

	 <b>MS ISO/IEC 17025</b> <b>TESTING</b> <b>SAMM No. 0825</b>																																					
<p><b>MOTOROLA PENANG ADV. COMM. LABORATORY</b>  <b>Motorola Solutions Malaysia Sdn. Bhd.</b>  <b>Innoplex Plot 2A Medan Bayan Lepas,</b>  <b>Mukim 12, S.W.D. 11900 Bayan Lepas,</b>  <b>Penang, Malaysia.</b></p>	<p><b>FCC / ISED TEST REPORT</b>  <b>Report Revision : Rev.B</b></p>																																					
<table border="0"> <tr> <td><b>Date/s Tested</b></td> <td>: 17-May-2019 - 02-Jul-2019</td> <td rowspan="15" style="text-align: center; vertical-align: middle;">  </td> </tr> <tr> <td><b>Report Issue Date</b></td> <td>: 02-Jul-2019</td> </tr> <tr> <td><b>Manufacturer/Location</b></td> <td>: Motorola Solutions - Penang</td> </tr> <tr> <td><b>Requestor</b></td> <td>: SZE KEAT NG</td> </tr> <tr> <td><b>Product Type</b></td> <td>: Portable</td> </tr> <tr> <td><b>Product Version (PMN)</b></td> <td>: APX6000</td> </tr> <tr> <td><b>Model Number (HVIN)</b></td> <td>: H98UCH9PW7BN</td> </tr> <tr> <td><b>Frequency Band</b></td> <td>: 2.402 - 2.480 GHz</td> </tr> <tr> <td><b>Rated / Max RF Output Power</b></td> <td>: 1.5 mWatts / 1.98 mWatts</td> </tr> <tr> <td><b>Applicant Name</b></td> <td>: Motorola Solution Malaysia Sdn Bhd</td> </tr> <tr> <td><b>Applicant Address</b></td> <td>: Innoplex Plot 2A, Medan Bayan lepas, Mukim 12, S.W.D. 11900 Bayan Lepas, Penang, Malaysia</td> </tr> <tr> <td><b>FCC Registrations</b></td> <td>: 461337</td> </tr> <tr> <td><b>ISED Registrations</b></td> <td>: 109AK</td> </tr> <tr> <td><b>Firmware Version (FVIN)</b></td> <td>: C23.22.46A</td> </tr> </table> <p><b>The equipment was tested accordance to the requirement listed below:</b></p> <table border="0" style="width: 100%;"> <tr> <td style="width: 60%;"><b>(2.4GHz BT LE )</b></td> <td style="text-align: center;"><b>PASS</b></td> </tr> <tr> <td><b>47 CFR Part 15C</b></td> <td></td> </tr> <tr> <td><b>ISED RSS 247 Issue 2</b></td> <td></td> </tr> <tr> <td><b>February 2017</b></td> <td></td> </tr> </table>		<b>Date/s Tested</b>	: 17-May-2019 - 02-Jul-2019		<b>Report Issue Date</b>	: 02-Jul-2019	<b>Manufacturer/Location</b>	: Motorola Solutions - Penang	<b>Requestor</b>	: SZE KEAT NG	<b>Product Type</b>	: Portable	<b>Product Version (PMN)</b>	: APX6000	<b>Model Number (HVIN)</b>	: H98UCH9PW7BN	<b>Frequency Band</b>	: 2.402 - 2.480 GHz	<b>Rated / Max RF Output Power</b>	: 1.5 mWatts / 1.98 mWatts	<b>Applicant Name</b>	: Motorola Solution Malaysia Sdn Bhd	<b>Applicant Address</b>	: Innoplex Plot 2A, Medan Bayan lepas, Mukim 12, S.W.D. 11900 Bayan Lepas, Penang, Malaysia	<b>FCC Registrations</b>	: 461337	<b>ISED Registrations</b>	: 109AK	<b>Firmware Version (FVIN)</b>	: C23.22.46A	<b>(2.4GHz BT LE )</b>	<b>PASS</b>	<b>47 CFR Part 15C</b>		<b>ISED RSS 247 Issue 2</b>		<b>February 2017</b>	
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<p>Prepared By:</p> <p>_____</p> <p><b>Gan Boon Teong</b>  <b>Test Personnel</b></p>	<p>Approved By:</p> <p>_____</p> <p><b>Vincent Foong Chuen Kit</b>  <b>Deputy Technical Manager</b></p>																																					

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### REVISION HISTORY

Revision History	Description	Date	Originator
Rev. A	Initial Report	<b>02-Jul-2019</b>	Gan Boon Teong
Rev. B	Amend 6.6 table height	<b>12-Sep-2019</b>	Vincent Foong

## 1.0 General Information

### EUT Description:

<b>Technologies</b>	2.4GHz BT LE
<b>TX Frequency range</b>	2402MHz – 2480MHz
<b>Modulation Type</b>	GFSK
<b>Antenna type</b>	INTERNAL BT/WLAN ANTENNA

The EUT contains following accessory devices and data cable:

<b>Item</b>	<b>Brand</b>	<b>Model or P/N</b>
BATT IMPRES 2 LIION R IP68 4850T	MOTOROLA	PMNN4487A
PROGRAMMING, TEST & ALIGNMENT CABLE	MOTOROLA	PMKN4013C
7-800/GPS STUBBY Antenna	MOTOROLA	NAF5085A

Channel number and frequency information:

40 channels are provided to this EUT:

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

### General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, the EUT is to comply with the requirements of the following standards:

**FCC 47 CFR Part 15 Subpart C**  
**KDB 558074 D01 15.247 Meas Guidance v05**  
**ANSI C63.10-2013**

No modifications were done to the UUT to facilitate the tests in this report.

### Deviation from standard

Not applicable as no deviation from standard test method

## 2.0 Summary of Test Results

FCC Clause	ISED Clause	Test Item	Result	Remark	Serial number tested
15.247 (a)(2)	RSS 247 5.2 (a)	DTS & 99% Channel Bandwidth	Pass	Highest 99% OCB: 1.056 MHz (1M06F1D)	765TVH3156
15.247 (b)(3)	RSS 247 5.4 (d)	Conducted RF Output Power (Average)	Pass	Highest output power: 2.541 dBm	765TVH3156
15.247(e)	RSS 247 5.2 (b)	Maximum Peak Power Spectral Density	Pass	Meet the limit requirement.	765TVH3156
15.247 (d)	RSS-247 5.5	Band-Edge Conducted Spurious Emission	Pass	Worst case emission: -42.55 dBm	765TVH3156
15.247 (b)	RSS-247 5.5	Conducted Spurious Emission	Pass	Worst case emission: -39.42 dBm	765TVH3156
15.205, 15.209, 15.247 (d)	RSS247 5.5	Radiated Emission within Restricted Bands	Pass	Meet the limit requirement.	765TVH3176
15.207	RSS-Gen 8.8	AC Power Line Conducted Spurious Emission	NA	NA	NA
15.203	-	Antenna Requirement	NA	Internal antenna is not accessible to the end-user	NA

## 3.0. Measurement Uncertainty

Measurement	Frequency	Expanded Uncertainty (k=1.96) (±dB)
AC Power Line Conducted Spurious Emission	150KHz ~ 30MHz	3.43
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	5.01
	200MHz ~ 1000MHz	5.01
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.01
	18GHz ~ 25GHz	5.01

#### 4.0 Equipment List

##### Bluetooth ATE # 1 (SW Version: Ate Main\_3.1.10\_R2)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
POWER SUPPLY ( 0-20V / 0-25A )	6652A	MY40001437	17-Aug-17	17-Aug-19
SPECTRUM ANALYZER	FSEK30	838495/014	11-Jul-18	11-Jul-19
STEP ATTENUATOR	RSC	102218	Not Required	Not Required
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	154549	8-May-18	8-May-20
SPECTRUM ANALYZER	E4443A	MY46181974	9-Aug-18	9-Aug-20
SIGNAL GENERATOR	IFR 2042	203002/961	13-Mar-19	13-Mar-20

##### Radiated Emission Station (SW Version: EMC FCC RE v1.5.2)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
DRG HORN FREQ.	SAS-571	719	18-Jul-17	18-Jul-19
DRG HORN FREQ.	SAS-571	1143	14-Feb-19	14-Feb-21
POWER SUPPLY	N7977A	MY54420135	18-Jun-19	18-Jun-20
SIGNAL GENERATOR	SMB 100A	181117	8-Nov-18	8-Nov-21
EMI TEST RECEIVER	ESW44	101750	25-Jun-18	25-Sep-19
5m Semi-anechoic Chamber	S800-HX	J2308	Not Required	Not Required
BILOG ANTENNA	CBL6112D	30991	23-Apr-18	23-Jul-19
BILOG ANTENNA	CBL6112B	2964	16-Feb-18	16-Feb-20
DATA LOGGER	SDL500	A.016800	19-Mar-19	18-Mar-20
SYSTEM CONTROLLER	SC104V	050806-1	Not Required	Not Required
TURNTABLE FLUSH MOUNT 2M	FM2011	NA	Not Required	Not Required
ANTENNA POSITIONING TOWER	TLT2	NA	Not Required	Not Required
BROAD-BAND HORN ANTENNA	BBHA9170	BBHA9170255	21-Dec-18	21-Dec-19
18 - 40GHz PREAMPLIFIER	Hi Gain Succ	1	Not Required	Not Required
PREAMPLIFIER	PAM-0118P	361	Not Required	Not Required
LOOP ANTENNA	6502	208416	17-Aug-18	17-Aug-19

### 5.0 Test Mode Applicability and Test Channel Detail

#### **Radiated Emission Test (Above 1GHz)**

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

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Environmental Conditions
Test Mode	0 to 39	0,19,39	GFSK	23.5°C, 69.6%RH

#### **Radiated Emission Test (Below 1GHz)**

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

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Environmental Conditions
Test Mode	0 to 39	0,19,39	GFSK	23.5°C, 69.6%RH

#### **Power Line Conducted Emission Test**

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

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Environmental Conditions
Application Mode	0 to 39	AUTO	AUTO	NA

#### **Antenna Port Conducted Measurement:**

This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

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

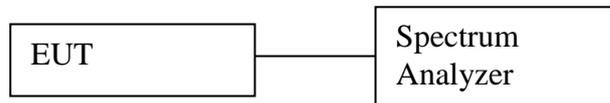
Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Environmental Conditions
Test Mode	0 to 39	0,19,39	GFSK	24.4°C, 61%RH

## 6.0 Transmitter Test Parameters

### 6.1 6dB Channel Bandwidth

#### 6.1.1 Test Setup



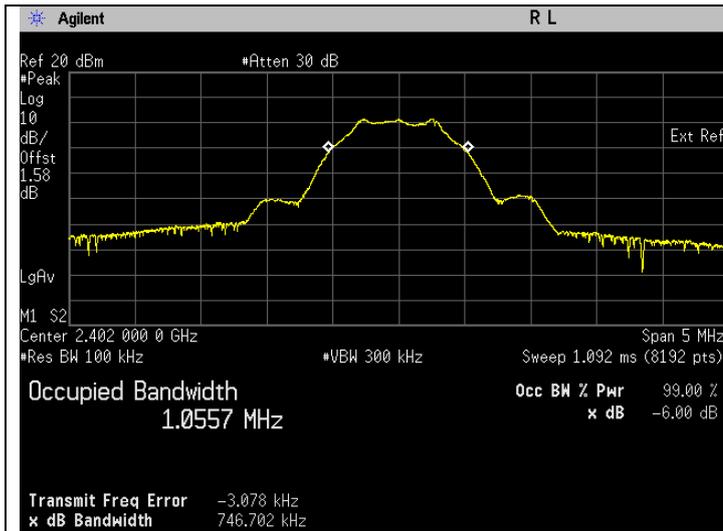
- 1) Check and ensure the spectrum analyzer well calibrate.
- 2) Turn on the DUT and set DUT to transmit maximum power.
- 3) Connect DUT's antenna terminal to spectrum analyzer with a low loss cable.
- 4) Setting of Spectrum analyzer :
  - a. RBW = 100 kHz
  - b. VBW = 300 kHz
  - c. Detector mode = Peak
  - d. Trace = Max hold
  - e. Sweep = auto
- 5) Measure the freq different of two frequencies that were attenuated 6dB from peak of the emission & record the frequency difference as the emission bandwidth.

#### 6.1.2 Test Limits:

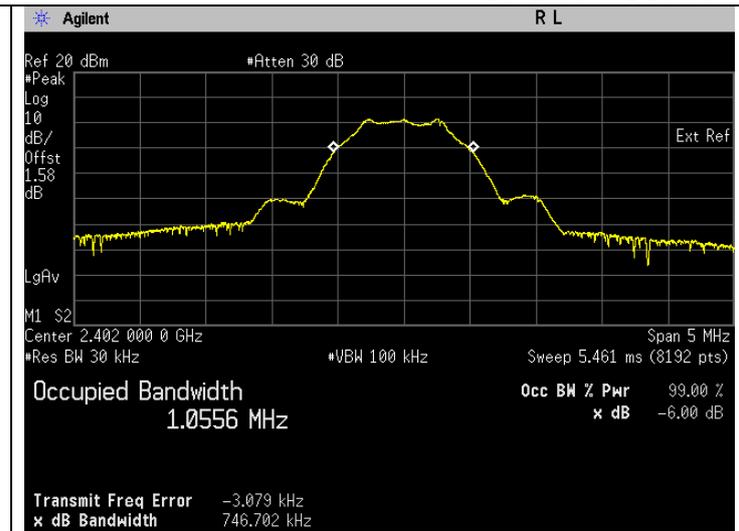
<b>Normal Condition (25 ° C)</b>
<b>≥500 kHz</b>

#### 6.1.3 Test Data:

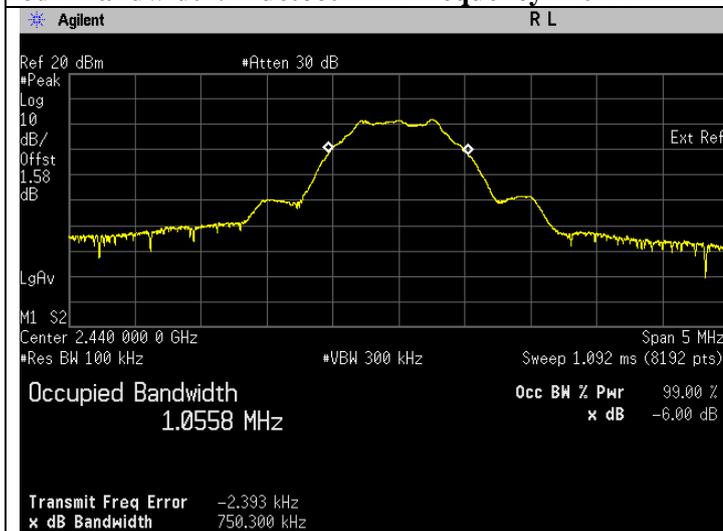
Test Conditions		Test Frequency	Results		
Standard	Modulation Type	Tx (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Status
Bluetooth L.E	GFSK	2402	0.747	1.056	Pass
Bluetooth L.E	GFSK	2440	0.750	1.056	Pass
Bluetooth L.E	GFSK	2480	0.748	1.055	Pass



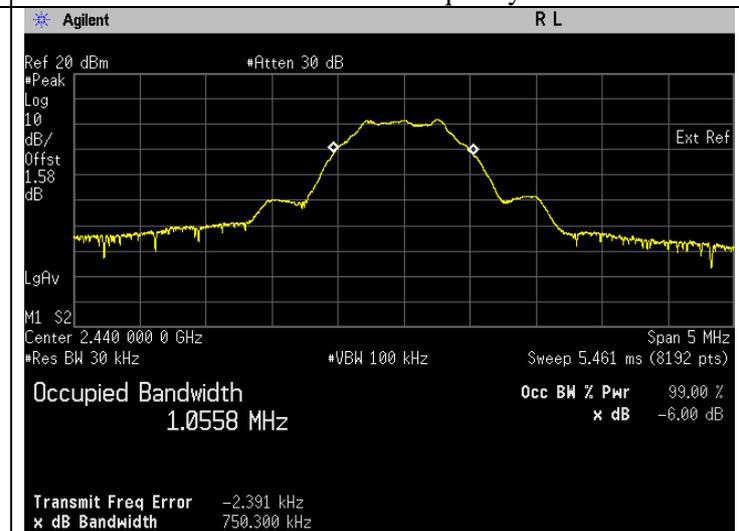
**6dB Bandwidth. Bluetooth LE Frequency 2402 MHz**



