

# TEST REPORT



REPORT NUMBER: R11965413-E4a

COMPANY NAME: Amway

EUT DESCRIPTION: Radio Transmitter

MODEL: 120539

SERIAL NUMBER: Non-Serialized

ISSUE DATE: 2018-07-16

DATE TESTED: 2017-10-09

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 LLC  
2800 Perimeter Park Drive, Suite B, Morrisville, NC 27560 USA

Test Result: Pass

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

Type of radio wave, Frequency and antenna power: G1D 2412-2472MHz (Interval of 5MHz 13ch) 0.003978W/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 LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

Approved & Released For UL LLC By:

Prepared By:

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Operations Leader  
UL LLC

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Project Engineer  
UL LLC



## 1. EUT Information

Report No. : R11965413-E4a
Applicant : Amway
Equipment Description: Radio Transmitter
Model No. : 120539
SerialNo. : Non-Serialized
The number of Tx Antenna : 1
Max Antenna Gain : 0.50dBi
Mode : IEEE802.11b
Type of Radio wave : G1D

<b>Supply Voltage</b> <input type="radio"/> DC <input checked="" type="radio"/> AC 100.00V -	<b>Modulation</b> <input checked="" type="radio"/> DS ( e.g. WLAN 11b) <input type="radio"/> OFDM & OBW ≤ 26MHz ( e.g. WLAN 11g, 11n HT20) <input type="radio"/> OFDM & OBW 26~38MHz (e.g. WLAN 11n HT40) <input type="radio"/> Other Modulation (e.g. GFSK, Not BT)
<b>Voltage Condition</b> <input checked="" type="radio"/> Non-Extreme <input type="radio"/> Extreme Normal AC100V Normal-10% - Normal+10% -	<b>EUT has</b> <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 Lowest Rate.

### Factors

	[MHz]	Other than for Power		For Power	
		Cable Loss [dB]	ATT/ [dB]	Cable Loss [dB]	ATT/ [dB]
Low Channel (Tx1)	2412	1.30	10.00	1.30	10.00
Middle Channel (Tx2)	2442	1.30	10.00	1.30	10.00
High Channel (Tx3)	2472	1.30	10.00	1.30	10.00

## 2.TEST Result

### 2.1. Frequency Tolerance

Job No. R11965413-E4a

Remark1

Remark2

#### [ DATA ]

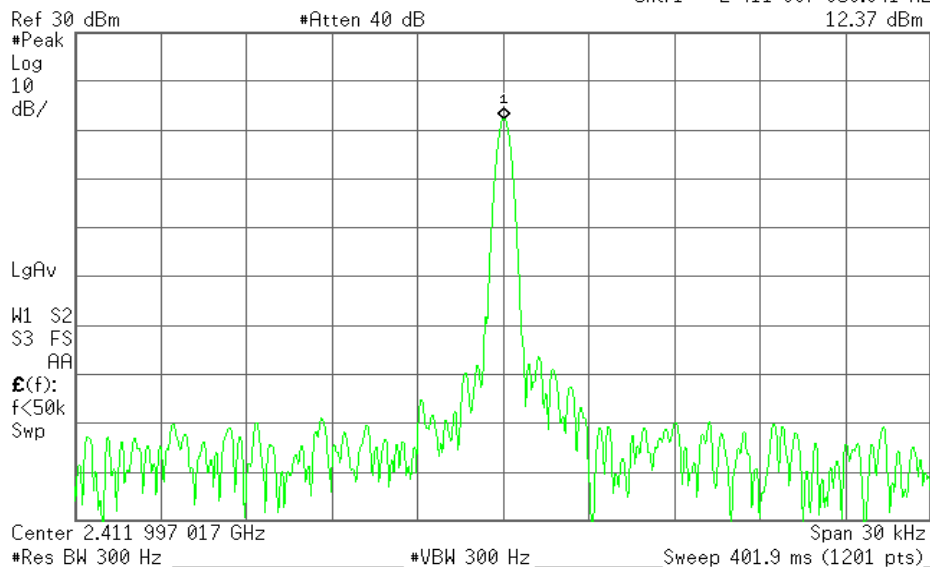
Voltage	Freq. [MHz]	Result [MHz]	Tolerance [kHz]	Tolerance [ppm]	Limit [ppm]
AC100V	2412	2411.9971	-2.9414	-1.22	±50.0
	2442	2441.9970	-3.0040	-1.23	±50.0
	2472	2471.9968	-3.1677	-1.28	±50.0

