TEST REPORT

REPORT NUMBER:	12197499-E41V2
COMPANY NAME:	Google LLC
EUT DESCRIPTION:	Multimedia Device with BLE/BT, 2.4GHz and 5GHz Radios
MODEL:	NC2-6A5
SERIAL NUMBER:	PROTO 1
ISSUE DATE:	29-Jun-18
DATE TESTED:	8/06/2015 to 8/12/2015, 4/30/18 to 5/10/18, and 6/29/18
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:	Pass
Classification of Specified Radio Equipment:	Article 2 Clause 1 Item 19-3
Type of radio wave, Frequency and antenna power:	G1D, D1D 5260-5320MHz (Interval of 20MHz 4ch) 0.001981W/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 de Anda
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UL Verification Services Inc.

NVLAP LAB CODE 200065-0

1. EUT Information

Report No. :	12197499-E41V2
Applicant :	Google LLC
Equipment Description:	Multimedia Device with BLE/BT, 2.4GHz and 5GHz Radios
Model No. :	NC2-6A5
SerialNo. :	PROTO 1
The number of Tx Antenna :	1
Max Antenna Gain :	4.0dBi
Mode :	IEEE802.11n HT20
Type of Radio wave :	G1D, D1D

Supply Voltage
(●) DC ( ) AC 5.00V
-

Voltage Condition
(●) Non-Extreme ( ) Extreme
Normal DC5V
Normal-10% -
Normal+10% -

Band
( ) W52
(●) W53

Modulation
(●) OFDM (OBW<19MHz)
( ) OFDM (OBW<19-38MHz)
( ) DS (OBW<18MHz)
( ) Other Modulation (OBW<18MHz)

EUT has
(●) ANT Connector
( ) No ANT Connector distance -

TEUT has
( ) TPC Function
(●) No TPC Funciton

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

		Other than for Power and ACP		For Power	
	[MHz]	Cable Loss [dB]	ATT/ [dB]	Cable Loss [dB]	ATT/ [dB]
Low Channel (Tx1)	5260	1.00	10.00	1.00	10.00
Middle Channel (Tx2)	5300	4.10	10.00	1.00	10.00
High Channel (Tx3)	5320	1.00	10.00	1.00	10.00

* Cable loss and ATT are not taken into account for ACP.

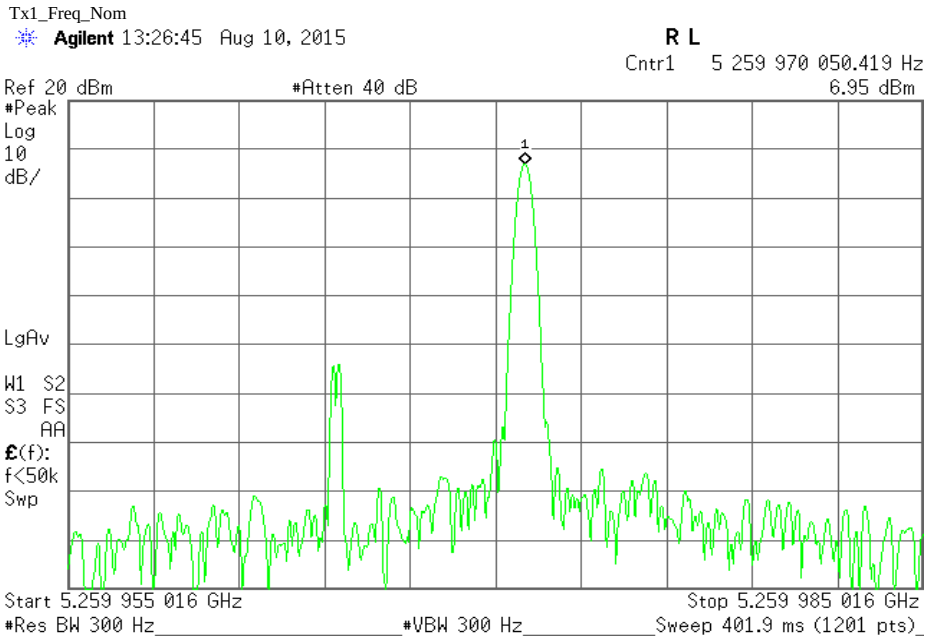
2.TEST Result

2.1. Frequency Tolerance

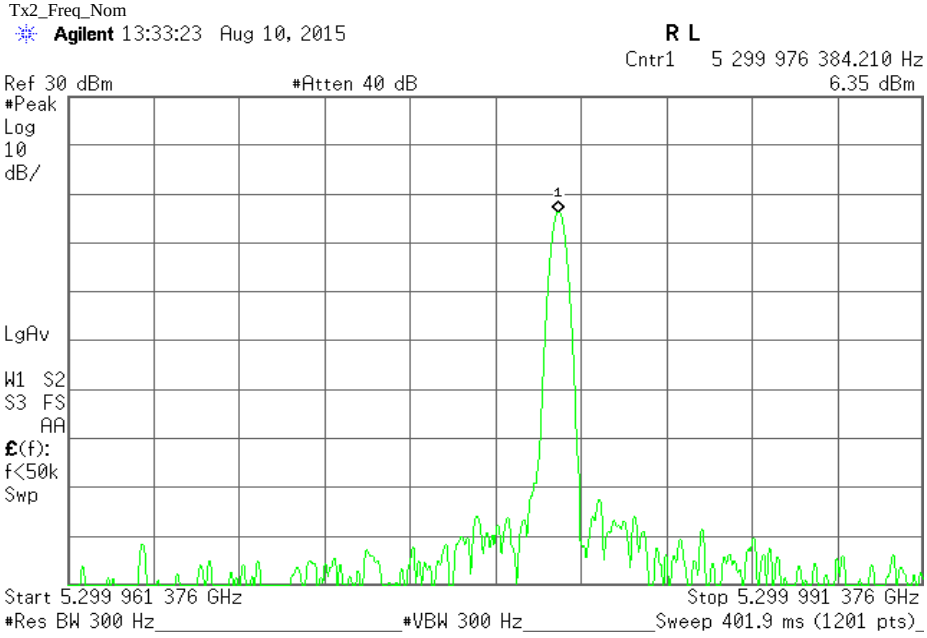
Job No.	12197499-E41V2
Remark1	
Remark2	

[DATA]

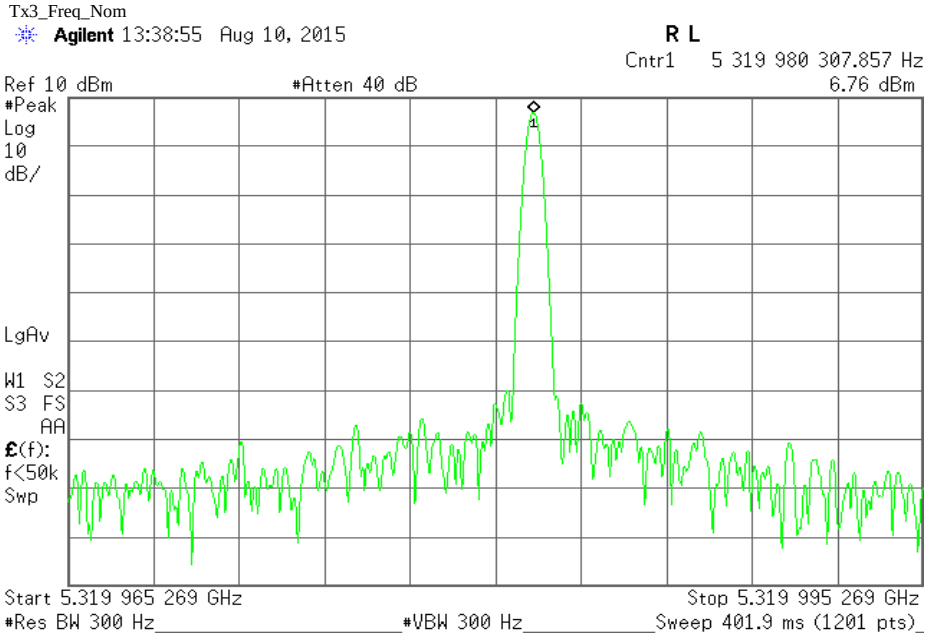
Voltage	Freq. [MHz]	Result [MHz]	Tolerance [kHz]	Tolerance [ppm]	Limit [ppm]
DC5V	5260	5259.9701	-29.9496	-5.69	±20.0
	5300	5299.9764	-23.6158	-4.46	±20.0
	5320	5319.9803	-19.6921	-3.70	±20.0



Tx2_Freq_Nom



Tx3_Freq_Nom



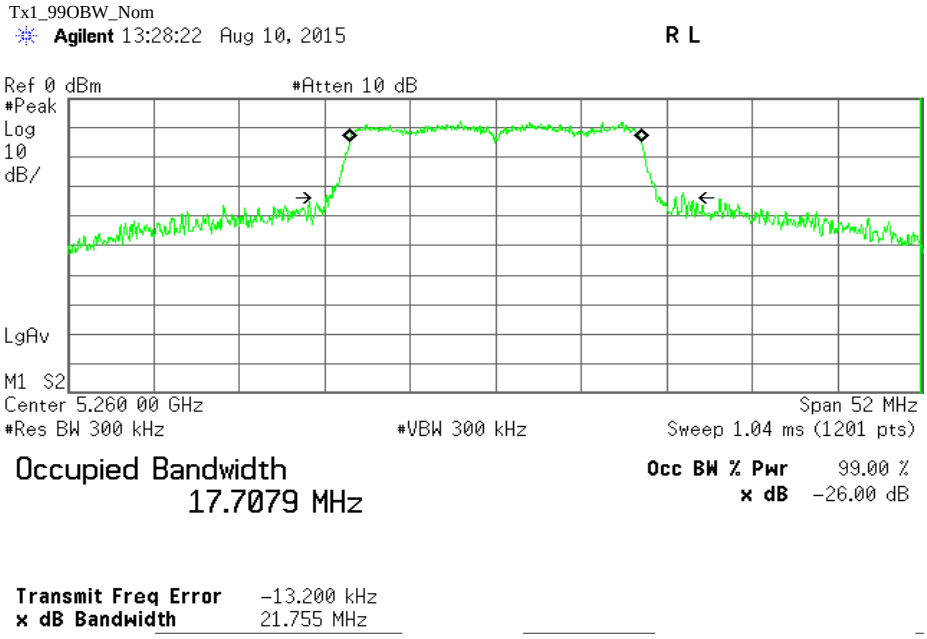
2.2. Occupied Bandwidth

Job No.	12197499-E41V2
Remark1	
Remark2	

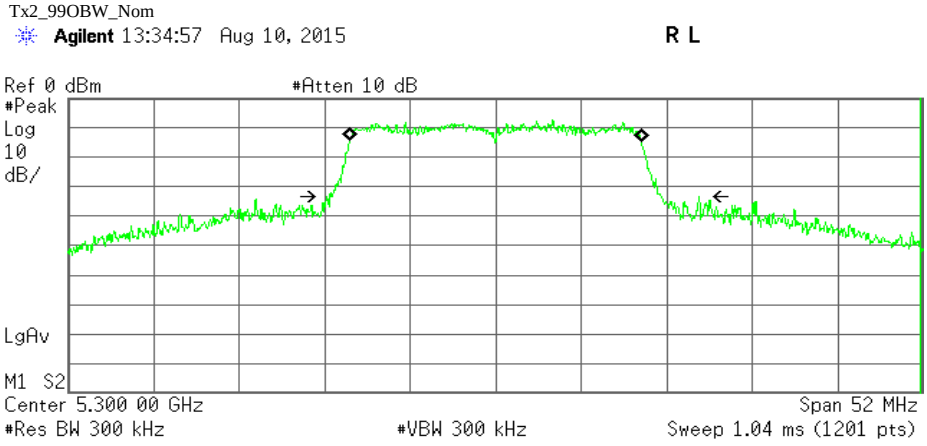
[DATA]

