

TEST REPORT



REPORT NUMBER: R12161950-E6a

COMPANY NAME: Bose Corp

EUT DESCRIPTION: Wireless Headset

MODEL: 424411

SERIAL NUMBER: DP2 A144

ISSUE DATE: 2018-04-06

DATE TESTED: 2018-02-09 and 2018-03-01

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
12 Laboratory Drive, Research Triangle Park, NC 27709 USA

Test Result: Compliant

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

Type of radio wave, Frequency and antenna power:

F1D	2402-2480MHz (Interval of 1MHz 79ch[Normal])	0.000033W/MHz
F1D	2402-2480MHz (Interval of 1MHz 20ch[AFH])	0.000116W/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:

Jeffrey Moser
Operations Leader
UL LLC

Prepared By:

Brian T. Kiewra
Project Engineer
UL LLC



NVLAP LAB CODE 200246-0

1. EUT Information

Report No. : R12161950-E6a
Applicant : Bose Corp
Equipment Description: Wireless Headset
Model No. : 424411
SerialNo. : DP2 A144
The number of Tx Antenna : 1
Mode : 1-DH5
Max Antenna Gain : 2.20dBi
Type of Radio wave : F1D

Supply Voltage <input checked="" type="radio"/> DC <input type="radio"/> AC 24.00V - -	Modulation <input checked="" type="radio"/> FH (Bluetooth)
Voltage Condition <input checked="" type="radio"/> Non-Extreme <input type="radio"/> Extreme Normal DC24V 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 1-DH5.

Factors

		Other than for Power		For Power	
		Cable Loss [dB]	ATT/ [dB]	Cable Loss [dB]	ATT/ [dB]
Low Channel (Tx1)	2402	1.84	10.00	1.84	10.00
Middle Channel (Tx2)	2441	1.84	10.00	1.84	10.00
High Channel (Tx3)	2480	1.84	10.00	1.84	10.00

Report Version Info			
Ver.	Issue Date	Description	Revised By
1	2018-03-02	Initial Release.	Brian T. Kiewra
2	2018-04-05	Corrected Tx Spur frequencies, added atten loss to Rx spur results, corrected voltage to 24VDC on some test sections, corrected reference to spreading bandwidth in output power section.	Brian T. Kiewra

2.TEST Result

2.1. Frequency Tolerance

Job No.	R12161950-E6a
Remark1	
Remark2	

[DATA]

Voltage	Freq. [MHz]	Result [MHz]	Tolerance [kHz]	Tolerance [ppm]	Limit [ppm]
DC24V	2441	2440.9829	-17.1041	-7.01	±50.0

Tx2_Freq_Nom

Agilent 13:00:15 Feb 9, 2018

R L

Cntr1 2 440 982 895.878 Hz

Ref 20 dBm

*Atten 30 dB

-11.49 dBm

#Peak
Log
10
dB/

LgAv

W1 S2
S3 FS
AA

E(f):
f<50k
Swp

Center 2.440 982 914 GHz

Span 30 kHz

#Res BW 300 Hz

#VBW 300 Hz

Sweep 401.9 ms (1201 pts)

2.2. Occupied Bandwidth / Spreading Bandwidth

Job No.	R12161950-E6a
Remark1	
Remark2	

[DATA]

99% Occupied Frequency Bandwidth

Voltage	Freq. [MHz]	Result [MHz]	Limit [MHz]
DC24V	2441	77.9420	83.5

Spreading Bandwidth

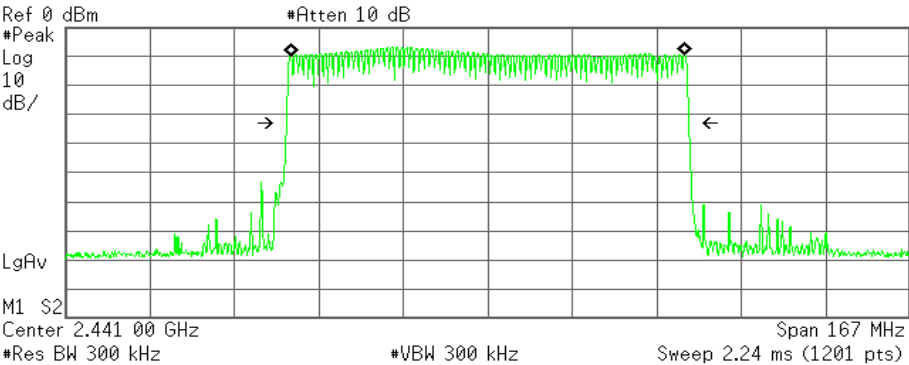
Voltage	Freq. [MHz]	Result [MHz]	Result [kHz]	Limit [kHz]
DC24V	2441	69.7452	69745	500

99% Occupied Frequency Bandwidth

Tx2_Hop99OBW_Nom

Agilent 08:41:07 Mar 1, 2018

R L



Occupied Bandwidth
77.9420 MHz

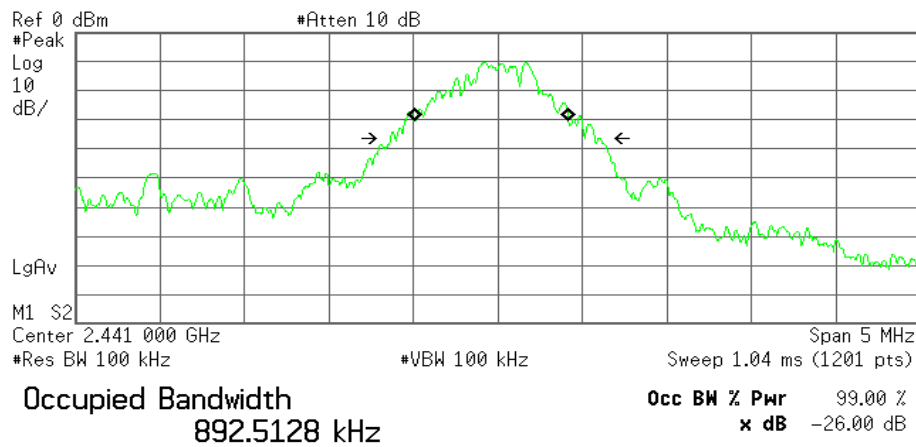
Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -12.535 kHz
x dB Bandwidth 79.583 MHz