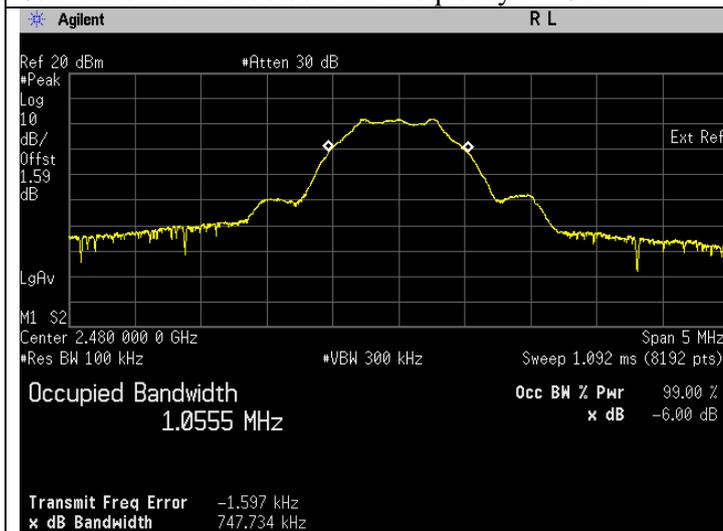
**99% Bandwidth. Bluetooth LE Frequency 2402 MHz**



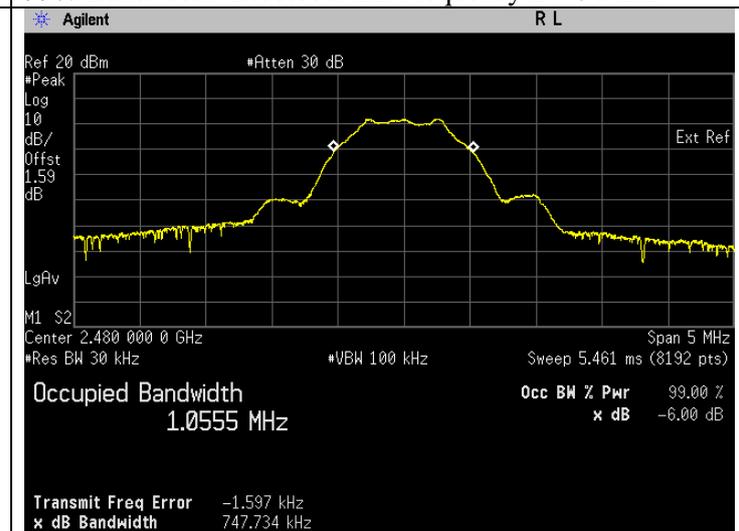
**6dB Bandwidth. Bluetooth LE Frequency 2440 MHz**



**99% Bandwidth. Bluetooth LE Frequency 2440 MHz**



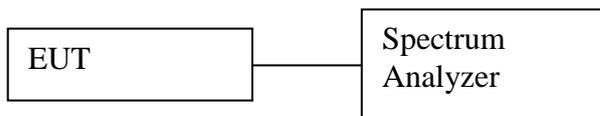
**6dB Bandwidth. Bluetooth LE Frequency 2480 MHz**



**99% Bandwidth. Bluetooth LE Frequency 2480 MHz**

## 6.2 Conducted RF Output Power

### 6.2.1 Test Setup



- 1) Check and ensure the spectrum analyzer well calibrate.
- 2) Turn on the DUT and set DUT to transmit maximum power.
- 3) Measure the duty cycle of transmitter output signal.
- 4) Setting of Spectrum analyzer :
  - a. Set the RBW = 300 kHz.
  - b. Set the VBW  $\geq [3 \times \text{RBW}]$ .
  - c. Set the span  $\geq [1.5 \times \text{OBW bandwidth}]$ .
  - d. Detector = average.
  - e. Sweep time = auto couple.
  - f. Trace mode = free run.
  - g. Allow trace to fully stabilize.
- 5) Add in duty cycle correction into final test result.
- 6) Duty cycle correction is calculated as below:  
 $10 \log (1/x)$

### 6.2.2 Test Limits:

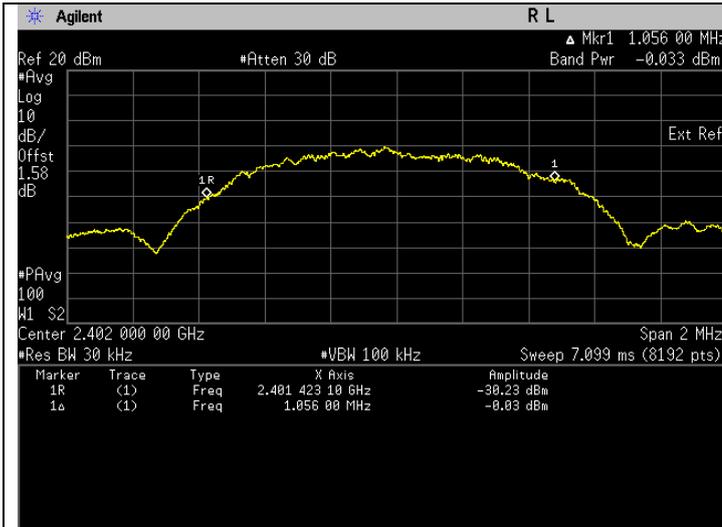
<b>Normal Condition (25 ° C)</b>
<b><math>\leq 1 \text{ Watt}(30 \text{ dBm})</math></b>

### 6.2.3 Test Data:

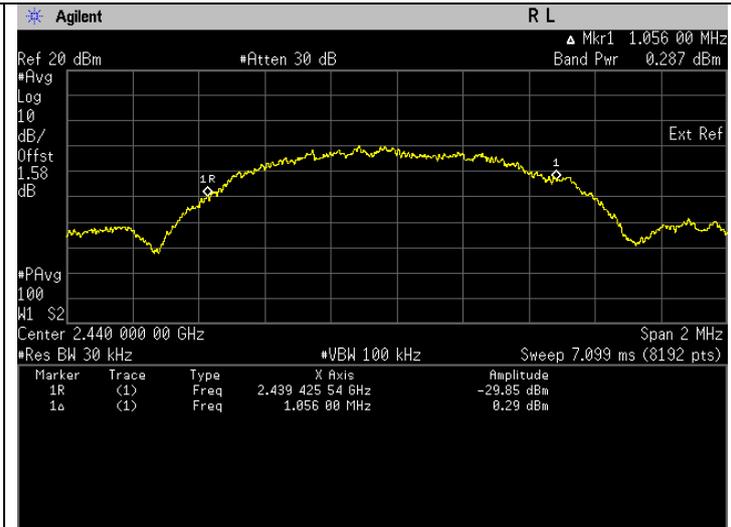
Output power = band power +duty cycle factor

Duty cycle factor =1.936dBm

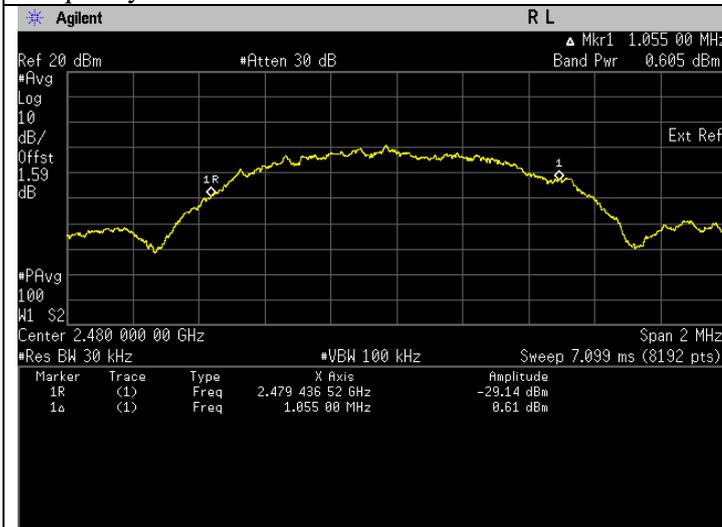
Test Conditions			Test Frequency	Results
Standard	Modulation Type	Tx (MHz)	Output Power (dBm)	Status
Bluetooth L.E	GFSK	2402	1.903	Pass
Bluetooth L.E	GFSK	2440	2.223	Pass
Bluetooth L.E	GFSK	2480	2.541	Pass



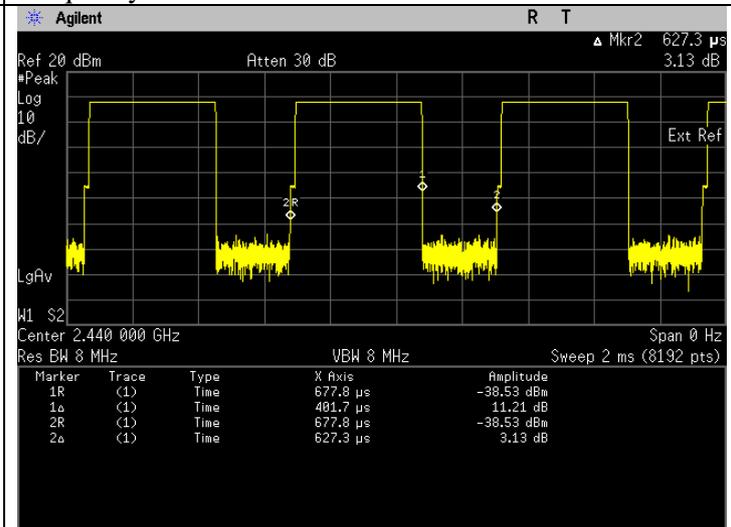
Frequency 2402 MHz



Frequency 2440 MHz



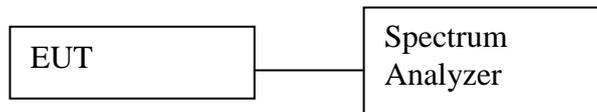
Frequency 2480 MHz



Duty Cycle

### 6.3 Maximum Peak Power Spectral Density

#### 6.3.1 Test Setup



##### Maximum Peak

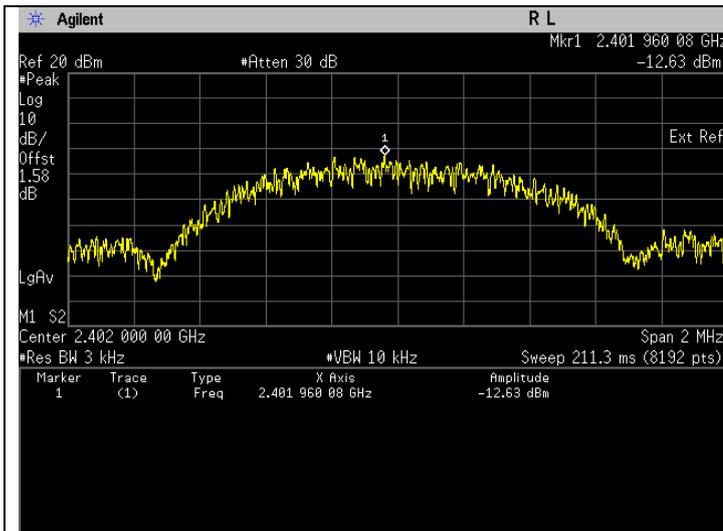
- 1) Check and ensure the spectrum analyzer well calibrate.
- 2) Turn on the DUT and set DUT to transmit maximum power.
- 3) Connect DUT's antenna terminal to spectrum analyzer with a low loss cable.
- 4) Setting of Spectrum analyzer :
  - a. Set analyzer center frequency to DTS channel center frequency.
  - b. Set the span to 1.5 times the DTS bandwidth.
  - c. Set the RBW to 3 kHz.
  - d. Set the VBW  $\geq [3 \times \text{RBW}]$ .
  - e. Detector = peak.
  - f. Sweep time = auto couple.
  - g. Trace mode = max hold.
  - h. Allow trace to fully stabilize.
  - i. Use the peak marker function to determine the maximum amplitude level within the RBW.
  - j. If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

#### 6.3.2 Test Limits:

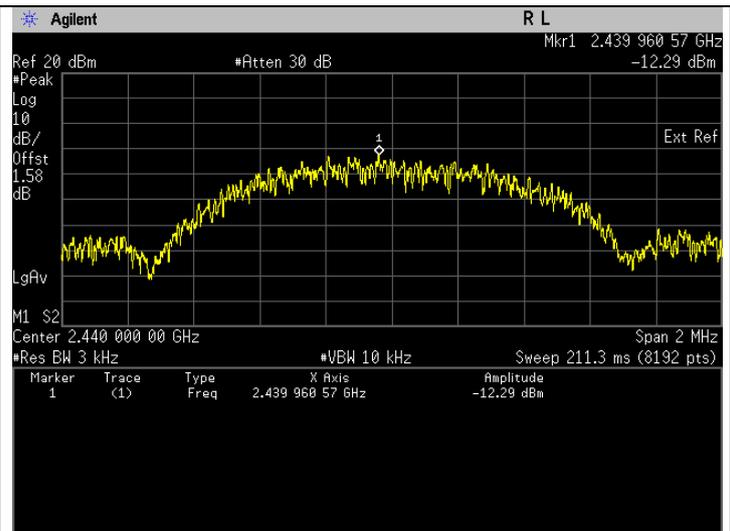
<b>Normal Condition (25 ° C)</b>
<b><math>\leq 8 \text{ dBm/3kHz}</math></b>

### 6.3.3 Test Result

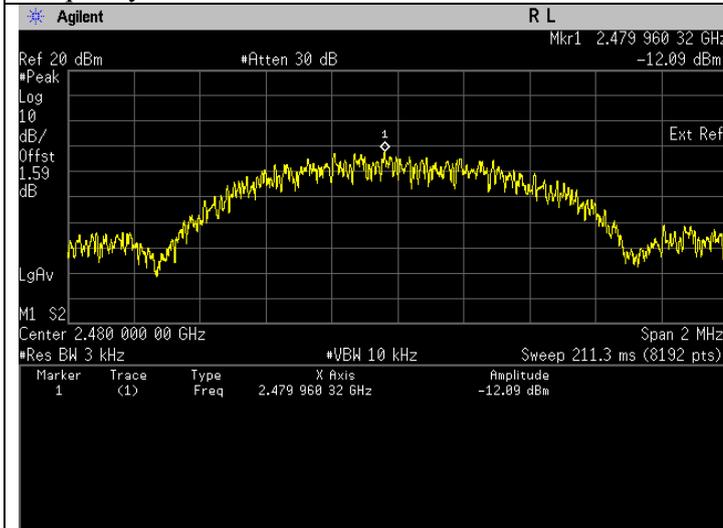
Test Conditions		Test Frequency	Results	
Standard	Modulation Type	Tx (MHz)	Power (dBm/3kHz)	Status
Bluetooth L.E.	GFSK	2402	-12.63	Pass
Bluetooth L.E.	GFSK	2440	-12.29	Pass
Bluetooth L.E.	GFSK	2480	-12.09	Pass



Maximum Power Spectral Density. Bluetooth LE  
 Frequency 2402 MHz



Maximum Power Spectral Density. Bluetooth LE  
 Frequency 2440 MHz



Maximum Power Spectral Density. Bluetooth LE  
 Frequency 2480 MHz

## 6.4 Conducted Spurious Emission

### 6.4.1 Test Setup



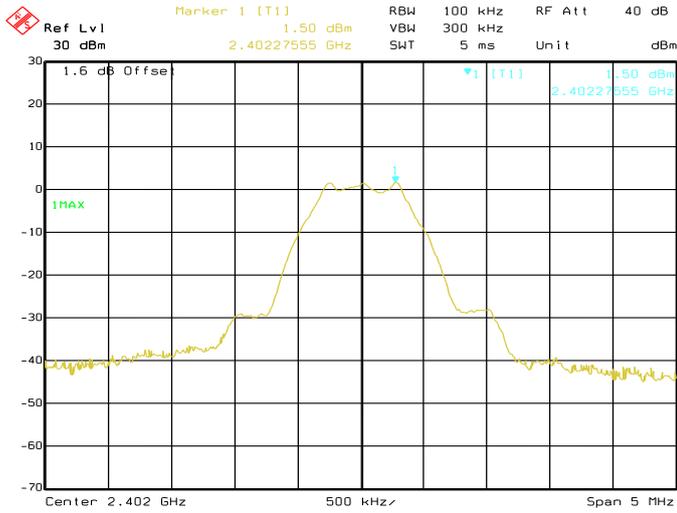
- 1) Check and ensure the spectrum analyzer well calibrate.
- 2) Turn on the DUT and set DUT to transmit maximum power.
- 3) Connect DUT's antenna terminal to spectrum analyzer with a low loss cable.
- 4) Setting of Spectrum analyzer :
  - a. RBW = 100 kHz
  - b. VBW = 300 kHz
  - c. Detector mode = Peak
  - d. Trace = Max Hold
  - e. Sweep = auto
- 5) Use the peak marker function to measure highest emission and scan up to 10<sup>th</sup> harmonic.