99% Occupied Frequency Bandwidth

Voltage	Freq. [MHz]	Result [MHz]	Limit [MHz]
DC5V	5260	17.7079	19
	5300	17.7098	19
	5320	17.6578	19



Tx2_99OBW_Nom

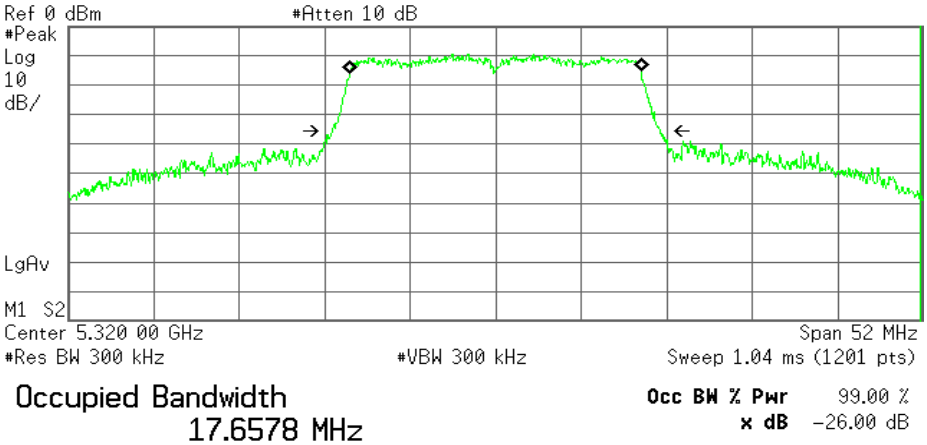


Occupied Bandwidth
17.7098 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -1.768 kHz
x dB Bandwidth 22.020 MHz

Tx3_99OBW_Nom



Occupied Bandwidth
17.6578 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -5.496 kHz
x dB Bandwidth 19.852 MHz

2.3.Unwanted Emission Strength (Normal Voltage)

Job No.	12197499-E41V2
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	5260	30.80	-70.38	1.00	10.00	-59.38	0.001	2.500	♦1
		3507.00	-65.49	1.00	10.00	-54.49	0.004	2.500	♦1
		5108.00	-60.70	1.00	10.00	-49.70	0.011	2.500	♦1
		5404.00	-62.22	1.00	10.00	-51.22	0.008	2.500	♦2
		10525.00	-58.11	1.00	10.00	-47.11	0.019	2.500	♦2
		15775.00	-56.22	1.00	10.00	-45.22	0.030	2.500	♦2
		25140.00	-62.21	1.00	10.00	-51.21	0.008	2.500	♦2
	5300	34.00	-70.88	4.10	10.00	-56.78	0.002	2.500	♦1
		4977.00	-63.72	4.10	10.00	-49.62	0.011	2.500	♦1
		5071.00	-61.99	4.10	10.00	-47.89	0.016	2.500	♦1
		5379.00	-56.52	4.10	10.00	-42.42	0.057	2.500	♦2
		10600.00	-58.67	4.10	10.00	-44.57	0.035	2.500	♦2
		15904.00	-57.35	4.10	10.00	-43.25	0.047	2.500	♦2
		24860.00	-61.60	4.10	10.00	-47.50	0.018	2.500	♦2
	5320	637.10	-71.28	1.00	10.00	-60.28	0.001	2.500	♦1
		3547.00	-65.95	1.00	10.00	-54.95	0.003	2.500	♦1
		5092.00	-62.83	1.00	10.00	-51.83	0.007	2.500	♦1
		5396.00	-58.58	1.00	10.00	-47.58	0.017	2.500	♦2
		10638.00	-58.45	1.00	10.00	-47.45	0.018	2.500	♦2
		15954.00	-61.52	1.00	10.00	-50.52	0.009	2.500	♦2
		24740.00	-62.08	1.00	10.00	-51.08	0.008	2.500	♦2

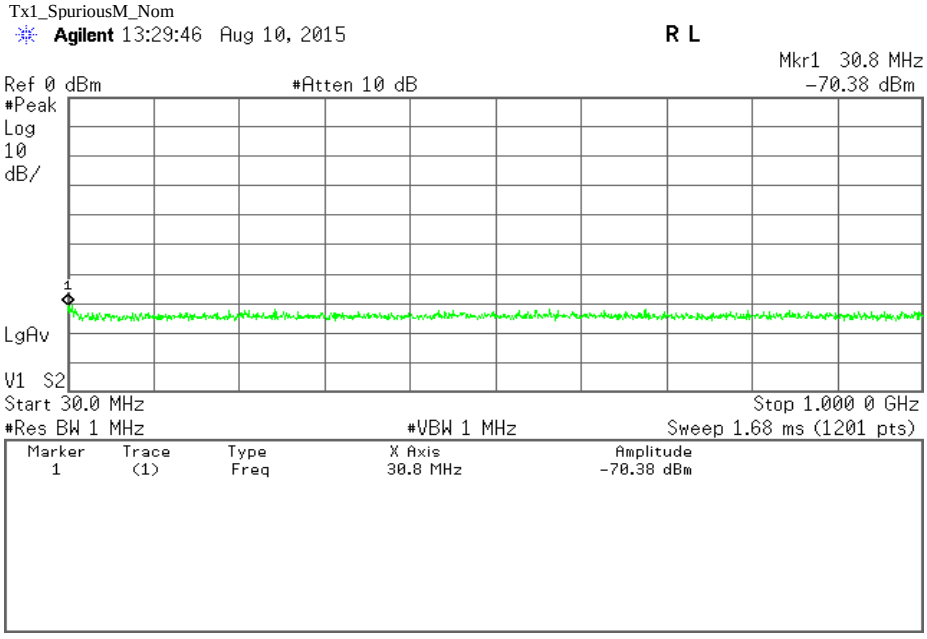
Sample Calculation :

Result = Reading + Cable Loss + Attenuator

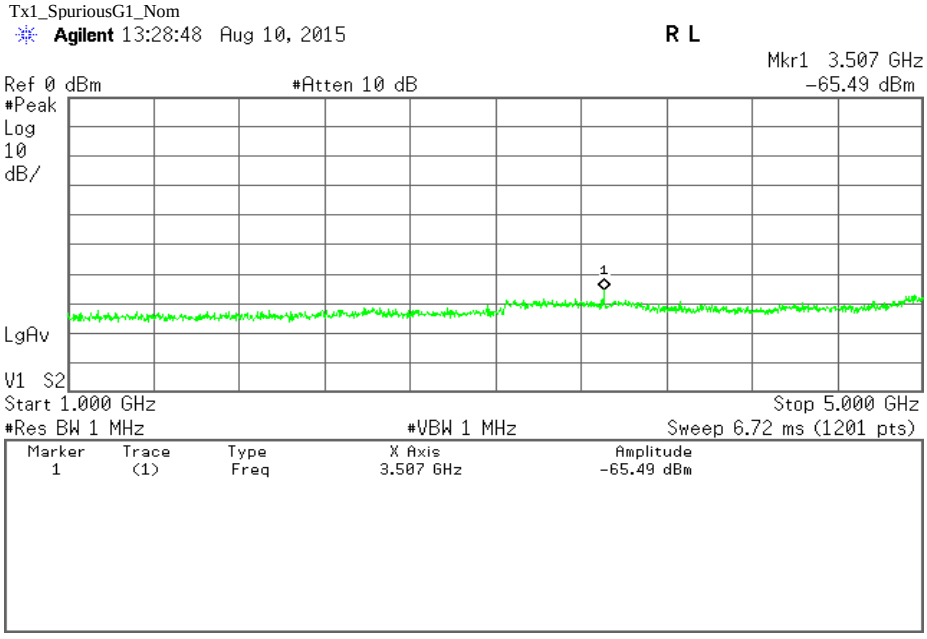
♦1:Freq Range1 (< 5,135MHz)

♦2:Freq Range2 (> 5,365MHz)

