

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Applicant: HTC Corporation
No. 88, Section 3, Zhongxing Road, Xindian District, New Taipei
City 231, Taiwan

Product Name: Vive headset

Brand Name: VIVE

Model No.: 2Q29100

Model Difference: N/A

FCC ID: NM82Q29100

Report Number: ER/2017/A0078

FCC Rule Part: §15.249

Issue Date: Nov. 16, 2017

Date of Test: Oct. 13, 2017~ Nov. 09, 2017


Date of EUT Received: Oct. 13, 2017

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

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

Prepared By:



Stefanie Yu / Clerk

Approved By:



Jim Chang / Asst. Manager



Testing Laboratory

0513

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Revision History

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ER/2017/A0078	Rev.00	Initial creation of document	Nov. 16, 2017

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1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	Vive headset	
Brand Name:	VIVE	
Model No.:	2Q29100	
Model Difference:	N/A	
Product HW version:	DVT	
Product SW version:	N/A	
All in 1 Cable	Model No.: N/A, Supplier: HTC	
DP Cable	Model No.: MG 1M-DP-C, Supplier: HTC	
USB Cable	Model No.: MG 1M-U3-C, Supplier: HTC	
Base Station	Model No.: 1004, Supplier: VALVE CORPORATION	
Power Supply:	12Vdc by AC/DC Power Adapter	
	Adapter:	1. Model No.: TC NE30W-EU, Supplier: HTC 2. Model No.: TC NE30W-UK, Supplier: HTC 3. Model No.: TC NE30W-US, Supplier: HTC
Antenna Designation:	PIFA Antenna, Ant 1 – Peak Gain: 2.66dBi Ant 2 – Peak Gain: -0.48dBi	

2.4GHz

Transmit Power	95.07dBuV/m (Peak)
Operation Frequency:	2402~2480MHz
Channel number:	79 channels
Channel space:	1MHz
Modulation Type:	FSK

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.249

ANSI C63.10:2013

Note:

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

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803 (TAF code 0513)

FCC Registration Number and Designation are: 509634 / TW0001

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 a placed on as turn table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz,. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50uH 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 Radiated Emissions

The EUT is a placed on as turn table. For emissions testing at or below 1 GHz, the table height shall be 80 cm 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.

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.

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2.5 Limitation

(1) Conducted Emission

Conducted Emission Limits is as following.

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 – 0.5	66 - 56	56 - 46
0.5 – 5	56	46
5 - 30	60	50

(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 $\mu\text{V}/\text{m}$	Distance (m)	Field strength at 3m $\text{dB}\mu\text{V}/\text{m}$
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 $\text{dB}\mu\text{V}/\text{m}=20 \log (\mu\text{V}/\text{m})$
 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 $\xi 15.205$ and RSS-Gen $\xi 8.10$
 4. Emission spurious frequency which appearing within the Restricted Bands specified in provision of $\xi 15.205$ and RSS-Gen $\xi 8.10$, then the general radiated emission limits in $\xi 15.209$ and RSS-Gen $\xi 8.9$ apply.

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2.6 Configuration of Tested System

Fig. 2-1 Radiated Emission Configuration

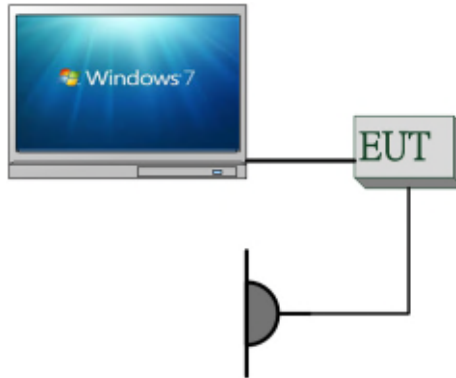


Fig. 2-2 Conducted (Antenna Port) Configuration



Fig. 2-3 AC Power Line Conducted Emission

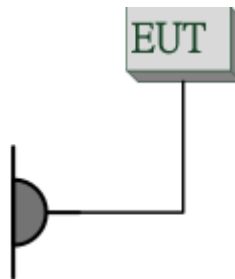


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	2.4GHz Wireless Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L430	R9-YYG88	Shielded	Unshielded

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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)(d)(e)	Radiated Emission	Compliant
§15.215(c)	20dB bandwidth Measurement	Compliant

4 DESCRIPTION OF TEST MODES

4.1 Operated in 2402 ~ 2480MHz Band

79 channels are provided.

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	---	21	2421MHz	41	2441MHz	61	2461MHz
2	2402MHz	22	2422MHz	42	2442MHz	62	2462MHz
3	2403MHz	23	2423MHz	43	2443MHz	63	2463MHz
4	2404MHz	24	2424MHz	44	2444MHz	64	2464MHz
5	2405MHz	25	2425MHz	45	2445MHz	65	2465MHz
6	2406MHz	26	2426MHz	46	2446MHz	66	2466MHz
7	2407MHz	27	2427MHz	47	2447MHz	67	2467MHz
8	2408MHz	28	2428MHz	48	2448MHz	68	2468MHz
9	2409MHz	29	2429MHz	49	2449MHz	69	2469MHz
10	2410MHz	30	2430MHz	50	2450MHz	70	2470MHz
11	2411MHz	31	2431MHz	51	2451MHz	71	2471MHz
12	2412MHz	32	2432MHz	52	2452MHz	72	2472MHz
13	2413MHz	33	2433MHz	53	2453MHz	73	2473MHz
14	2414MHz	34	2434MHz	54	2454MHz	74	2474MHz
15	2415MHz	35	2435MHz	55	2455MHz	75	2475MHz
16	2416MHz	36	2436MHz	56	2456MHz	76	2476MHz
17	2417MHz	37	2437MHz	57	2457MHz	77	2477MHz
18	2418MHz	38	2438MHz	58	2458MHz	78	2478MHz
19	2419MHz	39	2439MHz	59	2459MHz	79	2479MHz
20	2420MHz	40	2440MHz	60	2460MHz	80	2480MHz

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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 CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
2.4G	2 to 80	2,40,80	FSK	2	MAIN
RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
2.4G	2 to 80	2,40,80	FSK	2	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 Bluetooth LE Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
2.4G	2 to 80	2,40,80	FSK	2	MAIN

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
20dB & 99% Bandwidth	+/- 51.33 Hz
100 kHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : Horizontal)	9kHz – 30MHz: +/- 2.87 dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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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(uV)	
	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

- The lower limit shall apply at the transition frequencies
- 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.
EMI Test Receiver	R&S	ESC17	100760	05/11/2017	05/10/2018
LISN	SCHWARZBECK	NSLK 8127	8127-649	05/22/2017	05/21/2018
LISN	MESS TEC	FCC-LISN-50/2 50-25-2-01	4034	03/19/2017	03/18/2018
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2016	11/25/2017

6.3 EUT Setup:

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

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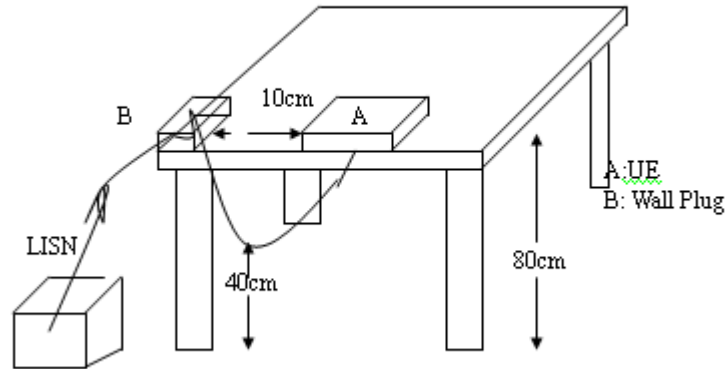
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6.4 Test SET-UP (Block Diagram of Configuration)



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:

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

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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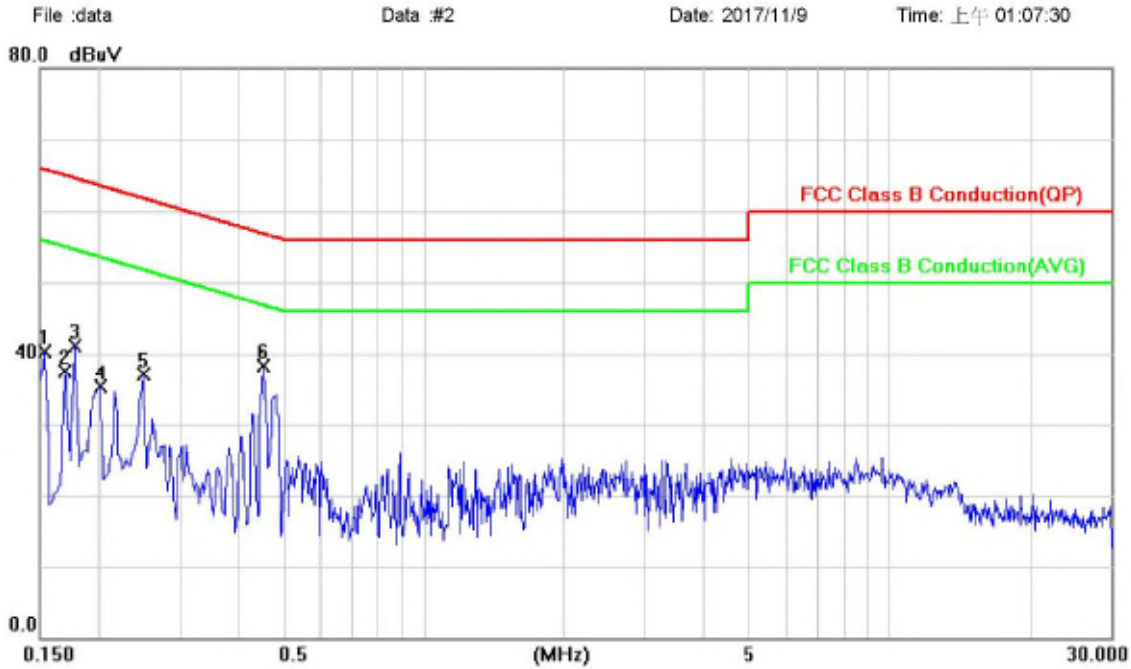
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Site: Conduction Room	Phase: L1	Temperature: 20 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 58 %
Mode: Operation		
Note: Adapter:TC NE18W-US		

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1540	40.29	0.00	40.29	65.78	-25.49	peak	
2		0.1700	37.55	0.00	37.55	64.96	-27.41	peak	
3		0.1780	41.20	0.00	41.20	64.58	-23.38	peak	
4		0.2020	35.33	0.00	35.33	63.53	-28.20	peak	
5		0.2500	37.07	0.00	37.07	61.76	-24.69	peak	
6 *		0.4540	38.29	0.00	38.29	56.80	-18.51	peak	

