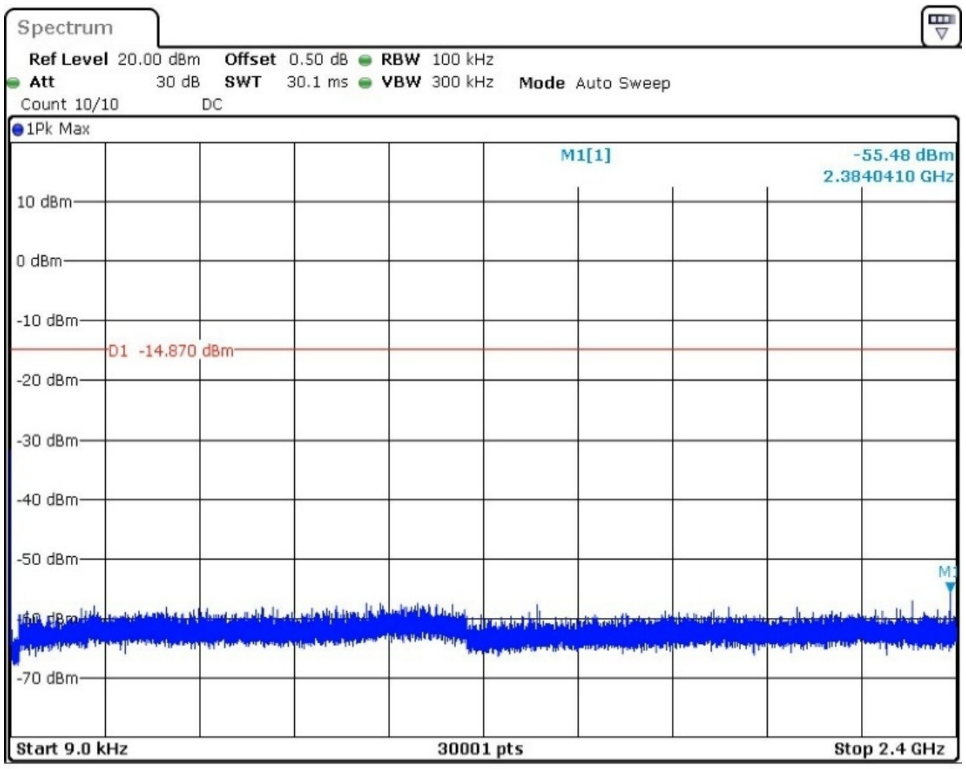


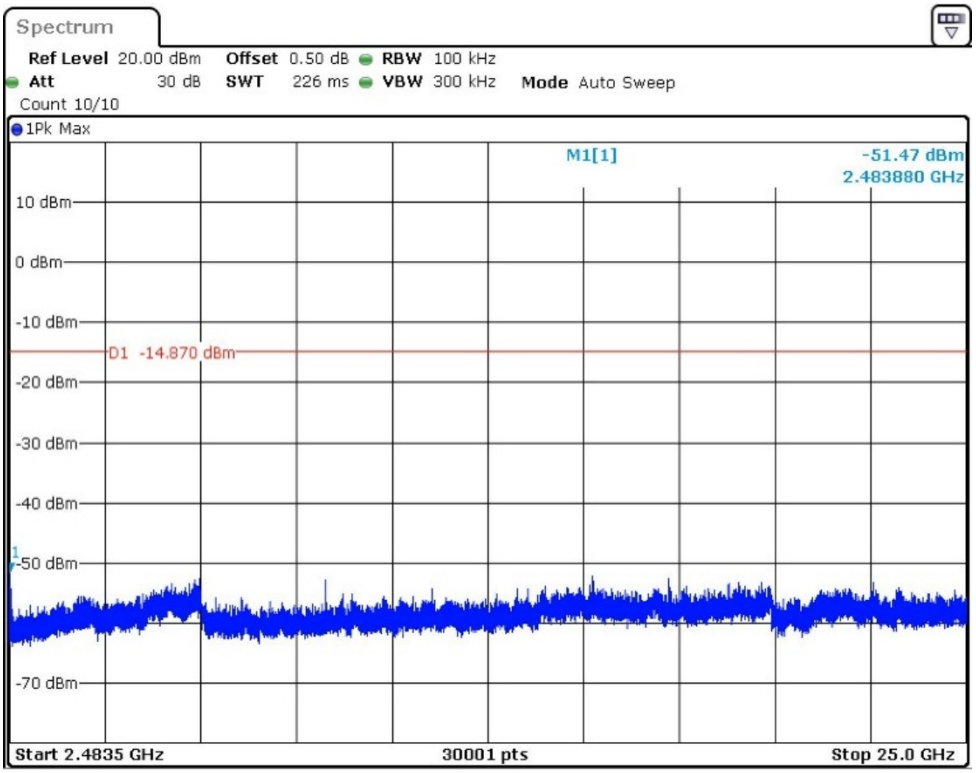


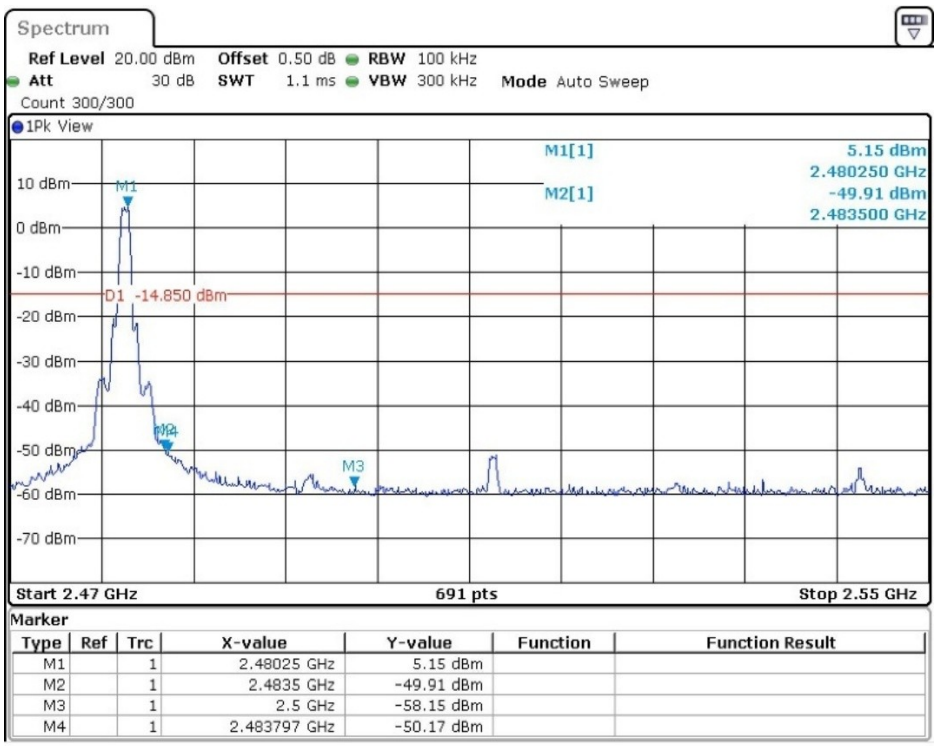


Channel 39 (2480MHz) Reference Level: 5.13dBm




Spectrum
Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz
Att 30 dB SWT 30.1 ms VBW 300 kHz Mode Auto Sweep
Count 10/10 DC
1Pk Max
M1[1] -55.48 dBm
2.3840410 GHz
10 dBm
0 dBm
-10 dBm
D1 -14.870 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-70 dBm