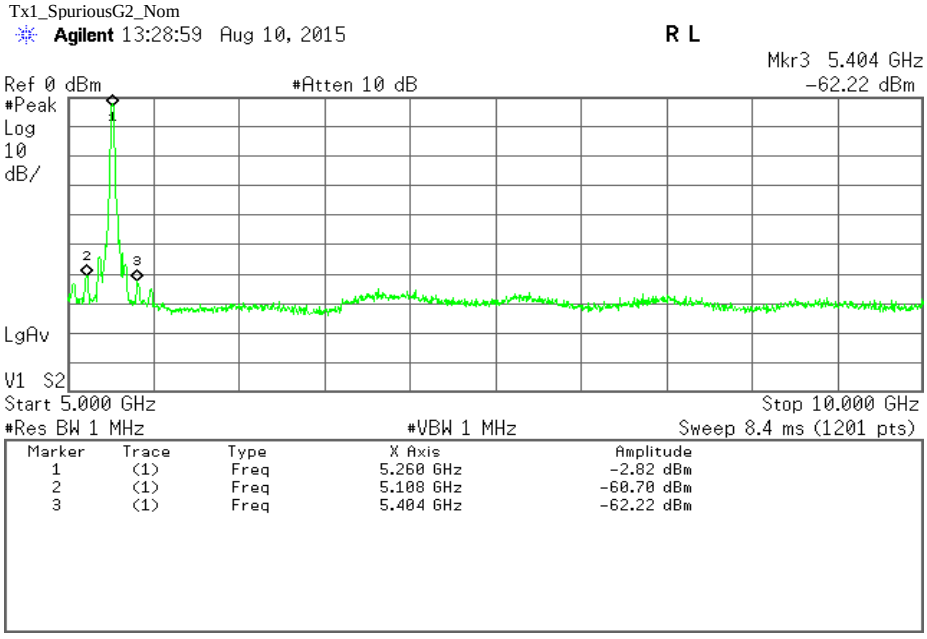
Tx1_SpuriousM_Nom



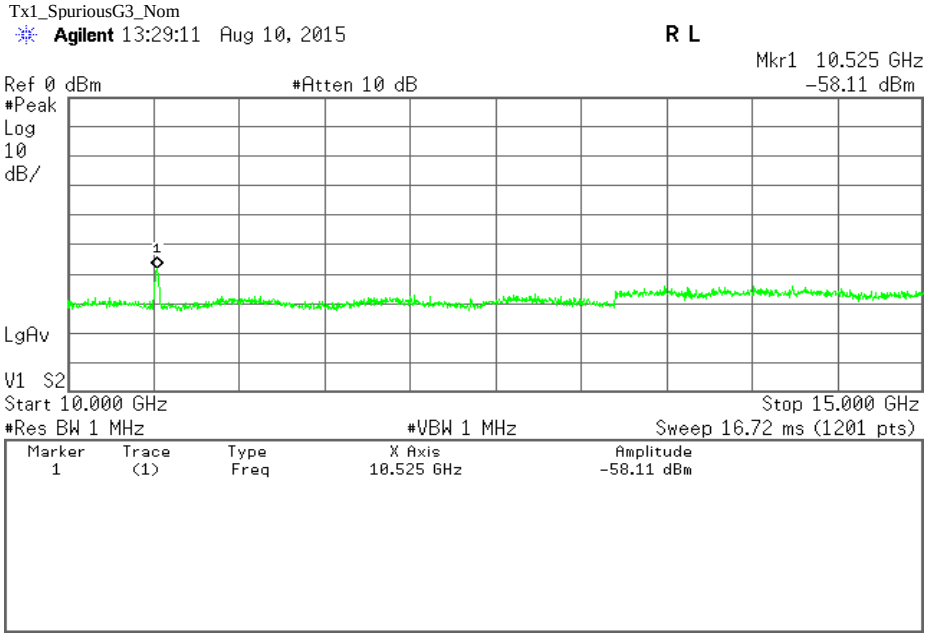
Tx1_SpuriousG1_Nom



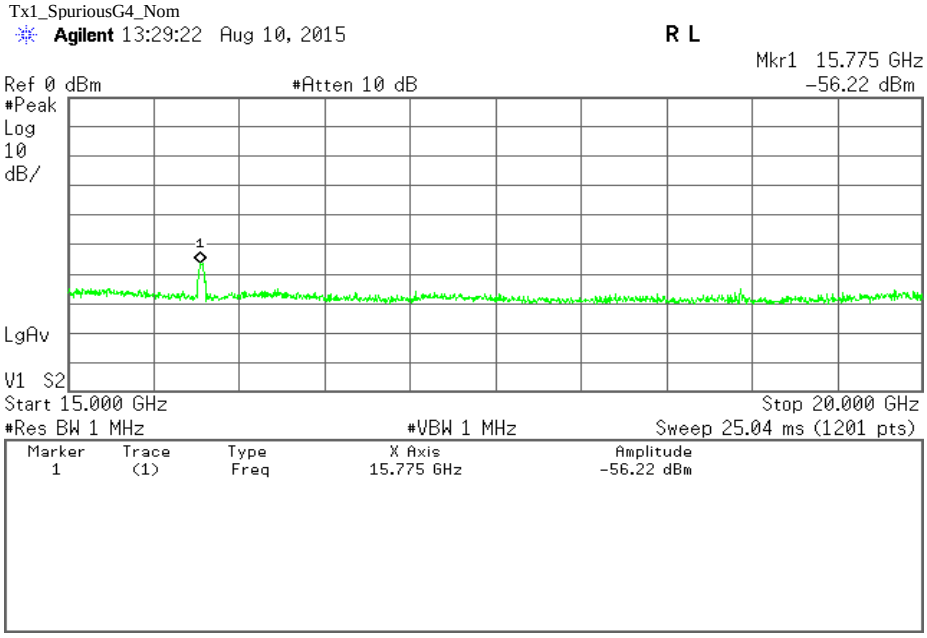
Tx1_SpuriousG2_Nom



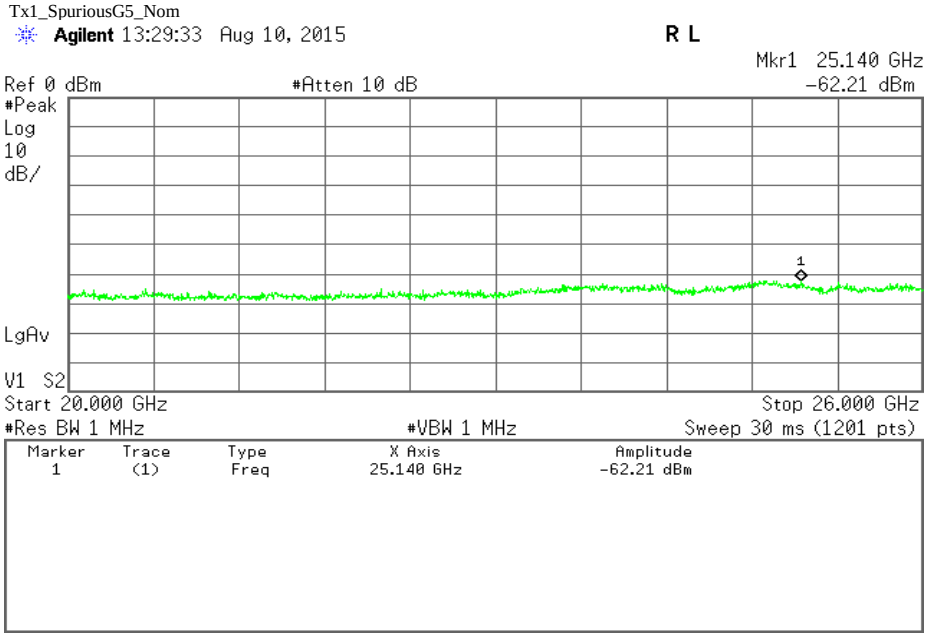
Tx1_SpuriousG3_Nom



Tx1_SpuriousG4_Nom



Tx1_SpuriousG5_Nom



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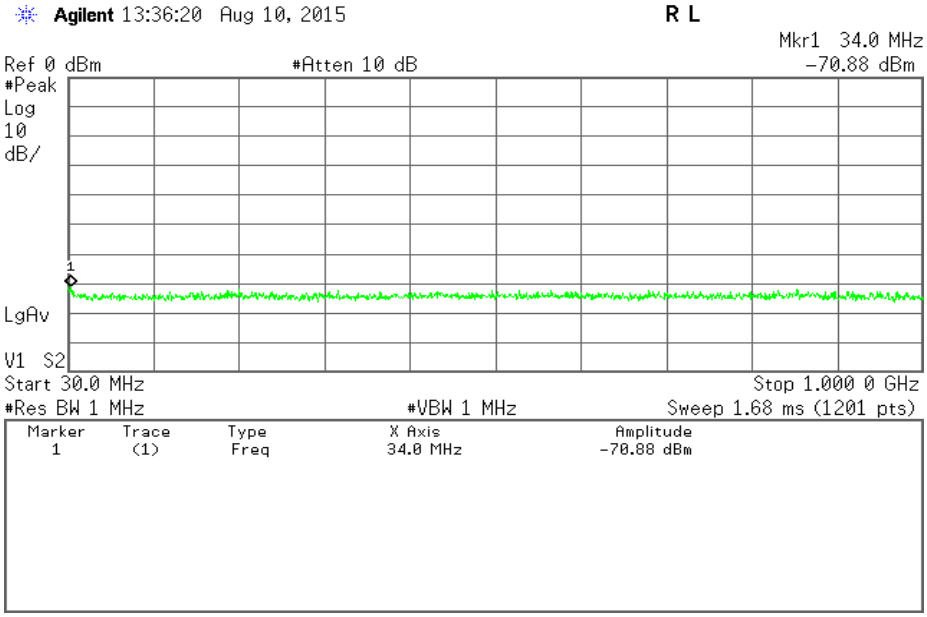
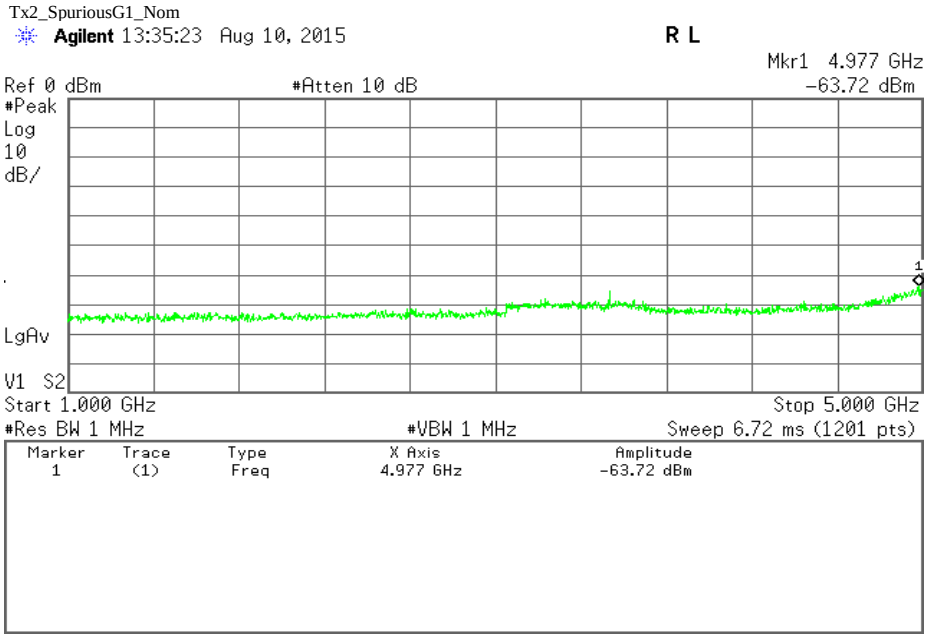
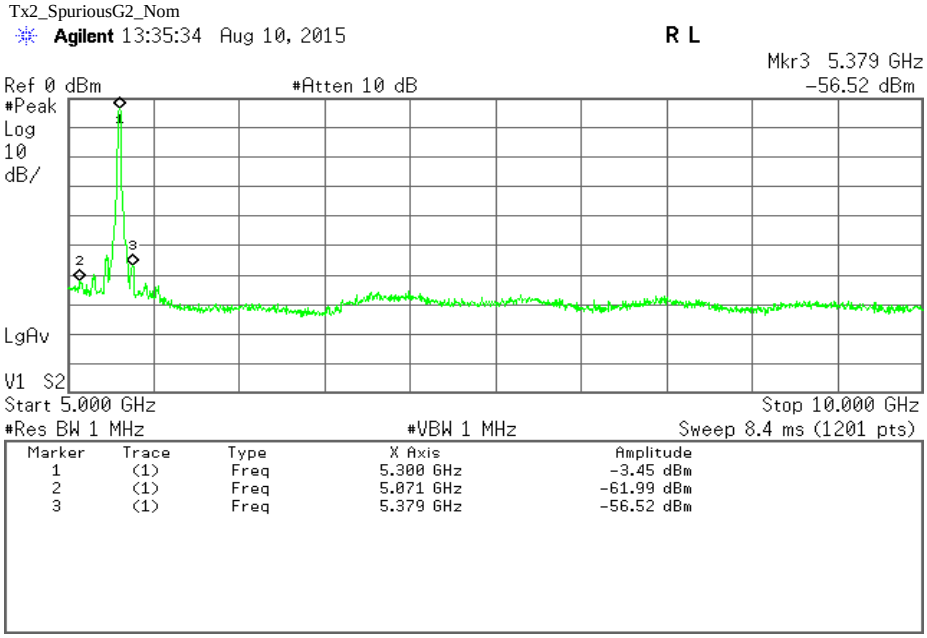