Tx1\_Freq\_Nom

Agilent 13:04:05 Oct 9, 2017

R L

Cntr1 2 411 997 058.641 Hz

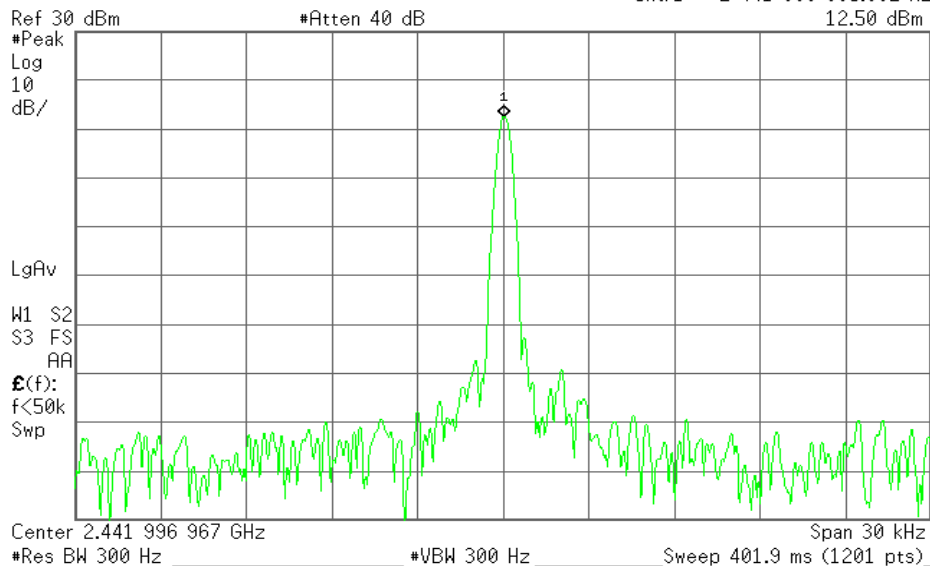


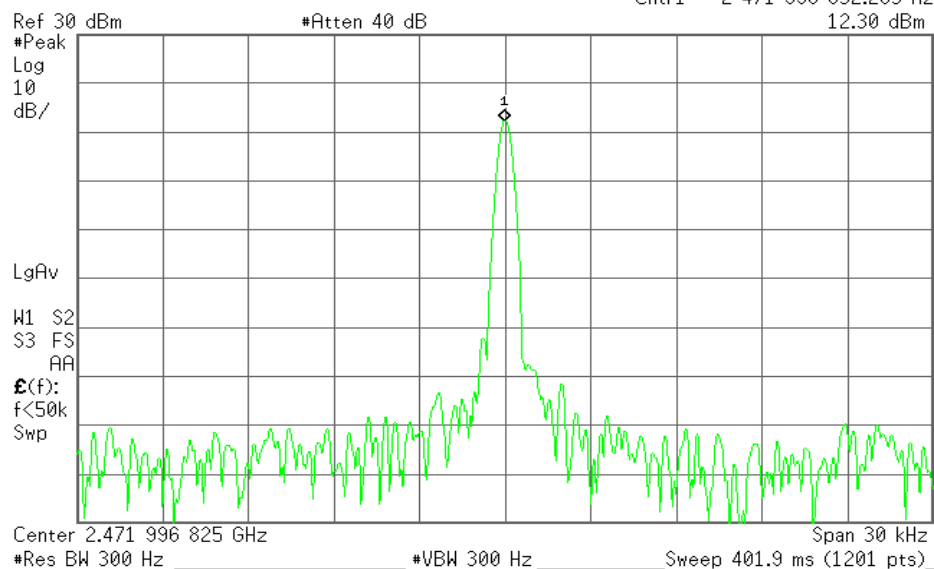
Tx2\_Freq\_Nom

Agilent 13:05:05 Oct 9, 2017

R L

Cntr1 2 441 996 995.982 Hz





## 2.2. Occupied Bandwidth / Spreading Bandwidth

Job No. R11965413-E4a  
 Remark1  
 Remark2

### [ DATA ]

#### 99% Occupied Frequency Bandwidth

Voltage	Freq. [MHz]	Result [MHz]	Limit [MHz]
AC100V	2412	13.9198	26
	2442	13.9292	26
	2472	13.9274	26

#### Spreading Bandwidth

Voltage	Freq. [MHz]	Result [MHz]	Result [kHz]	Limit [kHz]
AC100V	2412	10.1658	10165.8	500
	2442	10.1589	10158.9	500
	2472	10.1697	10169.7	500

#### Spreading Factor

1Mbps, 2Mbps 10.16 (Limit: >5)  
 5.5Mbps, 11Mbps 7.39 (Limit: >5)

