

TEST REPORT



REPORT NUMBER: R12161950-E7

COMPANY NAME: Bose Corp

EUT DESCRIPTION: Wireless Headset

MODEL: 424411

SERIAL NUMBER: DP2 A144

ISSUE DATE: 2018-04-06

DATE TESTED: 2018-02-22 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 2MHz 40ch) 0.002307W

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



NVLAP LAB CODE 200246-0

1. EUT Information

Report No. : R12161950-E7
Applicant : Bose Corp
Equipment Description: Wireless Headset
Model No. : 424411
SerialNo. : DP2 A144
The number of Tx Antenna : 1
Max Antenna Gain : 2.20dBi
Mode : GFSK
Type of Radio wave : FID

Supply Voltage <input checked="" type="radio"/> DC <input type="radio"/> AC 24.00V -	Modulation <input 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 checked="" type="radio"/> Other Modulation (e.g. GFSK, Not BT)
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 the Lowest Rate.

Factors

	[MHz]	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)	2440	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
	2018-04-05	Corrected Tx Spur Frequency and revised mode to GFSK	Brian T. Kiewra

2.TEST Result

2.1. Frequency Tolerance

Job No. R12161950-E7

Remark1

Remark2

[DATA]

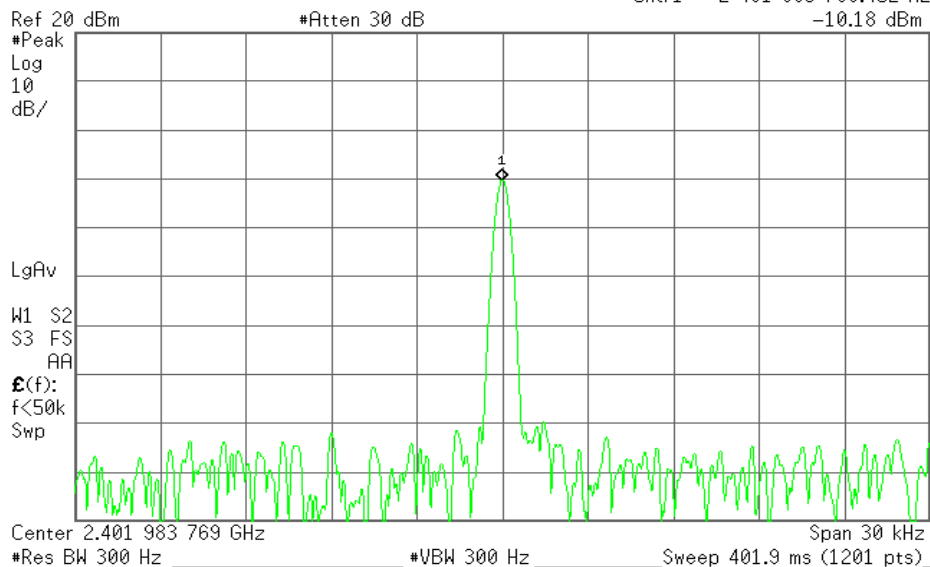
Voltage	Freq. [MHz]	Result [MHz]	Tolerance [kHz]	Tolerance [ppm]	Limit [ppm]
DC24V	2402	2401.9838	-16.2395	-6.76	±50.0
	2440	2439.9820	-18.0451	-7.40	±50.0
	2480	2479.9814	-18.6106	-7.50	±50.0

Tx1_Freq_Nom

Agilent 08:14:39 Feb 22, 2018

R L

Cntr1 2 401 983 760.452 Hz

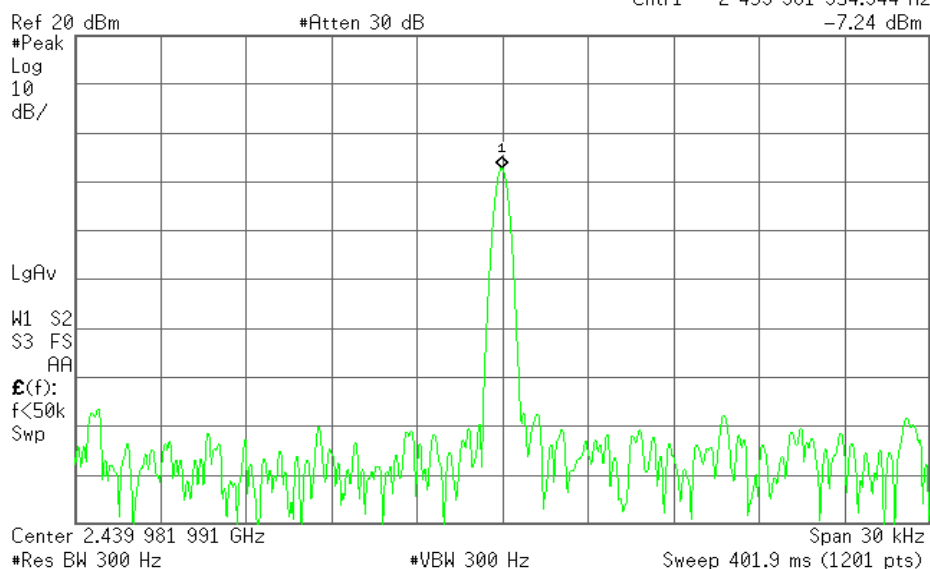


Tx2_Freq_Nom

Agilent 08:16:40 Feb 22, 2018

R L

Cntr1 2 439 981 954.944 Hz



Tx3_Freq_Nom

Agilent 08:19:11 Feb 22, 2018

R L

Cntr1 2 479 981 389.422 Hz

-9.44 dBm

Ref 20 dBm

#Atten 30 dB

#Peak
Log
10
dB/

LgAv

M1 S2
S3 FS
AA

E(f):
f<50k
Swp

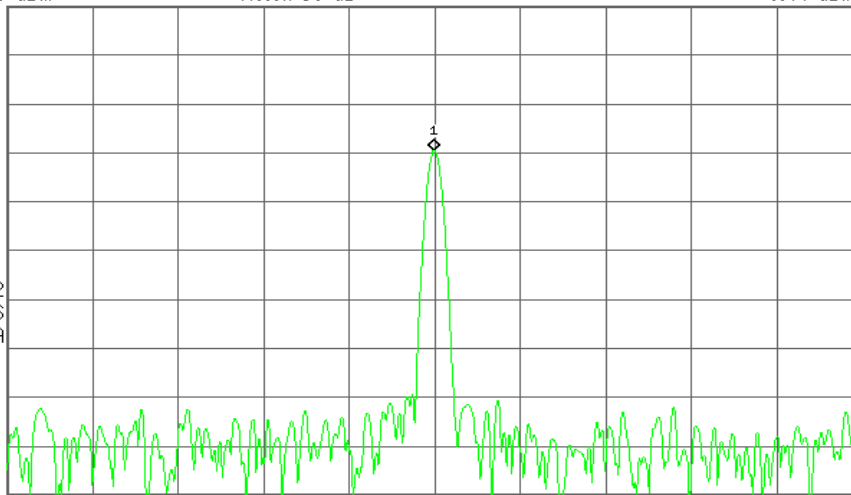
Center 2.479 981 398 GHz

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-E7

Remark1

Remark2 The Span was set suitably instead of 2 - 3.5 times the limit of OBW.