Tx2_99OBW_Nom

Agilent 08:42:06 Mar 1, 2018

R L



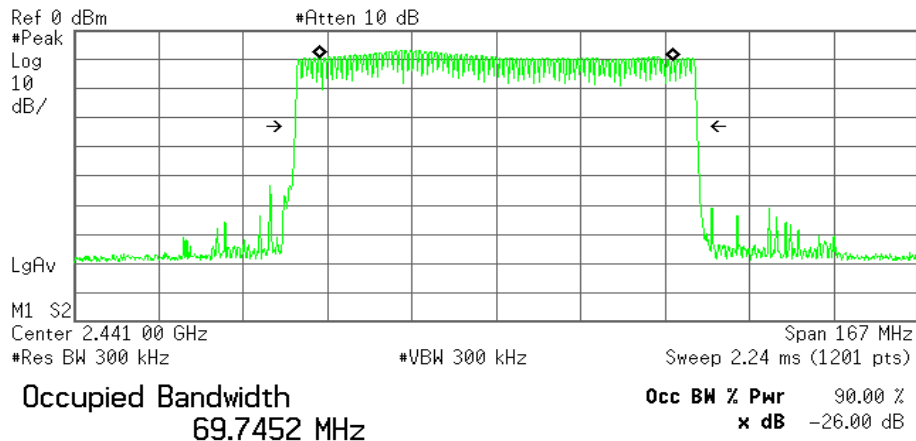
Transmit Freq Error 242.538 kHz
x dB Bandwidth 1.121 MHz

Spreading Bandwidth

Tx2_Hop90OBW_Nom

Agilent 08:41:13 Mar 1, 2018

R L

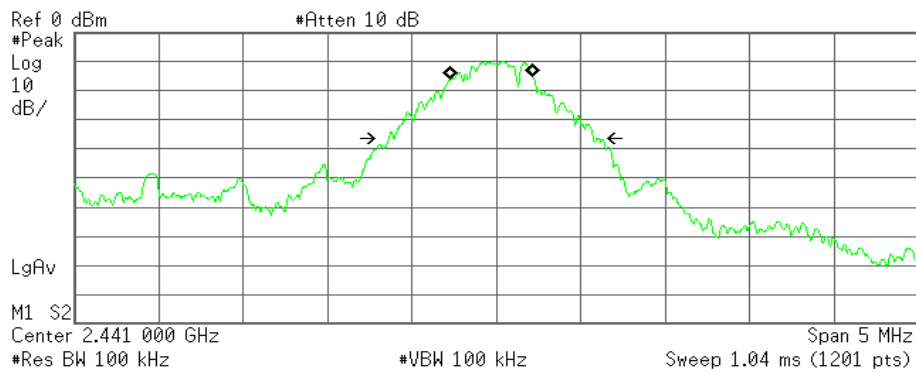


Transmit Freq Error -2.039 kHz
Occupied Bandwidth 79.583 MHz

Tx2_900BW_Nom

Agilent 08:42:12 Mar 1, 2018

R L



Transmit Freq Error -20.622 kHz
Occupied Bandwidth 1.215 MHz

2.3. Unwanted Emission Strength (Normal Voltage)

Job No. R12161950-E6a

Remark1

Remark2

[DATA]

Voltage	Freq.	Freq.	S/A	Cable	Atten.	Result	Result	Limit	Remark
	[MHz]	[MHz]	Reading [dBm]	Loss [dB]	Loss [dB]	[dBm]	[uW]	[uW]	
DC24V	2402	508.50	-80.57	1.84	10.00	-58.73	0.001	2.500	⬆1
		2332.00	-71.63	1.84	10.00	-59.79	0.001	2.500	⬆1
		2378.50	-71.63	1.84	10.00	-59.79	0.001	2.500	⬆1
		2399.99	-50.42	1.84	10.00	-38.58	0.139	25.000	⬆2
		2399.99	-50.42	1.84	10.00	-38.58	0.139	25.000	⬆2
		3175.00	-68.95	1.84	10.00	-57.11	0.002	2.500	⬆4
		7747.00	-66.76	1.84	10.00	-54.92	0.003	2.500	⬆4
	2441	775.30	-81.62	1.84	10.00	-59.78	0.001	2.500	⬆1
		2390.00	-69.58	1.84	10.00	-57.74	0.002	25.000	⬆2
		3175.00	-69.30	1.84	10.00	-57.46	0.002	2.500	⬆4
		6961.00	-67.15	1.84	10.00	-55.31	0.003	2.500	⬆4
	2480	904.60	-82.11	1.84	10.00	-60.27	0.001	2.500	⬆1
		2255.00	-71.32	1.84	10.00	-59.48	0.001	2.500	⬆1
		2483.51	-69.82	1.84	10.00	-57.98	0.002	25.000	⬆3
		2483.51	-69.82	1.84	10.00	-57.98	0.002	25.000	⬆3
		2505.17	-70.80	1.84	10.00	-58.96	0.001	2.500	⬆4
		3281.00	-69.26	1.84	10.00	-57.42	0.002	2.500	⬆4
		7612.00	-65.31	1.84	10.00	-53.47	0.004	2.500	⬆4

Sample Calculation :

Result = Reading + Cable Loss + Attenuator + RBW Correction (<1000MHz)

◆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)

