

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Applicant: Targus International LLC
1211 North Miller Street Anaheim, CA 92806 USA

Product Name: Wireless Receiver

Brand Name: TARGUS

Model No.: AMP32R

Model Difference: N/A

Report Number: T190416W03-RP

FCC ID: OXM000099

FCC Rule Part: §15.249

Issue Date: Jul. 15, 2019

Date of Test: Apr. 16, 2019 ~ Jun. 28, 2019

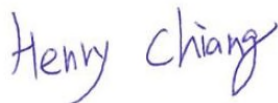
Date of EUT Received: Apr. 16, 2019

Issued by: Compliance Certification Services Inc. Wugu Lab.
No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)
service@ccsrf.com

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 re-port. The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc. (Wugu Laboratory).

Tested By:



Henry Chiang / Engineer

Approved By:



Kevin Tsai / Deputy Manager



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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
T190416W03-RP	Rev.00	Initial creation of document	All	Jul. 03, 2019	Elle Chang
T190416W03-RP	Rev.01	Updated Operating Frequency and Channel	4, 10	Jul. 15, 2019	Elle Chang

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Wireless Receiver
Brand Name:	TARGUS
Model No.:	AMP32R
Model Difference:	N/A
Hardware Version:	AMP032TX V18
Software Version:	Targus032_OTA_V27_0
Power Supply:	5Vdc from USB port

Radio Technology:	2.4GHz Short Range Radio
Frequency Range:	2404-2477MHz
Channel number:	5 channels
Modulation type:	GFSK
Transmit Power:	70.80 dBμV/m
Antenna Designation:	Printed antenna, Gain: -2.28 dBi

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.249

ANSI C63.10:2013

Note: All test items have been performed and record as per the above standards.

1.3 Test Facility

Compliance Certification Services Inc. Wugu Lab. No.11, Wugong 6th Rd.,
Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.) (TAF code 1309)
FCC Designation number: TW1309

1.4 Special Accessories

There are no special accessories used while test was conducted.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 μ H/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

2.3.3 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

2.5 Limitation

(2) Radiated Emission

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following.

Frequency (MHz)	Field strength of Fundamental	Field strength of Harmonics	Distance (m)
902 – 928	50 mV/m (94dBuV/m)	500 uV/m (54dBuV/m)	3
2400 – 2483.5	50 mV/m (94dBuV/m)	500 uV/m (54dBuV/m)	3
5725 – 5875	50 mV/m (94dBuV/m)	500 uV/m (54dBuV/m)	3
24.0 – 24.25 GHz	250 mV/m (107.95dBuV/m)	2500 uV/m (67.95dBuV/m)	3

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(3) Radiated Emission

Emission Radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits as below, whichever is the lesser attenuation.

Frequency (MHz)	Field strength $\mu\text{V/m}$	Distance (m)	Field strength at 3m dB $\mu\text{V/m}$
1.705-30	30	30	69.54
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
Above 960	500	3	54

(4) Radiated Emission

For frequencies above 1000MHz, the above field strength limits are based on average limits. The peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20dB under any condition of modulation.

- Re-mark:
1. Emission level in dB $\mu\text{V/m}$ =20 log ($\mu\text{V/m}$)
 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
 3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of ξ 15.205.
 4. Emission spurious frequency which appearing within the Restricted Bands specified in provision of ξ 15.205, then the general radiated emission limits in ξ 15.209 apply.

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2.6 Configuration of Tested System

Fig. 2-1 Radiated Emission Configuration

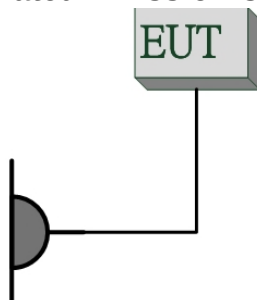


Fig. 2-2 AC Power Line Conducted Emission



Fig. 2-3 Conducted (Antenna Port) Configuration

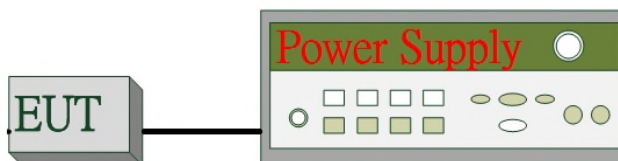


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	2.4G Test Software	N/A	N/A	N/A	N/A	N/A
2.	DC Power Supply	Agilent	E3640A	MY53130054	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.249(a)(e)	Field Strength of the Fundamental signal	Compliant
§15.249(a), 15.209	Spurious Emission	Compliant
15.249(a), 15.205	Restricted bands around fundamental frequency (Radiated Emission)	Compliant
§15.215(c)	20dB Bandwidth Measurement	Compliant
15.249(b)(2)	Frequency Stability	Compliant

4 DESCRIPTION OF TEST MODES

4.1 Operated in 2404 ~ 2477MHz Band

5 channels are provided.

Item	Frequency
1	2404
2	2425
3	2442
4	2463
5	2477

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4.2 The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED FREQUENCY	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
2.4G	2404 to 2477	2442	GFSK	N/A	MAIN
RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED FREQUENCY	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
2.4G	2404 to 2477	2404, 2442, 2477	GFSK	N/A	MAIN

Note:

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for 2.4GHz Wireless Transmitter for channel Low, Mid and High, the worst case H position was reported.

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST					
MODE	AVAILABLE CHANNEL	TESTED FREQUENCY	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
2.4G	2404 to 2477	2404, 2442, 2477	GFSK	N/A	MAIN

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5 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	+/- 1.2575 dB
Frequency Stability	+/- 147.256 Hz
20 dB Occupied Bandwidth	+/- 147.256 Hz
100 kHz Bandwidth of Frequency Band Edges	+/- 1.924 dB
3M Semi Anechoic Chamber / 30M~200M	+/- 4.12 dB
3M Semi Anechoic Chamber / 200M~1000M	+/- 4.68 dB
3M Semi Anechoic Chamber / 1G~8G	+/- 5.18 dB
3M Semi Anechoic Chamber / 8G~18G	+/- 5.47 dB
3M Semi Anechoic Chamber / 18G~26G	+/- 3.81 dB
3M Semi Anechoic Chamber / 26G~40G	+/- 3.87 dB

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable:

Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

Frequency range MHz	Limits dB(μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

6.2 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
CABLE	EMCI	CFD300-NL	CERF	06/29/2018	06/28/2019
EMI Test Receiver	R&S	ESCI	100064	07/24/2018	07/23/2019
LISN	SCHWARZ-BECK	NSLK 8127	8127-541	01/31/2019	01/30/2020
LISN	SCHAFFNER	NNB 41	03/10013	02/13/2019	02/12/2020
Software	EZ-EMC(CCS-3A1-CE)			N/A	N/A

6.3 EUT Setup:

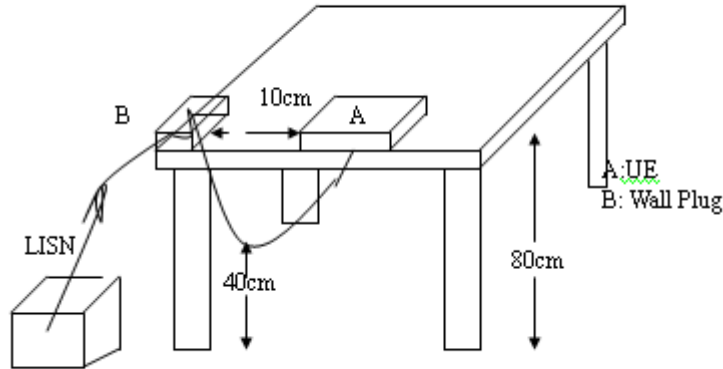
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed

6.6 Measurement Result:

Note: Refer to next page for measurement data and plots.

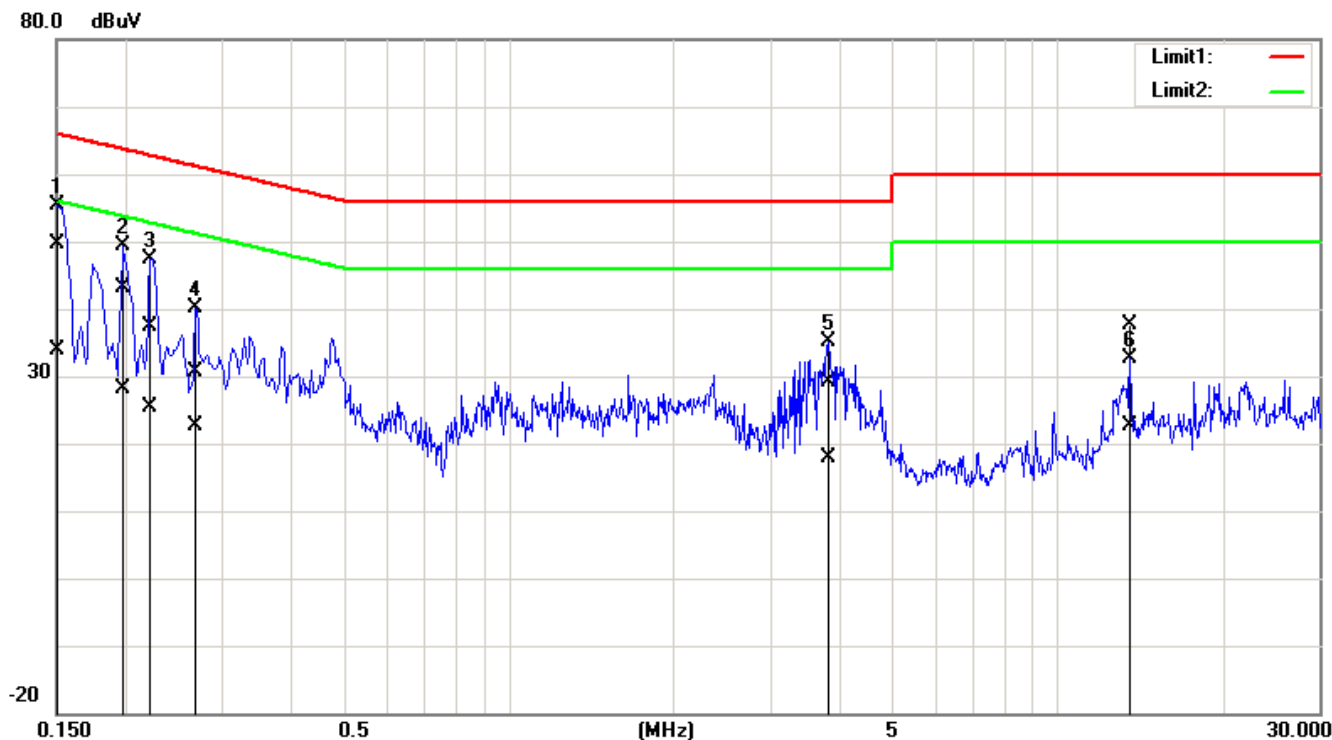
Note2: The * reveals the worst-case results that closet to the limit.