[DATA]

99% Occupied Frequency Bandwidth

Voltage	Freq. [MHz]	Result [MHz]	Limit [MHz]
DC24V	2402	1.2382	26
	2440	1.2288	26
	2480	1.2299	26

(Reference data)

Spreading Bandwidth

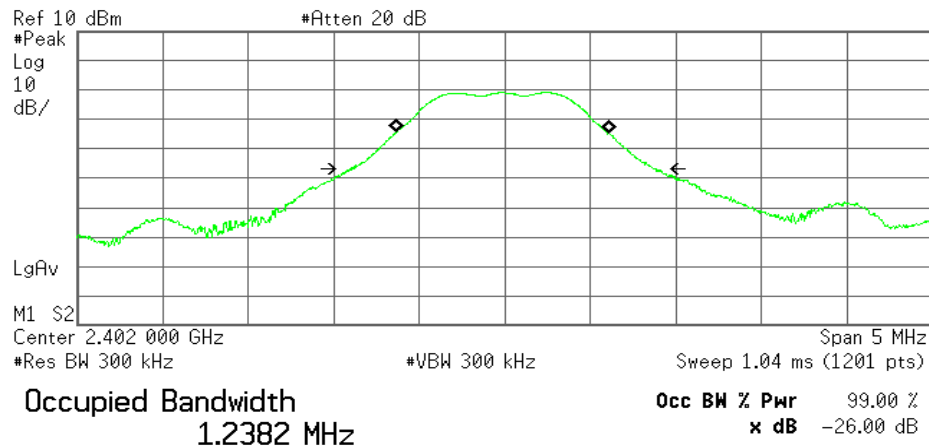
Voltage	Freq. [MHz]	Result [MHz]	Result [kHz]	Limit [kHz]
DC24V	2402	0.8421	-	-
	2440	0.8398	-	-
	2480	0.8417	-	-

99% Occupied Frequency Bandwidth

Tx1_99OBW_Nom

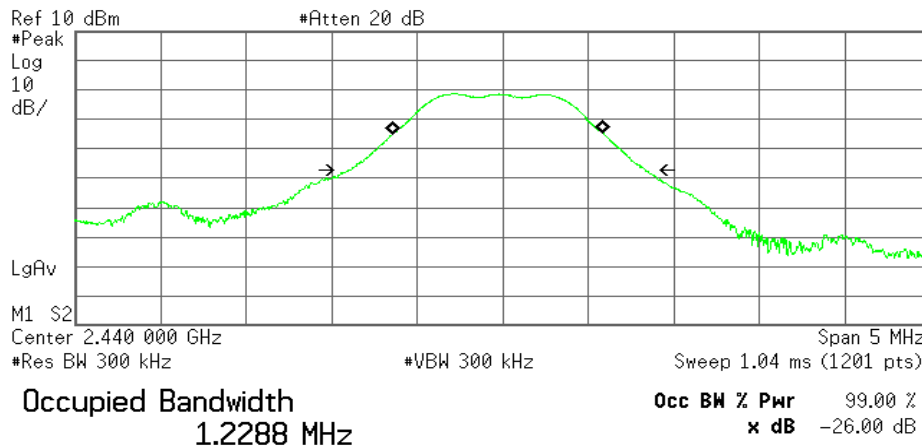
* Agilent 07:55:37 Feb 22, 2018

R L

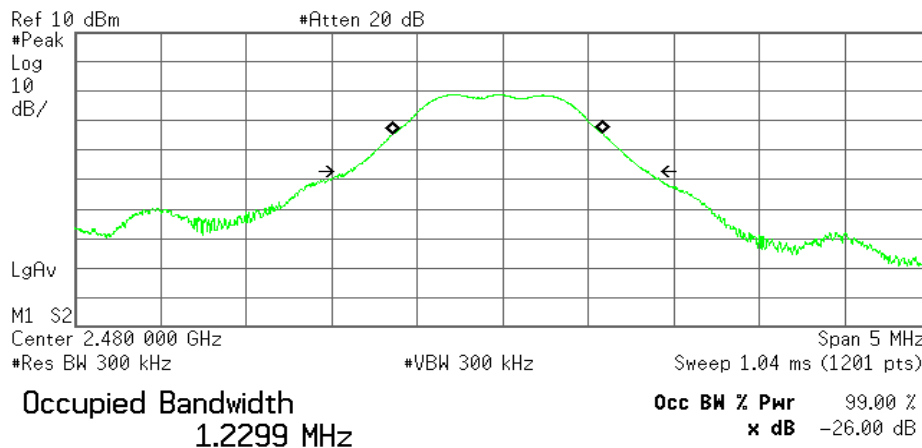


Transmit Freq Error -12.111 kHz

x dB Bandwidth 1.789 MHz



Transmit Freq Error -28.437 kHz
x dB Bandwidth 1.736 MHz



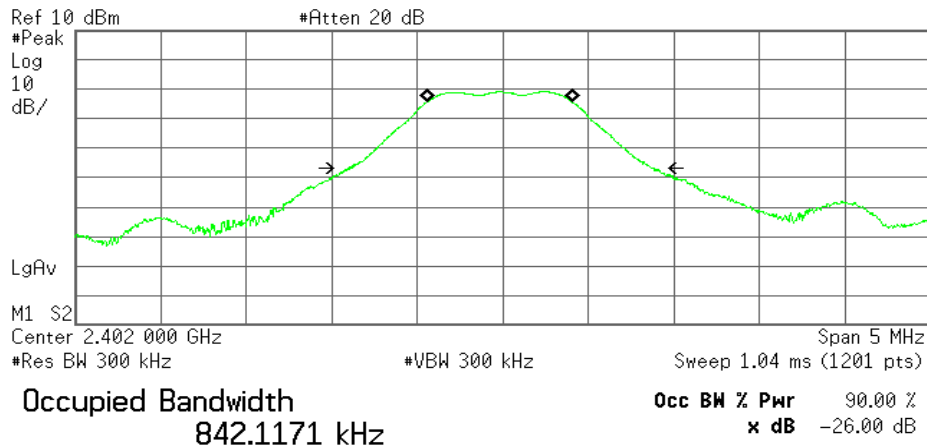
Transmit Freq Error -27.926 kHz
x dB Bandwidth 1.748 MHz