Tx2_SpuriousG1_Nom



Tx2_SpuriousG2_Nom



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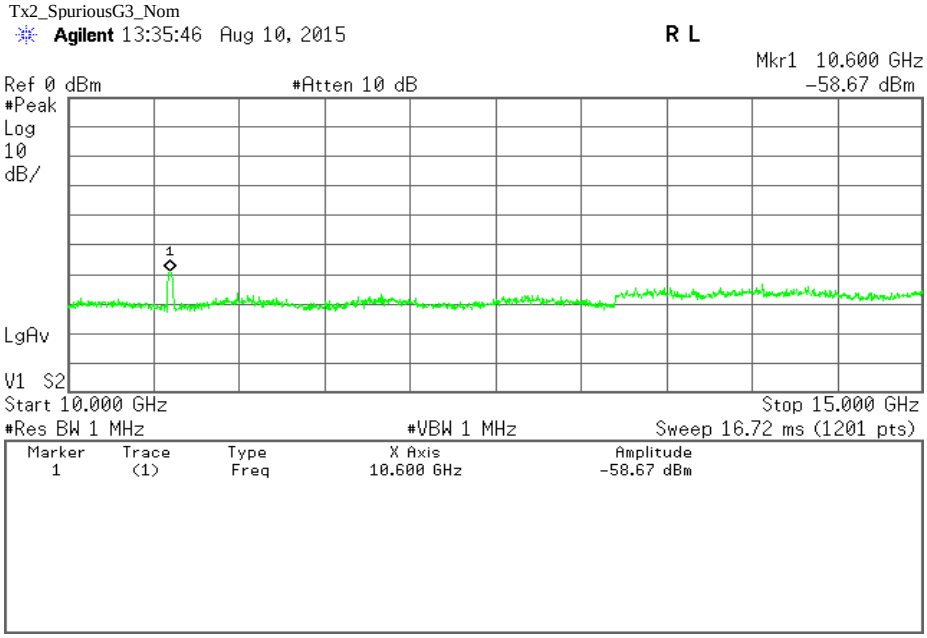
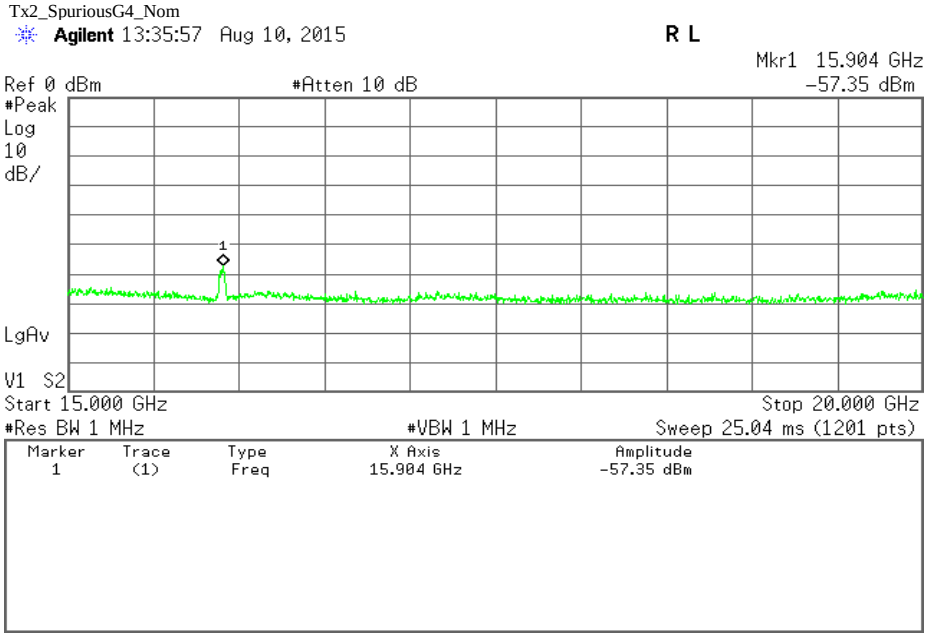
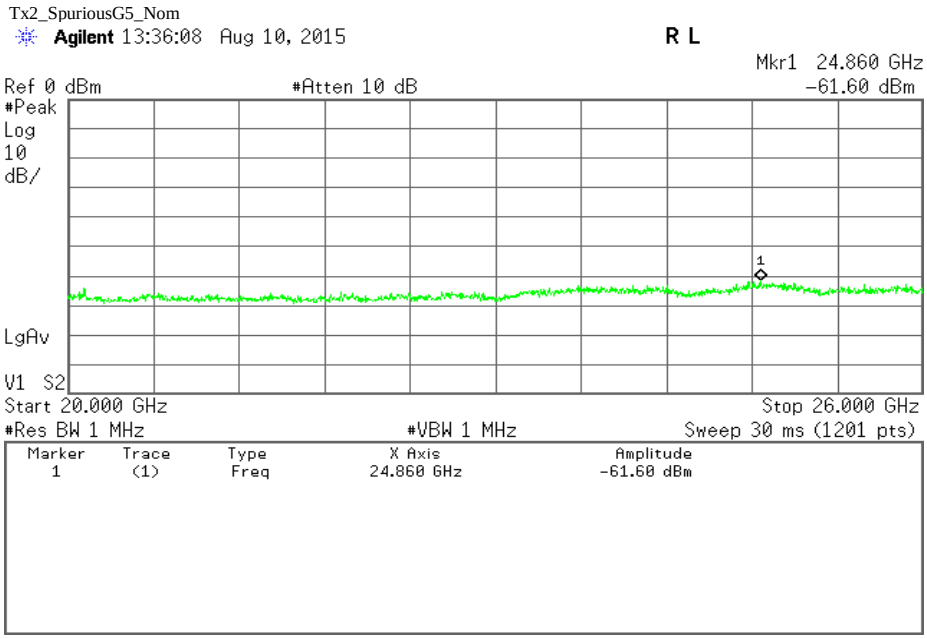


