

FCC RADIO TEST REPORT

FCC 47 CFR PART 15 SUBPART C

Test Standard	FCC Part 15.249(a)
FCC ID	WHBAFUTR
Trade name	AUDI
Product name	UTR (Universal Traffic Recorder)
Model No.	UTR (Universal Traffic Recorder)
Test Result	Pass

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

The test results of this report relate only to the tested sample (EUT) identified in this report.

The test Report of full or partial shall not copy. Without written approval of CCS. Inc.

The sample selected for test was production product and was provided by manufacturer.



Approved by:

A handwritten signature in black ink that reads "Sam Chuang".

Sam Chuang
Manager

Reviewed by:

A handwritten signature in black ink that reads "Zeus Chen".

Zeus Chen
Supervisor

Revision History

Rev.	Issue Date	Revisions	Revised By
00	November 24, 2016	Initial Issue	Angel Cheng

Table of contents

1. GENERAL INFORMATION	4
1.1 EUT INFORMATION	4
1.2 EUT CHANNEL INFORMATION	5
1.3 ANTENNA INFORMATION	5
1.4 MEASUREMENT UNCERTAINTY.....	6
1.5 FACILITIES AND TEST LOCATION	7
1.6 INSTRUMENT CALIBRATION	7
1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT	8
2. TEST SUMMERY	9
3. DESCRIPTION OF TEST MODES	10
3.1 THE WORST MODE OF OPERATING CONDITION	10
3.2 THE WORST MODE OF MEASUREMENT	10
4. TEST RESULT	11
4.1 FIELD STRENGTH OF FUNDAMENTAL AND SPURIOUS EMISSION	11
APPENDIX 1 - PHOTOGRAPHS OF EUT	

1. GENERAL INFORMATION

1.1 EUT INFORMATION

Applicant	Mobile Appliance, Inc. 401, simin-daero, Dongan-gu, #1701-1706, Daerung Techno Town 15, Gwanyang-dong, Anyang-si, Gyeonggi-do, 14057, South Korea
Equipment	UTR (Universal Traffic Recorder)
Model Name	UTR (Universal Traffic Recorder)
Model Discrepancy	N/A
EUT Functions	24G Radar
Received Date	September 20, 2016
Date of Test	Nov. 22, 2016
Output Power	Peak : 121.96 dBuV/m Average : 100.68 dBuV/m
Power Operation	☐ AC ☒ DC Type : ☐ Battery ☒ DC Power Supply : 12V ☐ External DC adapter

Remark:

All listed models are using an identical RF module with the only differences on number of key buttons mounted for additional functions.

Due to similarity of RF product constructions of given model series, only dedicated model as described in test report with the most complexity constructions was selected for testing and record

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1.2 EUT CHANNEL INFORMATION

Frequency Range	24.00GHz-24.25GHz
Modulation Type	CW
Number of channel	1

1.3 ANTENNA INFORMATION

Antenna Category	☒ Integral: antenna permanently attached ☐ External dedicated antennas ☐ External Unique antenna connector
Antenna Type	☐ PIFA ☒ PCB ☐ Dipole ☐ Printed ☐ Coils
Antenna Gain	9.5 dBi

1.4 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	+/- 1.2575
Emission bandwidth, 20dB bandwidth	+/- 1.4003
RF output power, conducted	+/- 1.1372
Power density, conducted	+/- 1.4003
3M Semi Anechoic Chamber / 30M~200M	+/- 4.0138
3M Semi Anechoic Chamber / 200M~1000M	+/- 3.9483
3M Semi Anechoic Chamber / 1G~8G	+/- 2.5975
3M Semi Anechoic Chamber / 8G~18G	+/- 2.6112
3M Semi Anechoic Chamber / 18G~26G	+/- 2.7389
3M Semi Anechoic Chamber / 26G~40G	+/- 2.9683
3M Semi Anechoic Chamber / 40G~60G	+/- 1.8509
3M Semi Anechoic Chamber / 60G~75G	+/- 1.9869
3M Semi Anechoic Chamber / 75G~110G	+/- 2.9651
3M Semi Anechoic Chamber / 110G~170G	+/- 2.7807
3M Semi Anechoic Chamber / 170G~220G	+/- 3.6437
3M Semi Anechoic Chamber / 220G~325G	+/- 4.2982

Remark:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$
2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.

1.5 FACILITIES AND TEST LOCATION

All measurement facilities used to collect the measurement data are located at No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)

Test site	Test Engineer	Remark
AC Conduction Room	-	-
Radiation	Kevin Kuo	-
RF Conducted	-	-

Remark: The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.6 INSTRUMENT CALIBRATION

3M 966 Chamber Test Site				
Equipment	Manufacturer	Model	S/N	Cal Due
Spectrum Analyzer	Agilent	E4446A	US42510252	12/07/2016
Loop Ant	COM-POWER	AL-130	121051	02/24/2017
Bilog Antenna	Sunol Sciences	JB3	A030105	07/02/2017
Pre-Amplifier	EMEC	EM330	60609	06/07/2017
Horn Antenna	ETC	MCTD 1209	DRH13M02003	09/01/2017
Pre-Amplifier	MITEQ	AMF-6F-260400-40-8P	985646	01/13/2017
Horn Antenna	EMCO	3116	26370	01/14/2017
Harmonic Mixer 40GHz - 60GHz	A-INFO / ROHDE&SCHWARZ	LB-19-20-A / FS-Z60	J202020872 / 100142	04/16/2017
Harmonic Mixer 50GHz - 75GHz	ROHDE&SCHWARZ	FH-PP-75 / FS-Z75	10001 / 100162	04/21/2017
Harmonic Mixer 75GHz - 110GHz	ROHDE&SCHWARZ	FH-PP-110 / FS-Z110	10003 / 100096	04/23/2017
Harmonic Mixer 110GHz - 170GHz	ROHDE&SCHWARZ	FH-PP-170 / SAM-170	10003 / 20011	04/26/2017
Harmonic Mixer 140GHz - 220GHz	ROHDE&SCHWARZ	FH-PP-220 / SAM-220	10003 / 20013	04/29/2017
Harmonic Mixer 220GHz - 325GHz	Radiometer Physics Gmbn	FH-PP-325 / SAM-325	10007 / 20048	05/04/2017
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R

Remark: Each piece of equipment is scheduled for calibration once a year and harmonic mixer twice a year.

1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT

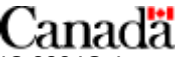
EUT Accessories Equipment					
No.	Equipment	Brand	Model	Series No.	FCC ID
	N/A				

Support Equipment					
No.	Equipment	Brand	Model	Series No.	FCC ID
1	DC Power Source	GWINSTEK	SPS-3610	N/A	N/A

1.8 Test methodology and applied standards

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10:2013, FCC Part 15.249.

1.9 Table of accreditations and listings

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3M Semi Anechoic Chamber (FCC MRA: TW1039) to perform FCC Part 15 measurements	 FCC MRA: TW1039
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	 IC 2324G-1 IC 2324G-2

2. TEST SUMMERY

FCC Standard Section	Report Section	Test Item	Result
15.203	1.2	Antenna Requirement	Pass
15.249(a)	4.1	Filed strength of fundamental	Pass
15.249(a)	4.1	Radiation Spurious Emission	Pass

3. DESCRIPTION OF TEST MODES

3.1 THE WORST MODE OF OPERATING CONDITION

Operation mode	24 GHz
Test Channel Frequencies	24.04GHz

3.2 THE WORST MODE OF MEASUREMENT

AC Power Line Conducted Emission	
Test Condition	AC Power line conducted emission for line and neutral
Voltage/Hz	120V/60Hz
Test Mode	☐ N/A
Worst Mode	☐ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4

Radiated Emission Measurement Above 1G	
Test Condition	Band edge, Emission for Unwanted and Fundamental
Voltage/Hz	120V/60Hz
Test Mode	☒ Mode 1:EUT power by DC Source.
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4
Worst Position	☐ Placed in fixed position. ☒ Placed in fixed position at X-Plane (E2-Plane) ☐ Placed in fixed position at Y-Plane (E1-Plane) ☐ Placed in fixed position at Z-Plane (H-Plane)
Worst Polarity	☐ Horizontal ☒ Vertical

Radiated Emission Measurement Below 1G	
Test Condition	Radiated Emission Below 1G
Voltage/Hz	120V/60Hz
Test Mode	☒ Mode 1:EUT power by DC Source.
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4

Remark:

1. The worst mode was record in this test report.
2. EUT pre-scanned in three axis ,X,Y, Z and two polarity, Horizontal and Vertical for radiated measurement. The worst case(X-Plane and Vertical) were recorded in this report.