Spreading Bandwidth

Tx1_900BW_Nom

✱ Agilent 07:55:43 Feb 22, 2018

R L

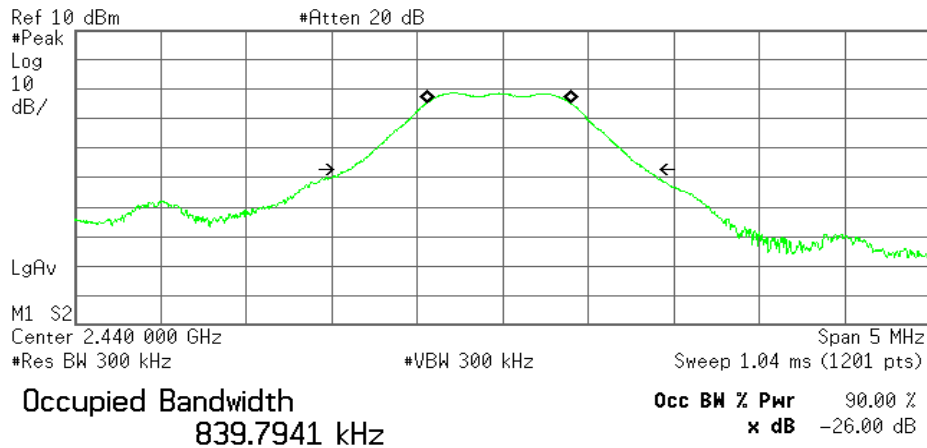


Transmit Freq Error -16.177 kHz
Occupied Bandwidth 1.789 MHz

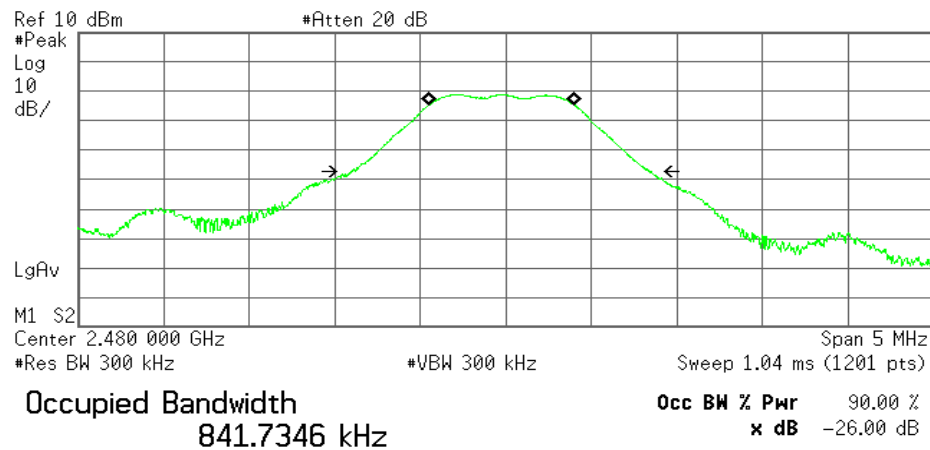
Tx2_900BW_Nom

✱ Agilent 08:00:30 Feb 22, 2018

R L



Transmit Freq Error -23.749 kHz
Occupied Bandwidth 1.736 MHz



Transmit Freq Error -23.404 kHz
Occupied Bandwidth 1.748 MHz

2.3. Unwanted Emission Strength (Normal Voltage)

Job No. R12161950-E7

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]	
DC24V	2402	638.70	-81.22	1.84	10.00	-59.38	0.001	2.500	♣1
		1920.00	-70.41	1.84	10.00	-58.57	0.001	2.500	♣1
		2359.83	-61.00	1.84	10.00	-49.16	0.012	2.500	♣1
		2399.99	-45.60	1.84	10.00	-33.76	0.421	25.000	♣2
		2399.99	-45.60	1.84	10.00	-33.76	0.421	25.000	♣2
		3137.00	-68.39	1.84	10.00	-56.55	0.002	2.500	♣4
	2440	12011.00	-66.13	1.84	10.00	-54.29	0.004	2.500	♣4
		736.50	-80.65	1.84	10.00	-58.81	0.001	2.500	♣1
		2399.00	-71.38	1.84	10.00	-59.54	0.001	25.000	♣2
		3175.00	-69.80	1.84	10.00	-57.96	0.002	2.500	♣4
	2480	7315.00	-66.78	1.84	10.00	-54.94	0.003	2.500	♣4
		846.40	-71.84	1.84	10.00	-50.00	0.010	2.500	♣1
		2198.00	-71.58	1.84	10.00	-59.74	0.001	2.500	♣1
		2483.51	-64.14	1.84	10.00	-52.30	0.006	25.000	♣3
		2485.42	-60.81	1.84	10.00	-48.97	0.013	25.000	♣3
		2518.17	-60.22	1.84	10.00	-48.38	0.015	2.500	♣4
		3060.00	-69.56	1.84	10.00	-57.72	0.002	2.500	♣4
		12030.00	-66.90	1.84	10.00	-55.06	0.003	2.500	♣4

Sample Calculation :

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

♣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)