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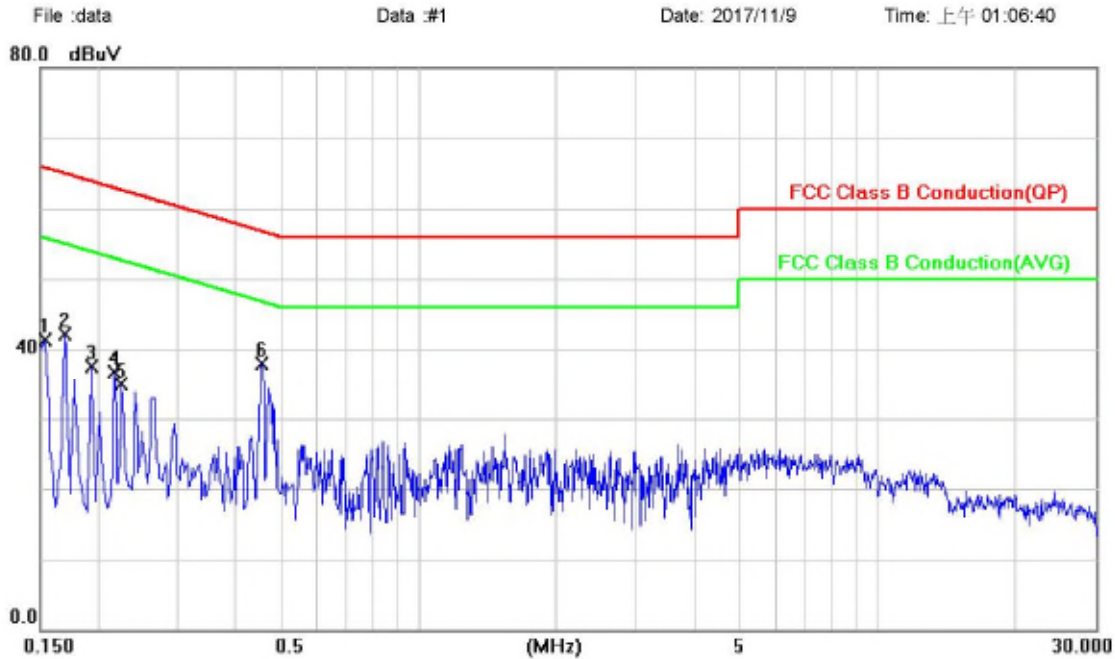
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Site Conduction Room	Phase: N	Temperature: 20 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 58 %
Mode: Operation		
Note: Adapter:TC NE18W-US		

Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1540	41.39	0.00	41.39	65.78	-24.39	peak	
2		0.1700	42.05	0.00	42.05	64.96	-22.91	peak	
3		0.1940	37.41	0.00	37.41	63.86	-26.45	peak	
4		0.2180	36.79	0.00	36.79	62.89	-26.10	peak	
5		0.2260	34.95	0.00	34.95	62.60	-27.65	peak	
6 *		0.4580	37.87	0.00	37.87	56.73	-18.86	peak	

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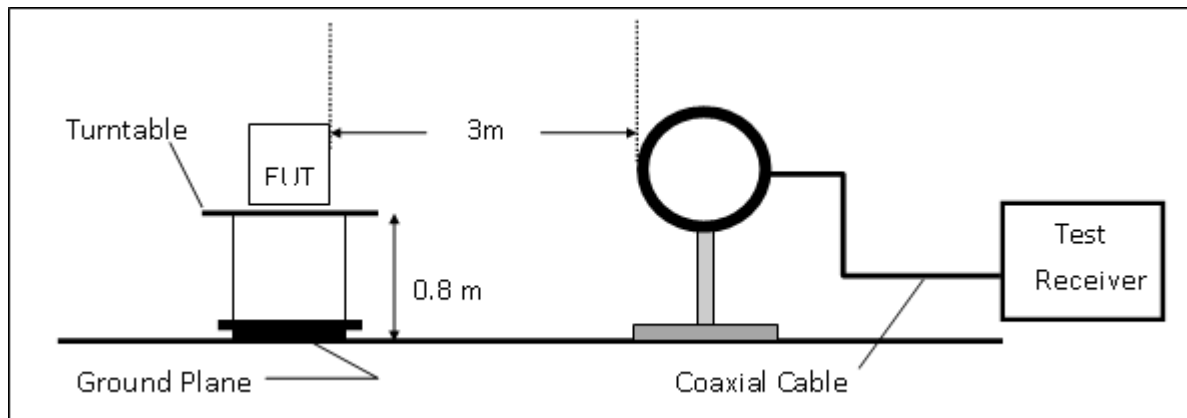
7 Radiated Emission Test

7.1. Measurement Procedure

1. The EUT was placed on a turntable 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.

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

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



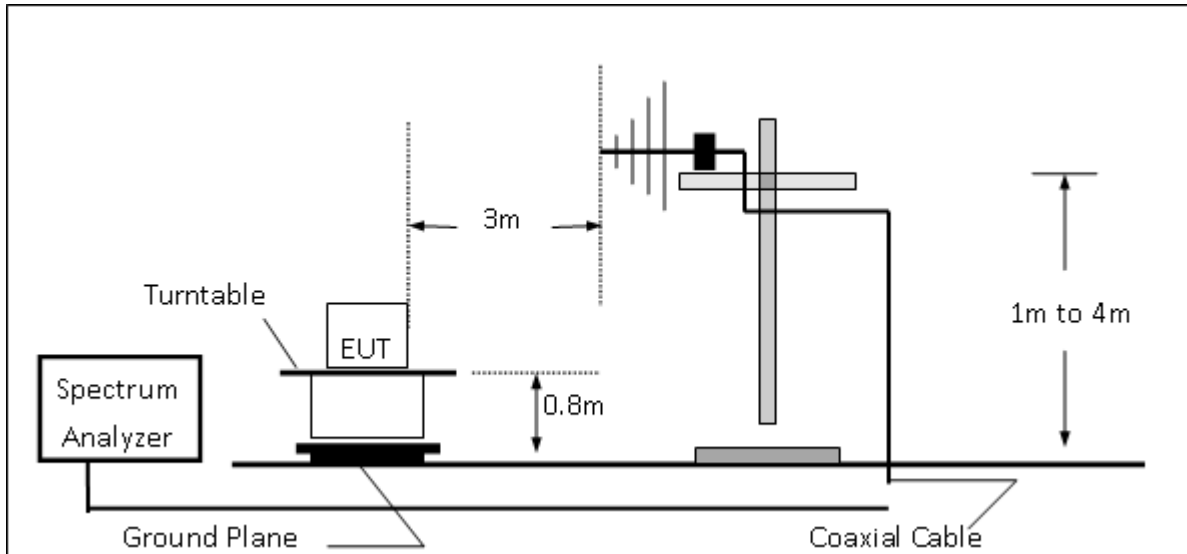
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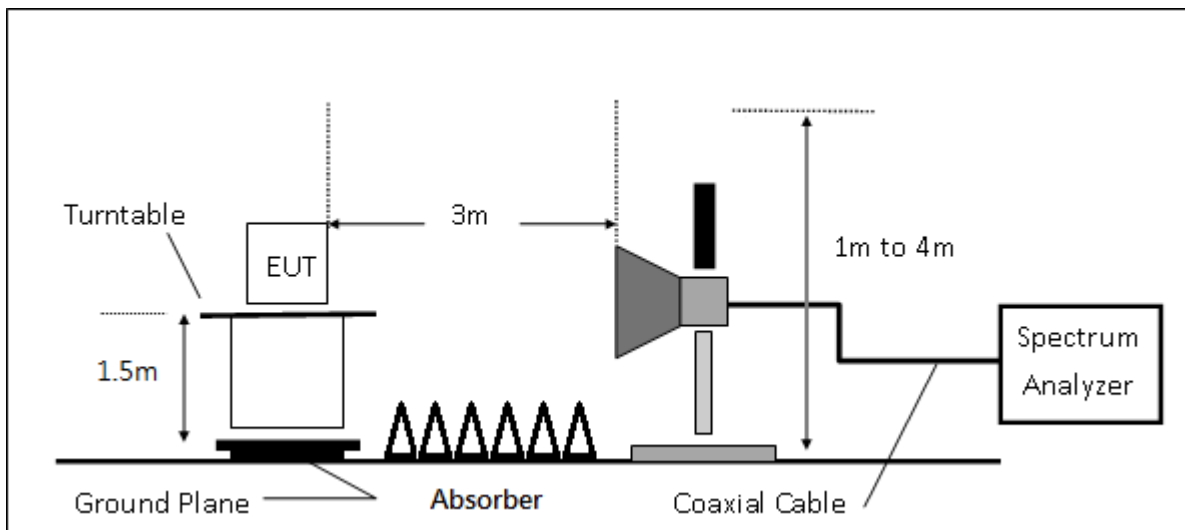
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(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



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



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7.3. Measurement Equipment Used:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100760	05/11/2017	05/10/2018
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/25/2017	04/24/2018
Loop Antenna	ETS-Lindgren	6502	148045	09/20/2017	09/19/2018
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/19/2016	12/18/2017
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/04/2017	08/03/2018
Pre-Amplifier	Agilent	8447D	2944A07676	01/03/2017	01/02/2018
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/03/2017	01/02/2018
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_RX	9	01/05/2017	01/04/2018
3m Site NSA	SGS	966 chamber	N/A	07/01/2017	06/30/2018
Low Loss Cable	Huber Suhner	966 TX	1	01/05/2017	01/04/2018
Horn Antenna	Schwarzbeck	BBHA9170	184	12/12/2016	12/11/2017
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/05/2017	01/04/2018

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

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7.4. 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(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

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

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.
“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

7.5. Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

7.6. Measurement Result

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

Note: There is a comparison data of both open-field test site and semi-Anechoic, and test result came out very similar.