#### Symbol Rate

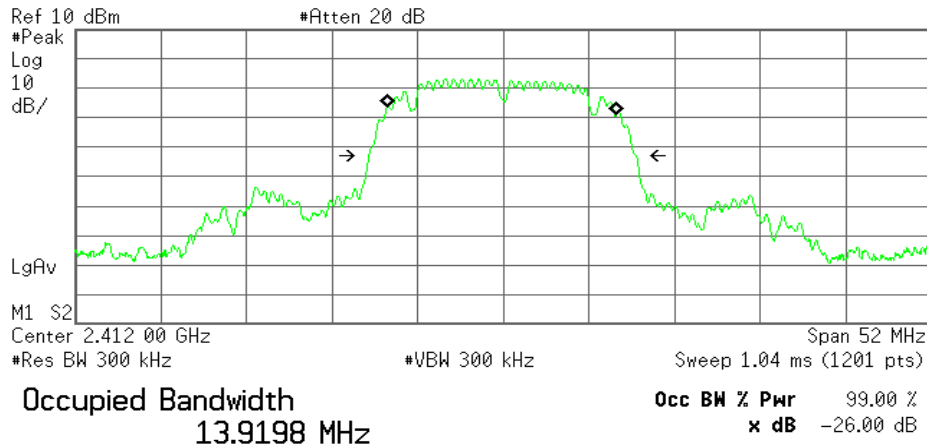
1 Msps  
 1.375 Msps

#### 99% Occupied Frequency Bandwidth

Tx1\_99OBW\_Nom

\* Agilent 12:41:57 Oct 9, 2017

R L

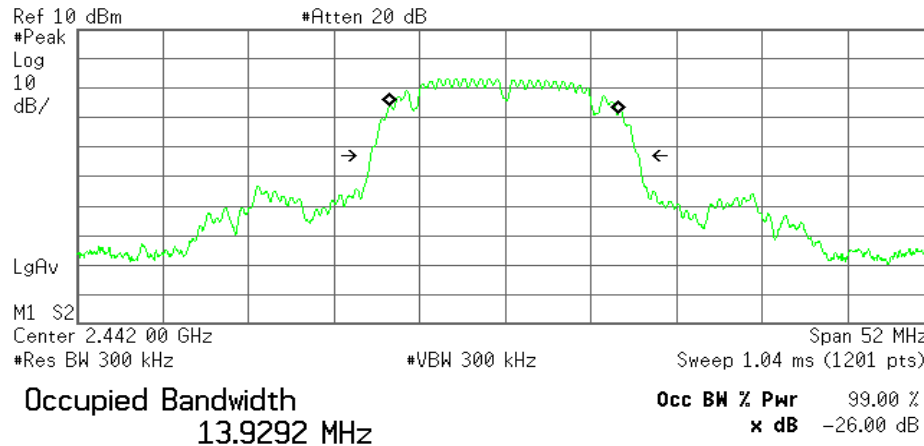


Transmit Freq Error -84.596 kHz  
 x dB Bandwidth 16.232 MHz

Tx2\_99OBW\_Nom

Agilent 12:44:49 Oct 9, 2017

R L

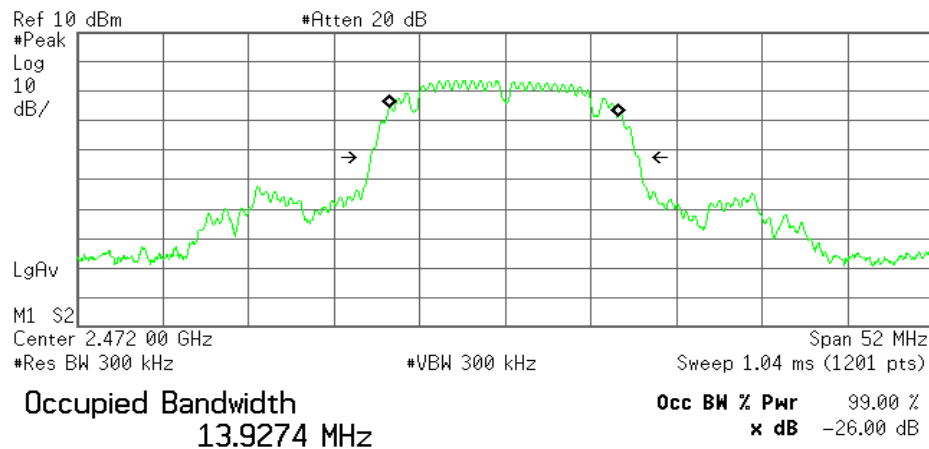


Transmit Freq Error -77.590 kHz  
x dB Bandwidth 16.246 MHz

Tx3\_99OBW\_Nom

Agilent 12:50:50 Oct 9, 2017

R L



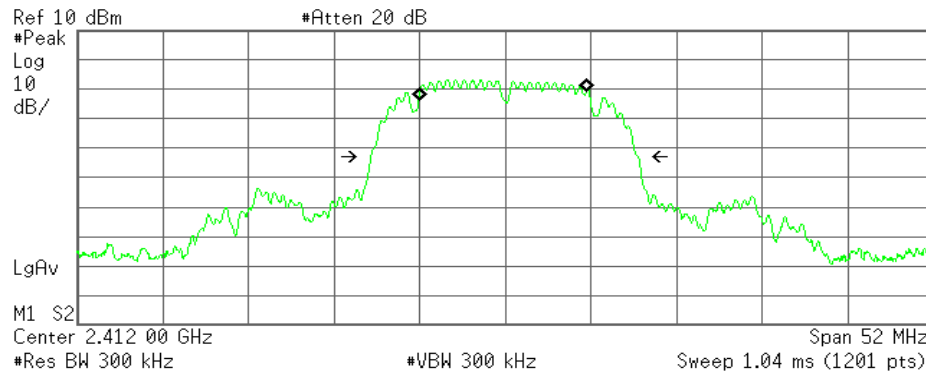
Transmit Freq Error -83.407 kHz  
x dB Bandwidth 16.251 MHz