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

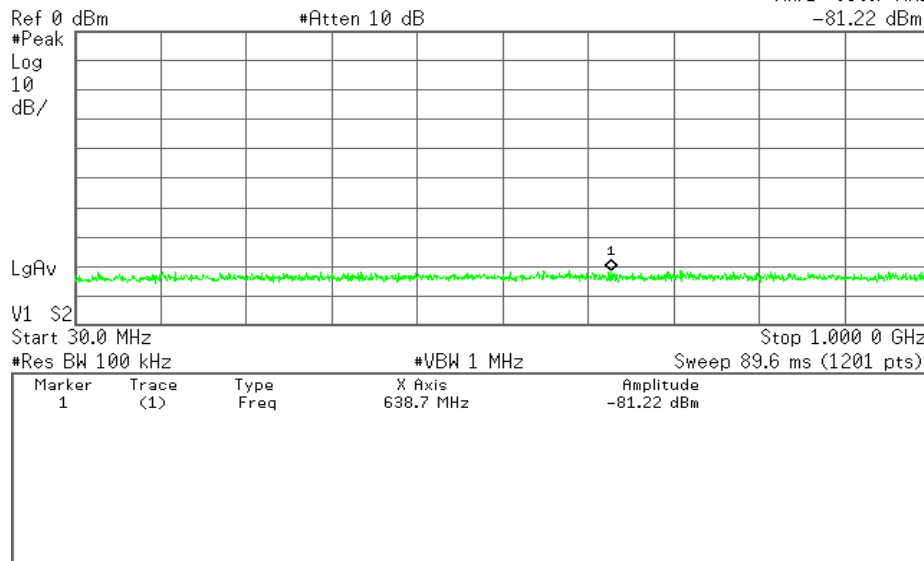
Tx1_SpuriousM_Nom

Agilent 09:12:03 Feb 22, 2018

R L

Mkr1 638.7 MHz

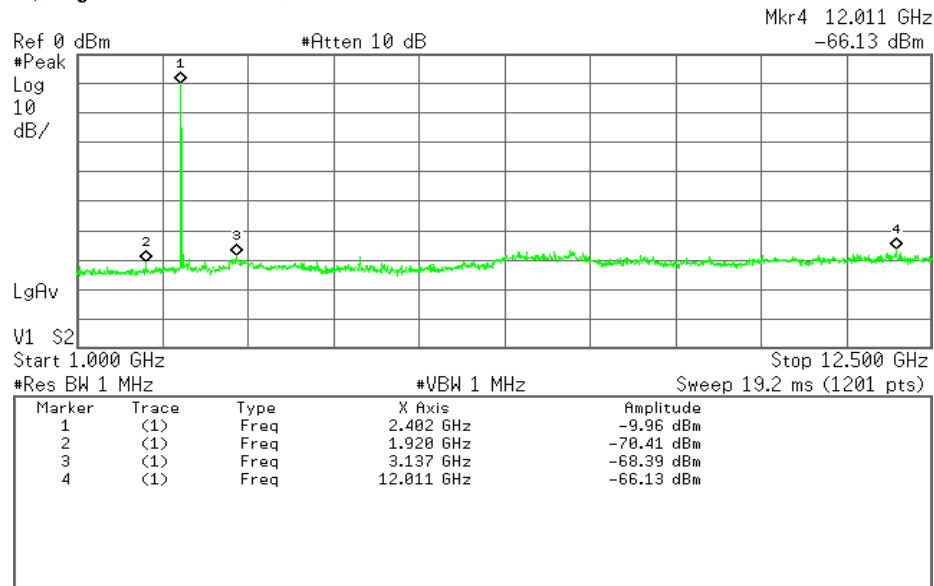
-81.22 dBm



Tx1_SpuriousG_Nom

Agilent 08:21:25 Mar 1, 2018

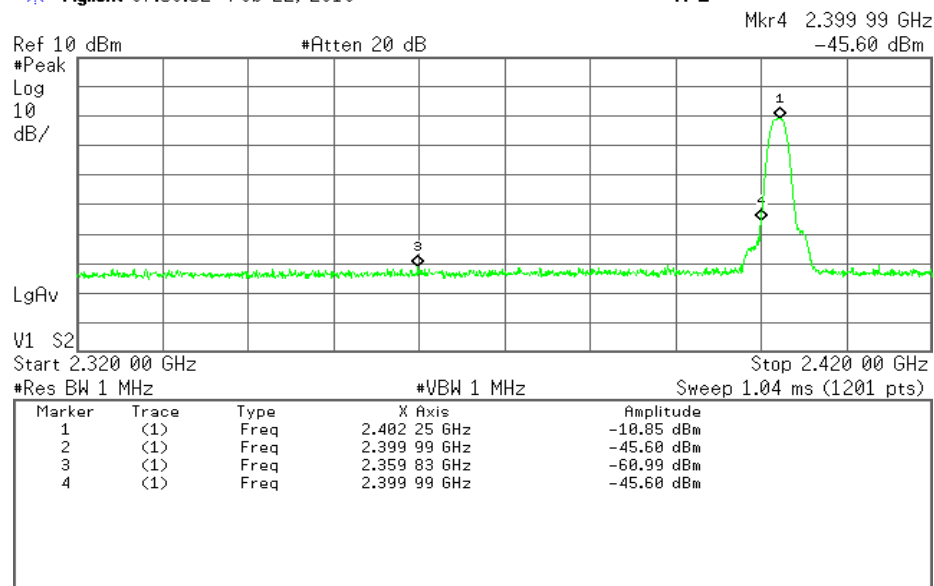
R L

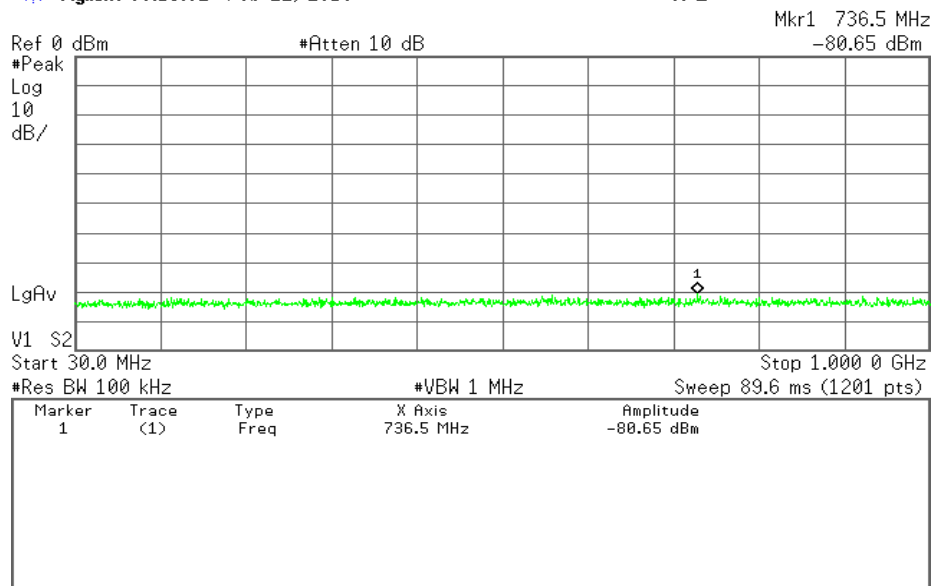
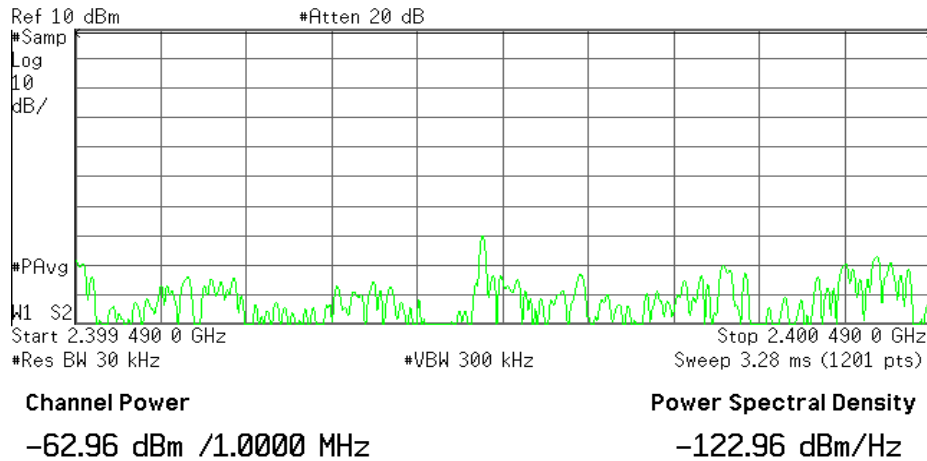