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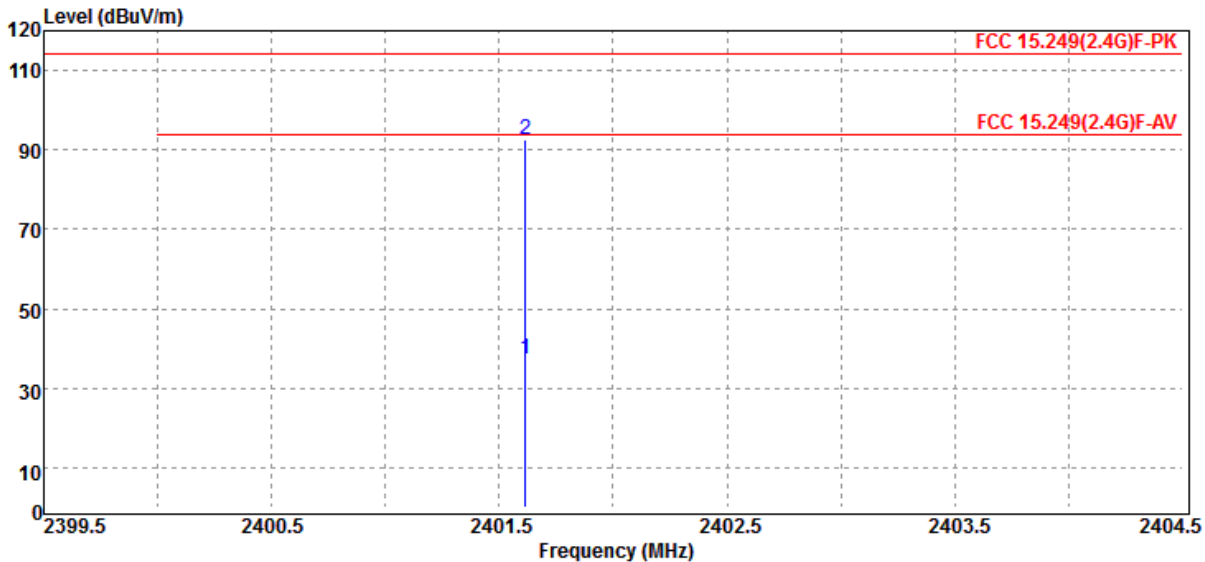
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Radiated Spurious Emission Measurement Result (MAIN)

Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Main CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
2401.62	F	Average	39.19	-1.77	37.42	94.00	-56.58
2401.62	F	Peak	94.24	-1.77	92.47	114.00	-21.53

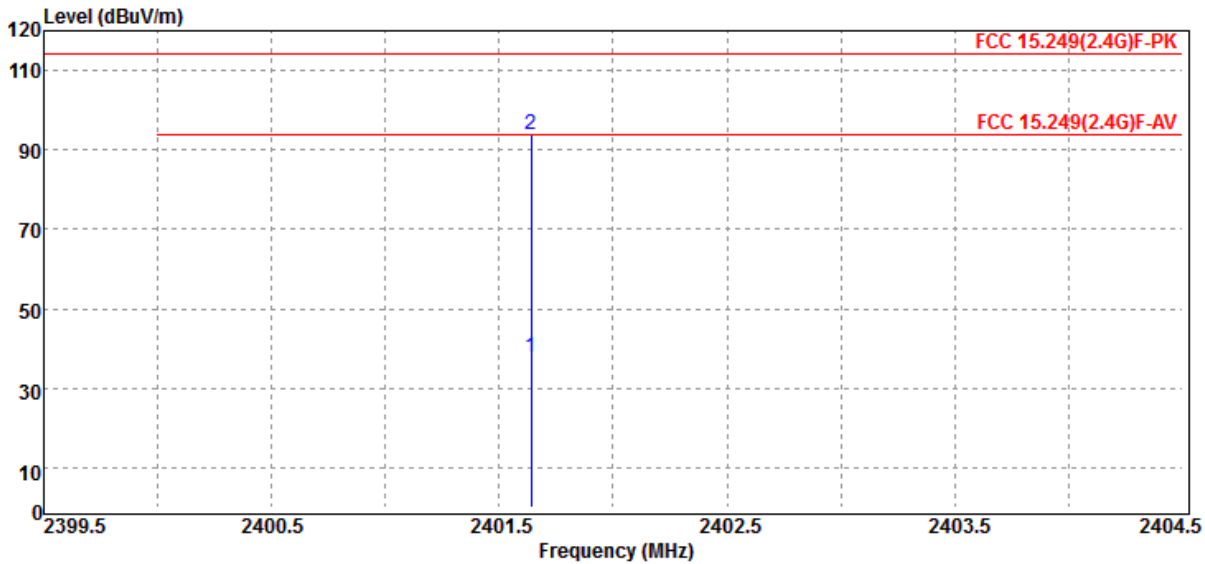
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Main CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
2401.64	F	Average	39.53	-1.77	37.76	94.00	-56.24
2401.64	F	Peak	95.68	-1.77	93.91	114.00	-20.09

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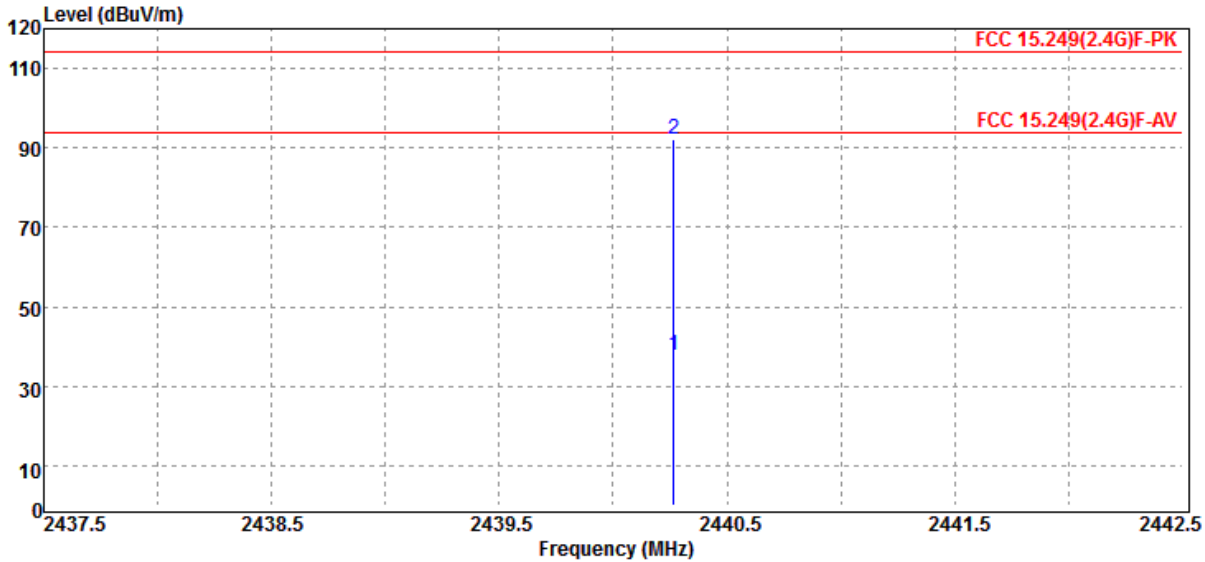
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2440 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Main CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
2440.27	F	Average	39.33	-1.66	37.67	94.00	-56.33
2440.27	F	Peak	93.91	-1.66	92.25	114.00	-21.75

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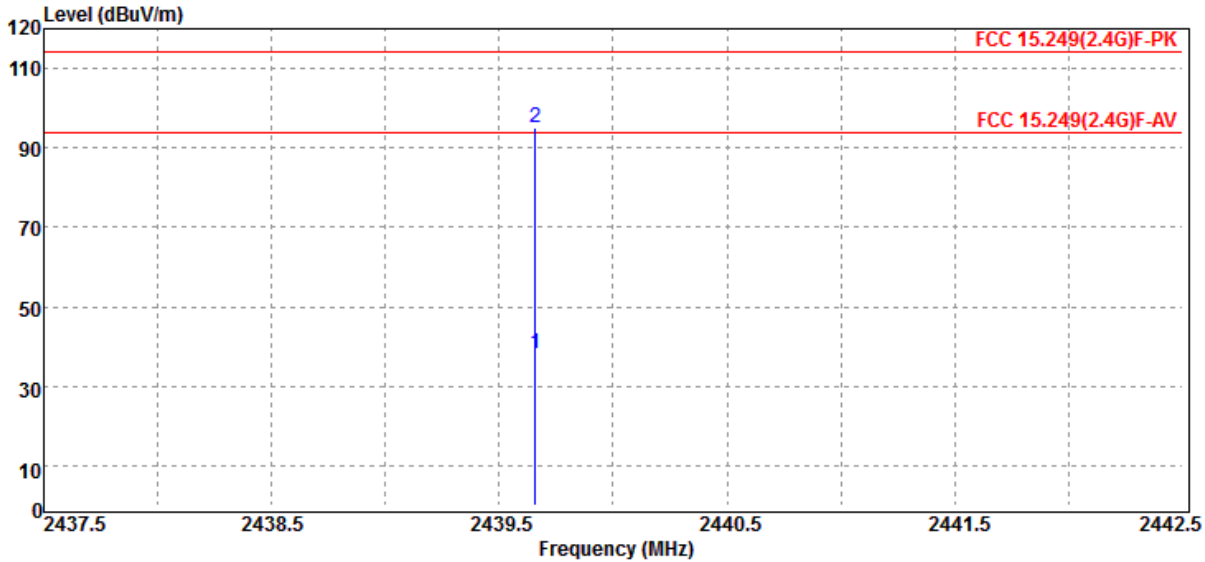
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2440 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Main CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
2439.66	F	Average	39.87	-1.67	38.20	94.00	-55.80
2439.66	F	Peak	96.74	-1.67	95.07	114.00	-18.93

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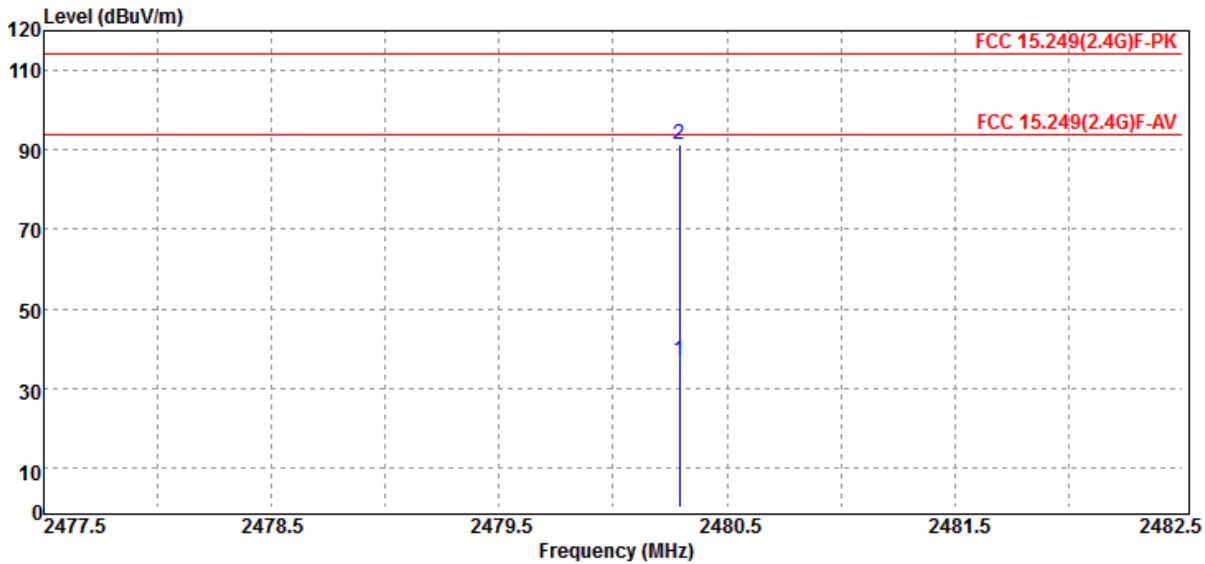
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2480 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Main CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
2480.29	F	Average	38.76	-1.61	37.15	94.00	-56.85
2480.29	F	Peak	93.01	-1.61	91.40	114.00	-22.60