## Spreading Bandwidth

Tx1\_900BW\_Nom

Agilent 12:42:02 Oct 9, 2017

R L



Occupied Bandwidth  
10.1658 MHz

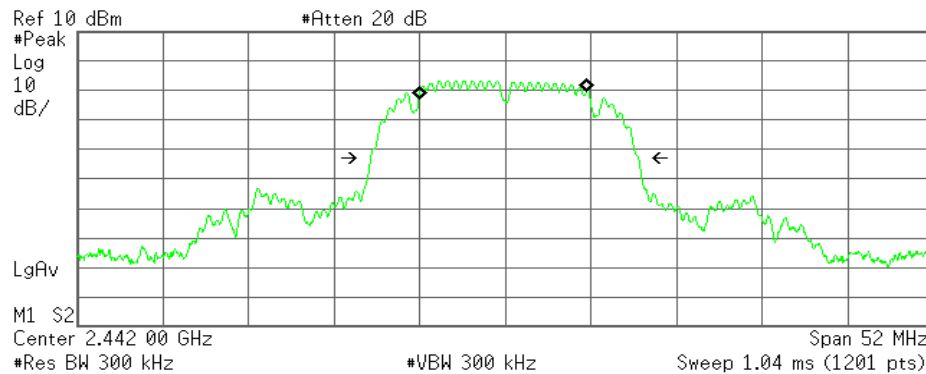
Occ BW % Pwr 90.00 %  
x dB -26.00 dB

Transmit Freq Error -157.569 kHz  
Occupied Bandwidth 16.232 MHz

Tx2\_900BW\_Nom

Agilent 12:44:56 Oct 9, 2017

R L

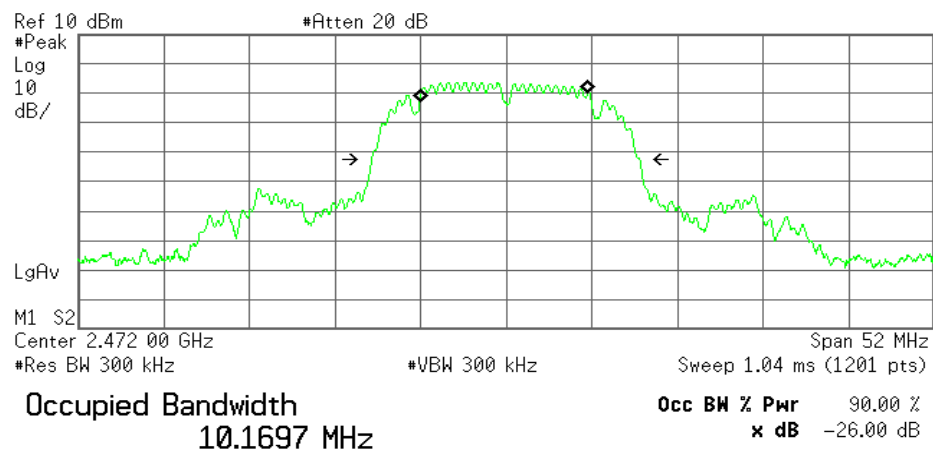


Occupied Bandwidth  
10.1589 MHz

Occ BW % Pwr 90.00 %  
x dB -26.00 dB

Transmit Freq Error -150.994 kHz  
Occupied Bandwidth 16.246 MHz

R L



Transmit Freq Error	-158.892 kHz
Occupied Bandwidth	16.254 MHz



## 2.3. Unwanted Emission Strength (Normal Voltage)

Job No. R11965413-E4a

Remark1

Remark2

### [ DATA ]

Voltage	Freq.	Freq.	S/A Reading	Cable Loss	Atten. Loss	Result	Result	Limit	Remark
	[MHz]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[uW]	[uW]	
AC100V	2412	510.20	-60.90	1.30	10.00	-49.60	0.011	2.500	♣1
		1910.00	-56.30	1.30	10.00	-45.00	0.032	2.500	♣1
		2381.75	-59.52	1.30	10.00	-48.22	0.015	2.500	♣1
		2397.25	-45.64	1.30	10.00	-34.34	0.368	25.000	♣2
		2399.99	-47.40	1.30	10.00	-36.10	0.245	25.000	♣2
		2869.00	-58.23	1.30	10.00	-46.93	0.020	2.500	♣4
	2442	4824.00	-45.51	1.30	10.00	-34.21	0.379	2.500	♣4
		747.80	-61.76	1.30	10.00	-50.46	0.009	2.500	♣1
		1882.00	-57.48	1.30	10.00	-46.18	0.024	2.500	♣1
		2840.00	-57.99	1.30	10.00	-46.69	0.021	2.500	♣4
	2472	4881.00	-42.71	1.30	10.00	-31.41	0.723	2.500	♣4
		769.60	-61.46	1.30	10.00	-50.16	0.010	2.500	♣1
		1441.00	-56.86	1.30	10.00	-45.56	0.028	2.500	♣1
		2483.51	-48.58	1.30	10.00	-37.28	0.187	25.000	♣3
		2486.83	-46.41	1.30	10.00	-35.11	0.308	25.000	♣3
		2497.67	-59.00	1.30	10.00	-47.70	0.017	2.500	♣4
		2811.00	-58.13	1.30	10.00	-46.83	0.021	2.500	♣4
		4948.00	-39.76	1.30	10.00	-28.46	1.425	2.500	♣4

Sample Calculation :

Result = Reading + Cable Loss + Attenuator

♣1:Freq Range1 ( ≥ 30MHz, < 2,387MHz)

♣2:Freq Range2 (2,387MHz以上, < 2,400MHz)

♣3:Freq Range3 (> 2,483.5MHz, ≤ 2,496.5MHz)

♣4:Freq Range4 (> 2,496.5MHz, ≤ 12.5GHz)

Tx1\_SpuriousM\_Nom

Agilent 12:42:50 Oct 9, 2017

R L

Mkr1 510.2 MHz

-60.90 dBm

Ref 10 dBm

#Atten 20 dB

#Peak

Log

10

dB/

LgAv

V1 S2

Start 30.0 MHz

Stop 1.000 0 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 1.68 ms (1201 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	510.2 MHz	-60.90 dBm

