

TEST REPORT



REPORT NUMBER: R11965413-E4c

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, D1D 2412-2472MHz (Interval of 5MHz 13ch) 0.004229W/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:

Tested By:

Jeffrey Moser
Operations Leader
UL LLC

Brian T. Kiewra
Project Engineer
UL LLC



1. EUT Information

Report No. : R11965413-E4c
Applicant : Amway
Equipment Description: Radio Transmitter
Model No. : 120539
SerialNo. : Non-Serialized
The number of Tx Antenna : 1
Max Antenna Gain : 0.50dBi
Mode : IEEE802.11nHT20
Type of Radio wave : G1D, D1D

Supply Voltage <input type="radio"/> DC <input checked="" type="radio"/> AC 100.00V -	Modulation <input type="radio"/> DS (e.g. WLAN 11b) <input checked="" 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)
Voltage Condition <input checked="" type="radio"/> Non-Extreme <input type="radio"/> Extreme Normal AC100V 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)	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-E4c

Remark1

Remark2

[DATA]

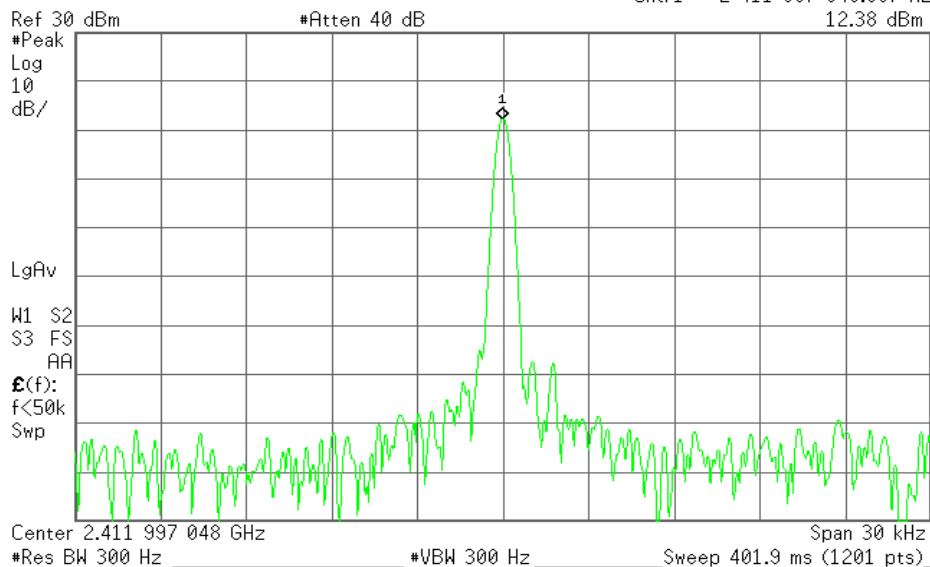
Voltage	Freq. [MHz]	Result [MHz]	Tolerance [kHz]	Tolerance [ppm]	Limit [ppm]
AC100V	2412	2411.9970	-2.9513	-1.22	±50.0
	2442	2441.9970	-2.9963	-1.23	±50.0
	2472	2471.9968	-3.2093	-1.30	±50.0