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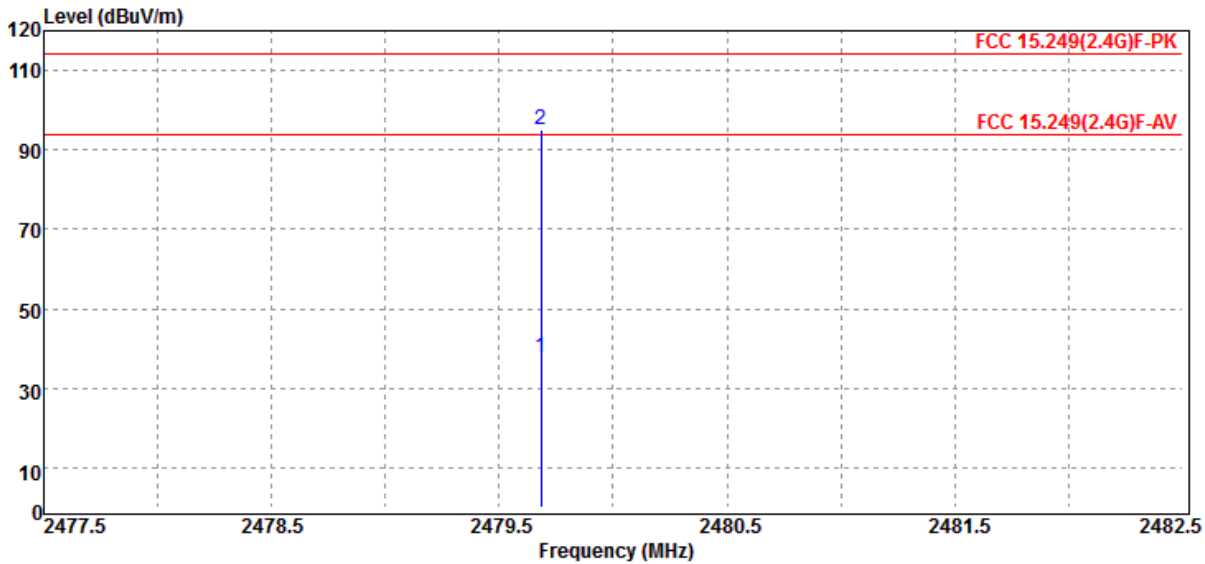
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2480 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Main CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
2479.69	F	Average	39.50	-1.62	37.88	94.00	-56.12
2479.69	F	Peak	96.54	-1.62	94.92	114.00	-19.08

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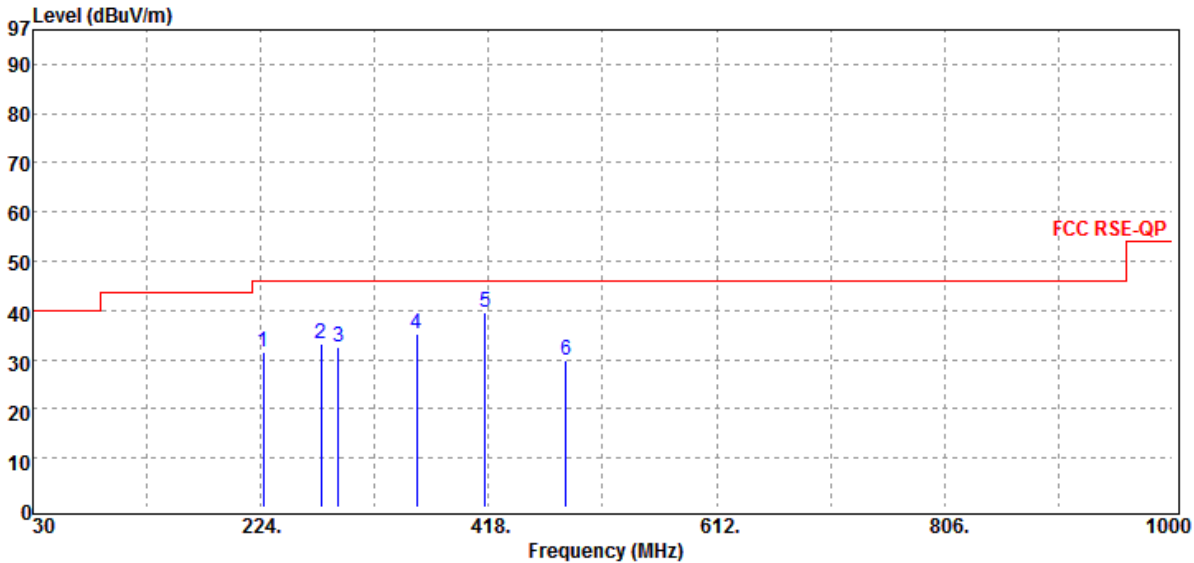
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Radiated Spurious Emission Measurement Result

Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 51 RH
Operation Mode	:TX CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
225.94	S	Peak	42.17	-10.69	31.48	46.00	-14.52
275.41	S	Peak	41.65	-8.39	33.26	46.00	-12.74
289.96	S	Peak	40.53	-7.87	32.66	46.00	-13.34
356.89	S	Peak	41.92	-6.82	35.10	46.00	-10.90
415.09	S	Peak	45.21	-5.73	39.48	46.00	-6.52
483.96	S	Peak	34.69	-4.75	29.94	46.00	-16.06

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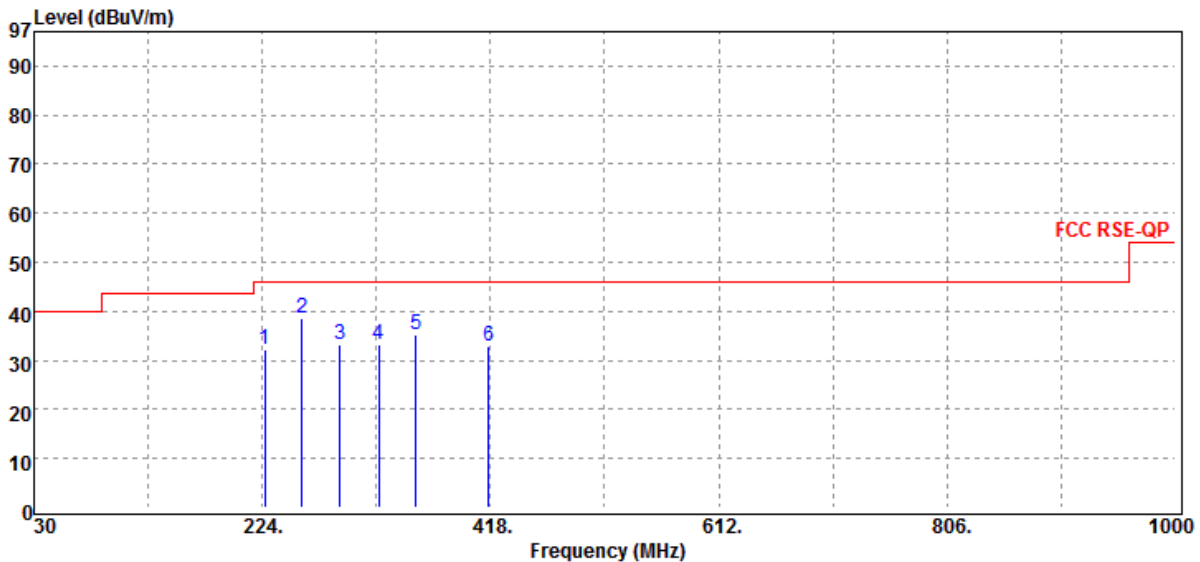
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 51 RH
Operation Mode	:TX CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
225.94	S	Peak	43.02	-10.69	32.33	46.00	-13.67
257.95	S	Peak	47.54	-9.02	38.52	46.00	-7.48
289.96	S	Peak	41.26	-7.87	33.39	46.00	-12.61
322.94	S	Peak	40.59	-7.31	33.28	46.00	-12.72
354.95	S	Peak	42.01	-6.84	35.17	46.00	-10.83
416.06	S	Peak	38.65	-5.73	32.92	46.00	-13.08

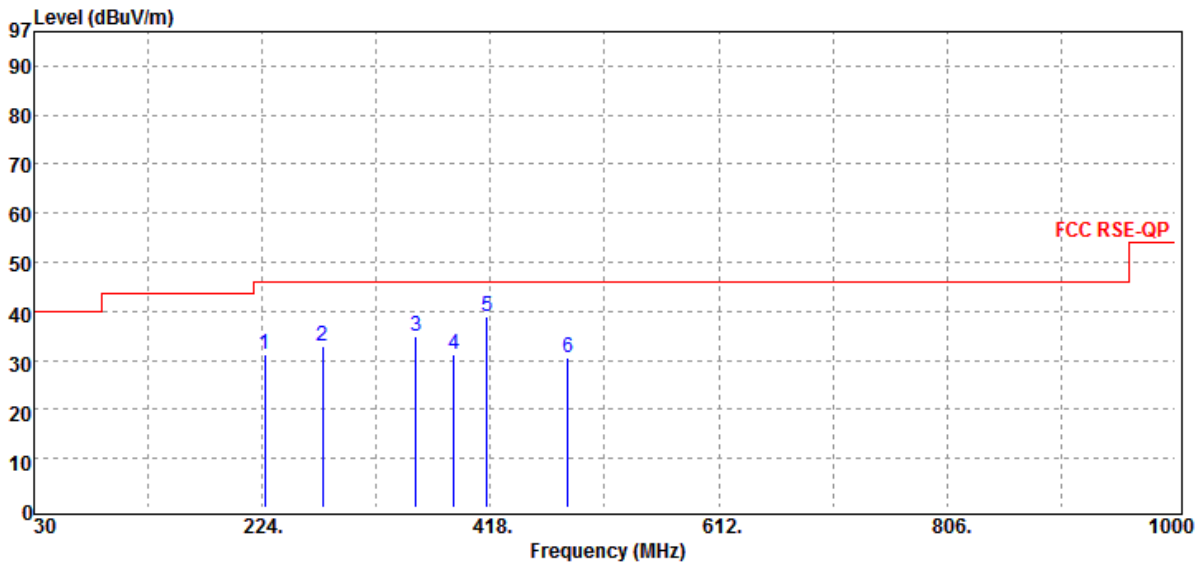
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2440 MHz	Temp./Humi.	:21 deg_C / 51 RH
Operation Mode	:TX CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
225.94	S	Peak	41.78	-10.69	31.09	46.00	-14.91
275.41	S	Peak	41.26	-8.39	32.87	46.00	-13.13
354.95	S	Peak	41.75	-6.84	34.91	46.00	-11.09
386.96	S	Peak	37.37	-6.31	31.06	46.00	-14.94
415.09	S	Peak	44.55	-5.73	38.82	46.00	-7.18
483.96	S	Peak	35.41	-4.75	30.66	46.00	-15.34