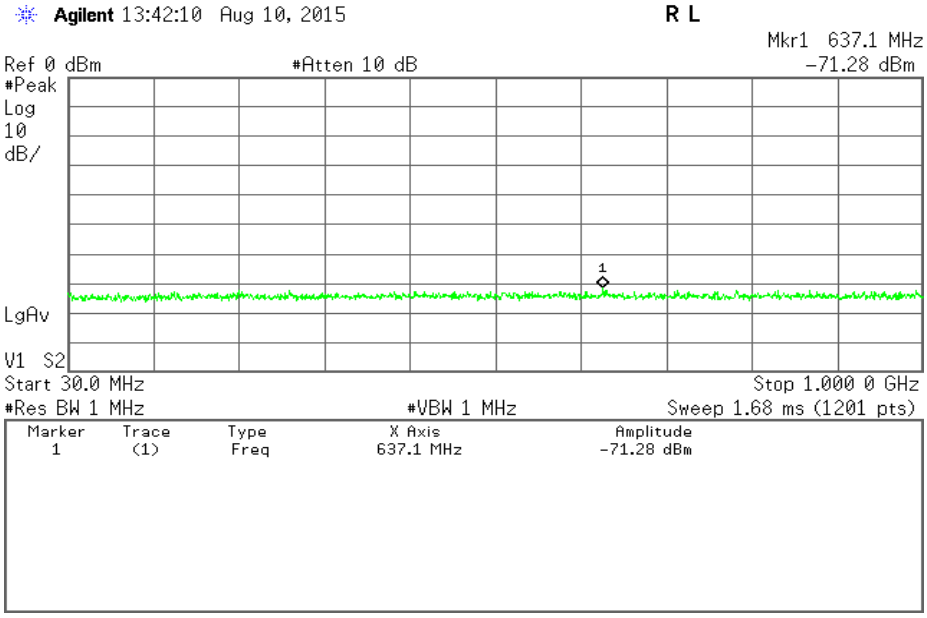
Tx2_SpuriousG4_Nom



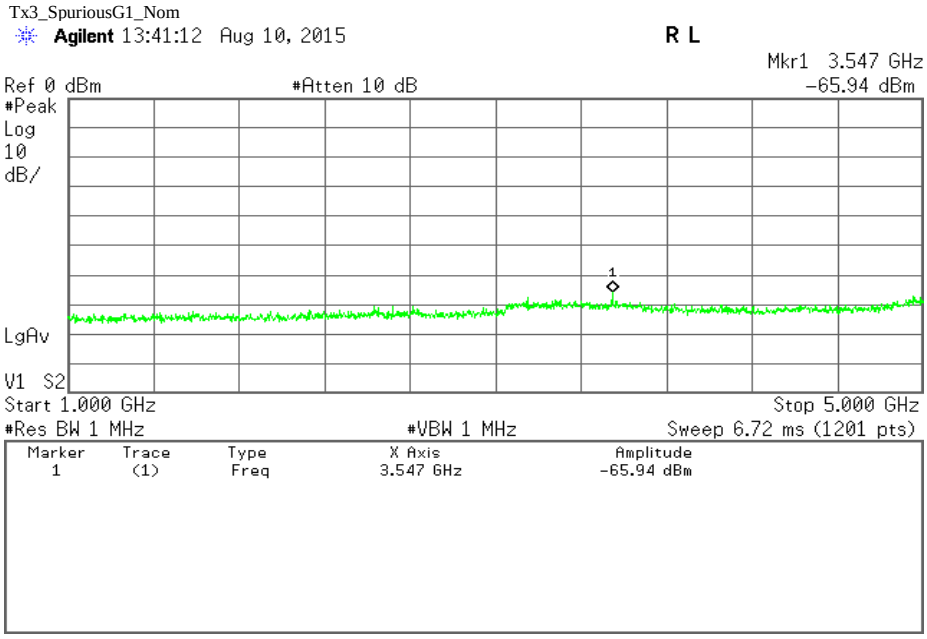
Tx2_SpuriousG5_Nom



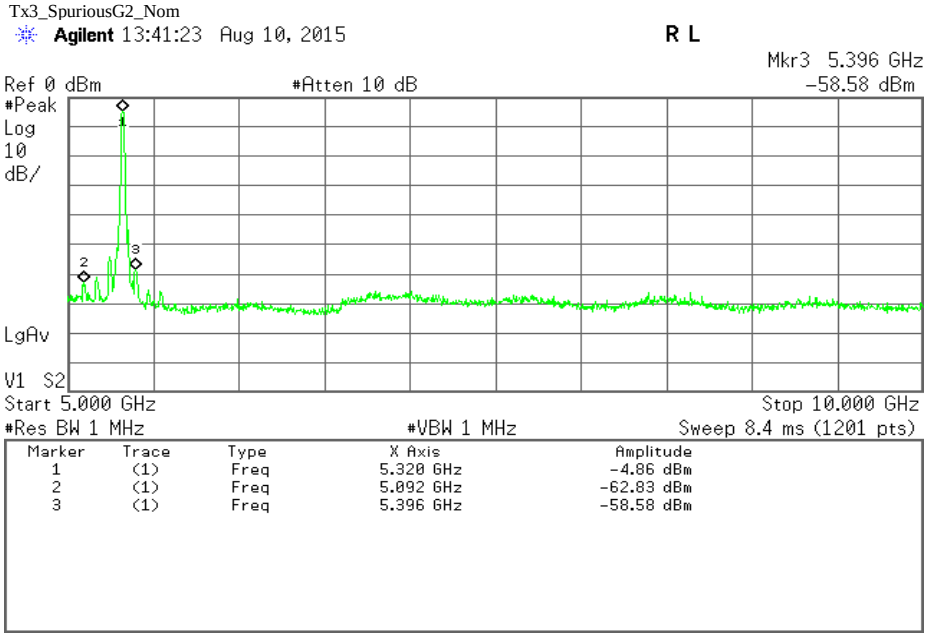
Tx3_SpuriousM_Nom



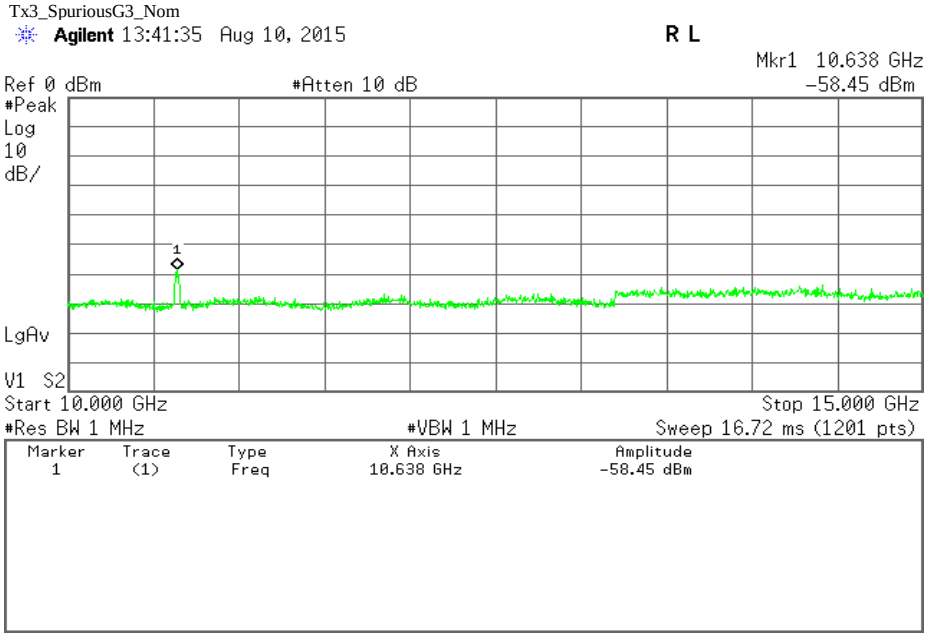
Tx3_SpuriousG1_Nom



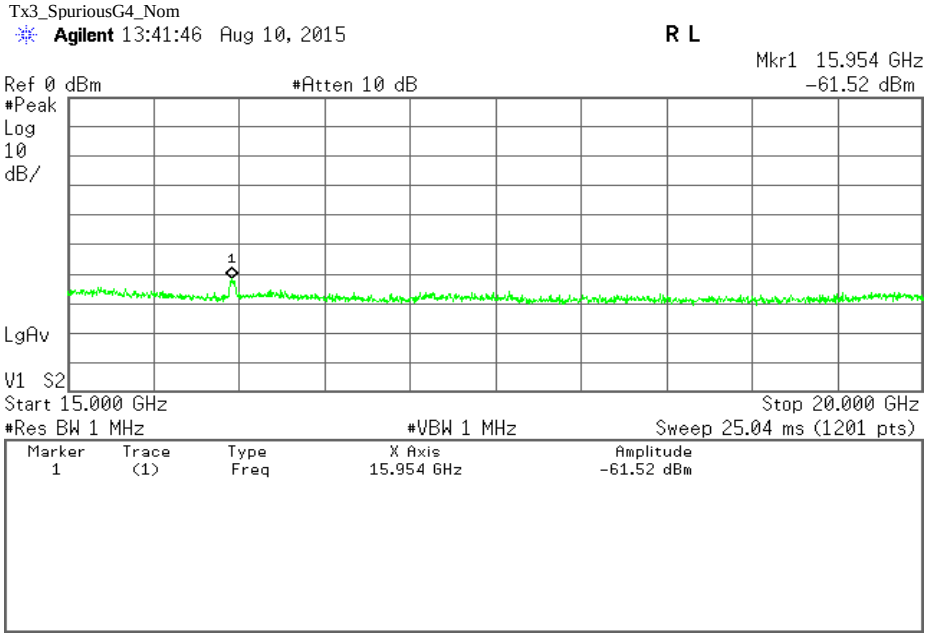
Tx3_SpuriousG2_Nom



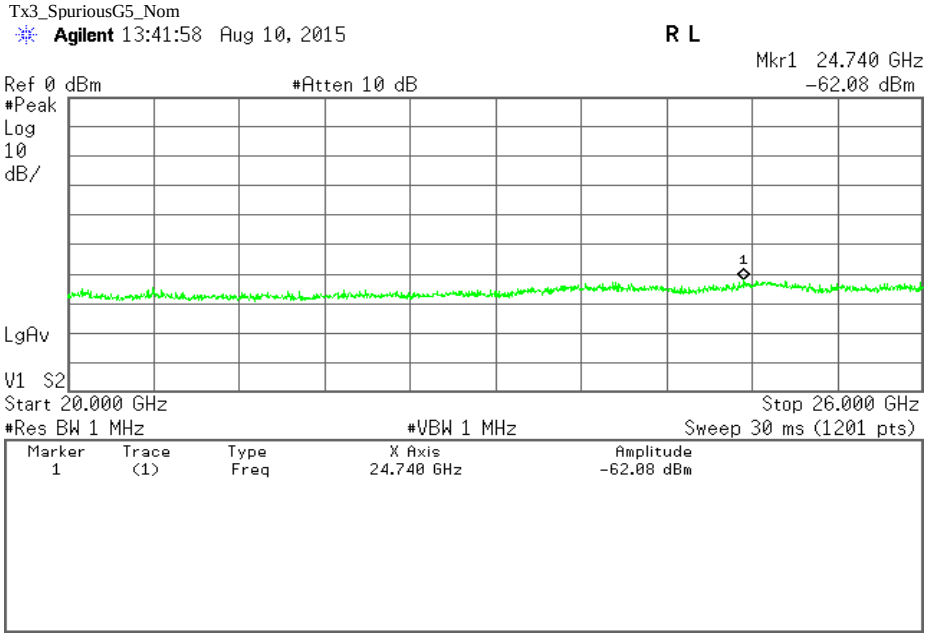
Tx3_SpuriousG3_Nom



Tx3_SpuriousG4_Nom



Tx3_SpuriousG5_Nom



2.4. Output Power/ E.I.R.P

Job No.	12197499-E41V2
Remark1	
Remark2	

[DATA]

Voltage	Port No.	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Burst Rate	Output Power (A) [W/MHz]	Antenna Gain [dBi]	E.I.R.P. (A) [W/MHz]
DC5V	0	5260	-9.53	1.00	10.00	1.00	0.001408	4.00	0.003537
		5300	-8.78	1.00	10.00	1.00	0.001672	4.00	0.004200
		5320	-9.90	1.00	10.00	1.00	0.001293	4.00	0.003248
DC5V	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
DC5V	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
DC5V	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-

Sample Calculation :
Output Power (A) = {Reading + Cable Loss + Atten. Loss} * Burst Rate
E.I.R.P. (A) = Output Power (A) * 10^(Antenna Gain[dBi]/10)

[Total Power / Result and Limit]

Voltage	Freq.	Output Power				E.I.R.P.	
		Result (B)	Tolerance Result	Limit	Tolerance Limit	Result (B)	Limit
	[MHz]	[W/MHz]	[%]	[W/MHz]	[%]	[W/MHz]	[W/MHz]
DC5V	5260	0.001408	-28.9	0.010000	+20 ～ -80	0.003537	0.005000
	5300	0.001672	-15.6	0.010000	+20 ～ -80	0.004200	0.005000
	5320	0.001293	-34.7	0.010000	+20 ～ -80	0.003248	0.005000

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.

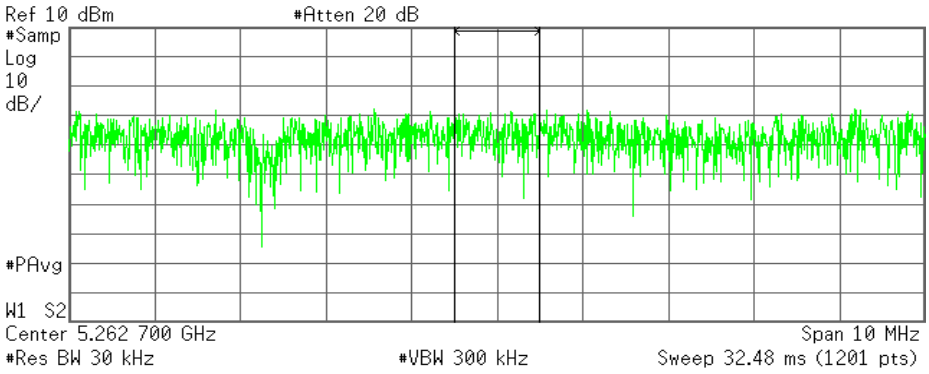
[Declared Output Power]

Average of Output Power Result (B)	0.001458	W/MHz	Average of E.I.R.P. Result(B)	0.003662	W/MHz
Declared Output Power	0.001981	W/MHz	E.I.R.P. for Declared Output Power	0.004977	W/MHz
+20	0.002377	W/MHz			
Middle (Declared Output Power -30%)	0.001387	W/MHz			
-80	0.000396	W/MHz			

Sample Calculation :
E.I.R.P. for Declared Output Power
= Average of E.I.R.P. Result (B) * (Declared Output Power / Average of Output Power Result (B))

Tx1_Power_Chain0_Nom

Agilent 12:56:06 May 10, 2018 R L



Channel Power

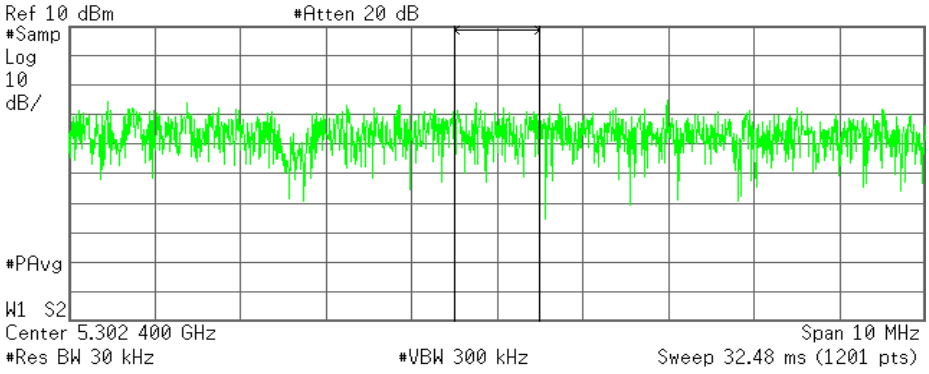
-9.53 dBm /1.0000 MHz

Power Spectral Density

-69.53 dBm/Hz

Tx2_Power_Chain0_Nom

Agilent 13:08:31 May 10, 2018 R L



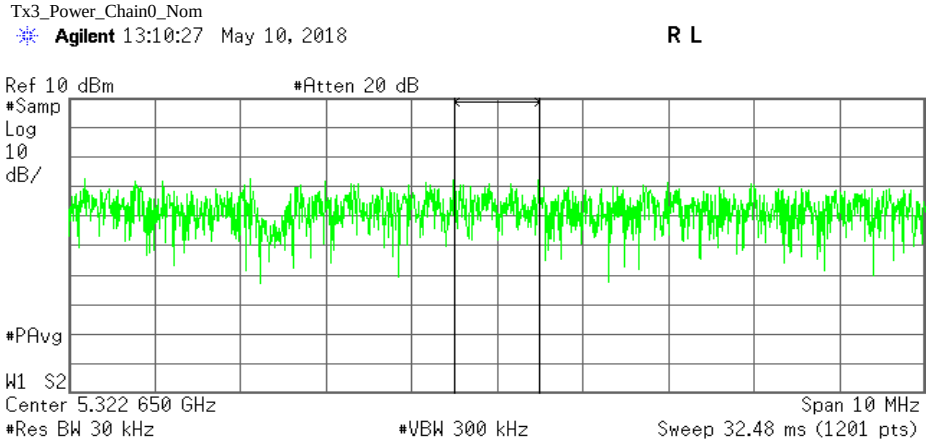
Channel Power

-8.78 dBm /1.0000 MHz

Power Spectral Density

-68.78 dBm/Hz

Tx3_Power_Chain0_Nom



Channel Power

-9.90 dBm /1.0000 MHz

Power Spectral Density

-69.90 dBm/Hz

2.5.Secondary Radiated Emission Strength(Normal Voltage)

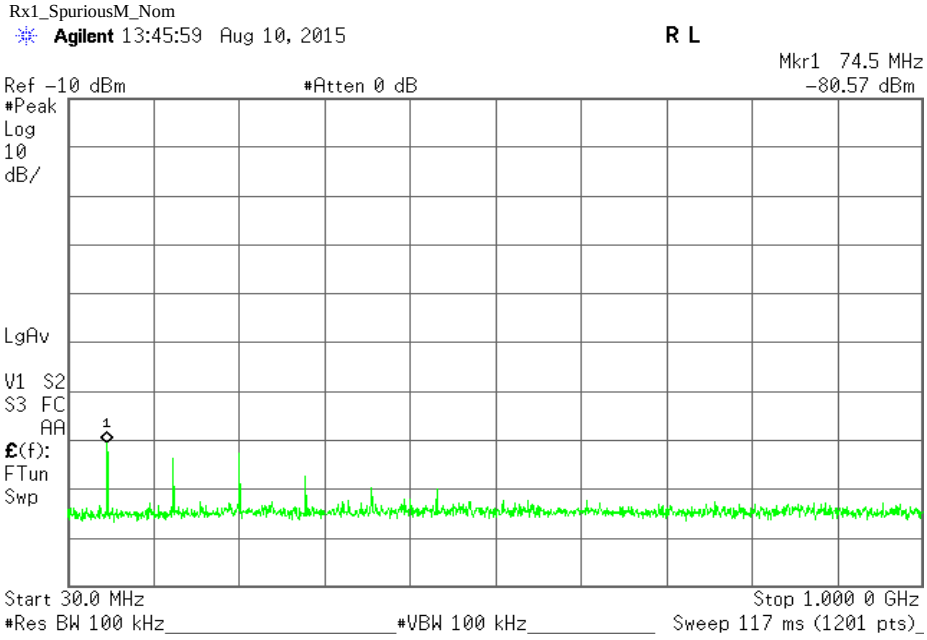
Job No.	12197499-E41V2
Remark1	
Remark2	

[DATA]