4. TEST RESULT

4.1 FIELD STRENGTH OF FUNDAMENTAL AND SPURIOUS EMISSION

4.1.1 Test Limit

According to §15.249(a)

(1) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
2400-2483.5	50	500
5725-5875	50	500
24000-24250	250	2500

* Field strength limits are specified at a distance of 3 meters

Fundamental Limit Conversion			
Average (mV/m) at 3M	Average (dBuV/m) at 3M	Average (dBuV/m) at 1M	Peak (dBuV/m) at 1M
250	107.9588	117.50	137.50

*(Limit=107.9588+20LOG(3/1)=117.50 dBuV/m)

Harmonic Limit Conversion			
Average (uV/m) at 3M	Average (dBuV/m) at 3M	Average (dBuV/m) at 1M	Peak (dBuV/m) at 1M
2500	67.9588	77.50	97.50

*(Limit=67.9588+20LOG(3/1)=77.50 dBuV/m)

(2) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209(follow the table), whichever is the lesser attenuation

Below 30 MHz

Frequency	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/F (F in kHz)	30
1.705-30 MHz	30	N/A	30

Above 30 MHz

Frequency (MHz)	Field Strength microvolts/m at 3 metres (watts, e.i.r.p.)	
	Transmitters	Receivers
30-88	100 (3 nW)	100 (3 nW)
88-216	150 (6.8 nW)	150 (6.8 nW)
216-960	200 (12 nW)	200 (12 nW)
Above 960	500 (75 nW)	500 (75 nW)

4.1.2 Test Procedure

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m, below 1 GHz and above 40G is 0.8m above ground plane. The EUT Configured un accordance with ANSI C63.10, and the EUT set in a continuous mode.

2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. And EUT is set 3m away from the receiving antenna, which is scanned from 1m to 4m above the ground plane to find out the highest emissions. Measurement are made polarized in both the vertical and the horizontal positions with antenna.

3. The SA setting following :

(1) Below 1G : RBW = 100kHz, VBW $\geq$ 3 RBW, Sweep = Auto, Detector = Peak,

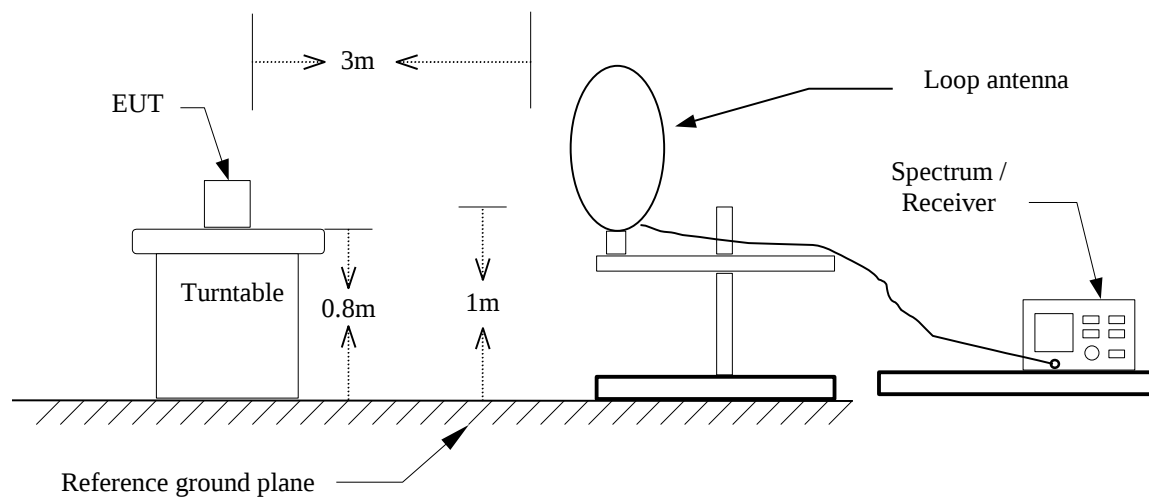
(2) Above 1G :

(2.1) For Peak measurement : RBW = 1MHz, VBW $\geq$ 3 RBW.

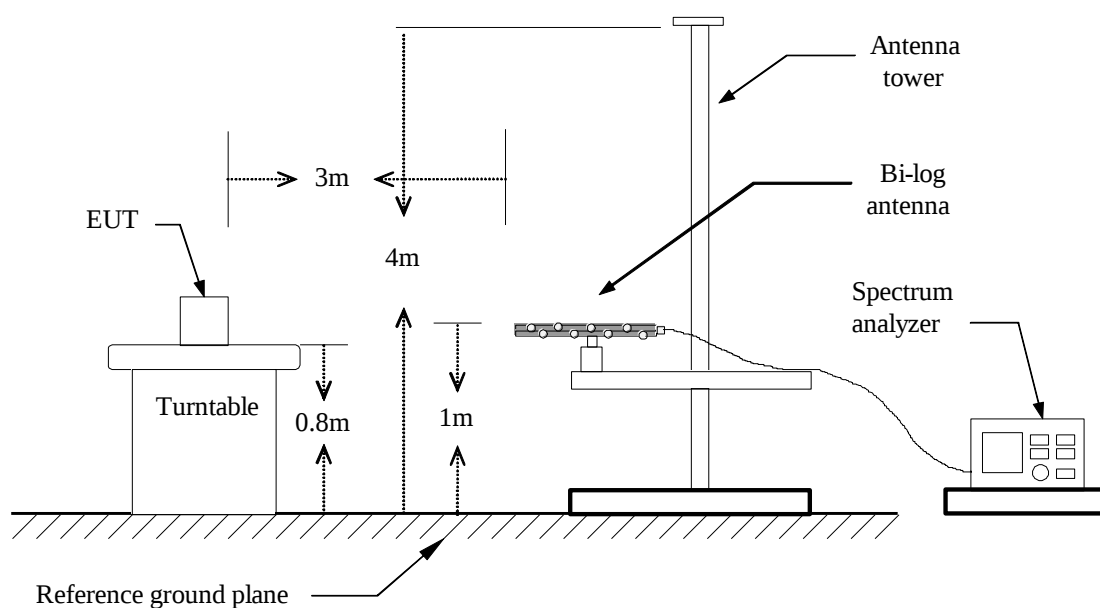
(2.2) For Average measurement : RBW = 1MHz, VBW = 10Hz.