Tx1_BandEdgeLow_Nom

Agilent 07:58:52 Feb 22, 2018

R L





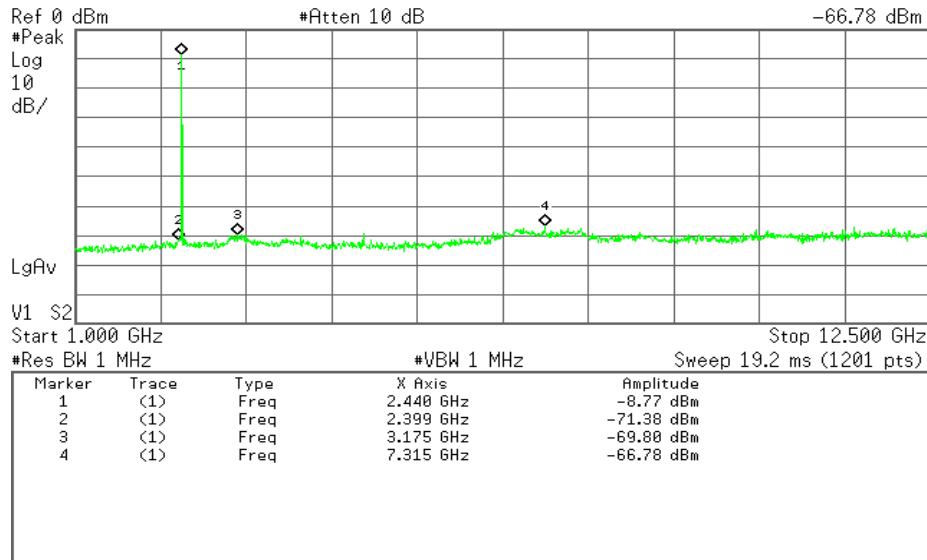
Tx2_SpuriousG_Nom

* Agilent 08:22:19 Mar 1, 2018

R L

Mkr4 7.315 GHz

-66.78 dBm



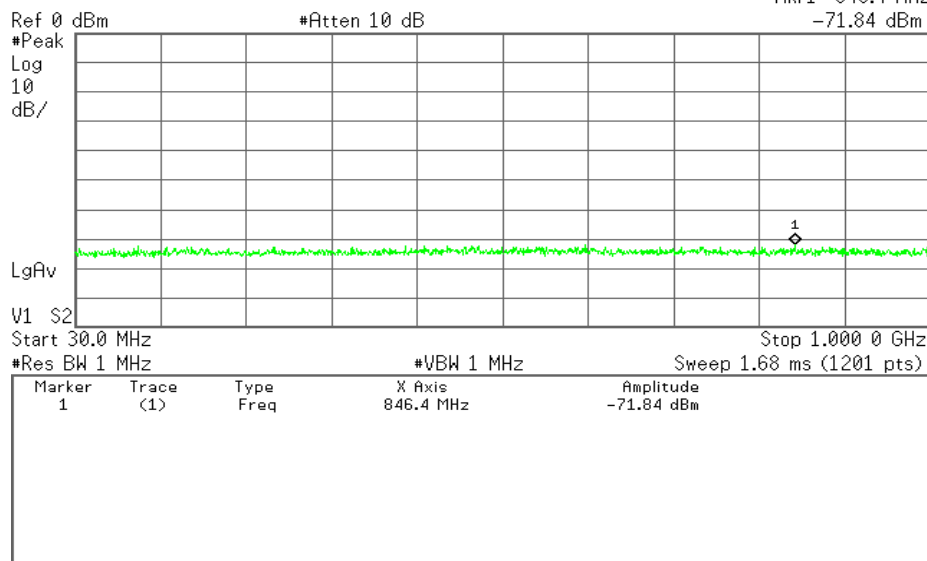
Tx3_SpuriousM_Nom

* Agilent 08:23:19 Mar 1, 2018

R L

Mkr1 846.4 MHz

-71.84 dBm



Tx3_SpuriousG_Nom

Agilent 08:23:06 Mar 1, 2018

R L

Mkr4 12.030 GHz

-66.90 dBm

Ref 0 dBm

#Atten 10 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	2.480 GHz	-9.54 dBm
2	(1)	Freq	2.198 GHz	-71.57 dBm
3	(1)	Freq	3.060 GHz	-69.56 dBm
4	(1)	Freq	12.030 GHz	-66.90 dBm

Tx3_BandEdgeHigh_Nom

Agilent 08:08:42 Feb 22, 2018

R L

Mkr4 2.485 42 GHz

-60.81 dBm

Ref 10 dBm

#Atten 20 dB

#Peak

Log

10

dB/

LgAv

V1 S2

Start 2.450 00 GHz

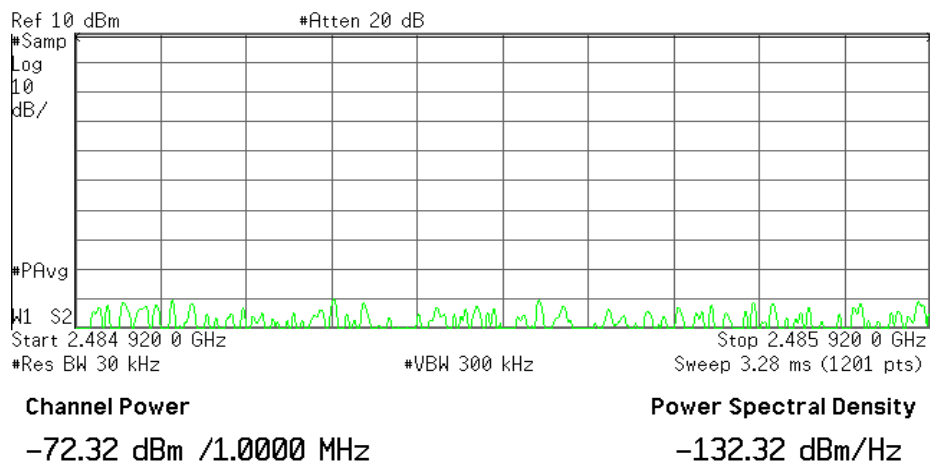
Stop 2.550 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 1.04 ms (1201 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 75 GHz	-11.14 dBm
2	(1)	Freq	2.483 51 GHz	-64.14 dBm
3	(1)	Freq	2.518 17 GHz	-60.22 dBm
4	(1)	Freq	2.485 42 GHz	-60.81 dBm