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Description:	Operation	Date:	2019/5/15
Line:	L1	Temp.(°C)/Hum.(%):	26.5(°C)/59%
Test Voltage:	AC 120V/60Hz	Test By:	Henry



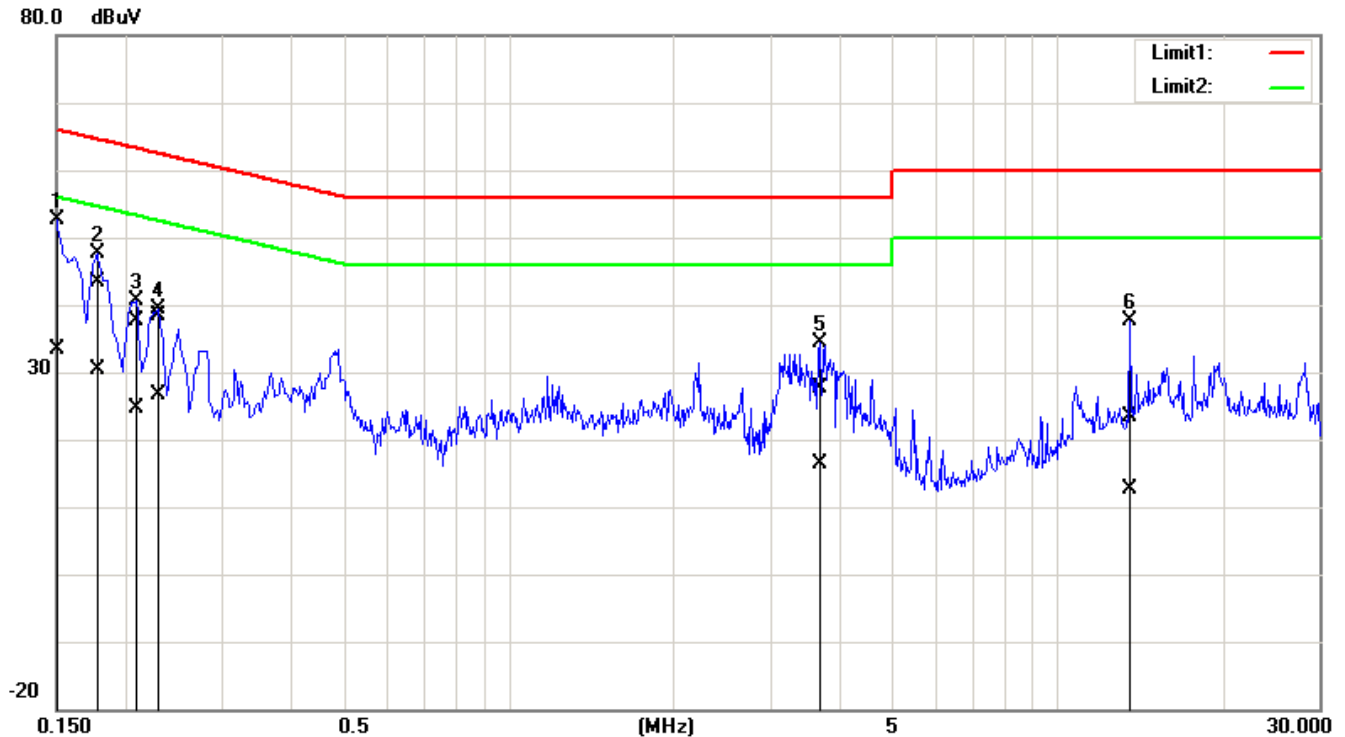
No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1*	0.1500	49.48	33.63	0.16	49.64	33.79	65.99	56.00	-16.35	-22.21	Pass
2	0.1980	43.07	27.86	0.15	43.22	28.01	63.69	53.69	-20.47	-25.68	Pass
3	0.2220	37.26	25.28	0.15	37.41	25.43	62.74	52.74	-25.33	-27.31	Pass
4	0.2700	30.41	22.37	0.15	30.56	22.52	61.12	51.12	-30.56	-28.60	Pass
5	3.8220	28.89	17.61	0.27	29.16	17.88	56.00	46.00	-26.84	-28.12	Pass
6	13.5620	37.07	21.97	0.54	37.61	22.51	60.00	50.00	-22.39	-27.49	Pass

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Description: Operation
Line: N
Test Voltage: AC 120V/60Hz

Date: 2019/5/15
Temp.(°C)/Hum.(%): 26.5(°C)/59%
Test By: Henry



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1*	0.1500	52.61	33.29	0.10	52.71	33.39	65.99	56.00	-13.28	-22.61	Pass
2	0.1780	43.17	30.33	0.10	43.27	30.43	64.57	54.58	-21.30	-24.15	Pass
3	0.2100	37.59	24.64	0.10	37.69	24.74	63.20	53.21	-25.51	-28.47	Pass
4	0.2300	38.33	26.60	0.10	38.43	26.70	62.45	52.45	-24.02	-25.75	Pass
5	3.7060	27.33	16.11	0.21	27.54	16.32	56.00	46.00	-28.46	-29.68	Pass
6	13.5620	23.00	12.25	0.44	23.44	12.69	60.00	50.00	-36.56	-37.31	Pass

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7 RADIATED EMISSION TEST

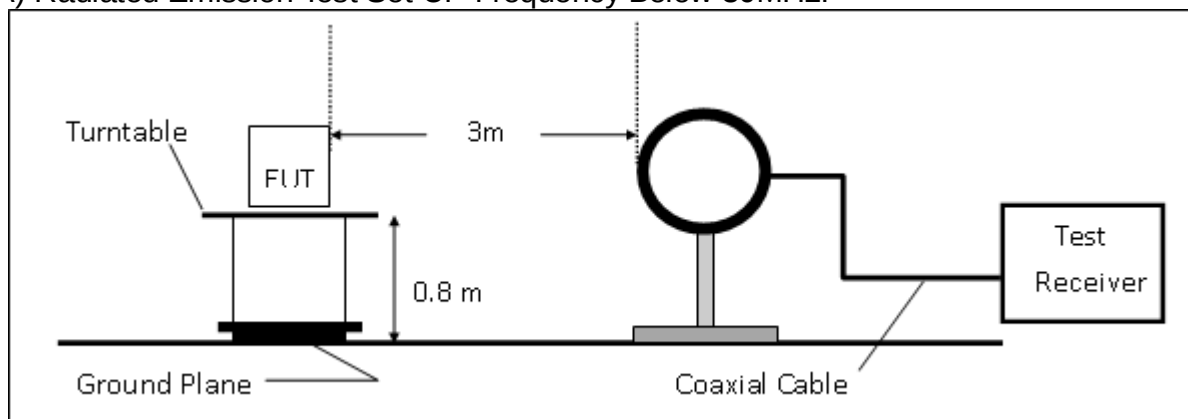
7.1. Standard Applicable

7.2. Measurement Procedure

1. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 1.5m for frequency > 1GHz above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured were complete.

7.3. Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-UP Frequency Below 30MHz.

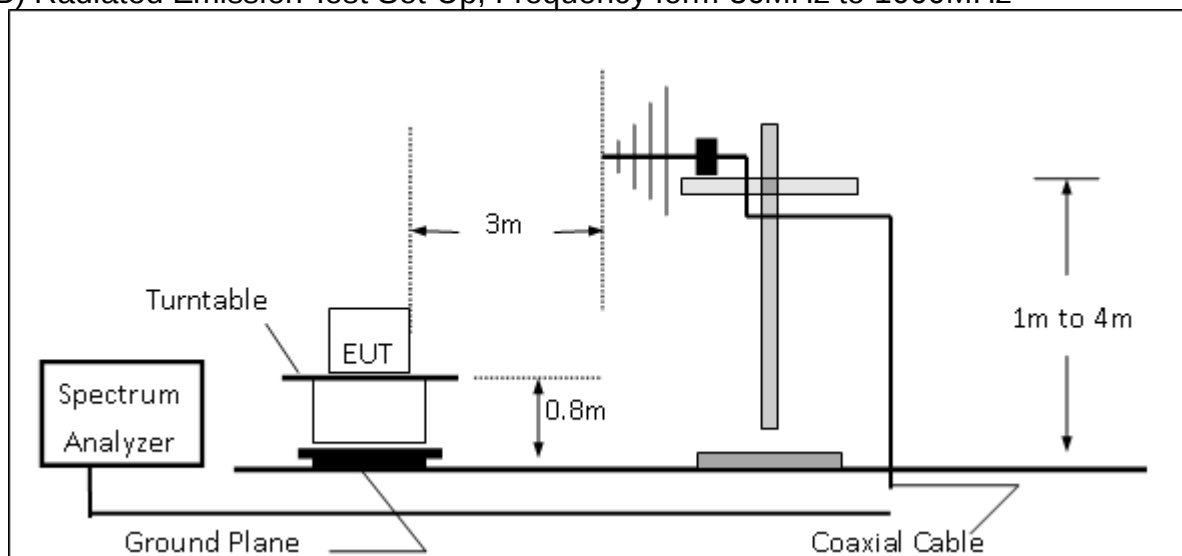


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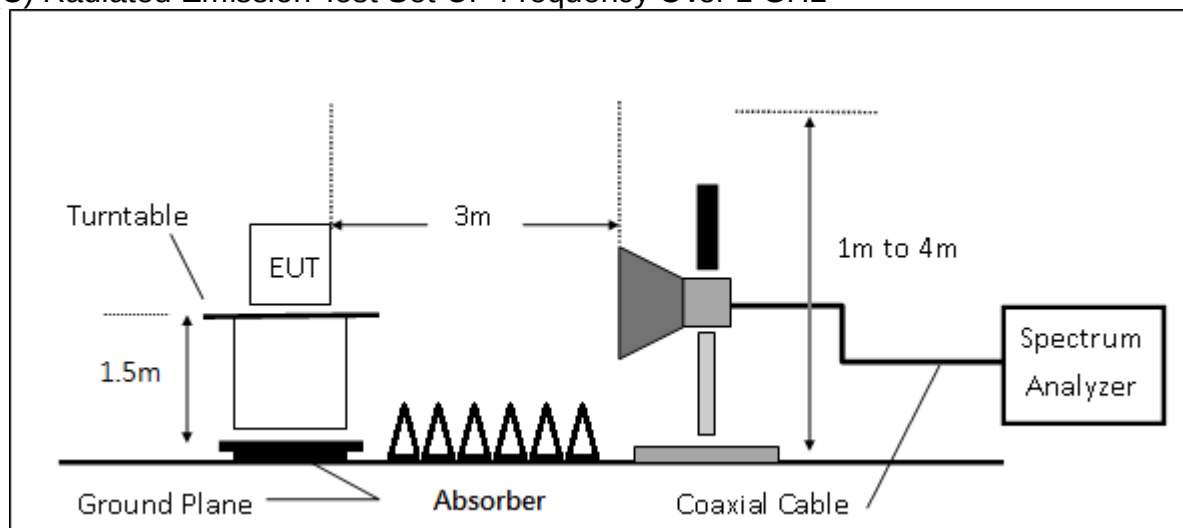
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(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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7.4. Measurement Equipment Used:

966A Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Band Reject Filters	MICRO TRONICS	BRM 50702	120	02/26/2019	02/25/2020
Bilog Antenna	Sunol Sciences	JB3	A030105	07/13/2018	07/12/2019
Cable	HUBER SUHNER	SUCOFLEX 104PEA	25157	02/26/2019	02/25/2020
Cable	HUBER SUHNER	SUCOFLEX 104PEA	20995	02/26/2019	02/25/2020
Digital Thermo-Hygro Meter	WISEWIND	1206	D07	01/30/2019	01/29/2020
double Ridged Guide Horn Antenna	ETC	MCTD 1209	DRH13M02003	08/20/2018	08/19/2019
Loop Antenna	COM-POWER	AL-130	121051	03/22/2019	03/21/2020
Pre-Amplifier	EMEC	EM330	060609	02/26/2019	02/25/2020
Pre-Amplifier	HP	8449B	3008A00965	02/26/2019	02/25/2020
PSA Series Spectrum Analyzer	Agilent	E4446A	MY46180323	05/29/2019	05/28/2020
DC Power Supply	Agilent	E3640A	MY40000811	12/11/2018	12/10/2019
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Software	e3 V6.11-20180413				

Note: N.C.R refers to Not Calibrated Required

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7.5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

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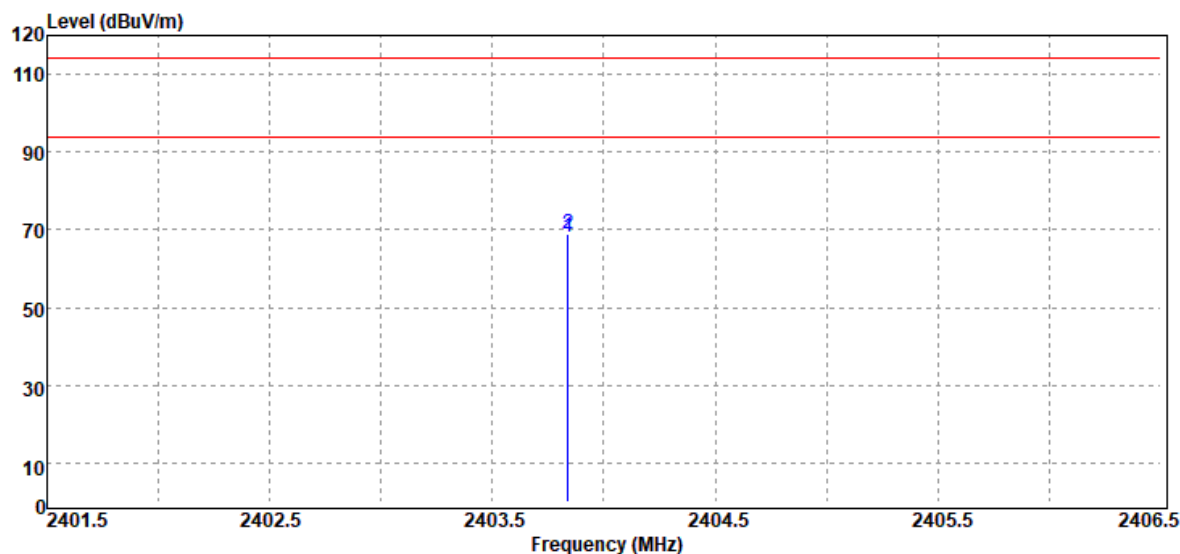
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7.6. Measurement Result

Field Strength of the Fundamental Signal

Project Number :T190416W03
Operation Band :2.4G
Frequency :2404 MHz
Operation Mode :Main CH Low
EUT Pol. :H Plan

Test Date :2019-06-19
Temp./Humi. :20/58
Antenna Pol. :VERTICAL
Engineer :Jerry



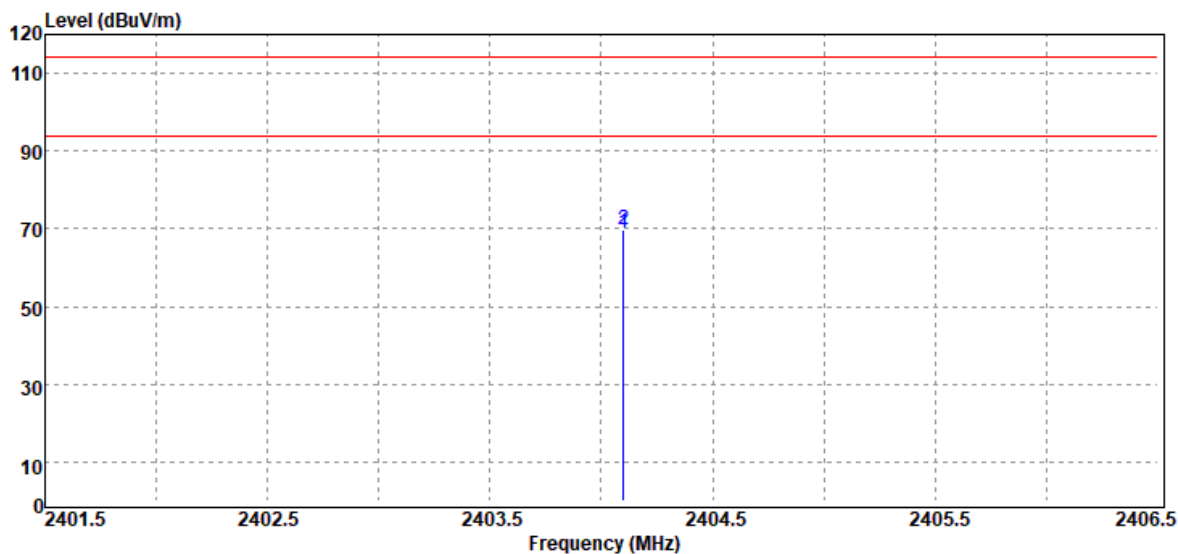
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2403.84	Average	71.60	-3.39	68.21	94.00	-25.79
2403.84	Peak	72.28	-3.39	68.89	114.00	-45.11

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Project Number :T190416W03
Operation Band :2.4G
Frequency :2404 MHz
Operation Mode :Main CH Low
EUT Pol. :H Plan

Test Date :2019-06-19
Temp./Humi. :20/58
Antenna Pol. :HORIZONTAL
Engineer :Jerry



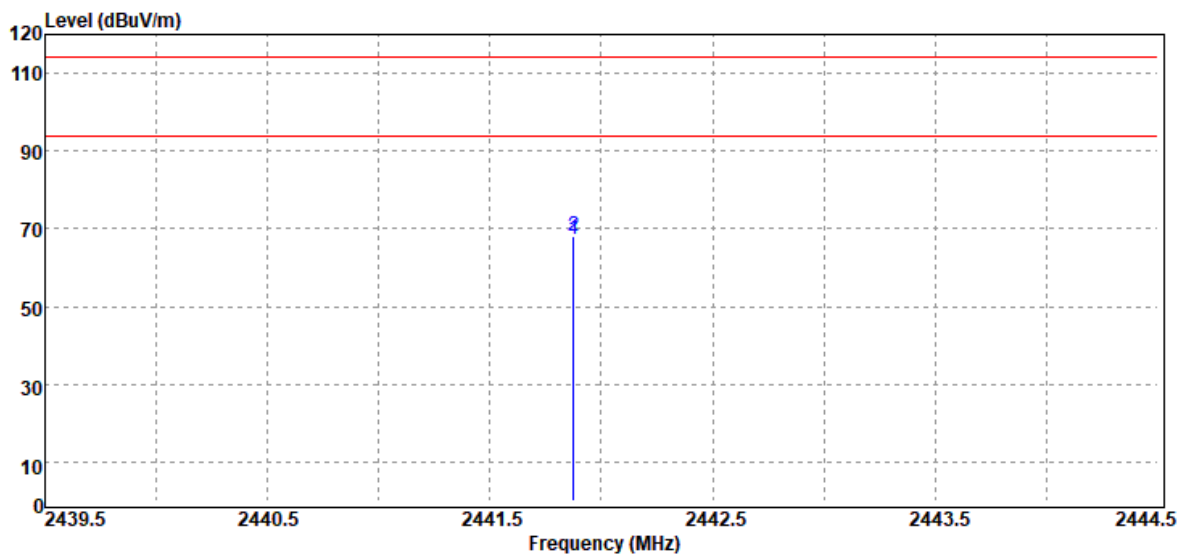
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2404.10	Average	72.41	-3.39	69.02	94.00	-24.98
2404.10	Peak	73.07	-3.39	69.68	114.00	-44.32

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Project Number :T190416W03
Operation Band :2.4G
Frequency :2442 MHz
Operation Mode :Main CH Mid
EUT Pol. :H Plan