Tx1_Freq_Nom

Agilent 13:13:15 Oct 9, 2017

R L

Cntr1 2 411 997 048.667 Hz

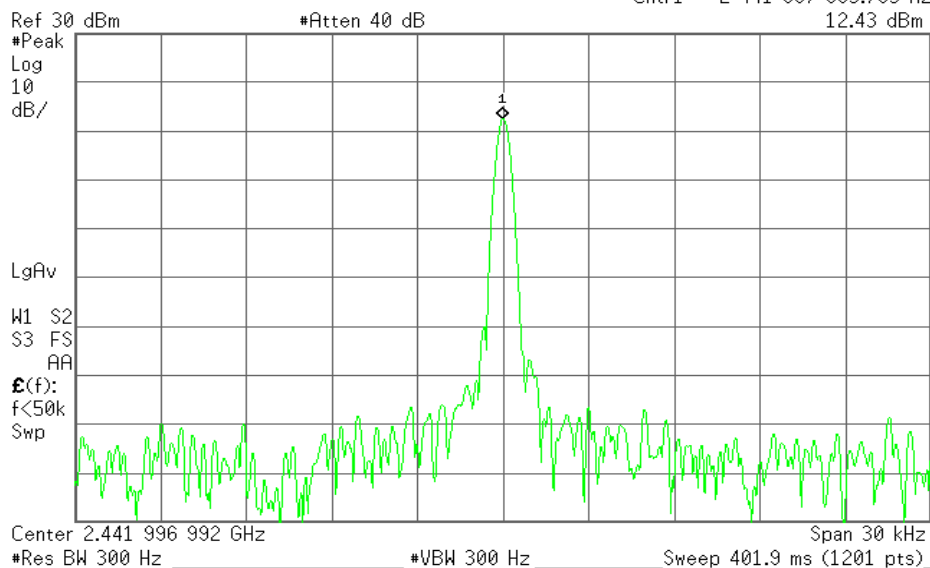


Tx2_Freq_Nom

Agilent 13:13:58 Oct 9, 2017

R L

Cntr1 2 441 997 003.703 Hz



Tx3_Freq_Nom

Agilent 13:14:44 Oct 9, 2017

R L

Cntr1 2 471 996 790.722 Hz

Ref 30 dBm

*Atten 40 dB

12.33 dBm

*Peak
Log
10
dB/

LgAv

W1 S2
S3 FS
AA

E(f):
f<50k
Swp

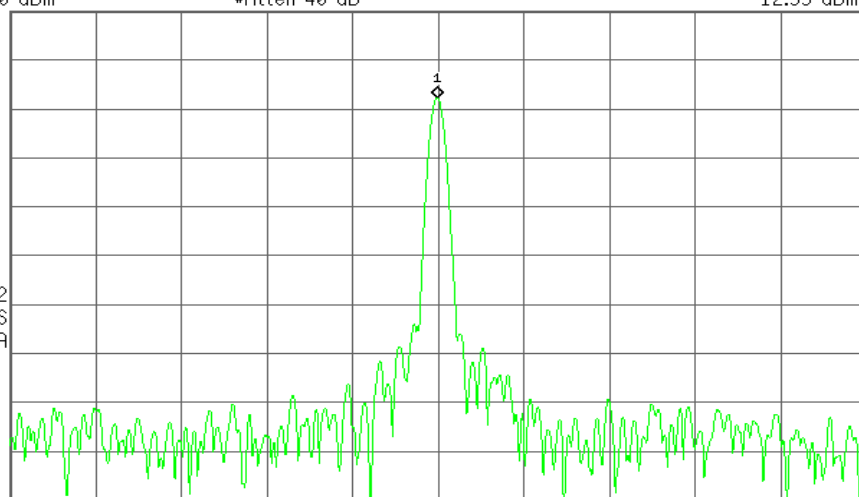
Center 2.471 996 800 GHz

Span 30 kHz

*Res BW 300 Hz

*VBW 300 Hz

Sweep 401.9 ms (1201 pts)



2.2. Occupied Bandwidth / Spreading Bandwidth

Job No. R11965413-E4c

Remark1

Remark2

[DATA]

99% Occupied Frequency Bandwidth

Voltage	Freq. [MHz]	Result [MHz]	Limit [MHz]
AC100V	2412	17.8199	38
	2442	17.8264	38
	2472	17.7893	38

(Reference data)

Spreading Bandwidth

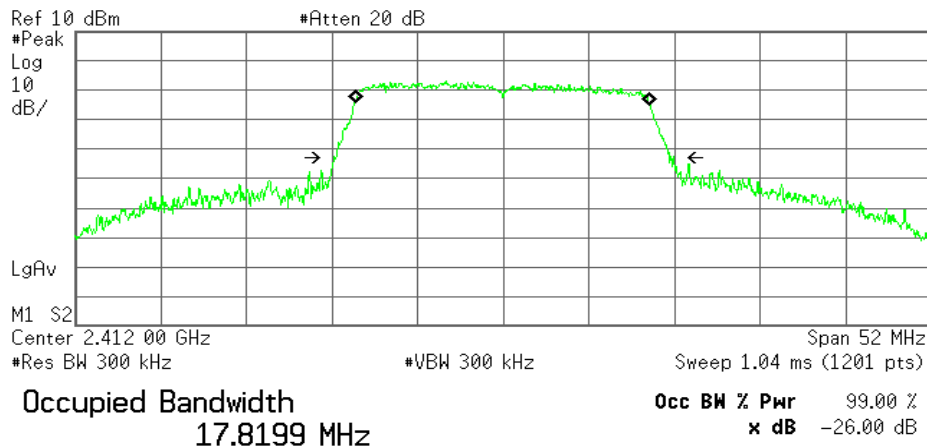
Voltage	Freq. [MHz]	Result [MHz]	Result [kHz]	Limit [kHz]
AC100V	2412	15.4854	15485.4	500
	2442	15.5830	15583.0	500
	2472	15.5511	15551.1	500