Start 9.0 kHz
30001 pts
Stop 2.4 GHz

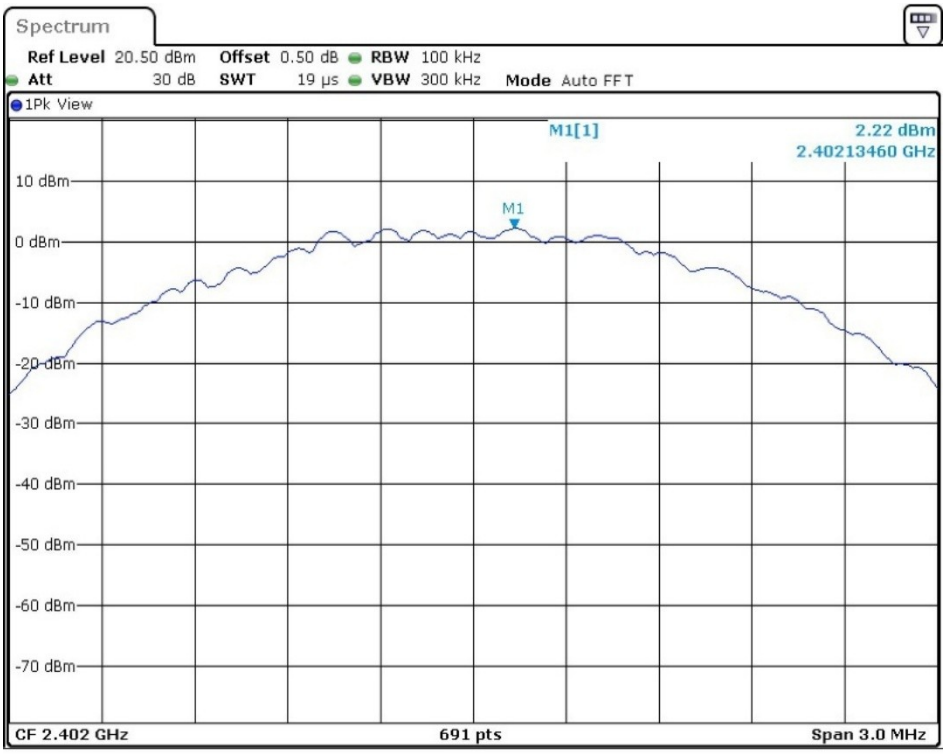

Spectrum
Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz
Att 30 dB SWT 226 ms VBW 300 kHz Mode Auto Sweep
Count 10/10
1Pk Max
M1[1] -51.47 dBm
2.483880 GHz
10 dBm
0 dBm
-10 dBm
D1 -14.870 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-70 dBm
Start 2.4835 GHz
30001 pts
Stop 25.0 GHz