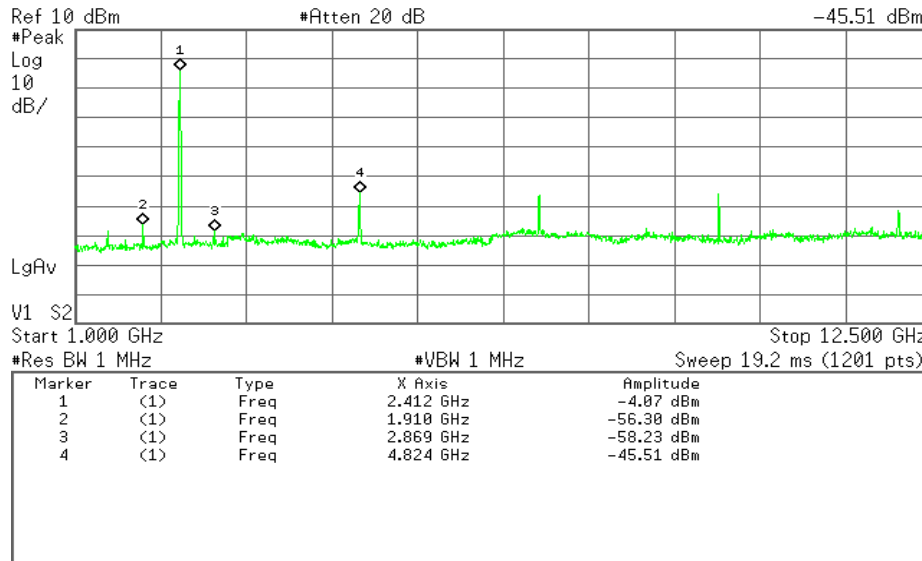
Tx1\_SpuriousG\_Nom

Agilent 12:42:37 Oct 9, 2017

R L

Mkr4 4.824 GHz

-45.51 dBm



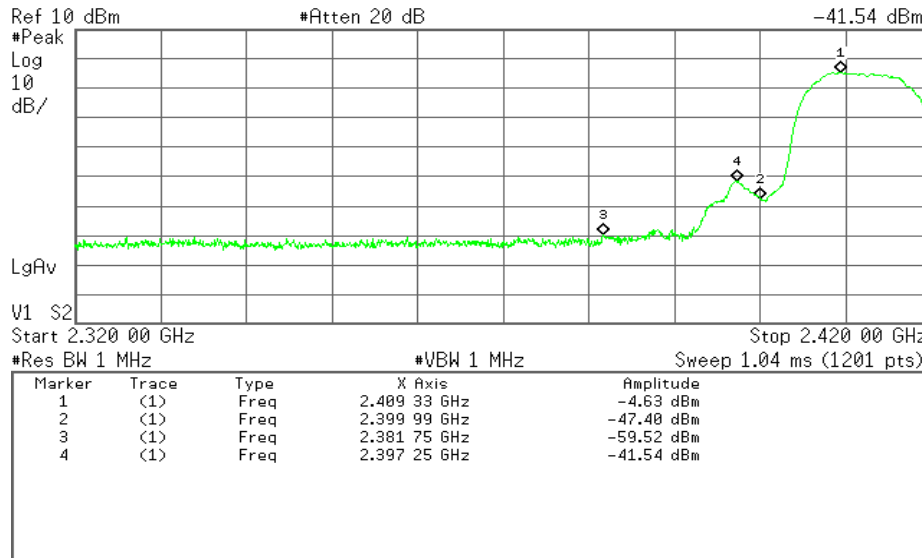
Tx1\_BandEdgeLow\_Nom

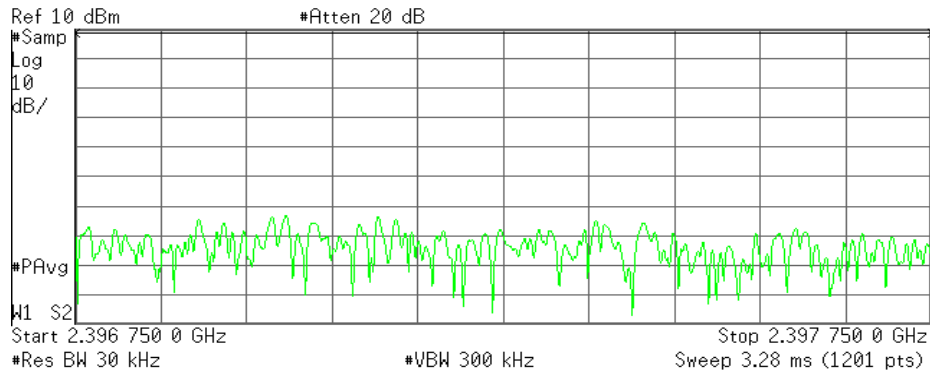
Agilent 12:43:12 Oct 9, 2017

R L

Mkr4 2.397 25 GHz

-41.54 dBm





**Channel Power**

**-45.64 dBm /1.0000 MHz**

**Power Spectral Density**

**-105.64 dBm/Hz**

Tx2\_SpuriousM\_Nom

Agilent 12:45:36 Oct 9, 2017

R L

Mkr1 747.8 MHz  
-61.76 dBm

Ref 10 dBm

#Atten 20 dB

#Peak  
Log  
10  
dB/

LgAv

V1 S2

Start 30.0 MHz

Stop 1.000 0 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 1.68 ms (1201 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	747.8 MHz	-61.76 dBm

Tx2\_SpuriousG\_Nom

Agilent 12:45:24 Oct 9, 2017

R L

Mkr4 4.881 GHz  
-42.71 dBm

Ref 10 dBm

#Atten 20 dB

#Peak  
Log  
10  
dB/

LgAv

V1 S2

Start 1.000 GHz

Stop 12.500 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 19.2 ms (1201 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.442 GHz	-3.60 dBm
2	(1)	Freq	1.882 GHz	-57.48 dBm
3	(1)	Freq	2.840 GHz	-57.99 dBm
4	(1)	Freq	4.881 GHz	-42.71 dBm

Tx3\_SpuriousM\_Nom

\* Agilent 12:51:58 Oct 9, 2017

R L

Mkr1 769.6 MHz

-61.46 dBm

Ref 10 dBm

#Atten 20 dB

#Peak

Log

10

dB/

LgAv

V1 S2

Start 30.0 MHz

Stop 1.000 0 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 1.68 ms (1201 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	769.6 MHz	-61.46 dBm

Tx3\_SpuriousG\_Nom

\* Agilent 12:51:46 Oct 9, 2017

R L

Mkr4 4.948 GHz

-39.76 dBm

Ref 10 dBm

#Atten 20 dB

#Peak

Log

10

dB/

LgAv

V1 S2

Start 1.000 GHz

Stop 12.500 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 19.2 ms (1201 pts)

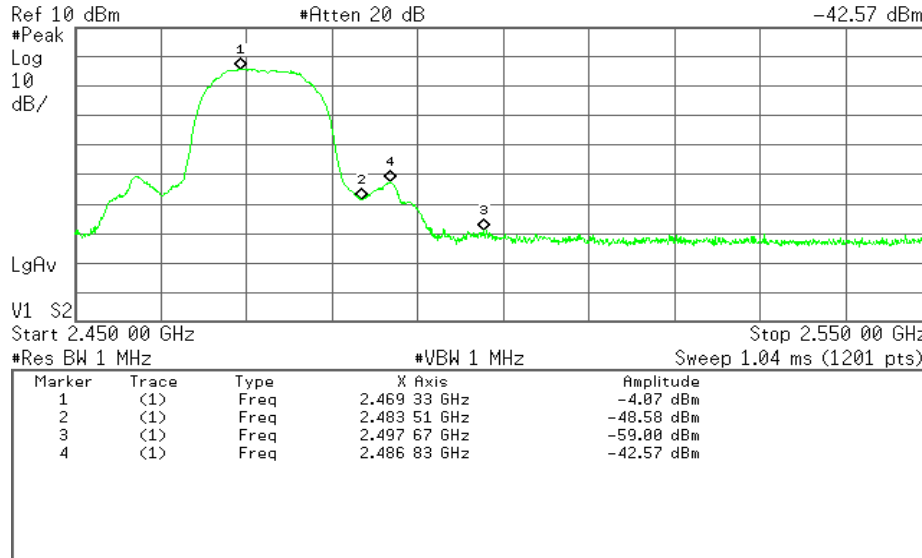
Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.472 GHz	-4.05 dBm
2	(1)	Freq	1.441 GHz	-56.86 dBm
3	(1)	Freq	2.811 GHz	-58.13 dBm
4	(1)	Freq	4.948 GHz	-39.76 dBm