99% Occupied Frequency Bandwidth

Tx1_99OBW_Nom

* Agilent 13:54:08 Oct 9, 2017

R L

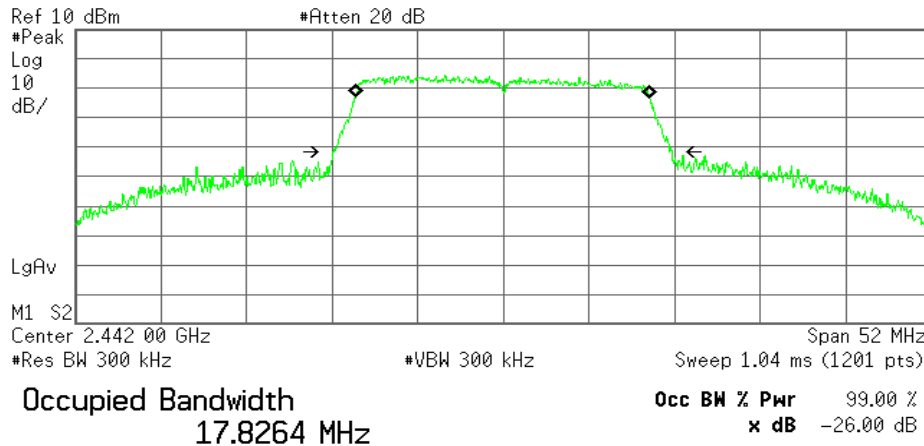


Transmit Freq Error -58.594 kHz
x dB Bandwidth 20.570 MHz

Tx2_99OBW_Nom

Agilent 13:57:43 Oct 9, 2017

R L



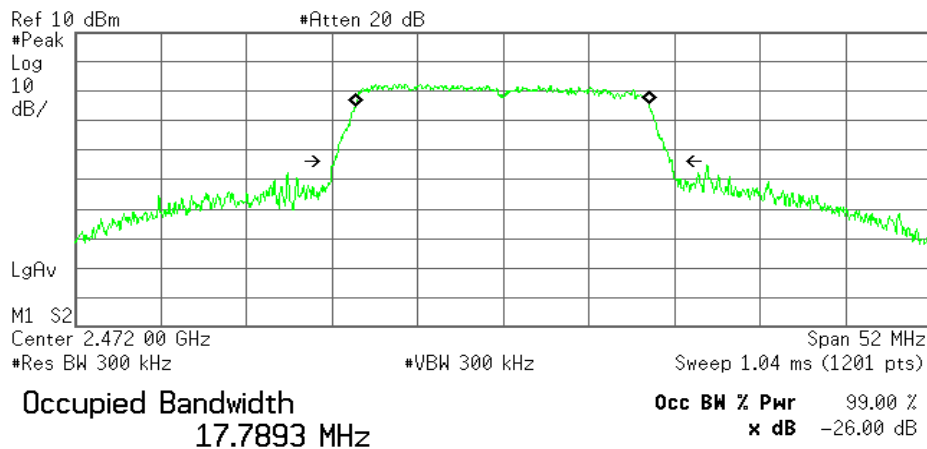
Transmit Freq Error -42.784 kHz

x dB Bandwidth 20.542 MHz

Tx3_99OBW_Nom

Agilent 14:08:24 Oct 9, 2017

R L



Transmit Freq Error -56.490 kHz

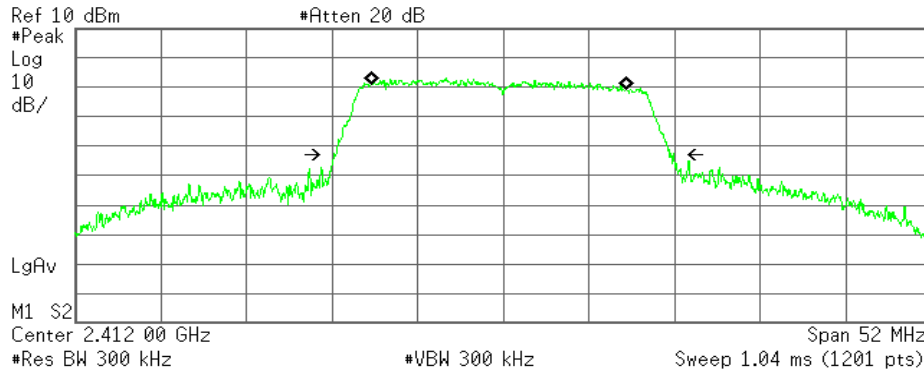
x dB Bandwidth 20.452 MHz

(Reference data)
Spreading Bandwidth

Tx1_900BW_Nom

✱ Agilent 13:54:15 Oct 9, 2017

R L



Occupied Bandwidth
15.4854 MHz

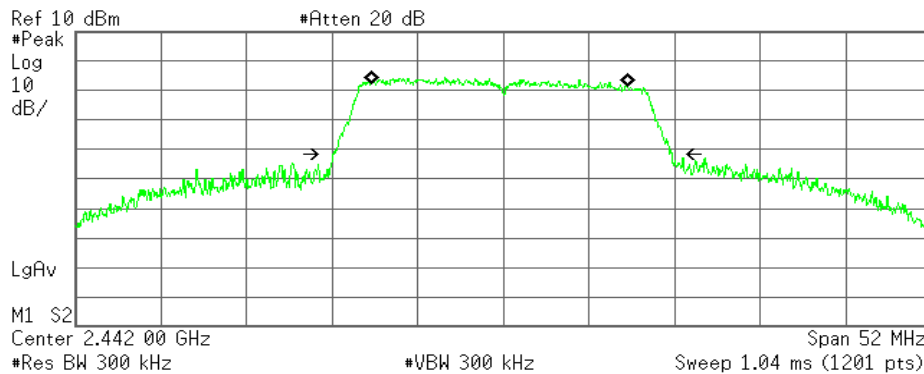
Occ BW % Pwr 90.00 %
x dB -26.00 dB

Transmit Freq Error -261.695 kHz
Occupied Bandwidth 20.607 MHz

Tx2_900BW_Nom

✱ Agilent 13:57:49 Oct 9, 2017

R L



Occupied Bandwidth
15.5830 MHz

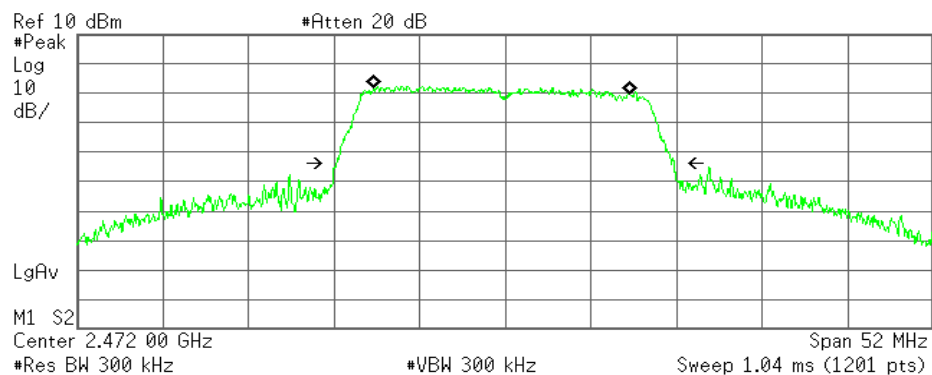
Occ BW % Pwr 90.00 %
x dB -26.00 dB

Transmit Freq Error -241.581 kHz
Occupied Bandwidth 20.542 MHz

Tx3_900BW_Nom

Agilent 14:08:30 Oct 9, 2017

R L



Occupied Bandwidth
15.5511 MHz

Occ BW % Pwr 90.00 %
x dB -26.00 dB

Transmit Freq Error -223.186 kHz
Occupied Bandwidth 20.457 MHz