4.1.3 Test Setup

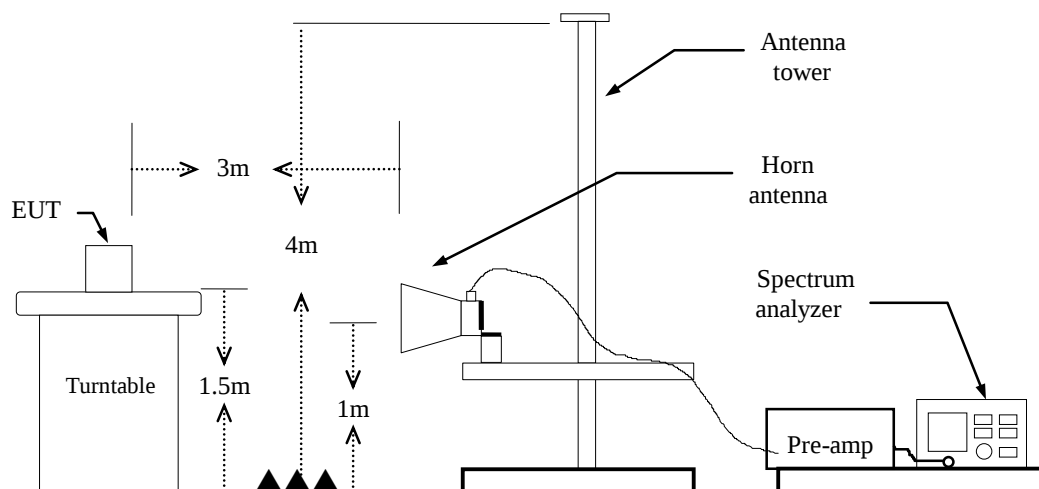
9kHz ~ 30MHz



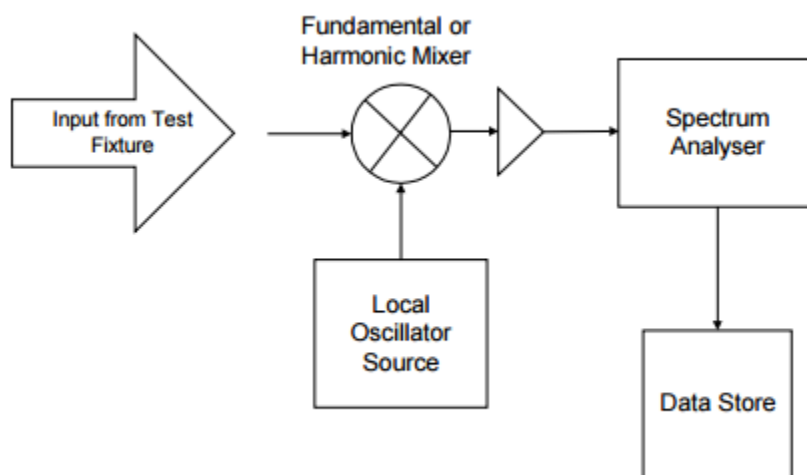
30MHz ~ 1GHz



Above 1 GHz



Above 40 GHz

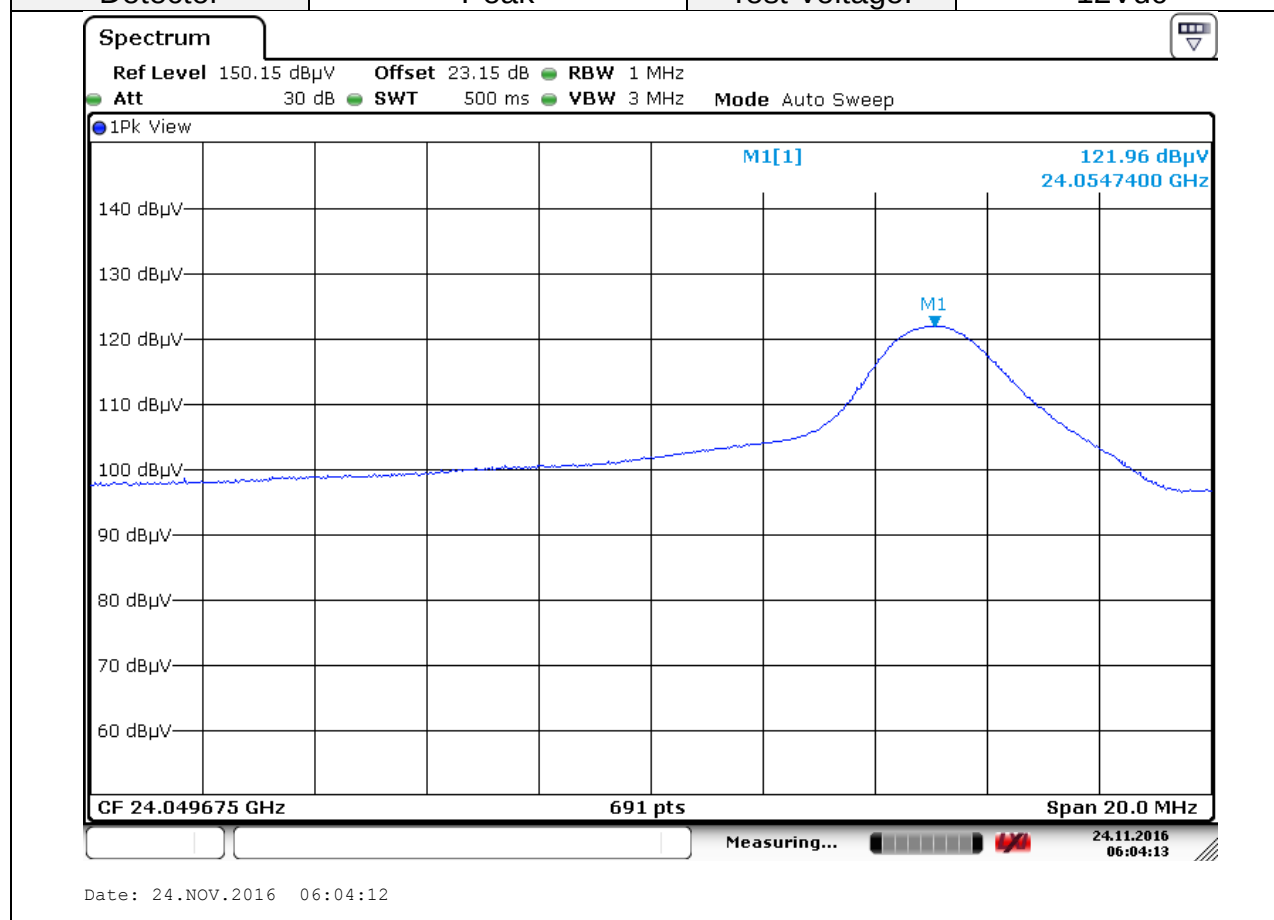


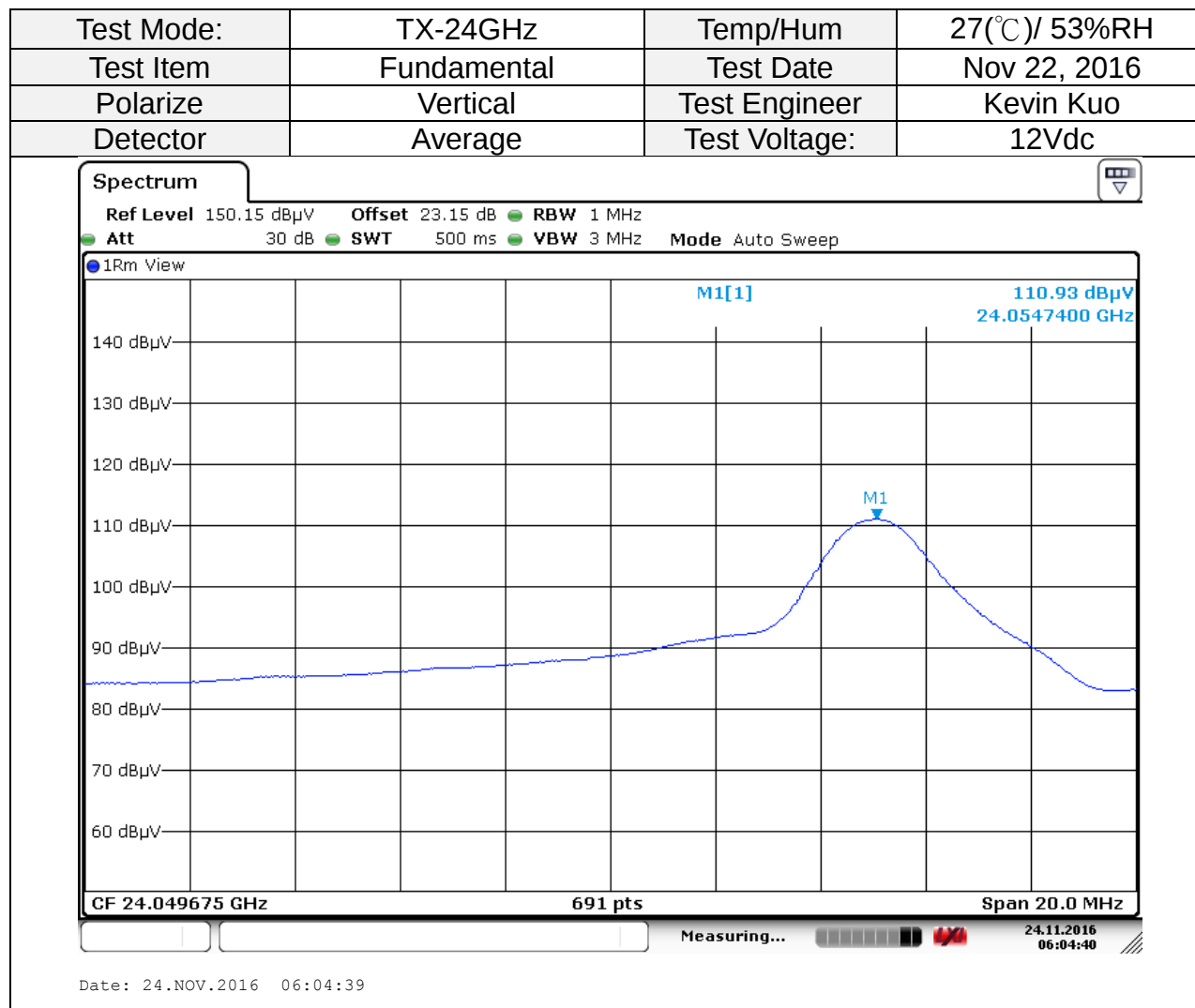
4.1.4 Test Result

Freq. (GHz)	Peak Value (dBuV/m)	Average Value (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
24.04	121.96	100.68	137.50	117.50	Pass

