

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C AND INDUSTRIAL CANADA RSS-210 REQUIREMENT

OF

Applicant: Pioneer Corporation
28-8, Honkomagome 2-chome, Bunkyo-ku, Tokyo, Japan

Product Name: GPS Cycle Computer

Brand Name: Pioneer

Model No.: SGX-CA600

Model Difference: N/A

FCC ID: AJDK110

IC: 775E-K110

Report Number: E2/2018/A0042

FCC Rule Part: §15.249

IC Rule Part: RSS-210 Issue 9 Nov. 2017

Issue Date: Nov. 27, 2018

Date of Test: Oct. 22, 2018 ~ Nov. 08, 2018

Date of EUT Received: Oct. 22, 2018

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.

Tested By:

Aken Huang

Aken Huang / Engineer

Approved By:

Jay Lin

Jay Lin / Asst. Supervisor

Testing Laboratory
0513

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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
E2/2018/A0042	Rev.00	Initial creation of document	All	Nov. 27, 2018	Stefanie Yu / Clerk

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1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	GPS Cycle Computer	
Brand Name:	Pioneer	
Model No.:	SGX-CA600	
Model difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Antenna Designation:	3.7Vdc from Rechargeable Li-ion Battery	
	Battery:	Model No.: BP-N463-11/1500 MX, Supplier: PIONEER CORPORATION

ANT+:

Operation Frequency:	2403 ~ 2480MHz
Channel number:	3 channels
Modulation Type:	GFSK
Antenna Designation:	PCB Antenna, Antenna Gain: -2.8 dBi

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.249

ANSI C63.10:2013

RSS-Gen. issue 5 Apr. 2018

RSS-210 Issue 9 Nov. 2017

ANSI C63.10:2013

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

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd.,
Guishan District, Taoyuan City, Taiwan 333 (TAF code 0513)

FCC Registration Number and Designation are: 735305

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

(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 $\mu\text{V/m}$	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 § 15.205 and RSS-Gen § 8.10
 4. Emission spurious frequency which appearing within the Restricted Bands specified in provision of §15.205 and RSS-Gen § 8.10, then the general radiated emission limits in § 15.209 and RSS-Gen § 8.9 apply.

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2.6 Configuration of Tested System

Fig. 2-1 Radiated Emission & Conducted (Antenna Port) Configuration

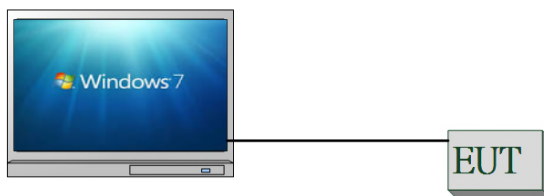


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L420	S0011721	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	ISED Rules	Description Of Test	Result
§15.207(a)	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.249(a)(d)(e)	RSS-210 §B.10(a)(b) RSS-Gen § 8.9, RSS-Gen § 8.10	Radiated Emission	Compliant
§15.215(c)	RSS-Gen § 6.6	20Db & 99% bandwidth Measurement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operated in 2403 ~ 2480MHz Band

3 channels are provided.

Channel	Frequency
1	2403MHz
2	2457MHz
3	2480MHz

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	ANTENNA PORT
ANT+	1 to 3	1,2,3	GFSK	MAIN
RADIATED EMISSION TEST (ABOVE 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	ANTENNA PORT
ANT+	1 to 3	1,2,3	GFSK	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 H position was reported.

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	ANTENNA PORT
ANT+	1 to 3	1,2,3	GFSK	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(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.
LISN	TESEQ	NNB 51	36076	2018/02/14	2019/2/13
EMI Test Receiver	R&S	ESCI	101343	2018/07/31	2019/7/30
Notebook	Lenovo	L420	S0012467	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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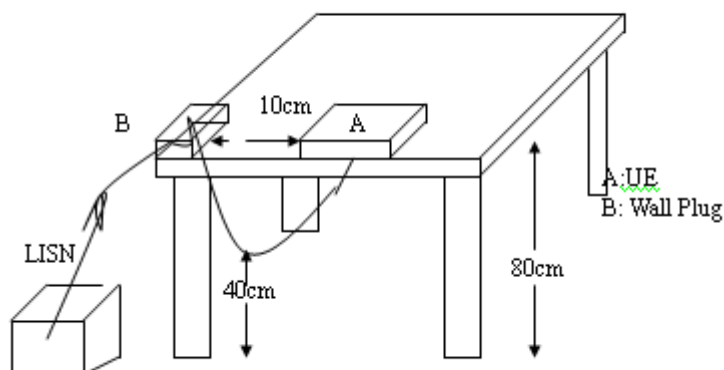
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6.4 Test SET-UP (Block Diagram of Configuration)



