

TEST REPORT

REPORT NUMBER: 12241662-E5V2

COMPANY NAME: Google LLC

EUT DESCRIPTION: Radio Transmitter

MODEL: NC2-6A5

SERIAL NUMBER: MLB1

ISSUE DATE: 25-Jun-18

DATE TESTED: 12-Apr-18

APPLICABLE STANDARDS: JAPAN RADIO LAW RADIO EQUIPMENT REGULATIONS

TEST METHOD: Notice 88 of Ordinance Concerning Technical Regulations Conformity Certification of Specified Radio Equipment

Place of Testing: UL Verification Services Inc.  
47173 BENICIA ST, FREMONT, CA 94538, USA

Test Result: Complies

Classification of Specified Radio Equipment: Article 2 Clause 1 Item 19

Type of radio wave, Frequency and antenna power:	G1D	2402-2480MHz (Interval of 1MHz 79ch[Normal])	0.000555W/MHz
	G1D	2402-2480MHz (Interval of 1MHz 20ch[AFH])	0.002028W/MHz

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted

Approved & Released For UL Verification Services Inc. By:

*Francisco Deanda*

FRANCISCO DEANDA  
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GERARDO ABREGO  
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NVLAP Lab Code 200065-0

1. EUT Information

Report No. :	12241662-E5V2
Applicant :	Google LLC
Equipment Description:	Multimedia Device with BLE/BT, 2.4GHz and 5GHz Radios
Model No. :	NC2-6A5
SerialNo. :	MLB1
The number of Tx Antenna :	1
Mode :	8PSK
Max Antenna Gain :	2.30dBi
Type of Radio wave :	G1D

Supply Voltage	
<input checked="" type="radio"/> DC <input type="radio"/> AC	5.00V
	-

Modulation	
<input checked="" type="radio"/> FH (Bluetooth)	

Voltage Condition	
<input checked="" type="radio"/> Non-Extreme <input type="radio"/> Extreme	
Normal DC5V	
Normal-10%	-
Normal+10%	-

EUT has	
<input checked="" type="radio"/> ANT Connector	
<input type="radio"/> No ANT Connector	distance -

The worst-case data rate for each mode is determined to be as follows, based on preliminary test of the chipset utilized in this radio.  
All final tests were made at the 8PSK Rate on Antenna 2.

Factors

		Other than for Power		For Power	
		Cable Loss	ATT/	Cable Loss	ATT/
	[MHz]	[dB]	[dB]	[dB]	[dB]
Low Channel (Tx1)	2402	0.80	10.00	0.80	10.00
Middle Channel (Tx2)	2441	0.80	10.00	0.80	10.00
High Channel (Tx3)	2480	0.80	10.00	0.80	10.00

## 2.TEST Result

### 2.1. Frequency Tolerance

Job No. 12241662-E5V2

Remark1

Remark2

#### [ DATA ]

Voltage	Freq. [MHz]	Result [MHz]	Tolerance [kHz]	Tolerance [ppm]	Limit [ppm]
DC5V	2441	2440.9855	-14.5226	-5.95	±50.0

Tx2\_Freq\_Nom

Agilent 21:27:37 Apr 12, 2018

R L

Cntr1 2 440 985 477.439 Hz

Ref -20 dBm

#Atten 30 dB

-36.87 dBm

#Peak

Log

10

dB/

LgAv

W1 S2

S3 FS

AA

f(f):

f<50k

Swp

Center 2.440 985 471 GHz

#VBW 300 Hz

Span 30 kHz

#Res BW 300 Hz

Sweep 401.9 ms (1201 pts)

## 2.2. Occupied Bandwidth / Spreading Bandwidth

Job No.	12241662-E5V2
Remark1	
Remark2	

[ DATA ]

### 99% Occupied Frequency Bandwidth

Voltage	Freq. [MHz]	Result [MHz]	Limit [MHz]
DC5V	2441	78.0367	83.5

### Spreading Bandwidth

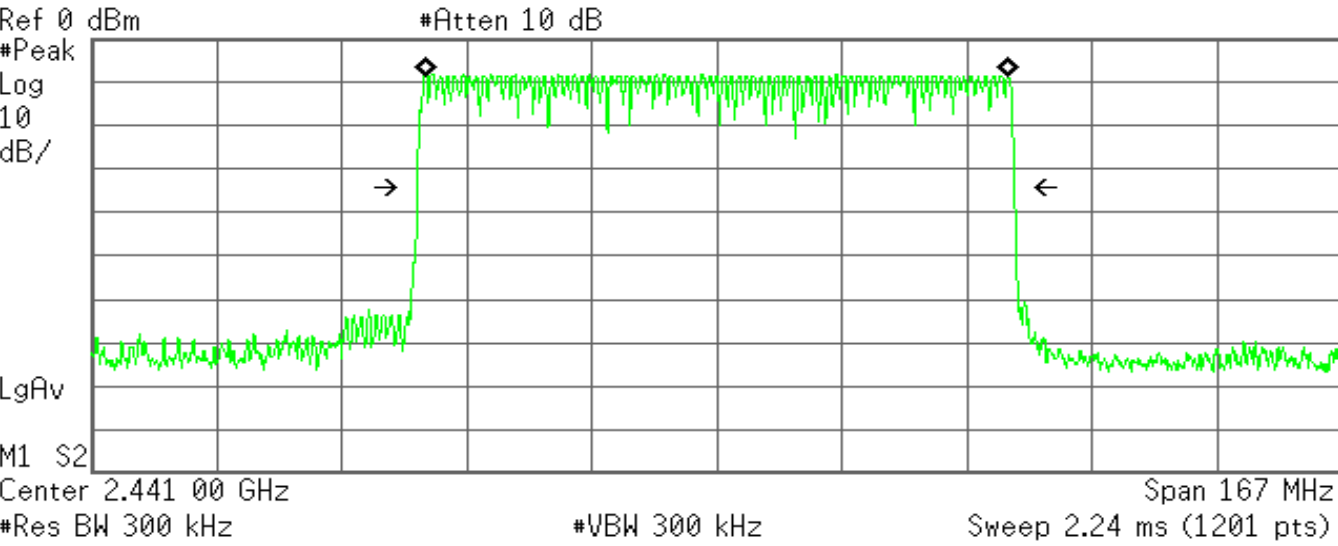
Voltage	Freq. [MHz]	Result [MHz]	Result [kHz]	Limit [kHz]
DC5V	2441	71.4679	71468	500