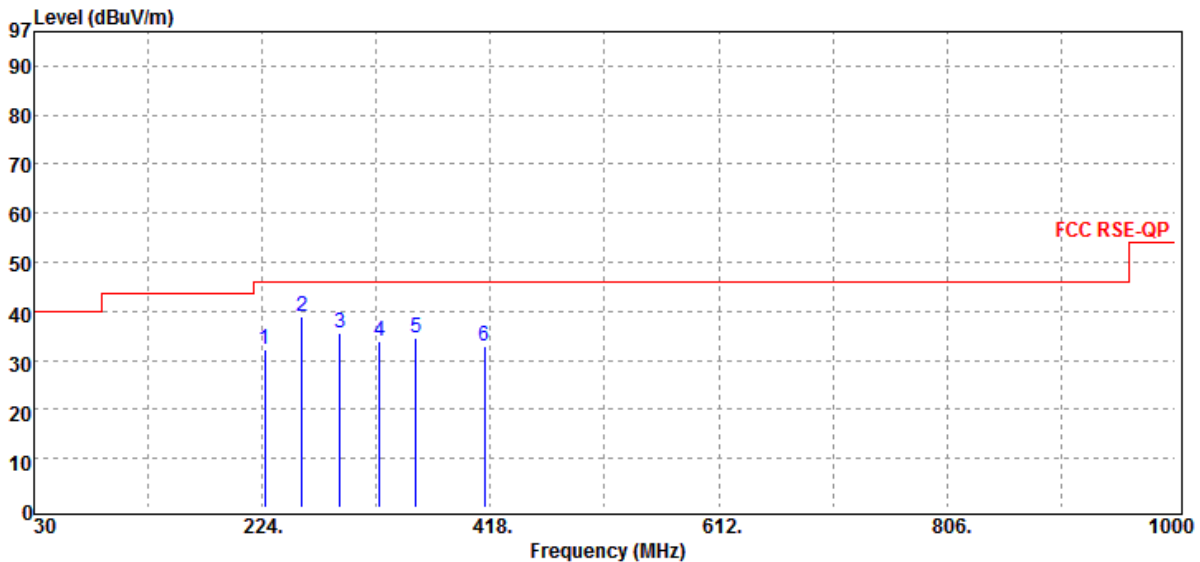
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2440 MHz	Temp./Humi.	:21 deg_C / 51 RH
Operation Mode	:TX CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
225.94	S	Peak	42.86	-10.69	32.17	46.00	-13.83
257.95	S	Peak	47.86	-9.02	38.84	46.00	-7.16
289.96	S	Peak	43.58	-7.87	35.71	46.00	-10.29
323.91	S	Peak	41.06	-7.31	33.75	46.00	-12.25
354.95	S	Peak	41.34	-6.84	34.50	46.00	-11.50
413.15	S	Peak	38.67	-5.74	32.93	46.00	-13.07

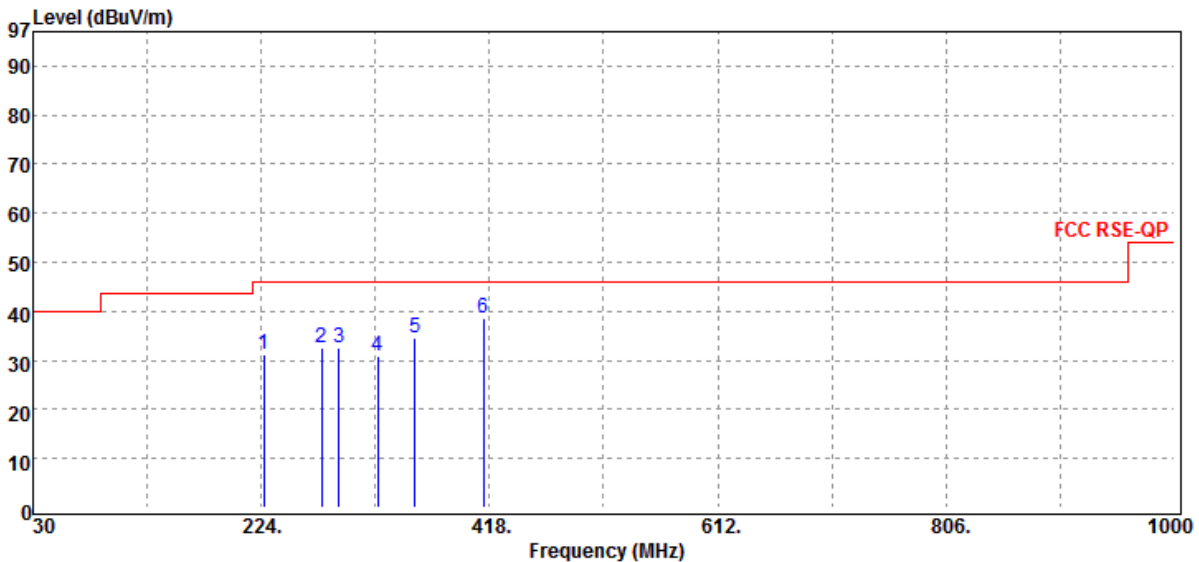
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 51 RH
Operation Mode	:TX CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
225.94	S	Peak	41.77	-10.69	31.08	46.00	-14.92
275.41	S	Peak	41.02	-8.39	32.63	46.00	-13.37
289.96	S	Peak	40.45	-7.87	32.58	46.00	-13.42
322.94	S	Peak	38.18	-7.31	30.87	46.00	-15.13
354.95	S	Peak	41.30	-6.84	34.46	46.00	-11.54
413.15	S	Peak	44.44	-5.74	38.70	46.00	-7.30

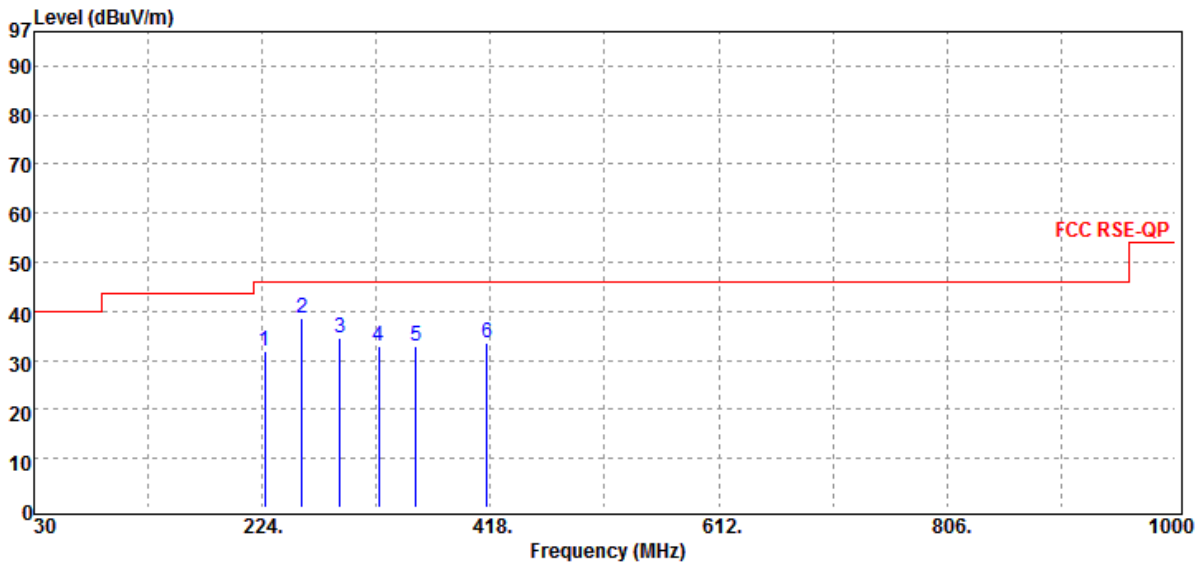
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 51 RH
Operation Mode	:TX CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level d μ V	Factor dB	Actual FS d μ V/m	Limit @3m d μ V/m	Margin dB
225.94	S	Peak	42.57	-10.69	31.88	46.00	-14.12
257.95	S	Peak	47.61	-9.02	38.59	46.00	-7.41
289.96	S	Peak	42.29	-7.87	34.42	46.00	-11.58
322.94	S	Peak	40.15	-7.31	32.84	46.00	-13.16
354.95	S	Peak	39.60	-6.84	32.76	46.00	-13.24
415.09	S	Peak	39.25	-5.73	33.52	46.00	-12.48

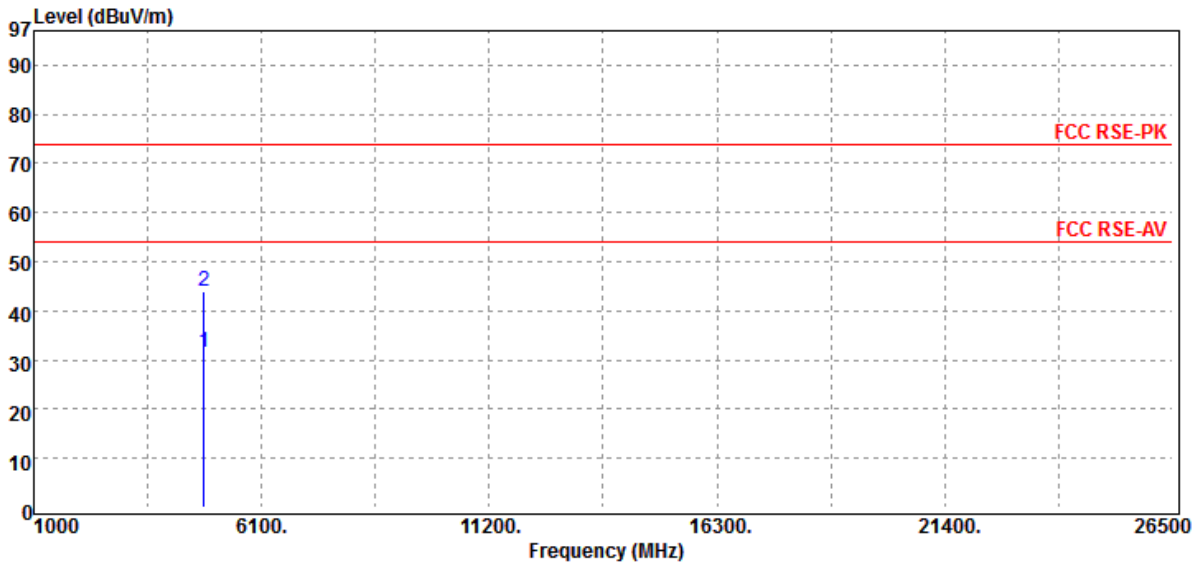
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
4804.00	H	Average	26.58	4.92	31.50	54.00	-22.50
4804.00	H	Peak	39.18	4.92	44.10	74.00	-29.90