2.4. Output Power

Job No. R12161950-E7

Remark1

Remark2

[DATA]

Voltage	Chain	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [W]	Burst Rate	Output Power (A) [W]	Antenna Gain [dBi]	E.I.R.P. (A) [W]
DC24V	0	2402	-12.32	1.84	10.00	0.000895	1.60	0.001431	2.20	0.002374
		2440	-11.43	1.84	10.00	0.001099	1.60	0.001756	2.20	0.002914
		2480	-11.68	1.84	10.00	0.001038	1.60	0.001658	2.20	0.002751
DC24V	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
DC24V	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
DC24V	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-

Sample Calculation :

Output Power (A) = $10^{((\text{Reading [dBm]} + \text{Cable Loss} + \text{Atten. Loss}) / 10)}$ * 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) [W]	Tolerance Result [%]	Limit [W]	Tolerance Limit [%]	Result (B) [W]	Result [dBm]	Limit [dBm]
DC24V	2402	0.001431	-38.0	0.010000	+20 ~ -80	0.002374	3.75	12.14
	2440	0.001756	-23.9	0.010000	+20 ~ -80	0.002914	4.64	12.14
	2480	0.001658	-28.1	0.010000	+20 ~ -80	0.002751	4.39	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)	0.001615	[W]	Average of E.I.R.P. Result(B)	0.002680	[W]
Declared Output Power	0.002307	[W]	E.I.R.P. for Declared Output Power	5.83	[dBm]
+20	0.002768	[W]			
Middle (Declared Output Power -30%)	0.001615	[W]			
-80	0.000461	[W]			

Sample Calculation :

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

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

2.5. Secondary Radiated Emission Strength

Job No. R12161950-E7

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	238.2	-81.50	1.84	10.00	-69.66	0.108	4.000	◆5
		7488.0	-67.12	1.84	10.00	-55.28	2.965	20.000	◆6

The sum of the results exceeding 1/10 of the Limit [nW] : 2.965

Sample Calculation :

Result = Reading + Cable Loss + Atten Loss

◆5:Freq Range5 (≥ 30MHz, <1GHz)

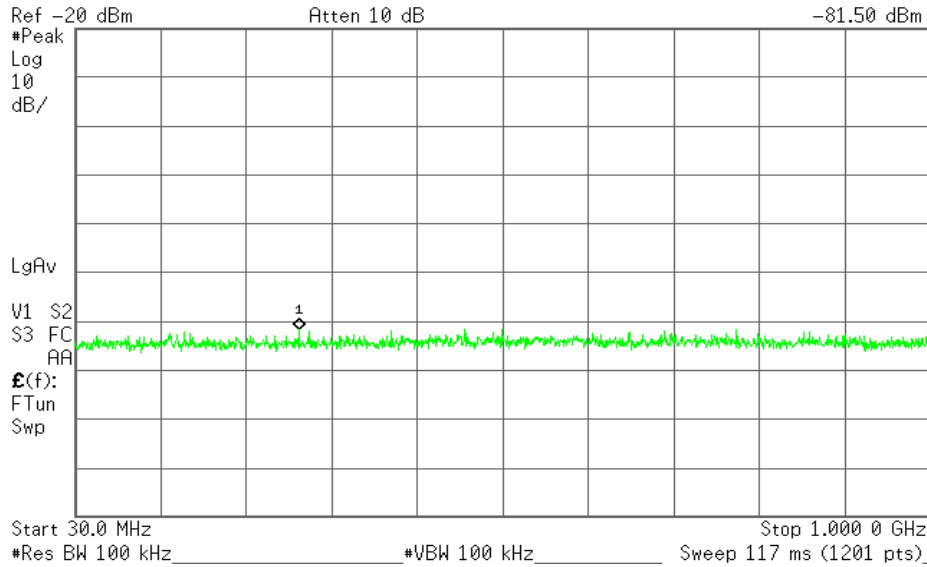
◆6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)

Rx1_SpuriousM_Nom

Agilent 08:34:18 Feb 22, 2018

R L

Mkr1 283.8 MHz



Ref -20 dBm

Atten 10 dB

#Peak
 Log
 10
 dB/

LgAv

V1 S2
 S3 FC
 AA

E(f):
 FTun
 Swp

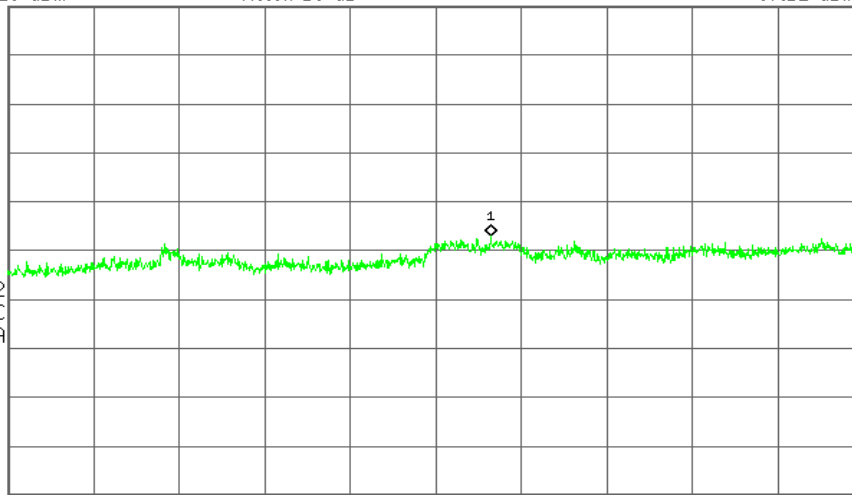
Start 1.000 GHz

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-E7

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	2440	497.2	-81.55	1.84	10.00	-69.71	0.107	4.000	◆5
		7258.0	-66.66	1.84	10.00	-54.82	3.297	20.000	◆6

The sum of the results exceeding 1/10 of the Limit [nW] : 3.297

Sample Calculation :

Result = Reading + Cable Loss + Atten Loss

◆5:Freq Range5 (≥ 30MHz, <1GHz)