2.3. Unwanted Emission Strength (Normal Voltage)

Job No. R11965413-E4c

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	625.70	-60.59	1.30	10.00	-49.29	0.012	2.500	♣1
		1910.00	-56.11	1.30	10.00	-44.81	0.033	2.500	♣1
		2386.67	-46.11	1.30	10.00	-34.81	0.330	2.500	♣1
		2398.08	-52.82	1.30	10.00	-41.52	0.071	25.000	♣2
		2399.99	-33.31	1.30	10.00	-22.01	6.298	25.000	♣2
		2869.00	-58.30	1.30	10.00	-47.00	0.020	2.500	♣4
	2442	4824.00	-42.31	1.30	10.00	-31.01	0.793	2.500	♣4
		726.00	-61.67	1.30	10.00	-50.37	0.009	2.500	♣1
		1882.00	-56.56	1.30	10.00	-45.26	0.030	2.500	♣1
		2840.00	-58.30	1.30	10.00	-47.00	0.020	2.500	♣4
	2472	4881.00	-40.74	1.30	10.00	-29.44	1.138	2.500	♣4
		343.60	-61.57	1.30	10.00	-50.27	0.009	2.500	♣1
		1843.00	-57.59	1.30	10.00	-46.29	0.023	2.500	♣1
		2483.51	-37.14	1.30	10.00	-25.84	2.607	25.000	♣3
		2484.00	-47.95	1.30	10.00	-36.65	0.216	25.000	♣3
		2497.08	-49.18	1.30	10.00	-37.88	0.163	2.500	♣4
		2811.00	-55.61	1.30	10.00	-44.31	0.037	2.500	♣4
		4939.00	-41.86	1.30	10.00	-30.56	0.879	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 13:54:55 Oct 9, 2017

R L

Mkr1 625.7 MHz

-60.59 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	625.7 MHz	-60.59 dBm