### 99% Occupied Frequency Bandwidth

Tx2\_Hop99OBW\_Nom

Agilent 21:42:13 Apr 12, 2018

R L



Occupied Bandwidth  
78.0367 MHz

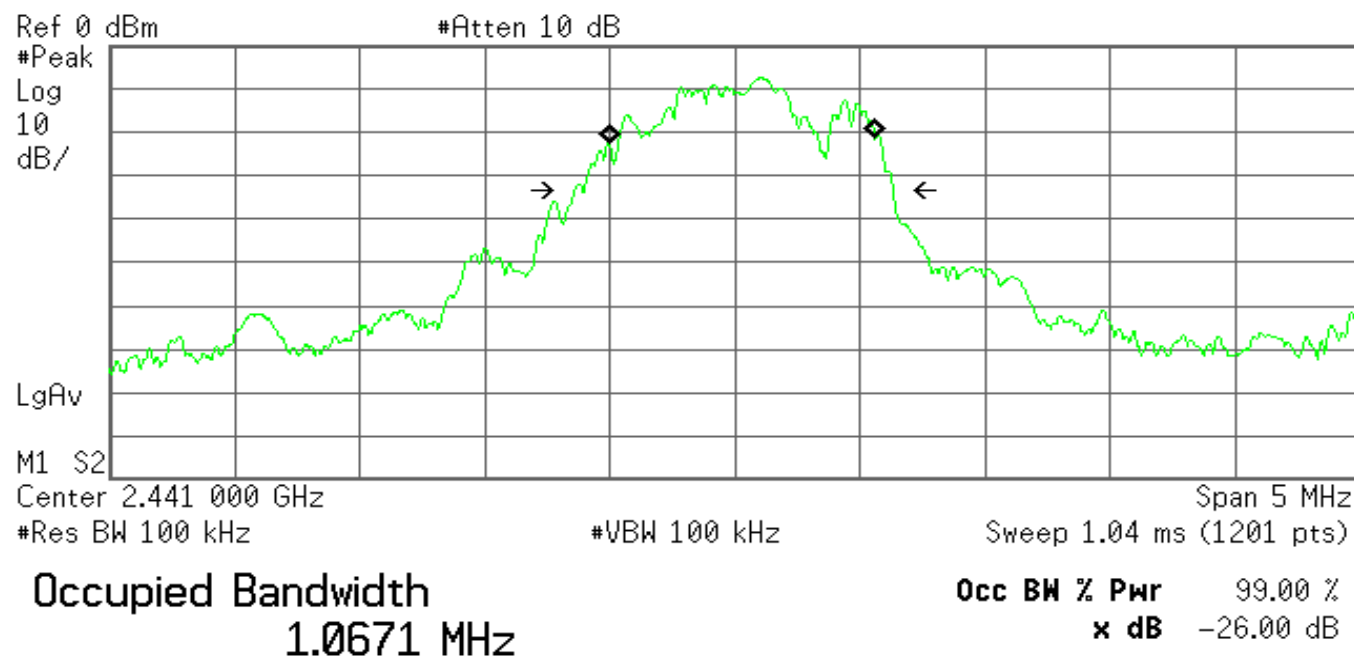
Occ BW % Pwr 99.00 %  
x dB -26.00 dB

Transmit Freq Error -1.920 kHz  
x dB Bandwidth 79.836 MHz

Tx2\_990BW\_Nom

✱ Agilent 21:39:31 Apr 12, 2018

R L



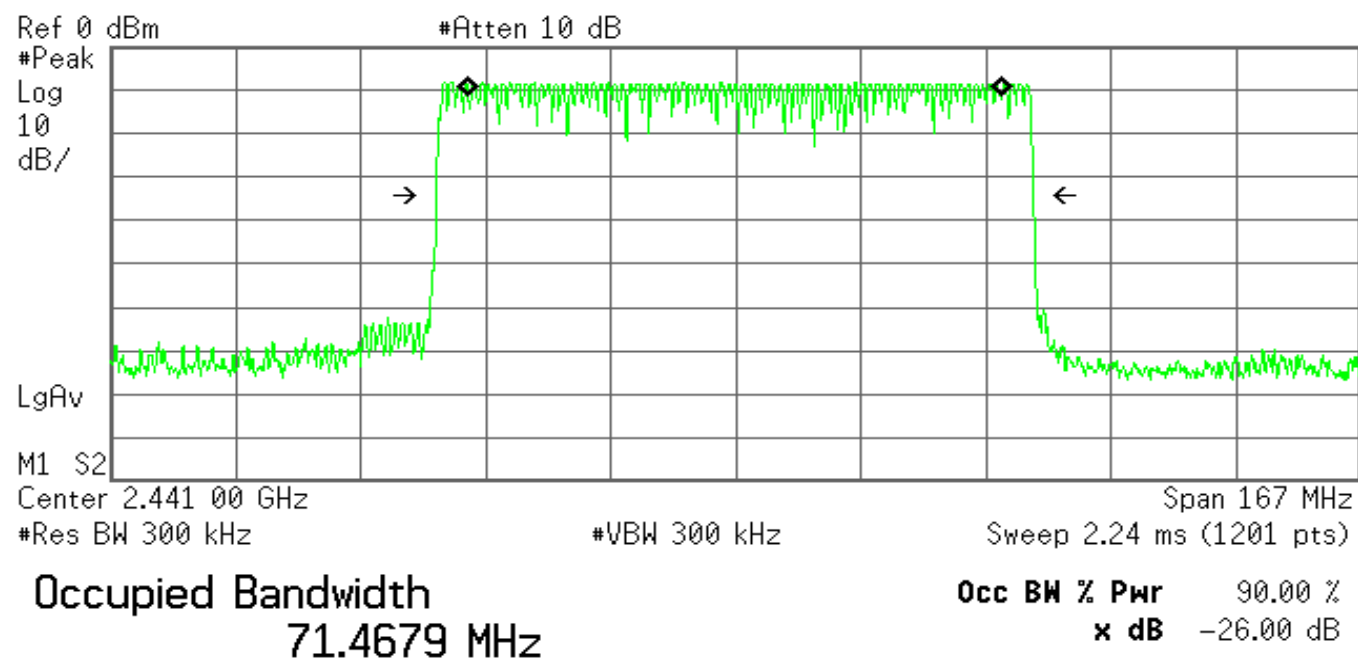
**Transmit Freq Error** 27.955 kHz  
**x dB Bandwidth** 1.278 MHz