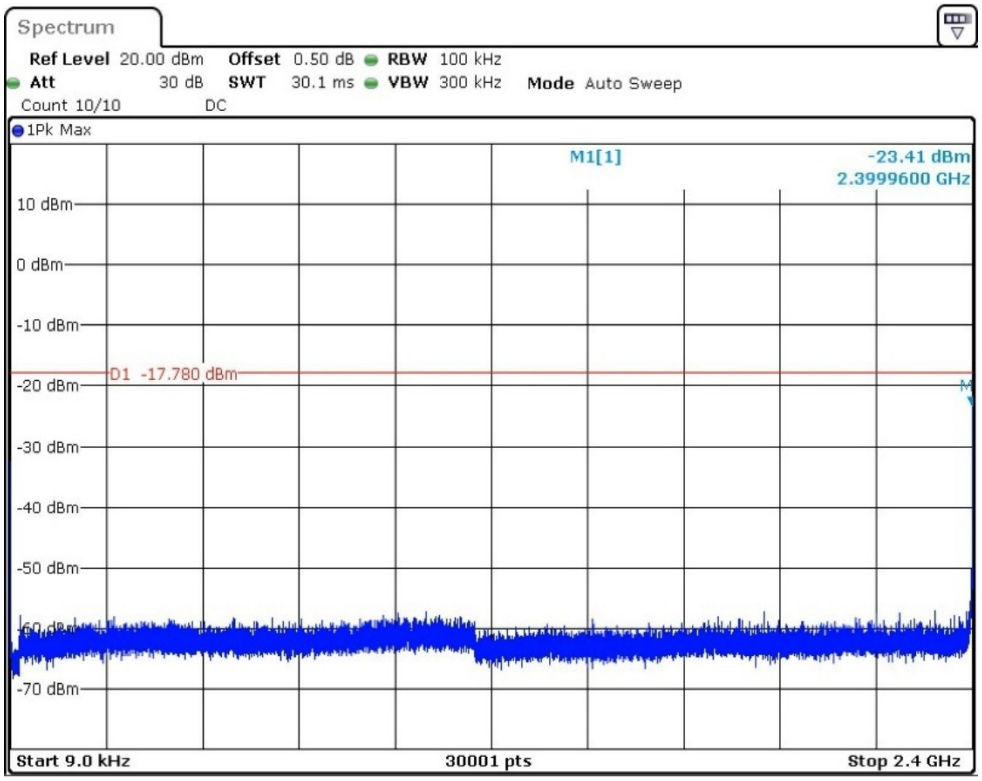


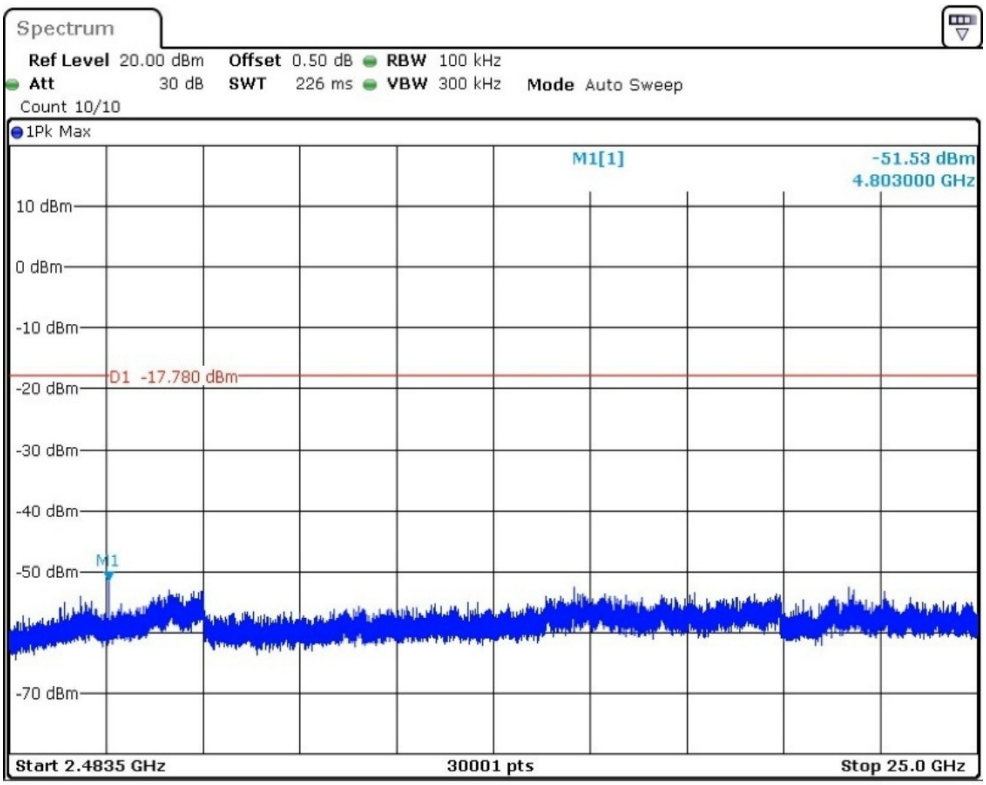
Marker

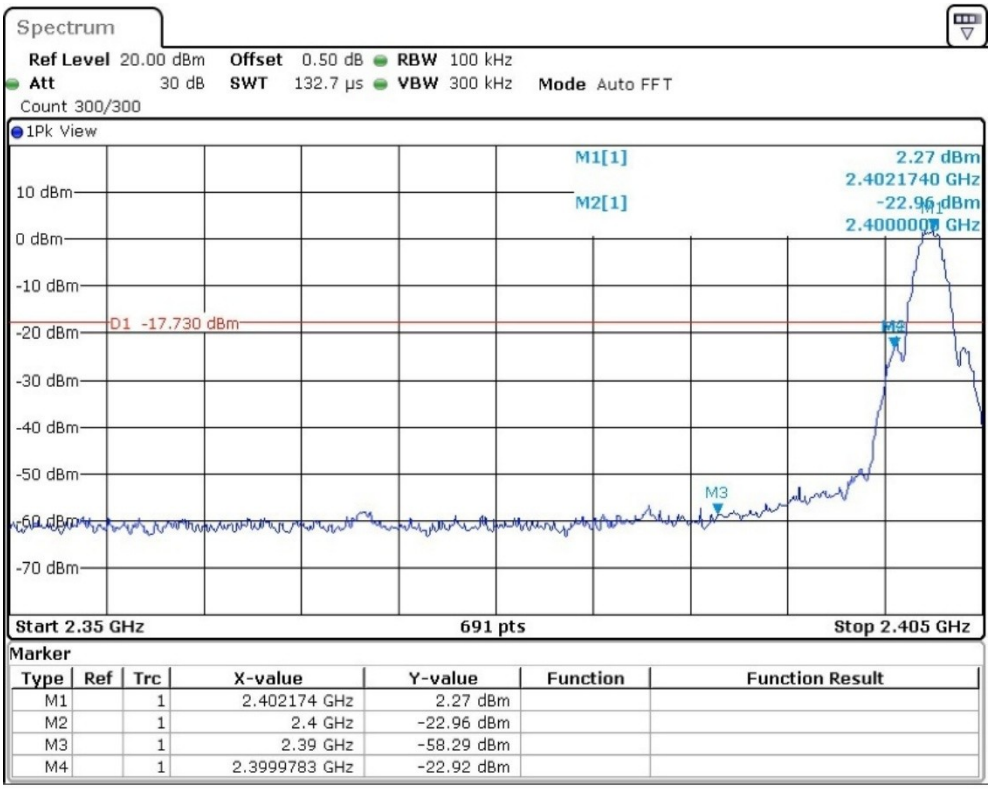
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.48025 GHz	5.15 dBm		
M2		1	2.4835 GHz	-49.91 dBm		
M3		1	2.5 GHz	-58.15 dBm		
M4		1	2.483797 GHz	-50.17 dBm		