Tx3\_BandEdgeHigh\_Nom

Agilent 12:52:21 Oct 9, 2017

R L

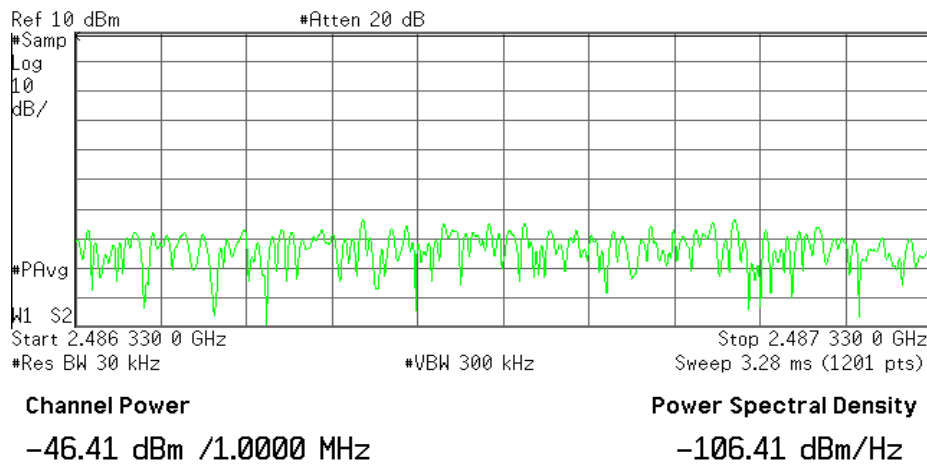
Mkr4 2.486 83 GHz  
-42.57 dBm



Tx3\_BandEdgeHighZoom\_Nom

Agilent 12:52:34 Oct 9, 2017

R L



## 2.4. Output Power

Job No. R11965413-E4a

Remark1

Remark2

### [DATA]

Voltage	Chain	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [W/MHz]	Burst Rate	Output Power (A) [W/MHz]	Antenna Gain [dBi]	E.I.R.P. (A) [W/MHz]
AC100V	0	2412	-7.17	1.30	10.00	0.002587	1.00	0.002599	0.50	0.002916
		2442	-6.83	1.30	10.00	0.002800	1.00	0.002813	0.50	0.003156
		2472	-6.63	1.30	10.00	0.002928	1.00	0.002941	0.50	0.003300
AC100V	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
AC100V	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
AC100V	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-

Sample Calculation :

Output Power (A) =  $10^{((\text{Reading [dBm]} + \text{Cable Loss} + \text{Atten. Loss}) / 10)} \times \text{Burst Rate}$

E.I.R.P. (A) = Output Power (A) \*  $10^{(\text{Antenna Gain[dBi]}/10)}$

### [Total Power / Result and Limit]

Voltage	Freq. [MHz]	Output Power				E.I.R.P.		
		Result (B)	Tolerance Result	Limit	Tolerance Limit	Result (B)	Result	Limit
		[W/MHz]	[%]	[W/MHz]	[%]	[W/MHz]	[dBm/MHz]	[dBm/MHz]
AC100V	2412	0.002599	-34.7	0.010000	+20 ~ -80	0.002916	4.65	12.14
	2442	0.002813	-29.3	0.010000	+20 ~ -80	0.003156	4.99	12.14
	2472	0.002941	-26.1	0.010000	+20 ~ -80	0.003300	5.18	12.14

Sample Calculation :

Tolerance = Output Power Result (B) / Declared Output Power \* 100 - 100.

Output Power Result (B) : Sum of all "Output Power (A)" at same Freq.

E.I.R.P. Result (B): Sum of all "E.I.R.P. (A)" at same Freq.

### [Declared Output Power]

Average of Output Power Result (B)	0.002784	[W/MHz]	Average of E.I.R.P. Result(B)	0.003124	[W/MHz]
Declared Output Power	0.003978	[W/MHz]	E.I.R.P. for Declared Output Power	6.50	[dBm/MHz]
+20	0.004773	[W/MHz]			
Middle (Declared Output Power -30%)	0.002784	[W/MHz]			
-80	0.000796	[W/MHz]			

Sample Calculation :

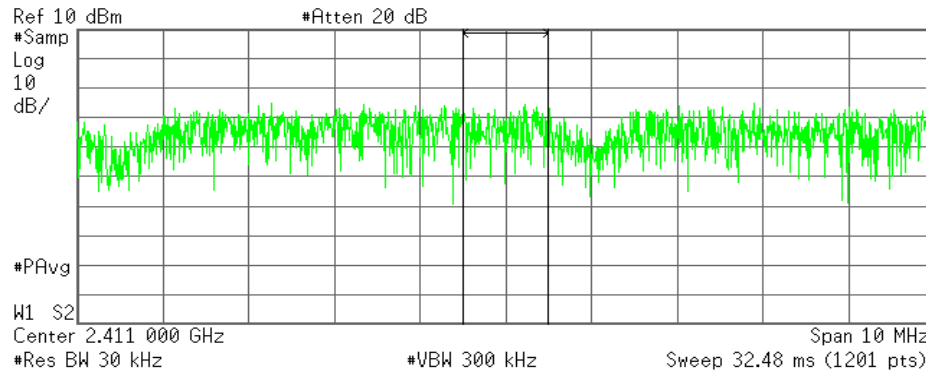
E.I.R.P. for Declared Output Power

=  $10 * \log (\text{Average of E.I.R.P. Result (B)} * (\text{Declared Output Power} / \text{Average of Output Power Result (B)}) * 1000)$