#### Spreading Bandwidth

Tx2\_Hop900BW\_Nom

✱ Agilent 21:42:19 Apr 12, 2018

R L

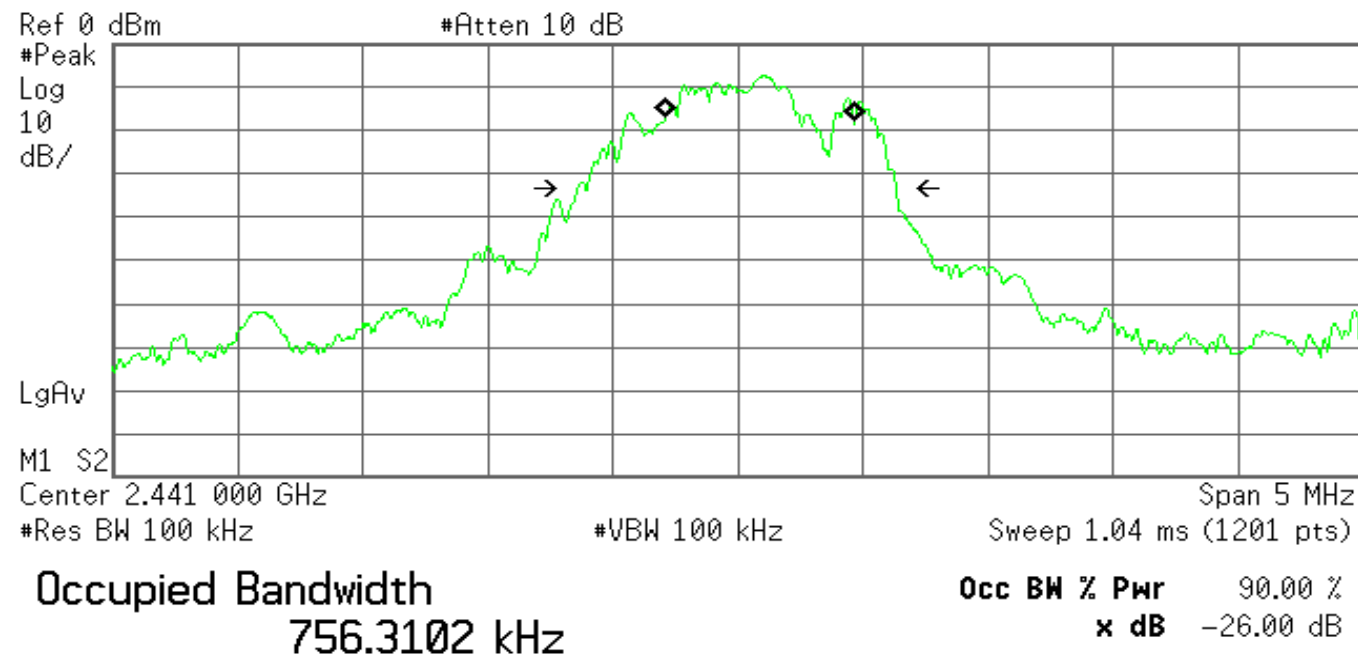


**Transmit Freq Error** -41.496 kHz  
**Occupied Bandwidth** 79.836 MHz

Tx2\_900BW\_Nom

Agilent 21:39:37 Apr 12, 2018

R L



Transmit Freq Error 89.924 kHz  
Occupied Bandwidth 1.278 MHz

2.3. Unwanted Emission Strength (Normal Voltage)

Job No.12241662-E5V2

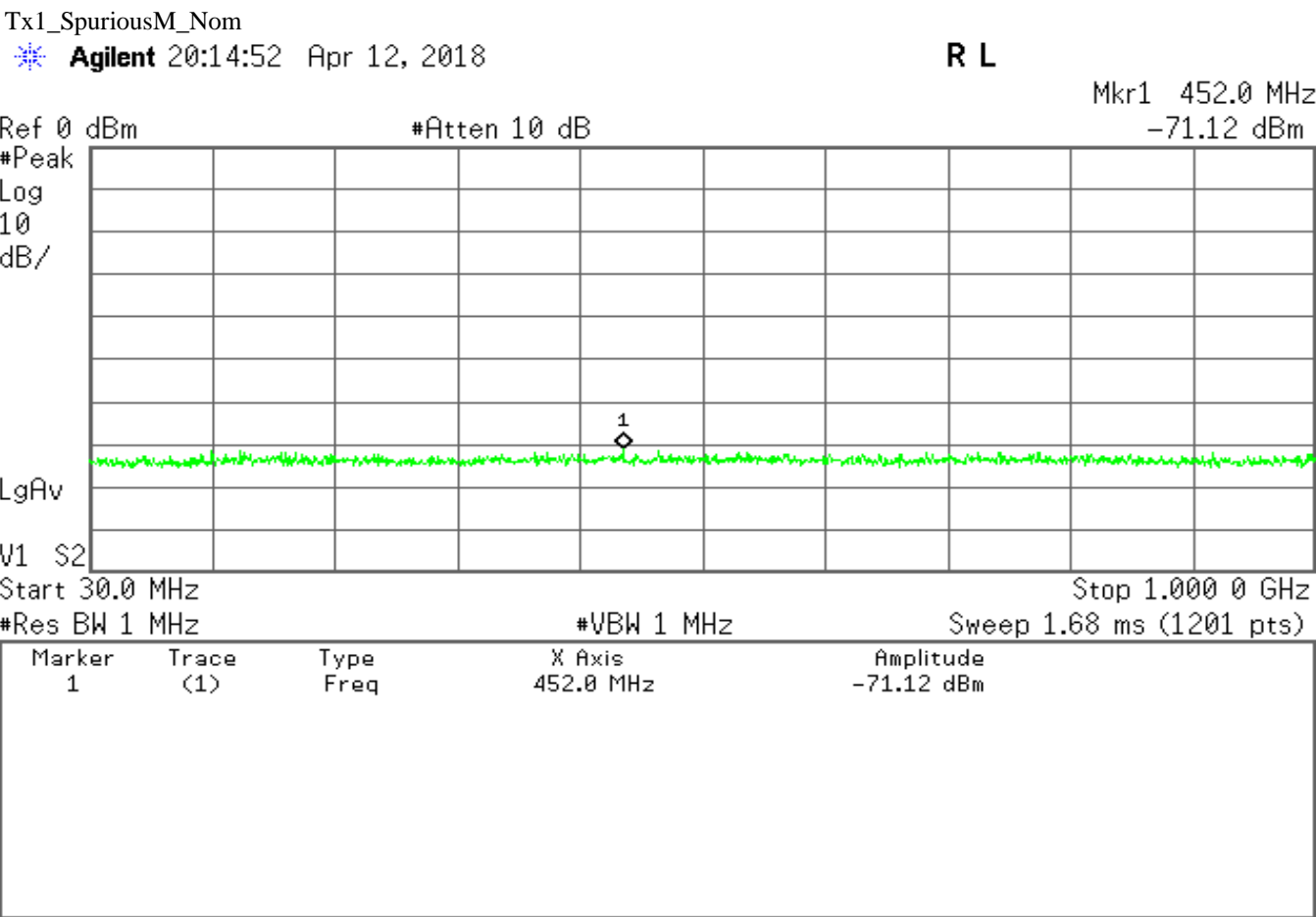
Remark1

Remark2

[ DATA]

Voltage	Freq. [MHz]	Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Result [uW]	Limit [uW]	Remark
DC5V	2402	452.00	-71.12	0.80	10.00	-60.32	0.001	2.500	◆1
		2332.00	-63.02	0.80	10.00	-52.22	0.006	2.500	◆1
		2505.00	-64.31	0.80	10.00	-53.51	0.004	2.500	◆4
		2399.99	-36.90	0.80	10.00	-26.10	2.455	25.000	◆2
		2329.42	-59.46	0.80	10.00	-48.66	0.014	2.500	◆1
		2399.99	-58.81	0.80	10.00	-48.01	0.016	25.000	◆2
		10305.00	-67.27	0.80	10.00	-56.47	0.002	2.500	◆4
	2441	978.20	-71.08	0.80	10.00	-60.28	0.001	2.500	◆1
		2361.00	-60.15	0.80	10.00	-49.35	0.012	2.500	◆1
		2514.00	-59.93	0.80	10.00	-49.13	0.012	2.500	◆4
		7919.00	-67.03	0.80	10.00	-56.23	0.002	2.500	◆4
	2480	733.20	-70.89	0.80	10.00	-60.09	0.001	2.500	◆1
		2370.00	-61.66	0.80	10.00	-50.86	0.008	2.500	◆1
		2591.00	-62.11	0.80	10.00	-51.31	0.007	2.500	◆4
		7105.00	-67.86	0.80	10.00	-57.06	0.002	2.500	◆4
		2483.51	-63.60	0.80	10.00	-52.80	0.005	25.000	◆3
		2508.42	-63.60	0.80	10.00	-52.80	0.005	2.500	◆4
		2484.08	-73.63	0.80	10.00	-62.83	0.001	25.000	◆3

Sample Calculation :  
Result = Reading + Cable Loss + Attenuator  
◆1:Freq Range1 ( ≥ 30MHz, < 2,387MHz)  
◆2:Freq Range2 ( ≥ 2,387MHz, < 2,400MHz)  
◆3:Freq Range3 ( > 2,483.5MHz, ≤ 2,496.5MHz)  
◆4:Freq Range4 ( > 2,496.5MHz, ≤ 12.5GHz)