Test Date :2019-06-19
Temp./Humi. :20/58
Antenna Pol. :VERTICAL
Engineer :Jerry



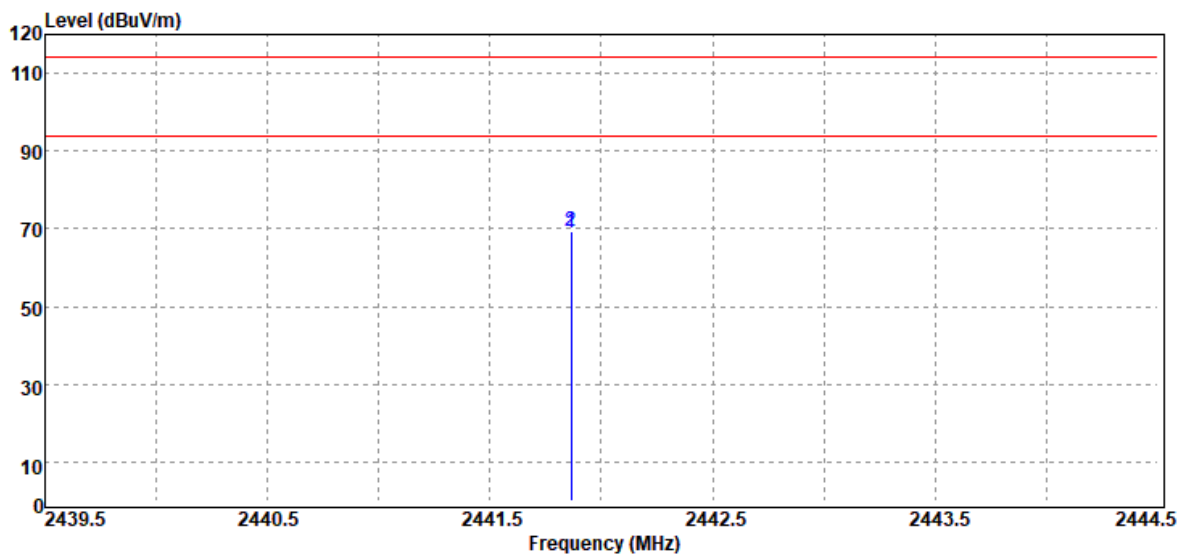
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit @3m dBUV/m	Margin dB
2441.88	Average	70.52	-3.21	67.31	94.00	-26.69
2441.88	Peak	71.26	-3.21	68.05	114.00	-45.95

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Project Number :T190416W03
Operation Band :2.4G
Frequency :2442 MHz
Operation Mode :Main CH Mid
EUT Pol. :H Plan

Test Date :2019-06-19
Temp./Humi. :20/58
Antenna Pol. :HORIZONTAL
Engineer :Jerry



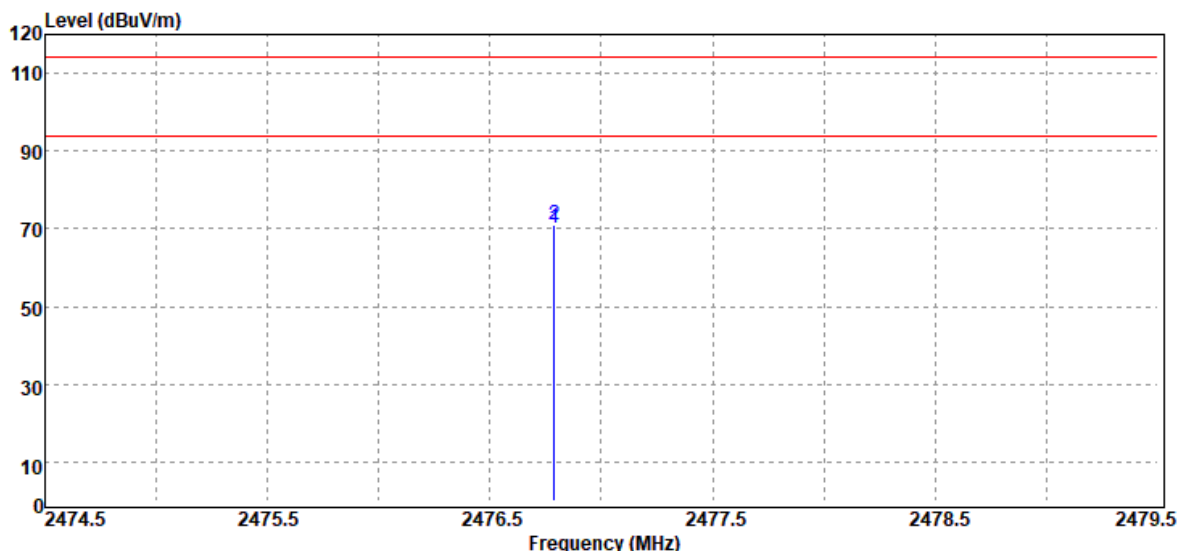
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit @3m dBUV/m	Margin dB
2441.87	Average	71.95	-3.21	68.74	94.00	-25.26
2441.87	Peak	72.61	-3.21	69.40	114.00	-44.60

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Project Number :T190416W03
Operation Band :2.4G
Frequency :2477 MHz
Operation Mode :Main CH High
EUT Pol. :H Plan

Test Date :2019-06-19
Temp./Humi. :20/58
Antenna Pol. :VERTICAL
Engineer :Jerry



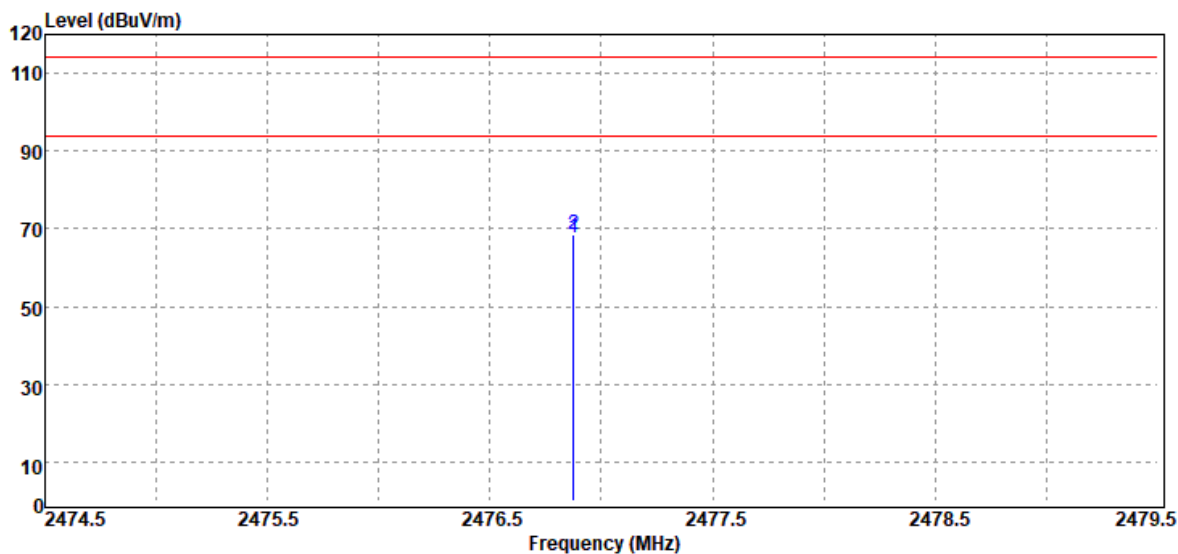
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS	@3m	
	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2476.79	Average	73.13	-2.89	70.24	94.00	-23.76
2476.79	Peak	73.69	-2.89	70.80	114.00	-43.20

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Project Number :T190416W03
Operation Band :2.4G
Frequency :2477 MHz
Operation Mode :Main CH High
EUT Pol. :H Plan

Test Date :2019-06-19
Temp./Humi. :20/58
Antenna Pol. :HORIZONTAL
Engineer :Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2476.88	Average	70.51	-2.89	67.62	94.00	-26.38
2476.88	Peak	71.22	-2.89	68.33	114.00	-45.67

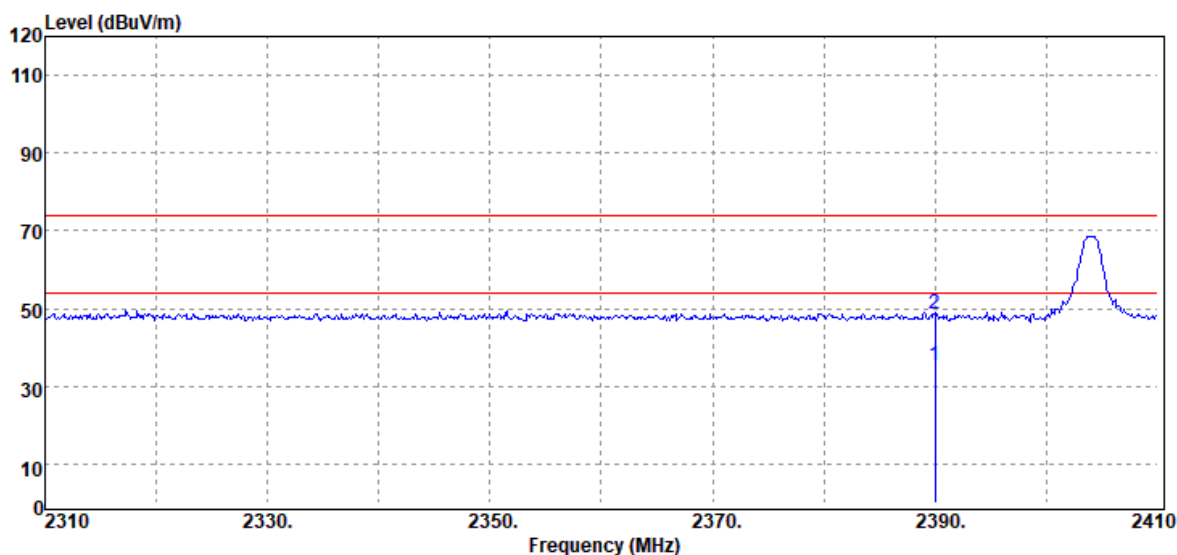
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Restricted bands around fundamental frequency

Project Number :T190416W03
Operation Band :2.4G
Frequency :2404 MHz
Operation Mode :BE CH Low
EUT Pol. :H Plan