Tx1\_Power\_Chain0\_Nom

Agilent 12:41:27 Oct 9, 2017

R L



Channel Power

-7.17 dBm /1.0000 MHz

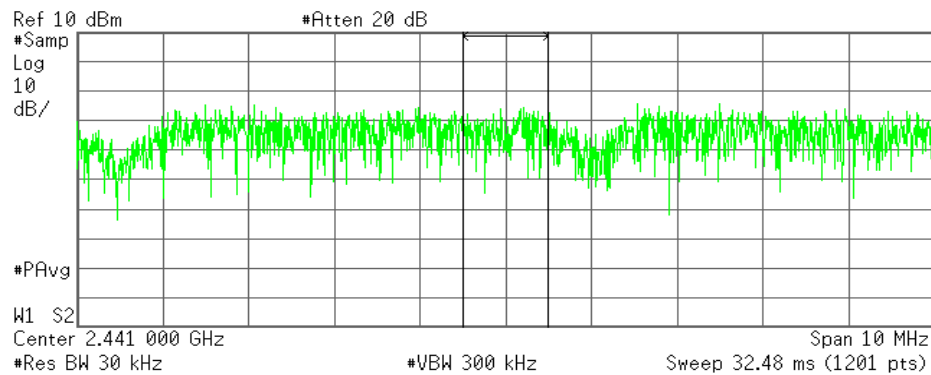
Power Spectral Density

-67.17 dBm/Hz

Tx2\_Power\_Chain0\_Nom

Agilent 12:44:20 Oct 9, 2017

R L



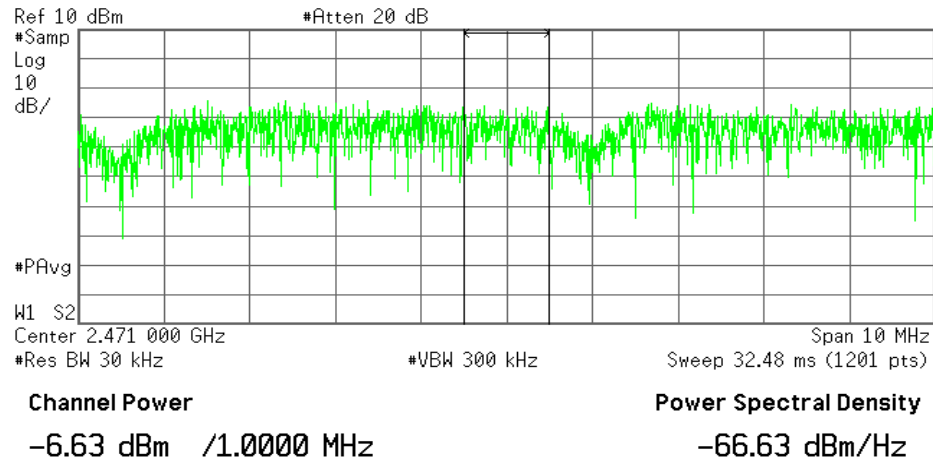
Channel Power

-6.83 dBm /1.0000 MHz

Power Spectral Density

-66.83 dBm/Hz





## 2.5. Secondary Radiated Emission Strength

Job No. R11965413-E4a

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]	
AC100V	2442	220.0	-81.27	1.30	10.00	-69.97	0.101	4.000	◆5
		11647.0	-67.30	1.30	10.00	-56.00	2.510	20.000	◆6

The sum of the results exceeding 1/10 of the Limit [nW] : 2.510

Sample Calculation :

Result = Reading + Cable Loss

◆5:Freq Range5 (≥ 30MHz, <1GHz)

◆6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)

Rx1\_SpuriousM\_Nom

Agilent 12:53:56 Oct 9, 2017

R L

Mkr1 220.0 MHz

Ref -10 dBm

Atten 10 dB

-81.27 dBm

#Peak  
Log  
10  
dB/

LgAv

V1 S2  
S3 FC  
AA

E(f):  
FTun  
Swp

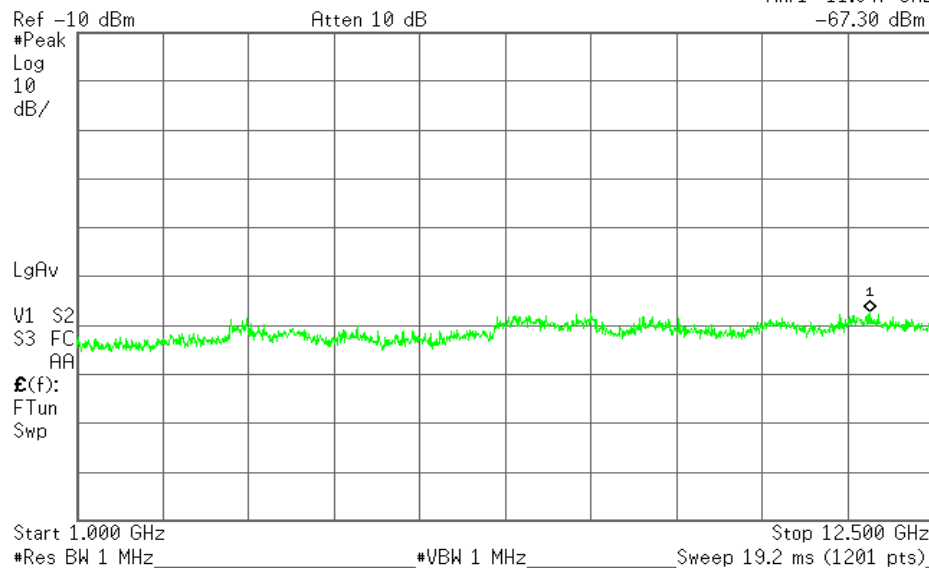
Start 30.0 MHz

Stop 1.000 0 GHz

\*Res BW 100 kHz

\*VBW 100 kHz

Sweep 117 ms (1201 pts)



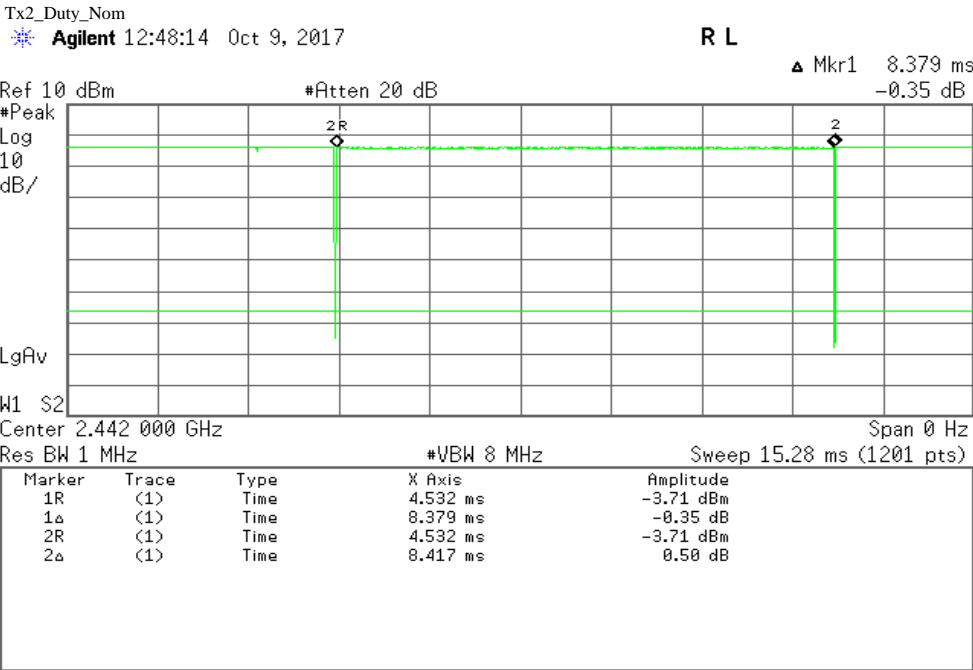
2.6. Duty / Burst Rate

Job No.	R11965413-E4a
Remark1	
Remark2	

[ DATA ]