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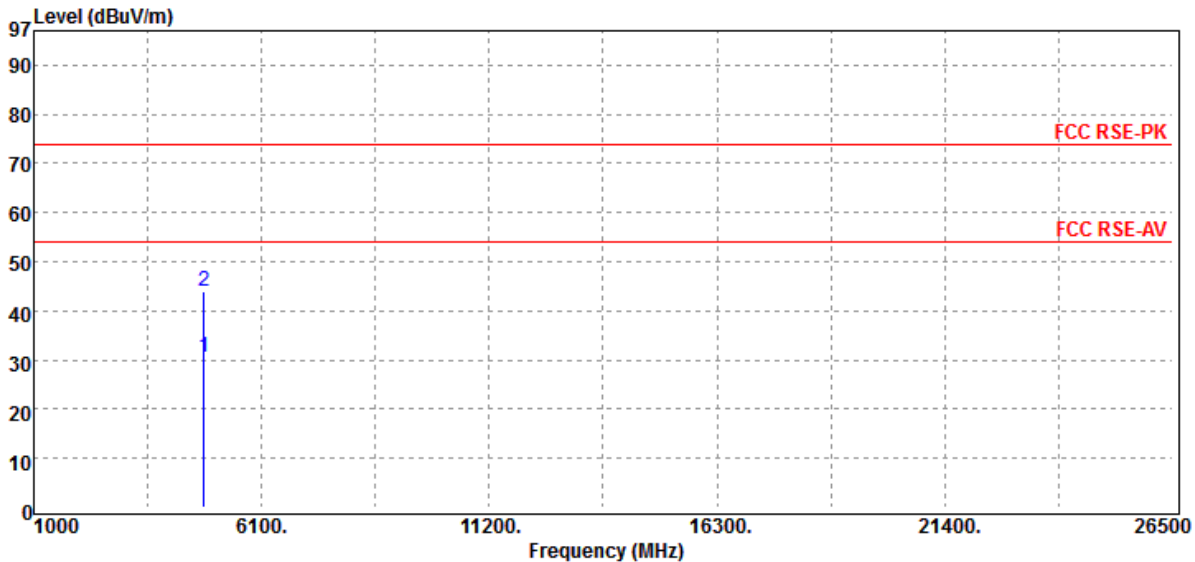
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2402 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Tx CH LOW	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
4804.00	H	Average	25.48	4.92	30.40	54.00	-23.60
4804.00	H	Peak	38.96	4.92	43.88	74.00	-30.12

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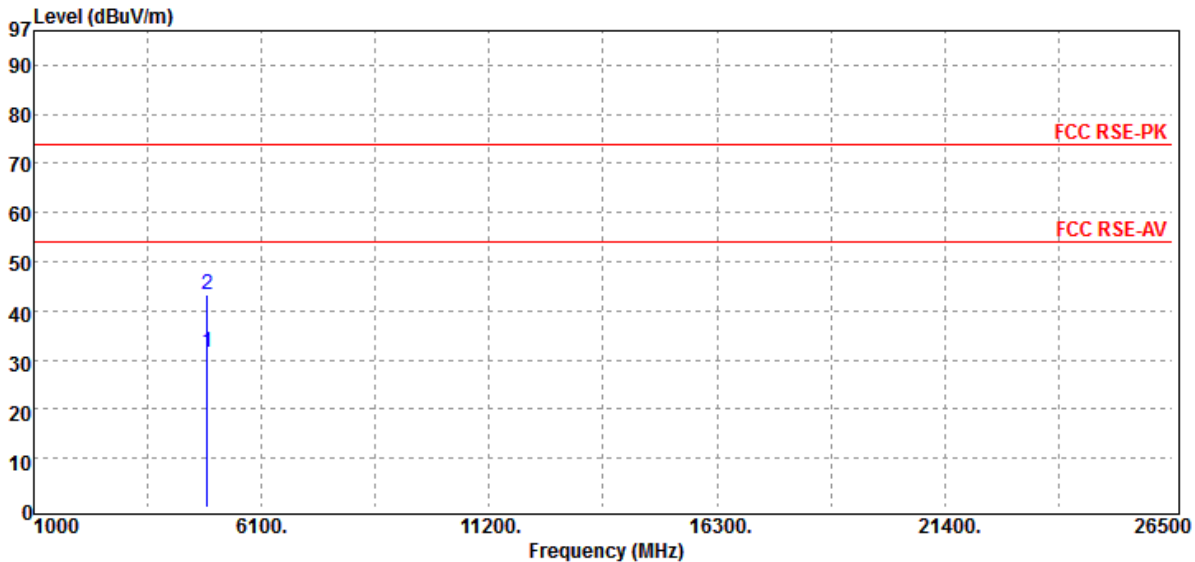
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2440 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Tx CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
4880.00	H	Average	26.43	5.17	31.60	54.00	-22.40
4880.00	H	Peak	38.11	5.17	43.28	74.00	-30.72

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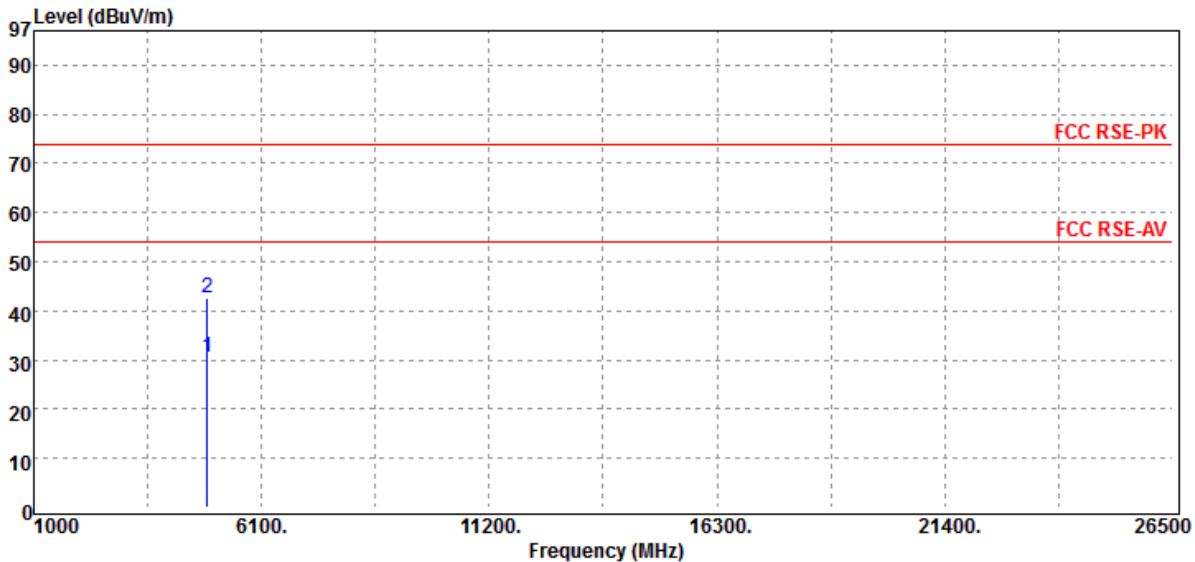
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2440 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Tx CH MID	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
4880.00	H	Average	25.21	5.17	30.38	54.00	-23.62
4880.00	H	Peak	37.40	5.17	42.57	74.00	-31.43

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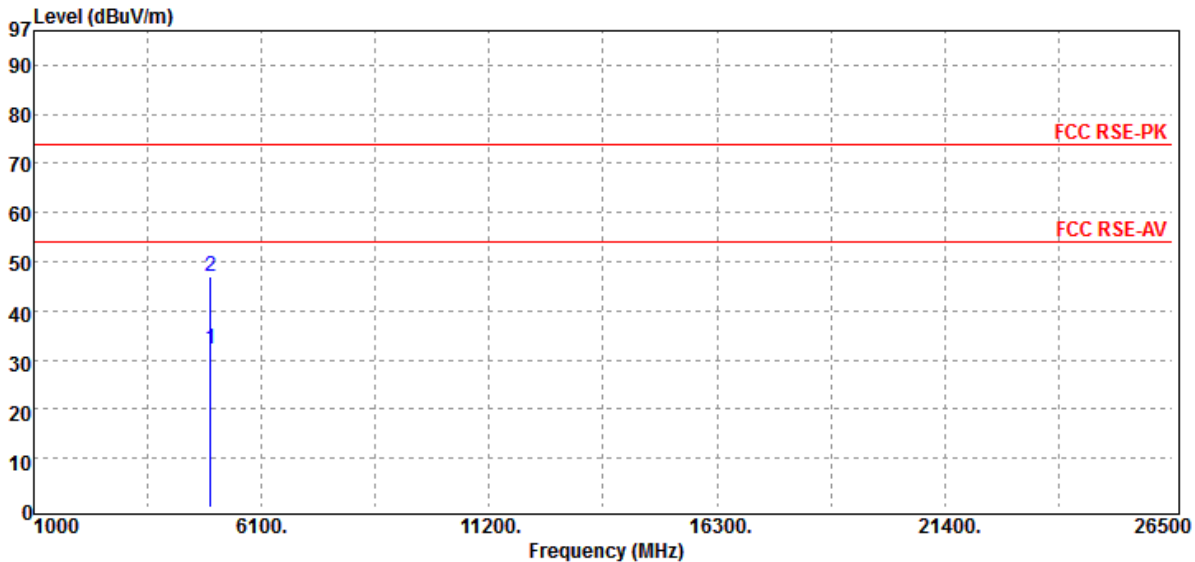
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2480 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
4960.00	H	Average	26.80	5.29	32.09	54.00	-21.91
4960.00	H	Peak	41.53	5.29	46.82	74.00	-27.18

