



## FCC / ISED Canada Test Report

FOR:

iRhythm Technologies, Inc.

Model Name:

A101A5001

Product Description:

Zio AT ECG Patch

FCC ID: 2AFBP-AT17P

IC ID: N/A

Applied Rules and Standards:

47 CFR Part 15.247 (DTS)

RSS-247 Issue 1 (DTSs)

RSS-Gen Issue 4

REPORT #: EMC\_IRHYT-008-17001\_15.247\_DTS\_PATCH

DATE: 2017-05-09



A2LA Accredited

IC recognized #  
3462B-1

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CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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**1 Assessment**

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations and the relevant ISSED Canada standard RSS-247 Issue 1, and RSS-Gen Issue 4. No deviations have been ascertained in the course of testing.

Company	Description	Model #
iRhythm Technologies, Inc.	Zio AT ECG Patch	A101A5001

**Responsible for Testing Laboratory:**

Dr. Peter Nevermann

2017-05-09

RC&amp;E

(Director Radio Communications and EMC)

Date	Section	Name	Signature
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**Responsible for the Report:**

Cindy Li

2017-05-09

RC&amp;E

(EMC Engineer)

Date	Section	Name	Signature
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The test results of this test report relate exclusively to the test item specified in Section 3.

CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

## 2 Administrative Data

### 2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Director Radio Com. and EMC:	Peter Nevermann
Responsible Project Leader:	Cindy Li

### 2.2 Identification of the Client

Applicant's Name:	iRhythm Technologies, Inc.
Street Address:	650 Townsend St # 500
City/Zip Code	San Francisco, CA 94103
Country	USA
Contact Person:	Matt Ho, Chase Hathaway

### 2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Applicant
Manufacturers Address:	-----
City/Zip Code	-----
Country	-----

### 3 Equipment Under Test (EUT)

#### 3.1 EUT Specifications

<b>Model No:</b>	A101A5001
<b>HW Version :</b>	A101A6001.02
<b>SW Version :</b>	Application firmware: 170407 Patch MAX32621 Production 2.1.4.4.hex BLE firmware : 160914 Patch CC2640 Production 2.1.1.8.hex
<b>FCC-ID :</b>	2AFBP-AT17P
<b>IC-ID:</b>	N/A
<b>HVIN:</b>	N/A
<b>PMN:</b>	N/A
<b>Product Description:</b>	Zio AT ECG Patch
<b>Frequency Range / number of channels:</b>	Nominal band: 2402 MHz – 2480 MHz; Center to center: 2402 MHz (Ch 0) – 2480 MHz (Ch 39), 40 channels
<b>Type(s) of Modulation:</b>	Bluetooth version 4.0, Low Energy, GFSK modulation.
<b>Modes of Operation:</b>	Bluetooth LE. Based on TI chip CC2640
<b>Antenna Information:</b>	PCB trace antenna. Gain -1.1dBi for 2480MHz. Gain determined from measured EIRP and measured conducted power
<b>Max. declared Output Powers conducted:</b>	2dBm declared in operational description and used during testing.
<b>Power Supply/ Rated Operating Voltage Range:</b>	2 Lithium Manganese Dioxide Coin Cells (2.7V – 3.2V)
<b>Operating Temperature Range</b>	2 °C to 40 °C
<b>Other Radios included in the device:</b>	N/A
<b>Sample Revision</b>	<input checked="" type="checkbox"/> Prototype Unit <input type="checkbox"/> Production Unit <input type="checkbox"/> Pre-Production

### 3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	AJNPI00014	A101A6001.02	Application firmware: 170407 Patch MAX32621 Production 2.1.4.4.hex BLE firmware : 160914 Patch CC2640 Production 2.1.1.8.hex	Conducted testing
2	NPI41402	A101A6001.02	Application firmware: 170407 Patch MAX32621 Production 2.1.4.4.hex BLE firmware : 160914 Patch CC2640 Production 2.1.1.8.hex	Radiated testing

### 3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
1	N/A	N/A	N/A	N/A

### 3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	AJNPI00014	Conducted testing
2	NPI41402	Radiated testing

### **3.5 Worst Case Mode of Operation**

During the testing process the EUT was tested with transmitter sets on low, mid and high channels. For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

The channels and modulation scheme of the EUT was set with diagnostic software (not available to the end user), and the transmitter output power was measured using spectrum analyzer (Peak Power).

The applications "AT Patch controller v1.03" and "HCITester - BLE\_2dBm\_TX\_Test", were used to program the sample to low, mid and high carrier channel with the following parameters that were declared by the customer.

- Output power set to +2 dBm which is the maximum power used according to customer declaration in operational description.
- Data Rate to 1Mb/s, the standard for Bluetooth Low Energy.

These settings are considered worst case for all measurements in scope of this report.

#### 4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-247 Issue 1 of ISED Canada.

This test report is to support a request for new equipment authorization.

Testing procedures are based on 558074 D01 DTS Meas Guidance v04 – “GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER §15.247; April 5, 2017” by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.

#### 5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.247(a)(1) RSS-247 5.2(1)	Emission Bandwidth	Nominal	BTLE	■	□	□	□	Complies
§15.247(e) RSS-247 5.2(2)	Power Spectral Density	Nominal	BTLE	■	□	□	□	Complies
§15.247(b)(1) RSS-247 5.4(4)	Maximum Conducted Output Power and EIRP	Nominal	BTLE	■	□	□	□	Complies
§15.247(d) RSS-247 5.5	Band edge compliance Unrestricted Band Edges	Nominal	BTLE	■	□	□	□	Complies
§15.247; 15.209; 15.205 RSS-Gen 8.9; 8.10	Band edge compliance Restricted Band Edges	Nominal	BTLE	■	□	□	□	Complies
§15.247(d); §15.209 RSS-Gen 6.13	TX Spurious emissions- Radiated	Nominal	BTLE	■	□	□	□	Complies
§15.207(a) RSS Gen 8.8	AC Conducted Emissions	Nominal	BTLE	□	□	■	□	Complies

**Note:** NA= Not Applicable; NP= Not Performed.



## 6 Measurements

### 6.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

#### Radiated measurement

9 kHz to 30MHz	$\pm 2.5$ dB (Magnetic Loop Antenna)
30 MHz to 1000 MHz	$\pm 2.0$ dB (Biconilog Antenna)
1 GHz to 40 GHz	$\pm 2.3$ dB (Horn Antenna)

#### Conducted measurement

150 kHz to 30 MHz	$\pm 0.7$ dB (LISN)
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RF conducted measurement	$\pm 0.5$ dB
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### 6.2 Environmental Conditions during Testing:

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25°C
- Relative humidity: 40-60%

### 6.3 Dates of Testing:

4/20/2017 – 5/02/2017

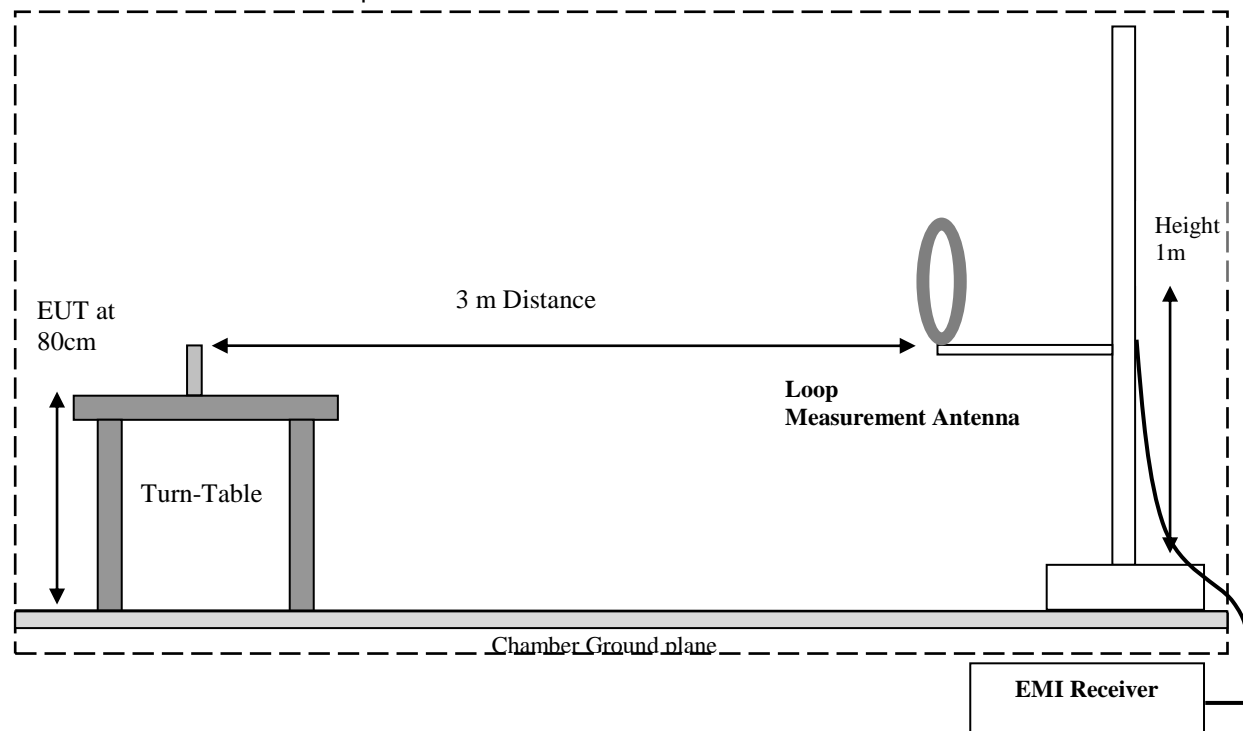
## 7 Measurement Procedures

### 7.1 Radiated Measurement

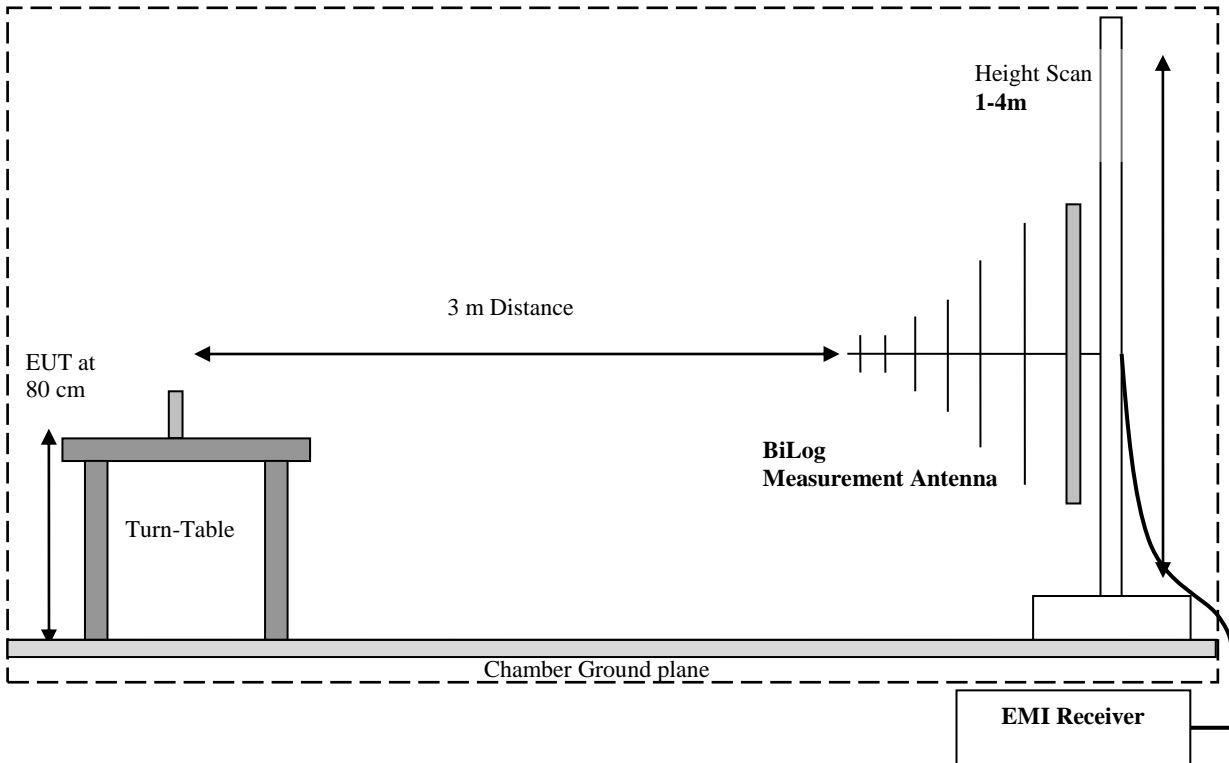
The radiated measurement is performed according to: ANSI C63.10 (2013)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

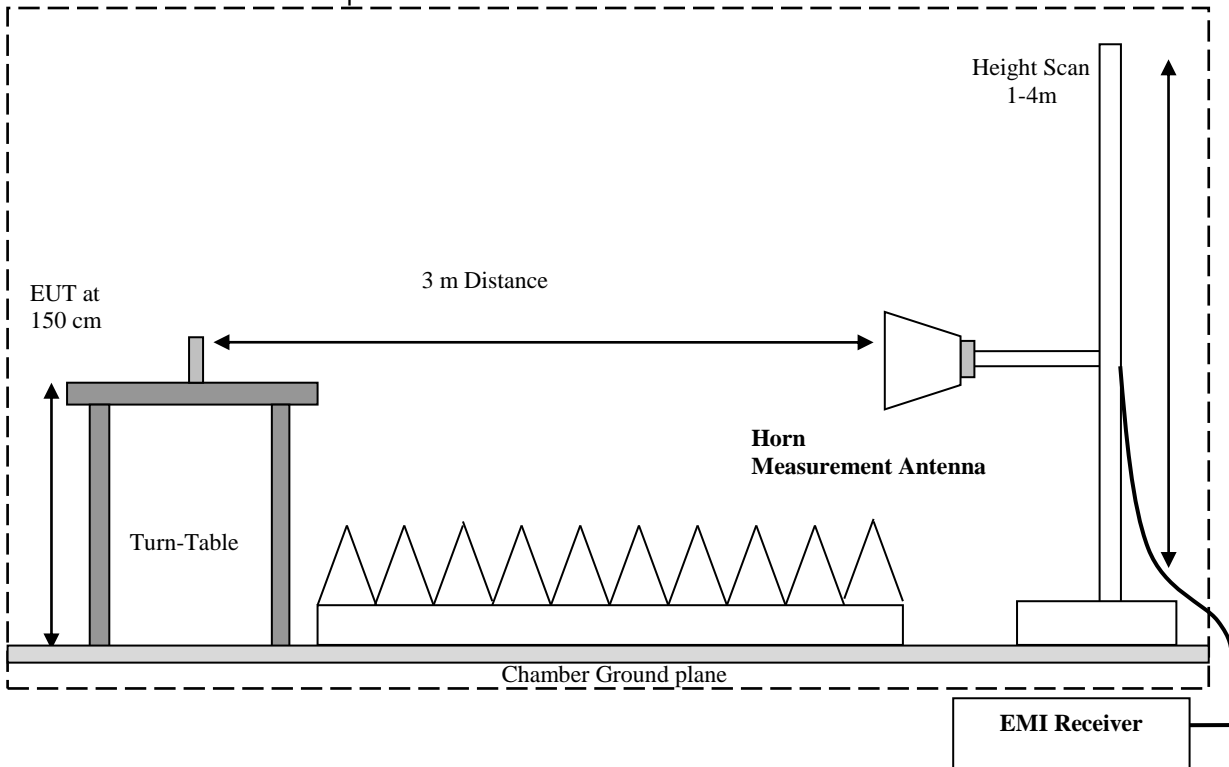
Radiated Emissions Test Setup below 30MHz Measurements



### Radiated Emissions Test Setup 30MHz-1GHz Measurements



### Radiated Emissions Test Setup above 1GHz Measurements



### 7.1.1 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dBμV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} - \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

Example:

Frequency (MHz)	Measured SA (dBμV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBμV/m)
1000	80.5	3.5	14	98.0

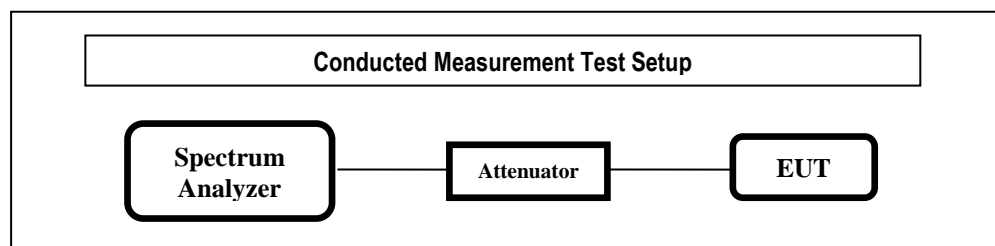
### 7.2 Power Line Conducted Measurement Procedure

AC Power Line conducted emissions measurements performed according to: ANSI C63.10 (2013)

### 7.3 RF Conducted Measurement Procedure

Reference: 558074 D01 DTS Meas Guidance v03r05 – “GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER §15.247; April 8, 2016” by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.