Voltage	Freq.	On Time	Period	Result (Duty)	Result (Burst Rate)
[V]	[MHz]	[msec]	[msec]	[ % ]	
AC100V	2442	8.379	8.417	99.5	1.005

Sample Calculation :  
Result(Duty) = On Time / Period \* 100  
Result(Burst Rate) = Period / On Time



## Average Power

Job No. R11965413-E4a

Remark1

Remark2

### [ DATA ]

Voltage	Port No.	Freq.	Reading	Cable Loss	Atten. Loss	Burst Rate	Output Power Result
		[MHz]	[dBm]	[dB]	[dB]		[dBm]
AC100V	0	2412	4.79	1.30	10.00	1.00	16.11
		2442	4.85	1.30	10.00	1.00	16.17
		2472	4.96	1.30	10.00	1.00	16.28
AC100V	-	-	-	-	-	-	-
		-	-	-	-	-	-
		-	-	-	-	-	-
AC100V	-	-	-	-	-	-	-
		-	-	-	-	-	-
		-	-	-	-	-	-
AC100V	-	-	-	-	-	-	-
		-	-	-	-	-	-
		-	-	-	-	-	-

### Total Output Power

Voltage	Freq.	Power
	[MHz]	[mW]
DC5V	2412	40.83
	2442	41.40
	2472	42.46

### 3. Measurement Equipment

Use	Int. No.	Kind of Equipment	Model No.	Manufacturer	Serial No.	Calibration Authority	Calibration Date
X	T177	Spectrum Analyzer	E4446A	Agilent Technologies	MY46180491	Keysight Technologies	2017-03-30
X	PWM001	Power Meter	N1912A	Keysight Technologies	MY55136012	World Cal Inc	2017-05-23
X	PWS001	Power Sensor	N1921A	Keysight Technologies	MY55120011	World Cal Inc	2017-05-18
X	15-077-963	Humidity/temp Sensor	Tracable	Fisher Scientific	1610024885	Tracable Calibration	2017-12-23

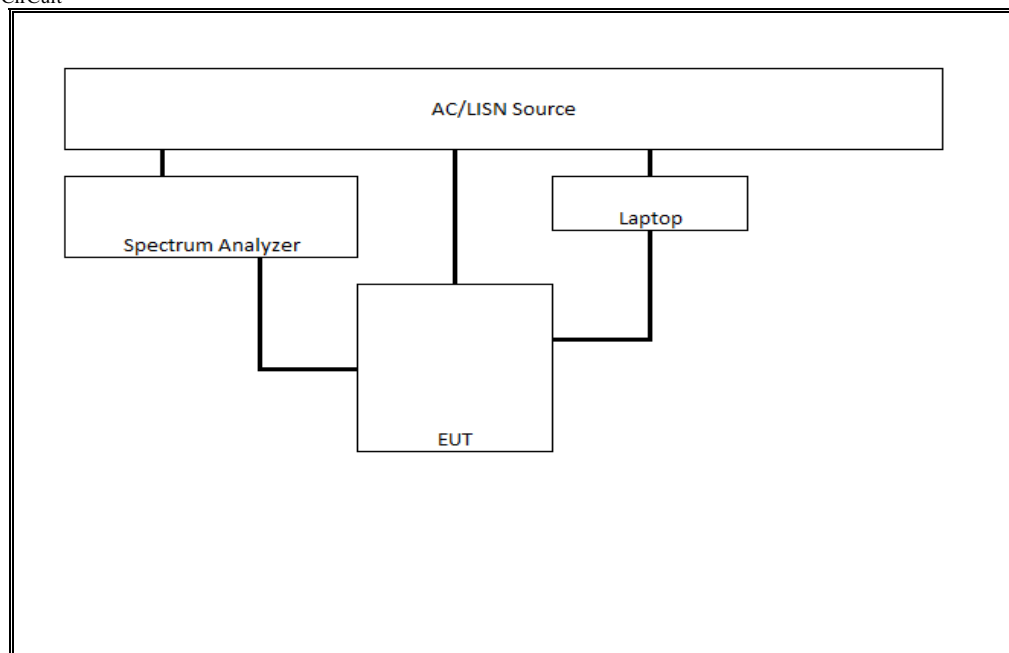
- Note :
1. The calibration of measurement equipment is valid for a one year period.
  2. "X" used equipment.
  3. All equipment is calibrated and traceable to ISO17025

### 4. Test Condition

Test Item	Date	Temp	Hum	Engineer	Test Room
Frequency Tolerance	2017-10-09	23	51.9	Jeffrey Cabrera	Mor-Con2
Occupied Bandwidth	2017-10-09	23	51.9	Jeffrey Cabrera	Mor-Con2
Unwanted Emission Strength	2017-10-09	23	51.9	Jeffrey Cabrera	Mor-Con2
Output Power/ E.I.R.P	2017-10-09	23	51.9	Jeffrey Cabrera	Mor-Con2
Secondary Radiated Emission Strength	2017-10-09	23	51.9	Jeffrey Cabrera	Mor-Con2
Burst Length / Duty	2017-10-09	23	51.9	Jeffrey Cabrera	Mor-Con2
Adjacent Channel Power	2017-10-09	23	51.9	Jeffrey Cabrera	Mor-Con2
Outband Leakage Power Strength	2017-10-09	23	51.9	Jeffrey Cabrera	Mor-Con2

## 5. TEST CONFIGURATION

TEST CirCuit



PHOTO