Test Data**(1) Filed strength of fundamental:**

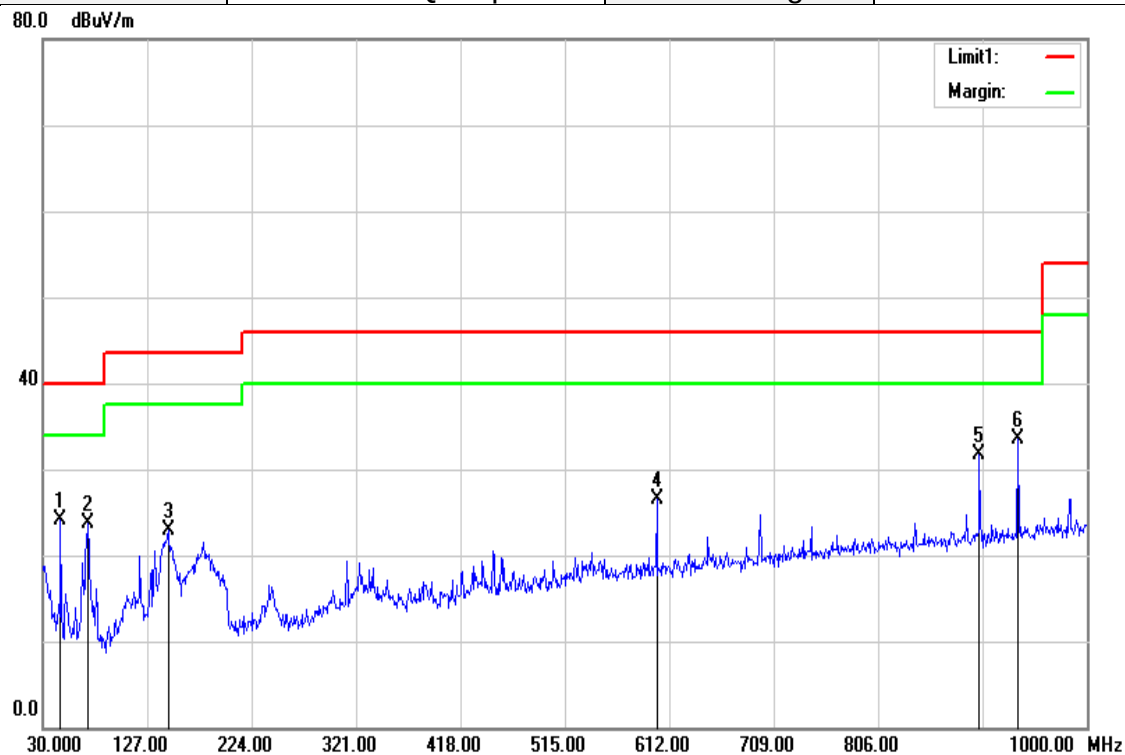
Test Mode:	TX-24GHz	Temp/Hum	27(°C)/ 53%RH
Test Item	Fundamental	Test Date	Nov 22, 2016
Polarize	Horizontal	Test Engineer	Kevin Kuo
Detector	Peak	Test Voltage:	12Vdc



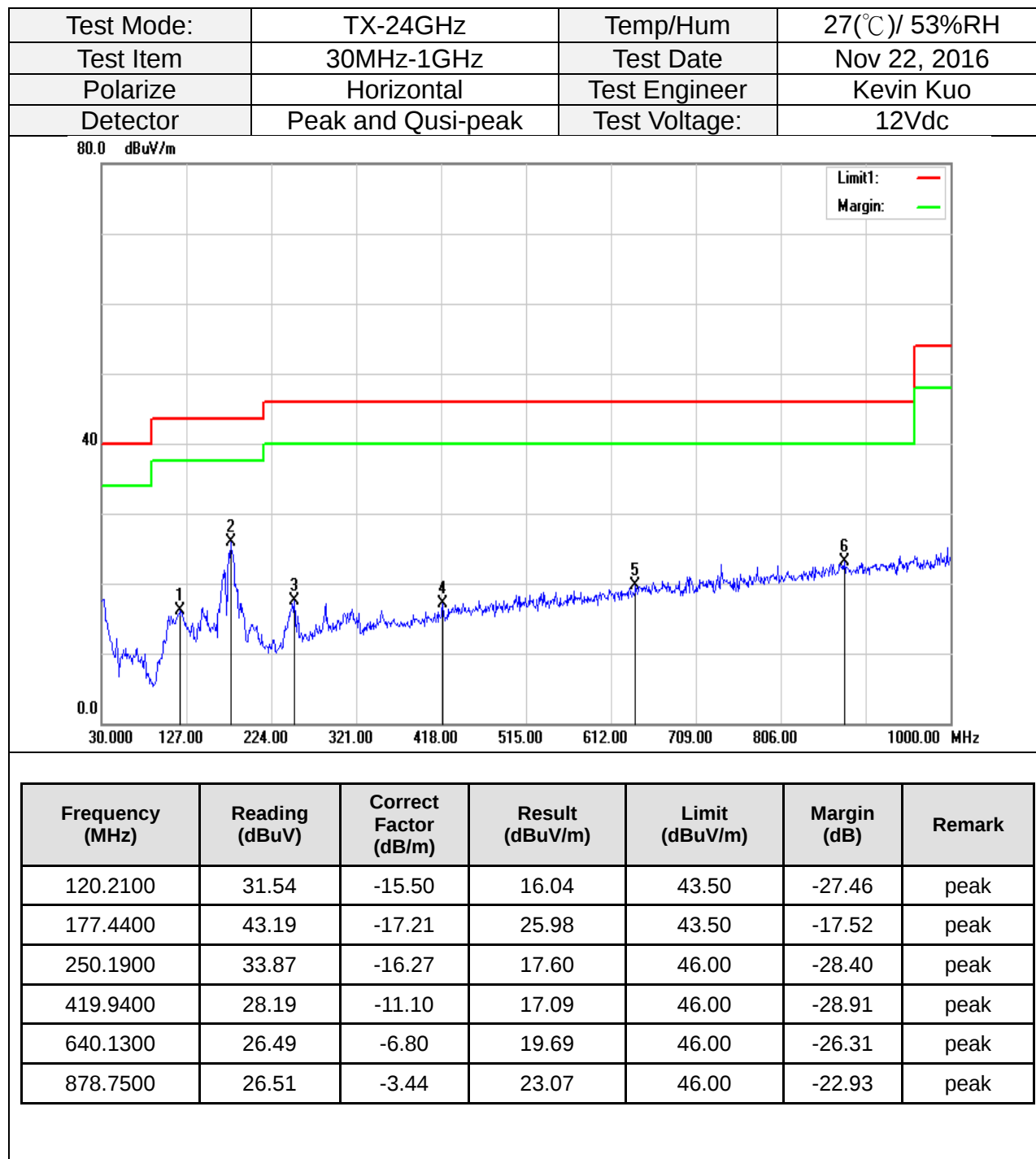


(2) Below 1G:

Test Mode:	TX-24GHz	Temp/Hum	27(°C)/ 53%RH
Test Item	30MHz-1GHz	Test Date	Nov 22, 2016
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak and Qusi-peak	Test Voltage:	12Vdc