### 7.4 Conducted Setup Block diagram



- Connect the equipment as shown in the above diagram.
- Adjust the settings of the SA (Rohde-Schwarz Spectrum Analyzer) to connect the EUT at the required mode of test.
- Measurements are to be performed with the EUT set to the low, middle and high channels and for worst case modulation schemes.

## 8 Test Result Data

### 8.1 Emission Bandwidth

#### 8.1.1 Measurement according to FCC KDB 558074 D01 DTS Meas Guidance v04

##### Spectrum Analyzer settings:

- Set RBW = 100 kHz
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW
- Detector = Peak
- Trace mode = max hold
- Sweep = auto couple
- Allow the trace to stabilize
- 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.

#### 8.1.2 Limits:

FCC §15.247(a)(1) and RSS-247 5.2(1)

- Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

#### 8.1.3 Test conditions and setup:

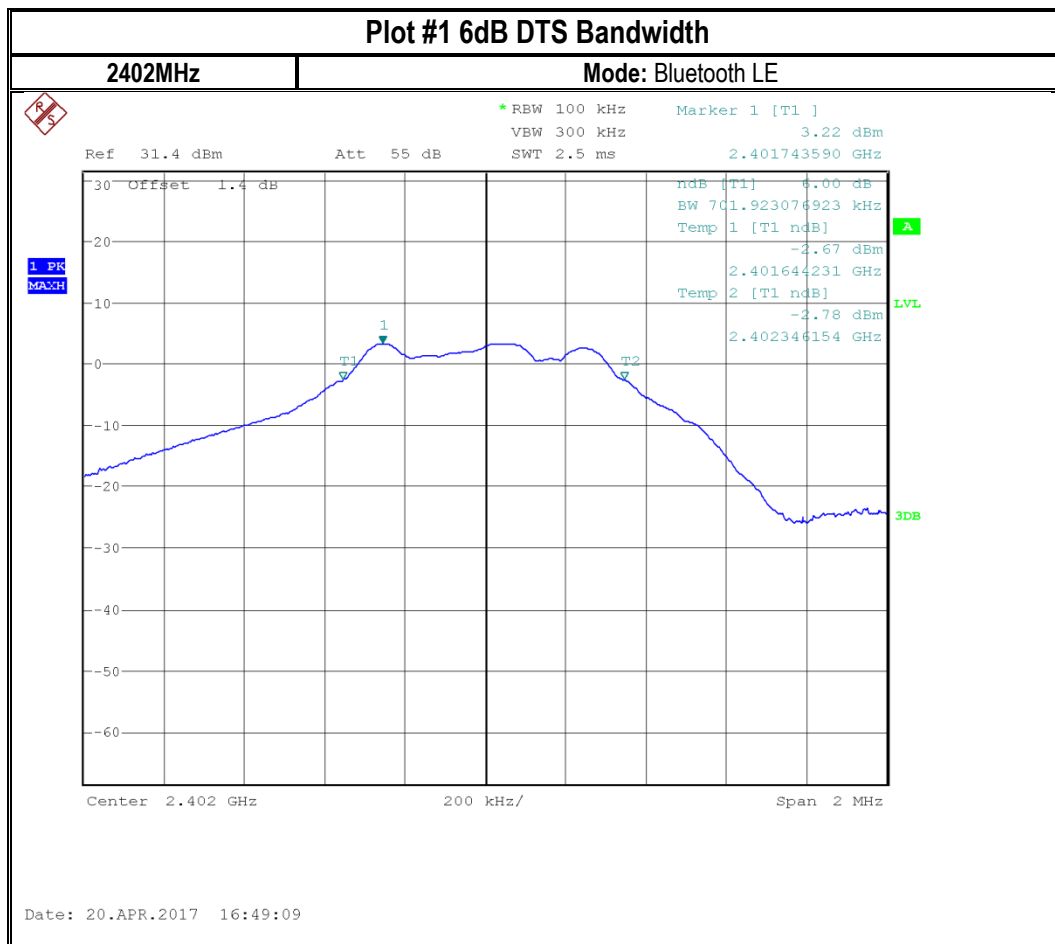
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Measurement Path Loss (dB)	Antenna Gain (dBi)
24° C	1	BT LE	3 VDC	1.4	1.8

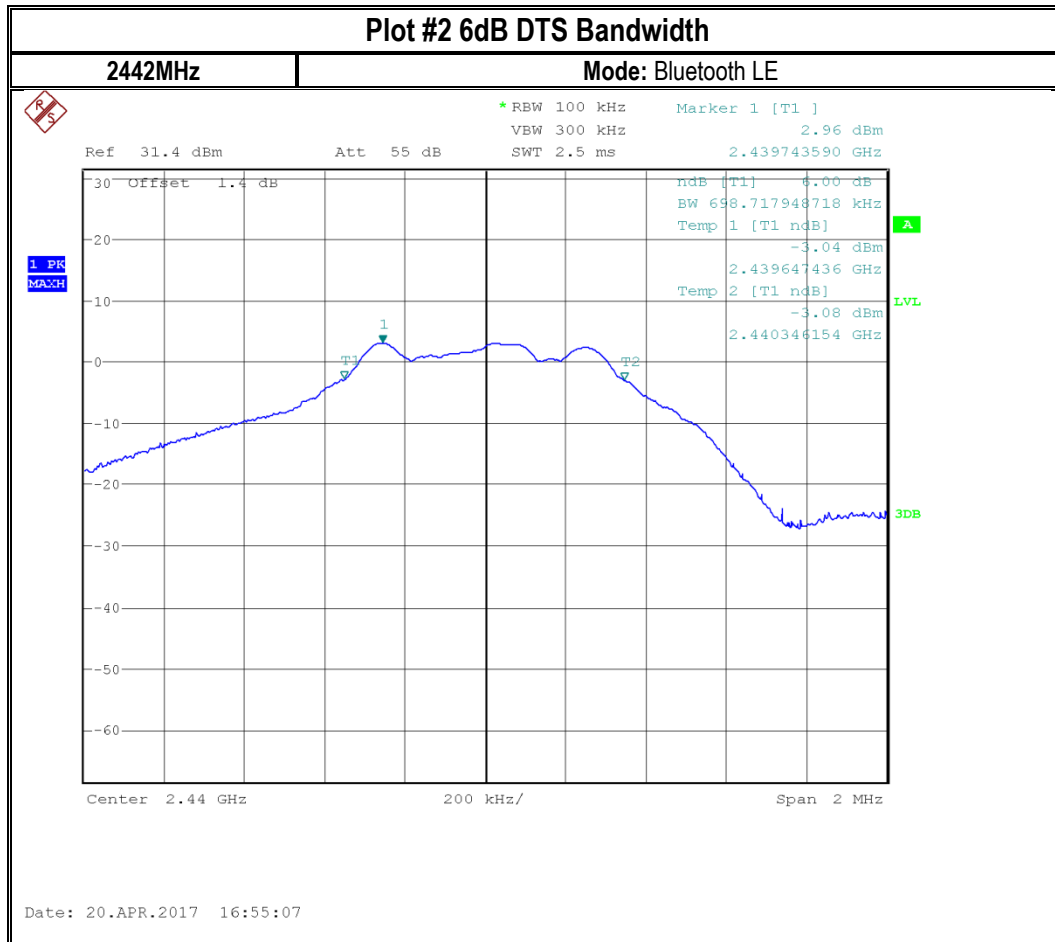
#### 8.1.4 Measurement result:

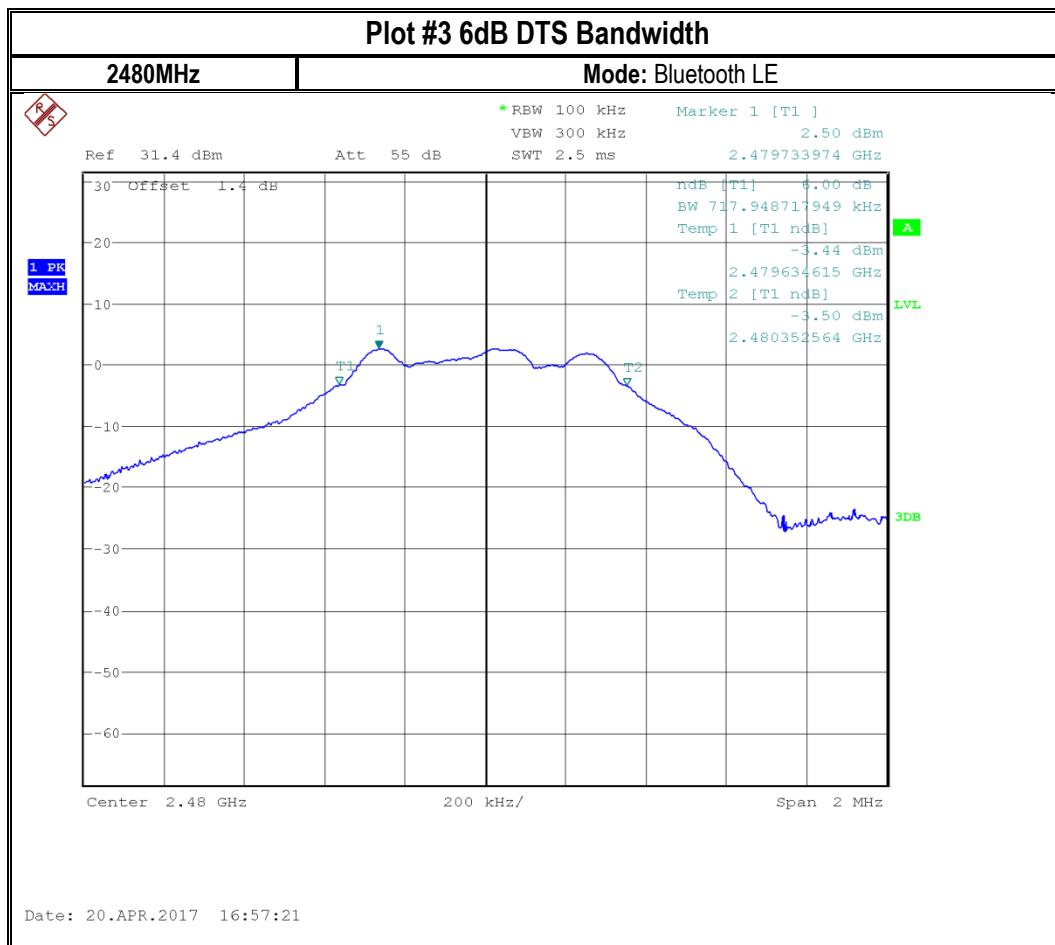
Plot #	Frequency (MHz)	6dB DTS Bandwidth (MHz)	Limit (MHz)	Result
1	2402	0.7	> 0.5	Pass
2	2442	0.7	> 0.5	Pass
3	2480	0.72	> 0.5	Pass

Plot #	Frequency (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Result
4	2402	1.29	> 0.5	Pass
5	2442	1.33	> 0.5	Pass
6	2480	1.30	> 0.5	Pass

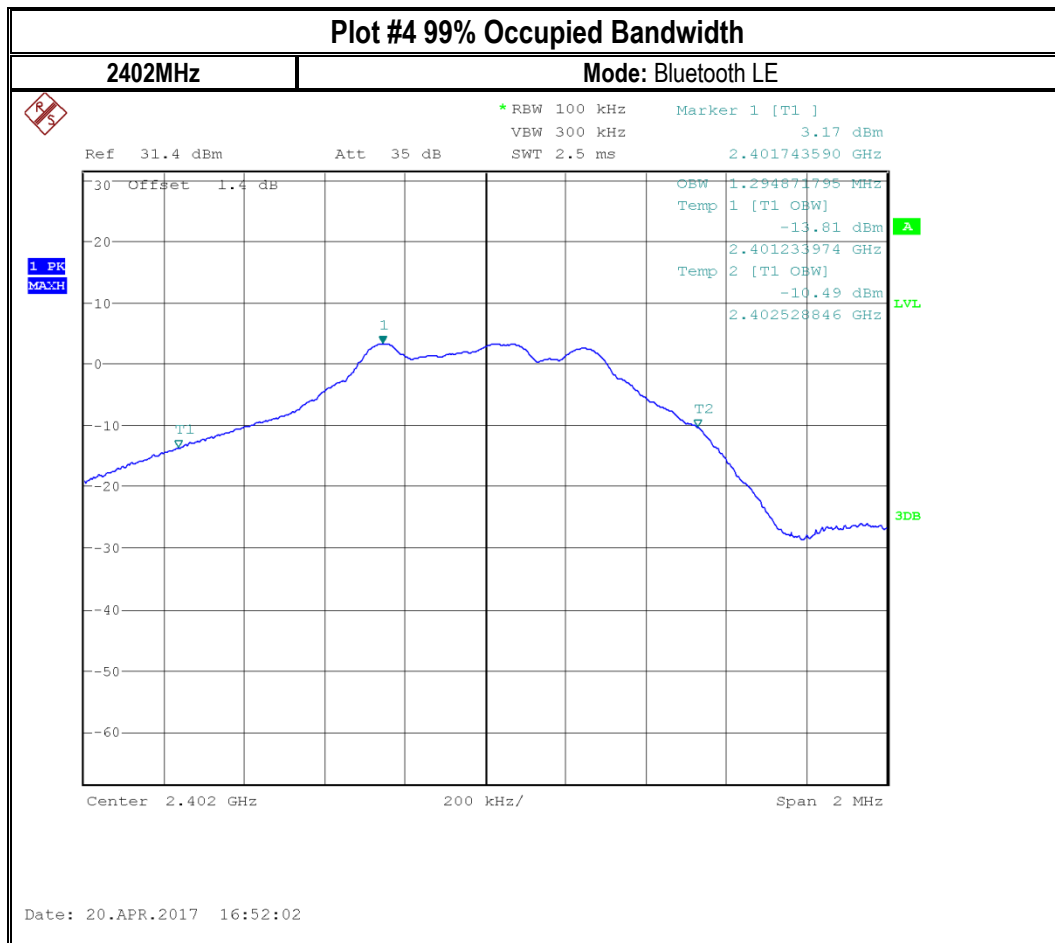
### 8.1.5 Measurement Plots:

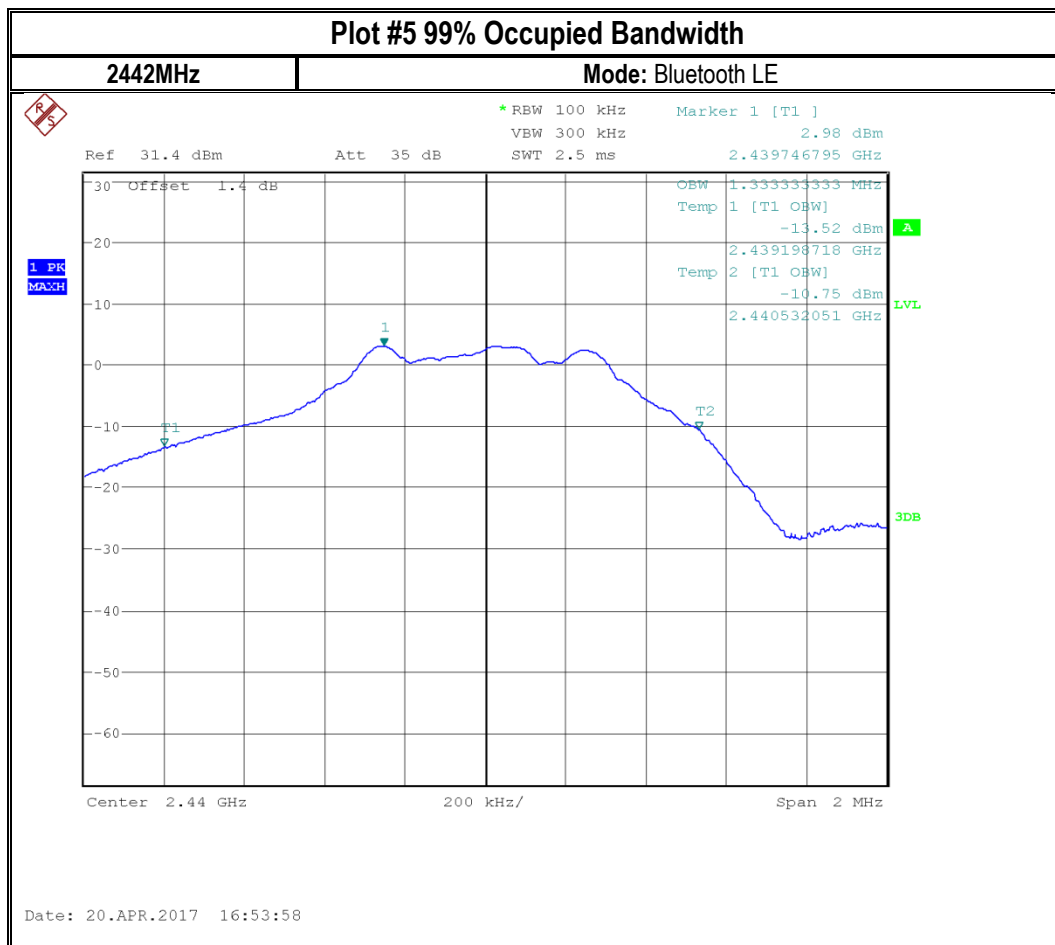


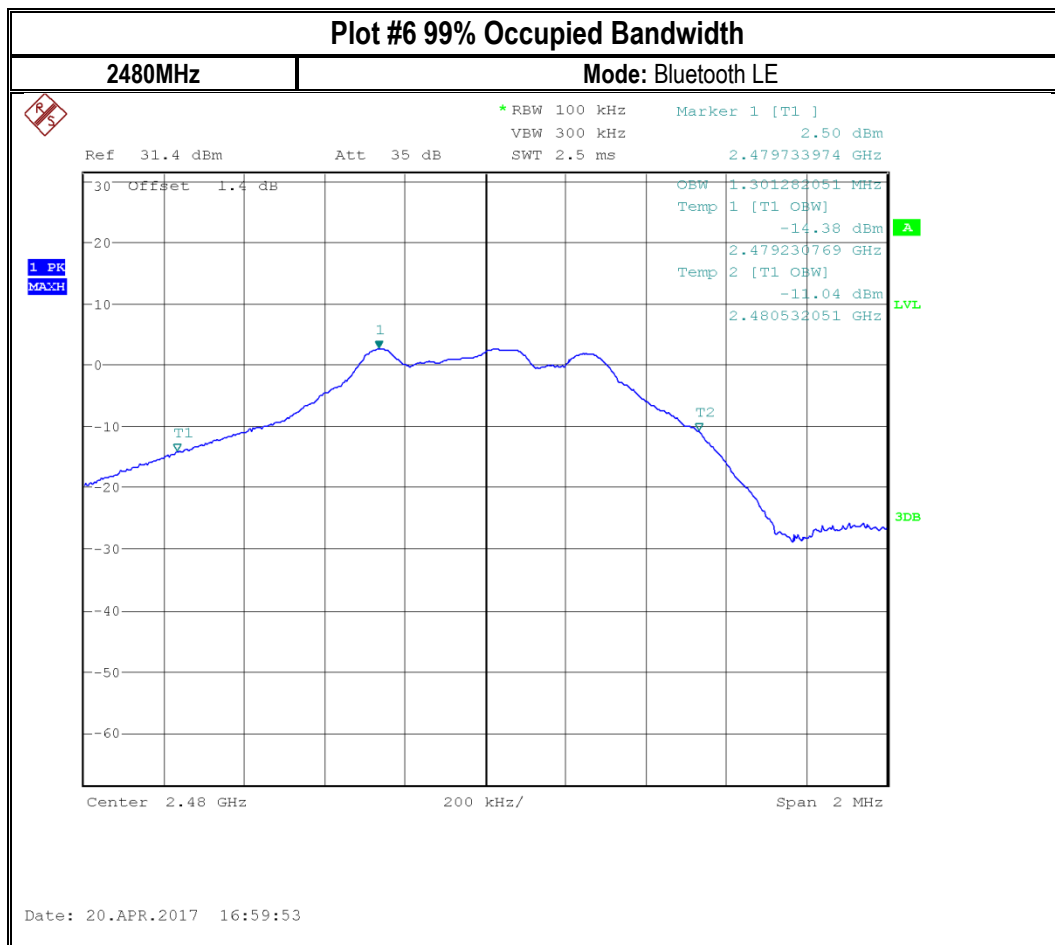












## 8.2 Maximum Peak Conducted Output Power and EIRP

### 8.2.1 Measurement according to FCC KDB 558074 D01 DTS Meas Guidance v04

#### Spectrum Analyzer settings:

- Span = approximately 5 times the 20 dB bandwidth
- RBW > the 20 dB bandwidth of the emission being measured
- VBW ≥ RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold
- Use the marker-peak function to set the marker to the peak of the emission.

### 8.2.2 Limits:

#### Maximum Peak Output Power:

- FCC §15.247 (b): 1W
- IC RSS-247: 1W

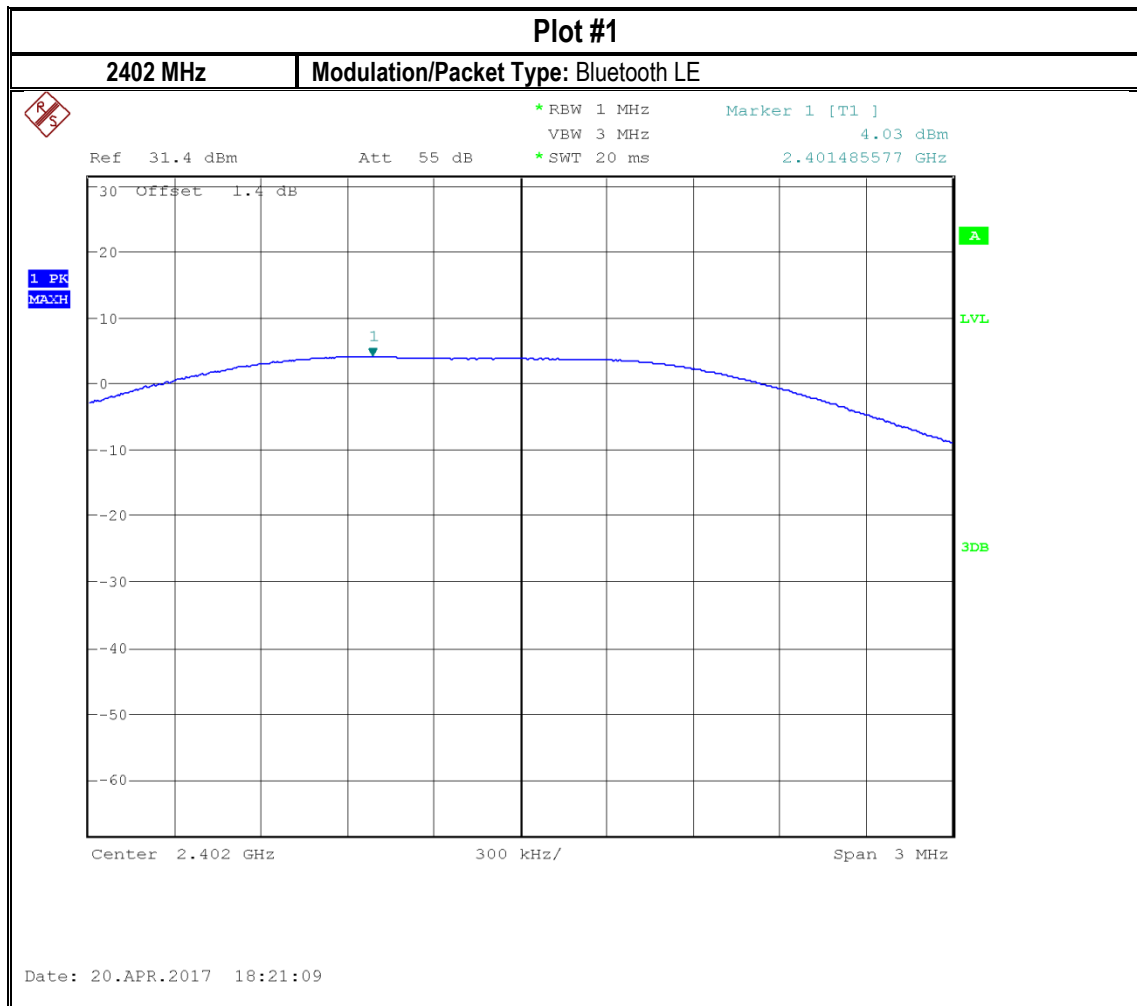
### 8.2.3 Test conditions and setup:

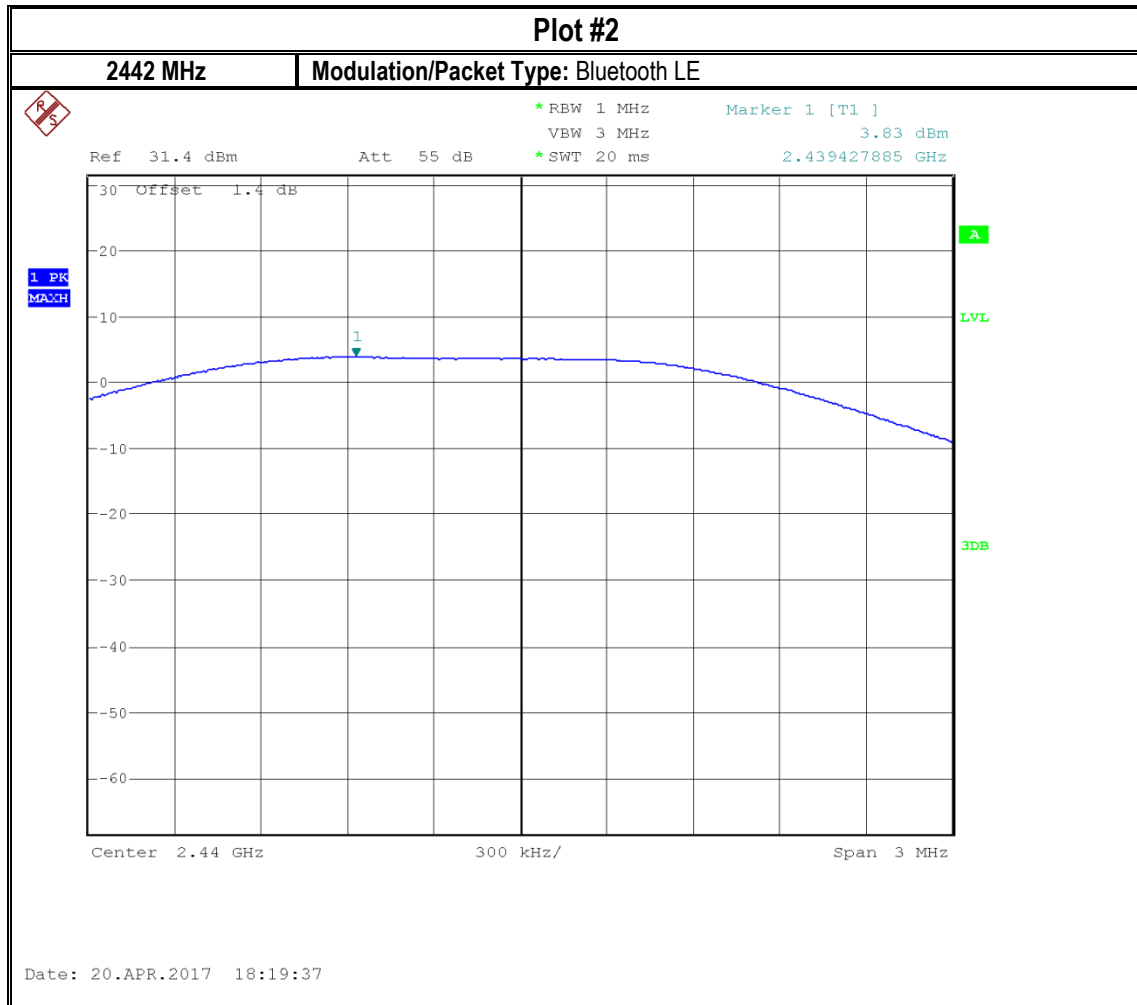
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Measurement Path Loss (dB)	Antenna Gain (dBi)
22° C	1	BT LE	3 VDC	1.4	-1.1

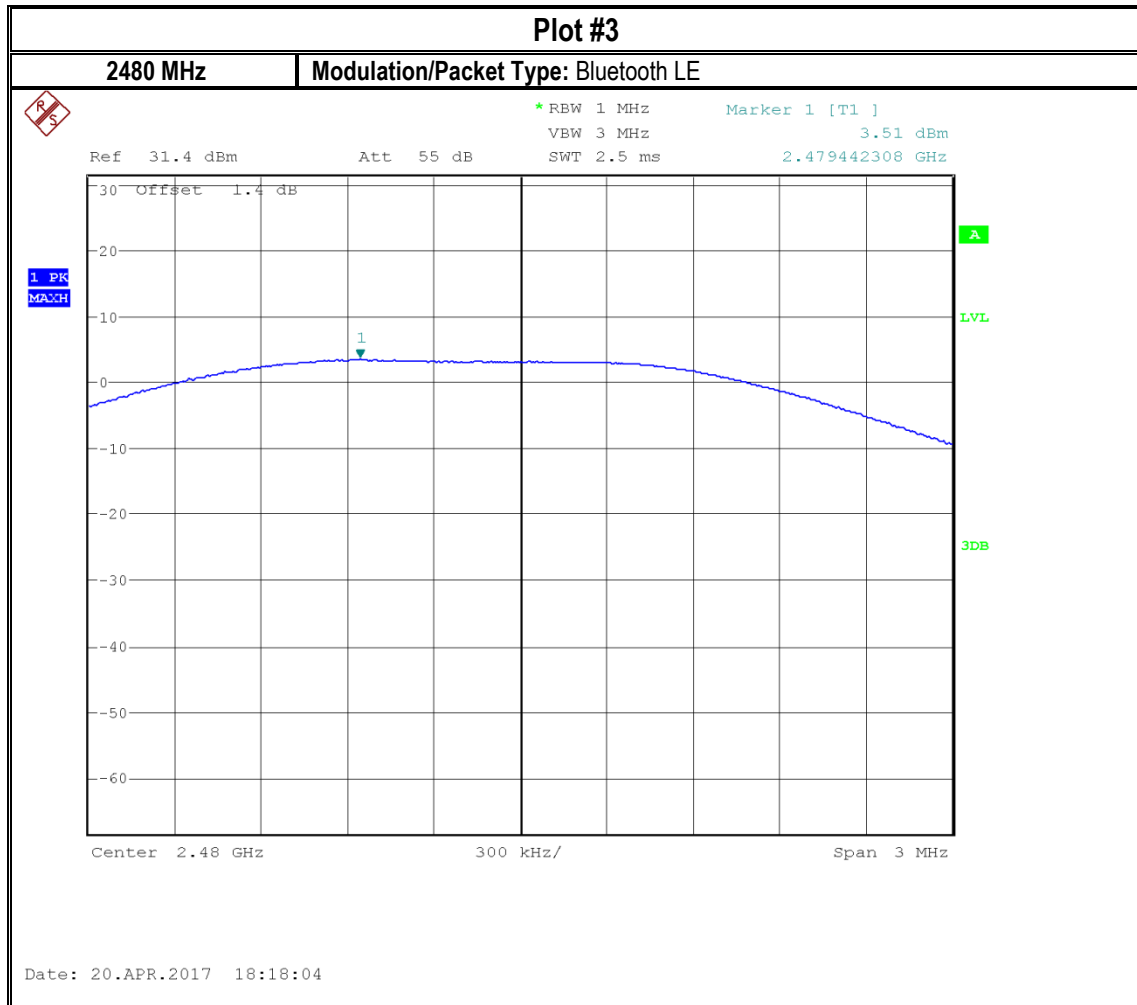
### 8.2.4 Measurement result:

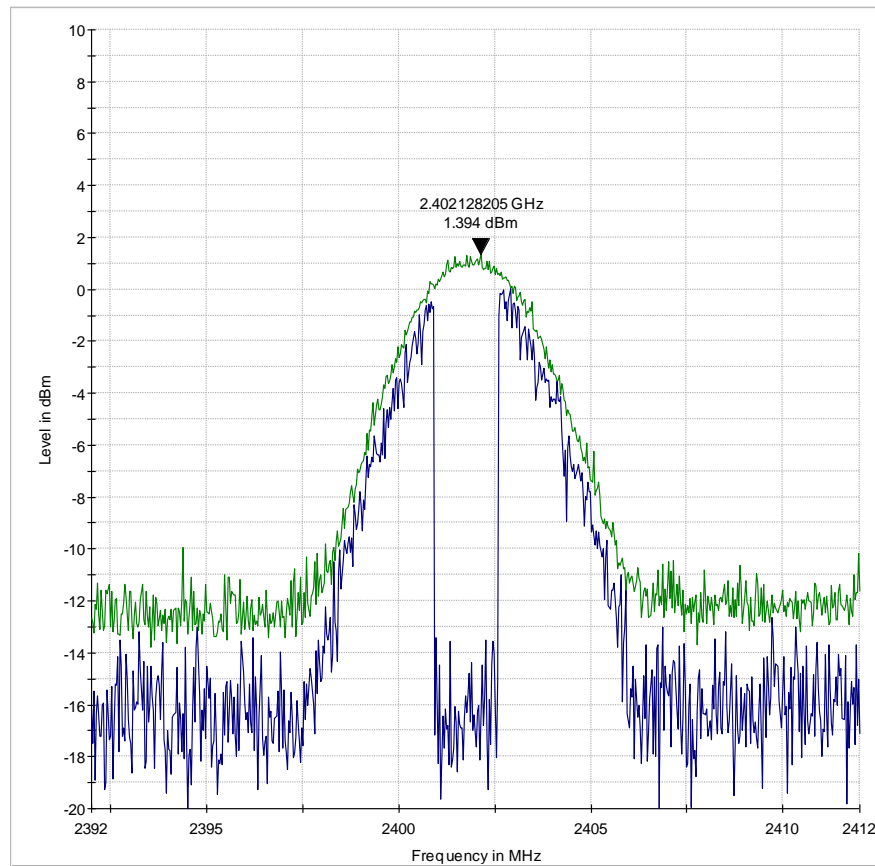
Plot #	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)	EIRP Peak (dBm)	Gain calculated (dBm)	Limit conducted output power (dBm) peak	Result
1	2402	4.03	-	$1.4 - 4.03 = -2.6$	30	Pass
2	2442	3.83	-	$1.6 - 3.83 = -2.2$	30	Pass
3	2480	3.51	-	$3.51 - 2.4 = -1.1$	30	Pass
4	2402	-	1.4		36	Pass
5	2442	-	1.6		36	Pass
6	2480	-	2.4		36	Pass

## 8.2.5 Measurement Plots:





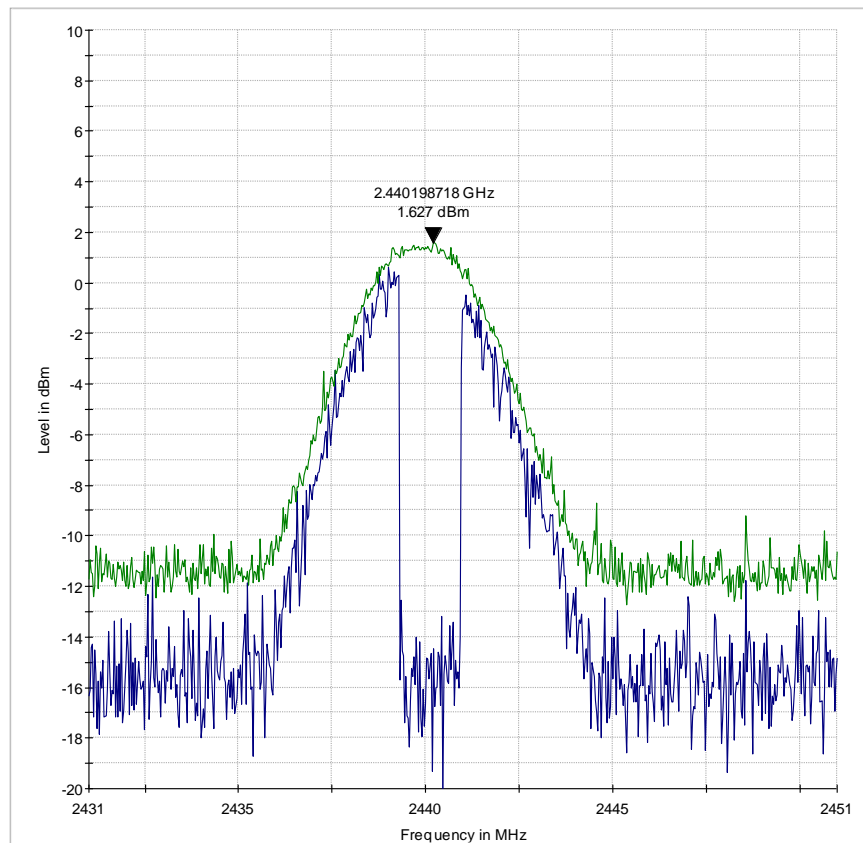


**Plot #4****2402 MHz****Modulation/Packet Type: Bluetooth LE EIRP**

— MaxPeak-ClearWrite-PK+

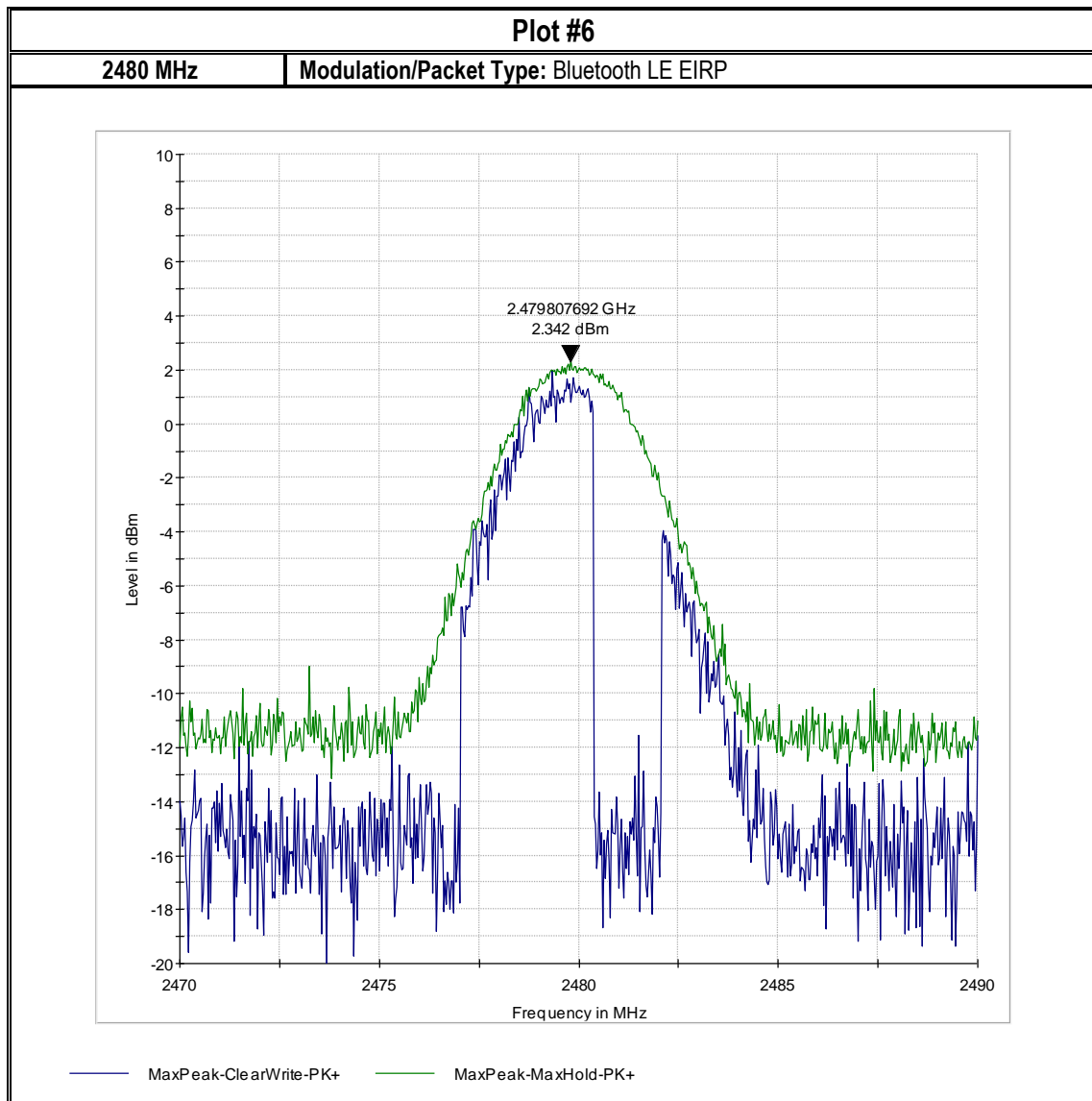
— MaxPeak-MaxHold-PK+



**Plot #5****2440 MHz****Modulation/Packet Type: Bluetooth LE EIRP**

— MaxPeak-ClearWrite-PK+

— MaxPeak-MaxHold-PK+



### 8.3 Power Spectral Density

#### 8.3.1 Measurement according to FCC KDB 558074 D01 DTS Meas Guidance v04

##### Spectrum Analyzer settings for Peak PSD method:

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth
- Set RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- Set the VBW  $\geq 3 \times \text{RBW}$ .
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

#### 8.3.2 Limits:

##### FCC§15.247(e) & RSS-247 5.2(2)

- For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

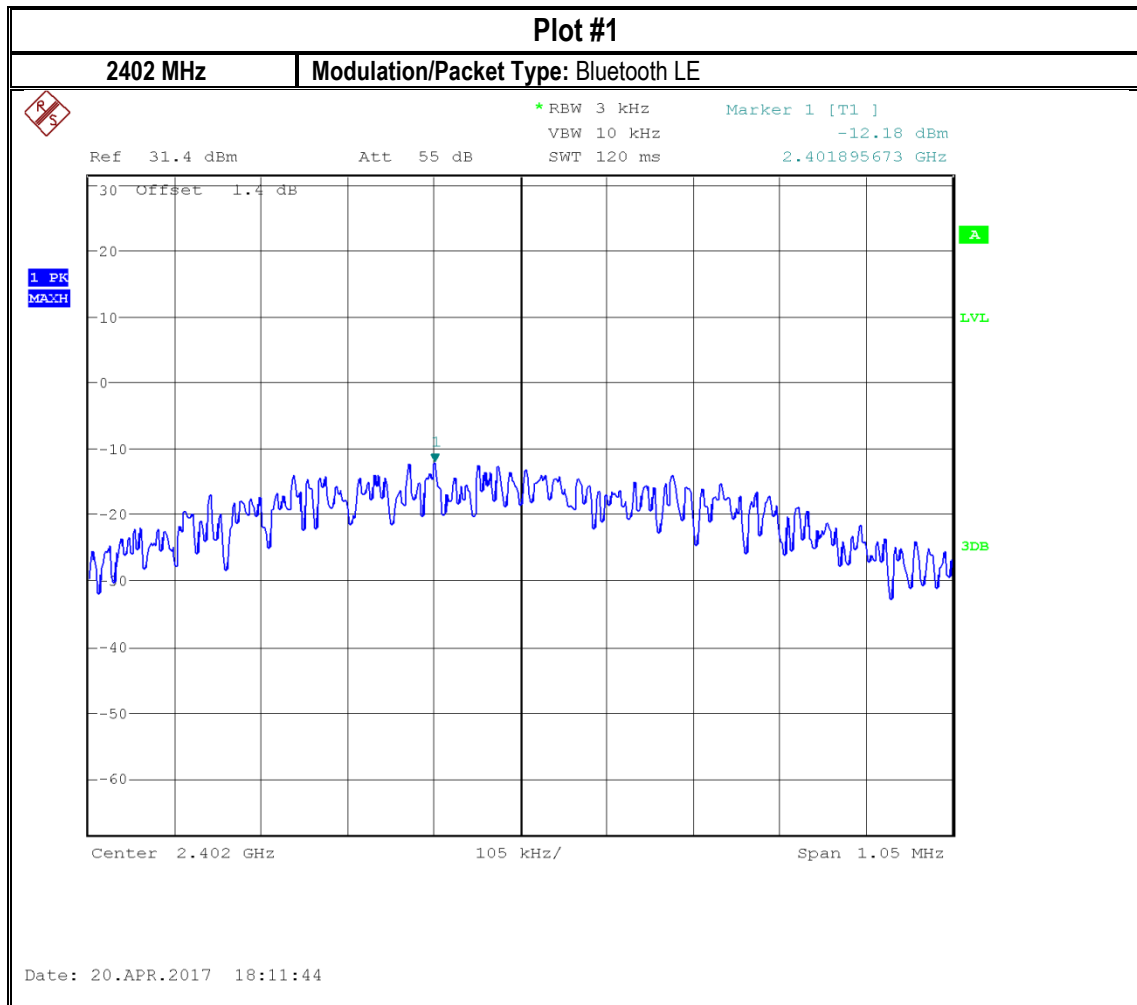
#### 8.3.3 Test conditions and setup:

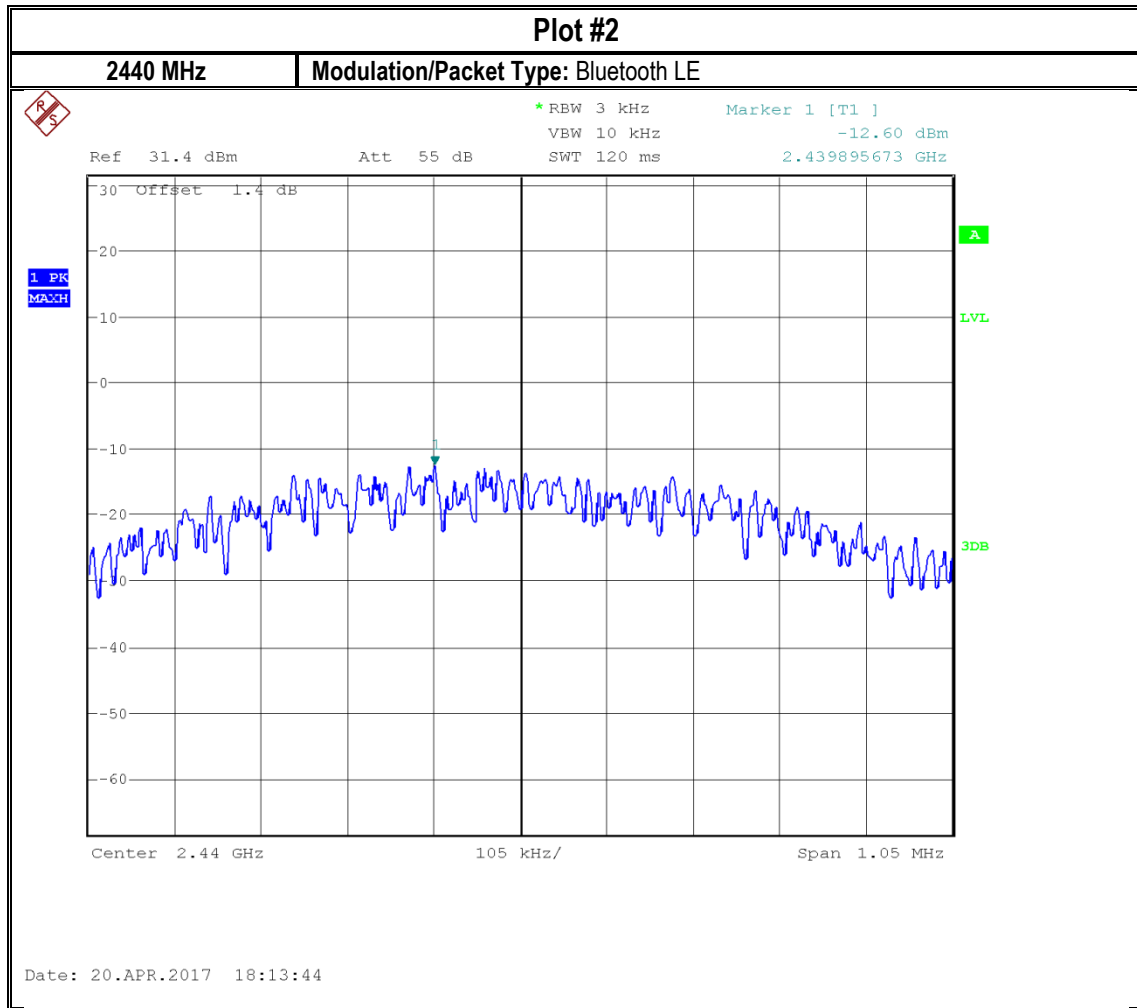
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Measurement Path Loss (dB)	Antenna Gain (dBi)
22° C	1	BT LE	3 VDC	1.4	1.8