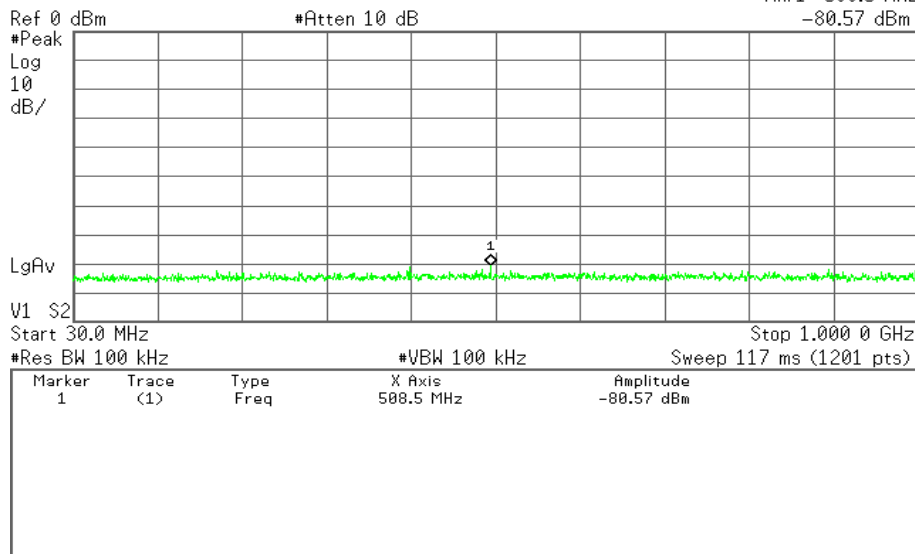
RBW Correction = 10* log(1MHz/100kHz)