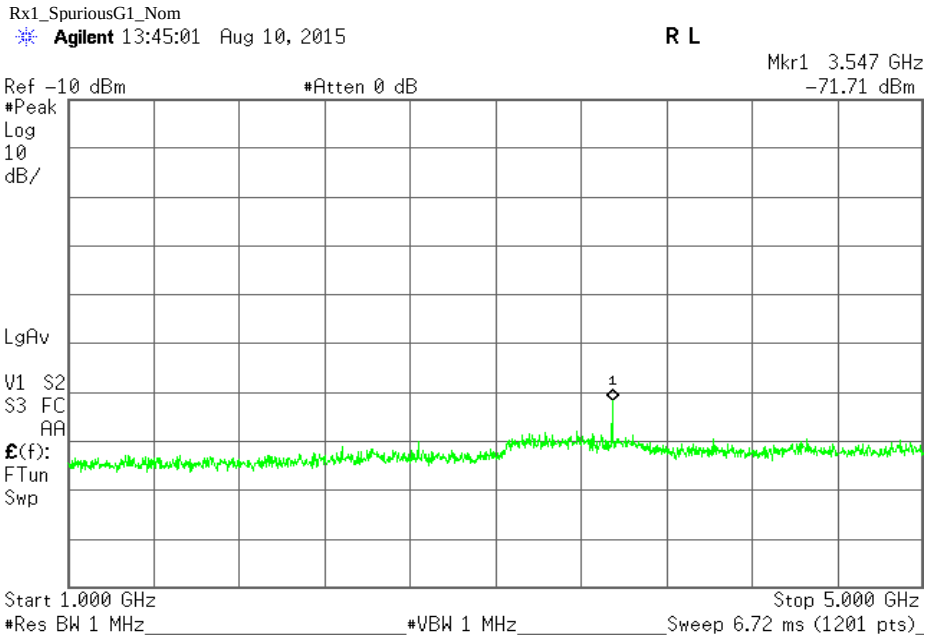
Voltage [V]	Freq. [MHz]	Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Result [nW]	Limit [nW]	Remark
DC5V	5300	74.5	-80.57	4.10	10.00	-66.47	0.225	4.000	♦8
		3547.0	-71.71	4.10	10.00	-57.61	1.733	20.000	♦9
		6829.0	-75.50	4.10	10.00	-61.40	0.725	20.000	♦9
		13962.0	-73.80	4.10	10.00	-59.70	1.071	20.000	♦9
		15096.0	-74.37	4.10	10.00	-60.27	0.940	20.000	♦9
		24905.0	-72.05	4.10	10.00	-57.95	1.604	20.000	♦9

Sample Calculation :
Result = Reading + Cable Loss
♦8:Freq Range8 (< 1GHz)
♦9:Freq Range9 (≥ 1GHz)