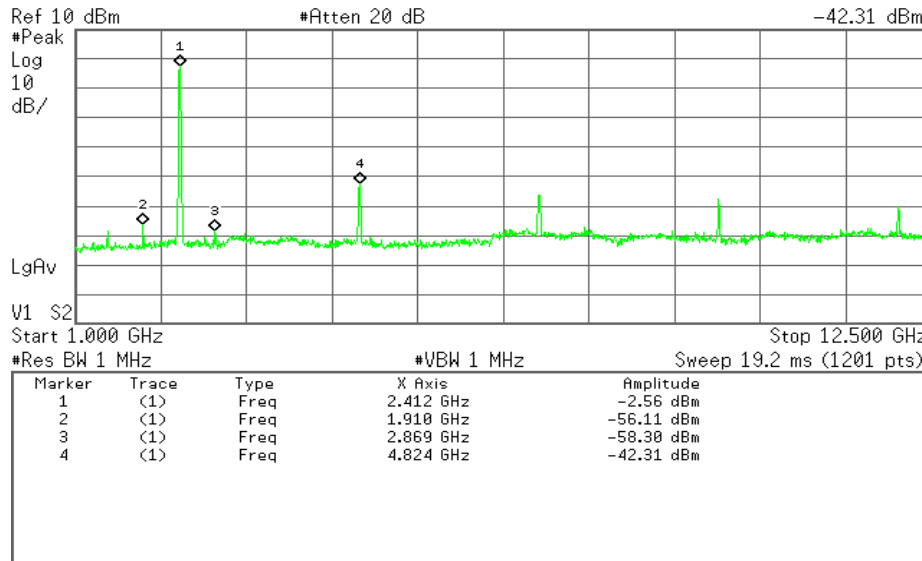
Tx1_SpuriousG_Nom

Agilent 13:54:42 Oct 9, 2017

R L

Mkr4 4.824 GHz

-42.31 dBm



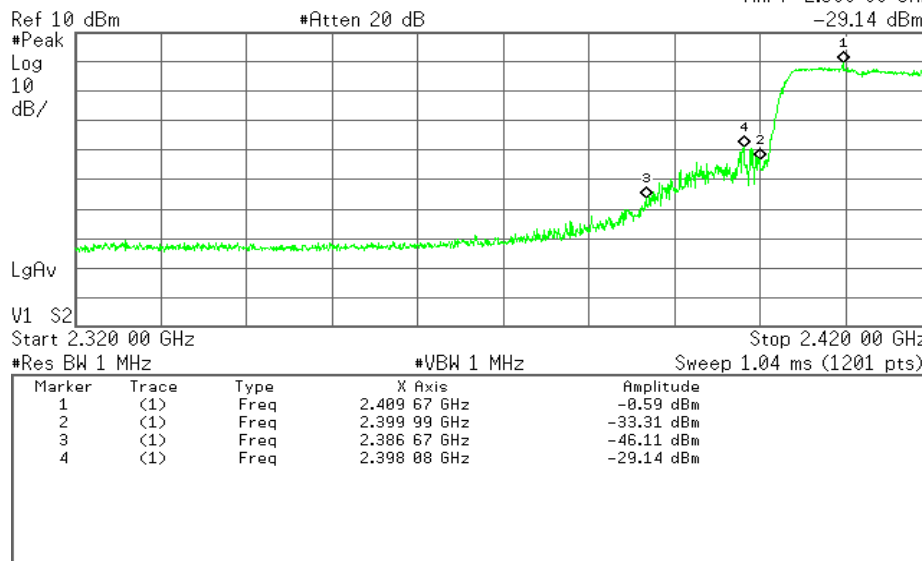
Tx1_BandEdgeLow_Nom

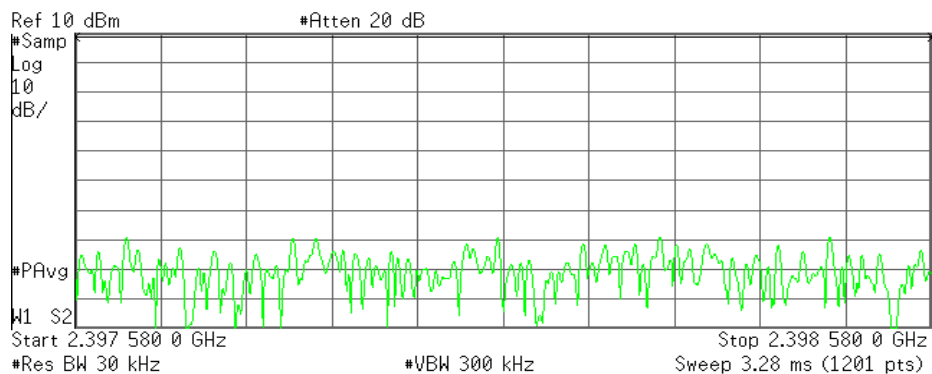
Agilent 13:55:31 Oct 9, 2017

R L

Mkr4 2.398 08 GHz

-29.14 dBm





Channel Power

-52.82 dBm /1.0000 MHz

Power Spectral Density

-112.82 dBm/Hz

Tx2_SpuriousM_Nom

Agilent 13:58:30 Oct 9, 2017

R L

Mkr1 726.0 MHz
-61.67 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	726.0 MHz	-61.67 dBm

Tx2_SpuriousG_Nom

Agilent 13:58:17 Oct 9, 2017

R L

Mkr4 4.881 GHz
-40.74 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	-1.15 dBm
2	(1)	Freq	1.882 GHz	-56.56 dBm
3	(1)	Freq	2.840 GHz	-58.30 dBm
4	(1)	Freq	4.881 GHz	-40.74 dBm

Tx3_SpuriousM_Nom

* Agilent 14:09:10 Oct 9, 2017

R L

Mkr1 343.6 MHz

-61.57 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	343.6 MHz	-61.57 dBm