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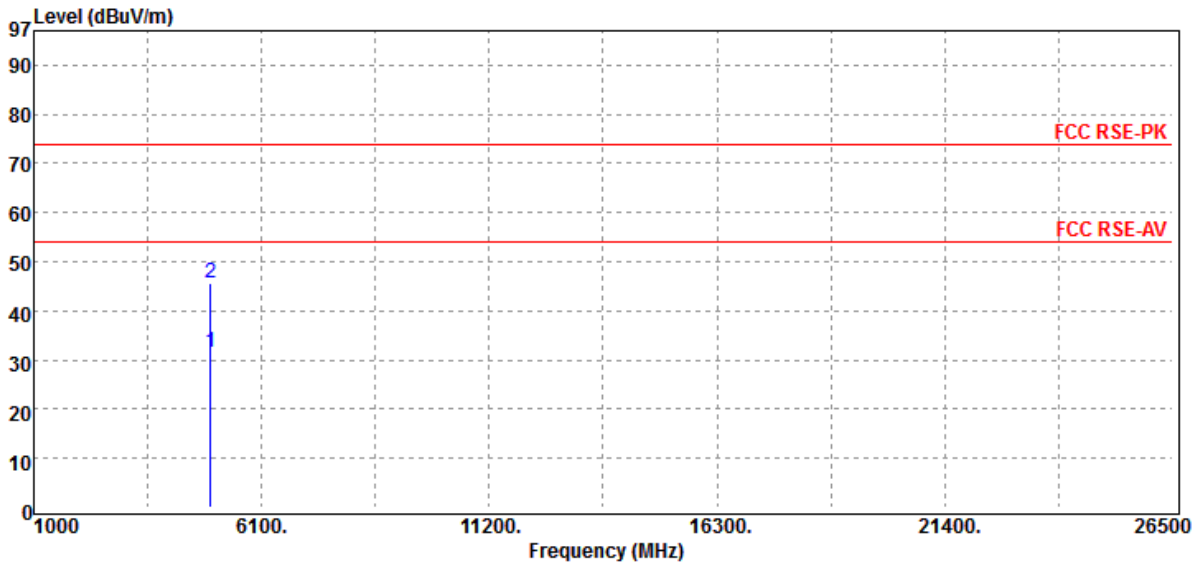
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Operation Band	:2.4G	Test Date	:2017-11-08
Fundamental Frequency	:2480 MHz	Temp./Humi.	:22 deg_C / 61 RH
Operation Mode	:Tx CH HIGH	Engineer	:Kane
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:HORIZONTAL



Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Safe Margin dB
4960.00	H	Average	26.27	5.29	31.56	54.00	-22.44
4960.00	H	Peak	40.33	5.29	45.62	74.00	-28.38

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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 = 5MHz.
4. Set SPA Max hold. Mark peak, -20dB.

8.2 Test SET-UP (Block Diagram of Configuration)

Refer to section 7.2 for the plot.

8.3 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	03/21/2017	03/20/2018
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2017	01/04/2018
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2017	01/04/2018

8.4 Measurement Results:

Frequency (MHz)	20dB Bandwidth (kHz)
2402	2140
2440	2070
2480	2073

Refer to attached data chart.

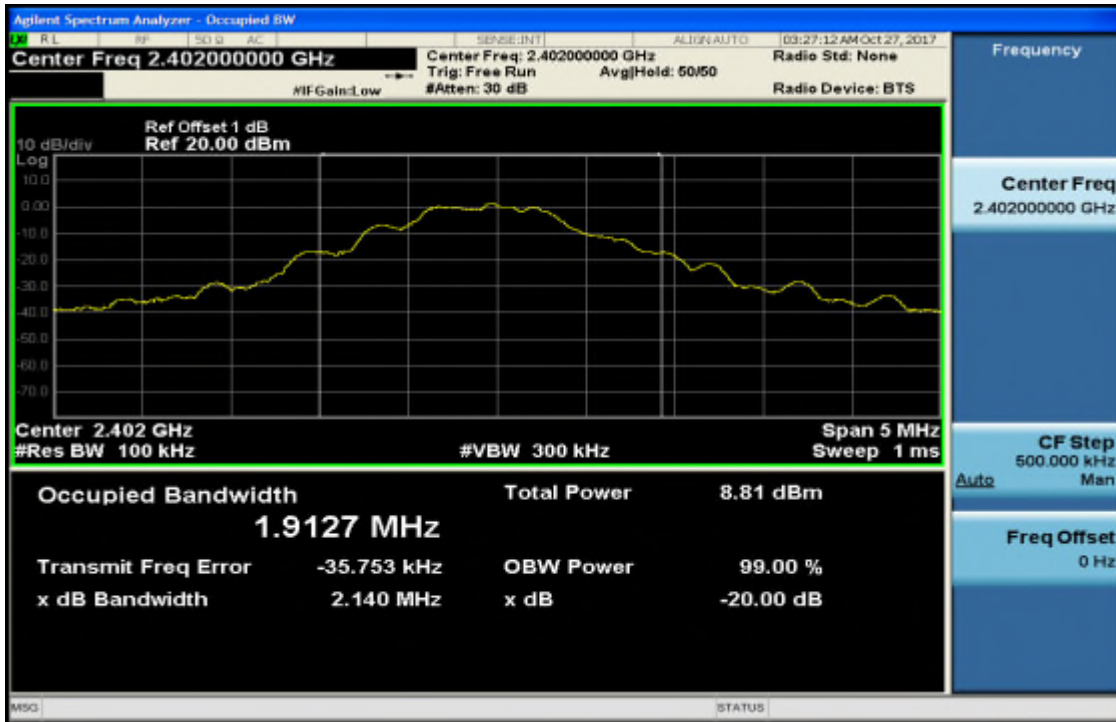
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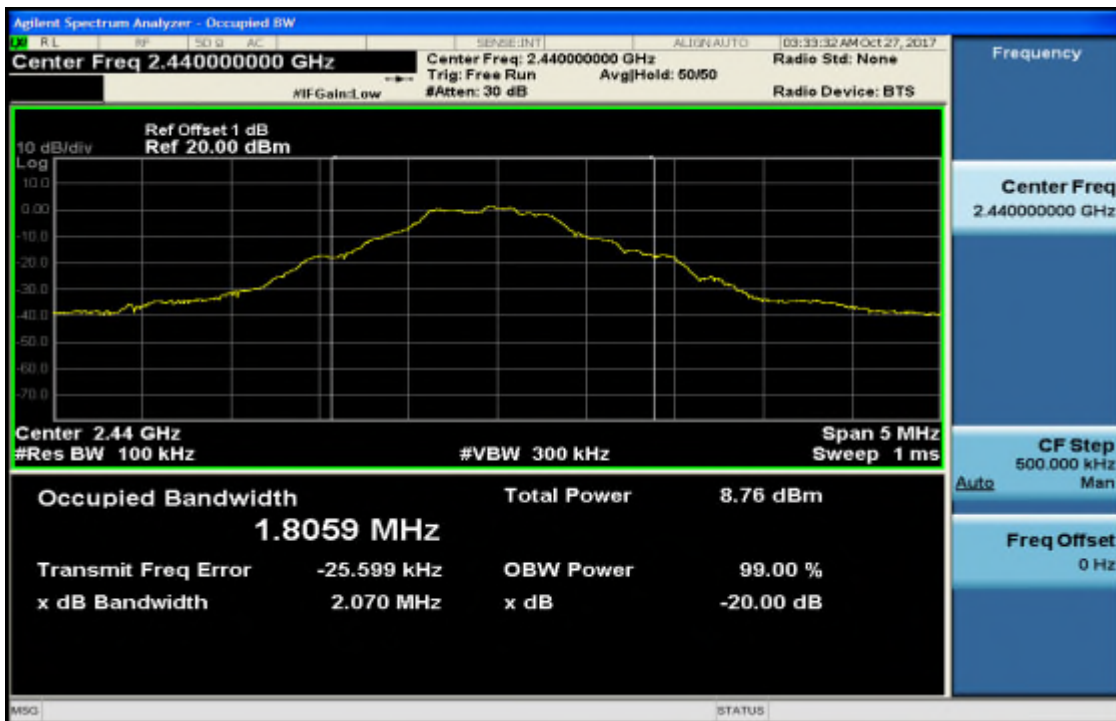
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2402MHz



2440MHz



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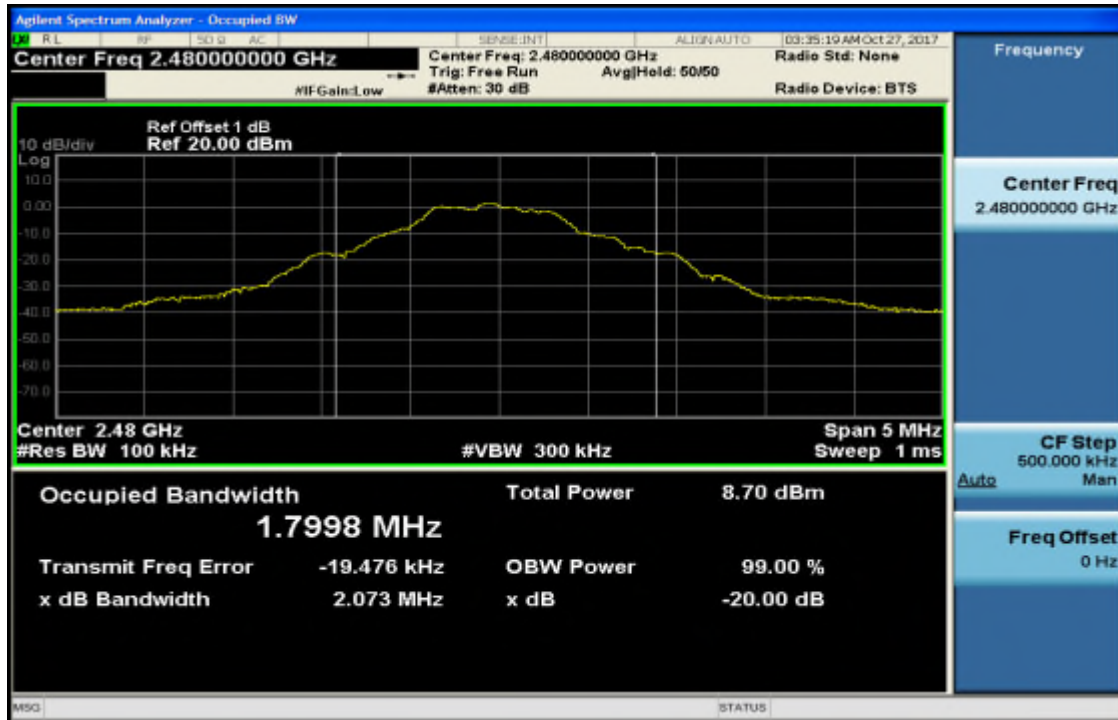
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2480MHz



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9 Antenna Requirement

9.1 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.

I

9.2 Antenna Connected Construction:

embedded-in antenna design is used.