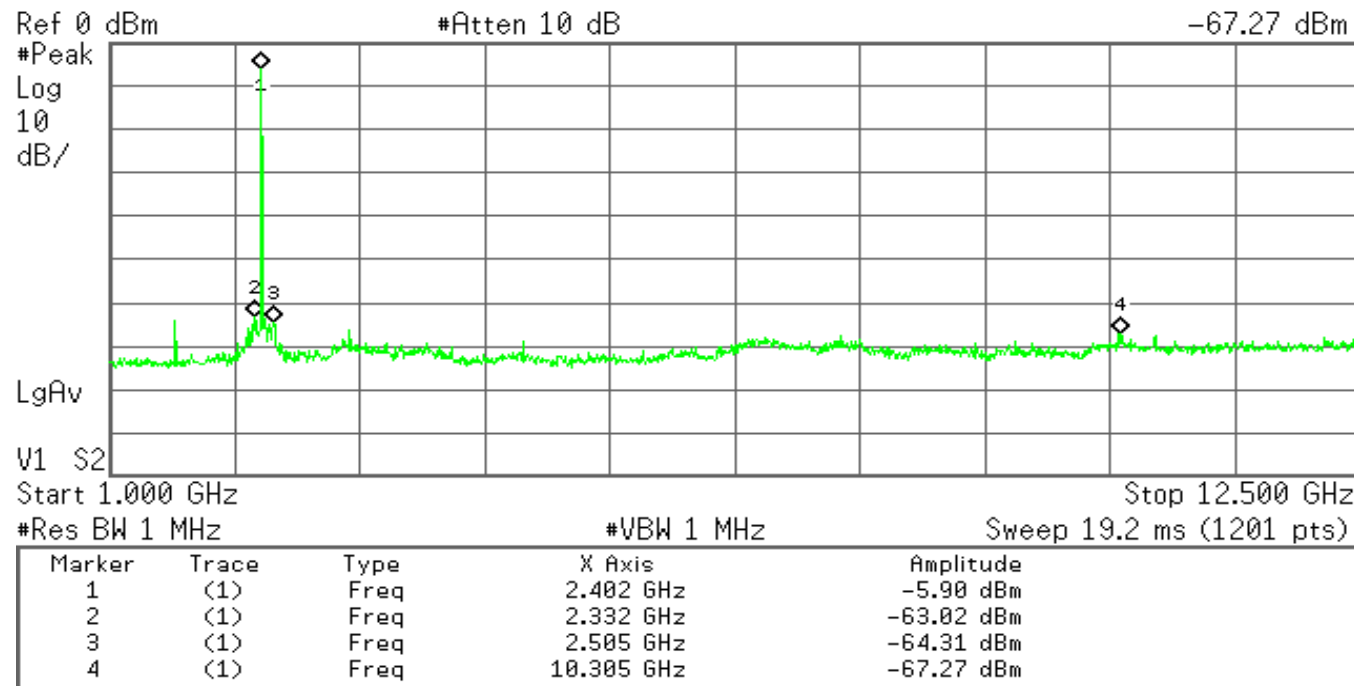
Tx1\_SpuriousG\_Nom

Agilent 20:14:40 Apr 12, 2018

R L

Mkr4 10.305 GHz

-67.27 dBm



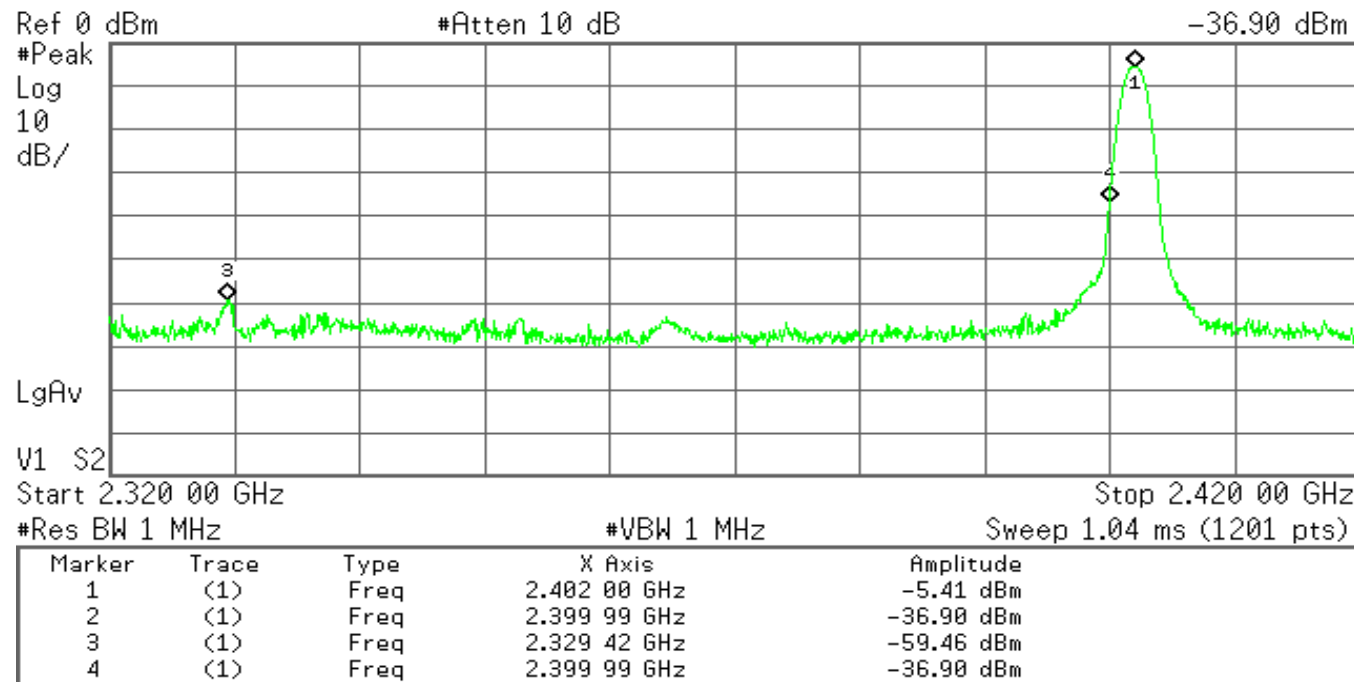
Tx1\_BandEdgeLow\_Nom

Agilent 20:15:24 Apr 12, 2018

R L

Mkr4 2.399 99 GHz

-36.90 dBm

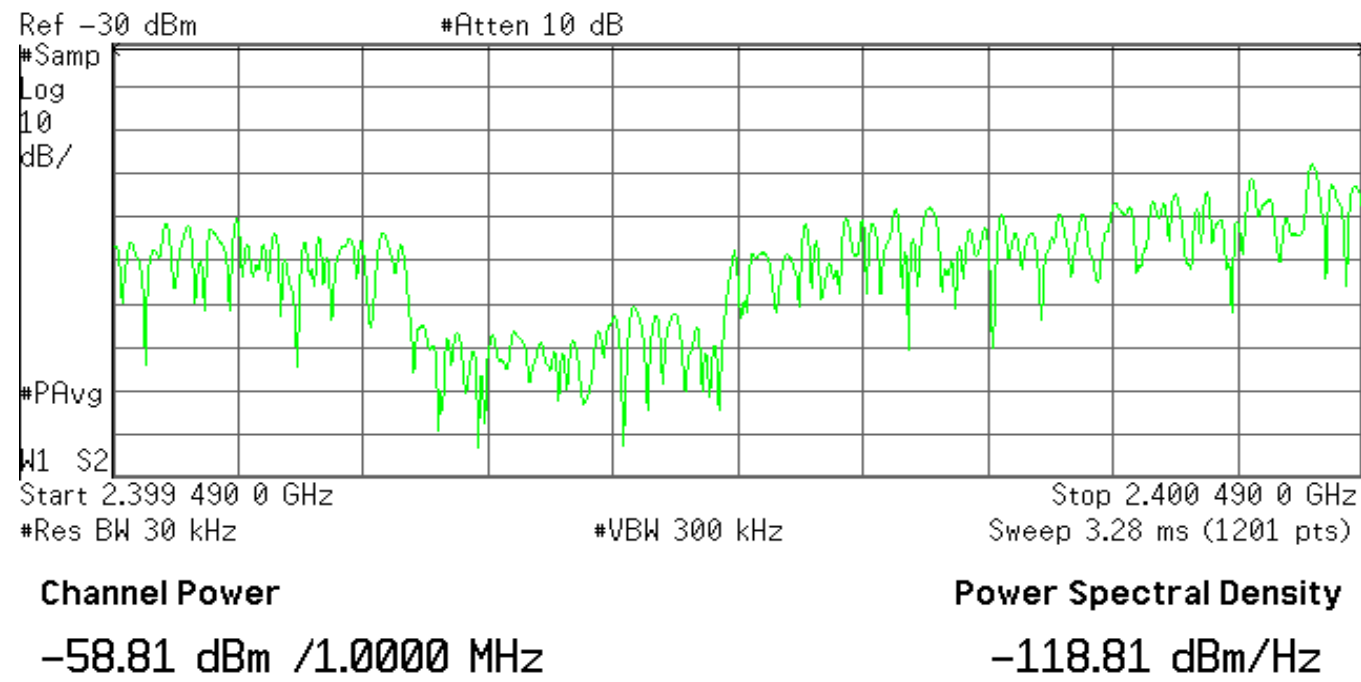




Tx1\_BandEdgeLowZoom\_Nom

Agilent 20:19:31 Apr 12, 2018

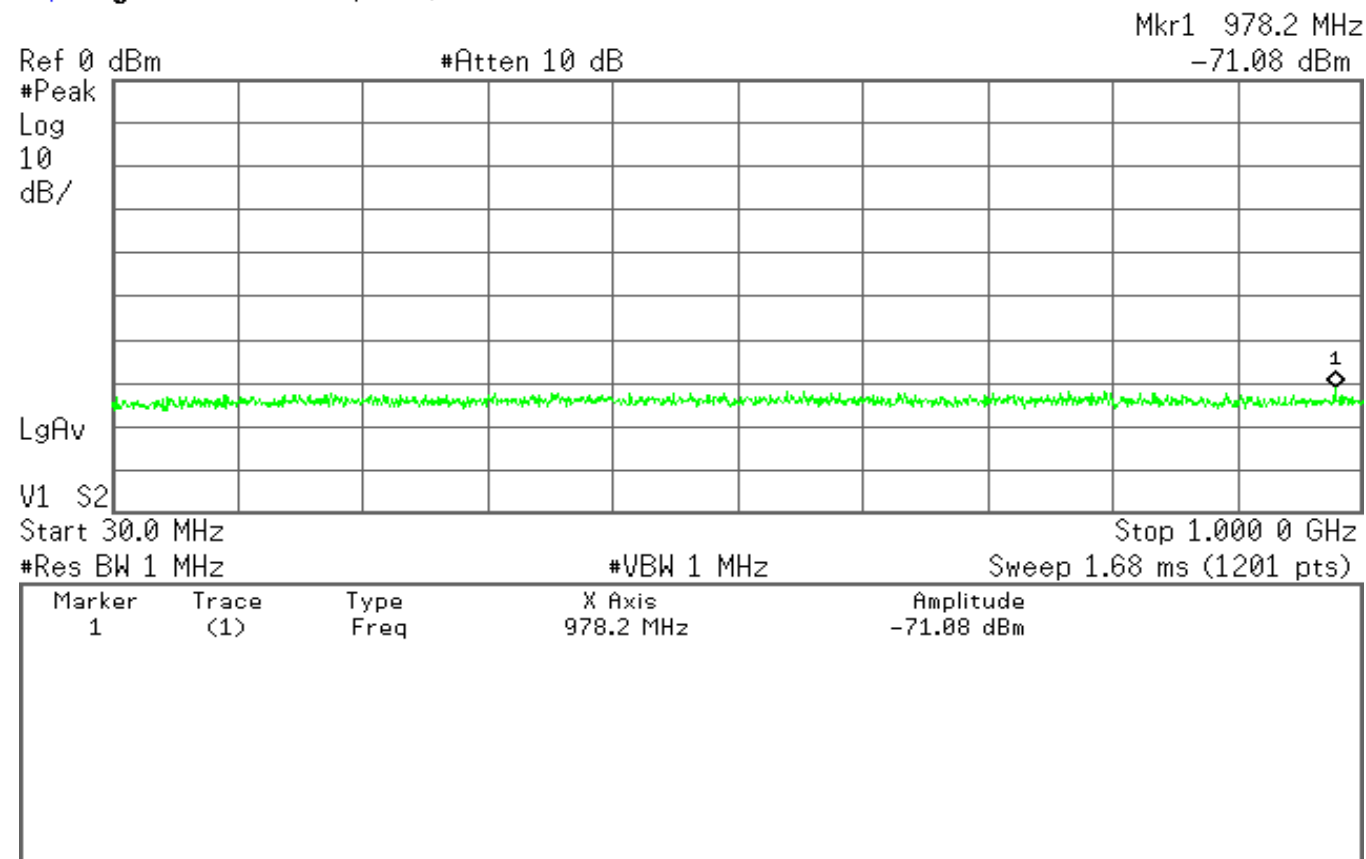
R L



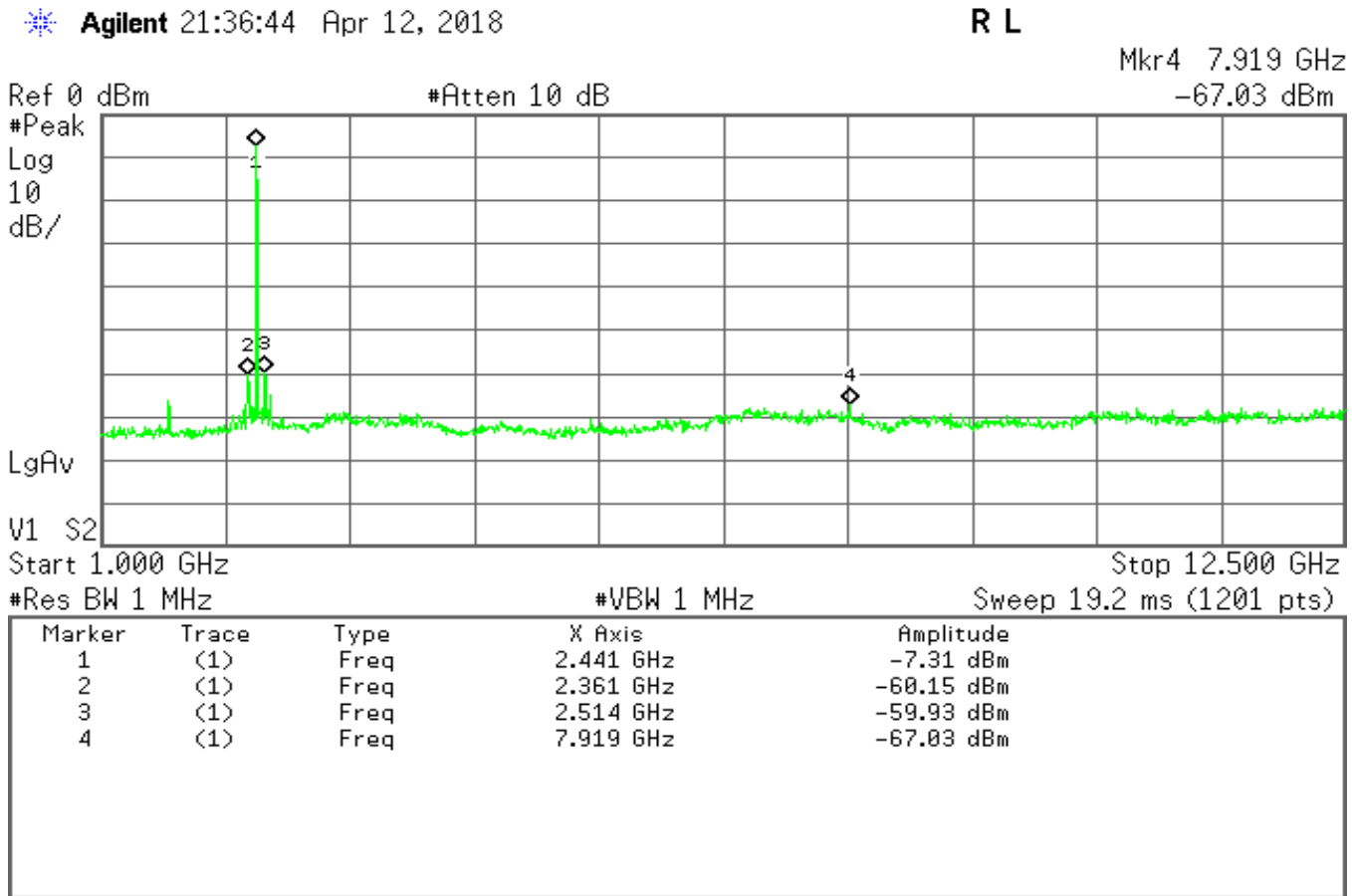
Tx2\_SpuriousM\_Nom

Agilent 21:36:57 Apr 12, 2018

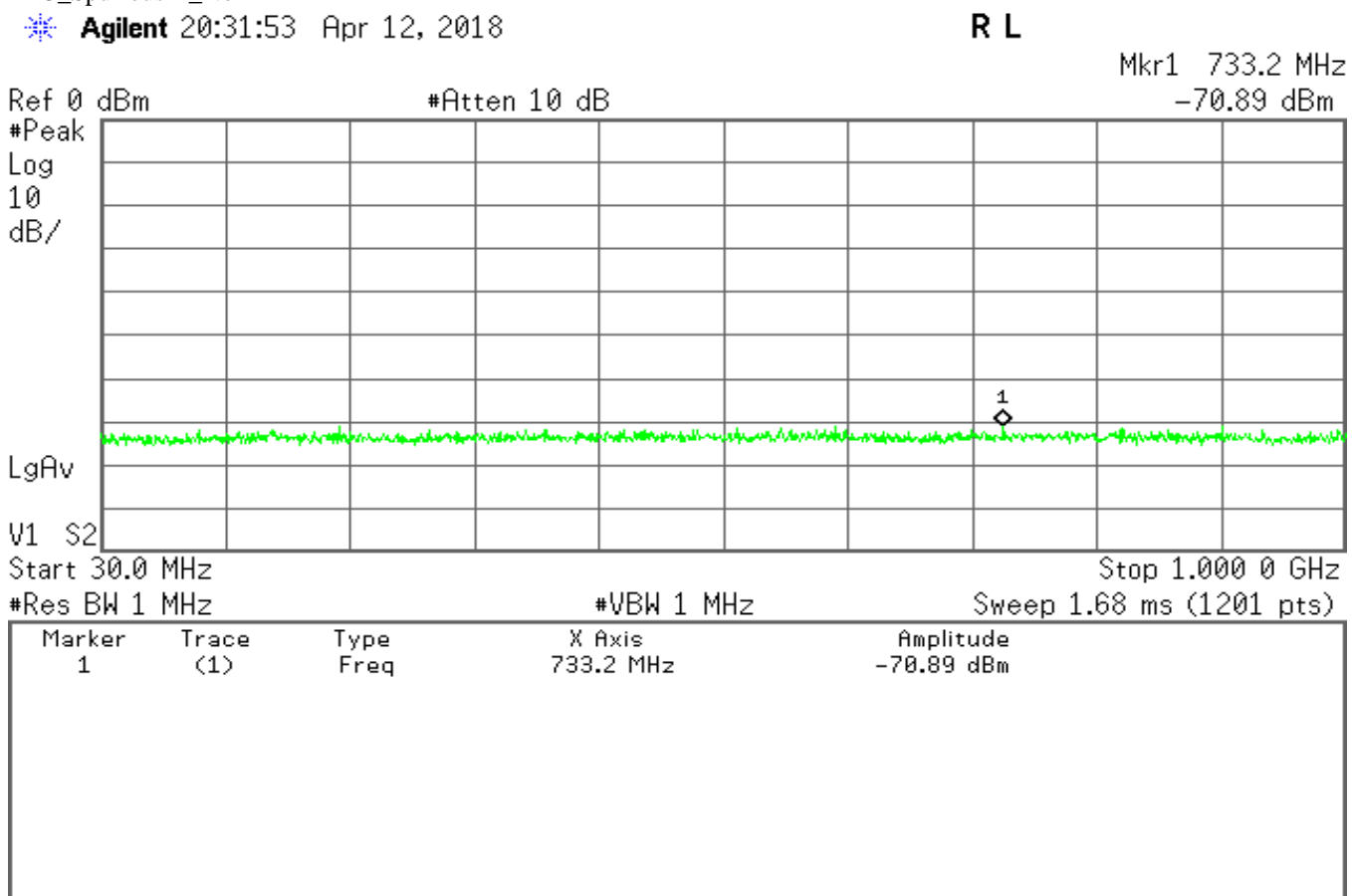
R L



Tx2\_SpuriousG\_Nom



Tx3\_SpuriousM\_Nom

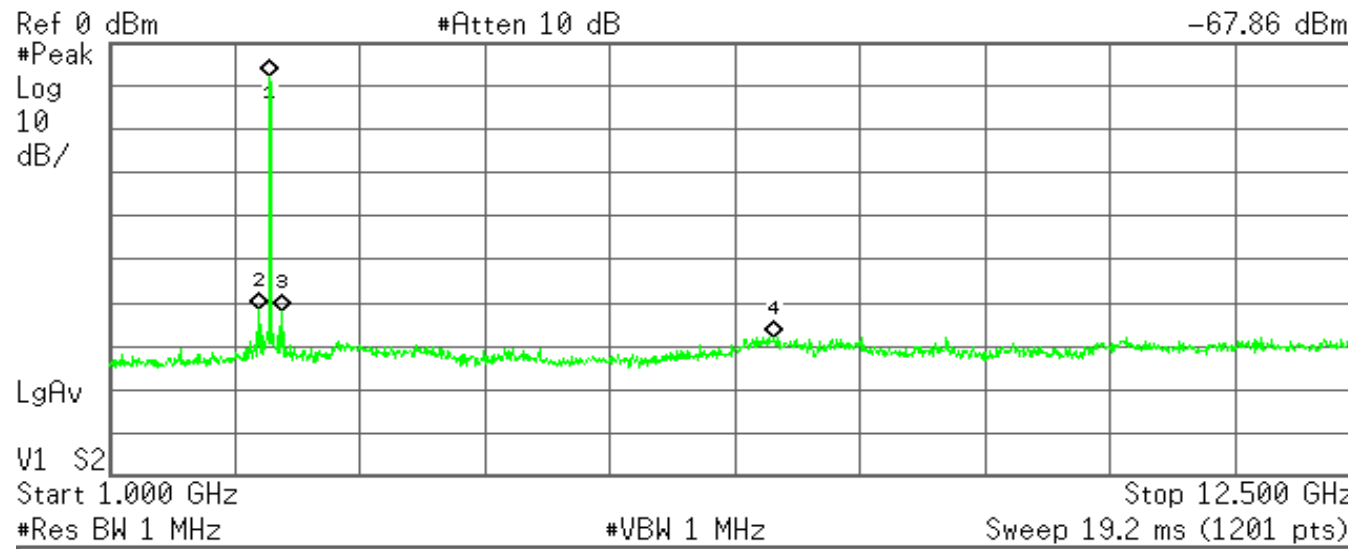


Tx3\_SpuriousG\_Nom

Agilent 20:31:41 Apr 12, 2018

R L

Mkr4 7.105 GHz



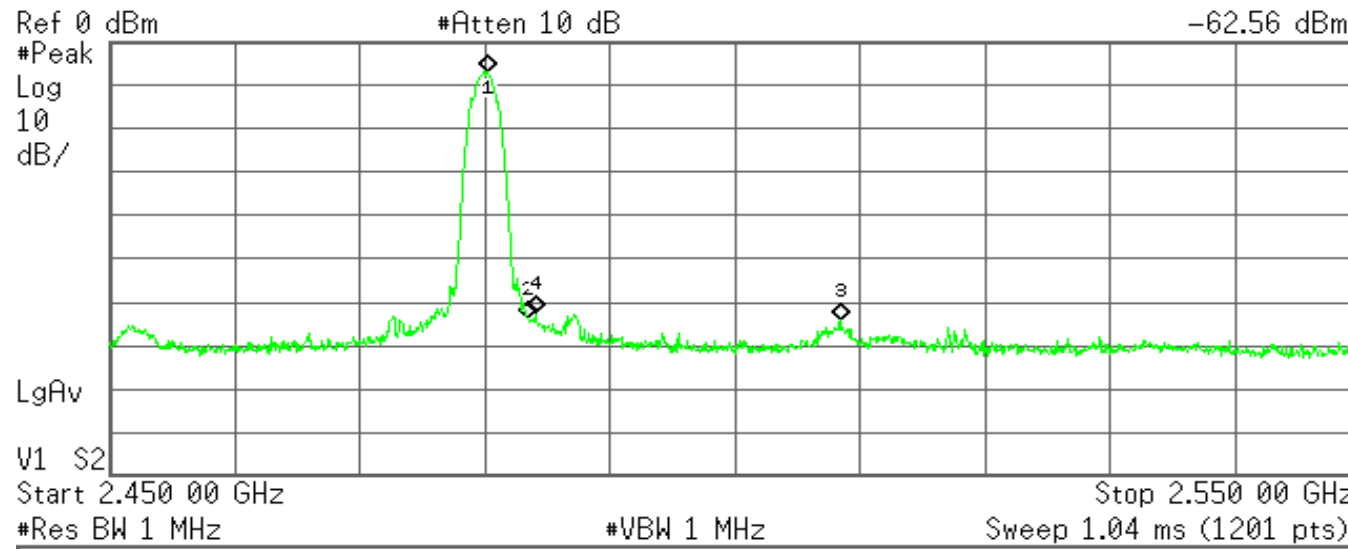
Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.480 GHz	-7.72 dBm
2	(1)	Freq	2.370 GHz	-61.66 dBm
3	(1)	Freq	2.591 GHz	-62.11 dBm
4	(1)	Freq	7.105 GHz	-67.86 dBm

Tx3\_BandEdgeHigh\_Nom

Agilent 20:32:24 Apr 12, 2018

R L

Mkr4 2.484 08 GHz

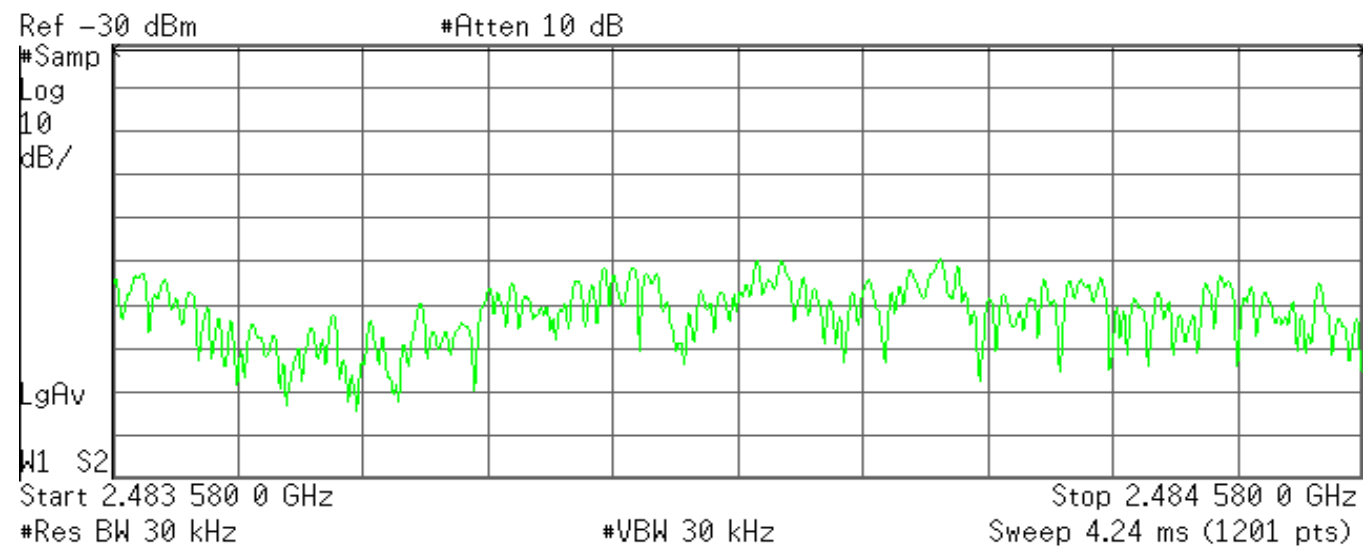


Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.480 25 GHz	-6.83 dBm
2	(1)	Freq	2.483 51 GHz	-63.60 dBm
3	(1)	Freq	2.508 42 GHz	-64.03 dBm
4	(1)	Freq	2.484 08 GHz	-62.56 dBm

Tx3\_BandEdgeHighZoom\_Nom

✱ Agilent 20:34:25 Apr 12, 2018

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**Channel Power**

**-73.63 dBm /1.0000 MHz**

**Power Spectral Density**

**-133.63 dBm/Hz**

2.4. Output Power

Job No.12241662-E5V2

Remark1

Remark2

[ DATA]

Voltage	Freq. [MHz]	P/M(AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result A [W]	Spreading Bandwidth [MHz]	Burst Rate	Result B [W/MHz]	Tolerance [%]	Remark	Limit [W/MHz]	Limit Tolerance [%]
DC5V	2402	2.29	0.80	10.00	0.020370	71.4679	1.34	0.000383	-31.0	-	0.003000	+20 ~ -80
	2441	2.45	0.80	10.00	0.021135	71.4679	1.34	0.000397	-28.4	-	0.003000	+20 ~ -80
	2480	2.31	0.80	10.00	0.020464	71.4679	1.34	0.000385	-30.7	-	0.003000	+20 ~ -80
	2441	2.25	0.80	10.00	0.021135	20.0000	1.34	0.001420	-30.0	20HOP	0.003000	+20 ~ -80

Sample Calculation :  
Result A = 10 ^ ( ( P/M Reading [dBm] (Detector:AV) + Cable Loss + Atten. Loss ) / 10 )  
Result B= (Result A / Spreading Bandwidth) \* Burst Rate  
Tolerance = Result / Declared Output Power \* 100 - 100.