Tx3_SpuriousG_Nom

* Agilent 14:08:57 Oct 9, 2017

R L

Mkr4 4.939 GHz

-41.86 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

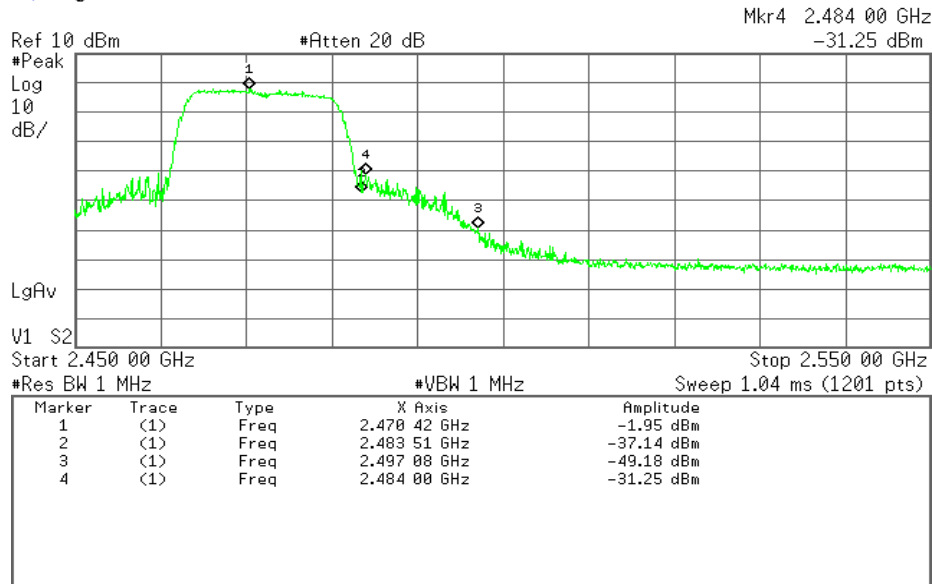
Sweep 19.2 ms (1201 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.472 GHz	-4.27 dBm
2	(1)	Freq	1.843 GHz	-57.59 dBm
3	(1)	Freq	2.811 GHz	-55.61 dBm
4	(1)	Freq	4.939 GHz	-41.86 dBm

Tx3_BandEdgeHigh_Nom

Agilent 14:09:31 Oct 9, 2017

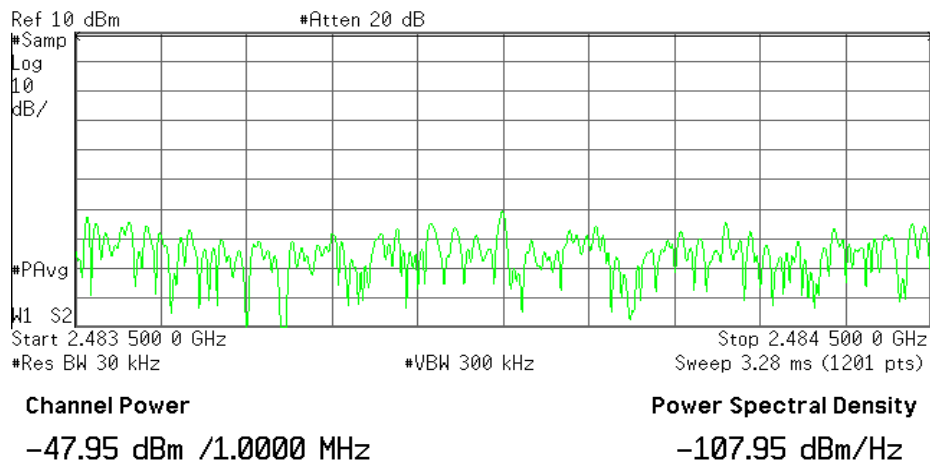
R L



Tx3_BandEdgeHighZoom_Nom

Agilent 14:09:45 Oct 9, 2017

R L



2.4. Output Power

Job No. R11965413-E4c

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	-6.94	1.30	10.00	0.002729	1.05	0.002863	0.50	0.003212
		2442	-6.81	1.30	10.00	0.002812	1.05	0.002950	0.50	0.003310
		2472	-6.64	1.30	10.00	0.002924	1.05	0.003068	0.50	0.003442
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	0.002863	-32.3	0.010000	+20 ~ -80	0.003212	5.07	12.14
	2442	0.002950	-30.2	0.010000	+20 ~ -80	0.003310	5.20	12.14
	2472	0.003068	-27.5	0.010000	+20 ~ -80	0.003442	5.37	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)	0.002960	[W/MHz]	Average of E.I.R.P. Result(B)	0.003322	[W/MHz]
Declared Output Power	0.004229	[W/MHz]	E.I.R.P. for Declared Output Power	6.76	[dBm/MHz]
+20	0.005075	[W/MHz]			
Middle (Declared Output Power -30%)	0.002960	[W/MHz]			
-80	0.000846	[W/MHz]			

Sample Calculation :