Test Date :2019-06-19
Temp./Humi. :20/58
Antenna Pol. :VERTICAL
Engineer :Jerry



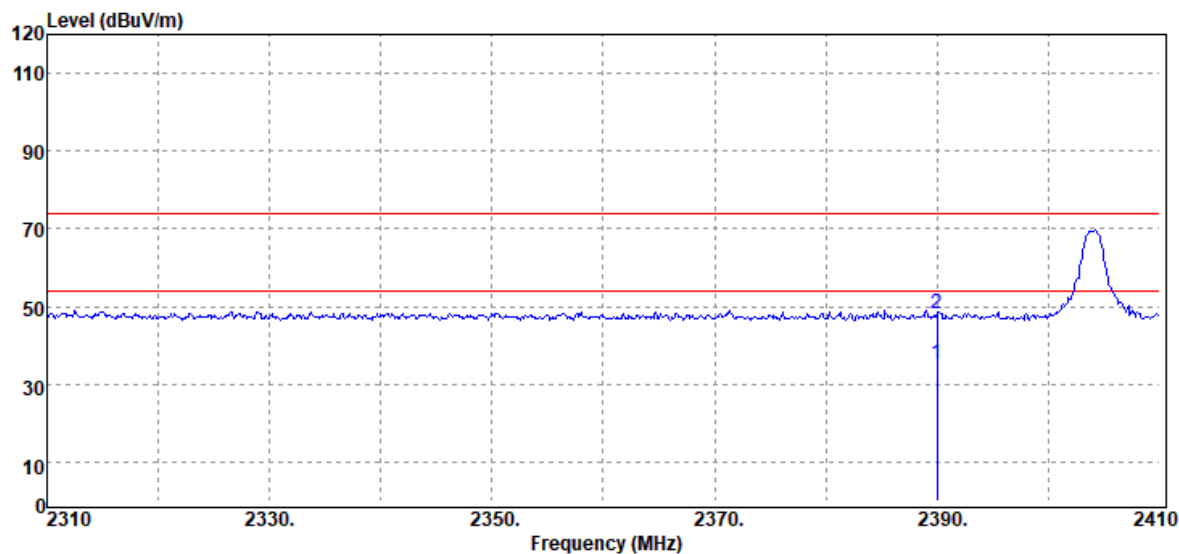
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2390.00	Average	38.84	-3.38	35.46	54.00	-18.54
2390.00	Peak	52.04	-3.38	48.66	74.00	-25.34

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Project Number :T190416W03
Operation Band :2.4G
Frequency :2404 MHz
Operation Mode :BE CH Low
EUT Pol. :H Plan

Test Date :2019-06-19
Temp./Humi. :20/58
Antenna Pol. :HORIZONTAL
Engineer :Jerry



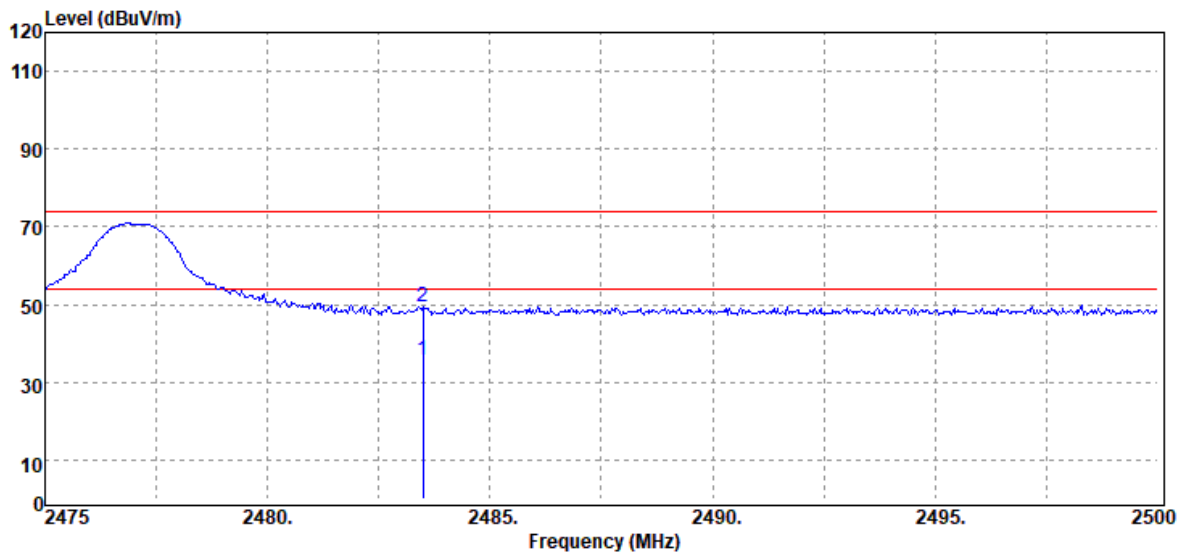
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2390.00	Average	38.74	-3.38	35.36	54.00	-18.64
2390.00	Peak	51.71	-3.38	48.33	74.00	-25.67

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Project Number :T190416W03
Operation Band :2.4G
Frequency :2477 MHz
Operation Mode :BE CH High
EUT Pol. :H Plan

Test Date :2019-06-19
Temp./Humi. :20/58
Antenna Pol. :VERTICAL
Engineer :Jerry



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS	@3m	
	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	Average	38.38	-2.83	35.55	54.00	-18.45
2483.50	Peak	52.14	-2.83	49.31	74.00	-24.69

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Project Number :T190416W03

Operation Band :2.4G

Frequency :2477 MHz

Operation Mode :BE CH High

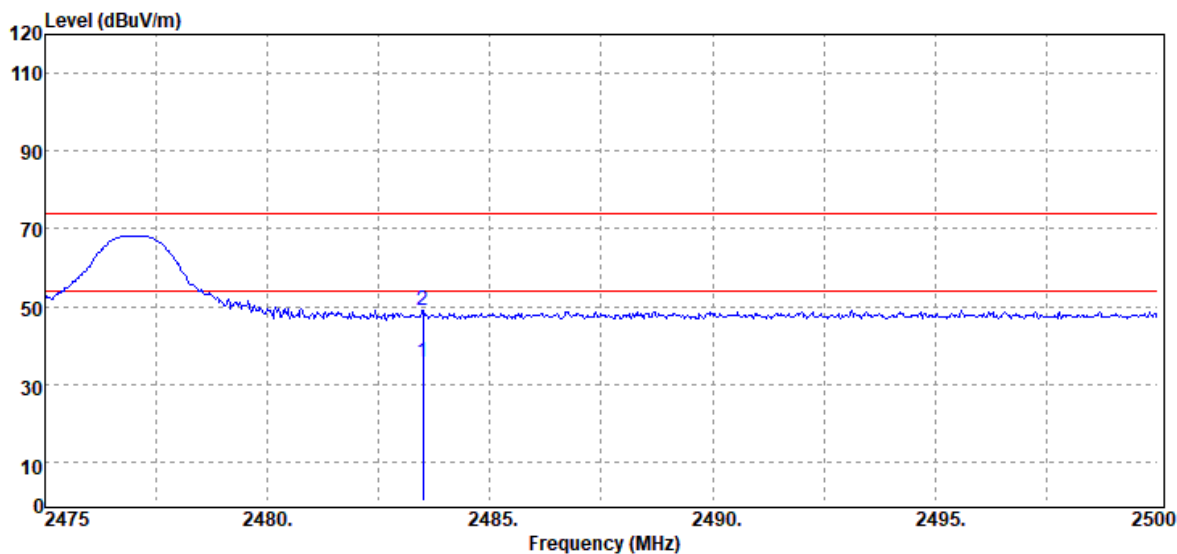
EUT Pol. :H Plan

Test Date :2019-06-19

Temp./Humi. :20/58

Antenna Pol. :HORIZONTAL

Engineer :Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.50	Average	38.53	-2.83	35.70	54.00	-18.30
2483.50	Peak	51.63	-2.83	48.80	74.00	-25.20

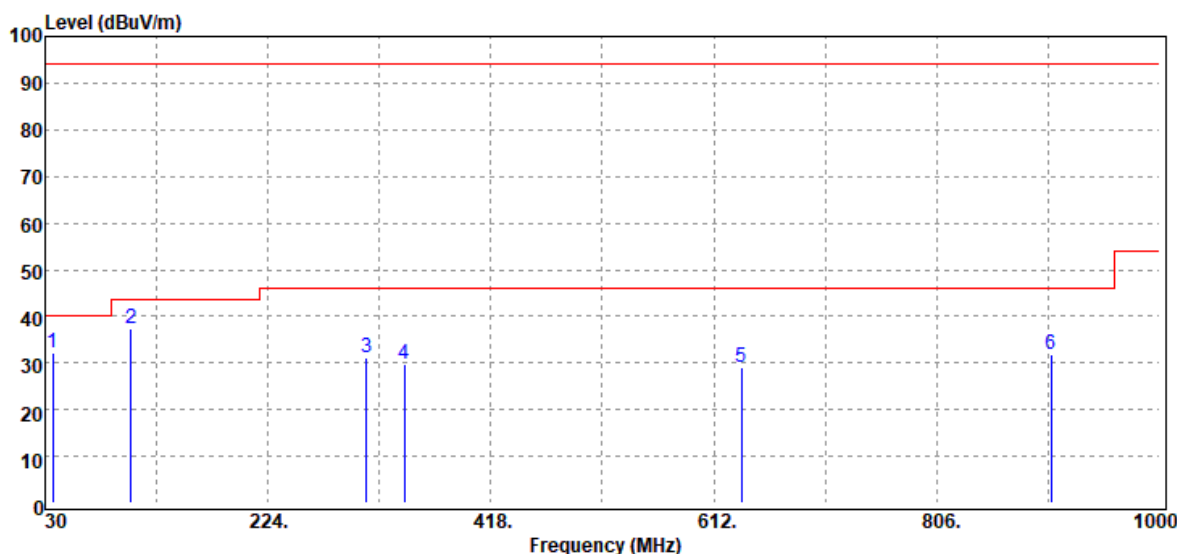
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Radiated Spurious Emission Measurement Result (Below 1GHz)

Project Number	: T190416W03	Test Date	: 2019-04-23
Operation Band	: 2.4G	Temp./Humi.	: 20/58
Fundamental Frequency	: 2442 MHz	Engineer	: Jerry
Operation Mode	: Tx CH Mid	Measurement Antenna	: VERTICAL
EUT Pol.	: H Plan	Pol.	