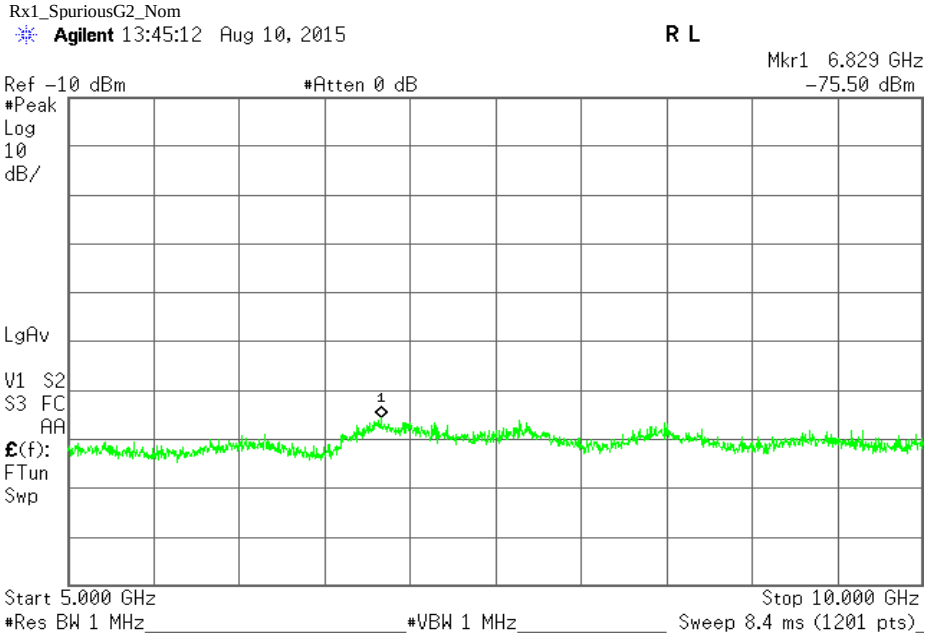
Rx1_SpuriousM_Nom



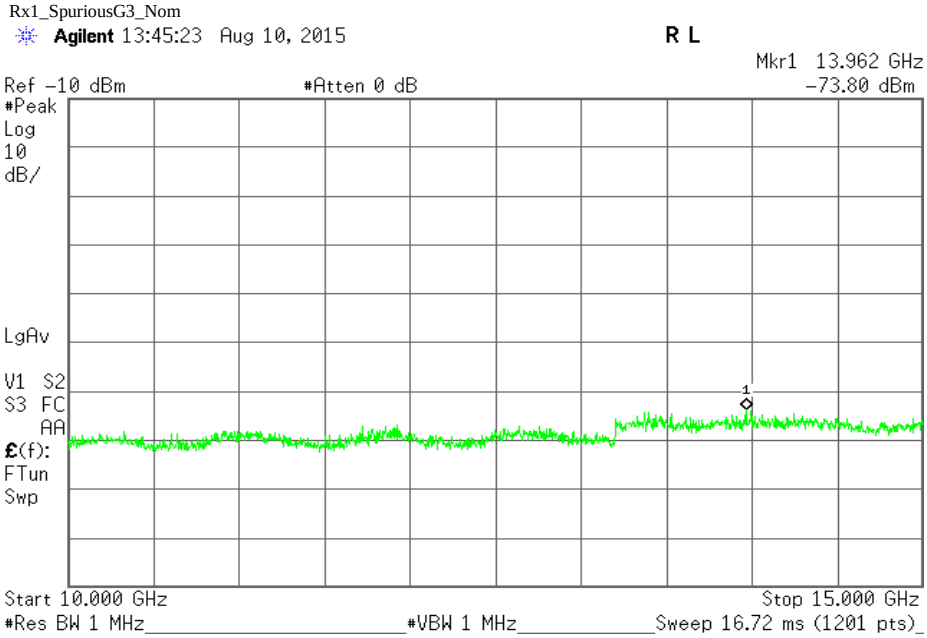
Rx1_SpuriousG1_Nom



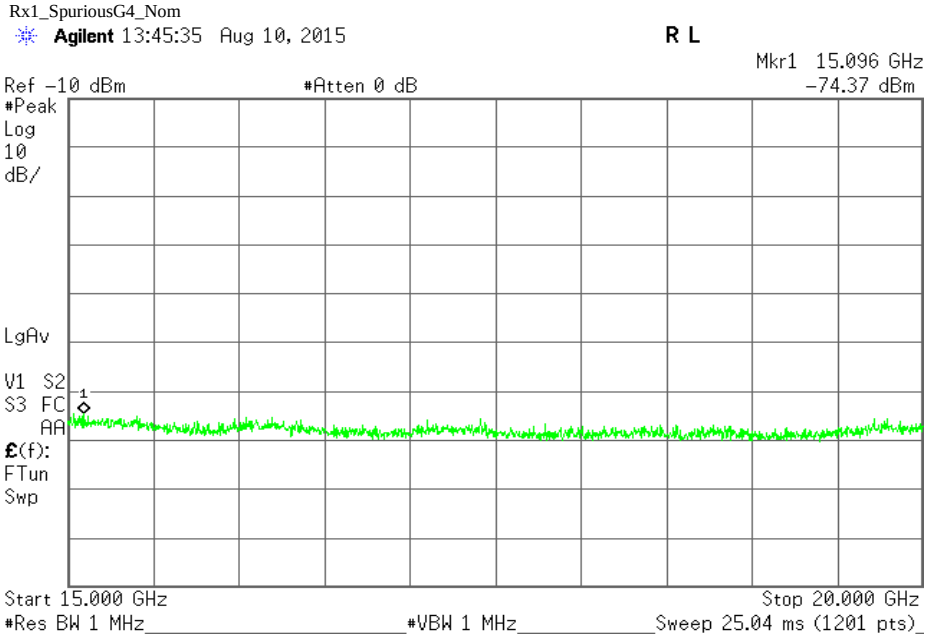
Rx1_SpuriousG2_Nom



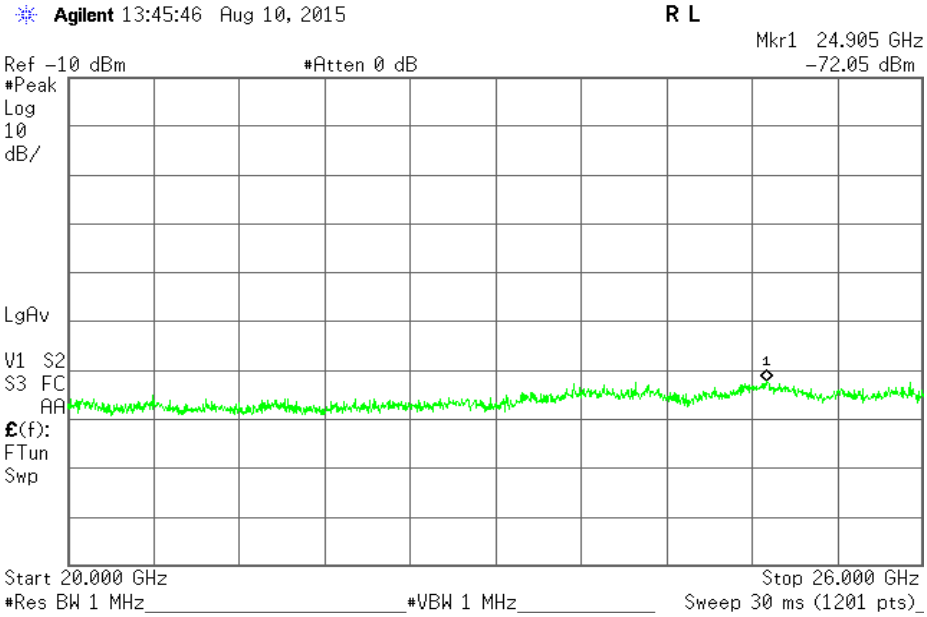
Rx1_SpuriousG3_Nom



Rx1_SpuriousG4_Nom



Rx1_SpuriousG5_Nom



2.6. Burst Length / Duty

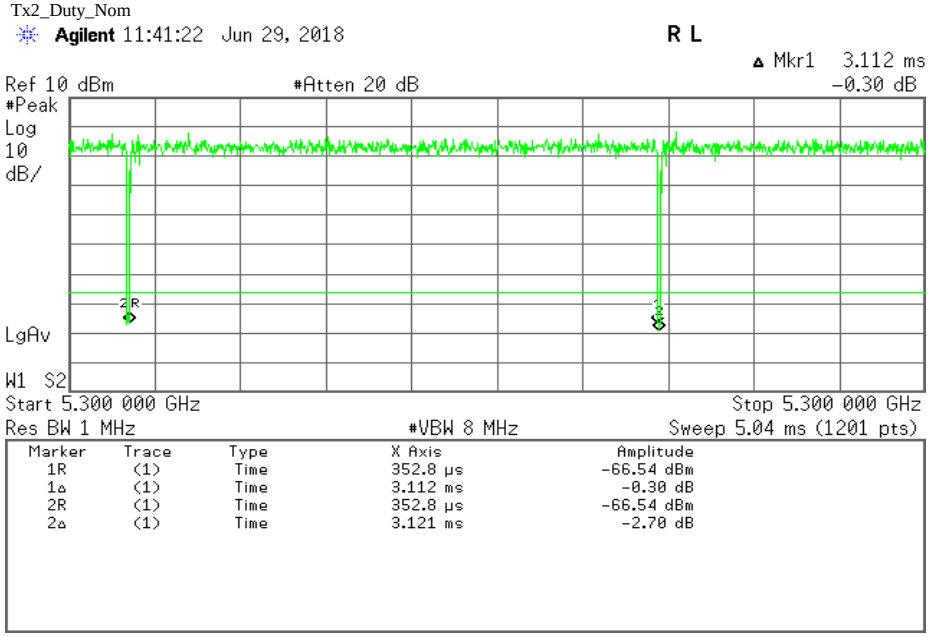
Job No.	12197499-E41V2
Remark1	
Remark2	

[DATA]

Voltage [V]	Freq. [MHz]	On Time [msec]	Period [msec]	Result (Duty) [%]	Result (Burst Rate)	Limit [msec]
DC5V	5300	3.112	3.121	99.7	1.003	4

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

Tx2_Duty_Nom



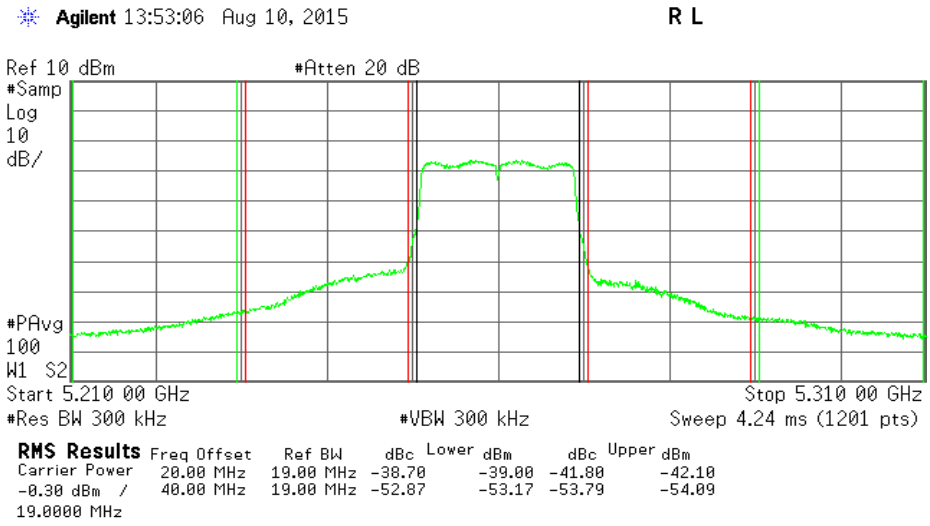
2.7. Adjacent Channel Power

Job No.	12197499-E41V2
Remark1	Chain 0
Remark2	

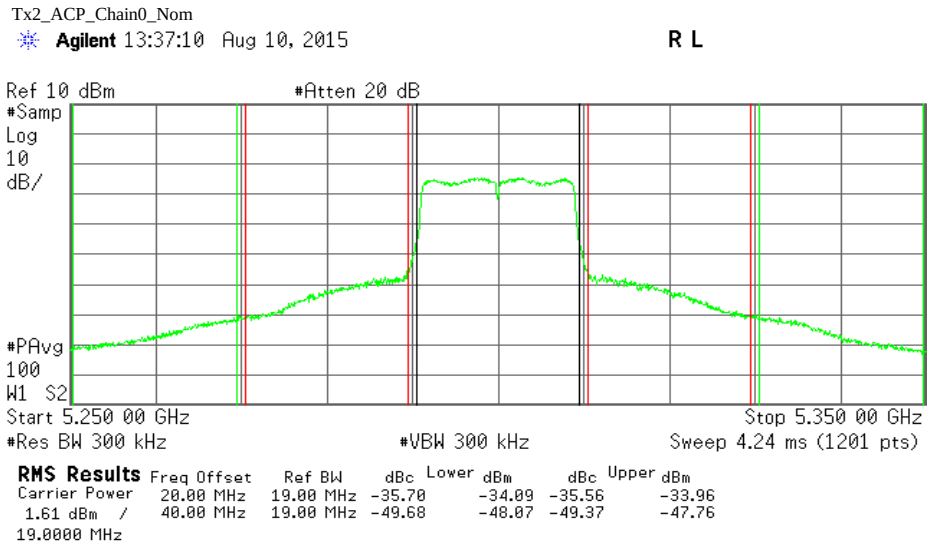
[DATA]

Voltage [V]	Freq. [MHz]	Separation [MHz]	Lower Side Result [dBc]	Upper Side Result [dBc]	Limit [dBc]	Remark
DC5V	5260	20	-38.70	-41.80	-25.00	
		40	-52.87	-53.79	-40.00	
	5300	20	-35.70	-35.56	-25.00	
		40	-49.68	-49.37	-40.00	
	5320	20	-39.86	-38.81	-25.00	
		40	-53.43	-53.51	-40.00	

Tx1_ACP_Chain0_Nom



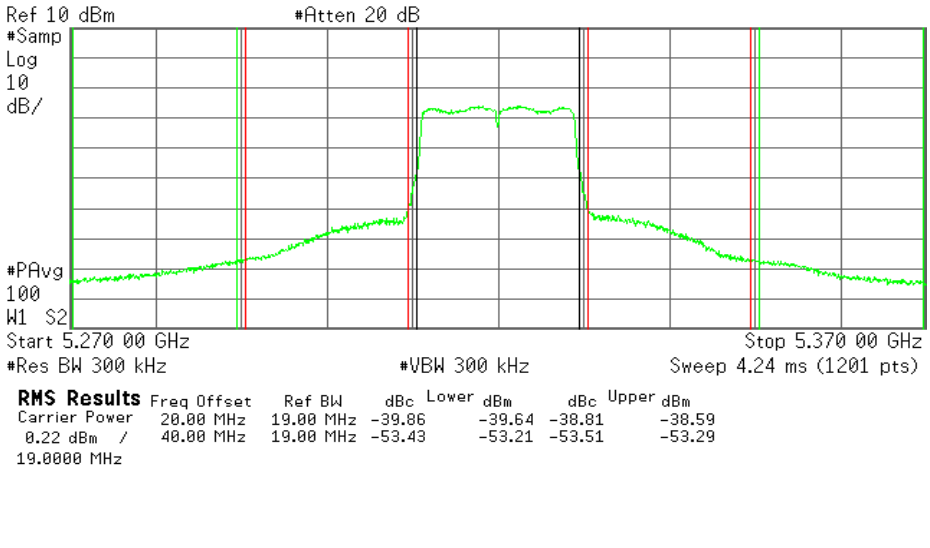
Tx2_ACP_Chain0_Nom



RMS Results

	Freq Offset	Ref BW	dBc	Lower dBm	dBc	Upper dBm
Carrier Power	20.00 MHz	19.00 MHz	-35.70	-34.09	-35.56	-33.96
1.61 dBm /	40.00 MHz	19.00 MHz	-49.68	-48.07	-49.37	-47.76
19.0000 MHz						

Tx3_ACP_Chain0_Nom



RMS Results

	Freq Offset	Ref BW	dBc	Lower dBm	dBc	Upper dBm
Carrier Power	20.00 MHz	19.00 MHz	-39.86	-39.64	-38.81	-38.59
0.22 dBm /	40.00 MHz	19.00 MHz	-53.43	-53.21	-53.51	-53.29
19.0000 MHz						

2.8. Outband Leakage Power Strength (Normal Voltage)

Job No.	12197499-E41V2
Remark1	
Remark2	

[DATA]

Voltage [V]	Freq. [MHz]	Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result [dBm]	Result [uW/MHz]	Limit [uW/MHz]	Remark
DC5V	5260	5233.14	-44.36	1.00	10.00	4.00	-29.36	1.159	2.500	♦3
		5239.96	-35.50	1.00	10.00	4.00	-20.50	8.913	15.653	♦4
		5248.88	-27.10	1.00	10.00	4.00	-12.10	61.660	97.574	♦5
		5250.00	-20.05	1.00	10.00	4.00	-5.05	312.608	996.093	♦6
	5320	5354.50	-46.39	1.00	10.00	4.00	-31.39	0.726	2.500	♦7

Sample Calculation :

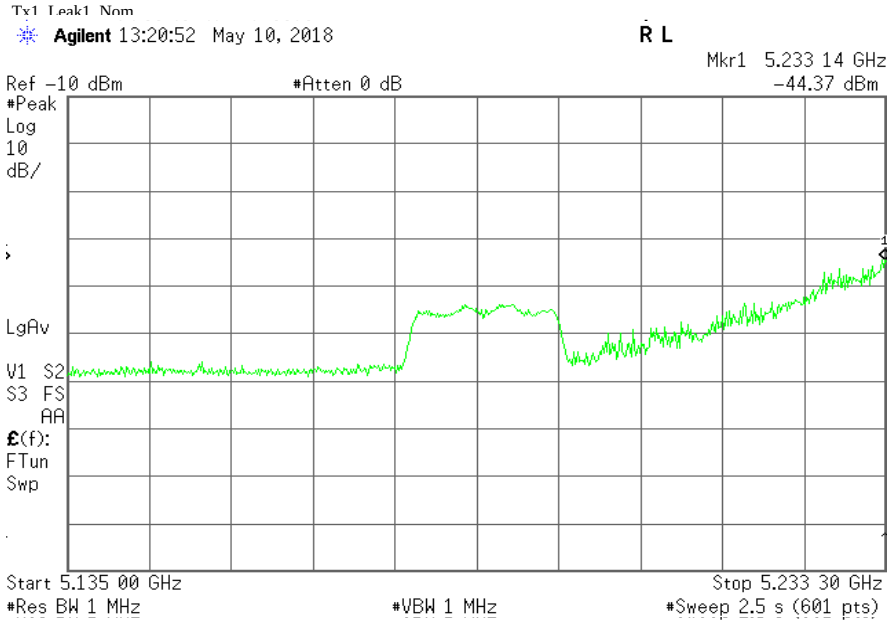
Result = Reading + Cable Loss + Attenuator+Antenna Gain

♦3:Freq Range3 (≥ 5,135MHz, ≤ 5,233.3MHz)