BW-2MHz Channel 00 (2402MHz) Reference Level: 2.22dBm

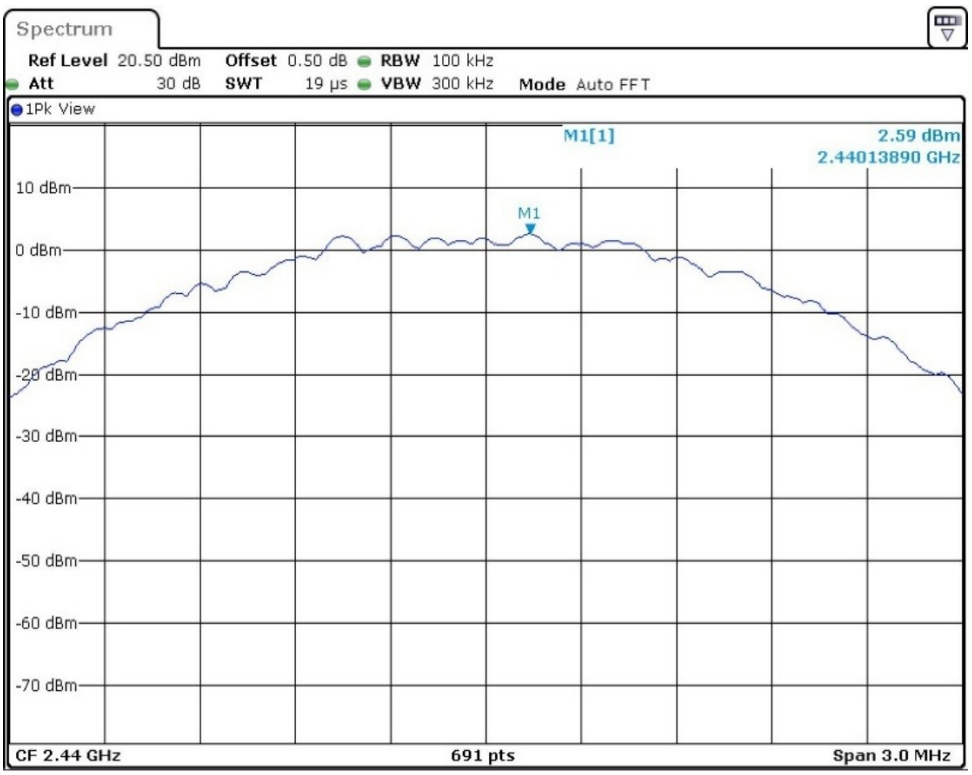


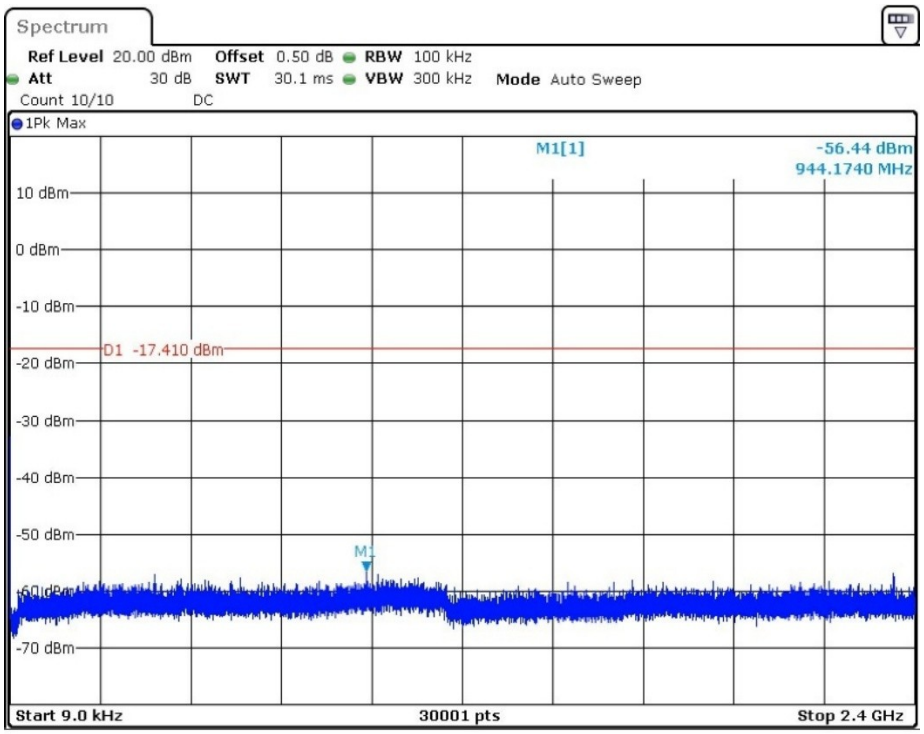

Spectrum
Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz
Att 30 dB SWT 30.1 ms VBW 300 kHz Mode Auto Sweep
Count 10/10 DC
1Pk Max
M1[1] -23.41 dBm
2.3999600 GHz
10 dBm
0 dBm
-10 dBm
D1 -17.780 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-70 dBm
Start 9.0 kHz
30001 pts
Stop 2.4 GHz

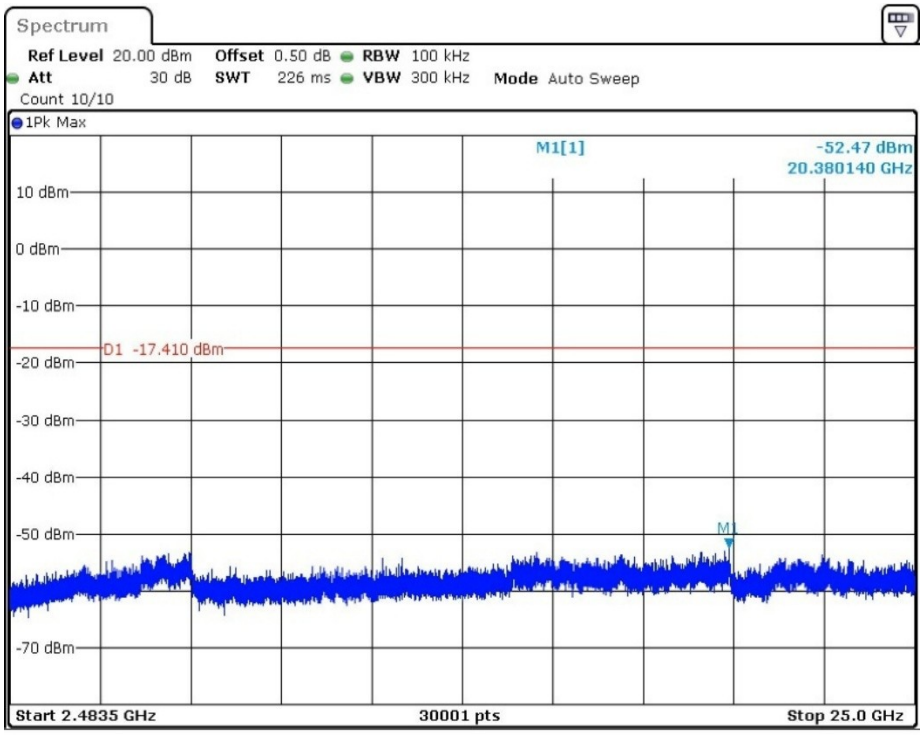

Spectrum
Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz
Att 30 dB SWT 226 ms VBW 300 kHz Mode Auto Sweep
Count 10/10
1Pk Max
M1[1] -51.53 dBm
4.803000 GHz
10 dBm
0 dBm
-10 dBm
D1 -17.780 dBm
-20 dBm
-30 dBm
-40 dBm
M1
-50 dBm
-70 dBm
Start 2.4835 GHz
30001 pts
Stop 25.0 GHz