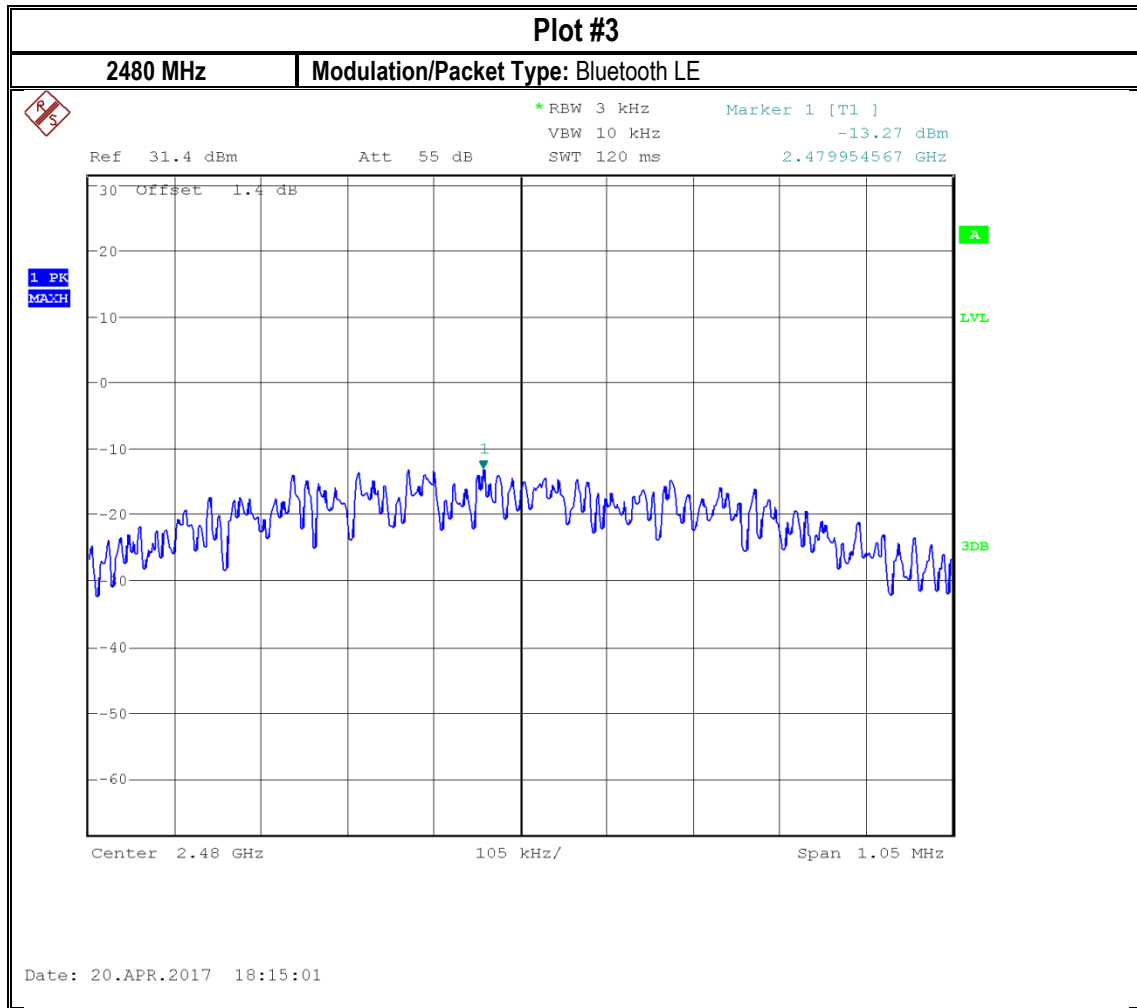
#### 8.3.4 Measurement result:

Plot #	Frequency (MHz)	Maximum Power Spectral Density (dBm / 3kHz)	Limit ( dBm / 3kHz )	Result
1	2402	-12.18	8	Pass
2	2440	-12.6	8	Pass
3	2480	-13.27	8	Pass

Note: PSD results were adjusted to include antenna gain.

**8.3.5 Measurement Plots:**





## **8.4 Band Edge and Restricted Band Compliance**

### **8.4.1 Measurement according to FCC KDB 558074 D01 DTS Meas Guidance v04**

#### **Spectrum Analyzer settings for non-restricted band edge:**

- Span: wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
- RBW  $\geq$  1% of the span
- VBW  $\geq$  RBW
- Sweep Time: Auto
- Detector = peak
- Trace = max hold
- Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge.

### **8.4.2 Limits non restricted band:**

#### **FCC§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, 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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

#### **RSS-247 5/5**

- 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, 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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30dB instead of 20dB.

#### **Spectrum Analyzer settings for restricted band:**

- Peak measurements are made using a peak detector and RBW=1 MHz, VBW  $\geq$  RBW

### 8.4.3 Limits restricted band §15.247/15.209/15.205 and RSS-Gen 8.9/8.10

- \*PEAK LIMIT= 74dB $\mu$ V/m @3m =-21.23dBm
- \*AVG. LIMIT= 54dB $\mu$ V/m @3m =-41.23dBm
- Start frequency & stop frequency according to frequency range specified in the restricted band table in FCC section 15.205 & RSS-Gen 8.10
- Measurements with a peak detector were used to show compliance to average limits, thus showing compliance to both peak and average limits.

- (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

### 8.4.4 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Measurement Path Loss (dB)	Antenna Gain (dBi)
22° C	3	BT LE	3 VDC	1.4	-1.1

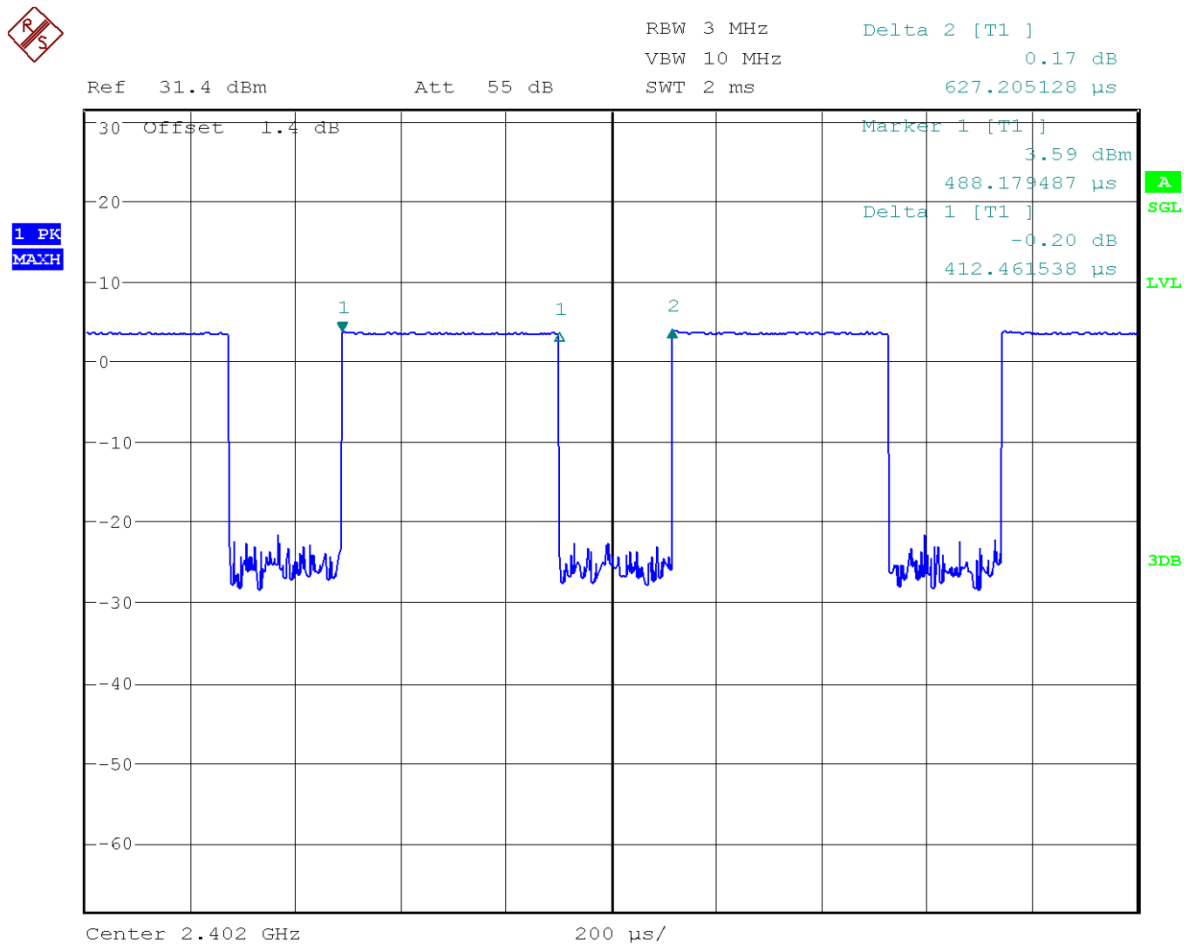
### 8.4.5 Measurement result:

Plot #	Band Edge	Band Edge Delta (dBc)	Limit (dBc)	Result
1	Lower non restricted	30.76	> 20	Pass

Plot #	EUT operating mode	Band Edge	Measured Value (dBm)	Corrected by Ant. Gain (dBm) - min 2dBi	Limit (dBm)	Result
2	BT LE	Upper restricted peak	-24.48	-22.48	PEAK = -21.23	Pass
3	BT LE	Upper restricted average	-49.29	-47.29	AVG = -41.23	Pass