Tx1_SpuriousM_Nom

Agilent 15:05:53 Mar 1, 2018

R L

Mkr1 508.5 MHz
-80.57 dBm

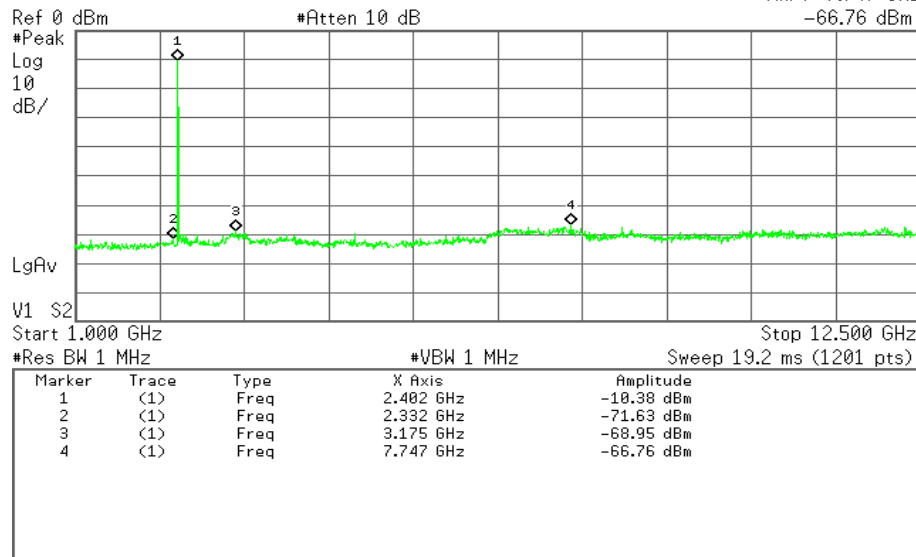


Tx1_SpuriousG_Nom

Agilent 08:39:03 Mar 1, 2018

R L

Mkr4 7.747 GHz
-66.76 dBm

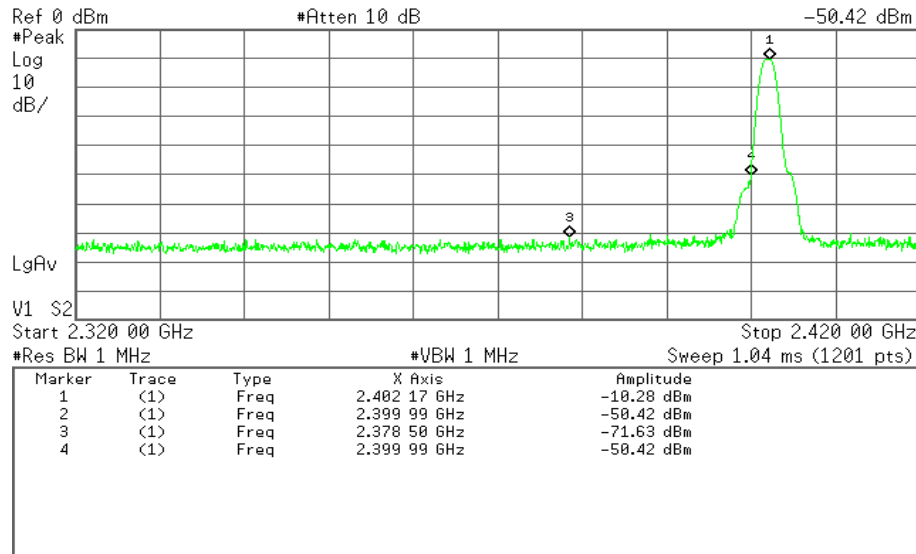


Tx1_BandEdgeLow_Nom

Agilent 08:54:47 Mar 1, 2018

R L

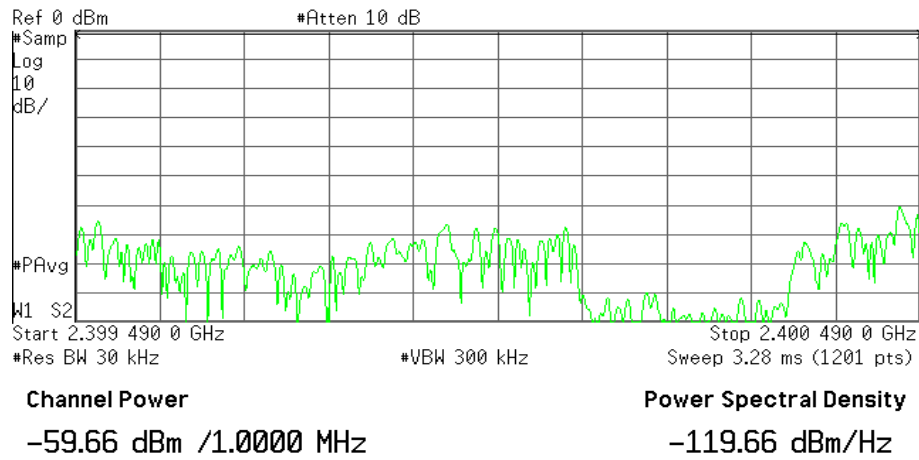
Mkr4 2.399 99 GHz
-50.42 dBm



Tx1_BandEdgeLowZoom_Nom

Agilent 08:55:00 Mar 1, 2018

R L

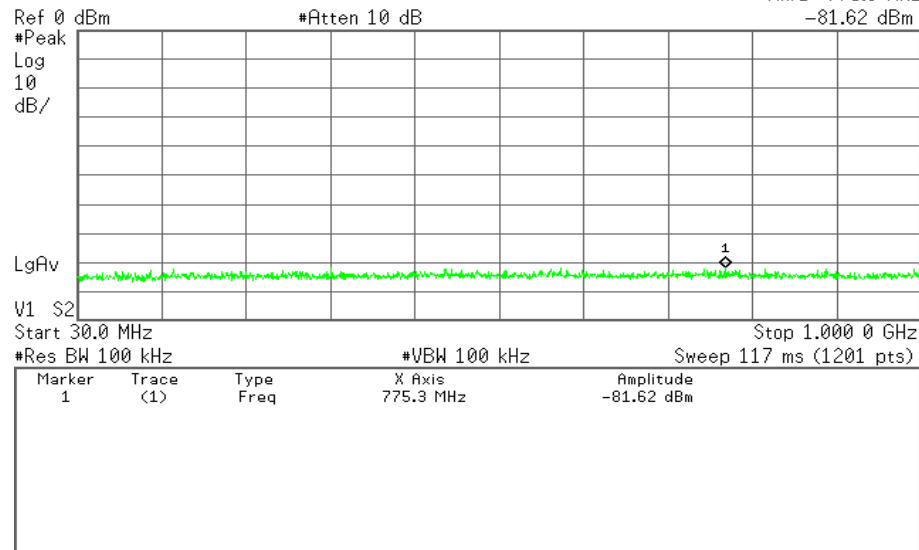


Tx2_SpuriousM_Nom

Agilent 15:07:31 Mar 1, 2018

R L

Mkr1 775.3 MHz
-81.62 dBm

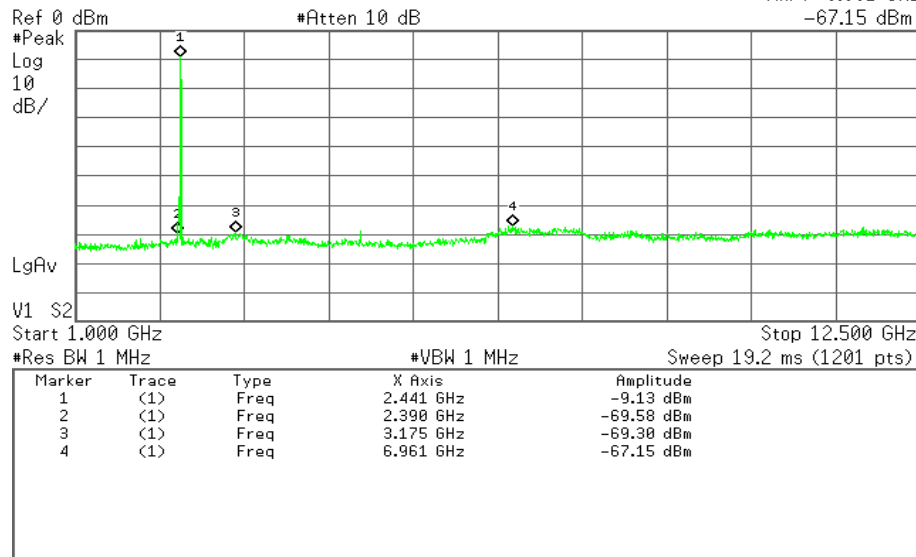


Tx2_SpuriousG_Nom

Agilent 08:42:56 Mar 1, 2018

R L

Mkr4 6.961 GHz
-67.15 dBm

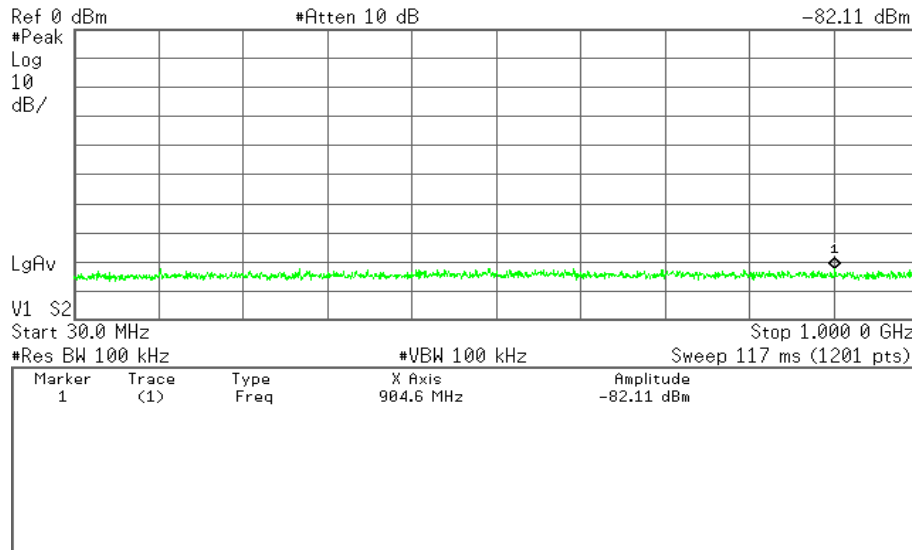


Tx3_SpuriousM_Nom

Agilent 15:09:40 Mar 1, 2018

R L

Mkr1 904.6 MHz
-82.11 dBm

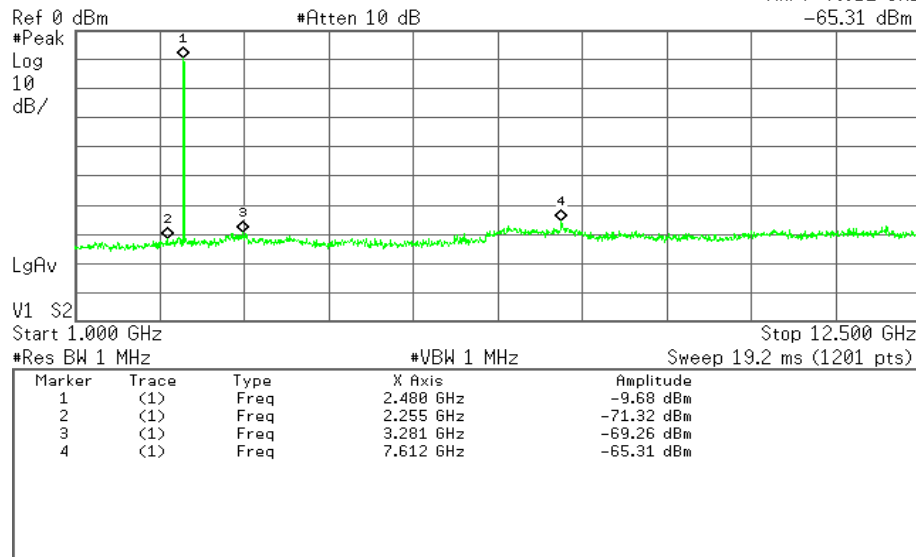


Tx3_SpuriousG_Nom

Agilent 08:44:06 Mar 1, 2018

R L

Mkr4 7.612 GHz
-65.31 dBm

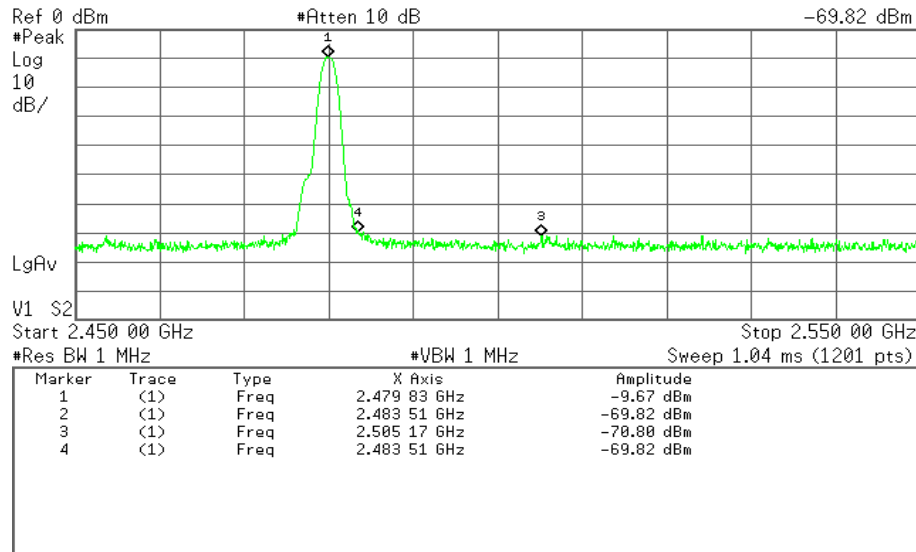


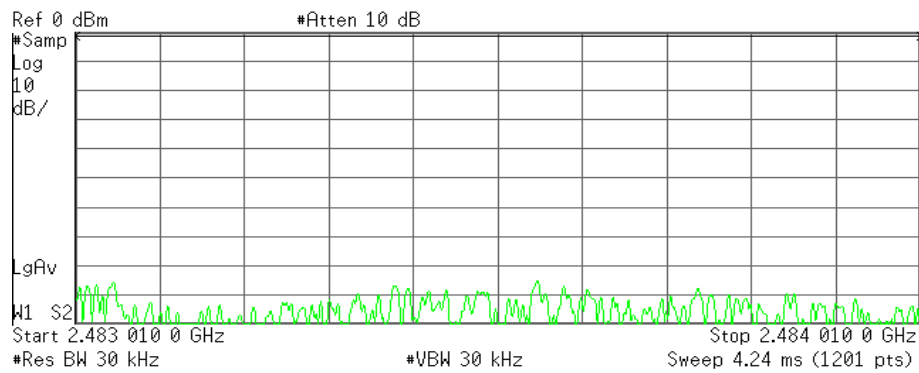
Tx3_BandEdgeHigh_Nom

Agilent 08:56:24 Mar 1, 2018

R L

Mkr4 2.483 51 GHz
-69.82 dBm





Channel Power

-79.05 dBm /1.0000 MHz

Power Spectral Density

-139.05 dBm/Hz

2.4. Output Power

Job No. R12161950-E6a
 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 [%]