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
36.79	Peak	39.39	-7.08	32.31	40.00	-7.69
104.69	Peak	48.48	-11.18	37.30	43.50	-6.20
309.36	Peak	39.10	-7.91	31.19	46.00	-14.81
342.34	Peak	36.90	-7.19	29.71	46.00	-16.29
636.25	Peak	29.37	-0.30	29.07	46.00	-16.93
905.91	Peak	27.62	4.12	31.74	46.00	-14.26

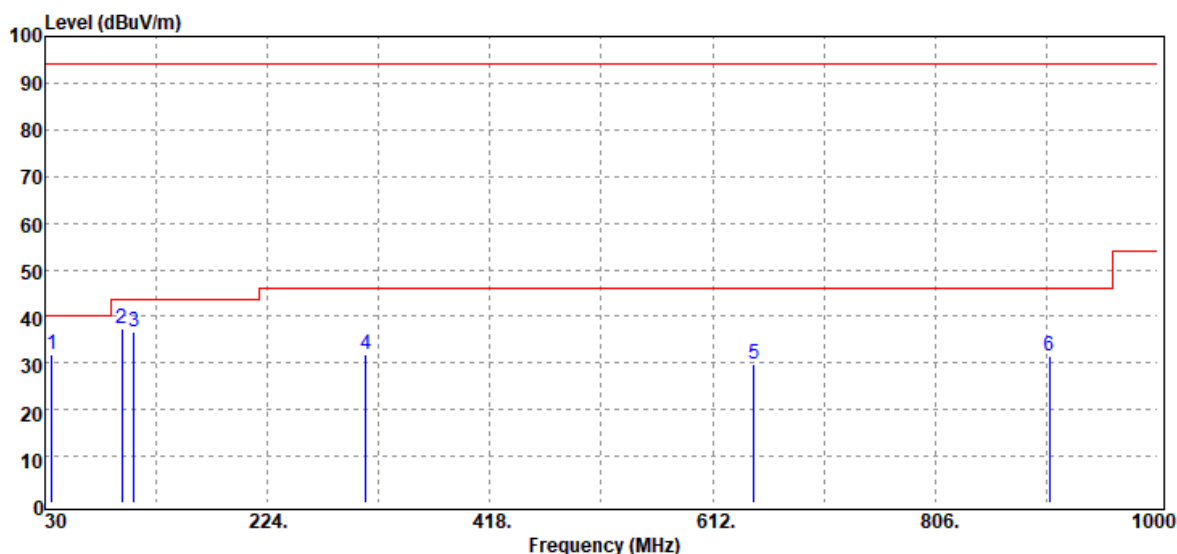
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Project Number : T190416W03
Operation Band : 2.4G
Fundamental Frequency : 2442 MHz
Operation Mode : Tx CH Mid
EUT Pol. : H Plan

Test Date : 2019-04-23
Temp./Humi. : 20/58
Engineer : Jerry
Measurement Antenna : VERTICAL
Pol.



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
35.82	Peak	38.27	-6.35	31.92	40.00	-8.08
96.93	Peak	50.70	-13.46	37.24	43.50	-6.26
107.60	Peak	47.42	-10.67	36.75	43.50	-6.75
309.36	Peak	39.77	-7.91	31.86	46.00	-14.14
647.89	Peak	29.90	-0.06	29.84	46.00	-16.16
905.91	Peak	27.25	4.12	31.37	46.00	-14.63

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Radiated Spurious Emission Measurement Result (Above 1GHz)

Project Number :T190416W03

Test Date :2019-06-19

Operation Band :2.4G

Temp./Humi. :20/58

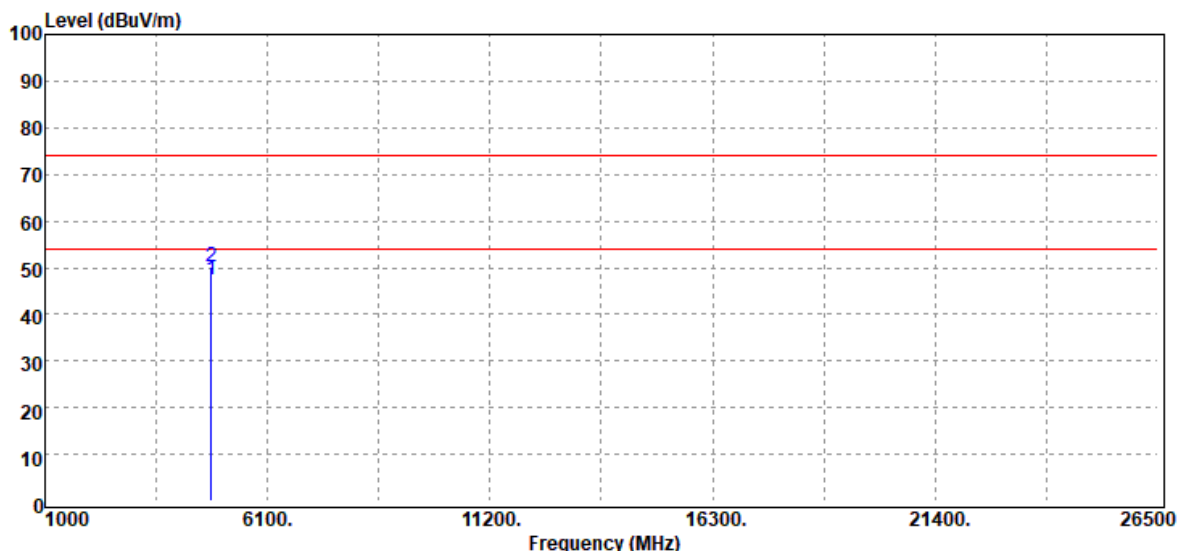
Frequency :2404 MHz

Antenna Pol. :VERTICAL

Operation Mode :Tx CH Low

Engineer :Jerry

EUT Pol. :H Plan



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS	@3m	
	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4808.00	Average	44.43	2.84	47.27	54.00	-6.73
4808.00	Peak	47.17	2.84	50.01	74.00	-23.99

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Project Number :T190416W03

Operation Band :2.4G

Frequency :2404 MHz

Operation Mode :Tx CH Low

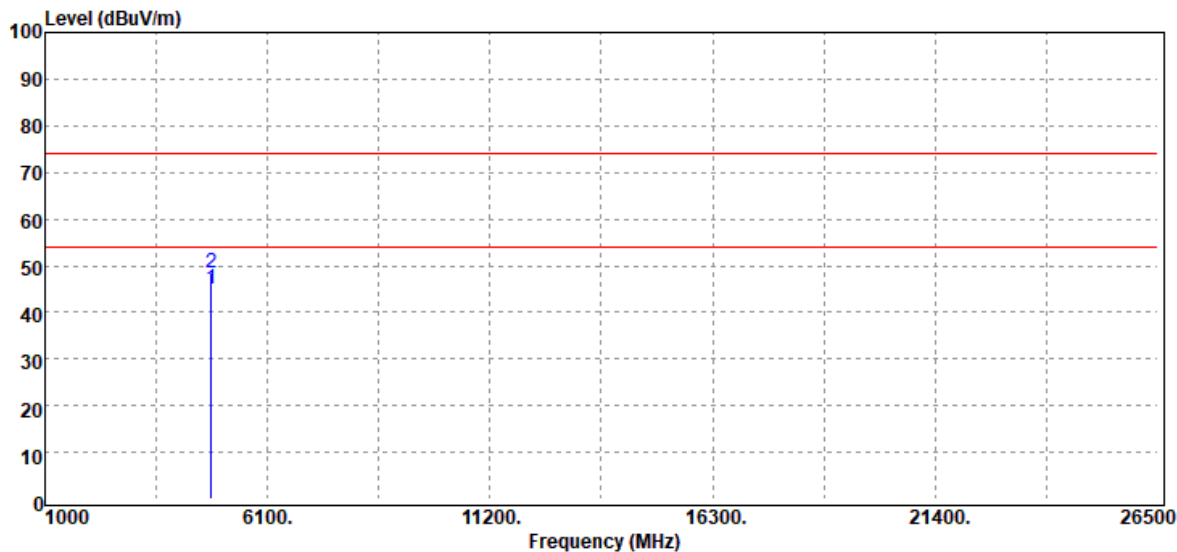
EUT Pol. :H Plan

Test Date :2019-06-19

Temp./Humi. :20/58

Antenna Pol. :HORIZONTAL

Engineer :Jerry



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS	@3m	
	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4808.00	Average	42.24	2.84	45.08	54.00	-8.92
4808.00	Peak	45.50	2.84	48.34	74.00	-25.66

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Project Number :T190416W03

Operation Band :2.4G

Frequency :2442 MHz

Operation Mode :Tx CH Mid

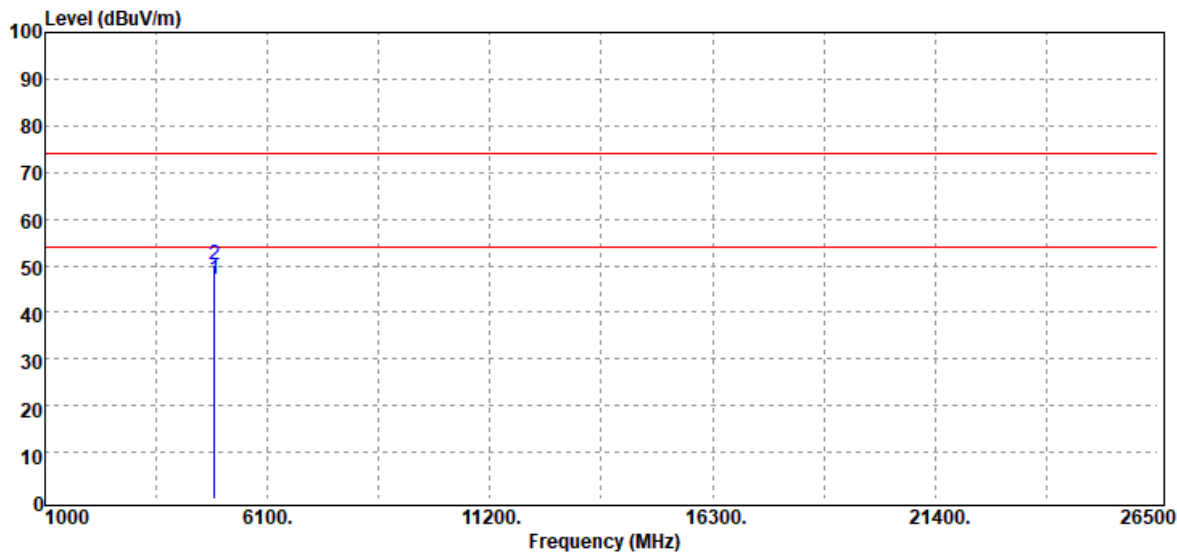
EUT Pol. :H Plan

Test Date :2019-06-19

Temp./Humi. :20/58

Antenna Pol. :VERTICAL

Engineer :Jerry



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS	@3m	
	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4884.00	Average	44.14	3.05	47.19	54.00	-6.81
4884.00	Peak	47.09	3.05	50.14	74.00	-23.86