#### 8.4.6 BT LE Continuous Transmit Mode Measured Duty cycle

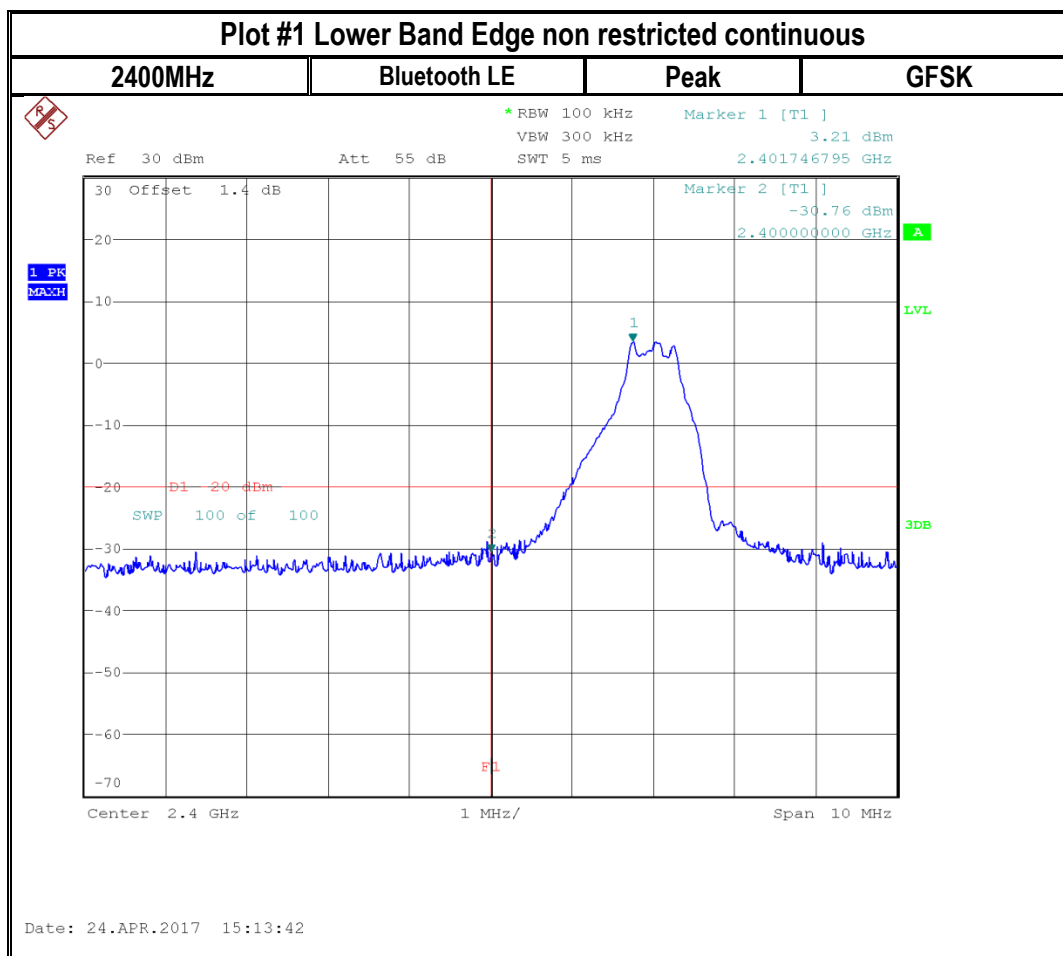


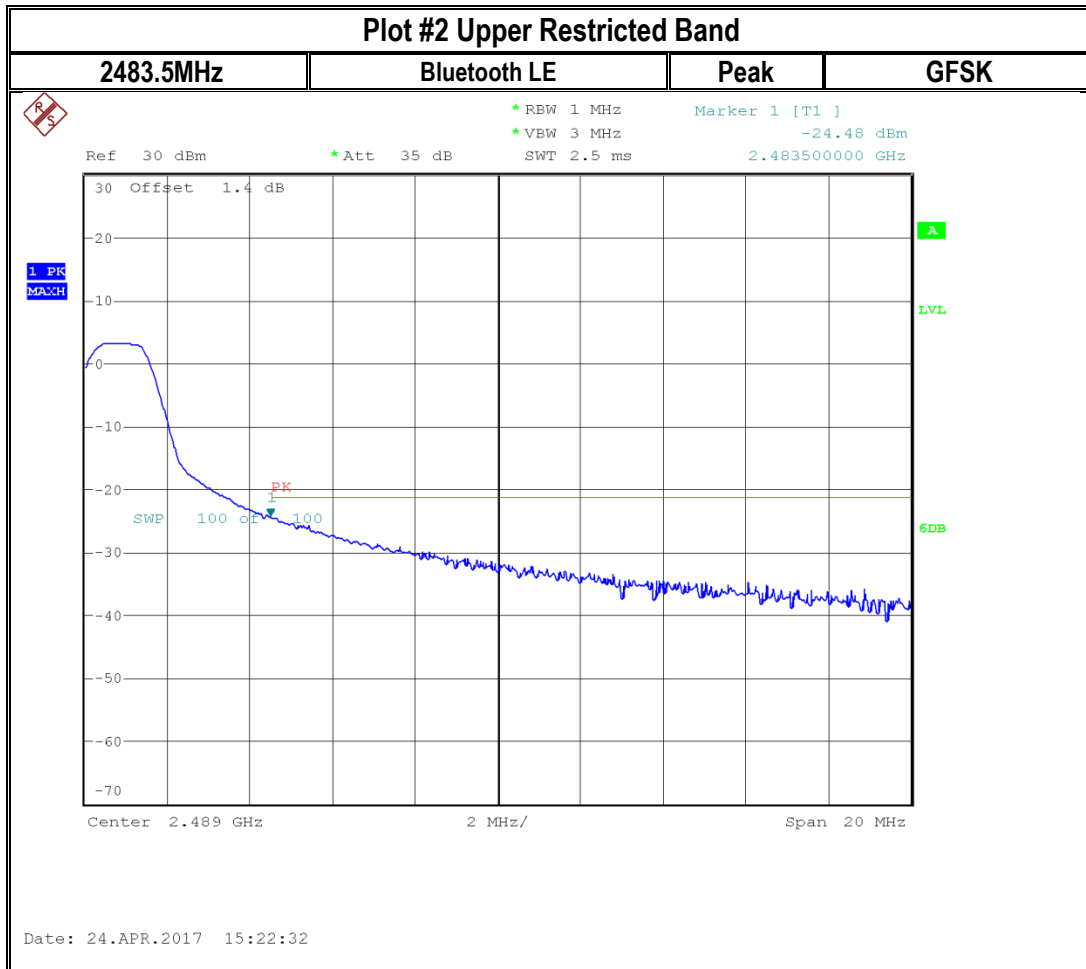
Date: 20.APR.2017 16:28:16

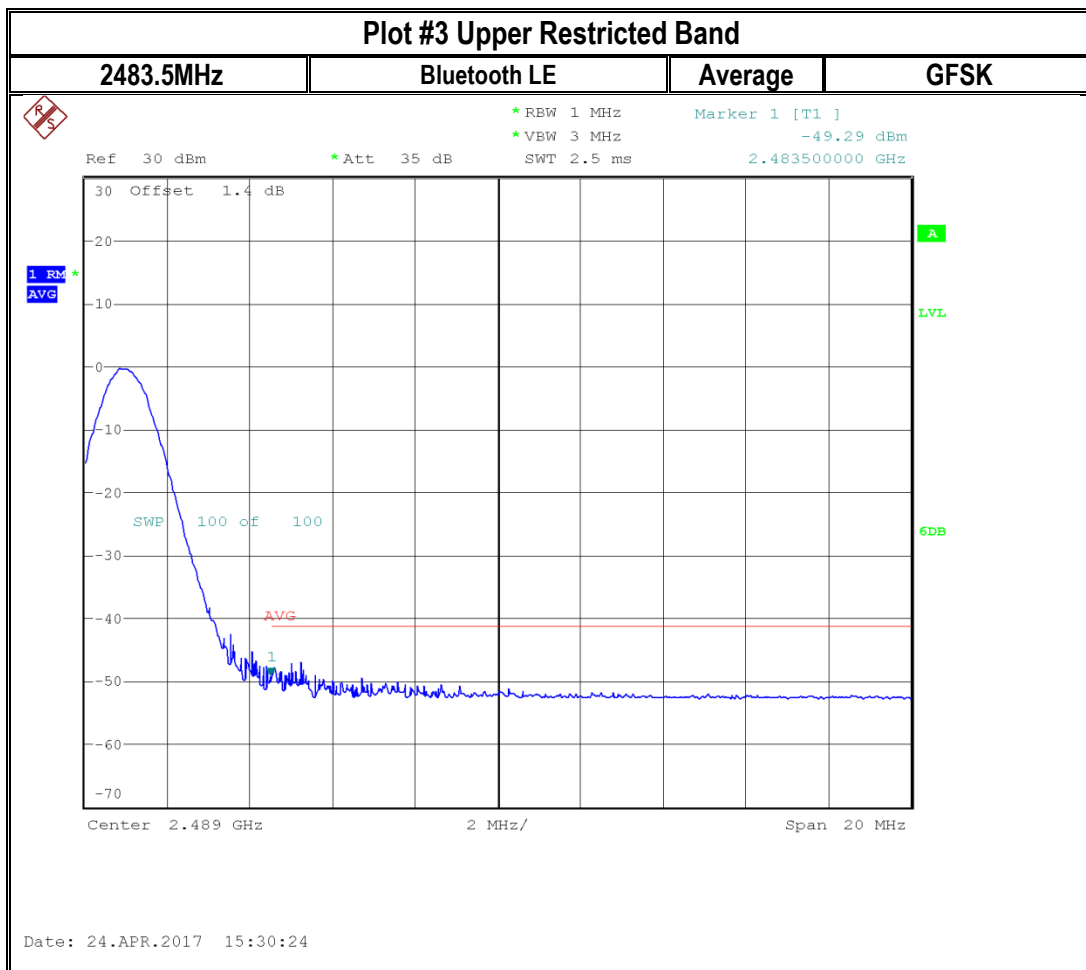
Duty Cycle=  $412.5/627.2=0.658=65.8\%$

Duty Cycle Correction Factor =  $10 \cdot \log(1/0.658) = 1.8 \text{ dB}$

#### 8.4.7 Measurement Plots:







1 RM  
AVG

## 8.5 Radiated Transmitter Spurious Emissions

### 8.5.1 Measurement according to ANSI C63.10 (2013)

#### Spectrum Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector: Peak
  
- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW=120 KHz (<1GHz)
  
- Frequency > 1 GHz
- Detector = Peak / Average
- RBW= 1MHz
  
- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) data rate shall be recorded for each measurement.
- For testing at distance other than the specified in the standard, the limit conversion is calculated by using 40 dB/decade extrapolation factor as follow: Conversion factor (CF) =  $40 \log (D/d) = 40 \log (300m / 3m) = 80dB$

### 8.5.2 Limits:

#### FCC §15.247

- 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, 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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

## FCC §15.209 &amp; RSS-Gen 8.9

- Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency of emission (MHz)	Field strength (μV/m)	Measurement Distance (m)	Field strength @ 3m (dBμV/m)
0.009–0.490	2400/F(kHz) / -----	300	-
0.490–1.705	24000/F(kHz) / -----	30	-
1.705–30.0	30 / (29.5)	30	-
30–88	100	3	40 dBμV/m
88–216	150	3	43.5 dBμV/m
216–960	200	3	46 dBμV/m
Above 960	500	3	54 dBμV/m

## FCC §15.205 &amp; RSS-Gen 8.10

- Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

- Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

\*PEAK LIMIT= 74dBμV/m

\*AVG. LIMIT= 54dBμV/m

**8.5.3 Test conditions and setup:**

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain (dBi)
23° C	1	BT LE	3 VDC	-1.1

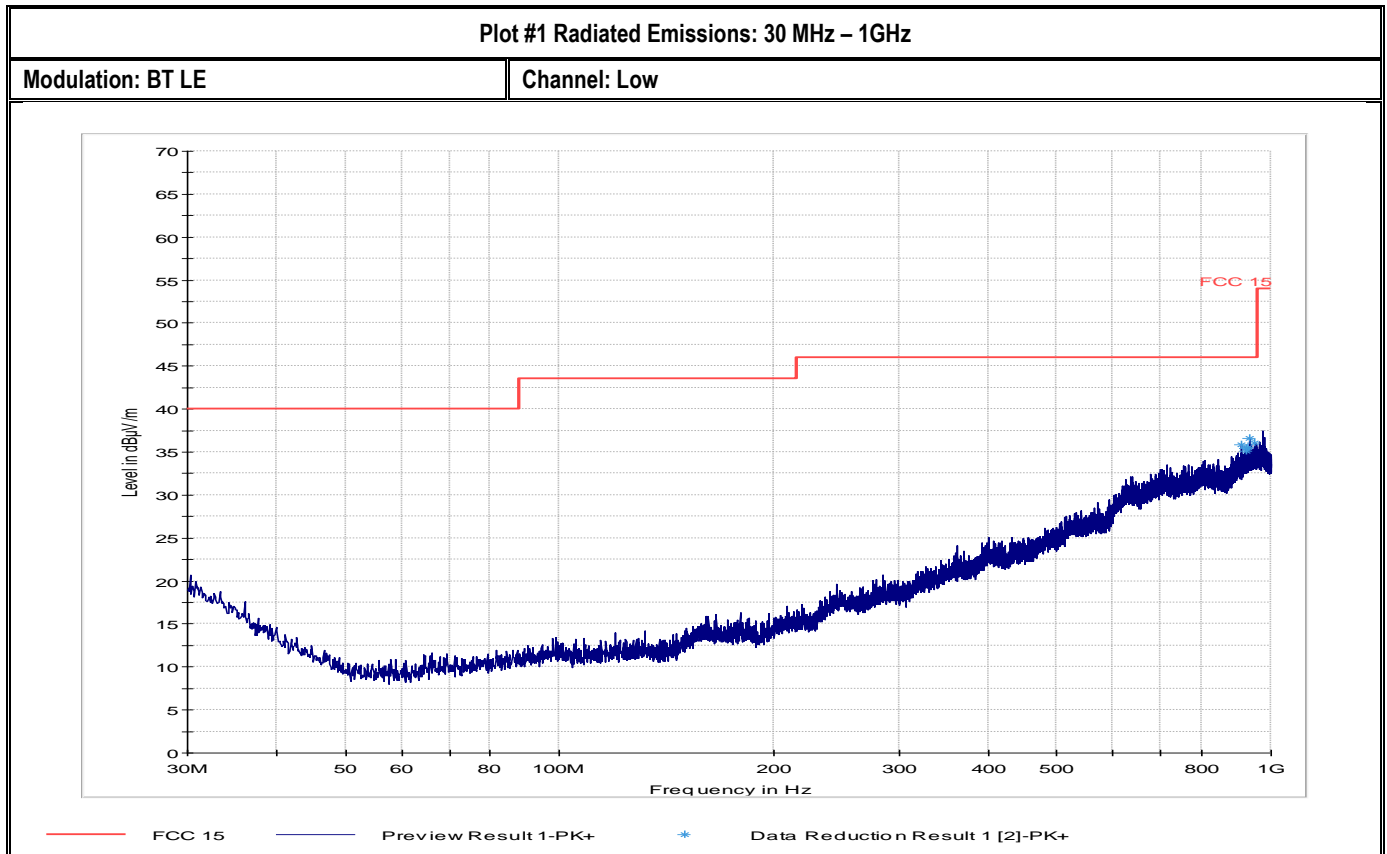
**8.5.4 Measurement result:**

Plot #	Channel #	EUT Set-Up #	Scan Frequency	Limit	Result
1-3	Low	1	30 MHz – 18 GHz	See section 8.6.2	Pass
4-5	Mid	1	9 kHz – 1 GHz	See section 8.6.2	Pass
6-8	Mid	1	1 GHz – 40 GHz	See section 8.6.2	Pass
9-11	High	1	30 MHz – 18 GHz	See section 8.6.2	Pass

Note: As the off times of the 66% DC signal was 200us and thus much shorter than the scan time of 2ms the average trace in the plots below are valid without correction.

### 8.5.5 Measurement Plots:

Plots reported here represent the worst case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT. Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.

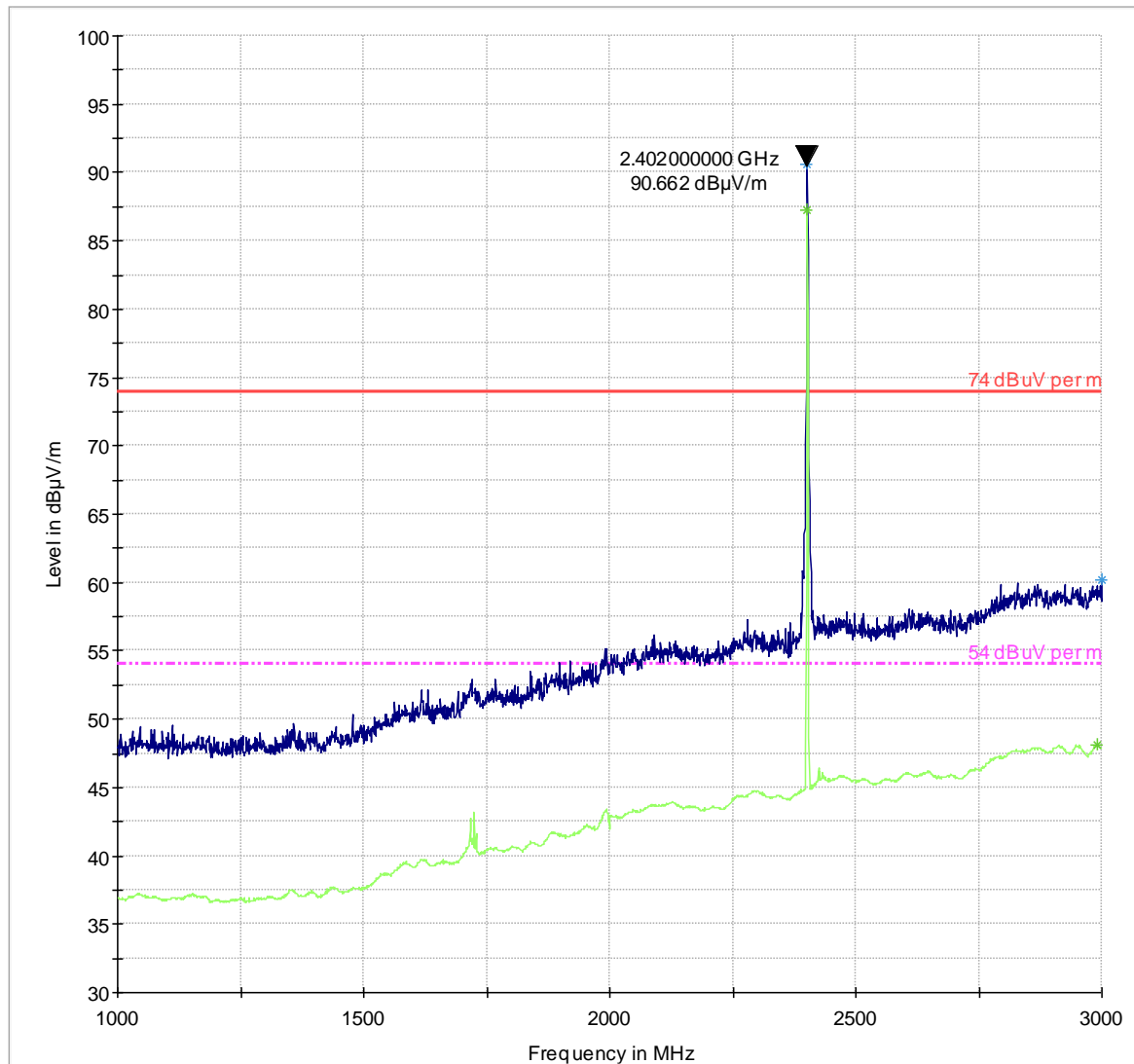




## Plot # 2 Radiated Emissions: 1-3 GHz

Modulation: BT LE

Channel: Low

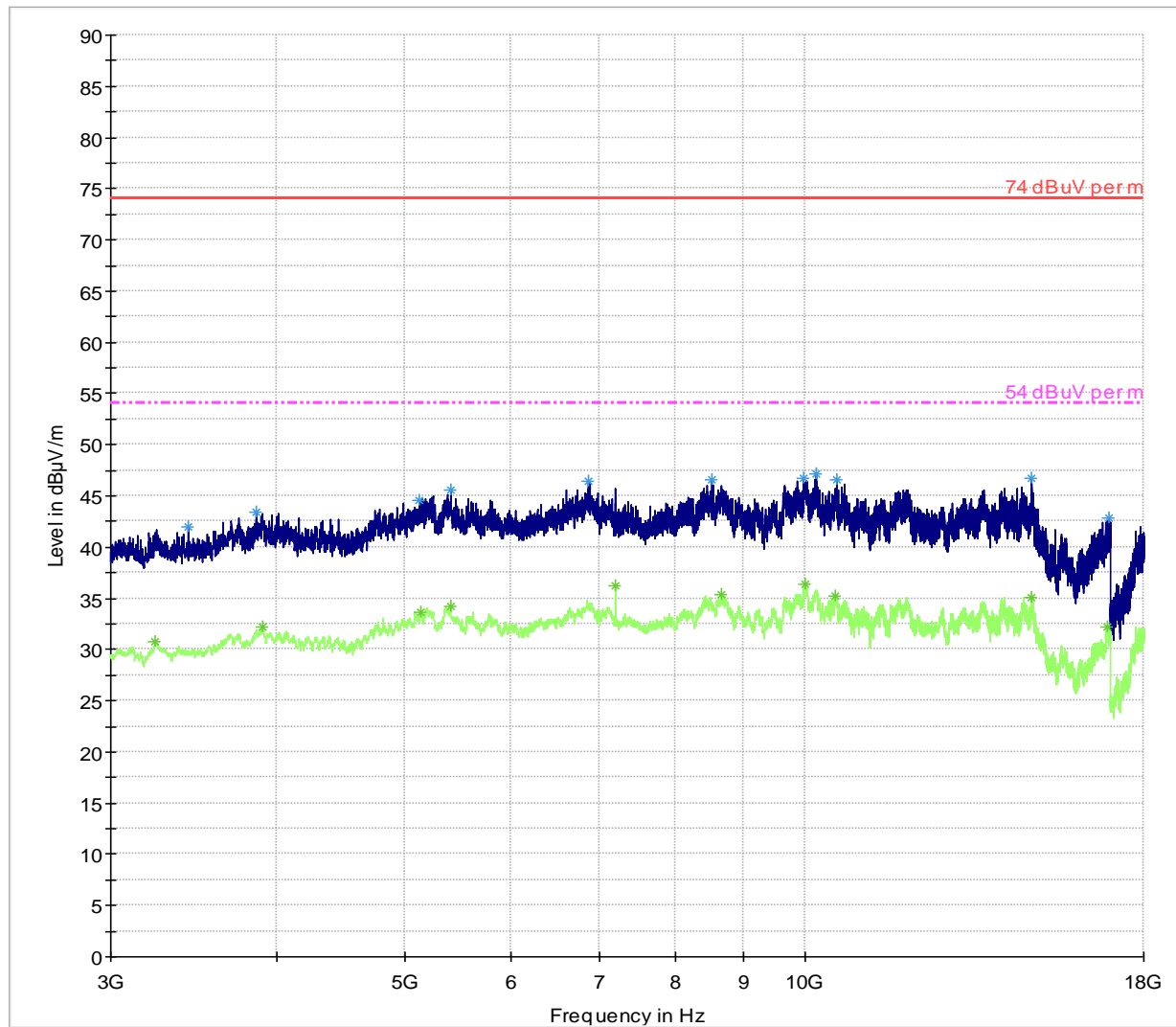


— 74 dBuV per m	- - - 54 dBuV per m
— Preview Result 1-PK+	— Preview Result 2-RMS
* Data Reduction Result 1 [4]-PK+	* Data Reduction Result 2 [4]-RMS

## Plot # 3 Radiated Emissions: 3-18 GHz

Modulation: BT LE

Channel: Low



—	74 dBuV per m	- - - - -	54 dBuV per m
—	Preview Result 1-PK+	—	Preview Result 2-RMS
*	Data Reduction Result 1 [5]-PK+	*	Data Reduction Result 2 [5]-RMS