### 6.4.2 Test Limits:

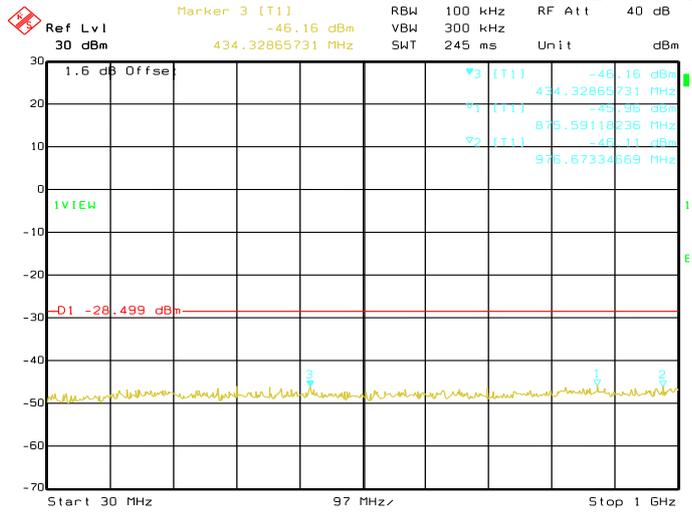
<b>Normal Condition (25 ° C)</b>
<b>Shall be at least 30 dB below peak (max) power.</b>

### 6.4.3 Test Result

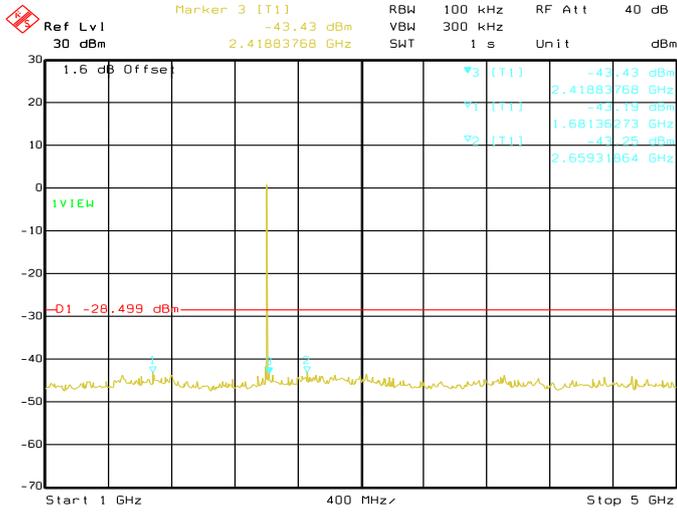
Test Conditions			Test Frequency	Results	
Standard	Modulation Type	Tx (MHz)	Spurs (MHz)	Level (dBm)	Status
Bluetooth L.E.	GFSK	2402	14188.38	-39.42	Pass
			15671.34	-41.00	Pass
			6683.37	-41.02	Pass
Bluetooth L.E.	GFSK	2440	14188.38	-39.87	Pass
			6713.43	-40.90	Pass
			6683.37	-41.11	Pass
Bluetooth L.E.	GFSK	2480	14188.38	-39.66	Pass
			22615.23	-41.03	Pass
			6663.33	-41.24	Pass



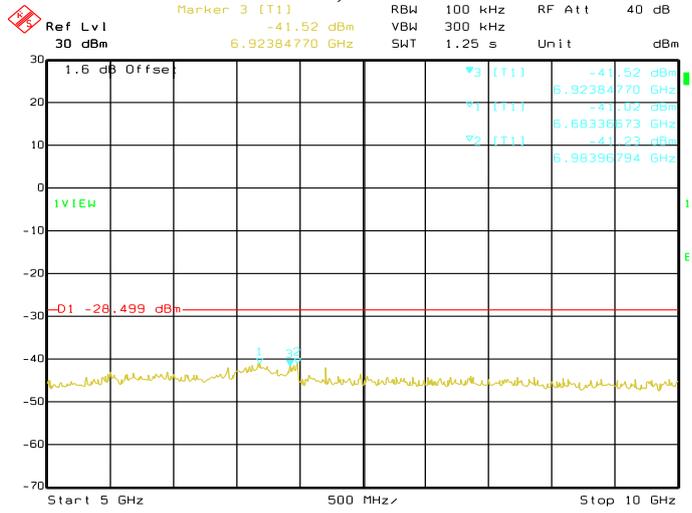
Date: 21.MAY 2019 07:53:14  
**Conducted Emissions. Bluetooth LE, Frequency**  
**2402 MHz Reference Level**



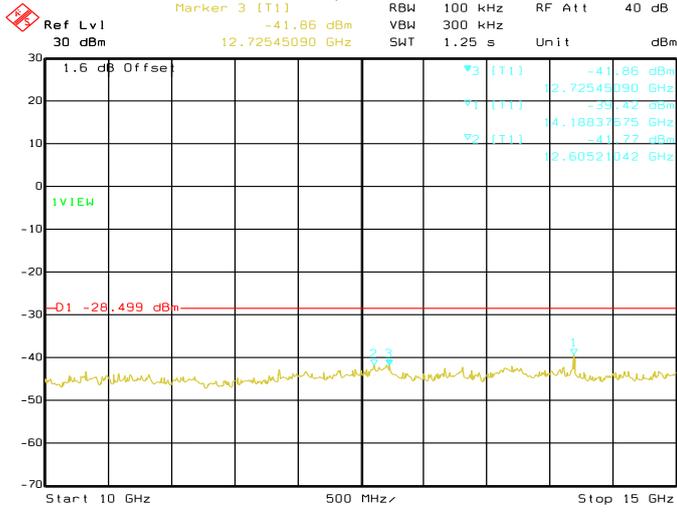
Date: 21.MAY 2019 07:54:09  
**Conducted Emissions. Bluetooth LE, Frequency**  
**2402 MHz Emission Level, 30 MHz -> 1 GHz**



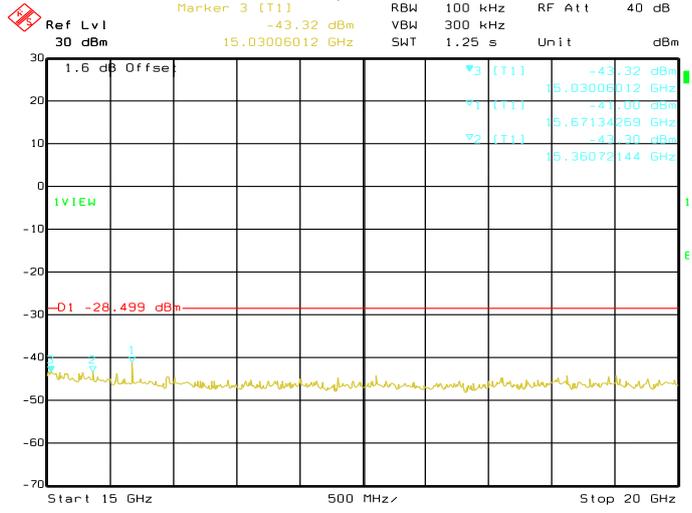
Date: 21.MAY 2019 07:55:02  
**Conducted Emissions. Bluetooth LE, Frequency**  
**2402 MHz Emission Level, 1 GHz -> 5 GHz**



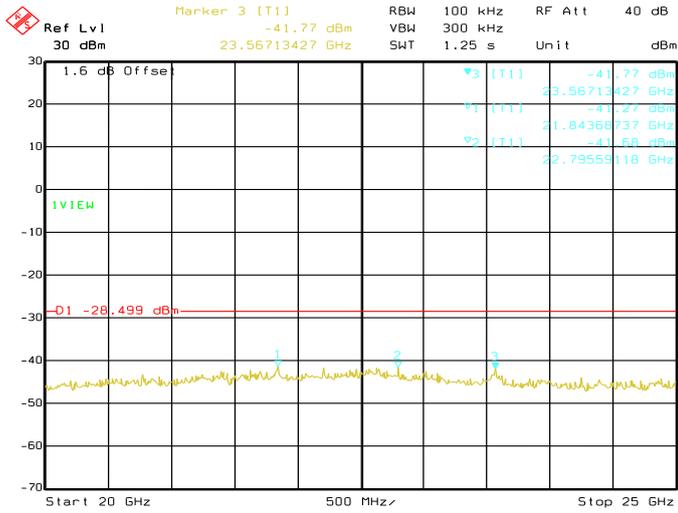
Date: 21.MAY 2019 07:55:56  
**Conducted Emissions. Bluetooth LE, Frequency**  
**2402 MHz Emission Level, 5 GHz -> 10 GHz**



Date: 21.MAY 2019 07:56:49  
**Conducted Emissions. Bluetooth LE, Frequency**  
**2402 MHz Emission Level, 10 GHz -> 15 GHz**

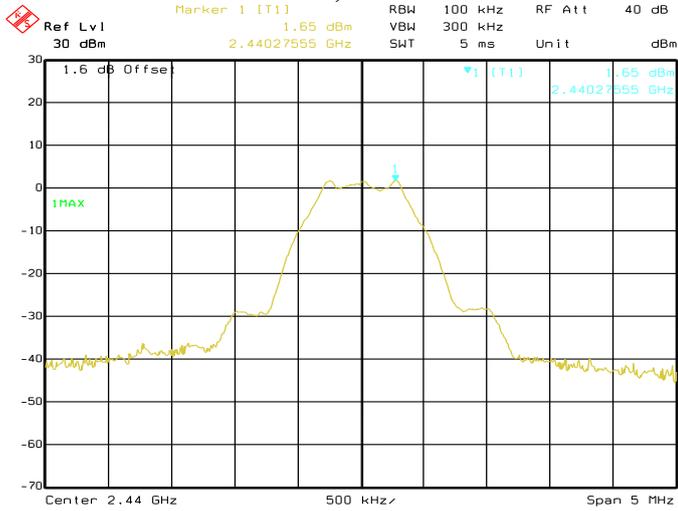


Date: 21.MAY 2019 07:57:42  
**Conducted Emissions. Bluetooth LE, Frequency**  
**2402 MHz Emission Level, 15 GHz -> 20 GHz**



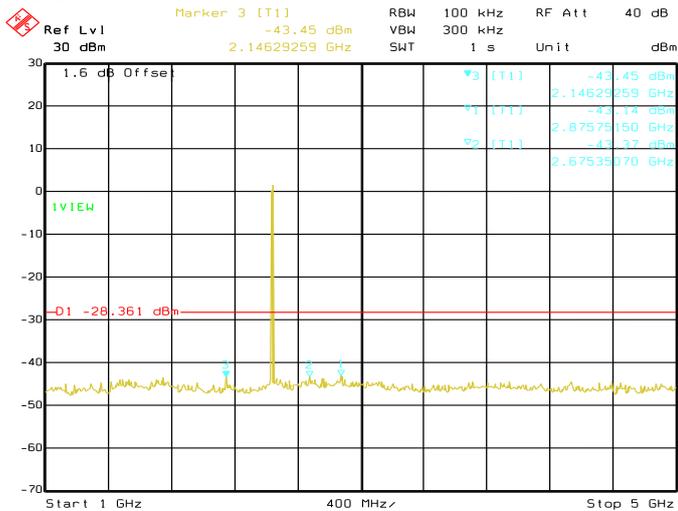
Date: 21.MAY 2019 07:58:35

**Conducted Emissions. Bluetooth LE, Frequency 2402 MHz Emission Level, 20 GHz -> 25 GHz**



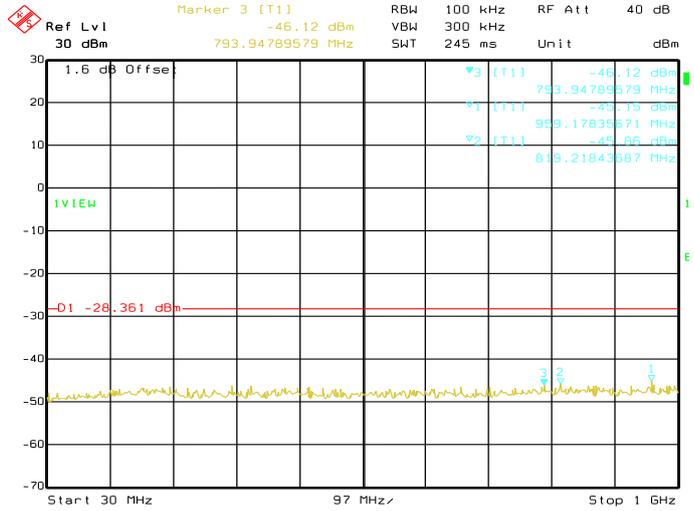
Date: 21.MAY 2019 14:12:27

**Conducted Emissions. Bluetooth LE, Frequency 2440 MHz Reference Level**



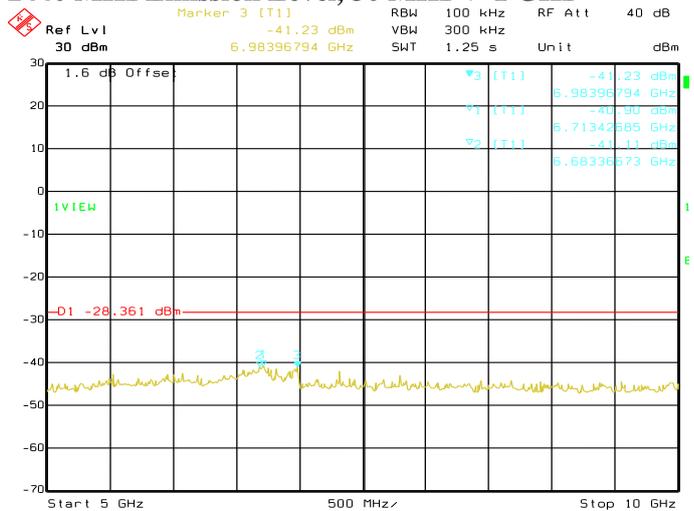
Date: 21.MAY 2019 14:14:15

**Conducted Emissions. Bluetooth LE, Frequency 2440 MHz Emission Level, 1 GHz -> 5 GHz**



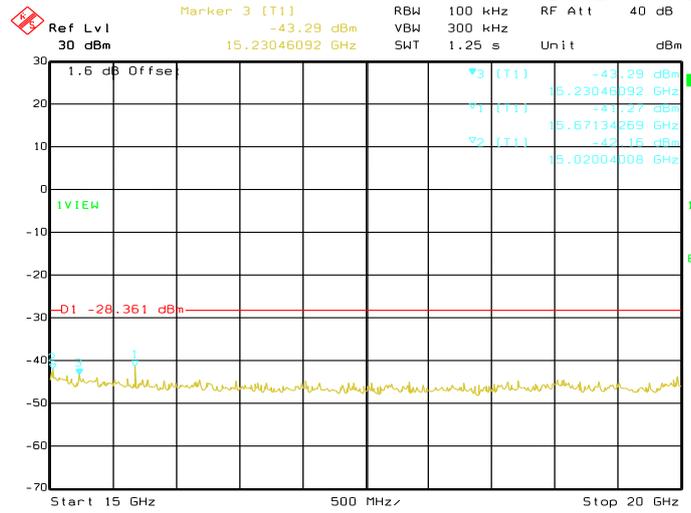
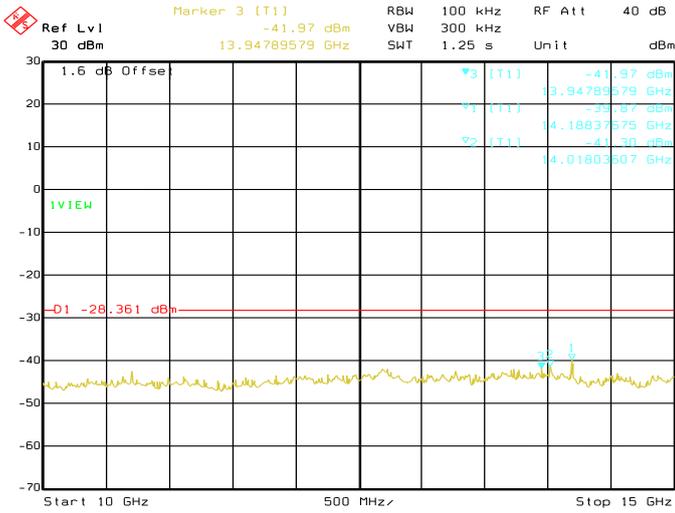
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**Conducted Emissions. Bluetooth LE, Frequency 2440 MHz Emission Level, 30 MHz -> 1 GHz**