DC24V	2402	-11.00	1.84	10.00	0.001213	69.7452	1.30	0.000023	-30.8	-	0.003000	+20 ~ -80
	2441	-10.88	1.84	10.00	0.001247	69.7452	1.30	0.000023	-28.8	-	0.003000	+20 ~ -80
	2480	-10.98	1.84	10.00	0.001219	69.7452	1.30	0.000023	-30.4	-	0.003000	+20 ~ -80
	2441	-10.88	1.84	10.00	0.001247	20.0000	1.30	0.000081	-30.0	20HOP	0.003000	+20 ~ -80

Sample Calculation :

Result A = $10^{\frac{1}{10} \left(\text{P/M Reading [dBm]} (\text{Detector:AV}) + \text{Cable Loss} + \text{Atten. Loss} \right)}$

Result B = (Result A / Spreading Bandwidth) * Burst Rate

Tolerance = Result / Declared Output Power * 100 - 100.

[Declared Output Power]

Average of Power between Channels (79HOP)	0.000023	W/MHz
Declared Output Power 1	0.000033	W/MHz
+20	0.000039	W/MHz
Middle (Declared Output Power -30%)	0.000023	W/MHz
-80	0.000007	W/MHz

(Bluetooth, 20HOP(AFH))

20HOP	0.000081	W/MHz
Declared Output Power 2	0.000116	W/MHz
+20	0.000139	W/MHz
Middle (Declared Output Power -30%)	0.000081	W/MHz
-80	0.000023	W/MHz

Antenna Gain	2.20	dBi
E.I.R.P. for Declared Output Power 1	-12.66	dBm/MHz
E.I.R.P. for Declared Output Power 2	-7.16	dBm/MHz
Limit	6.91	dBm/MHz

Sample Calculation :

E.I.R.P. for Declared Output Power = $10 * \log (\text{Declared Output Power} * 1000) + \text{Antenna Gain}$