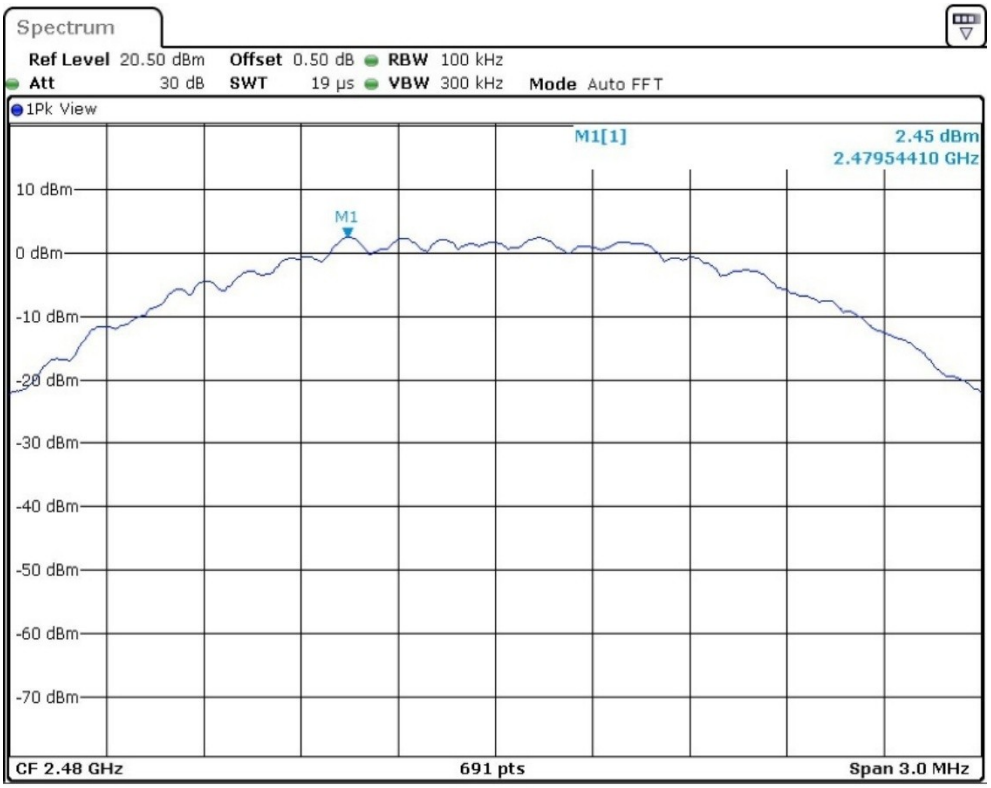
Channel 19 (2440MHz) Reference Level: 2.59dBm