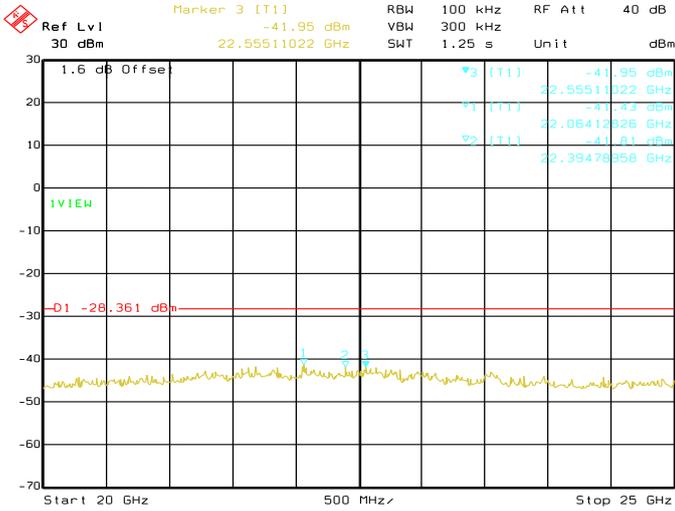
Date: 21.MAY 2019 14:15:08

**Conducted Emissions. Bluetooth LE, Frequency 2440 MHz Emission Level, 5 GHz -> 10 GHz**

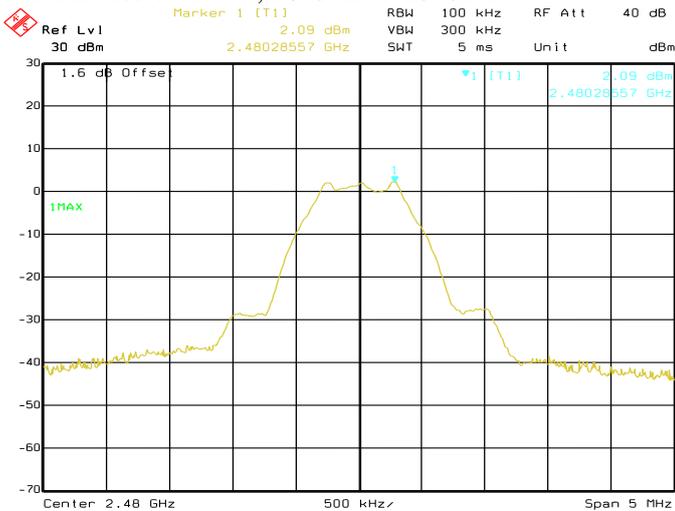


Date: 21.MAY 2019 14:16:02  
**Conducted Emissions. Bluetooth LE, Frequency 2440 MHz Emission Level, 10 GHz -> 15 GHz**

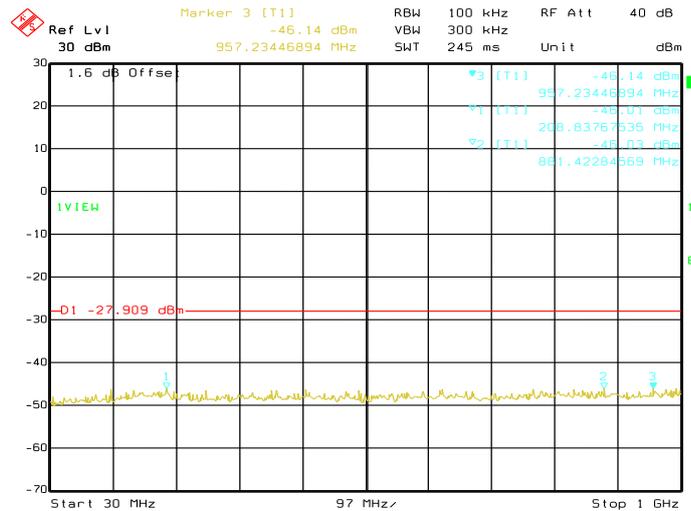
Date: 21.MAY 2019 14:17:05  
**Conducted Emissions. Bluetooth LE, Frequency 2440 MHz Emission Level, 15 GHz -> 20 GHz**



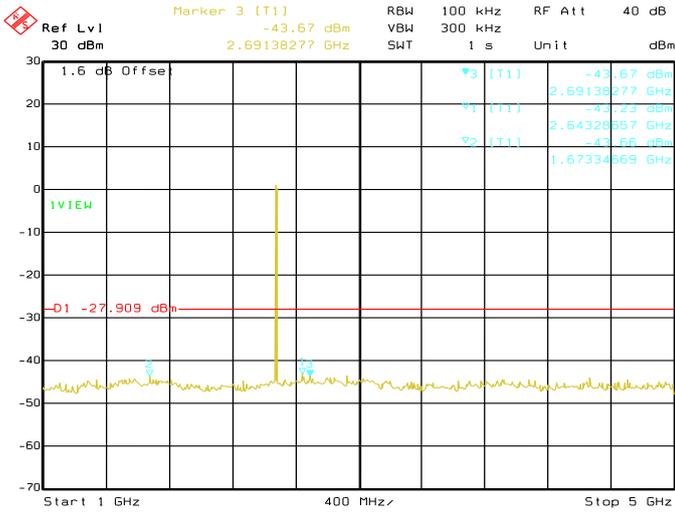
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**Conducted Emissions. Bluetooth LE, Frequency 2440 MHz Emission Level, 20 GHz -> 25 GHz**



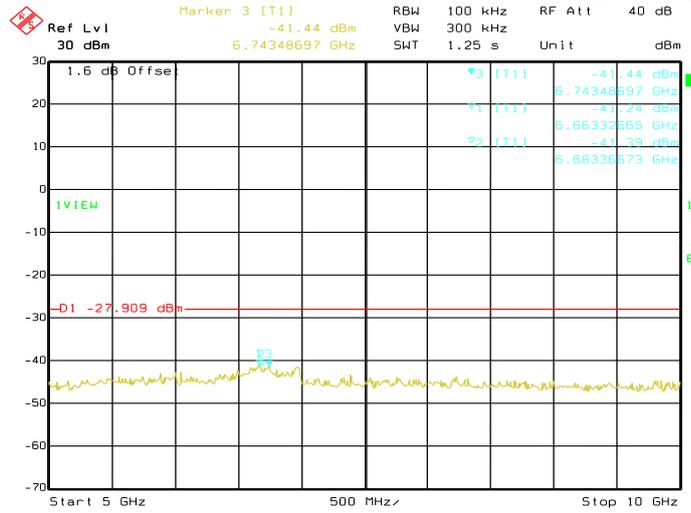
Date: 21.MAY 2019 08:07:00  
**Conducted Emissions. Bluetooth LE, Frequency 2480 MHz Reference Level**



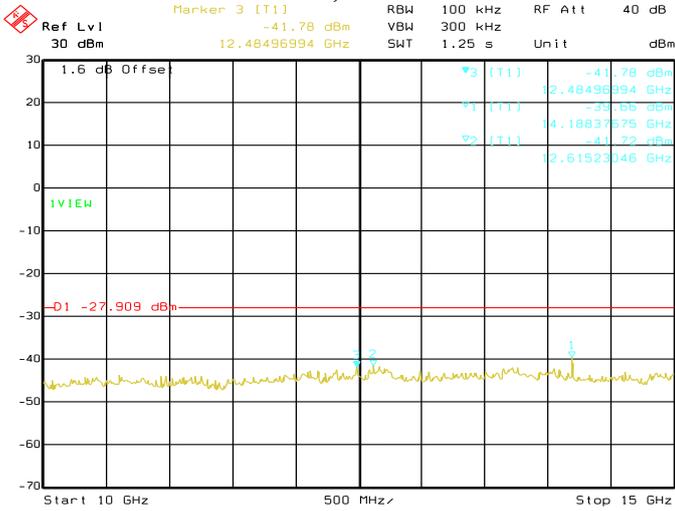
Date: 21.MAY 2019 08:07:53  
**Conducted Emissions. Bluetooth LE, Frequency 2480 MHz Emission Level, 30 MHz -> 1 GHz**



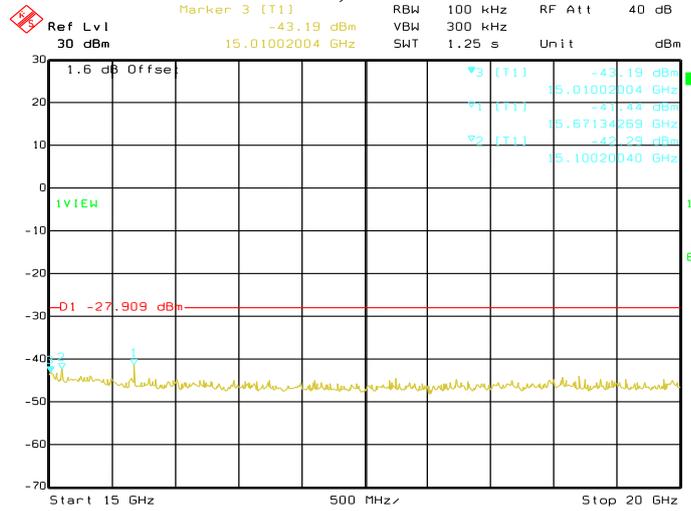
Date: 21.MAY 2019 08:08:48  
**Conducted Emissions. Bluetooth LE, Frequency**  
**2480 MHz Emission Level, 1 GHz -> 5 GHz**



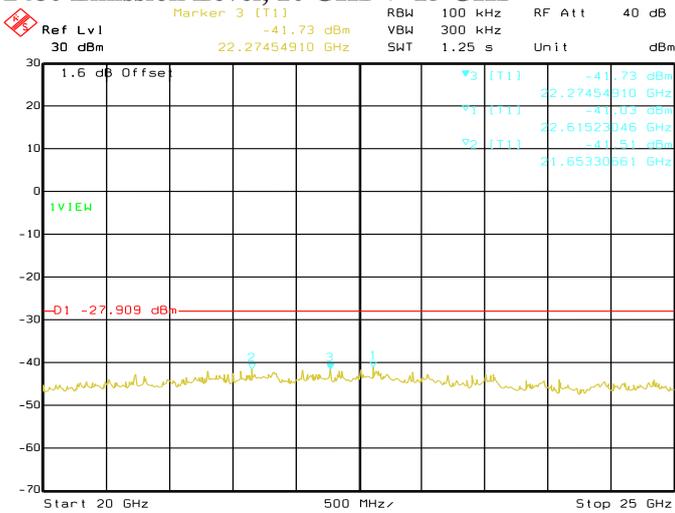
Date: 21.MAY 2019 08:09:41  
**Conducted Emissions. Bluetooth LE, Frequency**  
**2480 MHz Emission Level, 5 GHz -> 10 GHz**



Date: 21.MAY 2019 08:10:34  
**Conducted Emissions. Bluetooth LE, Frequency**  
**2480 MHz Emission Level, 10 GHz -> 15 GHz**



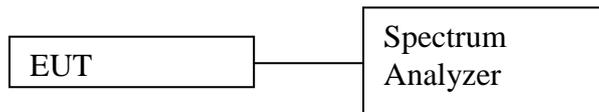
Date: 21.MAY 2019 08:11:27  
**Conducted Emissions. Bluetooth LE, Frequency**  
**2480 MHz Emission Level, 15 GHz -> 20 GHz**



Date: 21.MAY 2019 08:12:20  
**Conducted Emissions. Bluetooth LE, Frequency**  
**2480 MHz Emission Level, 20 GHz -> 25 GHz**

## 6.5 Band edge Conducted Spurious Emission

### 6.5.1 Test Setup



- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the DUT and set DUT to transmit maximum power.
- c) Connect DUT's antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
  - a. RBW = 100 kHz
  - b. VBW = 300 kHz
  - c. Detector mode = Peak
  - d. Trace = Max Hold
  - e. Sweep = auto
- e) Use the peak marker function to measure highest emission.

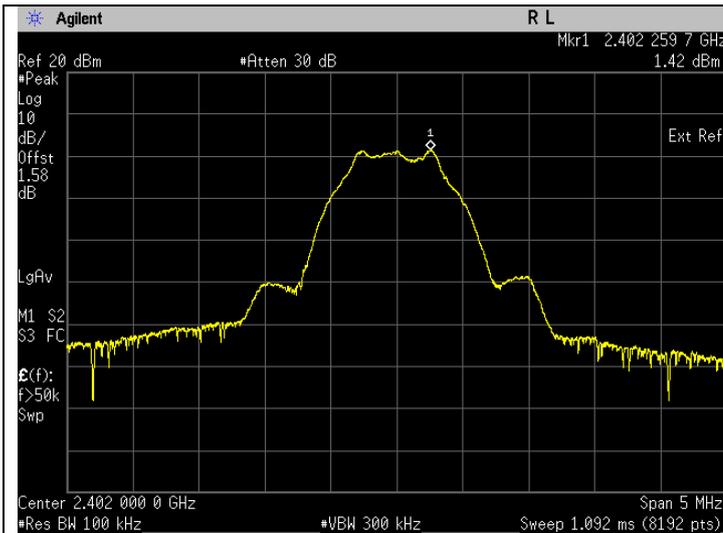
### 6.5.2 Test Limits:

**Normal Condition (25 ° C)**

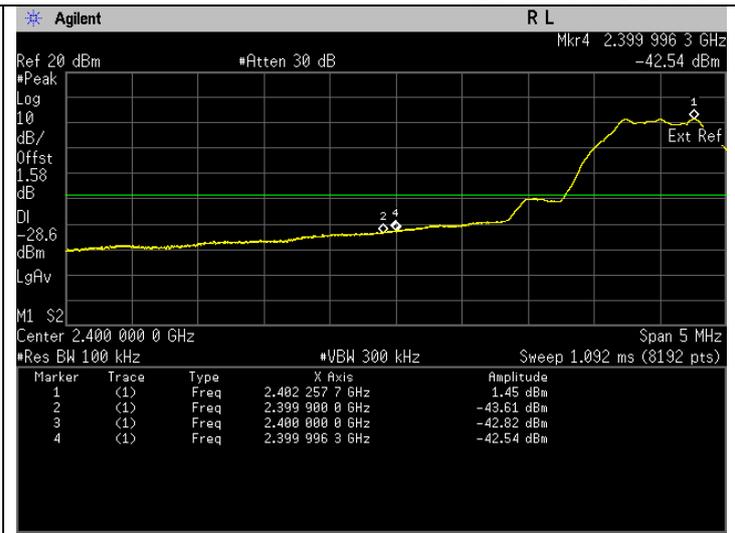
**Shall be at least 30 dB below peak (max) power.**

### 6.5.3 Test Result

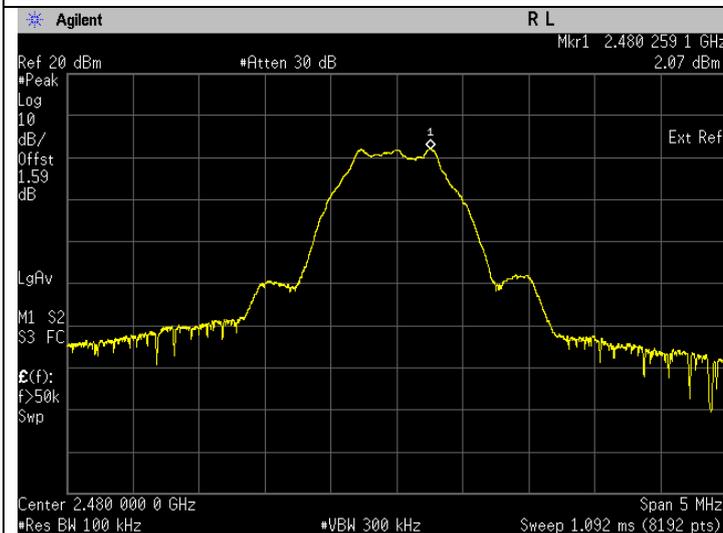
Test Conditions		Test Frequency	Results		
Standard	Modulation Type	Tx (MHz)	Frequencies (MHz)	Power (dBm)	Status
Bluetooth L.E	GFSK	2402	2400.00	-42.55	Pass
Bluetooth L.E	GFSK	2480	2483.50	-49.89	Pass



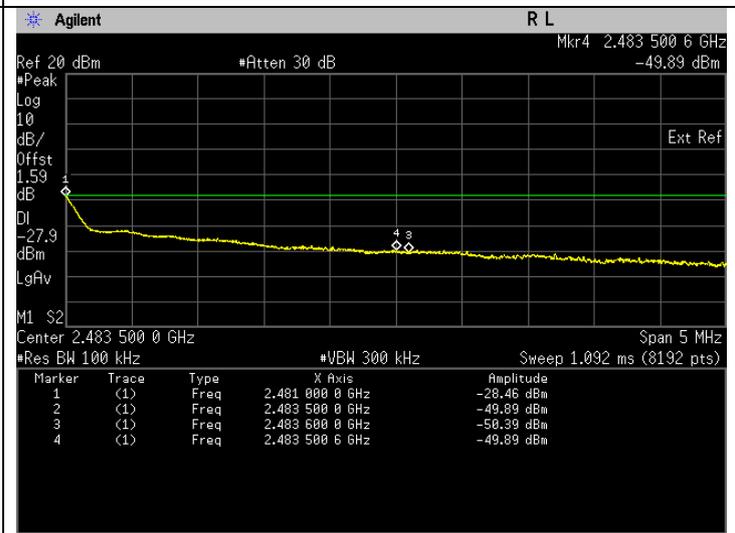
Band Edge. Bluetooth LE Frequency 2402 MHz Reference Level