[Declared Output Power]

Average of Power between Channels (79HOP)	0.000388	W/MHz
Declared Output Power 1	0.000555	W/MHz
+ 20	0.000666	W/MHz
Middle (Declared Output Power -30%)	0.000388	W/MHz
-80	0.000111	W/MHz

(Bluetooth, 20HOP(AFH))

20HOP	0.001420	W/MHz
Declared Output Power 2	0.002028	W/MHz
+ 20	0.002434	W/MHz
Middle (Declared Output Power -30%)	0.001420	W/MHz
-80	0.000406	W/MHz

Antenna Gain	2.30	dBi
E.I.R.P. for Declared Output Power 1	-0.26	dBm/MHz
E.I.R.P. for Declared Output Power 2	5.37	dBm/MHz
Limit	6.91	dBm/MHz

Sample Calculation :  
E.I.R.P. for Declared Output Power = 10 \* Log (Declared Output Power \* 1000) + Antenna Gain

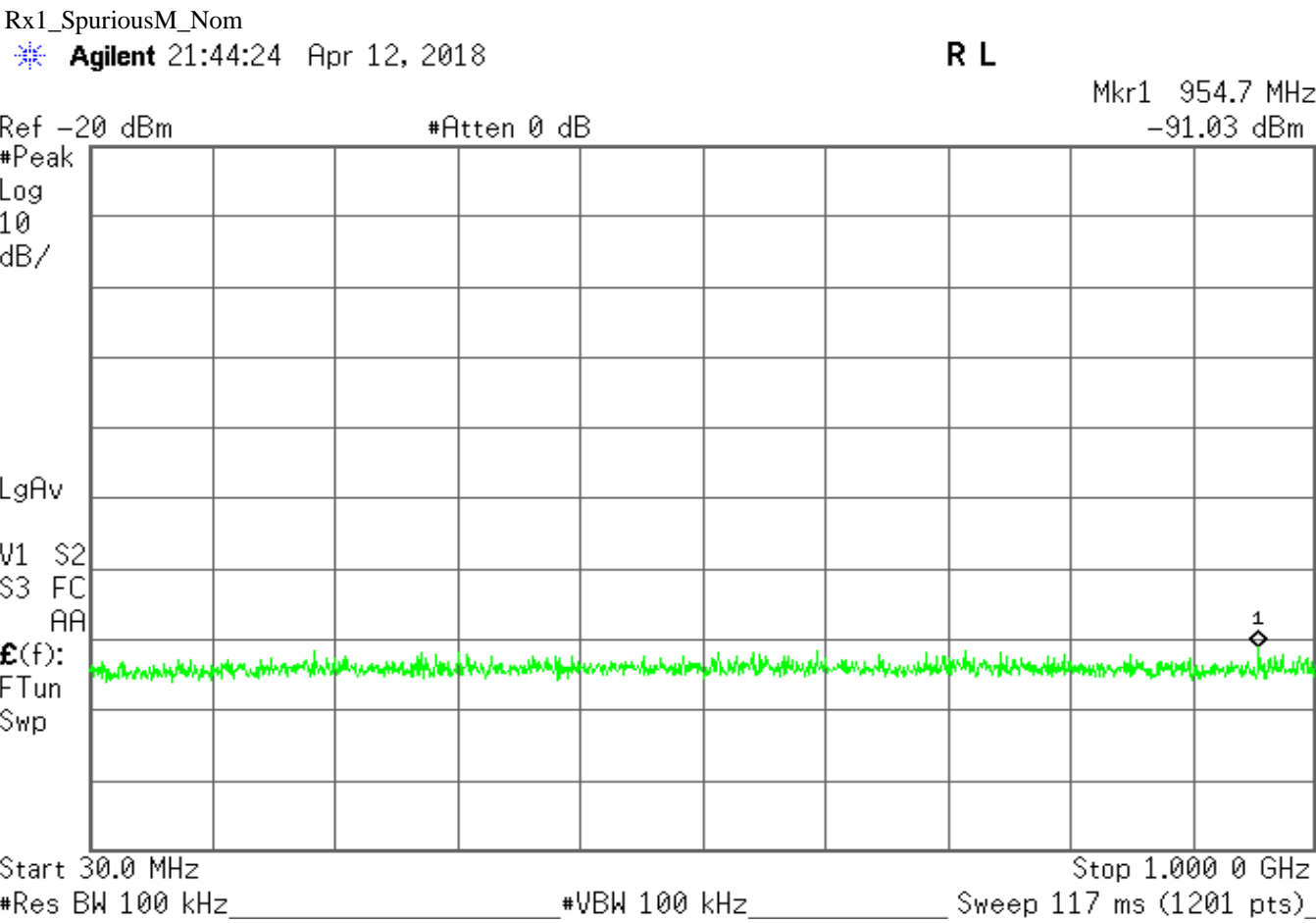
2.5. Secondary Radiated Emission Strength

Job No.	12241662-E5V2
Remark1	
Remark2	

[ DATA]									
Voltage	Freq.	Freq.	S/A Reading	Cable Loss	Atten. Loss	Result	Result	Limit	Remark
[V]	[MHz]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[nW]	[nW]	
DC5V	2441	954.7	-91.04	0.80	10.00	-90.24	0.001	4.000	◆5
		10363.0	-67.43	0.80	10.00	-66.63	0.217	20.000	◆6

Sample Calculation :  
Result = Reading + Cable Loss  
◆5:Freq Range5 (≥ 30MHz, <1GHz)  
◆6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)

[CHART] (V: Normal)



Rx1\_SpuriousG\_Nom

Agilent 21:44:12 Apr 12, 2018

R L

Mkr1 10.363 GHz  
-67.43 dBm

Ref -20 dBm

#Atten 0 dB

#Peak  
Log  
10  
dB/

LgAv

V1 S2  
S3 FC  
AA

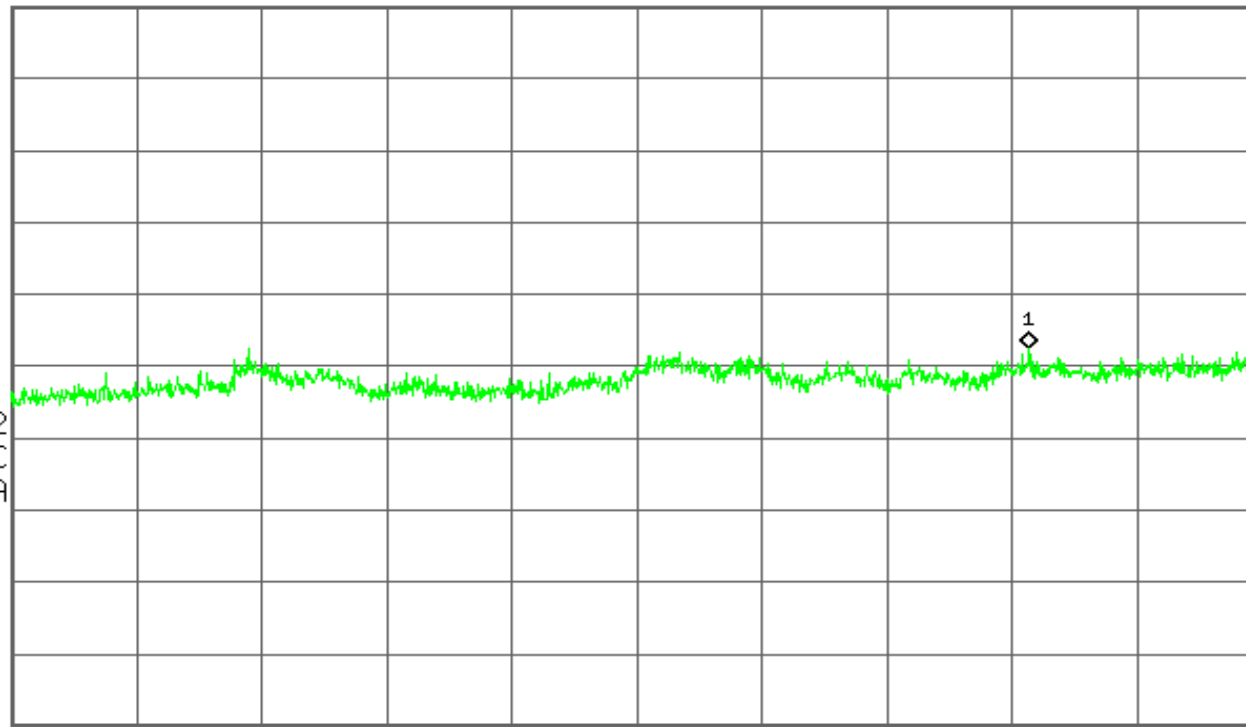
$\mathcal{E}(f)$ :  
FTun  
Swp

Start 1.000 GHz

#Res BW 1 MHz

#VBW 1 MHz

Stop 12.500 GHz  
Sweep 19.2 ms (1201 pts)



## 2.6. Dwell Time/ Duty

Job No. 12241662-E5V2

Remark1

Remark2

### [ DATA ]

Voltage	Freq.		Spreading Bandwidth	On Time	Period	Result (Duty)	Symbol Rate	Hopping Number	Result (Dwell time)	Limit
[V]	[MHz]	[sec]	[MHz]	[msec]	[msec]	[ % ]	[Mbps]	[times]	[sec]	[sec]
DC5V	2441	0.4	71.4679	2.767	3.717	74.4	1.0	79	0.269	0.4

Sample Calculation :