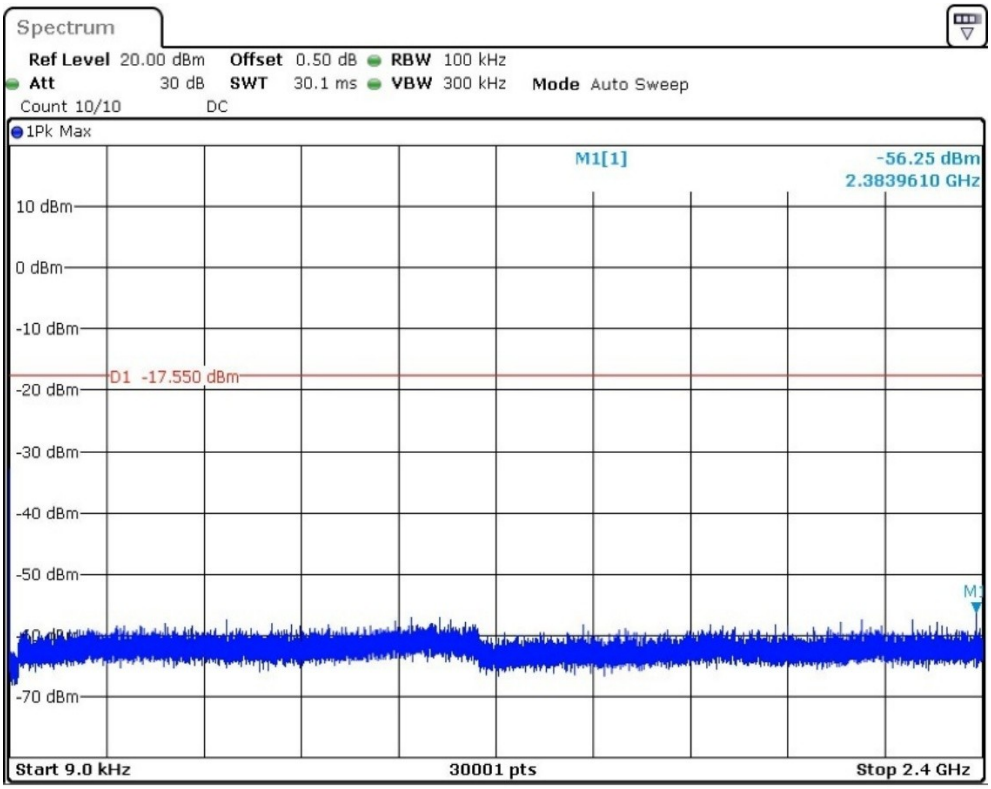


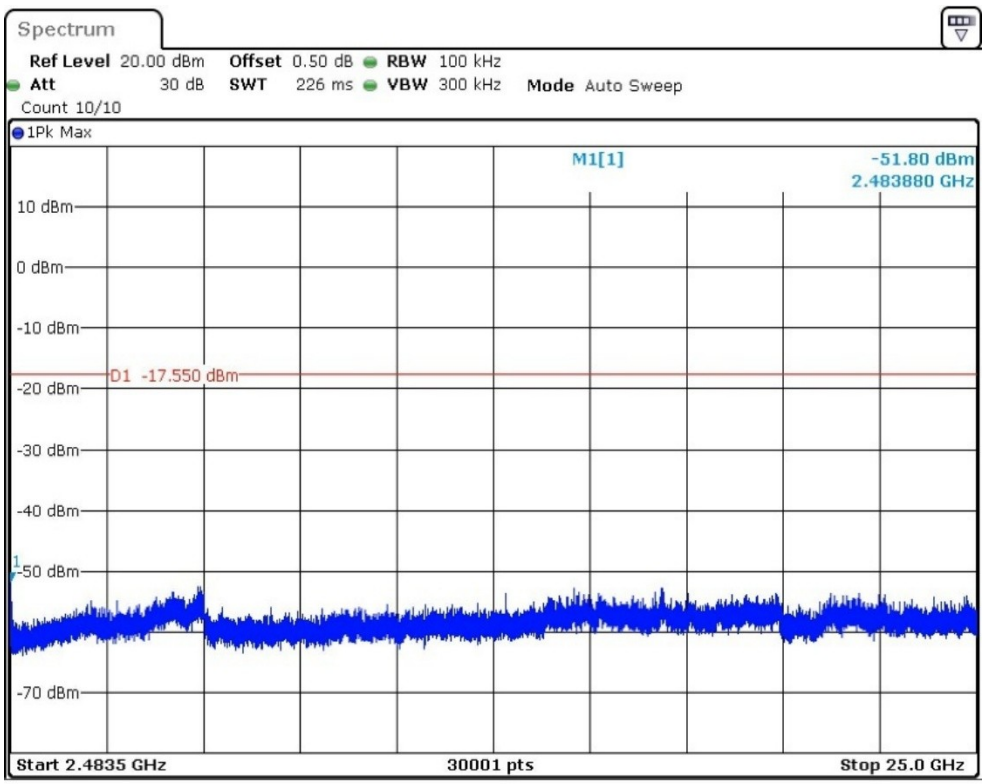

Spectrum
Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz
Att 30 dB SWT 30.1 ms VBW 300 kHz Mode Auto Sweep
Count 10/10 DC
1Pk Max
M1[1] -56.44 dBm
944.1740 MHz
10 dBm
0 dBm
-10 dBm
D1 -17.410 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-70 dBm
Start 9.0 kHz
30001 pts
Stop 2.4 GHz