Band Edge. Bluetooth LE Frequency 2402 MHz Band Edge



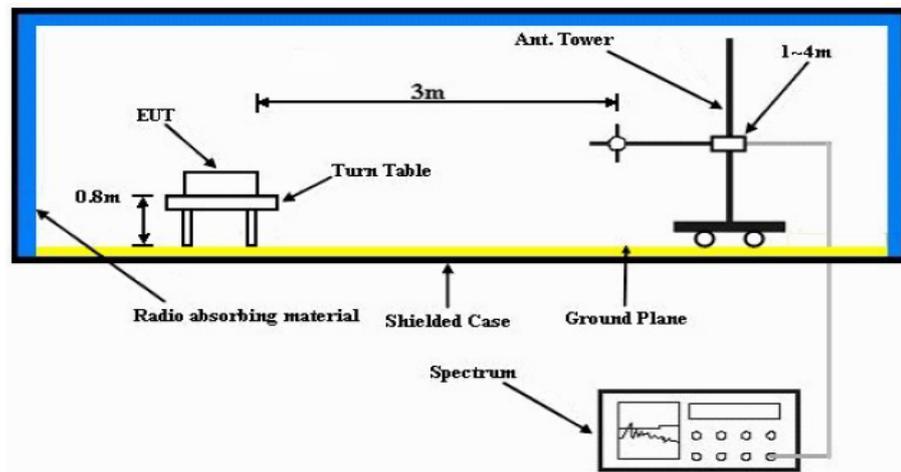
Band Edge. Bluetooth LE Frequency 2480 MHz Reference Level



Band Edge. Bluetooth LE Frequency 2480 MHz Band Edge

## 6.6 Radiated Emission within Restricted Bands

### 6.6.1 Test Setup



- The EUT is placed on the top of a rotating table 0.8m (frequency < 1GHz) or 1.5m (frequency > 1GHz) above the ground at a 3m semi-anechoic chamber. The table is rotated 360 degrees to determine the position of the highest radiation.
- The EUT is set 3m away from the interference-receiving antenna, which is mounted on the top of a variable-height antenna tower.
- The antenna is Bilog/Horn antenna depend on which frequency range uses, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT is arranged to its worst case and then the antenna is tuned to heights from 1m to 4m and the rotatable table is turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system is set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode is fall within the range of 10dB from the limit specified, the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. Otherwise, the testing could be stopped and the peak values of the EUT would be reported.

#### NOTE:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3 MHz for Peak detection at frequency above 1 GHz.
- All modes of operation were investigated and the worst-case emissions are reported.

### 6.6.2 Test Limits:

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power.

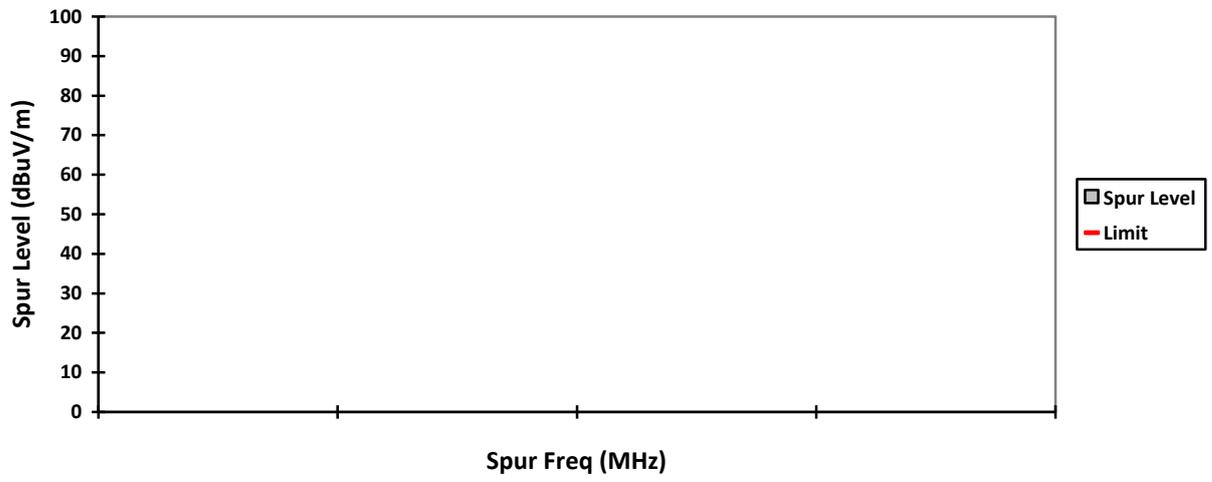
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

**NOTE:**

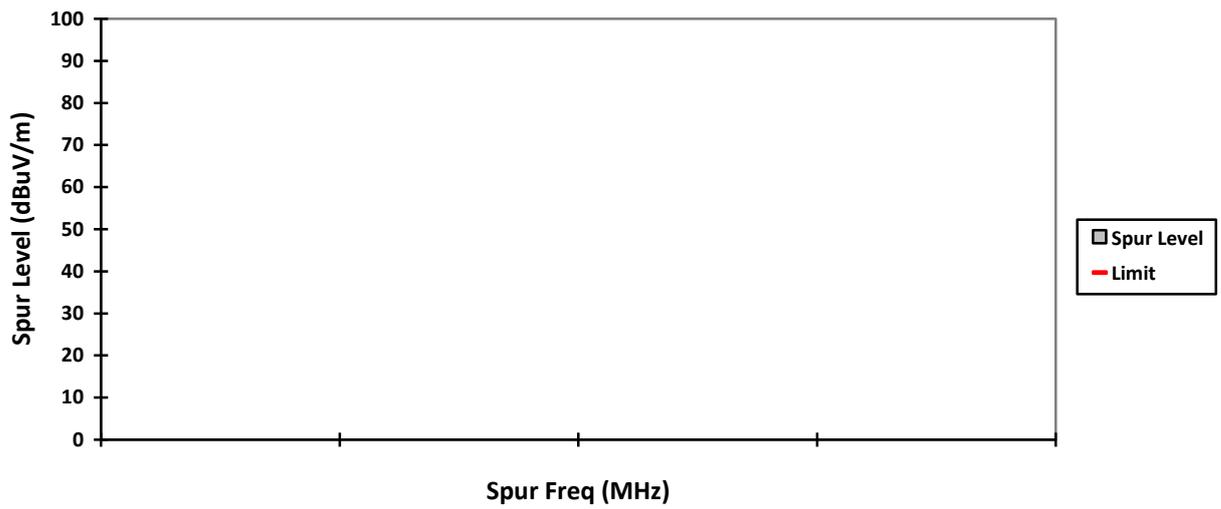
- 1) The lower limit shall apply at the transition frequencies.
- 2) Emission level (dBuV/m) = 20 log Emission level (uV/m).
- 3) For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