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Project Number :T190416W03

Operation Band :2.4G

Frequency :2442 MHz

Operation Mode :Tx CH Mid

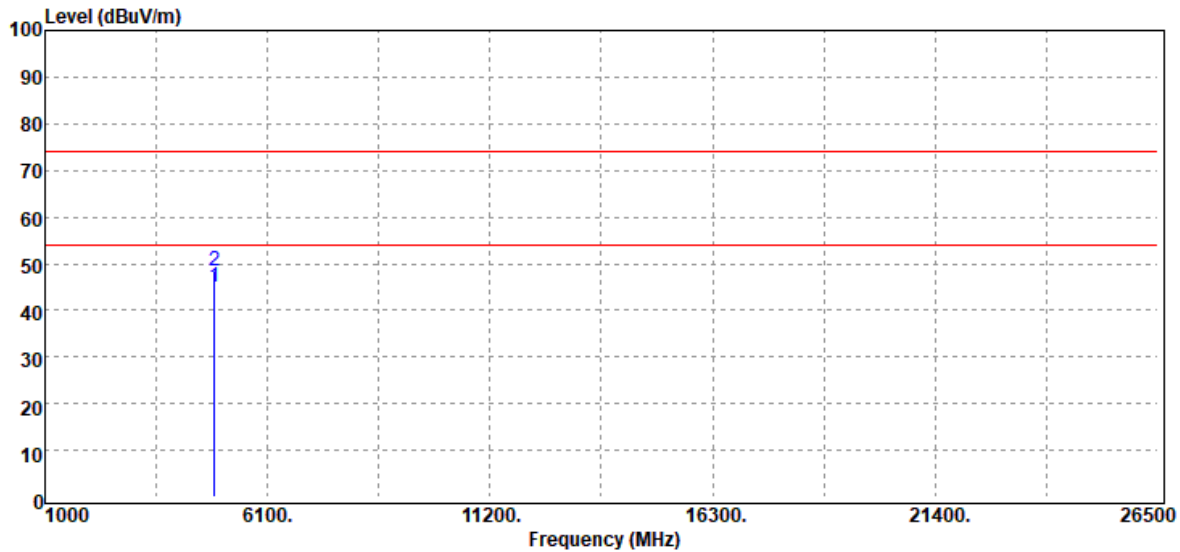
EUT Pol. :H Plan

Test Date :2019-06-19

Temp./Humi. :20/58

Antenna Pol. :HORIZONTAL

Engineer :Jerry



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS	@3m	
	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4884.00	Average	42.10	3.05	45.15	54.00	-8.85
4884.00	Peak	45.32	3.05	48.37	74.00	-25.63

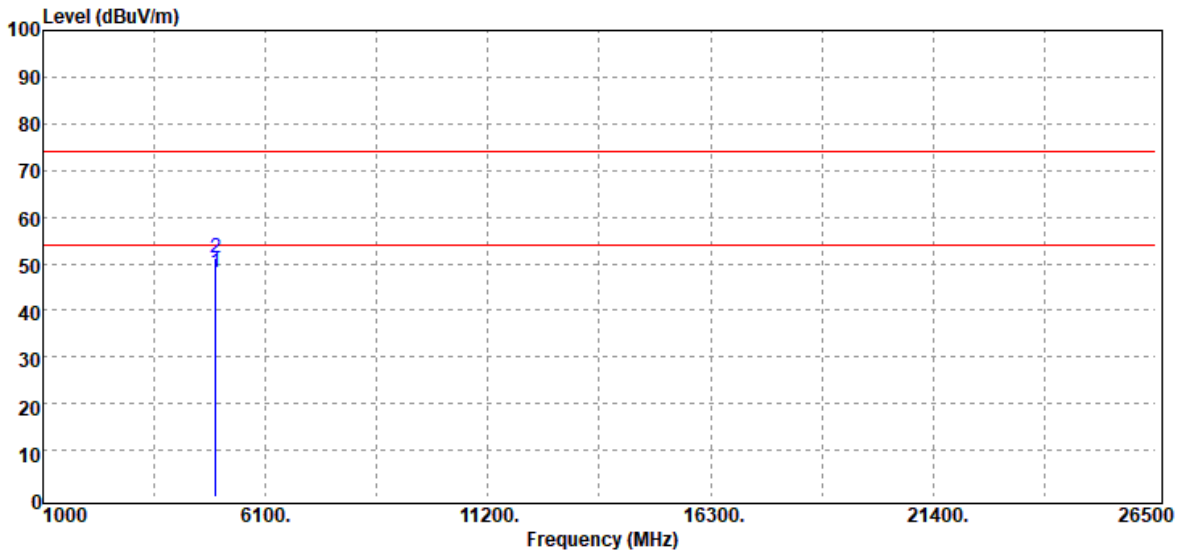
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Project Number :T190416W03
Operation Band :2.4G
Frequency :2477 MHz
Operation Mode :Tx CH High
EUT Pol. :H Plan

Test Date :2019-06-19
Temp./Humi. :20/58
Antenna Pol. :VERTICAL
Engineer :Jerry



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS	@3m	
	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4954.00	Average	44.36	3.80	48.16	54.00	-5.84
4954.00	Peak	47.28	3.80	51.08	74.00	-22.92

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Project Number :T190416W03

Operation Band :2.4G

Frequency :2477 MHz

Operation Mode :Tx CH High

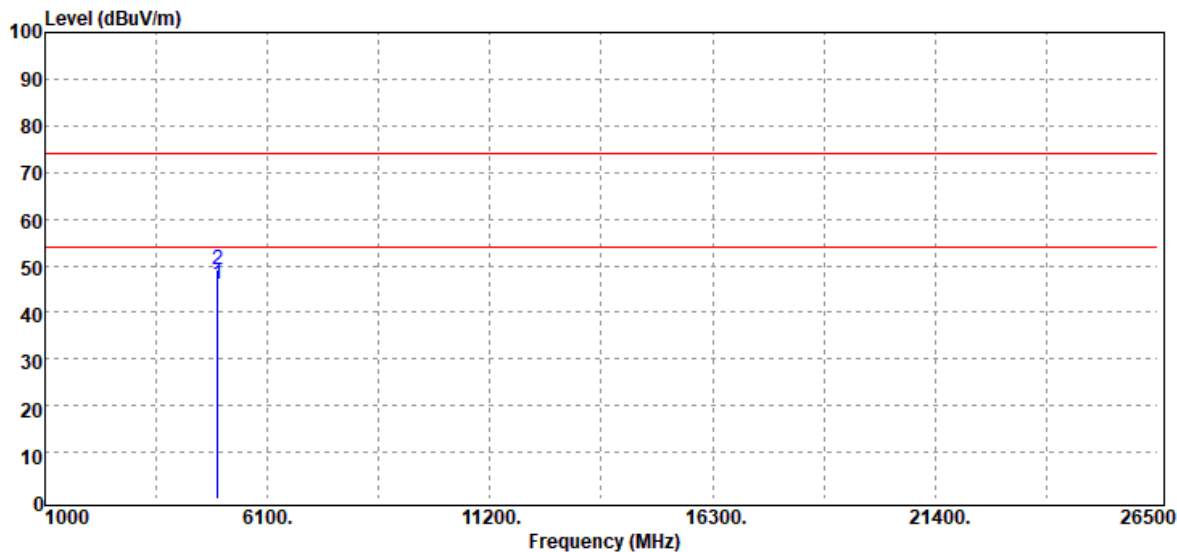
EUT Pol. :H Plan

Test Date :2019-06-19

Temp./Humi. :20/58

Antenna Pol. :HORIZONTAL

Engineer :Jerry



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS	@3m	
	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
4954.00	Average	42.15	3.80	45.95	54.00	-8.05
4954.00	Peak	45.38	3.80	49.18	74.00	-24.82

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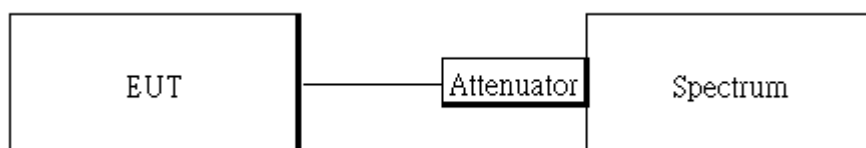
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8 20 dB BANDWIDTH MEASUREMENT

8.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set ETU normal operating mode.
3. Set SPA Center Frequency = fundamental frequency, RBW = 100kHz, VBW = 300kHz, Span = 3MHz.
4. Set SPA Max hold. Mark peak, -20dB.

8.2 Test SET-UP (Block Diagram of Configuration)



8.3 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY53400256	11/21/2018	11/20/2019
DC Block	PASTER-NACK	PE8210	RF256	02/26/2019	02/25/2020
DC Power Supply	Agilent	E3640A	MY53130054	09/03/2018	09/02/2019
Attenuator	Marvelous	MVE2213-10	RF80	02/26/2019	02/25/2020
Thermostat-ic/Hrgrosatic Chamber	TAICHY	MHG-150LF	930619	10/08/2018	10/07/2019

8.4 Measurement Results:

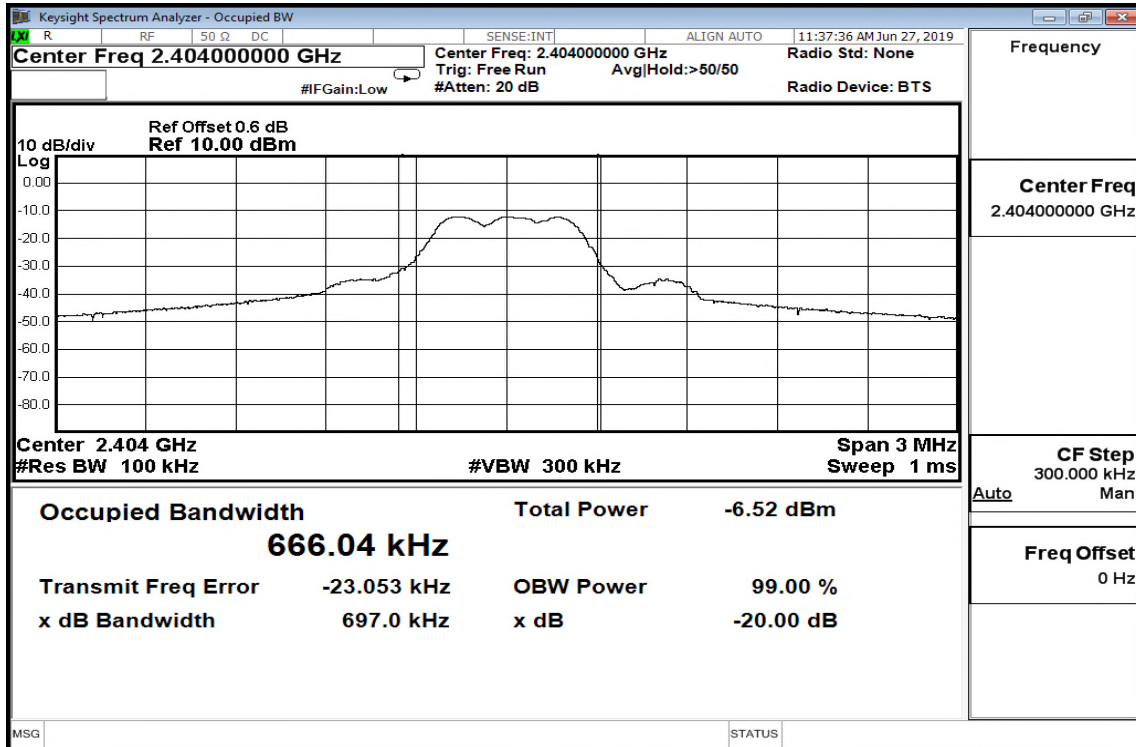
Frequency (MHz)	20dB Bandwidth (MHz)
2404	0.697
2442	0.693
2477	0.700