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

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PHOTOGRAPHS OF SET UP

Radiated Emission Set up Photos (Below 30MHz)



Radiated Emission Set up Photos (Below 1GHz)



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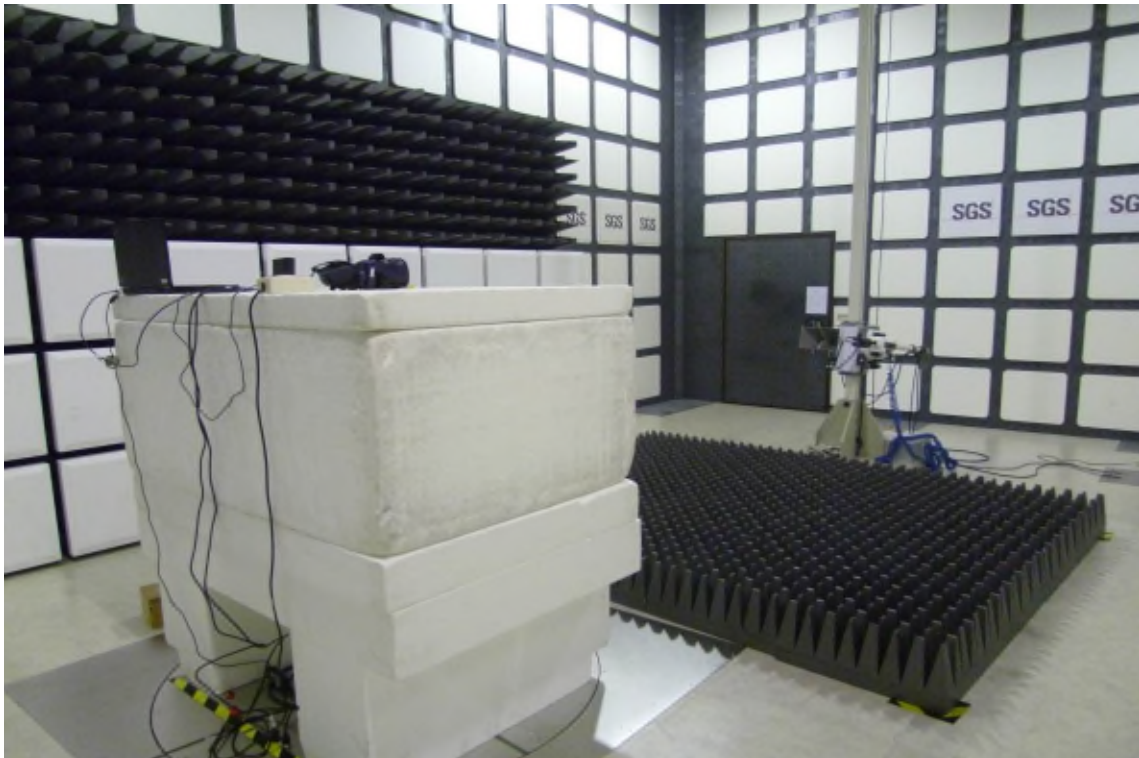
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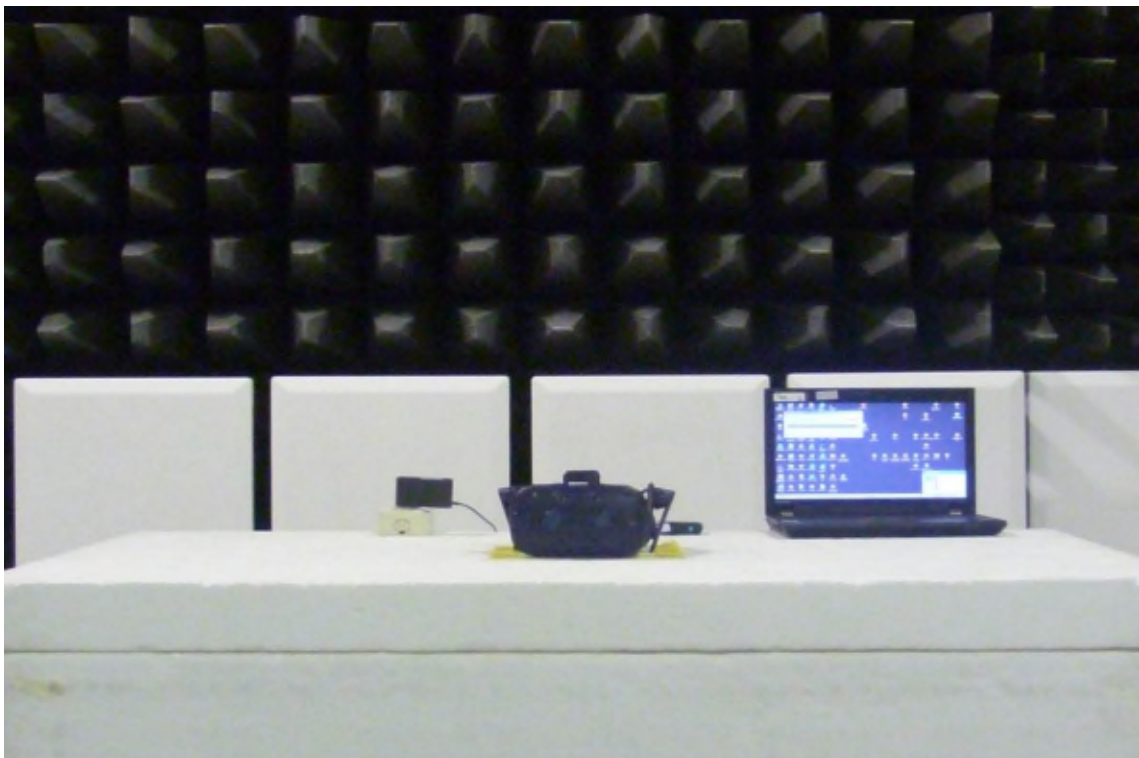
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Radiated Emission Set up Photos (Above 1GHz)



Radiated Emission Set up Photos (Front View)



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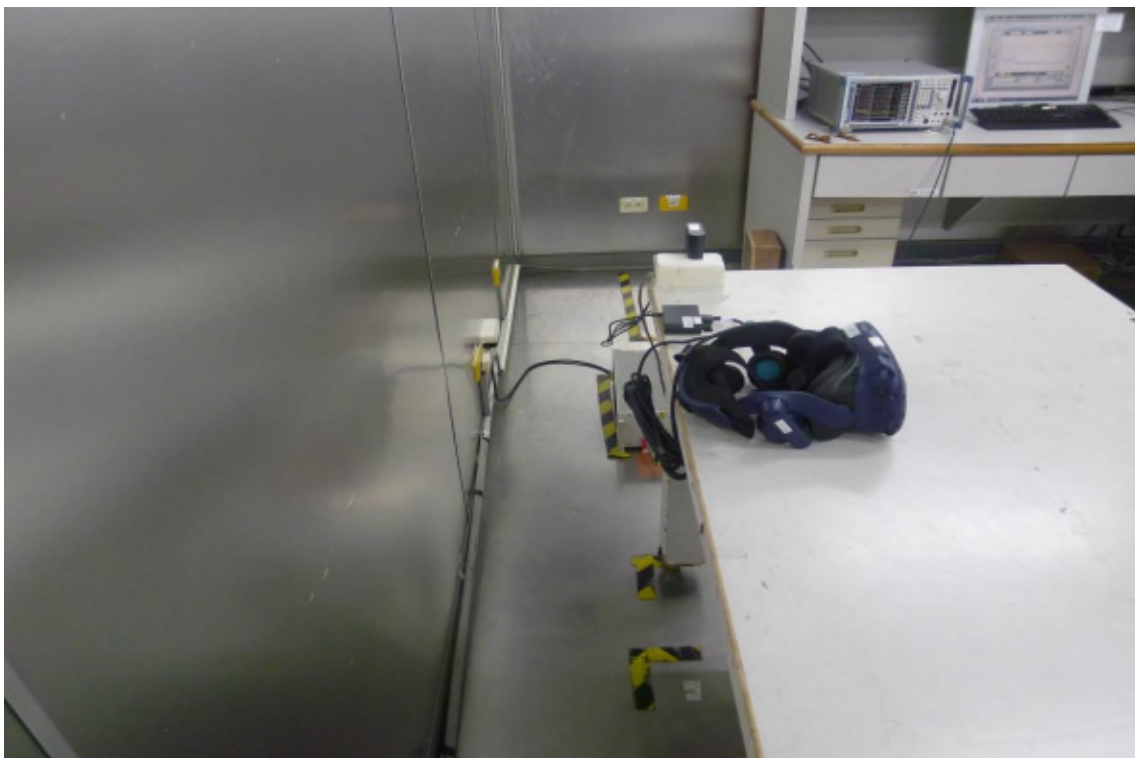
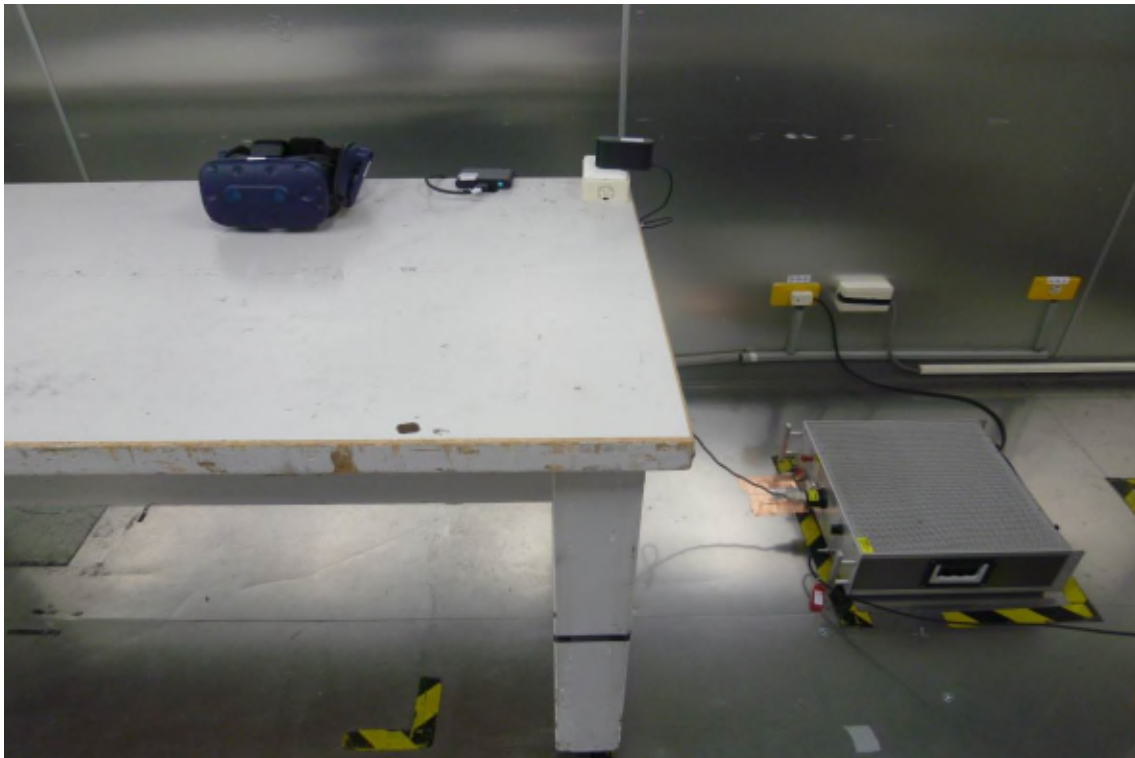
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Conduction Setup Photo (Measurement at AC Power Line)



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