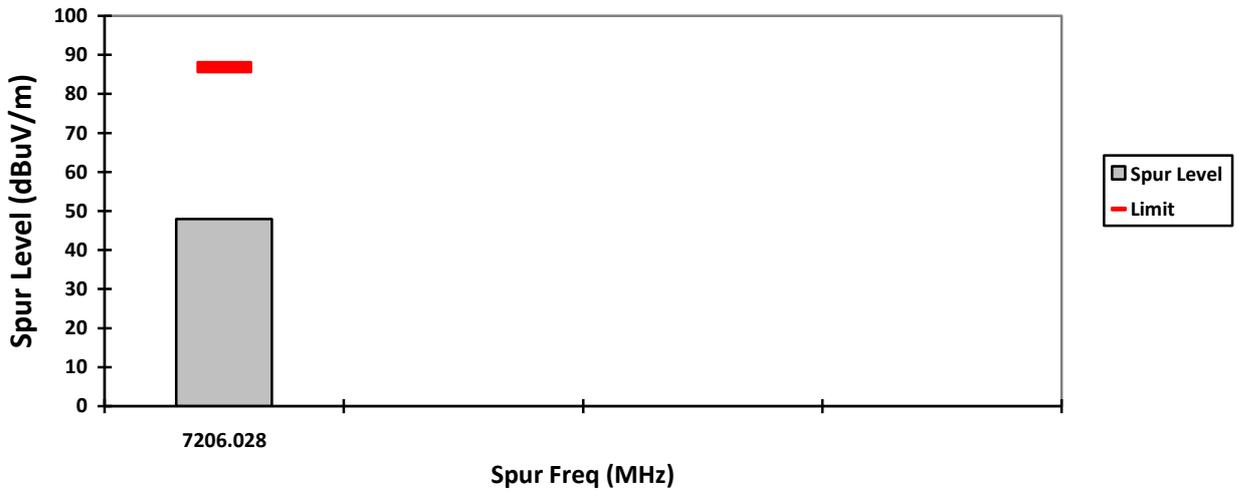
### VERTICAL, QPK



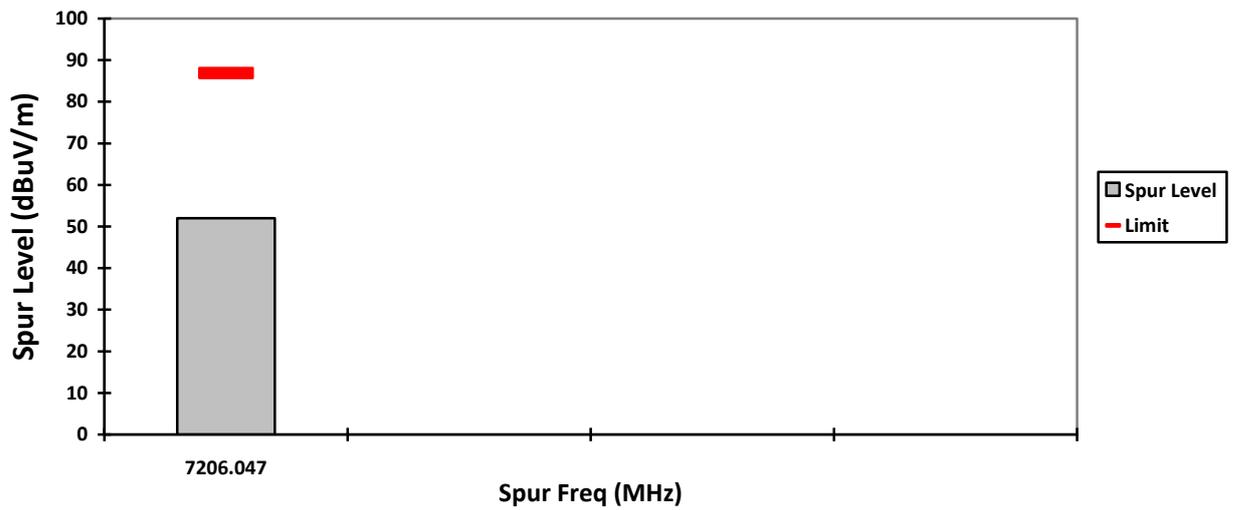
### HORIZONTAL, QPK



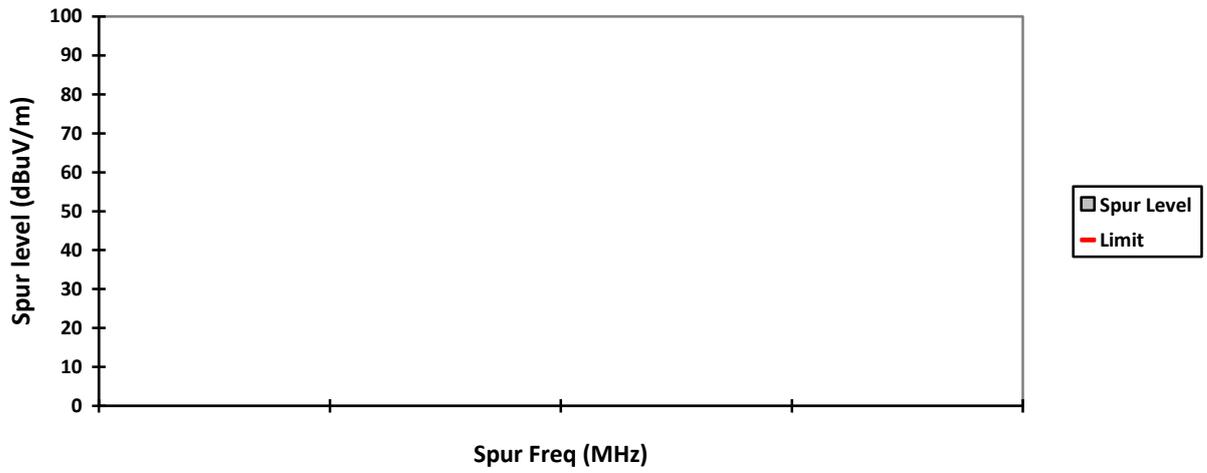
VERTICAL, PK



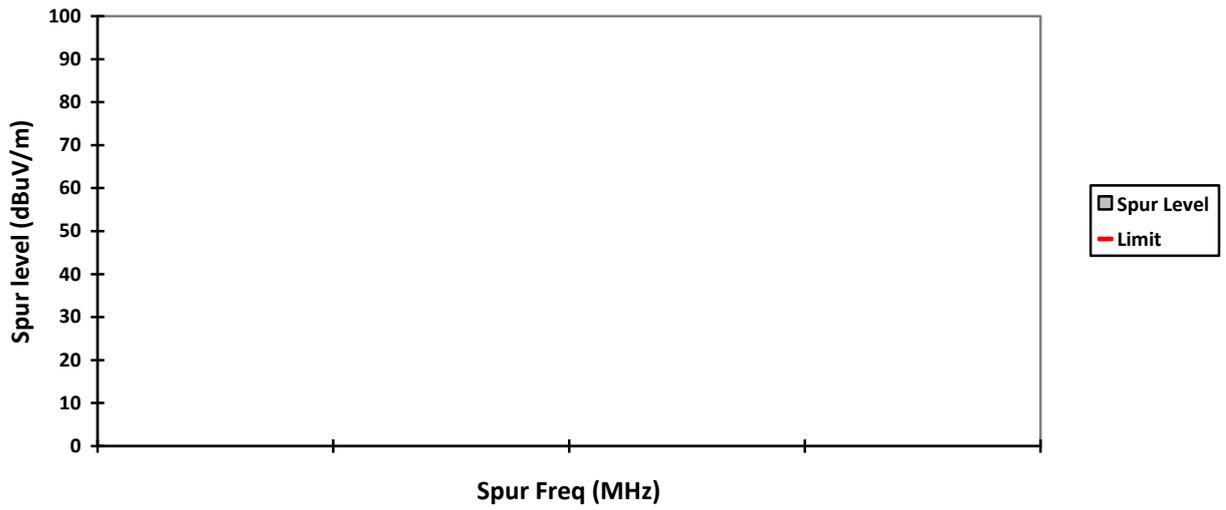
HORIZONTAL, PK



### VERTICAL, AV

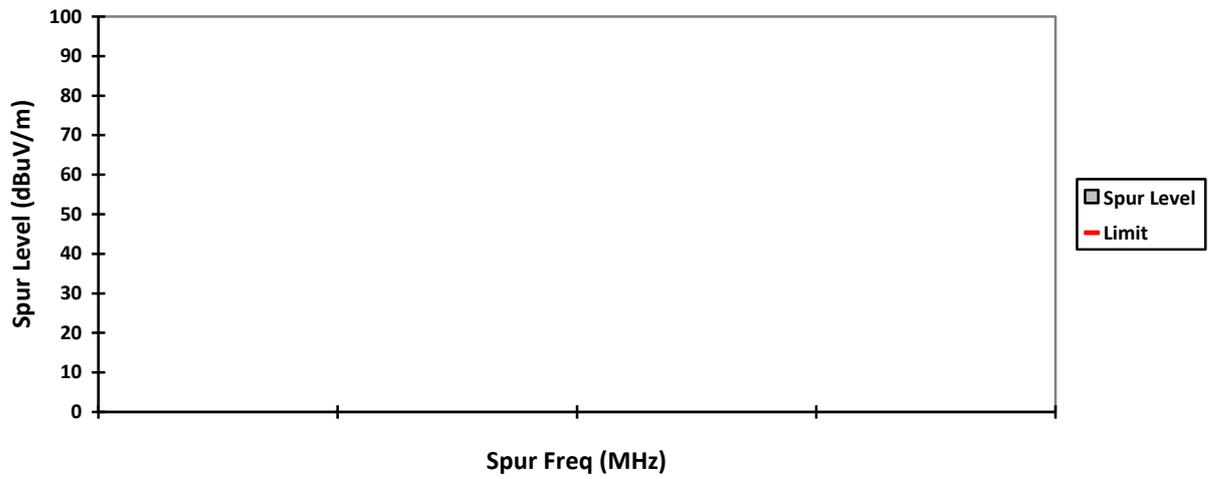


### HORIZONTAL, AV

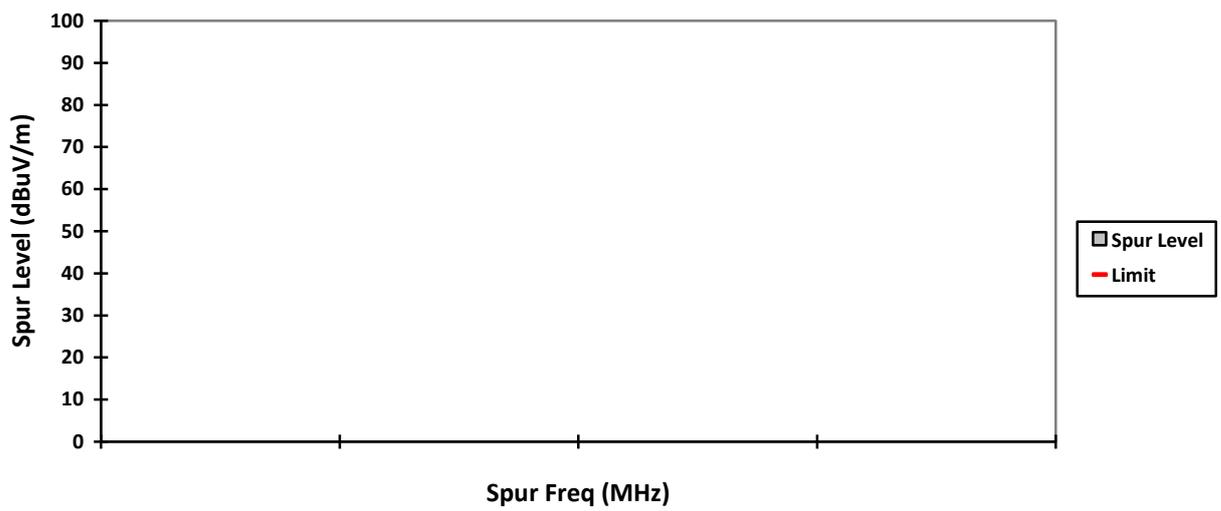




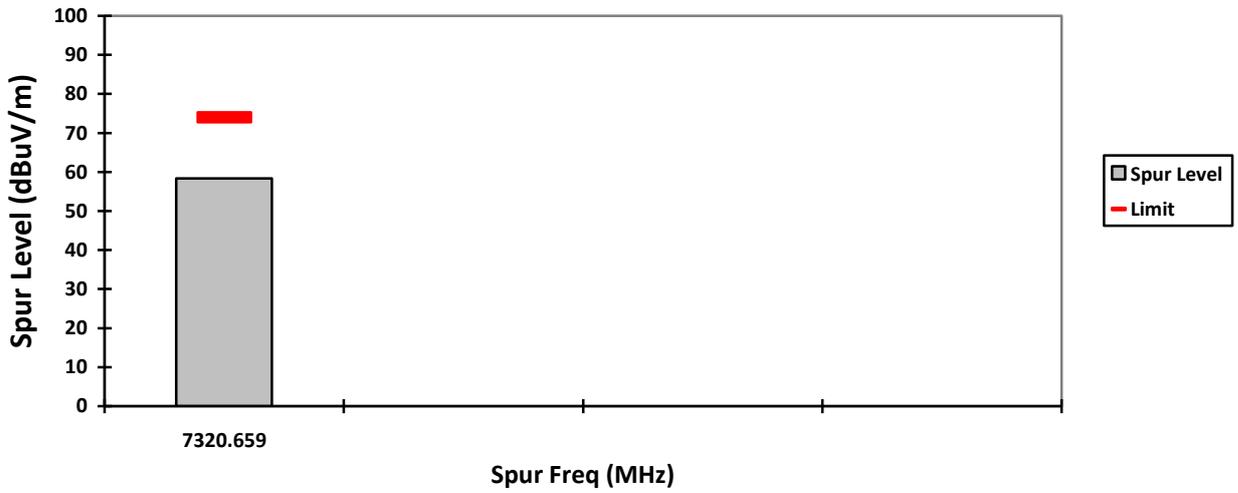
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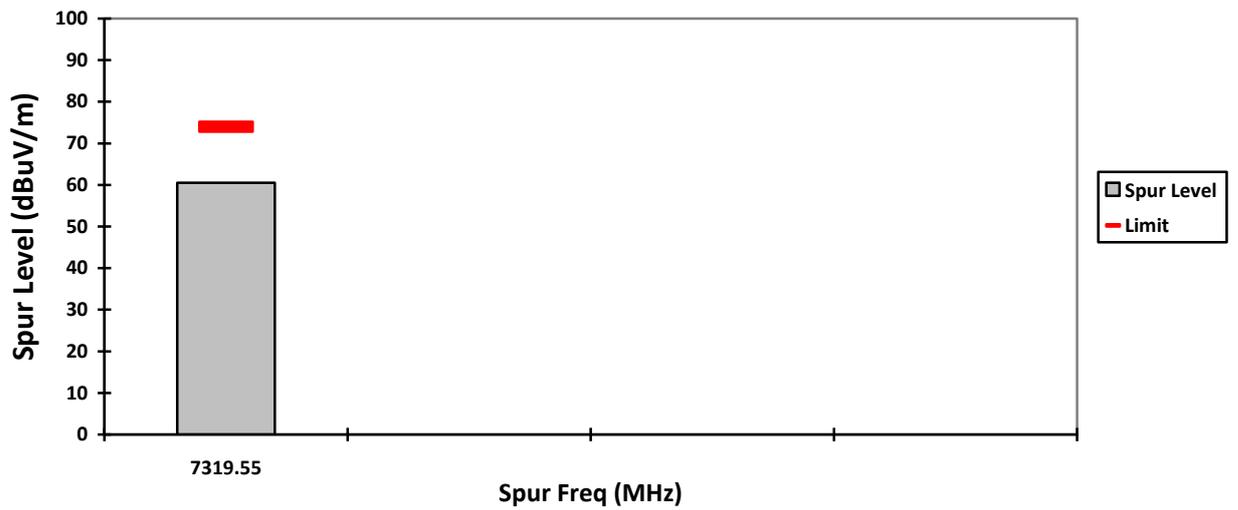
### HORIZONTAL, QPK