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

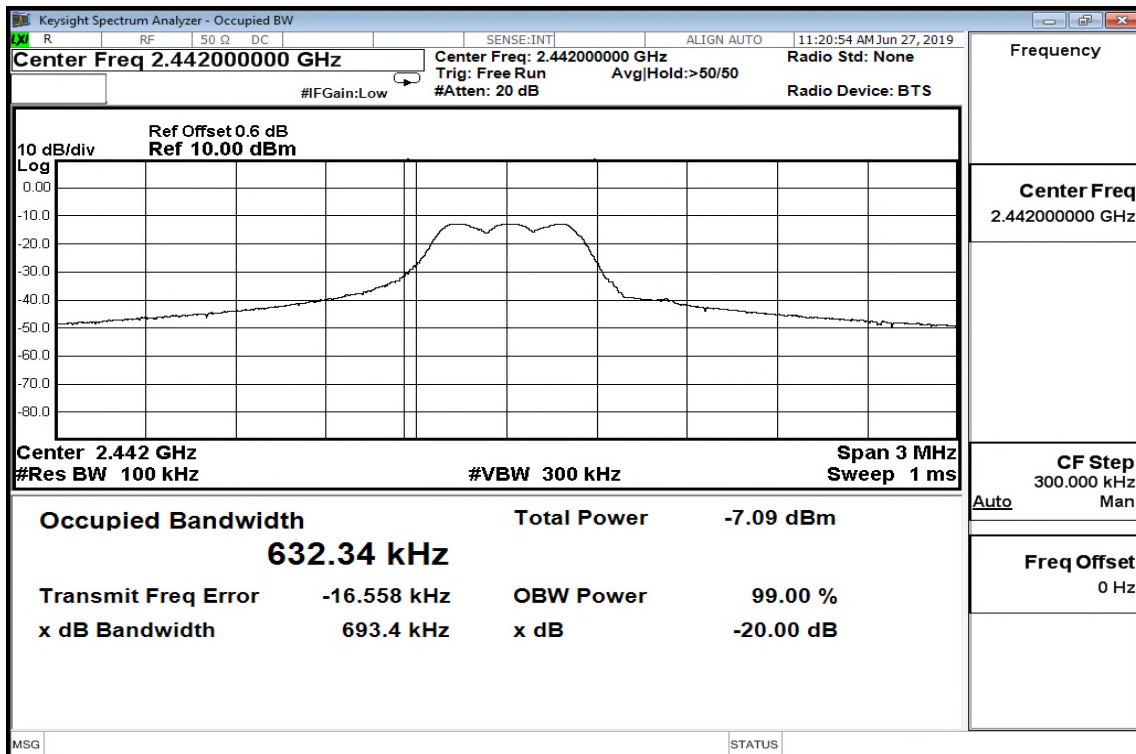
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20dB Bandwidth Test Plot CH Low



20dB Bandwidth Test Plot CH Mid

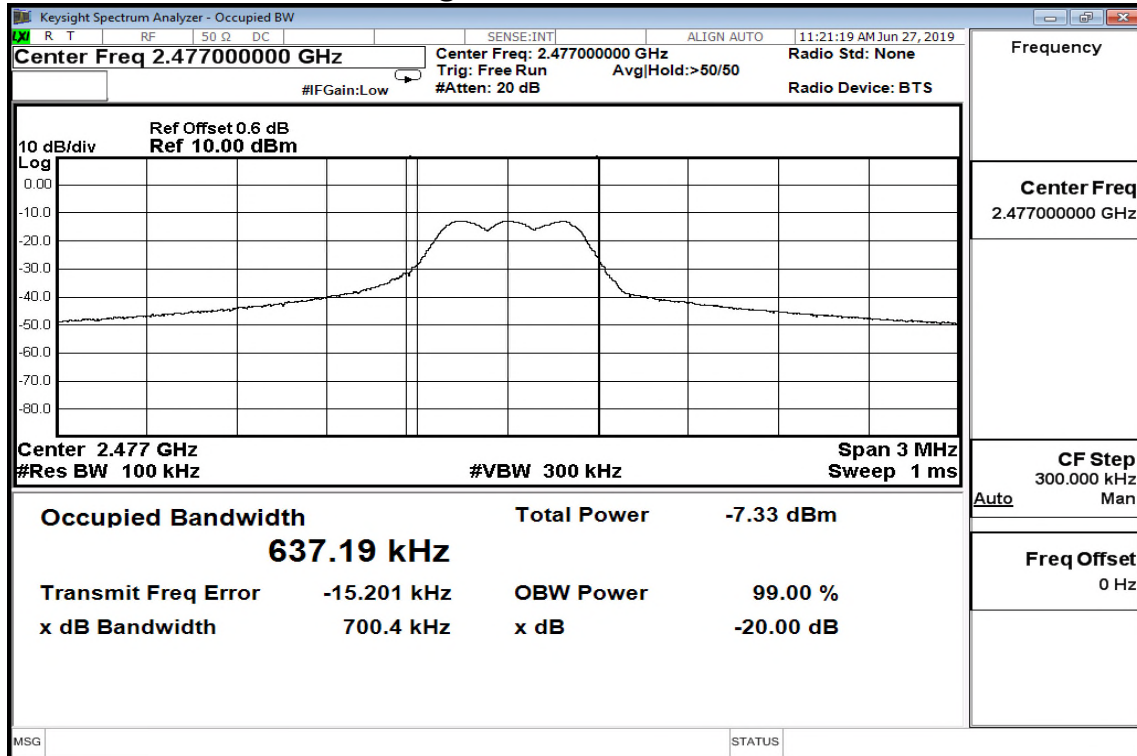


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20dB Bandwidth Test Plot CH High



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9 FREQUENCY STABILITY

9.1 Standard Applicable

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.001\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

9.2 Measurement Procedure

1. The EUT was placed inside temperature chamber and powered and powered by nominal DC voltage.
2. Set EUT as normal operation.
3. Turn the EUT on and couple its output to spectrum.
4. Turn the EUT off and set the chamber to the highest temperature specified.
5. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT and measure the operating frequency.
6. Repeat step with the temperature chamber set to the lowest temperature.

9.3 Measurement Equipment Used:

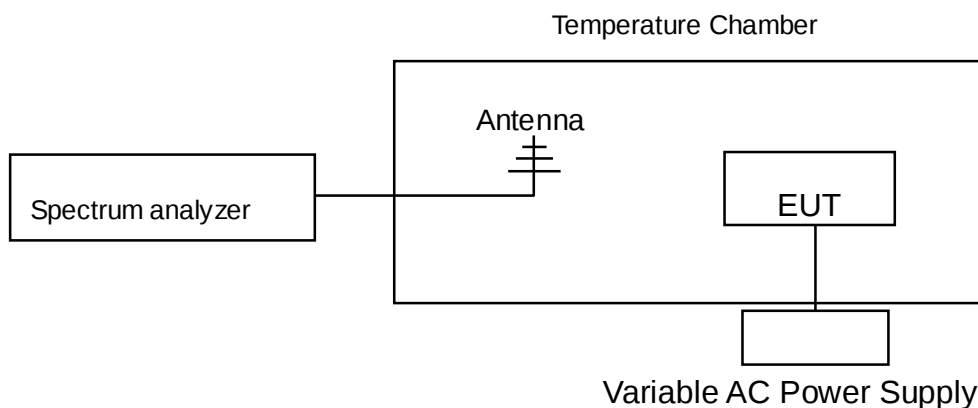
Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY53400256	11/21/2018	11/20/2019
DC Block	PASTERNAK	PE8210	RF256	02/26/2019	02/25/2020
DC Power Supply	Agilent	E3640A	MY53130054	09/03/2018	09/02/2019
Attenuator	Marvelous	MVE2213-10	RF80	02/26/2019	02/25/2020
Thermostat-ic/Hrgrosatic Chamber	TAICHY	MHG-150LF	930619	10/08/2018	10/07/2019

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9.4 Test SET-UP (Block Diagram of Configuration)



9.5 Measurement Results:

2404 MHz

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
4.25	20	2403.99707	0.02000	+/- 240.4
5.75	20	2403.99704	0.05000	+/- 240.4
5	20	2403.99709	0.00000	+/- 240.4
5	-20	2403.99706	0.03000	+/- 240.4
5	50	2403.99715	-0.06000	+/- 240.4

2442 MHz

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
4.25	20	2441.99682	-0.68000	+/- 244.2
5.75	20	2441.99764	-1.50000	+/- 244.2
5	20	2441.99614	0.00000	+/- 244.2
5	-20	2441.99716	-1.02000	+/- 244.2
5	50	2441.99635	-0.21000	+/- 244.2

2477 MHz

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
4.25	20	2476.99635	0.07000	+/- 247.7
5.75	20	2476.9973	-0.88000	+/- 247.7
5	20	2476.99642	0.00000	+/- 247.7
5	-20	2476.99674	-0.32000	+/- 247.7
5	50	2476.99658	-0.16000	+/- 247.7

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10 ANTENNA REQUIREMENT

10.1 Standard Applicable:

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

In case of point-to-point operation, the power shall be reduced by the one dB for every 3 dB that the directional gain of antenna exceeds 6dBi.

10.2 Antenna Connected Construction:

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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