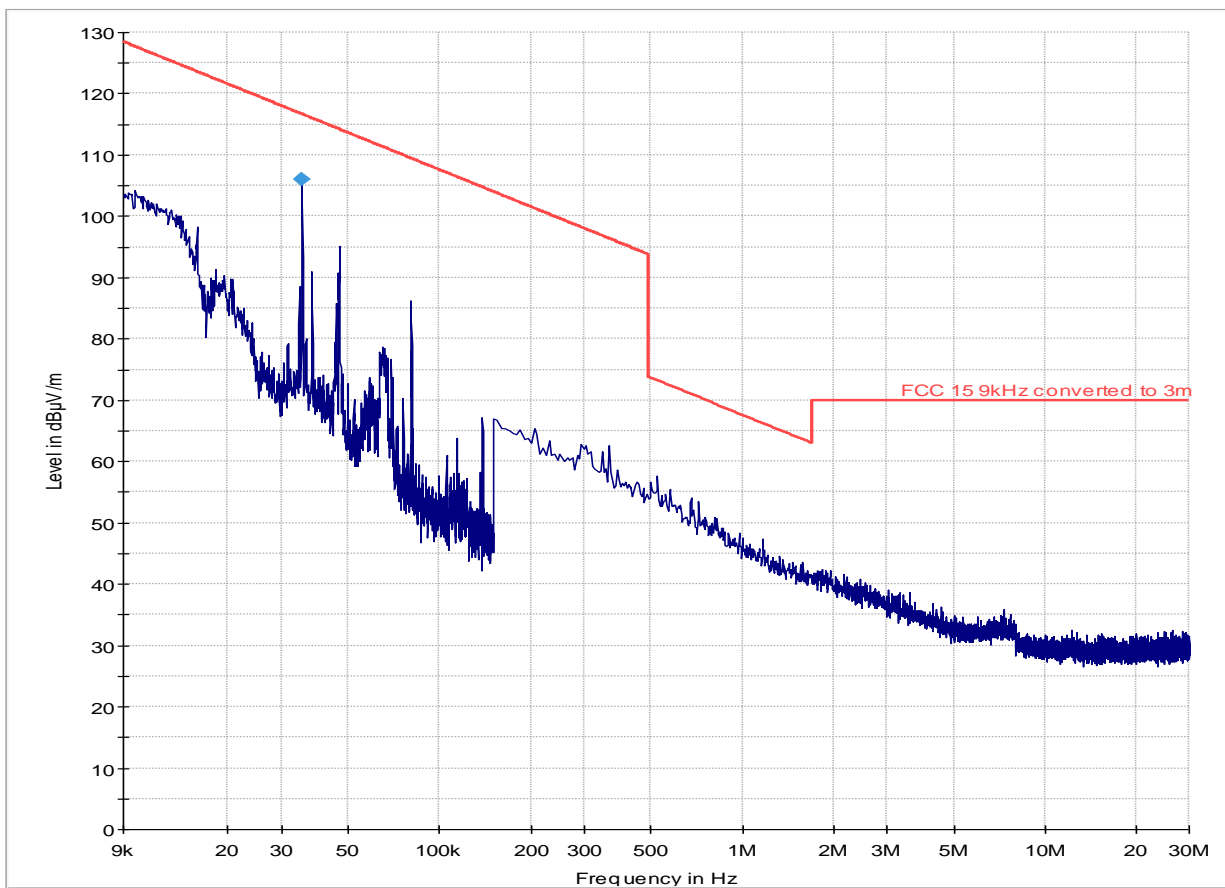
## Plot # 4 Radiated Emissions: 9 KHz - 30 MHz

Modulation: BT LE

Channel: Mid

## Final Measurement Result

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)
0.035040	106.1	2.0	0.200	260.0	H	148.0	75.2	10.6	116.7



FCC 15 9kHz converted to 3m

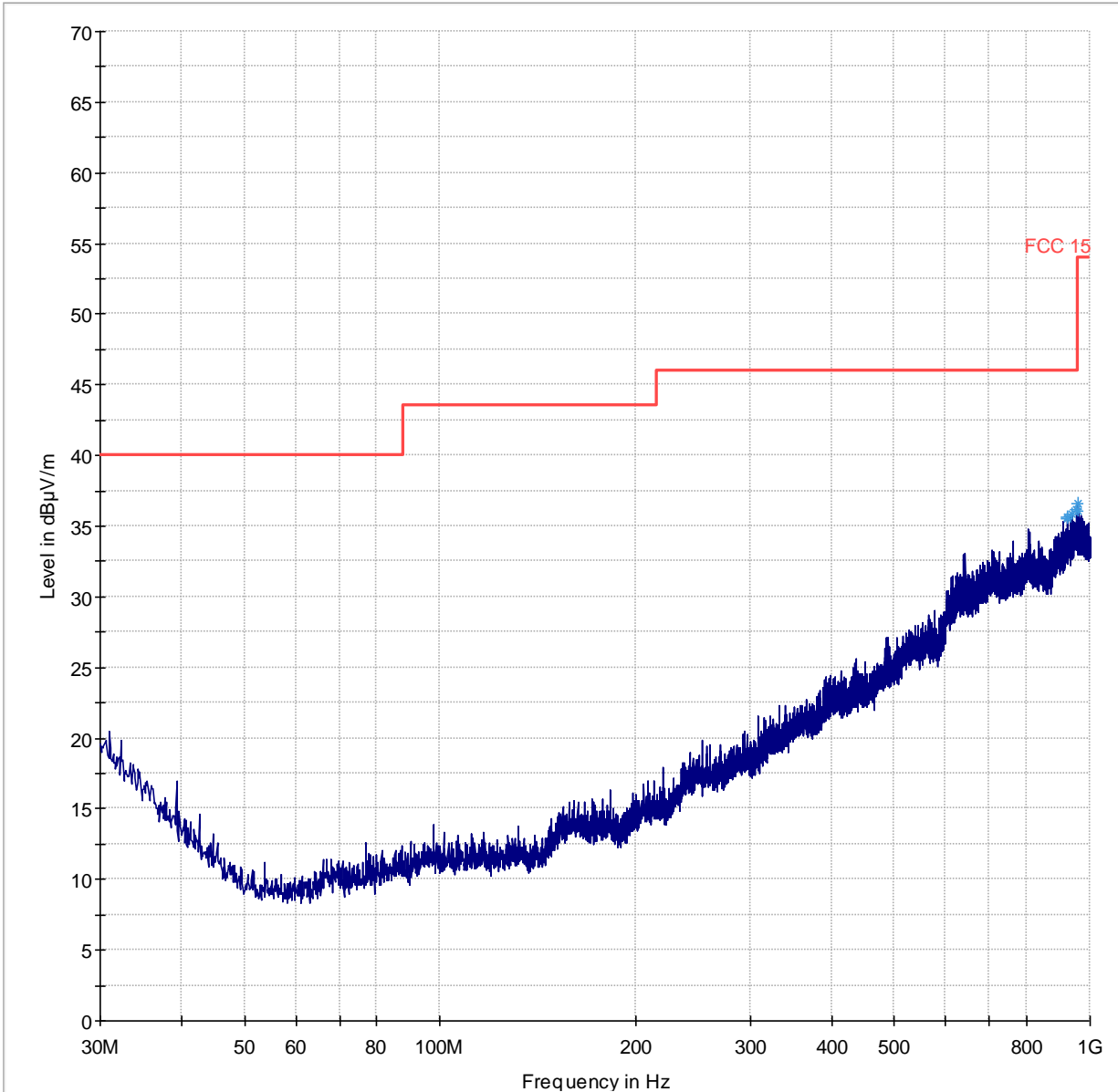
Preview Result 1-PK+

Final Result 1-PK+

## Plot #5 Radiated Emissions: 30 MHz – 1GHz

Modulation: BT LE

Channel: Mid

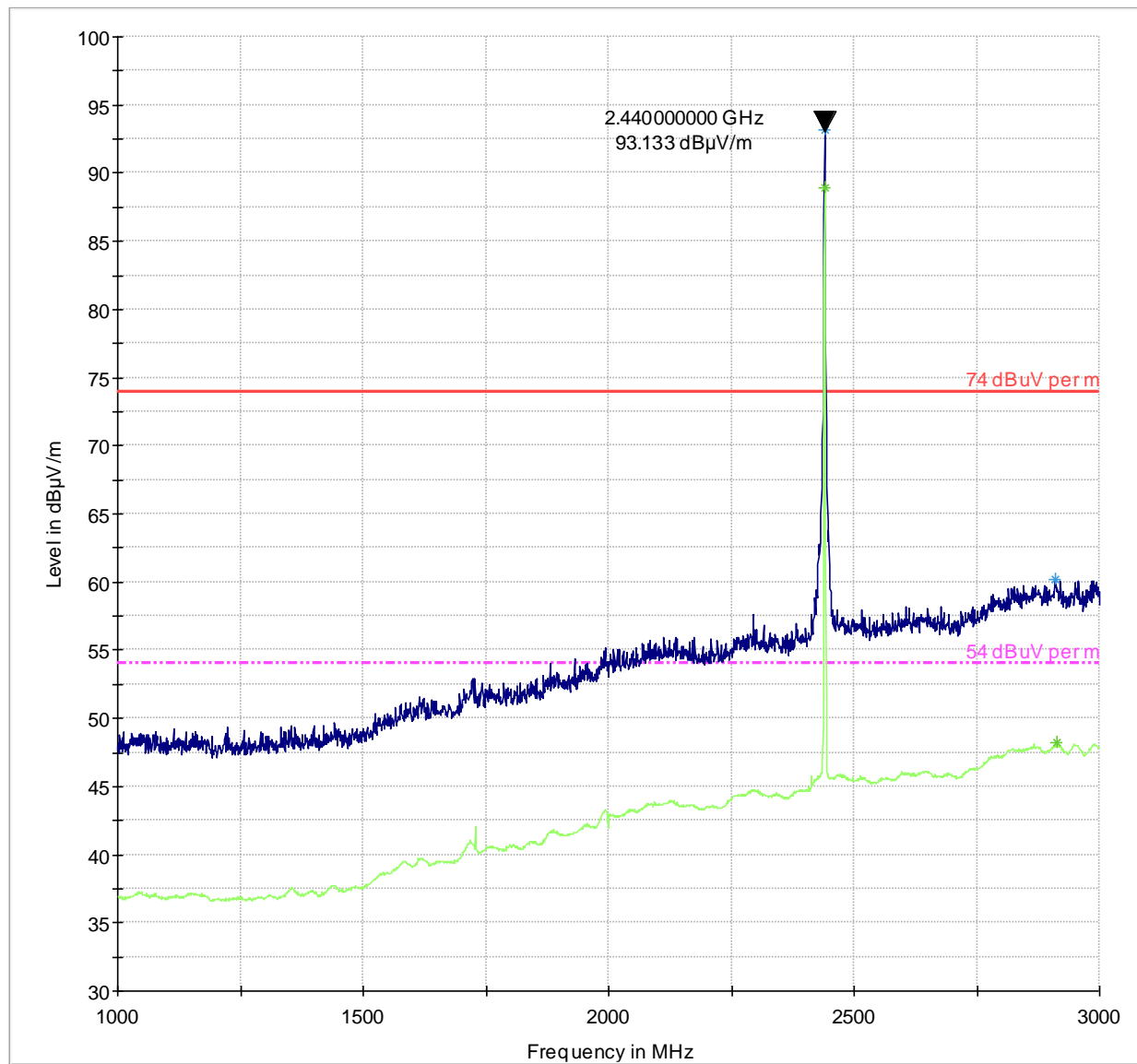


— FCC 15 — Preview Result 1-PK+ \* Data Reduction Result 1 [2]-PK+

## Plot #6 Radiated Emissions: 1-3 GHz

Modulation: BT LE

Channel: Mid

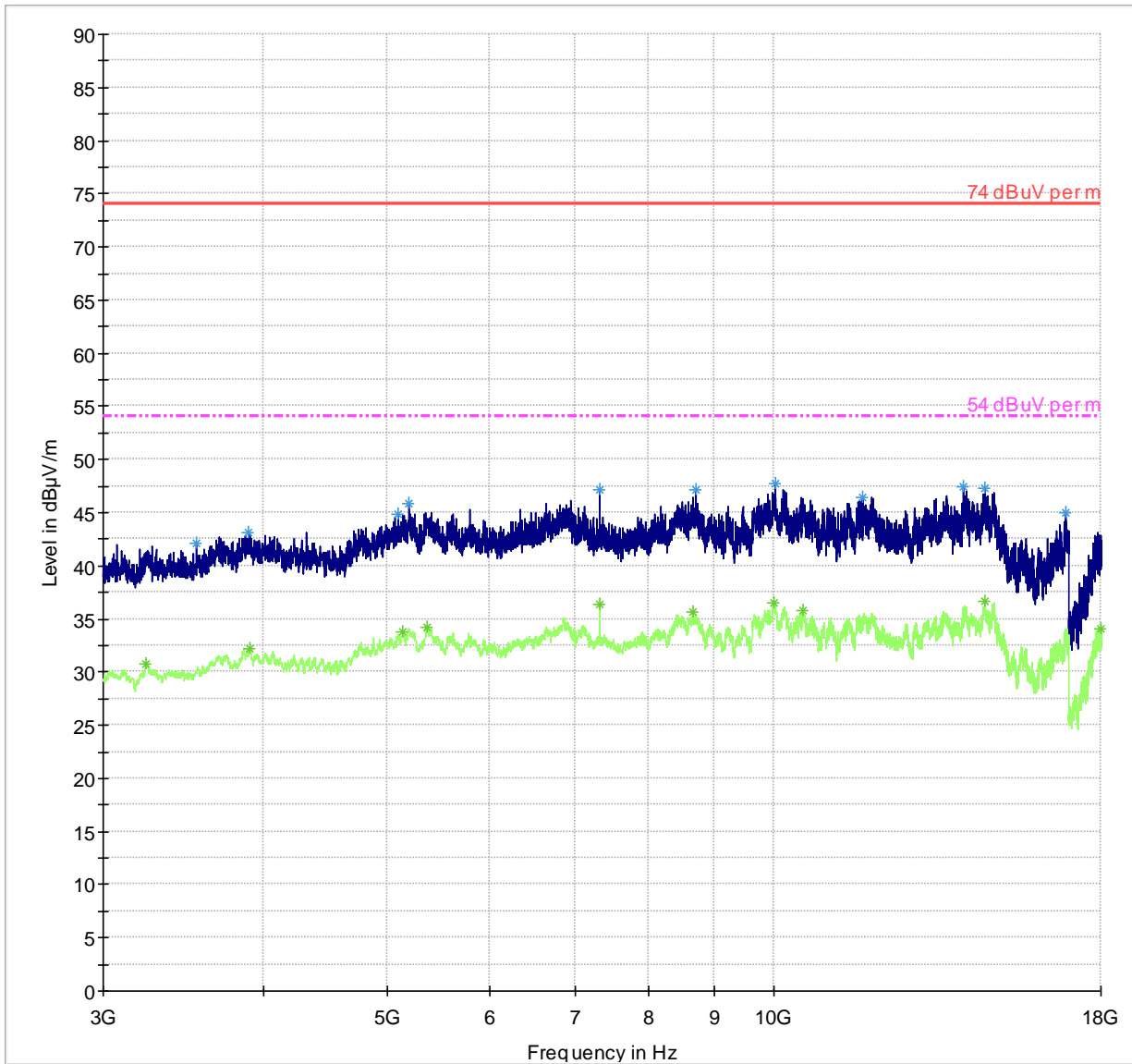


— 74 dBuV per m	- - - 54 dBuV per m
— Preview Result 1-PK+	— Preview Result 2-RMS
* Data Reduction Result 1 [4]-PK+	* Data Reduction Result 2 [4]-RMS