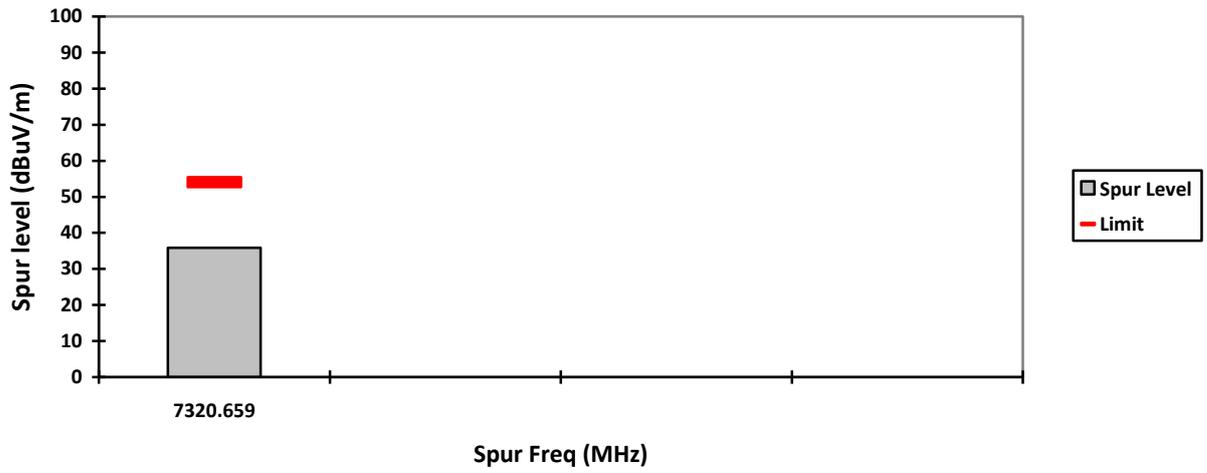
VERTICAL, PK



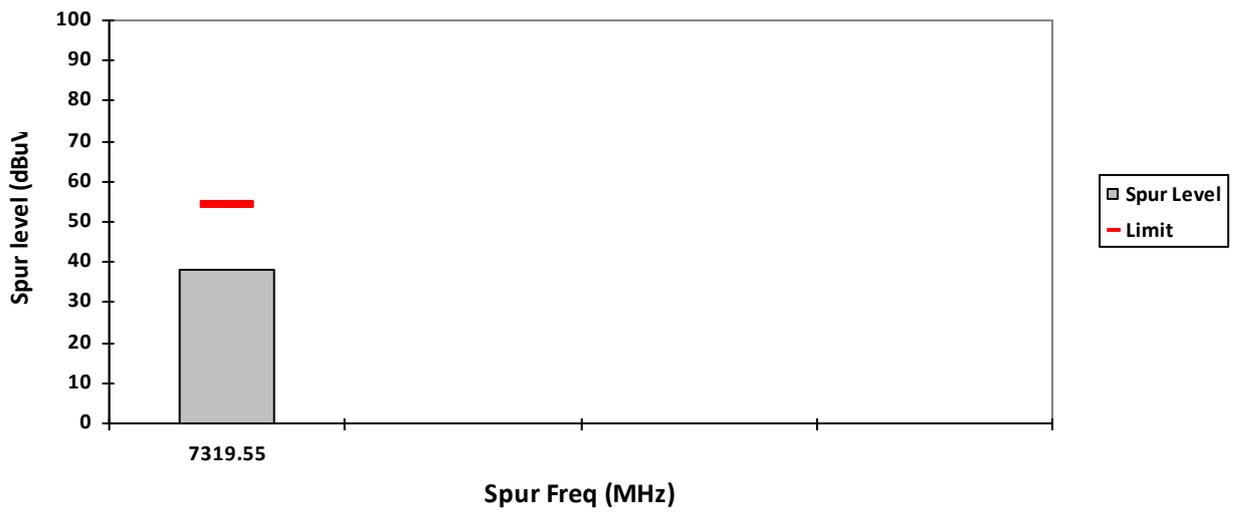
HORIZONTAL, PK



### VERTICAL, AV

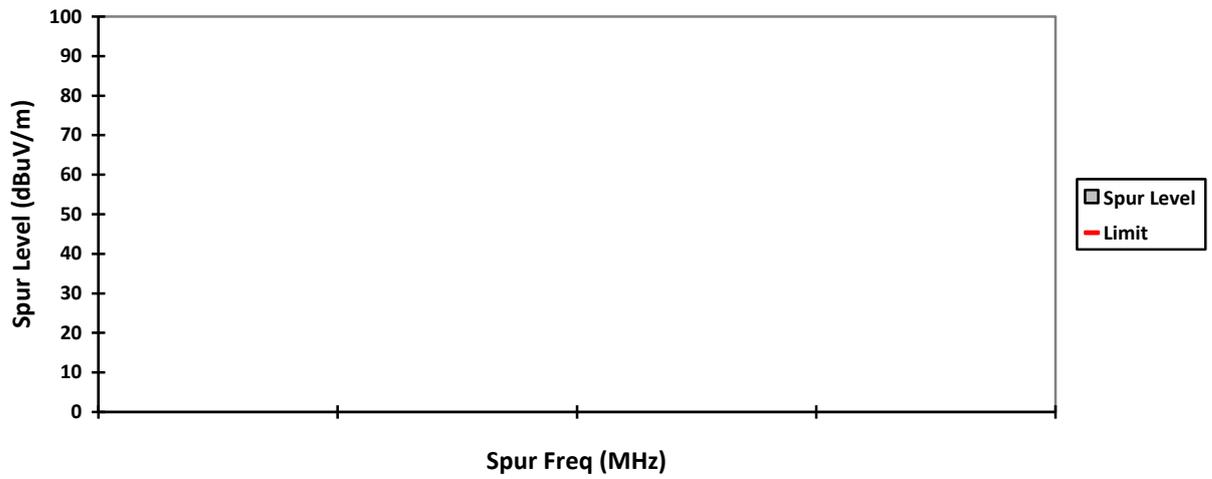


### HORIZONTAL, AV

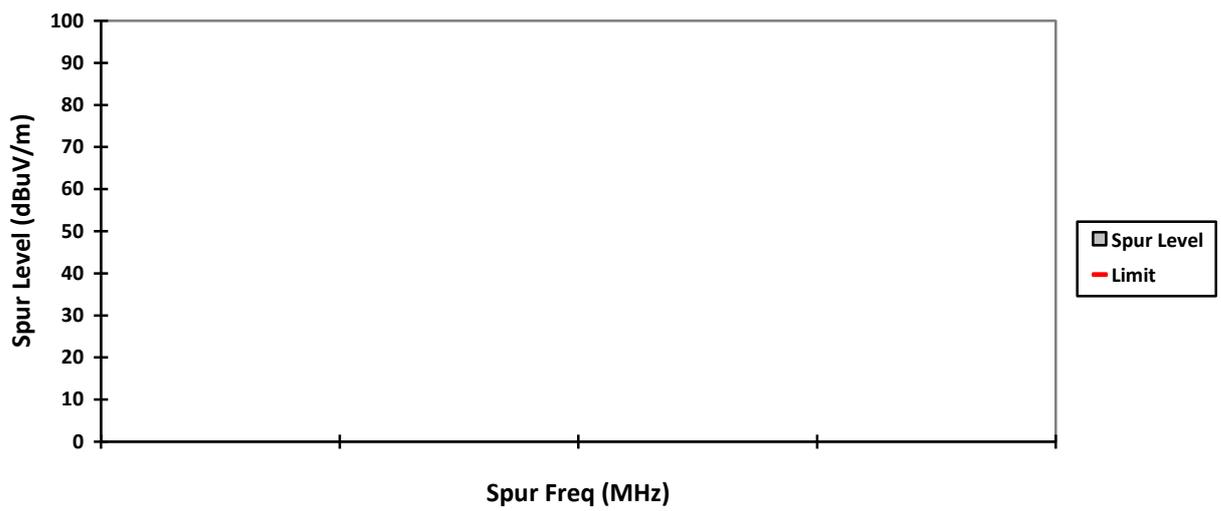




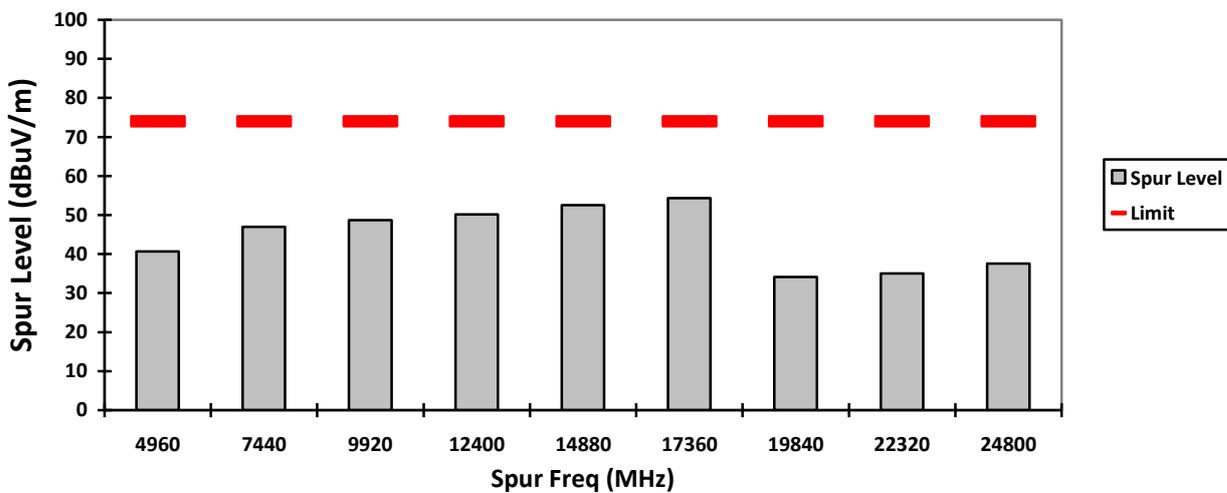
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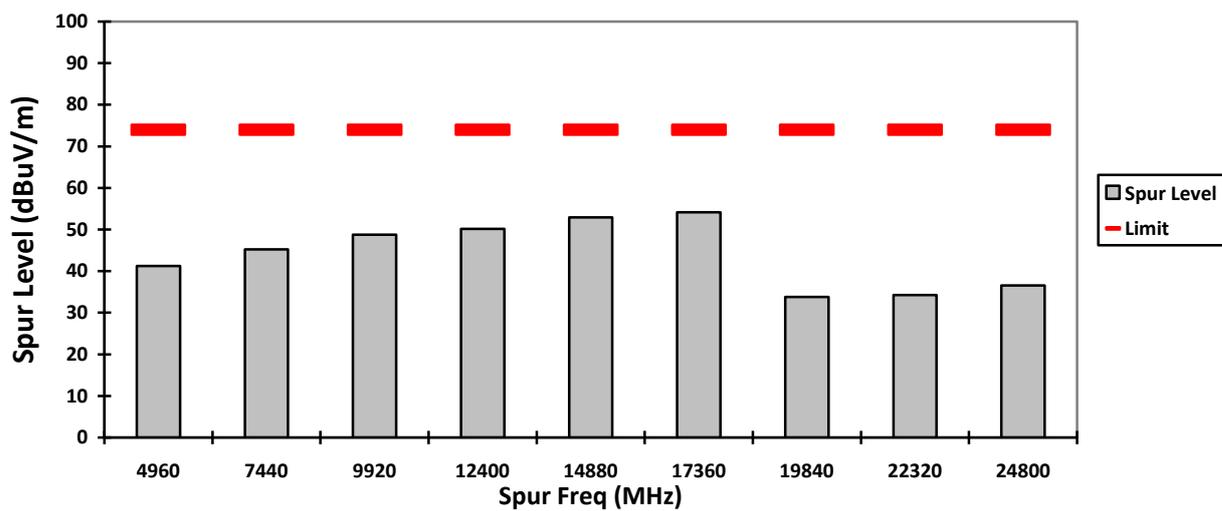
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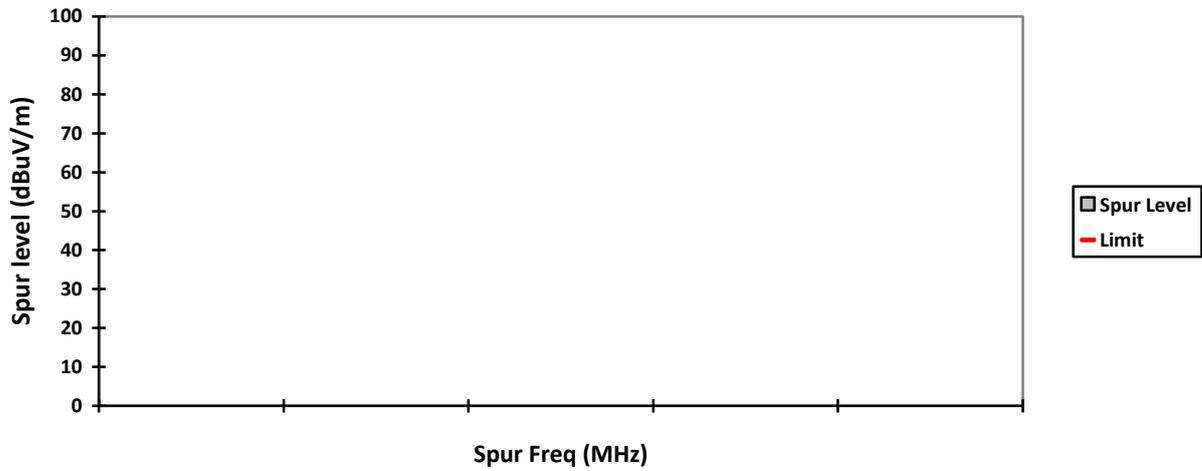
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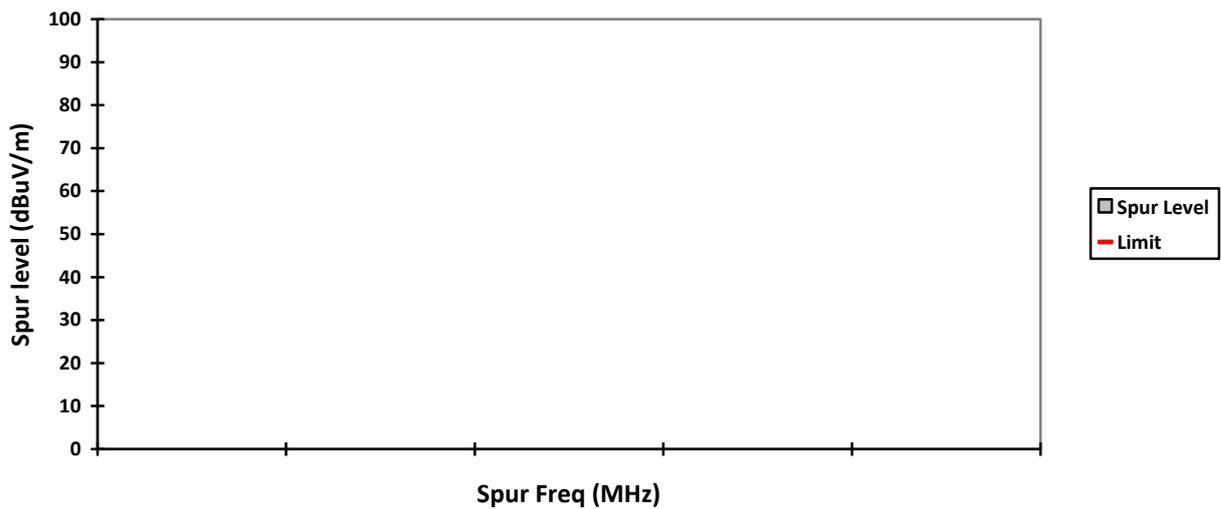
### HORIZONTAL, PK



### VERTICAL, AV



### HORIZONTAL, AV



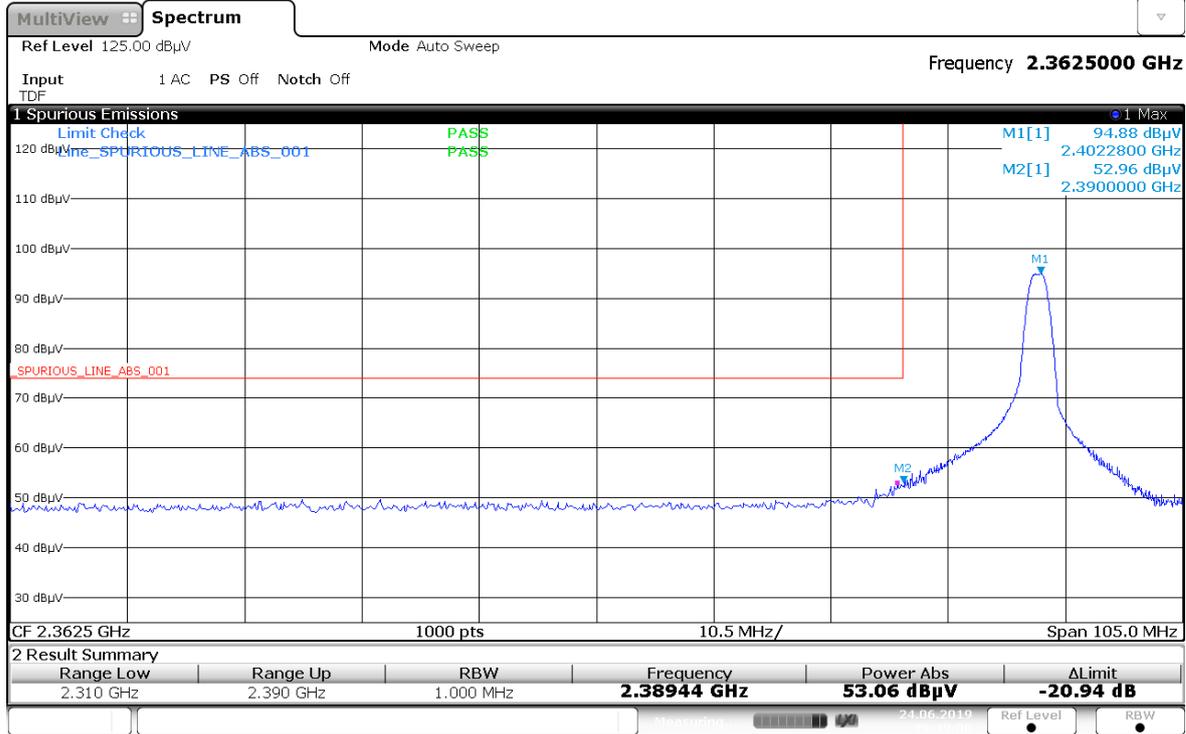
#### Transmitter Duty Cycle Calculation, FCC Rule 15.35 (b,c)

Based on the Bluetooth Specification Version 2.1+EDR, 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 =  $7.5 \times 20$  channels = 150 ms  
Number of times transmitter hits on one channel =  $100 \text{ ms} / 150 \text{ ms} = 1$  time(s)  
Worst case dwell time = 7.5 ms  
Duty cycle connection factor =  $20\log_{10} (7.5\text{ms} / 100\text{ms}) = -22.5 \text{ dB}$