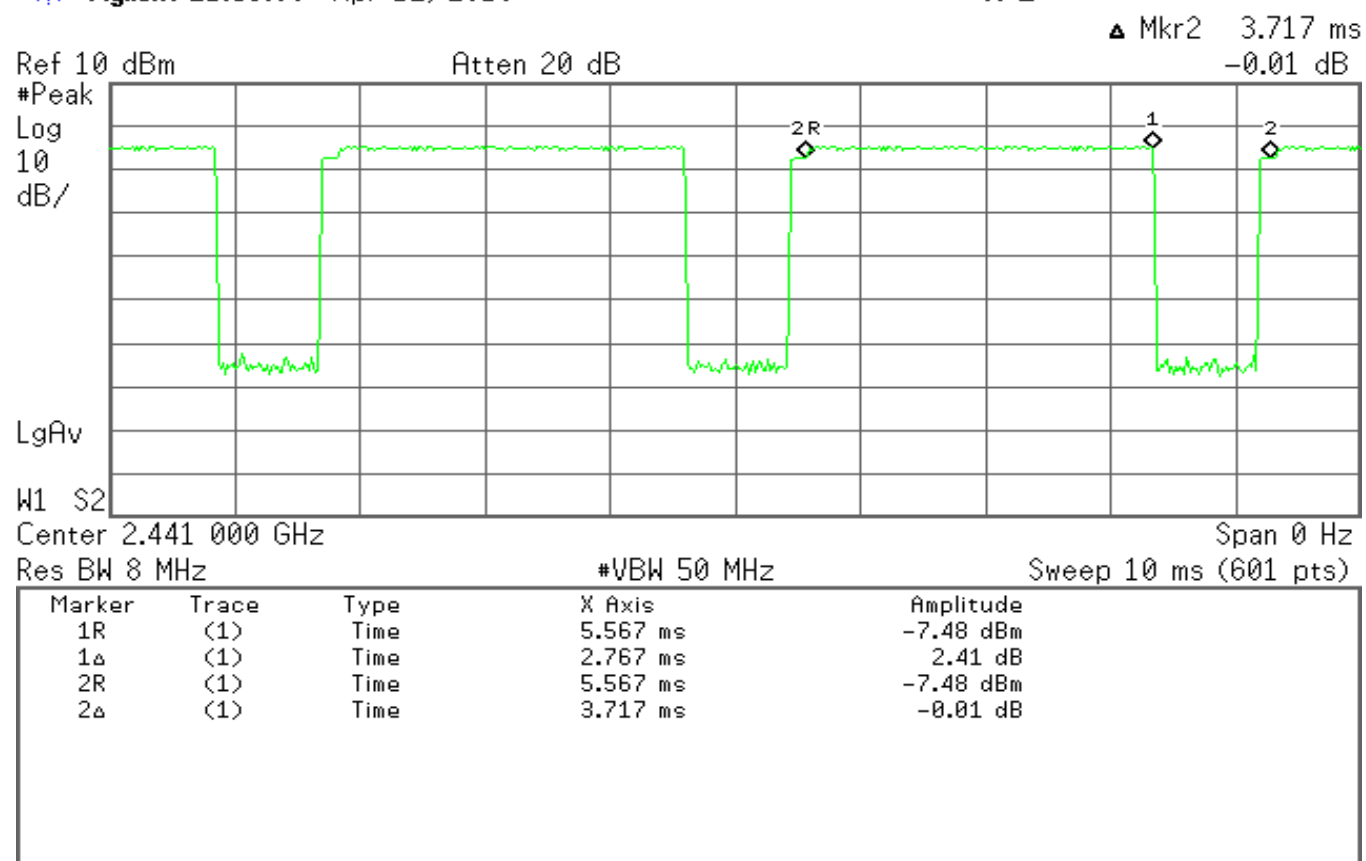
Result(Duty) = On Time / Period \* 100

Result (Dwell Time)= (0.4 \* Spreading Bandwidth [MHz] \* On Time / Symbol Rate [Mbps]) / (Period \* Hopping Number)

Tx2\_BurstRate\_Nom

Agilent 21:53:08 Apr 12, 2018

R L





3. Measurement Equipment

Use	Int. No.	Kind of Equipment	Model No.	Manufacturer	Serial No.	Calibration Authority	Calibration Date
X	T146	Spectrum Analyzer	E440A	Agilent	MY45300064	Keysight	2/3/2018
X	T1271	Power Meter	N1811A	Keysight	MY55196017	Keysight	7/17/2017
	T413	Power Sensor	N1921A	Keysight	MY52020011	Keysight	6/22/2017
X	T912	Hygro-Thermometer	445703	Extech	NSN	SE Labs	2/22/2018

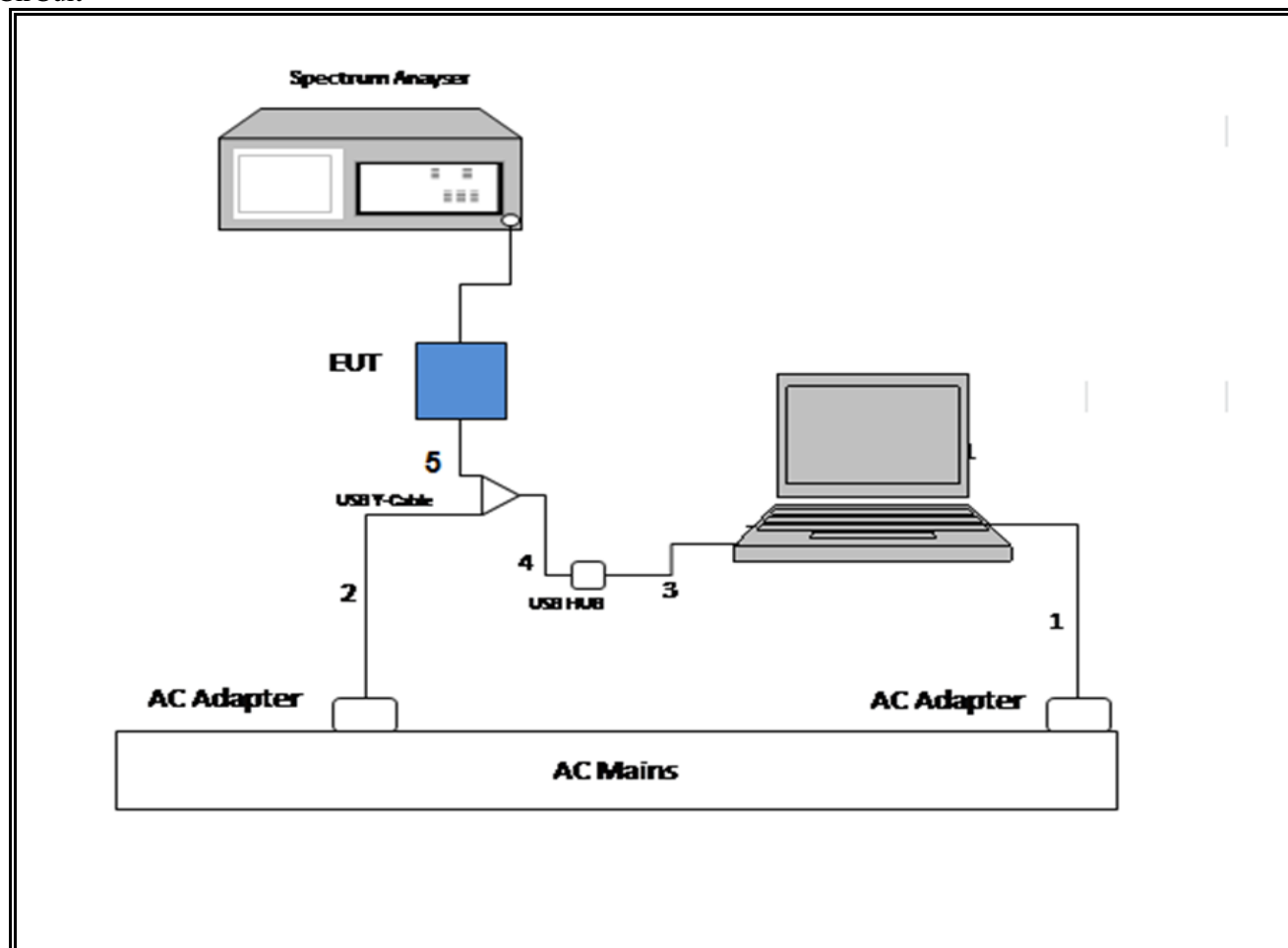
- Note :
- 1. The calibration of measurement equipment is valid for a one year period.
  - 2. "X" used equipment.
  - 3. All equipment is calibrated and traceable to ISO17025

4. Test Condition

Test Item	Date	Temp	Hum	Engineer	Test Room
Frequency Tolerance	12-Apr	23.5	45.8	GA12485	Conducted B
Occupied Bandwidth	12-Apr	23.5	45.8	GA12485	Conducted B
Unwanted Emission Strength	12-Apr	23.5	45.8	GA12485	Conducted B
Output Power/ E.I.R.P	12-Apr	23.5	45.8	GA12485	Conducted B
Secondary Radiated Emission Strength	12-Apr	23.5	45.8	GA12485	Conducted B
Burst Length / Duty	12-Apr	23.5	45.8	GA12485	Conducted B
Outband Leakage Power Strength	12-Apr	23.5	45.8	GA12485	Conducted B

## 5. TEST CONFIGURATION

TEST CirCuit



PHOTO