## Plot #7 Radiated Emissions: 3-18 GHz

Modulation: BT LE

Channel: Mid

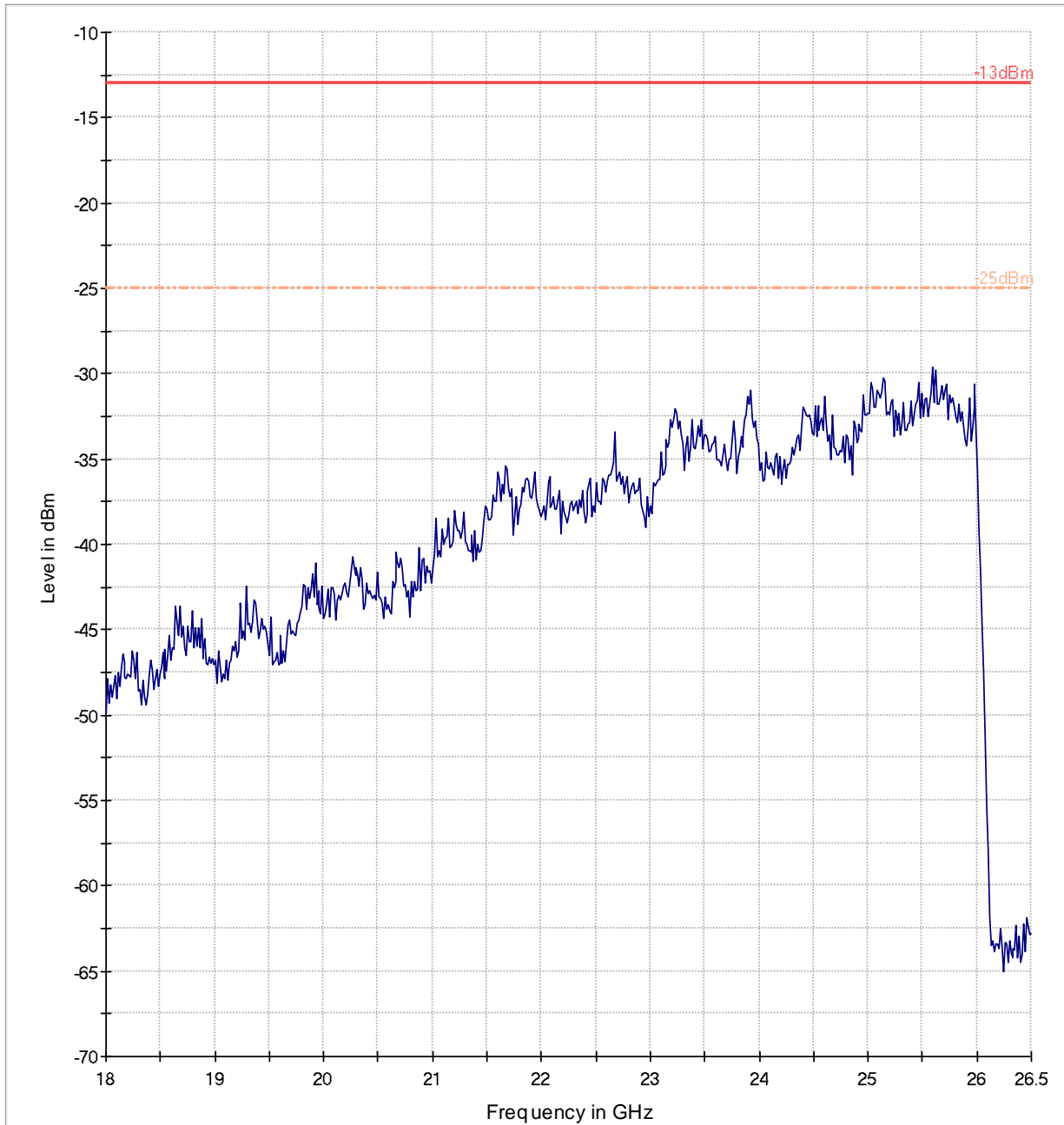


—	74 dBuV per m	- - - - -	54 dBuV per m
—	Preview Result 1-PK+	—	Preview Result 2-RMS
*	Data Reduction Result 1 [5]-PK+	*	Data Reduction Result 2 [5]-RMS

## Plot #8 Radiated Emissions: 18-26 GHz

Modulation: BT LE

Channel: Mid

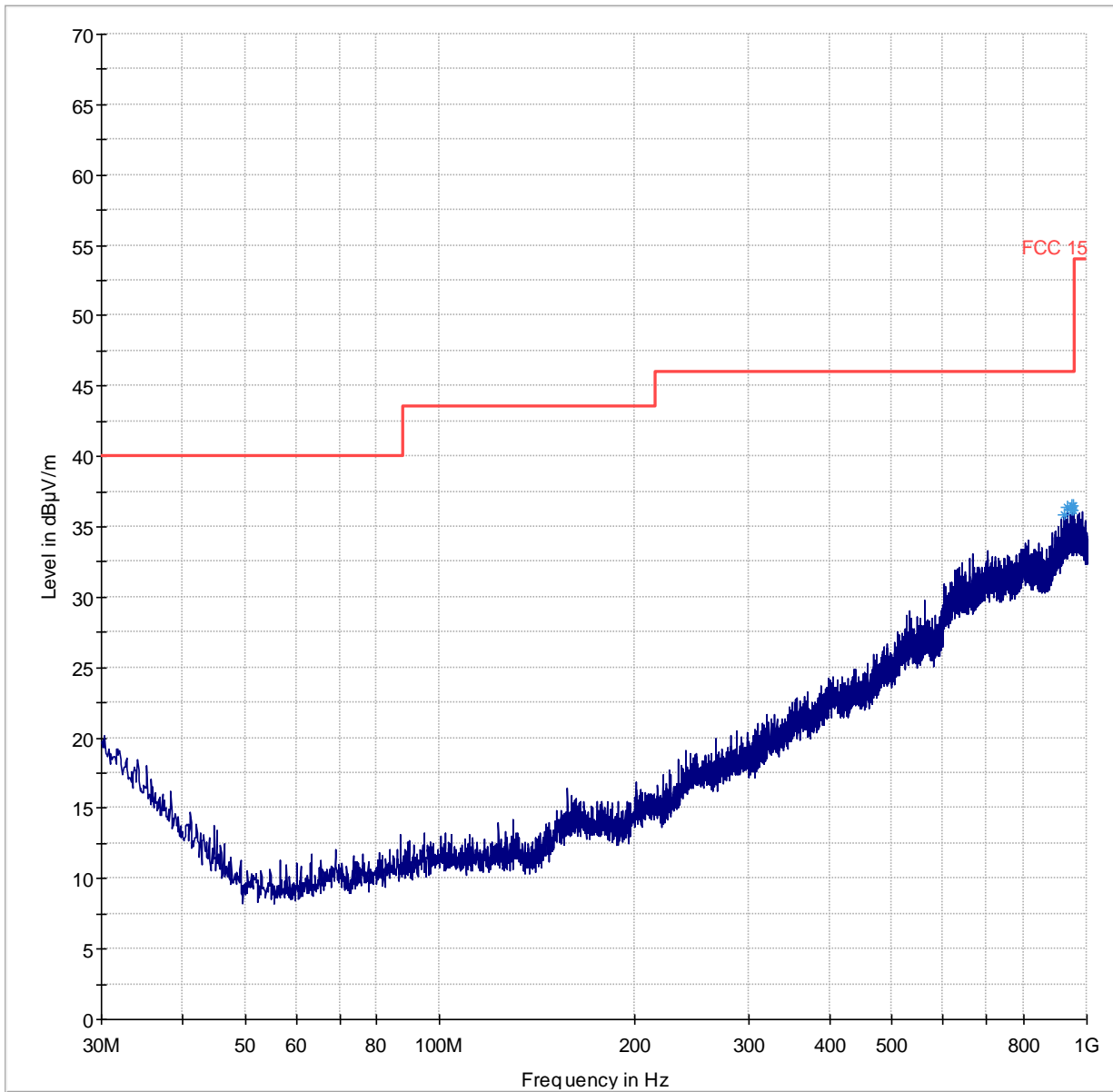


— -13dBm    - - - -25dBm.LimitLine    — Preview Result 1-PK+

## Plot #9 Radiated Emissions: 30 MHz – 1GHz

Modulation: BT LE

Channel: High



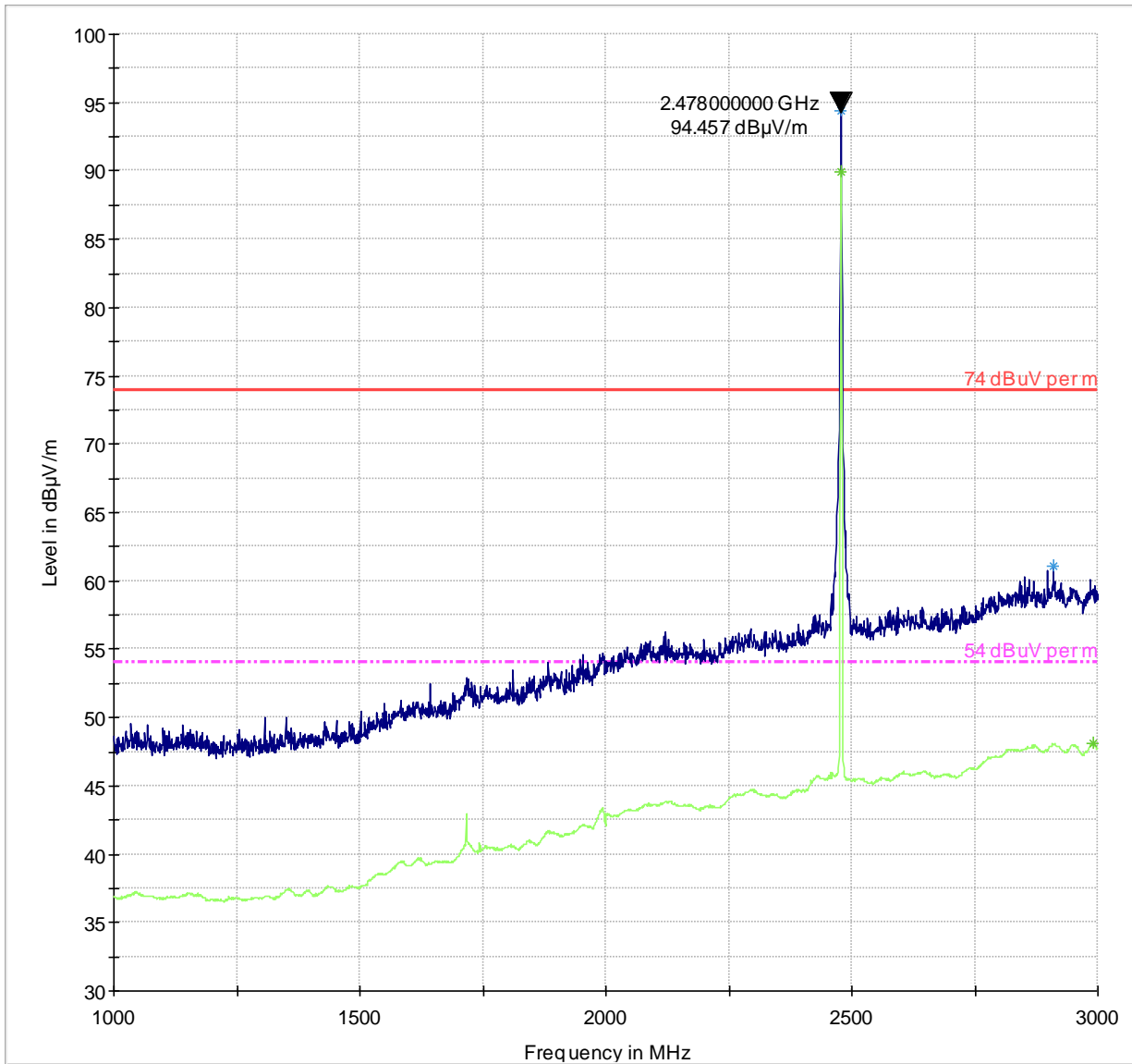
— FCC 15      — Preview Result 1-PK+      \* Data Reduction Result 1 [2]-PK+



## Plot # 10 Radiated Emissions: 1-3 GHz and Restricted Bands

Modulation: BT LE

Channel: High

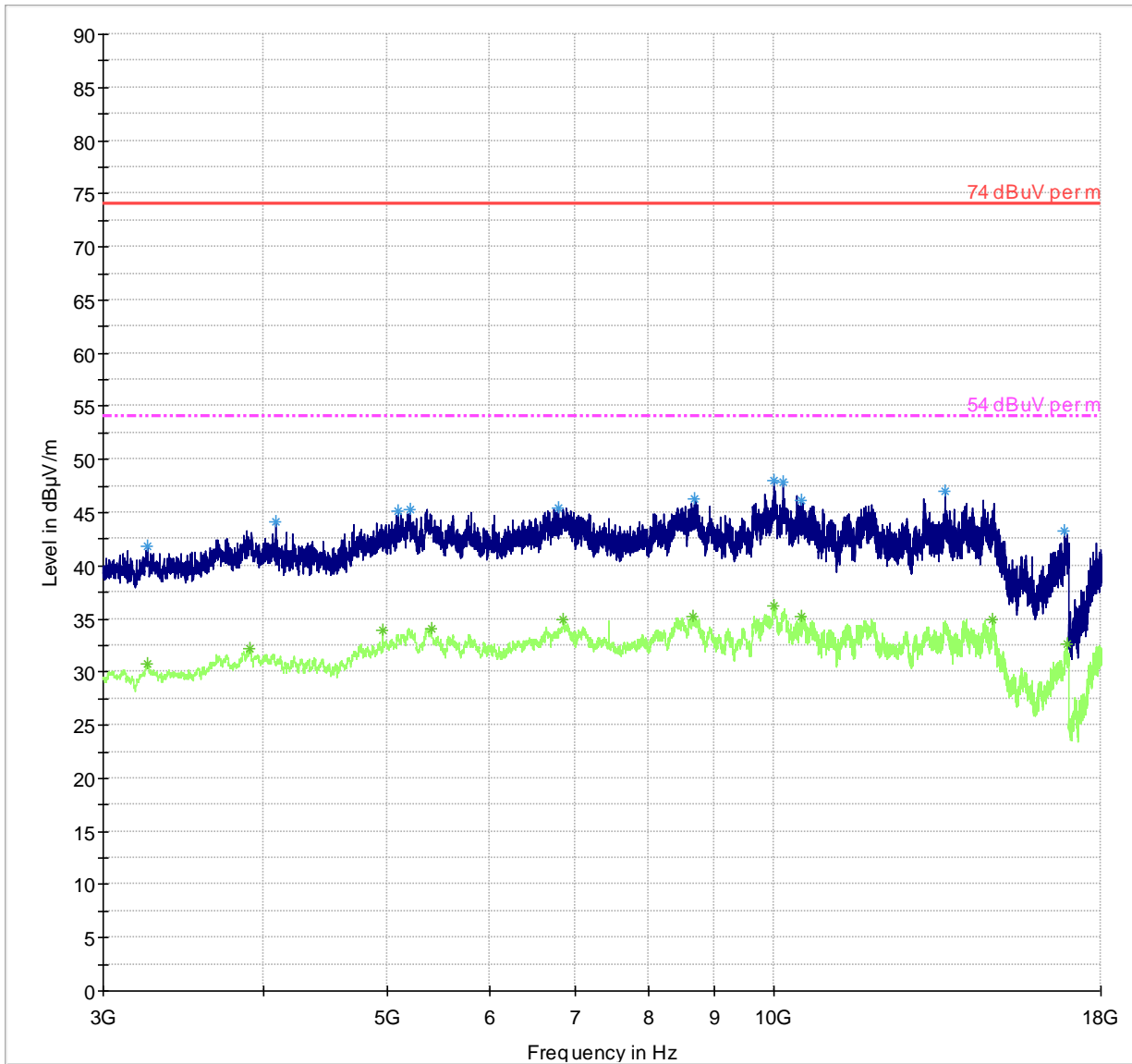


— 74 dBuV per m	- - - 54 dBuV per m
— Preview Result 1-PK+	— Preview Result 2-RMS
* Data Reduction Result 1 [4]-PK+	* Data Reduction Result 2 [4]-RMS

## Plot #11 Radiated Emissions: 3-18 GHz

Modulation: GFSK

Channel: High



— 74 dBuV per m	- - - 54 dBuV per m
— Preview Result 1-PK+	— Preview Result 2-RMS
* Data Reduction Result 1 [5]-PK+	* Data Reduction Result 2 [5]-RMS

## 9 Test setup photos

Setup photos are included in supporting file name: "EMC\_IRHYT-008-17001\_15.247\_DTS\_PATCH\_Setup\_Photos.pdf"

## 10 Test Equipment And Ancillaries Used For Testing

Item Name	Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
Antenna Biconilog 3142E	Biconlog Antenna	EMCO	3142E	166067	3 years	6/14/2014
Antenna Horn 3115 SN 35111	Horn Antenna	EMCO	3115	35111	3 years	7/24/2015
Antenna Horn 3116	Horn Antenna	ETS Lindgren	3116	70497	3 years	7/22/2015
Digital Barometer	Compact Digital Barometer	Control Company	35519-055	91119547	2 Years	4/7/2015
FSU26	Spectrum Analyzer	R&S	FSU26	200065	3 years	7/4/2015
FSU26	Spectrum Analyzer	R&S	FSU26	200302	3 years	7/4/2015
Thermometer Humidity TM320	Thermometer Humidity	Dickson	AY1072	0528	1 Year	11/2/2016

Note:

1. Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.
2. Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.

**11 Revision History**

<b>Date</b>	<b>Report Name</b>	<b>Changes to report</b>	<b>Report prepared by</b>
2017-04-25	EMC_IRHYT-008-17001_15.247_DTS_PATCH	Initial Version	Cindy Li