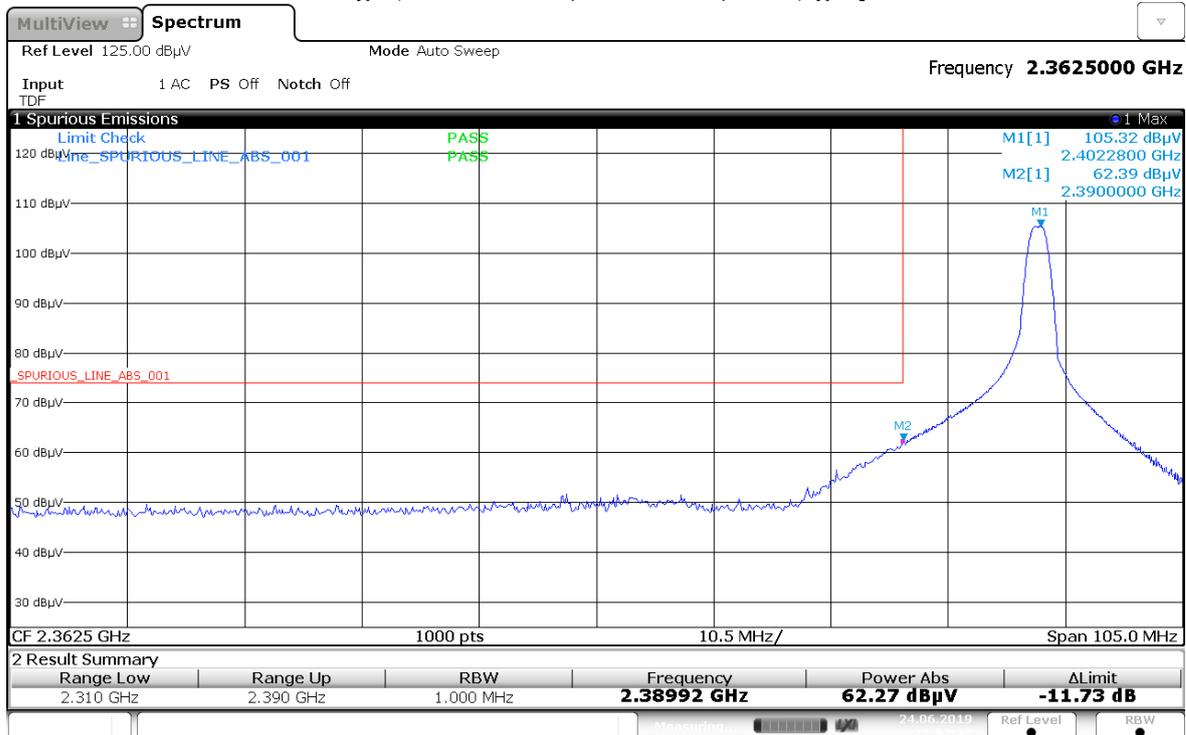


**Restricted Band Edge (Low Channel, Vertical, Peak) graphical screen shot**



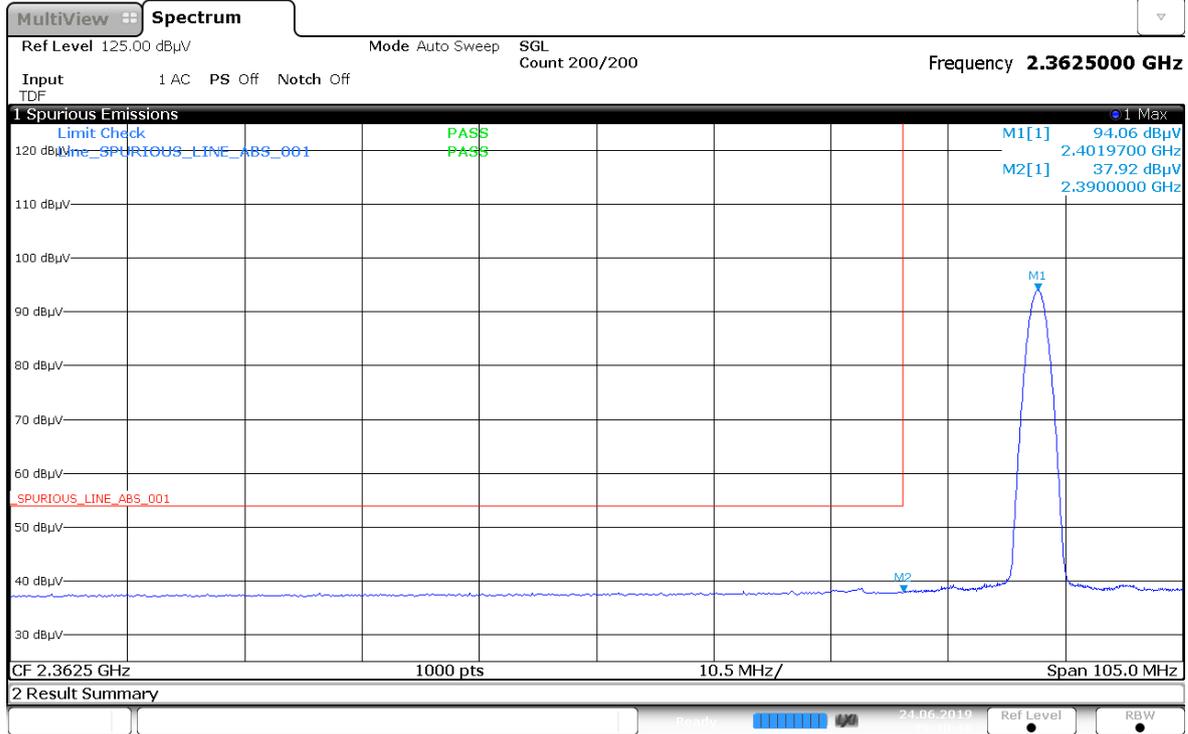
22:49:01 24.06.2019

**Restricted Band Edge (Low Channel, Horizontal, Peak) graphical screen shot**



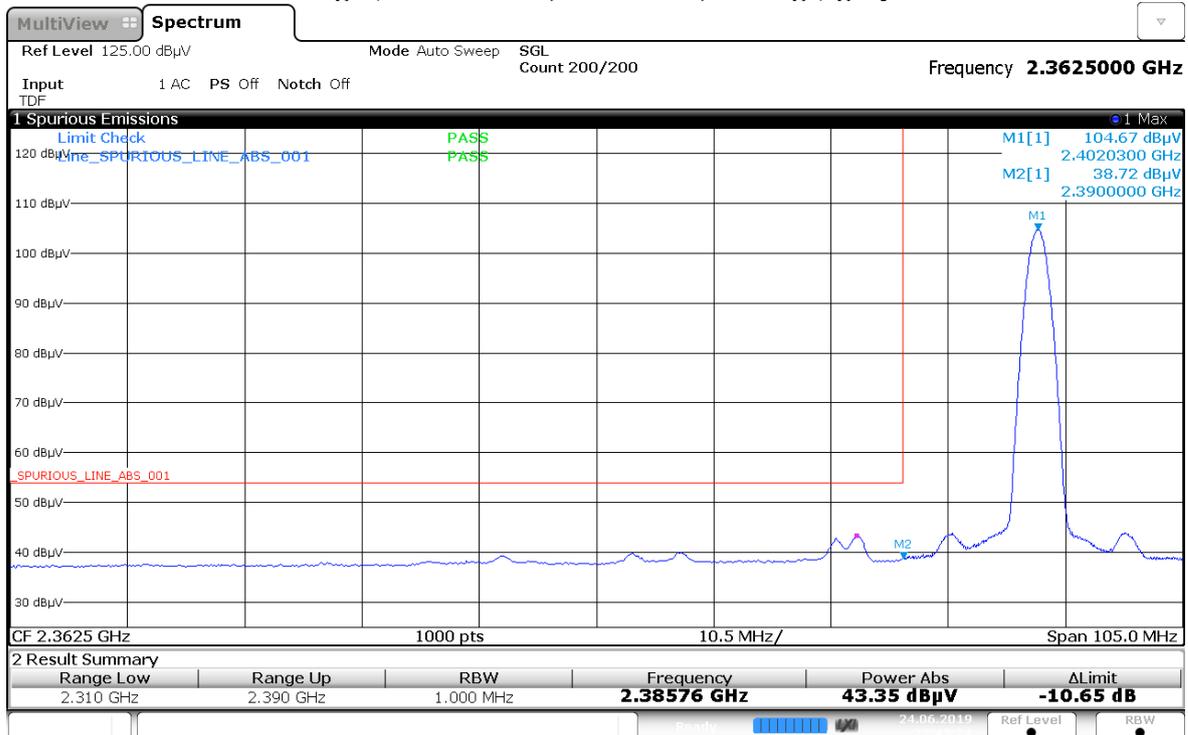
22:52:43 24.06.2019

**Restricted Band Edge (Low Channel, Vertical, Average) graphical screen shot**



22:40:48 24.06.2019

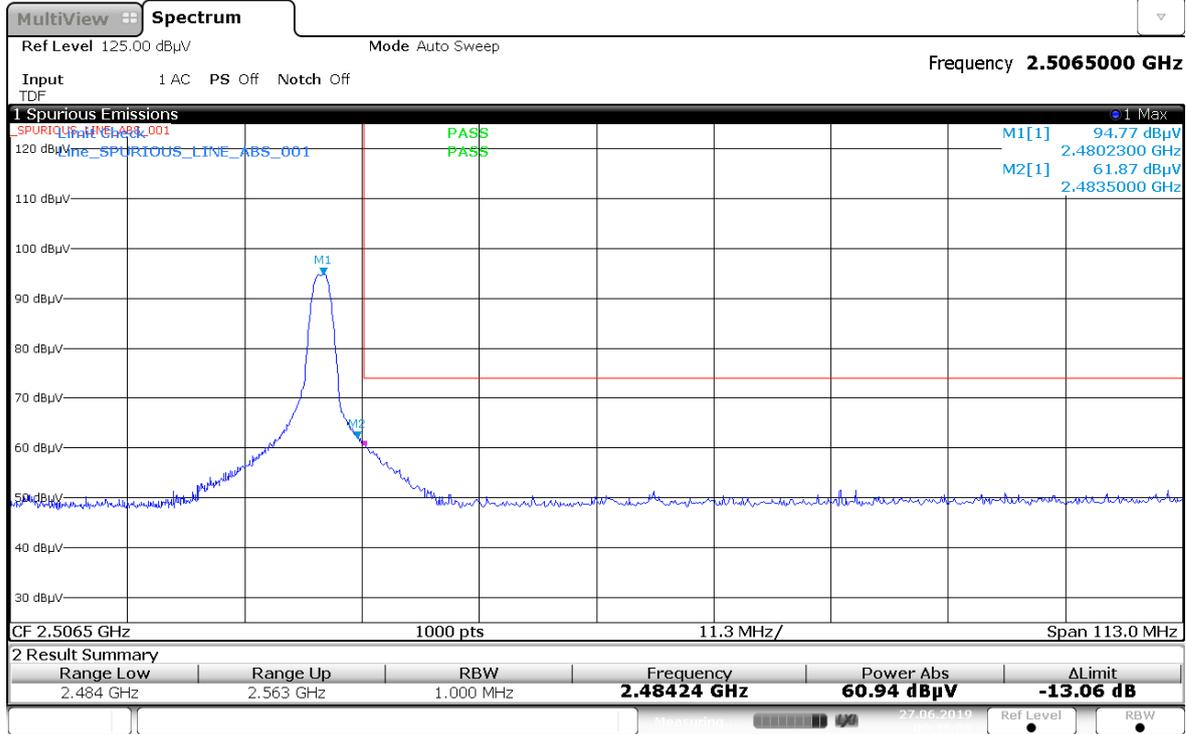
**Restricted Band Edge (Low Channel, Horizontal, Average) graphical screen shot**



22:45:25 24.06.2019

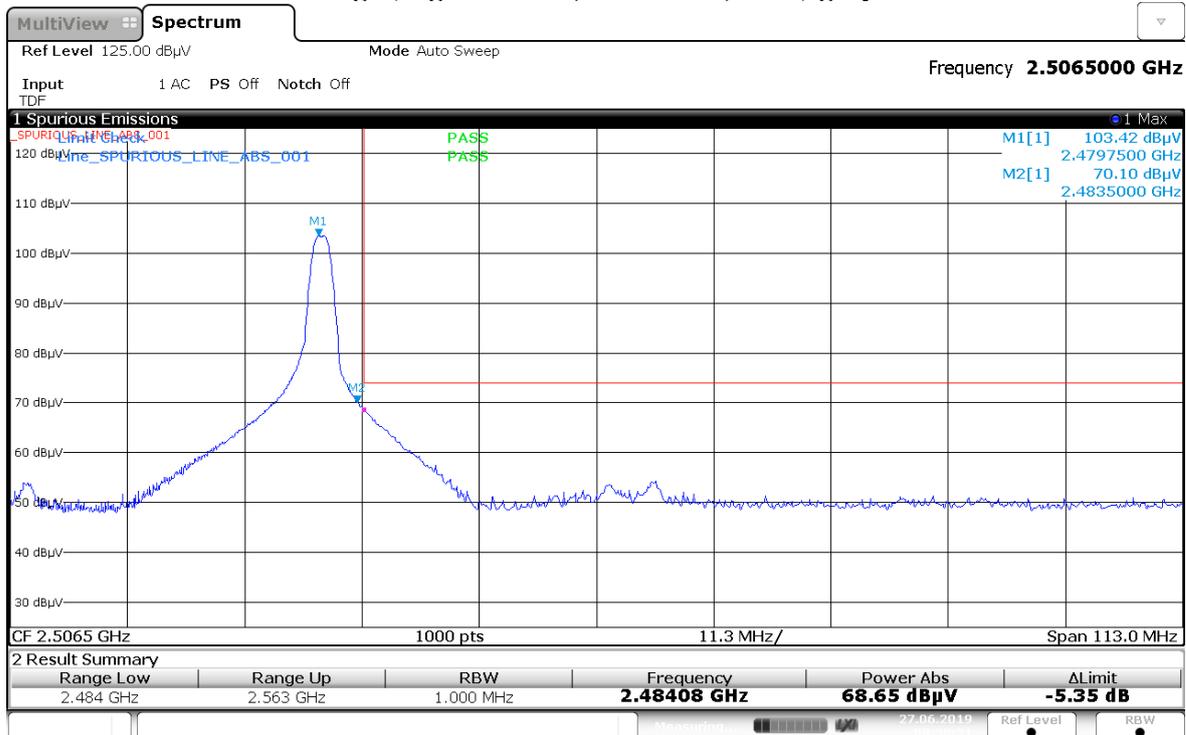


**Restricted Band Edge (High Channel, Vertical, Peak) graphical screen shot**



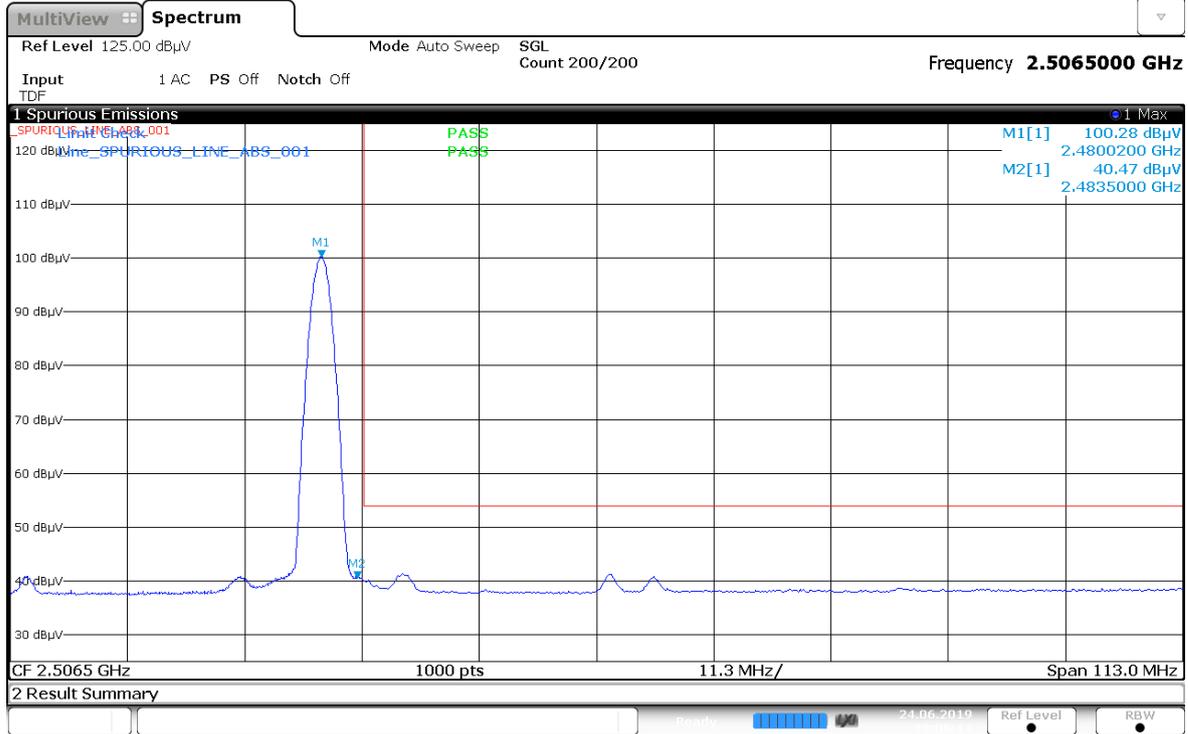
09:35:04 27.06.2019

**Restricted Band Edge (High Channel, Horizontal, Peak) graphical screen shot**



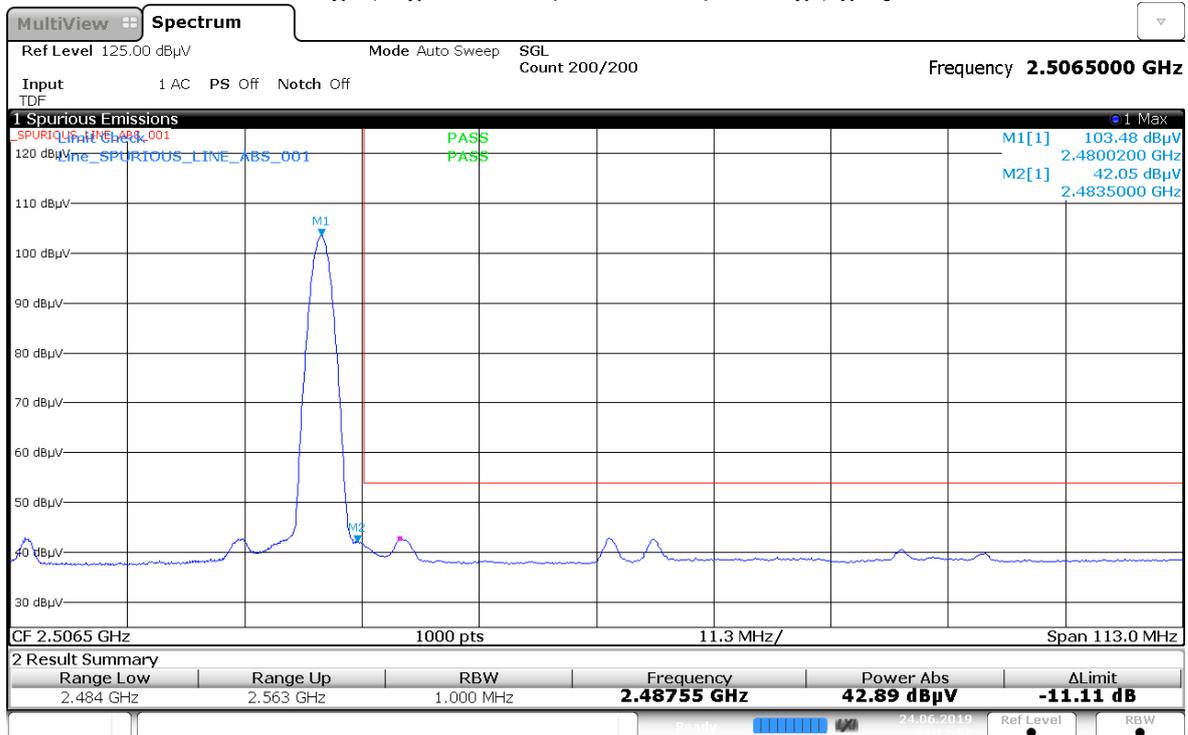
09:38:32 27.06.2019

**Restricted Band Edge (High Channel, Vertical, Average) graphical screen shot**



23:08:15 24.06.2019

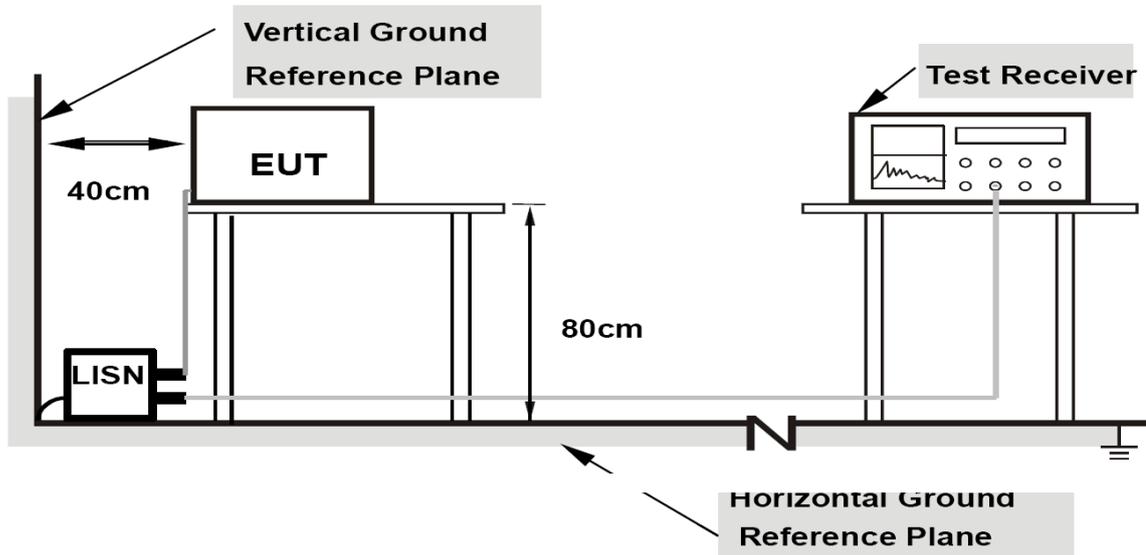
**Restricted Band Edge (High Channel, Horizontal, Average) graphical screen shot**



23:12:53 24.06.2019

## 6.7 AC Powerline Conducted Emission

### 6.7.1 Test Setup



- 1) Tests were conducted for both Receive and Transmit Mode of the EUT.
- 2) The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50uH of coupling impedance for the measuring instrument.
- 3) Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- 4) The frequency range from 150 kHz to 30MHz was measured.

### 6.7.2 Test Limits:

**For AC Power Line Conducted Test Limit can be Class A or B depends on product classification.**

Limits for conducted disturbance at the mains ports  
of class A ITE

Frequency range MHz	Limits dB( $\mu$ V)	
	Quasi-peak	Average
0,15 to 0,50	79	66
0,50 to 30	73	60
NOTE The lower limit shall apply at the transition frequency.		

**Table 1: Limits for Conducted Disturbance at the Mains Ports of Class A ITE.**

**Limits for conducted disturbance at the mains ports  
of class B ITE**

Frequency range MHz	Limits dB( $\mu$ V)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

NOTE 1 The lower limit shall apply at the transition frequencies.  
NOTE 2 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.

**Table 2: Limits for Conducted Disturbance at the Mains Ports of Class B ITE**

### 6.7.3 Test Result

**Not Applicable. Testing is not required, radio shall turn off during charging mode.**

**END OF TEST REPORT**