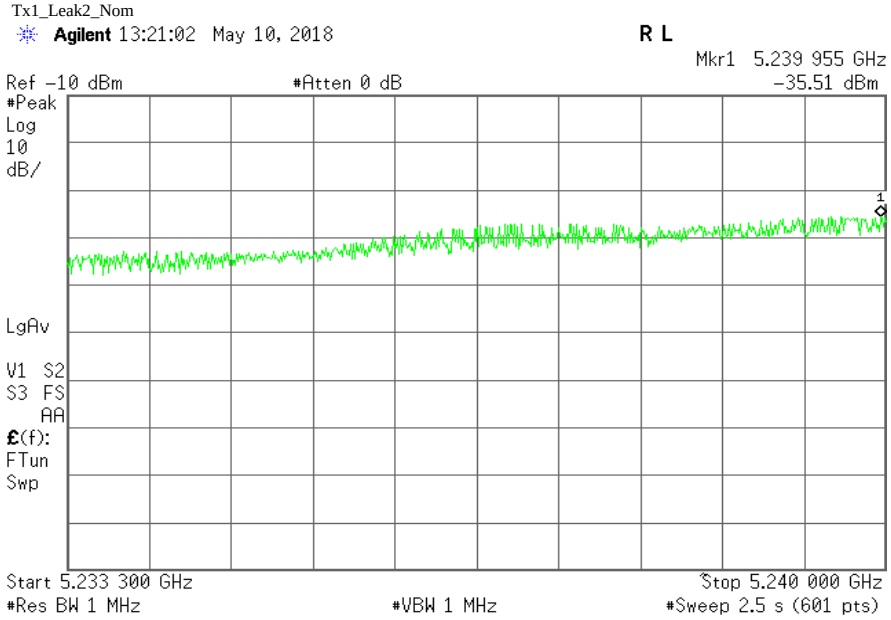
♦4:Freq Range4 (> 5,233.3MHz, ≤ 5,240MHz)

♦5:Freq Range5 (> 5,240MHz, ≤ 5,249MHz)

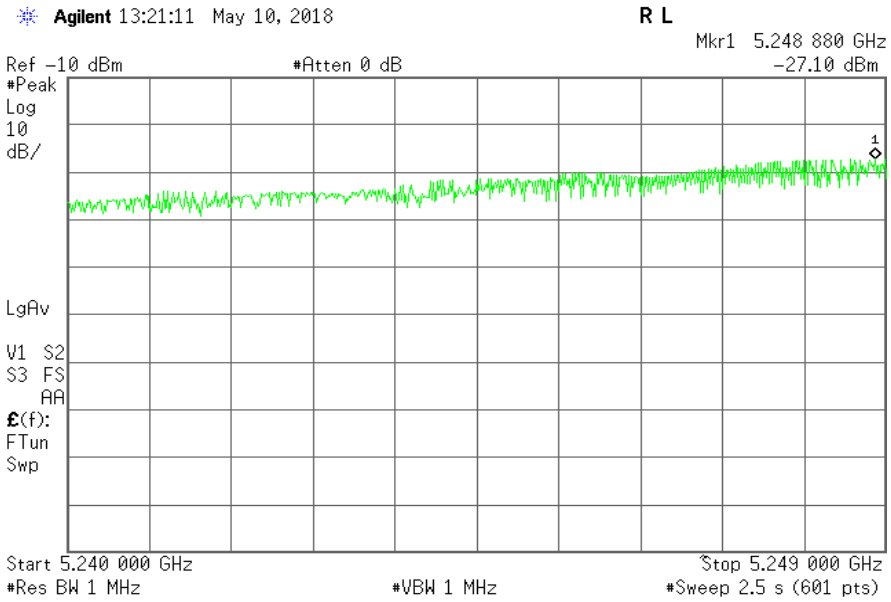
♦6:Freq Range6 (> 5,249MHz, ≤ 5,250MHz)



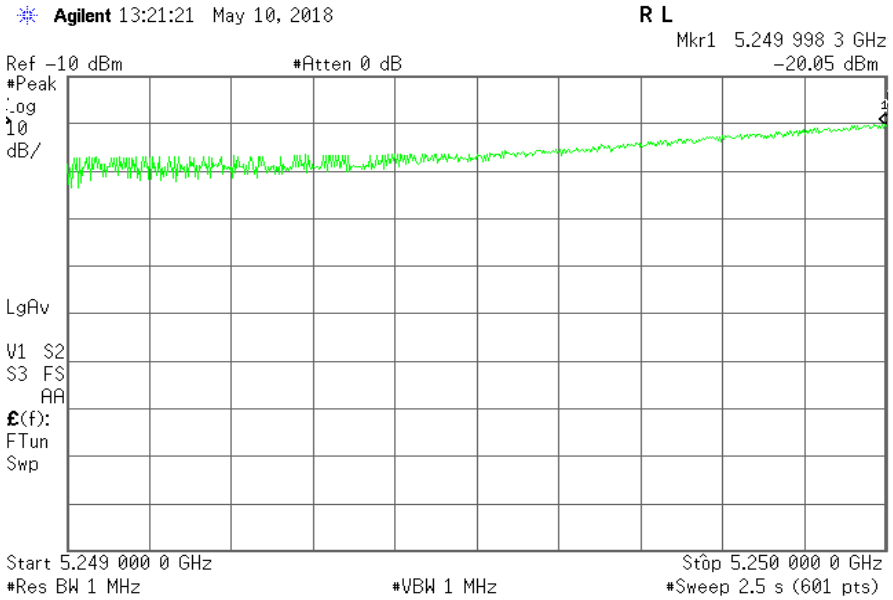
Tx1_Leak2_Nom

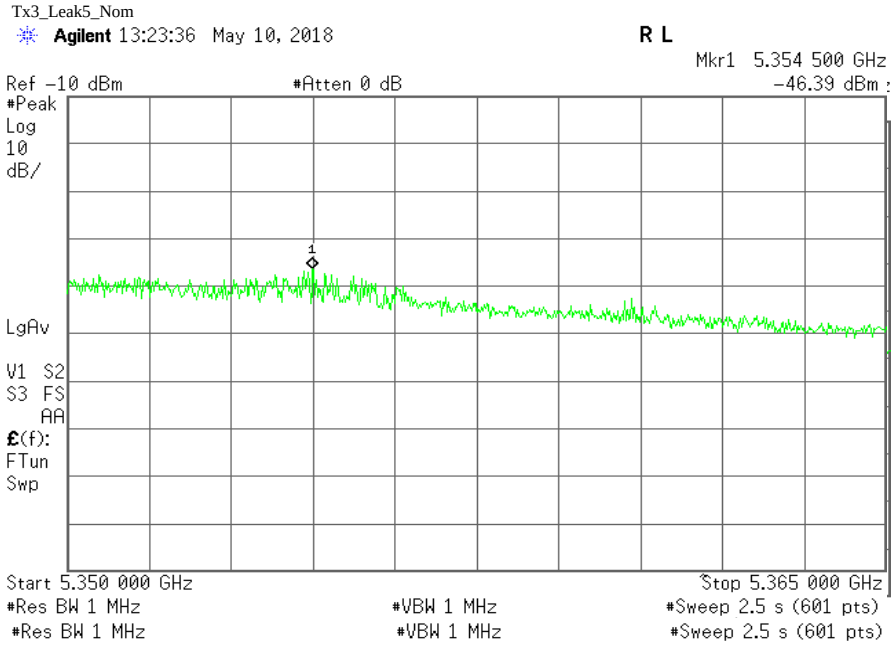


Tx1_Leak3_Nom



Tx1_Leak4_Nom





Average Power

Job No.	12197499-E41V2
Remark1	
Remark2	

[DATA]

Voltage	Port No.	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Burst Rate	Output Power Result [dBm]
DC5V	0	5260	2.01	1.00	10.00	1.00	13.02
		5300	2.81	1.00	10.00	1.00	13.82
		5320	1.94	1.00	10.00	1.00	12.95
DC5V	-	-		-	-	-	-
		-		-	-	-	-
		-		-	-	-	-
DC5V	-	-		-	-	-	-
		-		-	-	-	-
		-		-	-	-	-
DC5V	-	-		-	-	-	-
		-		-	-	-	-
		-		-	-	-	-

Total Output Power

Voltage	Freq. [MHz]	Power [mW]
DC5V	5260	20.06
	5300	24.11
	5320	19.74

3. Measurement Equipment

Use	Int. No.	Kind of Equipment	Model No.	Manufacturer	Serial No.	Calibration Authority	Calibration Date
X	T146	Spectrum Analyzer	E4446A	Agilent	MY53322020	Keysight	2/3/2018
X	T1268	Power Meter	N1911A	Keysight	MY55196017	Keysight	6/15/2017
X	T1226	Power Sensor	N1921A	Keysight	MY55200004	Keysight	8/30/2017
X	T1829	Hygro-Thermometer	14-650-118	Control Company	170024385	Control Company	1/11/2018

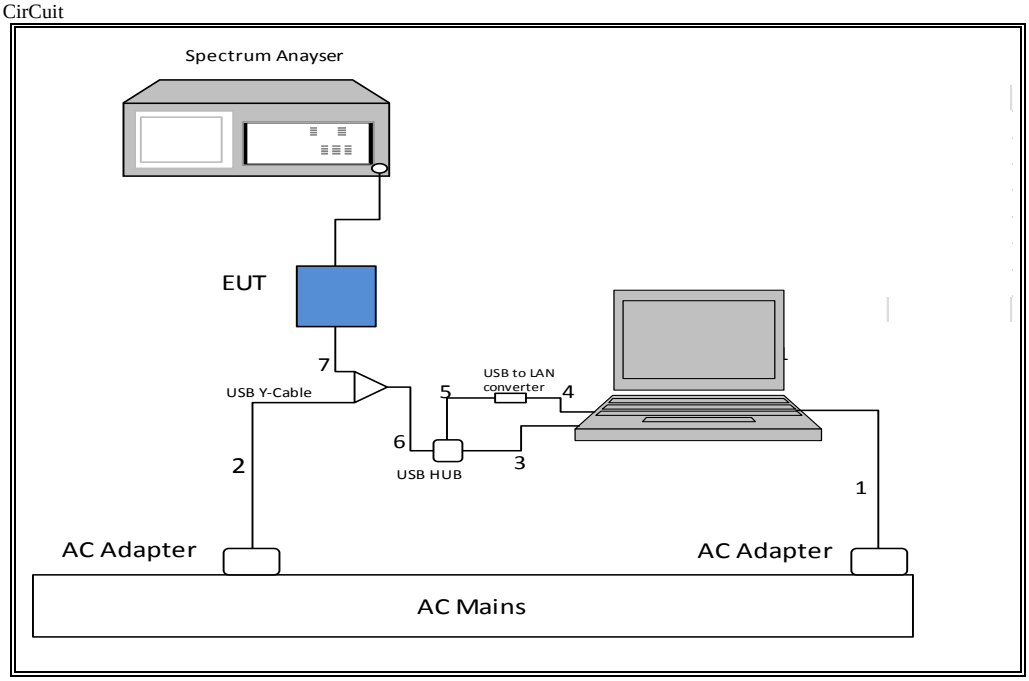
Note : 1. The calibration of measurement equipment is valid for a one year period.
2. "X" used equipment.
3 Calibrated per ISO/IEC 17025

4. Test Condition

Test Item	Date	Temp	Hum	Engineer	Test Room
Frequency Tolerance	8/10/2015	21.9	50	C. Susa	Temp Room B
Occupied Bandwidth	8/10/2015	21.9	50	C. Susa	Temp Room B
Unwanted Emission Strength	8/10/2015	21.9	50	C. Susa	Temp Room B
Output Power/ E.I.R.P	5/4/2018	22.6	50	Steven Tran	Temp Room A
Secondary Radiated Emission Strength	8/10/2015	21.9	50	C. Susa	Temp Room B
Burst Length / Duty	6/29/2018	21.9	47	Steven Tran	Temp Room A
Adjacent Channel Power	8/10/2015	21.9	50	C. Susa	Temp Room B
Outband Leakage Power Strength	5/4/2018	22.6	50	Steven Tran	Temp Room A
Average Power	5/4/2018	22.6	50	Steven Tran	Temp Room A

5. TEST CONFIGURATION

TEST CirCuit



PHOTO