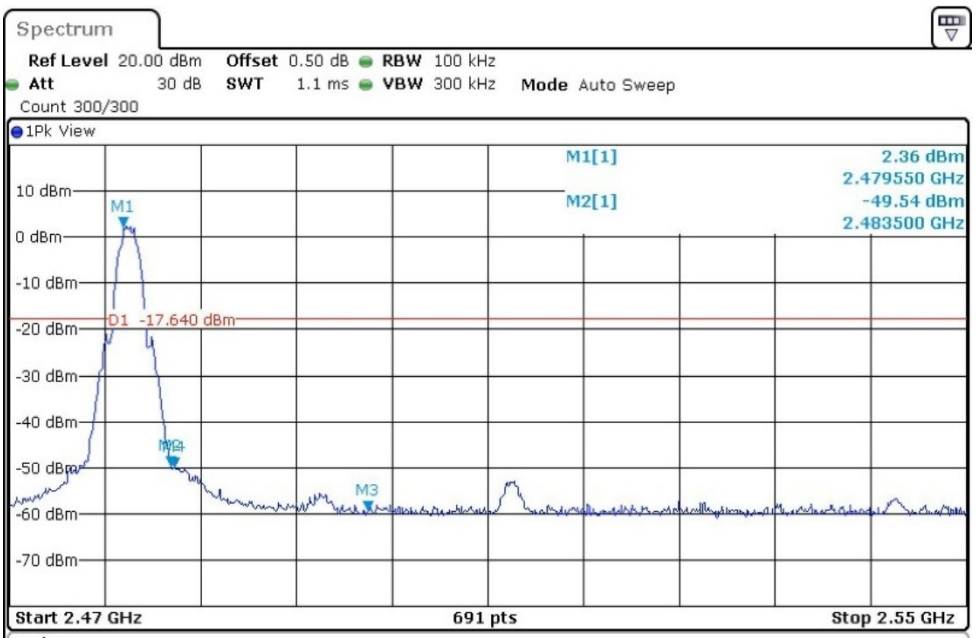

Spectrum
Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz
Att 30 dB SWT 226 ms VBW 300 kHz Mode Auto Sweep
Count 10/10
1Pk Max
M1[1] -52.47 dBm
20.380140 GHz
10 dBm
0 dBm
-10 dBm
D1 -17.410 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-70 dBm
Start 2.4835 GHz
30001 pts
Stop 25.0 GHz

Channel 39 (2480MHz) Reference Level: 2.45dBm









Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47955 GHz	2.36 dBm		
M2		1	2.4835 GHz	-49.54 dBm		
M3		1	2.5 GHz	-59.16 dBm		
M4		1	2.483797 GHz	-49.91 dBm		

5.0 Equipment Photographs

For electronic filing, the photographs of the tested EUT are saved with filename: external photos.pdf & internal photos.pdf.

6.0 Product Labelling

For electronic filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

7.0 Technical Specifications

For electronic filing, the block diagram and schematics of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

8.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

9.0 Miscellaneous Information

This miscellaneous information includes details of the measured bandedge, the test procedure and calculation of factor such as pulse desensitization.

9.1 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period (T_{eff}) is approximately 625µs for Bluetooth. With a resolution bandwidth (3dB) of 1MHz, so the pulse desensitivity factor is 0dB.

9.2 Calculation of Average Factor

Based on the Bluetooth Specification Version 5.0 (EDR mode) and worst case AFH mode, transmitter ON time is independent of packet type (DH1, DH3 and DH5) and packet length, the AFH mode Duty cycle connection factor as below:

Channel hop rate = 800 hops/second (AFH Mode)

Adjusted channel hop rate for DH5 mode = 133.33 hops/second

Time per channel hop = 1 / 133.33 hops/second = 7.5 ms

Time to cycle through all channels = 7.5 x 20 channels = 150 ms

Number of times transmitter hits on one channel = 100 ms / 150 ms = 1 time(s)

Worst case dwell time = 7.5 ms

Duty cycle connection factor = 20log10 (7.5ms / 100ms) = -22.5 dB

9.3 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.10: 2013.

The transmitting equipment under test (EUT) is placed on a styrene turntable which is four feet in diameter, up to 1GHz 0.8m and above 1GHz 1.5m in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjust through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in section 9.2.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 150 kHz to 30 MHz with RBW 9KHz used.

9.3 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements are made as described in ANSI C63.10: 2013.

The IF bandwidth used for measurement of radiated signal strength was 10 kHz for emission below 30 MHz and 120 kHz for emission from 30 MHz to 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. Above 1000 MHz, a resolution bandwidth of 1 MHz is used (RBW 3MHz used for fundamental emission).

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the restricted bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

10 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ182-02	RF Power Meter	Anritsu	ML2496A	1302005	2025-04-21	2026-04-21
SZ182-02-01	Power Sensor	Anritsu	MA2411B	1207429	2025-04-21	2026-04-21
SZ061-13	BiConiLog Antenna	ETS	3142E	00217919	2025-05-29	2028-05-29
SZ185-03	EMI Receiver	R&S	ESCI	101975	2025-04-13	2026-04-13
SZ061-08	Double - Ridged Waveguide Horn Antenna	ETS	3115	00092346	2024-09-13	2027-09-13
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	2024-05-05	2027-05-05
SZ056-03	Spectrum Analyzer	R&S	FSP 30	101148	2024-04-22	2025-04-22
SZ056-08	Signal Analyzer	R&S	FSV 40	101430	2025-04-21	2026-04-21
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	2025-04-21	2026-04-21
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	2021-12-12	2026-12-12
SZ062-24	RF Cable	RADIALL	RG 213U	--	2024-09-30	2025-09-30
SZ062-25	RF Cable	RADIALL	0.04-26.5GHz	--	2024-09-30	2025-09-30
SZ062-38	RF Cable	RADIALL	0.04-26.5GHz	--	2024-09-30	2025-09-30
SZ067-04	Notch Filter	Micro-Tronics	BRM50702-02	--	2025-04-21	2026-04-21
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	2024-07-09	2025-07-09
SZ187-02	Two-Line V-Network	R&S	ENV216	100073	2025-04-25	2026-04-25
SZ188-03	Shielding Room	ETS	RFD-100	4100	2022-12-20	2025-12-20

********** End of Report**********