2.5. Secondary Radiated Emission Strength

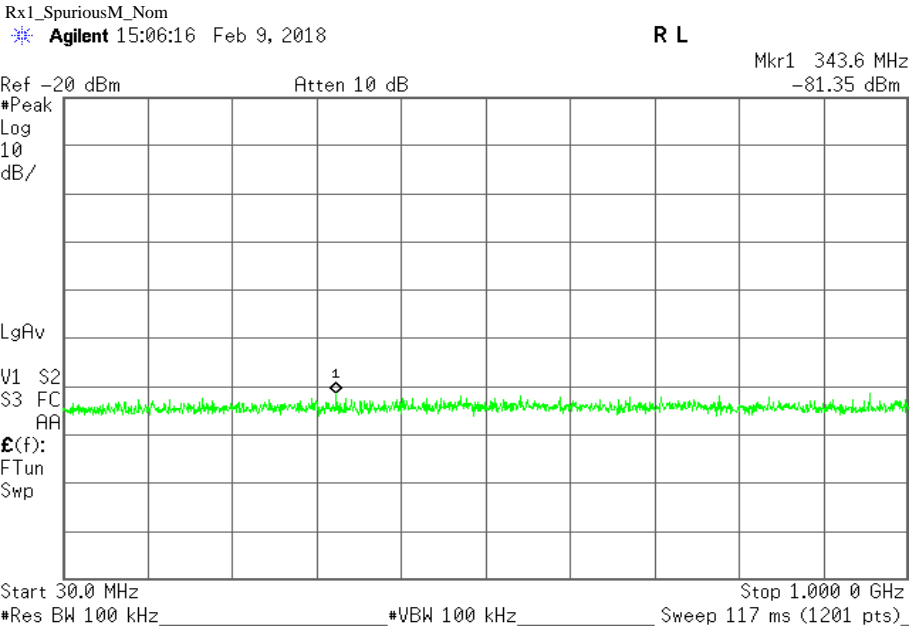
Job No.	R12161950-E6a
Remark1	
Remark2	

[DATA]									
Voltage	Freq.	Freq.	S/A Reading	Cable Loss	Atten. Loss	Result	Result	Limit	Remark
[V]	[MHz]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[nW]	[nW]	
DC24V	2402	343.6	-81.35	1.84	10.00	-69.51	0.112	4.000	◆5
		7584.0	-66.91	1.84	10.00	-55.07	3.110	20.000	◆6

The sum of the results exceeding 1/10 of the Limit [nW] : 3.110

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

[CHART] (V: Normal)



Rx1_SpuriousG_Nom

Agilent 15:06:04 Feb 9, 2018

R L

Mkr1 7.584 GHz

Ref -20 dBm

Atten 10 dB

-66.91 dBm

#Peak
Log
10
dB/

LgAv

V1 S2
S3 FC
AA

£(f):
FTun
Swp

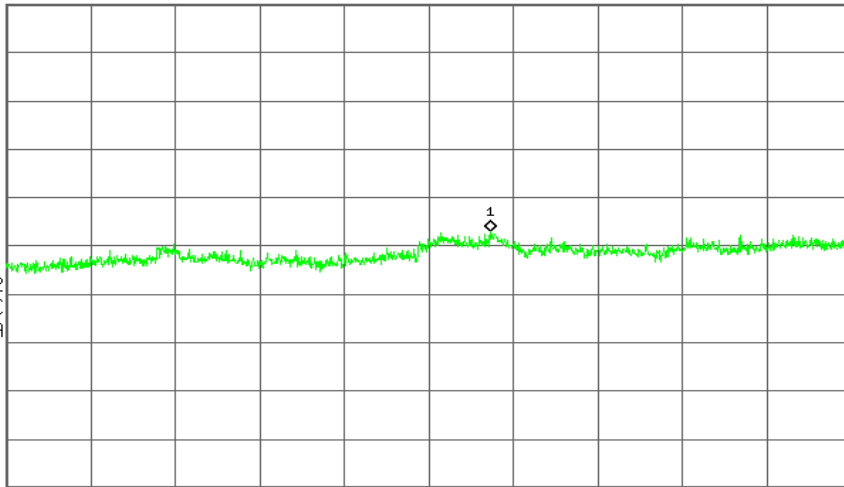
Start 1.000 GHz

Stop 12.500 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 19.2 ms (1201 pts)



2.5. Secondary Radiated Emission Strength

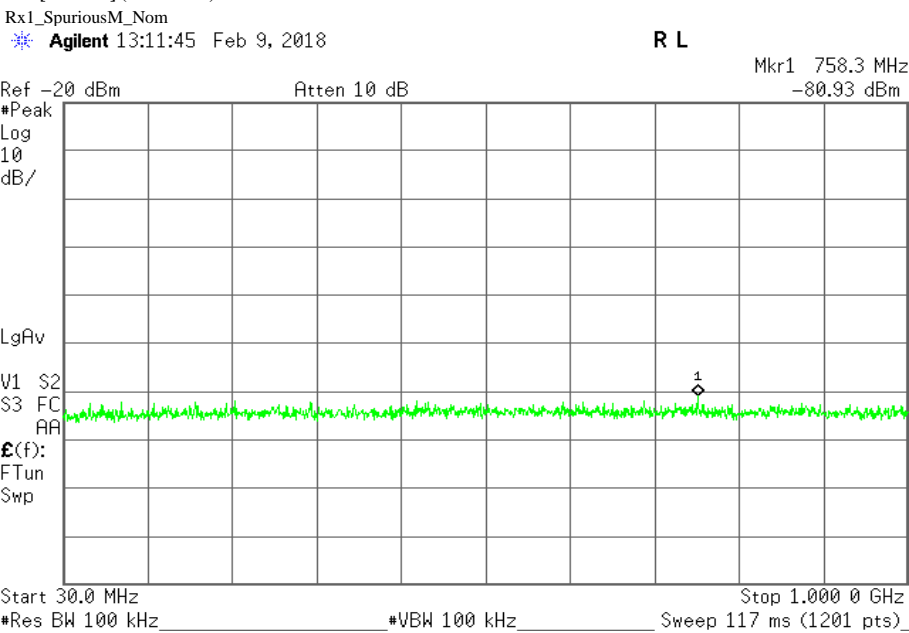
Job No.	R12161950-E6a
Remark1	
Remark2	

[DATA]									
Voltage	Freq.	Freq.	S/A Reading	Cable Loss	Atten. Loss	Result	Result	Limit	Remark
[V]	[MHz]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[nW]	[nW]	
DC24V	2441	758.3	-80.93	1.84	10.00	-69.09	0.123	4.000	◆5
		7766.0	-67.66	1.84	10.00	-55.82	2.617	20.000	◆6