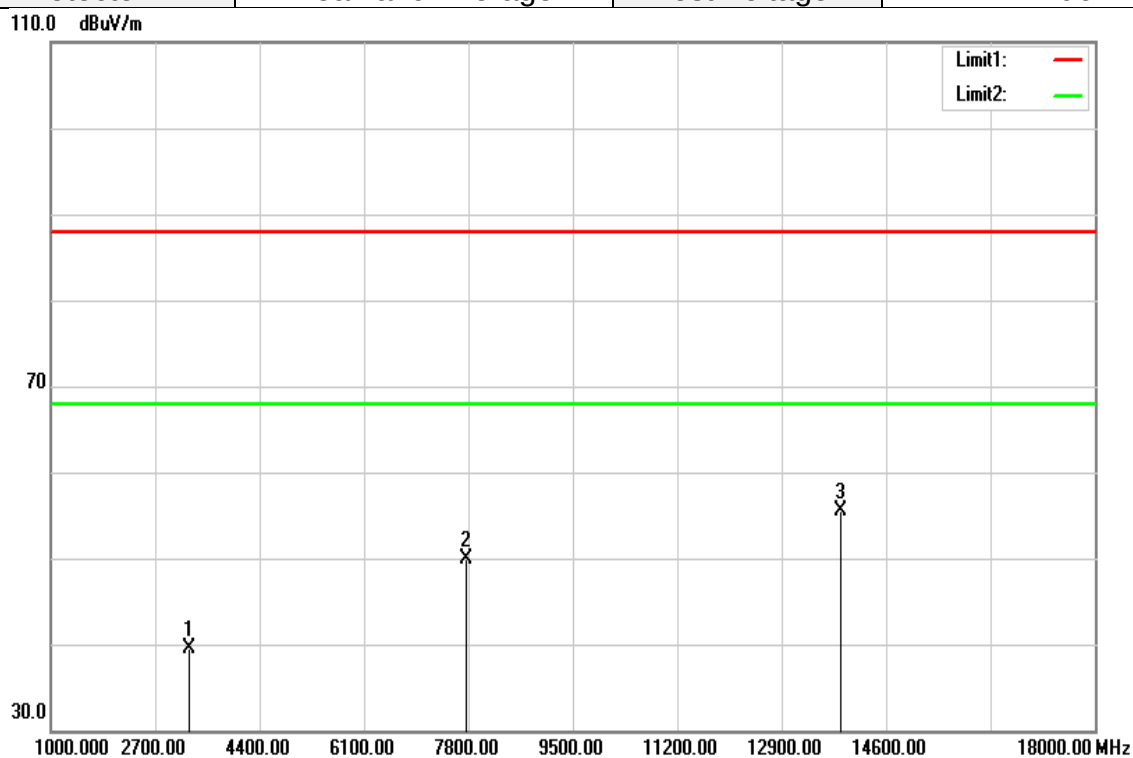


Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
46.4900	43.13	-19.06	24.07	40.00	-15.93	peak
71.7100	44.49	-20.81	23.68	40.00	-16.32	peak
146.4000	38.81	-15.97	22.84	43.50	-20.66	peak
600.3600	34.25	-7.75	26.50	46.00	-19.50	peak
900.0900	34.94	-3.19	31.75	46.00	-14.25	peak
935.9800	36.17	-2.62	33.55	46.00	-12.45	peak

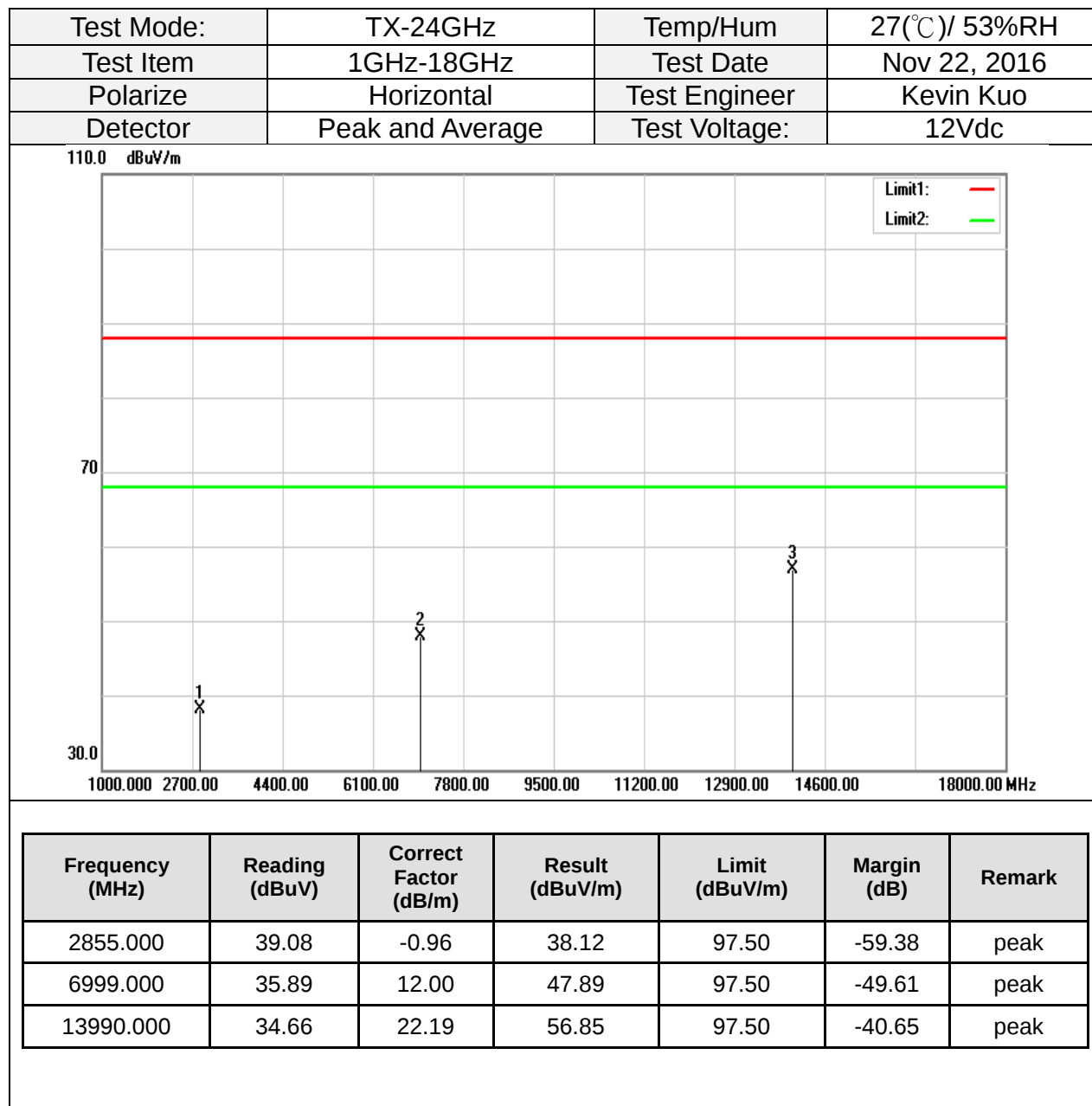


(3) Above 1G:

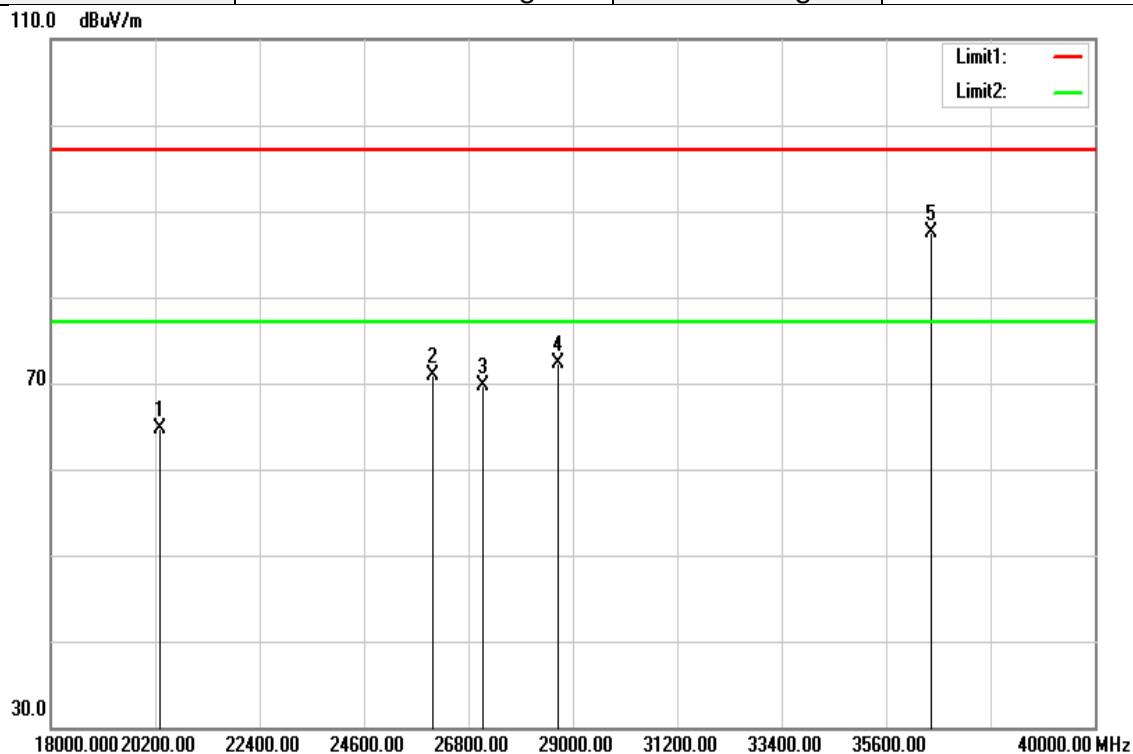
Test Mode:	TX-24GHz	Temp/Hum	27(°C)/ 53%RH
Test Item	1GHz-18GHz	Test Date	Nov 22, 2016
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
3247.000	39.50	-0.02	39.48	97.50	-58.02	peak
7762.000	35.79	14.03	49.82	97.50	-47.68	peak
13860.000	33.75	21.73	55.48	97.50	-42.02	peak