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

Site : Conduction Room
 Limit: FCC Class B Conduction(QP)
 Mode:
 Note:

Phase: **L1**
 Power: AC 120V/60Hz

Temperature: 23 °C
 Humidity: 64 %

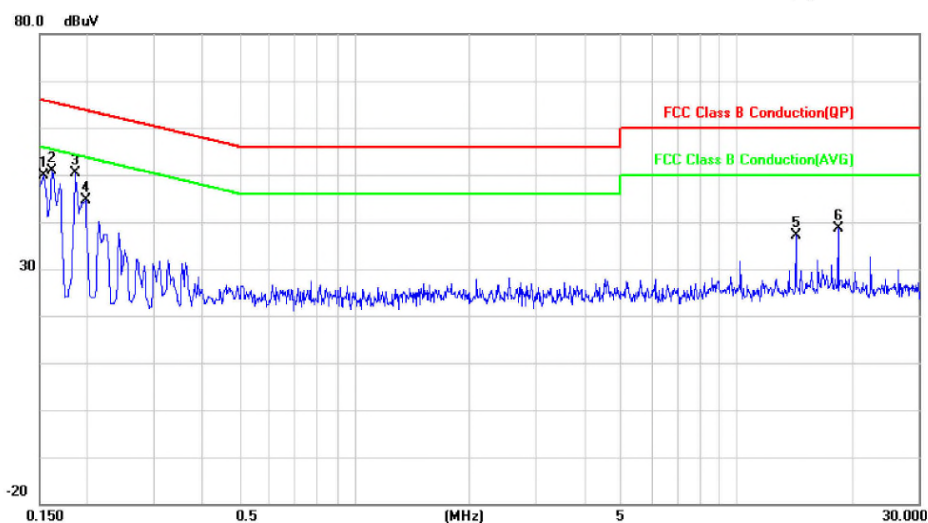
Conducted Emission

File :Conduction

Data :#1116

Date: 2018/10/23

Time: 下午 11:20:41



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1540	30.34	19.65	49.99	65.78	-15.79	peak	
2		0.1620	31.12	19.66	50.78	65.36	-14.58	peak	
3	*	0.1860	30.79	19.70	50.49	64.21	-13.72	peak	
4		0.1980	24.82	19.72	44.54	63.69	-19.15	peak	
5		14.3380	17.17	19.99	37.16	60.00	-22.84	peak	
6		18.4340	18.47	20.04	38.51	60.00	-21.49	peak	

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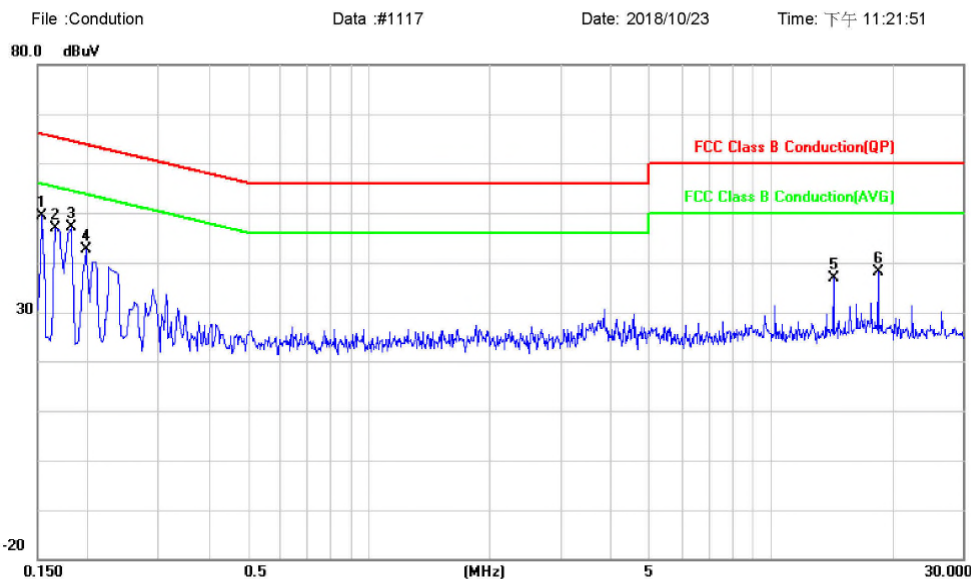
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Site : Conduction Room Phase: **N** Temperature: 23 °C
Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 64 %
Mode:
Note:

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1540	29.82	19.65	49.47	65.78	-16.31	peak	
2		0.1660	27.30	19.66	46.96	65.16	-18.20	peak	
3		0.1820	27.48	19.69	47.17	64.39	-17.22	peak	
4		0.1980	22.86	19.72	42.58	63.69	-21.11	peak	
5		14.3380	16.89	19.99	36.88	60.00	-23.12	peak	
6		18.4340	18.13	20.04	38.17	60.00	-21.83	peak	

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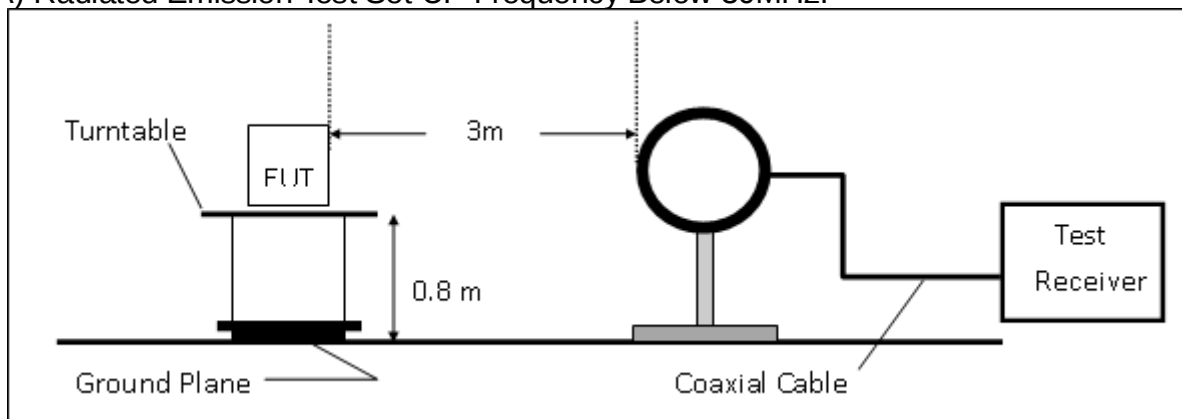
7 RADIATED EMISSION TEST

7.1 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.