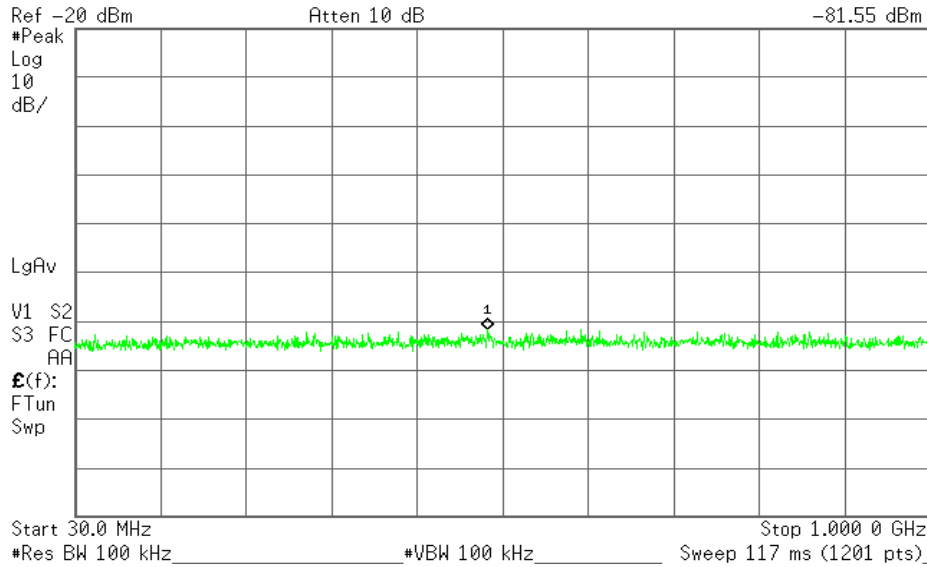
◆6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)

Rx1_SpuriousM_Nom

Agilent 08:42:05 Feb 22, 2018

R L

Mkr1 497.2 MHz



Ref -20 dBm

Atten 10 dB

*Peak
Log
10
dB/

LgAv

V1 S2
S3 FC
AA

£(f):
FTun
Swp

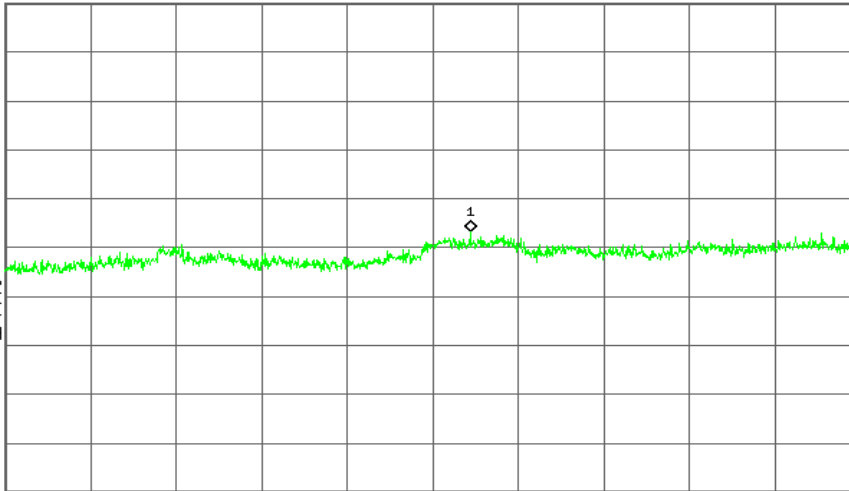
Start 1.000 GHz

Stop 12.500 GHz

*Res BW 1 MHz

*VBW 1 MHz

Sweep 19.2 ms (1201 pts)



2.5. Secondary Radiated Emission Strength

Job No. R12161950-E7

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	460.0	-81.15	1.84	10.00	-69.31	0.117	4.000	◆5
		7085.0	-66.63	1.84	10.00	-54.79	3.319	20.000	◆6

The sum of the results exceeding 1/10 of the Limit [nW] : 3.319

Sample Calculation :

Result = Reading + Cable Loss + Atten Loss

◆5:Freq Range5 (≥ 30MHz, <1GHz)

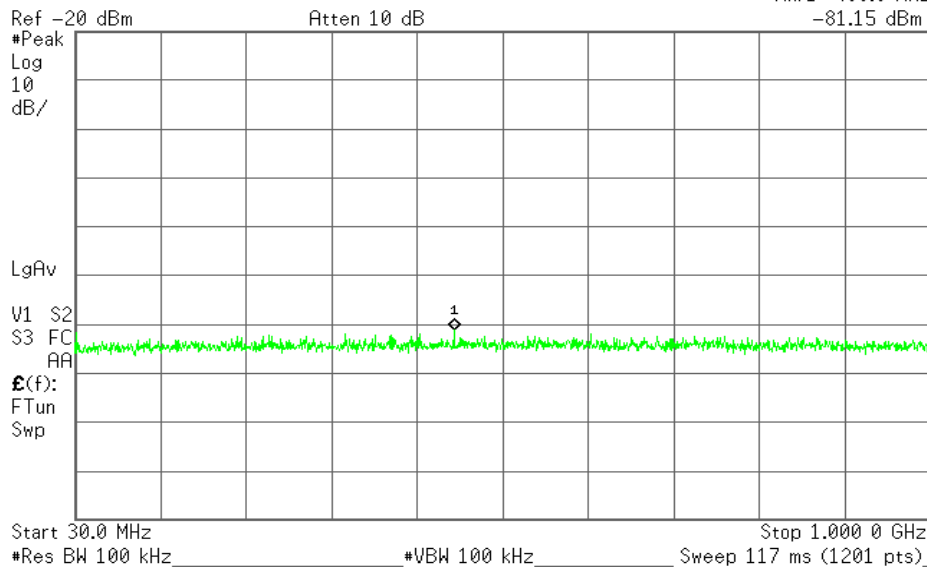
◆6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)

Rx1_SpuriousM_Nom

Agilent 08:10:25 Feb 22, 2018

R L

Mkr1 460.0 MHz



Ref -20 dBm

Atten 10 dB

*Peak
Log
10
dB/

LgAv

V1 S2
S3 FC
AA

£(f):
FTun
Swp

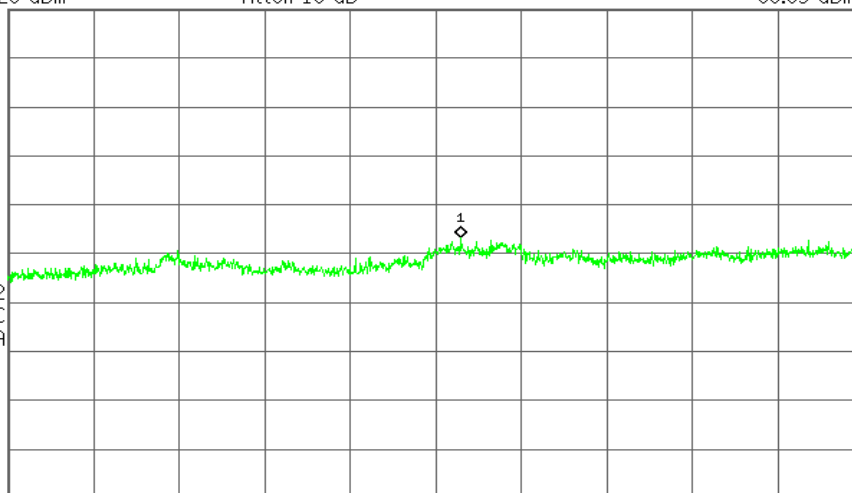
Start 1.000 GHz

Stop 12.500 GHz

*Res BW 1 MHz

*VBW 1 MHz

Sweep 19.2 ms (1201 pts)