Test Mode:	TX-24GHz	Temp/Hum	27(°C)/ 53%RH
Test Item	18GHz-40GHz	Test Date	Nov 22, 2016
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc

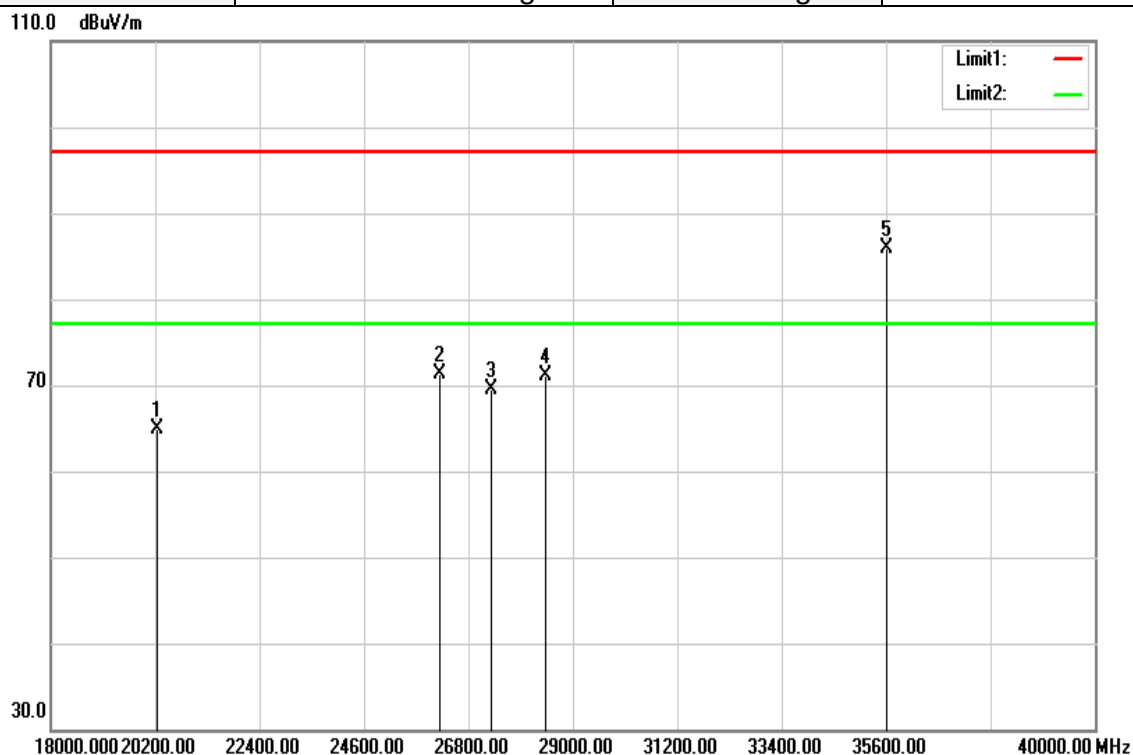


Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
20292.000	33.76	30.88	64.64	97.50	-32.86	peak
26060.000	36.90	33.97	70.87	97.50	-26.63	peak
27116.000	35.12	34.67	69.79	97.50	-27.71	peak
28680.500	35.81	36.55	72.36	97.50	-25.14	peak
36540.000	48.26	39.33	87.59	97.50	-9.91	peak

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode:	TX-24GHz	Temp/Hum	27(°C)/ 53%RH
Test Item	18GHz-40GHz	Test Date	Nov 22, 2016
Polarize	Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc

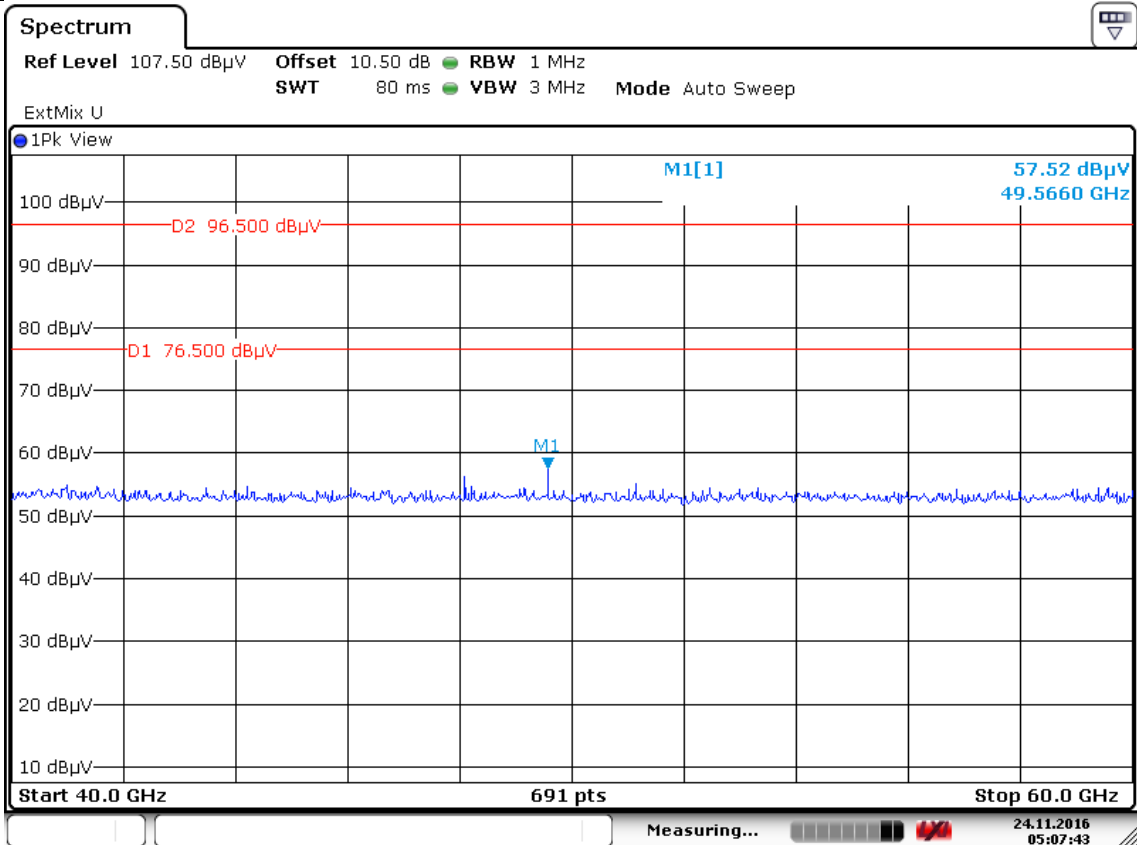


Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
20252.000	33.94	30.88	64.82	97.50	-32.68	peak
26188.000	37.18	34.11	71.29	97.50	-26.21	peak
27298.000	34.41	35.18	69.59	97.50	-27.91	peak
28439.000	34.65	36.54	71.19	97.50	-26.31	peak
35620.000	43.96	42.02	85.98	97.50	-11.52	peak

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode:	TX-24GHz	Temp/Hum	27(°C)/ 53%RH
Test Item	40GHz-60GHz	Test Date	Nov 22, 2016
Polarize	Vertical/Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc

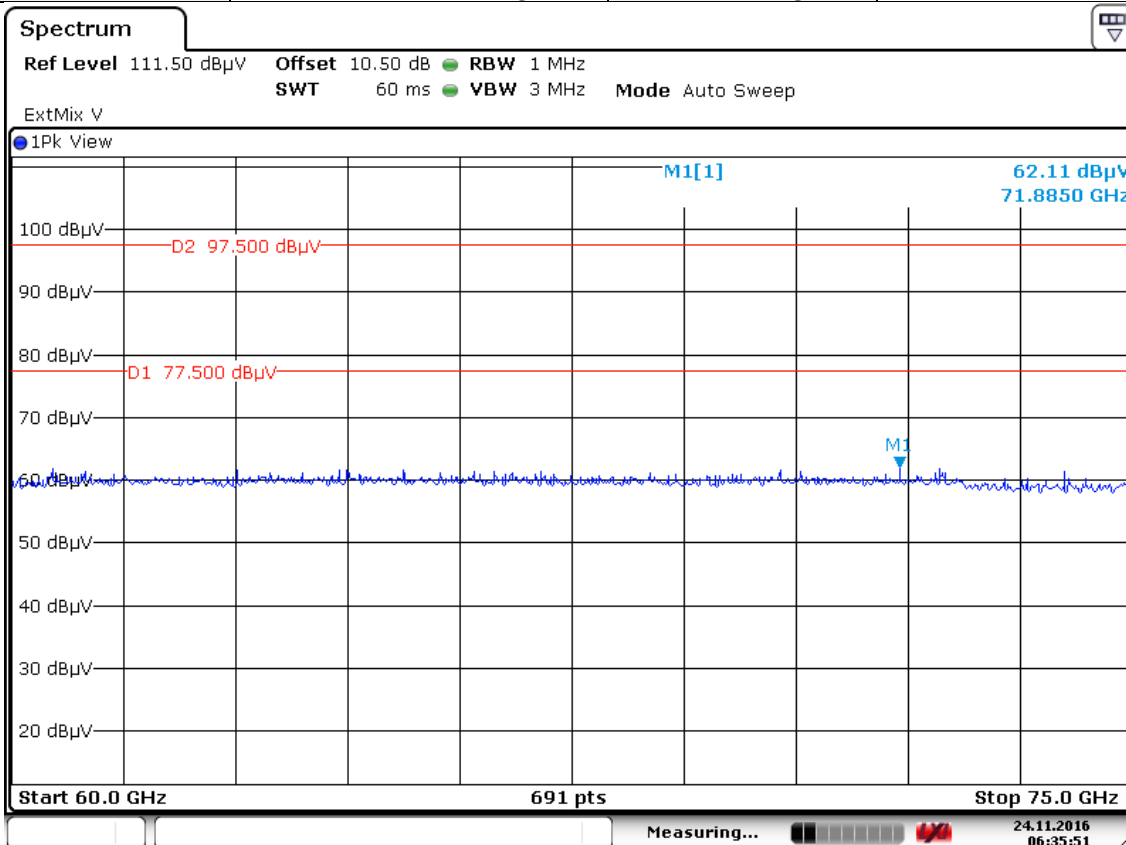


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Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode:	TX-24GHz	Temp/Hum	27(°C)/ 53%RH
Test Item	60GHz-75GHz	Test Date	Nov 22, 2016
Polarize	Vertical/Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc

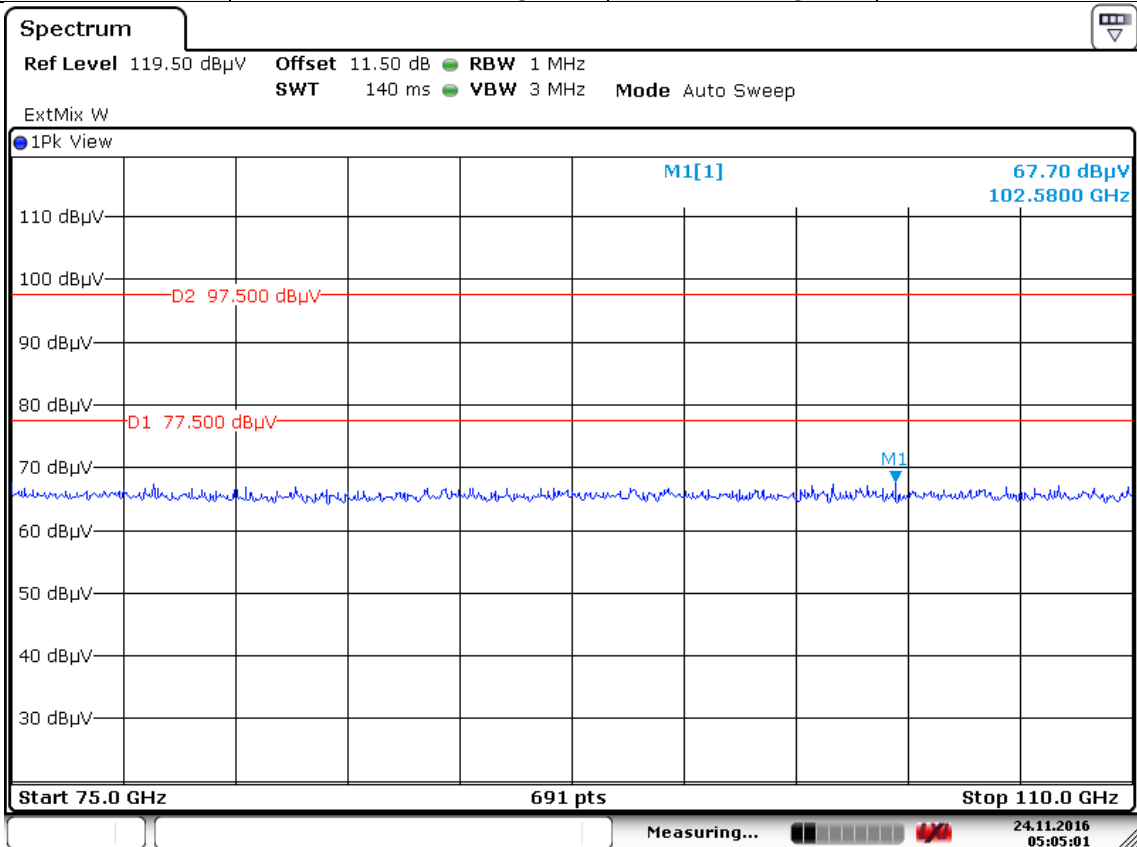


Date: 24.NOV.2016 06:35:51

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode:	TX-24GHz	Temp/Hum	27(°C)/ 53%RH
Test Item	75GHz-110GHz	Test Date	Nov 22, 2016
Polarize	Vertical/Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc

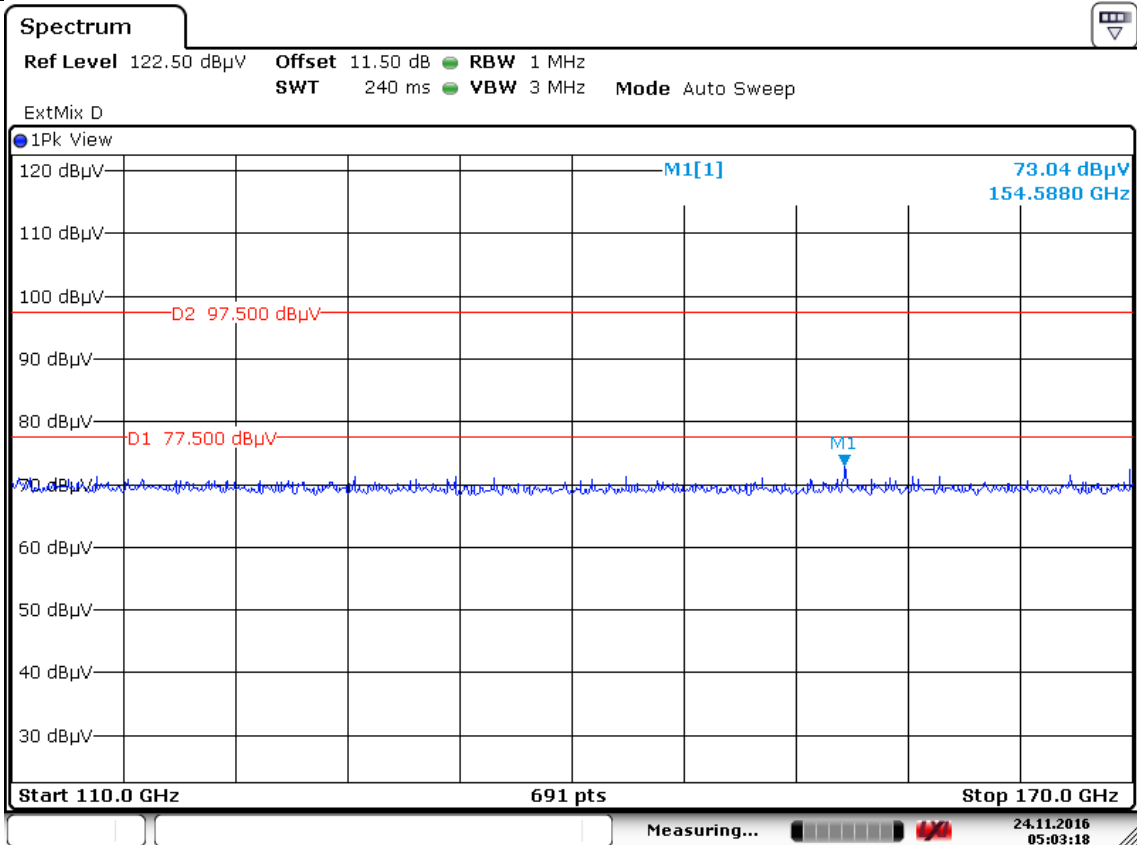


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Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode:	TX-24GHz	Temp/Hum	27(°C)/ 53%RH
Test Item	110GHz-170GHz	Test Date	Nov 22, 2016
Polarize	Vertical/Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc

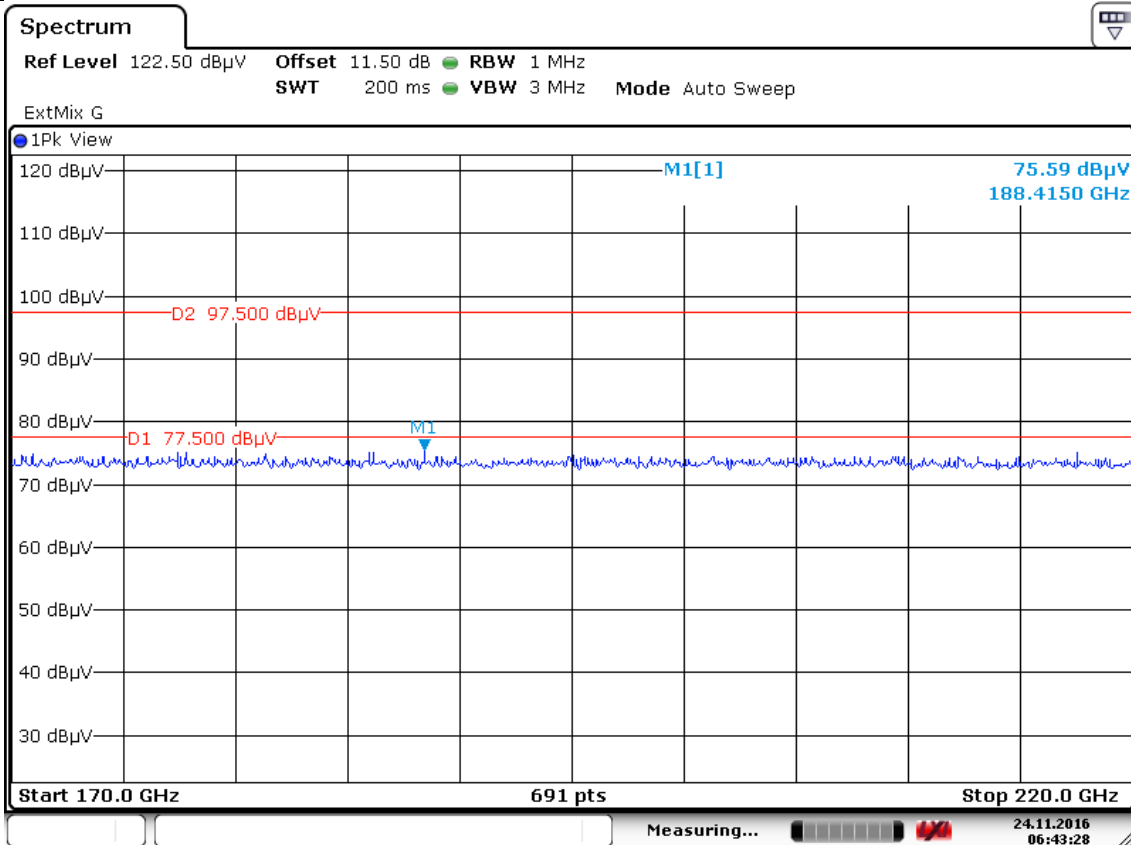


Date: 24.NOV.2016 05:03:18

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode:	TX-24GHz	Temp/Hum	27(°C)/ 53%RH
Test Item	170GHz-220GHz	Test Date	Nov 22, 2016
Polarize	Vertical/Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc

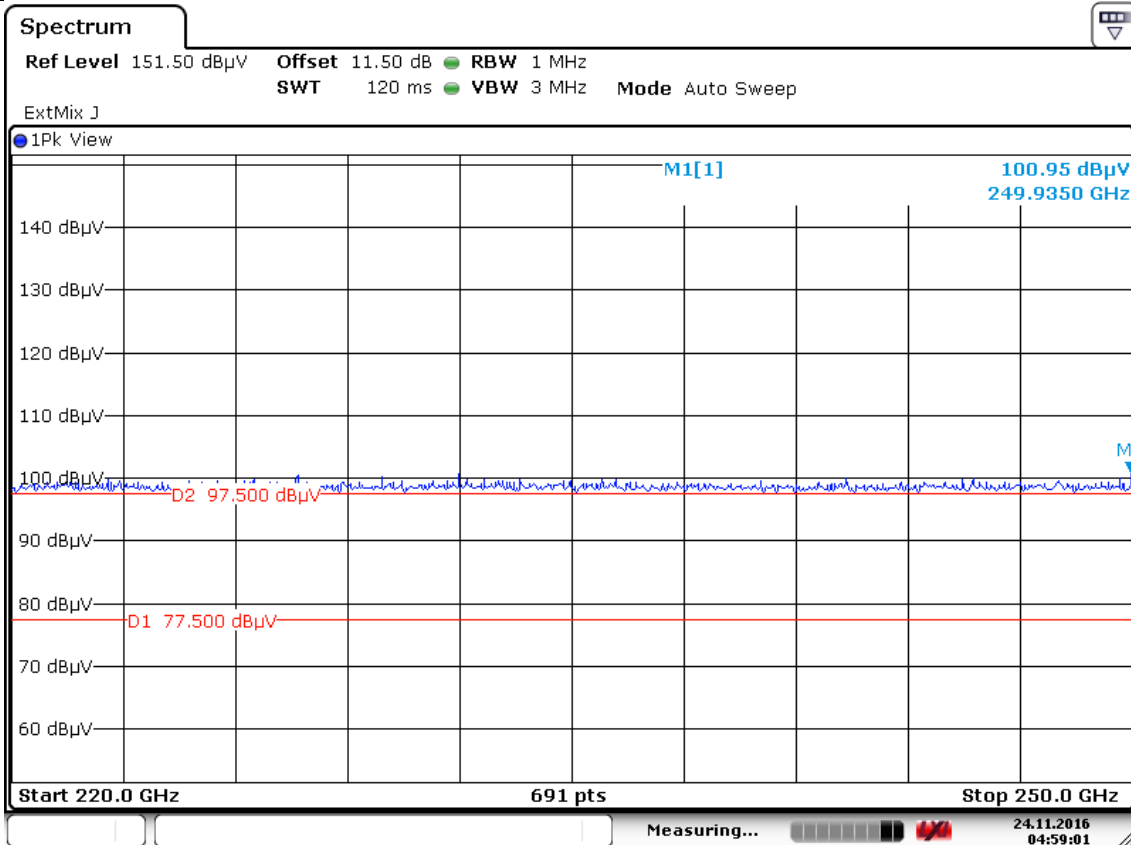


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Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

Test Mode:	TX-24GHz	Temp/Hum	27(°C)/ 53%RH
Test Item	220GHz-250GHz	Test Date	Nov 22, 2016
Polarize	Vertical/Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc



Date: 24.NOV.2016 04:59:01

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit
3. Above 220G, noise floor is higher than EUT signal..