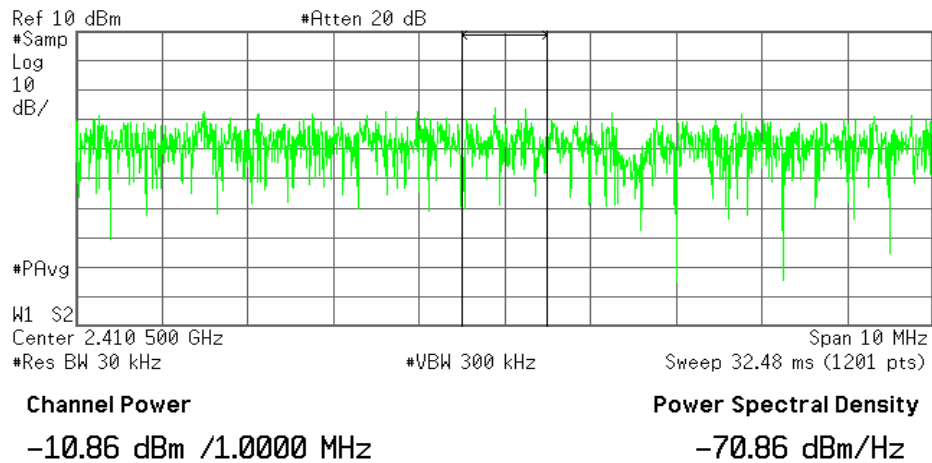
E.I.R.P. for Declared Output Power

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

Tx1_Power_Chain0_Nom

Agilent 14:11:16 Oct 9, 2017

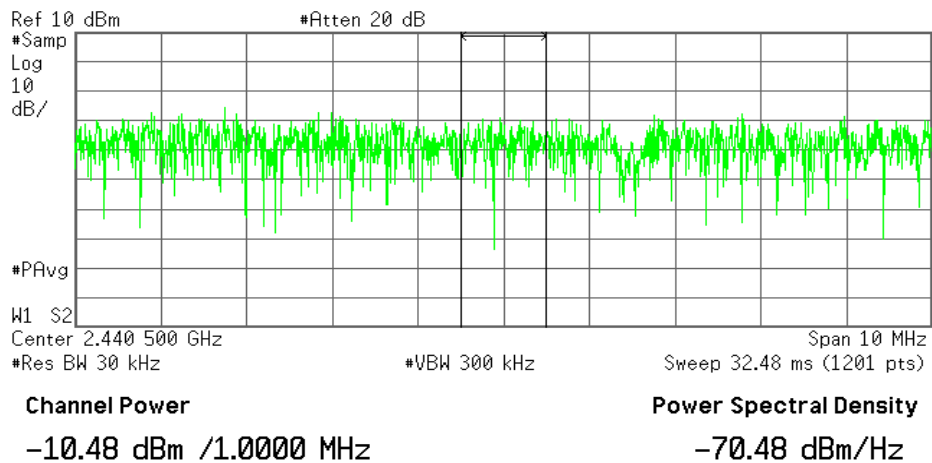
R L

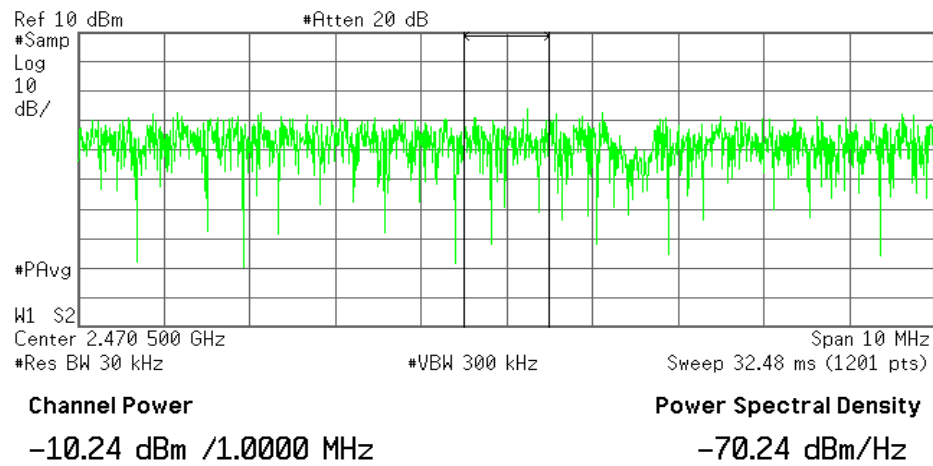


Tx2_Power_Chain0_Nom

Agilent 14:12:00 Oct 9, 2017

R L





2.5. Secondary Radiated Emission Strength

Job No. R11965413-E4c

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	202.2	-81.13	1.30	10.00	-69.83	0.104	4.000	◆5
		7095.0	-67.05	1.30	10.00	-55.75	2.662	20.000	◆6

The sum of the results exceeding 1/10 of the Limit [nW] : 2.662

Sample Calculation :

Result = Reading + Cable Loss

◆5:Freq Range5 (≥ 30MHz, <1GHz)

◆6:Freq Range6 (≥ 1GHz, ≤ 12.5GHz)

Rx1_SpuriousM_Nom

Agilent 14:02:58 Oct 9, 2017

R L

Mkr1 202.2 MHz

Ref -10 dBm

Atten 10 dB

-81.13 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)

Ref -10 dBm

Atten 10 dB

*Peak
Log
10
dB/

LgAv

V1 S2

S3 FC

RA

E(f):