2.6. Duty / Burst Rate

Job No. R12161950-E7

Remark1

Remark2

[DATA]

Voltage	Freq.	On Time	Period	Result (Duty)	Result (Burst Rate)
[V]	[MHz]	[msec]	[msec]	[%]	
DC24V	2440	0.390	0.623	62.6	1.598

Sample Calculation :

Result(Duty) = On Time / Period * 100

Result(Burst Rate) = Period / On Time

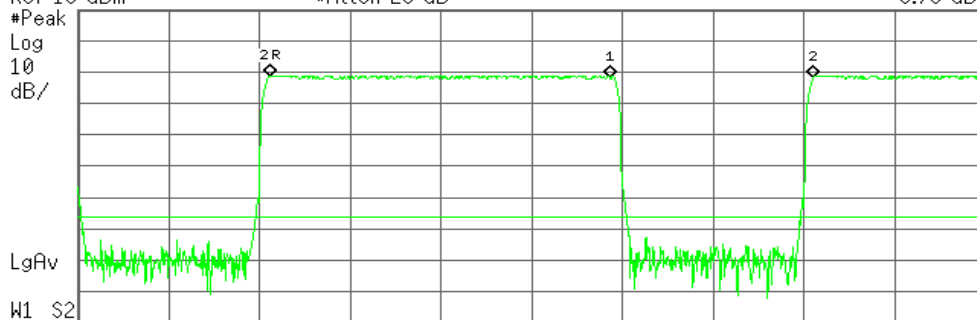
Tx2_Duty_Nom

Agilent 08:02:14 Feb 22, 2018

R L

Δ Mkr1 390 μs
-0.78 dB

Ref 10 dBm #Atten 20 dB



Center 2.440 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 8 MHz

Sweep 1.04 ms (1201 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	220 μs	-11.05 dBm
1Δ	(1)	Time	390 μs	-0.78 dB
2R	(1)	Time	220 μs	-11.05 dBm
2Δ	(1)	Time	623.1 μs	-0.57 dB

Average Power

Job No. R12161950-E7

Remark1

Remark2

[DATA]

Voltage	Port No.	Freq.	Reading	Cable Loss	Atten. Loss	Burst Rate	Output Power Result
		[MHz]	[dBm]	[dB]	[dB]		[dBm]
DC24V	0	2402	-12.32	1.84	10.00	1.60	1.55
		2440	-11.43	1.84	10.00	1.60	2.44
		2480	-11.68	1.84	10.00	1.60	2.19
DC24V	-	-	-	-	-	-	-
		-	-	-	-	-	-
		-	-	-	-	-	-
DC24V	-	-	-	-	-	-	-
		-	-	-	-	-	-
		-	-	-	-	-	-
DC24V	-	-	-	-	-	-	-
		-	-	-	-	-	-
		-	-	-	-	-	-

Total Output Power

Voltage	Freq.	Power
	[MHz]	[mW]
DC24V	2402	1.43
	2440	1.76
	2480	1.66

3. Measurement Equipment

Use	Int. No.	Kind of Equipment	Model No.	Manufacturer	Serial No.	Calibration Authority	Calibration Date
X	SA0020	Spectrum Analyzer	E4446A	Agilent	MY22110003	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	Environmental Meter	15-077-963	Fisher Scientific	161016511	Traceable Calibration	2016-12-21

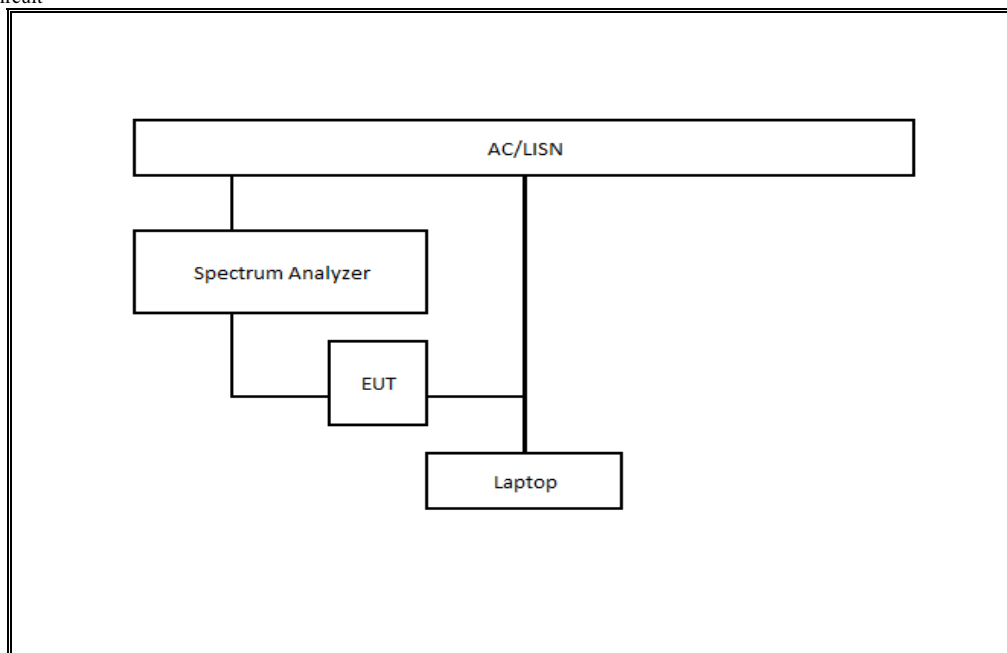
- Note :
1. The calibration of measurement equipment is valid for a one year period.
Except for the environmental meter, which is on a 2yr calibration cycle.
 2. "X" used equipment.
 3. All equipment is calibrated and traceable to ISO17025

4. Test Condition

Test Item	Date	Temp	Hum	Engineer	Test Room
Frequency Tolerance	2018-02-22	25	61	Jeffrey Cabrera	MOR CON 2
Occupied Bandwidth	2018-02-22	25	61	Jeffrey Cabrera	MOR CON 2
Unwanted Emission Strength	2018-02-22 and 2018-03-01	25	61	Jeffrey Cabrera	MOR CON 2
Output Power/ E.I.R.P	2018-02-22	25	61	Jeffrey Cabrera	MOR CON 2
Secondary Radiated Emission Strength	2018-02-22	25	61	Jeffrey Cabrera	MOR CON 2
Burst Length / Duty	2018-02-22	25	61	Jeffrey Cabrera	MOR CON 2

5. TEST CONFIGURATION

Test Circuit



Photo