The sum of the results exceeding 1/10 of the Limit [nW] : 2.617

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

[CHART] (V: Normal)



Rx1_SpuriousG_Nom

Agilent 13:11:32 Feb 9, 2018

R L

Mkr1 7.766 GHz

Ref -20 dBm

Atten 10 dB

-67.66 dBm

#Peak
Log
10
dB/

LgAv

V1 S2
S3 FC
AA

£(f):
FTun
Swp

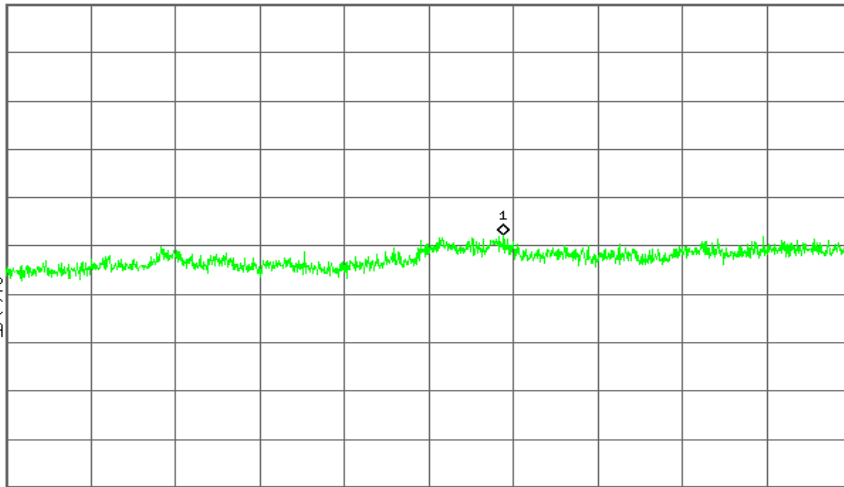
Start 1.000 GHz

Stop 12.500 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 19.2 ms (1201 pts)



2.5. Secondary Radiated Emission Strength

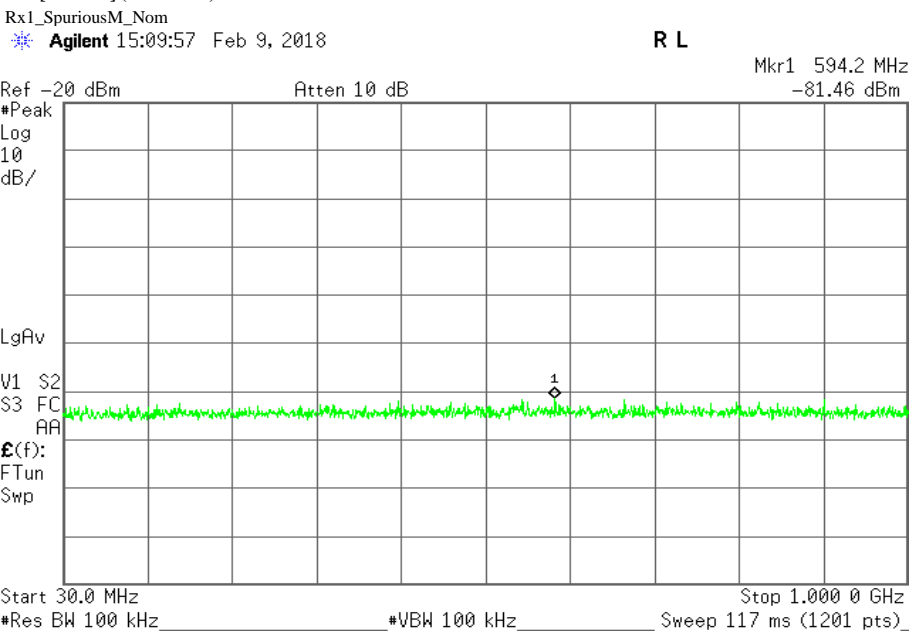
Job No.	R12161950-E6a
Remark1	
Remark2	

[DATA]									
Voltage	Freq.	Freq.	S/A Reading	Cable Loss	Atten. Loss	Result	Result	Limit	Remark
[V]	[MHz]	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[nW]	[nW]	
DC24V	2480	594.2	-81.46	1.84	10.00	-69.62	0.109	4.000	◆5
		11810.0	-67.48	1.84	10.00	-55.64	2.730	20.000	◆6

The sum of the results exceeding 1/10 of the Limit [nW] : 2.730

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

[CHART] (V: Normal)



Rx1_SpuriousG_Nom

Agilent 15:09:44 Feb 9, 2018

R L

Mkr1 11.810 GHz
-67.48 dBm

Ref -20 dBm

Atten 10 dB

#Peak
Log
10
dB/

LgAv

V1 S2
S3 FC
AA

£(f):
FTun
Swp

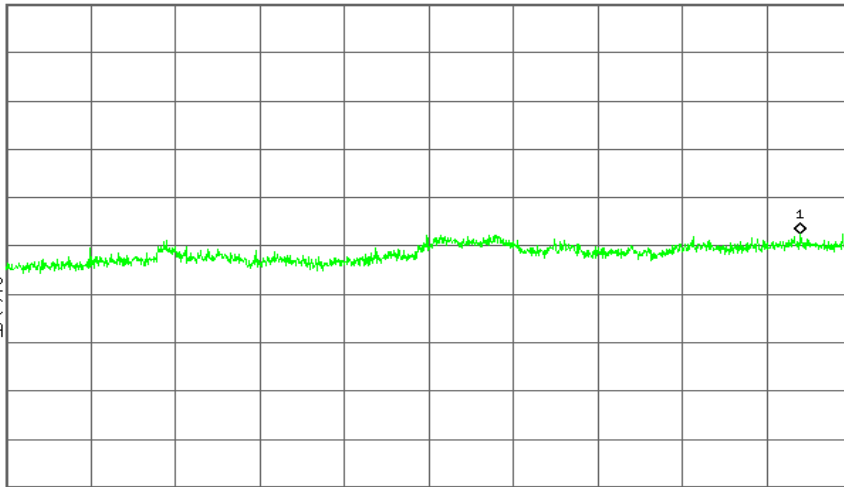
Start 1.000 GHz

Stop 12.500 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 19.2 ms (1201 pts)