FTun

Swp

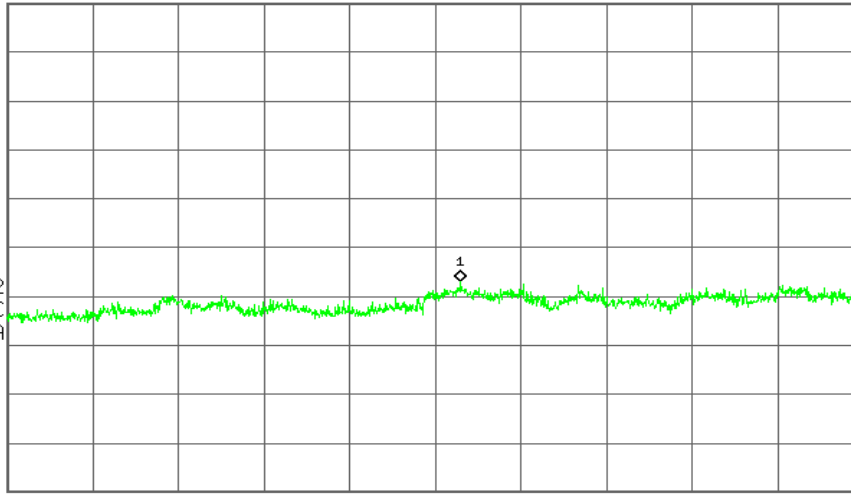
Start 1.000 GHz

Stop 12.500 GHz

*Res BW 1 MHz

*VBW 1 MHz

Sweep 19.2 ms (1201 pts)



2.6. Duty / Burst Rate

Job No. R11965413-E4c

Remark1

Remark2

[DATA]

Voltage	Freq.	On Time	Period	Result (Duty)	Result (Burst Rate)
[V]	[MHz]	[msec]	[msec]	[%]	
AC100V	2442	1.282	1.345	95.3	1.049

Sample Calculation :

Result(Duty) = On Time / Period * 100

Result(Burst Rate) = Period / On Time

Tx2_Duty_Nom

Agilent 13:59:32 Oct 9, 2017

R L

Δ Mkr1 1.282 ms
1.32 dB

Ref 10 dBm

#Atten 20 dB

#Peak

Log

10

dB/

LgAv

W1 S2

Center 2.442 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 8 MHz

Sweep 3.04 ms (1201 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	1.34 ms	-6.71 dBm
1Δ	(1)	Time	1.282 ms	1.32 dB
2R	(1)	Time	1.34 ms	-6.71 dBm
2Δ	(1)	Time	1.345 ms	-8.28 dB

Average Power

Job No. R11965413-E4c

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	9.13	1.30	10.00	1.05	20.64
		2442	9.23	1.30	10.00	1.05	20.74
		2472	9.26	1.30	10.00	1.05	20.77
AC100V	-	-	-	-	-	-	-
		-	-	-	-	-	-
		-	-	-	-	-	-
AC100V	-	-	-	-	-	-	-
		-	-	-	-	-	-
		-	-	-	-	-	-
AC100V	-	-	-	-	-	-	-
		-	-	-	-	-	-
		-	-	-	-	-	-

Total Output Power

Voltage	Freq.	Power
	[MHz]	[mW]
DC5V	2412	115.83
	2442	118.53
	2472	119.35

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

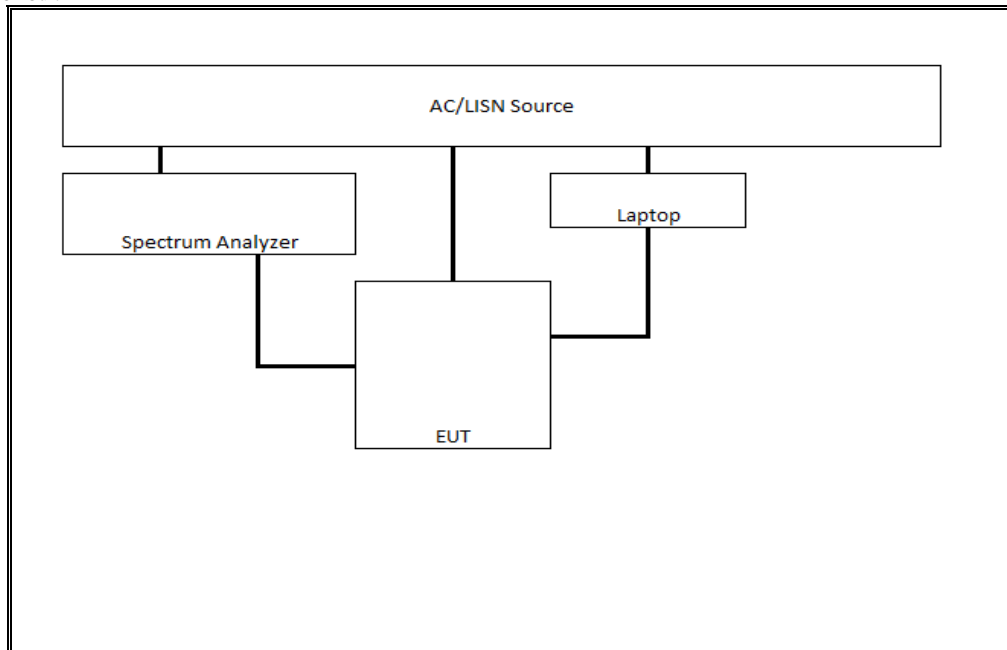
- Note :
1. The calibration of measurement equipment is valid for a one year period.
 2. "X" used equipment.
 3. All equipment is calibrated and traceable to ISO17025

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