2.6. Dwell Time/ Duty

Job No. R12161950-E6a

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]
DC24V	2441	0.4	69.7452	2.892	3.759	76.9	1.0	79	0.272	0.4

Sample Calculation :

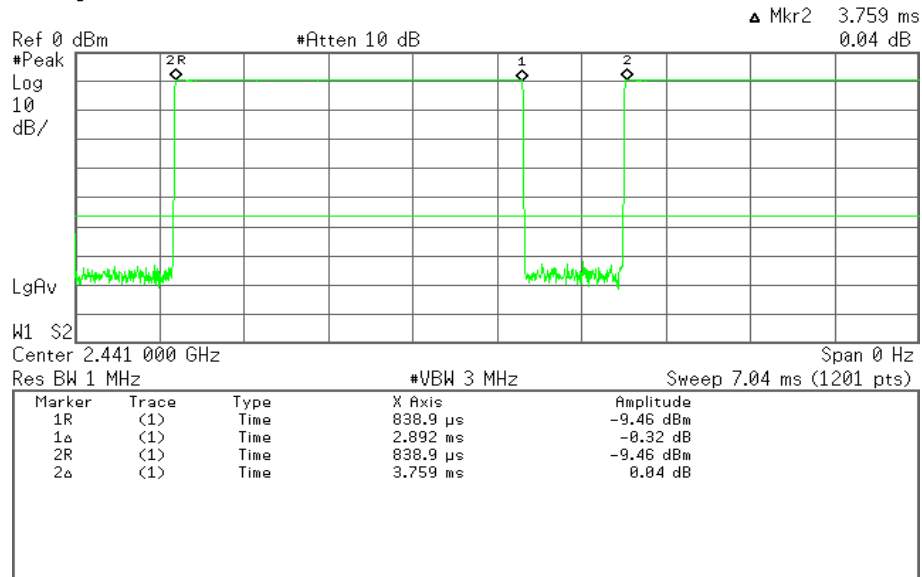
Result(Duty) = On Time / Period * 100

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

Tx2_BurstRate_Nom

Agilent 08:43:36 Mar 1, 2018

R L



3. Measurement Equipment

Use	Int. No.	Kind of Equipment	Model No.	Manufacturer	Serial No.	Calibration Authority	Calibration Date
X	SA0020	Spectrum Analyzer	E4446A	Agilent	MY221100033	Keysight Calibration	2017-11-06
X	PWM002	Power Meter	N1911A	Keysight	MY55116001	World Cal Inc	2017-07-17
X	PWS004	Power Sensor	E9323A	Keysight	MY55110008	World Cal Inc	2017-07-17
X	EC0225	Temp Chamber	Z8 Plus	Cincinnati Sub-Zero	1100502	C & C Technologies	2017-06-06
X	161016511	Enviromental Meter	15-077-963	Fisher Scientific	161016511	Traceable Calibration	2016-12-21

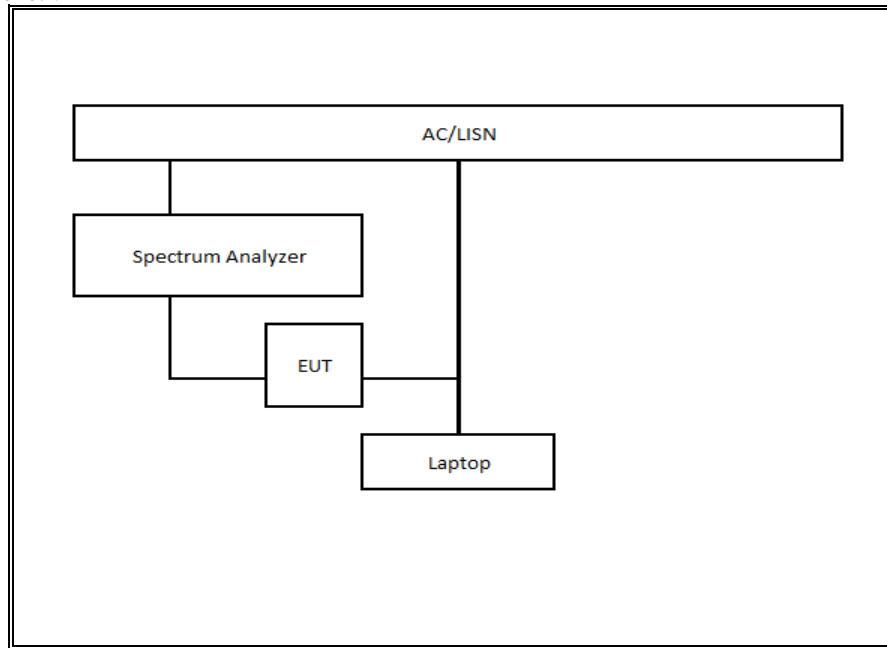
- Note :
1. The calibration of measurement equipment is valid for a one year period.
Except the environmental meter, which is on a 2 yr calibration cycle
 2. "X" used equipment.
 3. All equipment is calibrated and traceable to ISO17025

4. Test Condition

Test Item	Date	Temp	Hum	Engineer	Test Room
Frequency Tolerance	2018-02-09	25	45	Jeffrey Cabrera	MOR CON 2
Occupied Bandwidth	2018-03-01	25	45	Jeffrey Cabrera	MOR CON 2
Unwanted Emission Strength	2018-03-01	25	45	Jeffrey Cabrera	MOR CON 2
Output Power/ E.I.R.P	2018-03-01	25	45	Jeffrey Cabrera	MOR CON 2
Secondary Radiated Emission Strength	2018-02-09	25	45	Jeffrey Cabrera	MOR CON 2
Burst Length / Duty	2018-03-01	25	45	Jeffrey Cabrera	MOR CON 2

5. TEST CONFIGURATION

TEST CirCuit



PHOTO