7.2 Test SET-UP (Block Diagram of Configuration)

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



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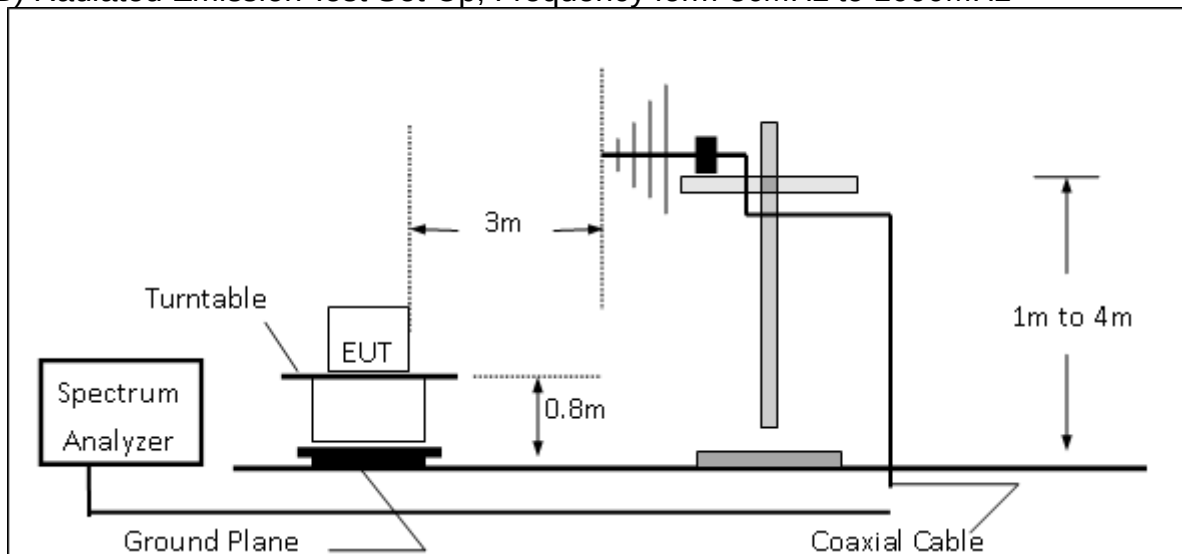
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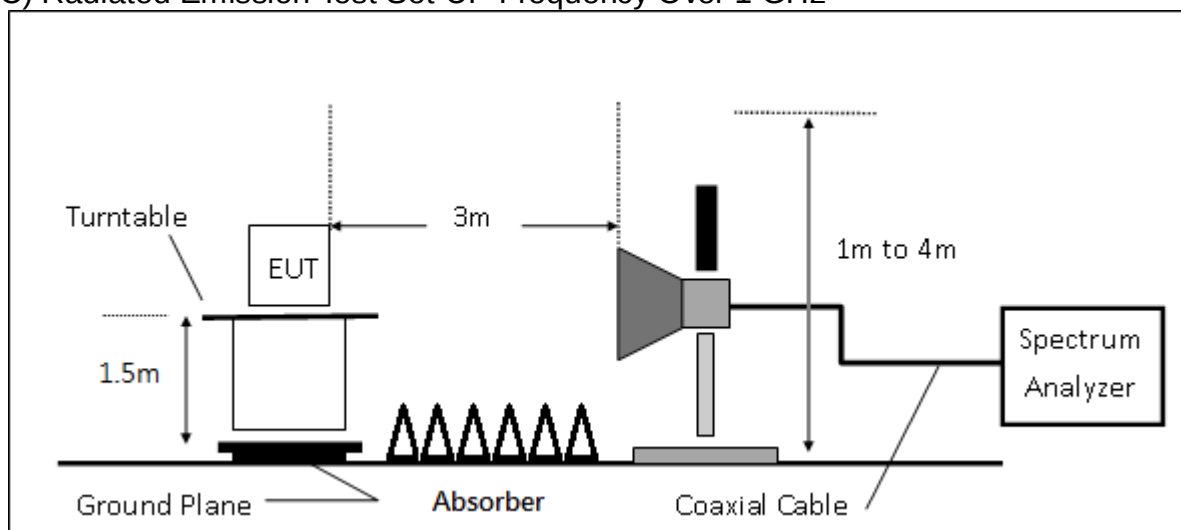
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(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



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



7.3 Measurement Equipment Used:

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

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	SCHWAZBECK	VULB 9168	9168-617	2018/10/30	2019/10/29
Horn Antenna	Schwarzbeck	BBHA9120D	1341	2018/06/07	2019/06/06
Horn Antenna	SCHWAZBECK	BBHA9170	184	2017/12/12	2018/12/11
Loop Antenna	ETS.LINDGREN	6502	148045	2018/04/19	2019/04/18
3m Site NSA	SGS	966 chamber D	N/A	2018/07/06	2019/07/05
EMI Test Receiver	R&S	ESU 40	100363	2018/04/11	2019/04/10
Pre-Amplifier	EMC Instruments	EMC184045B	980135	2017/10/27	2018/10/26
Pre-Amplifier	EMC Instruments	EMC9135	980234	2017/12/26	2018/12/25
Pre-Amplifier	EMC Instruments	EMC12630SE	980271	2017/12/26	2018/12/25
Attenuator	Marvelous	WATT-218FS-10	RF246	2017/12/26	2018/12/25
Highpass Filter	Micro Tronics	BRM50701-01	G008	2017/12/26	2018/12/25
Coaxial Cable	Huber Suhner	EMC106-SM-S M-7200	150703	2017/12/26	2018/12/25
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	2017/12/26	2018/12/25
Notebook	Lenovo	L420	S0012467	N/A	N/A

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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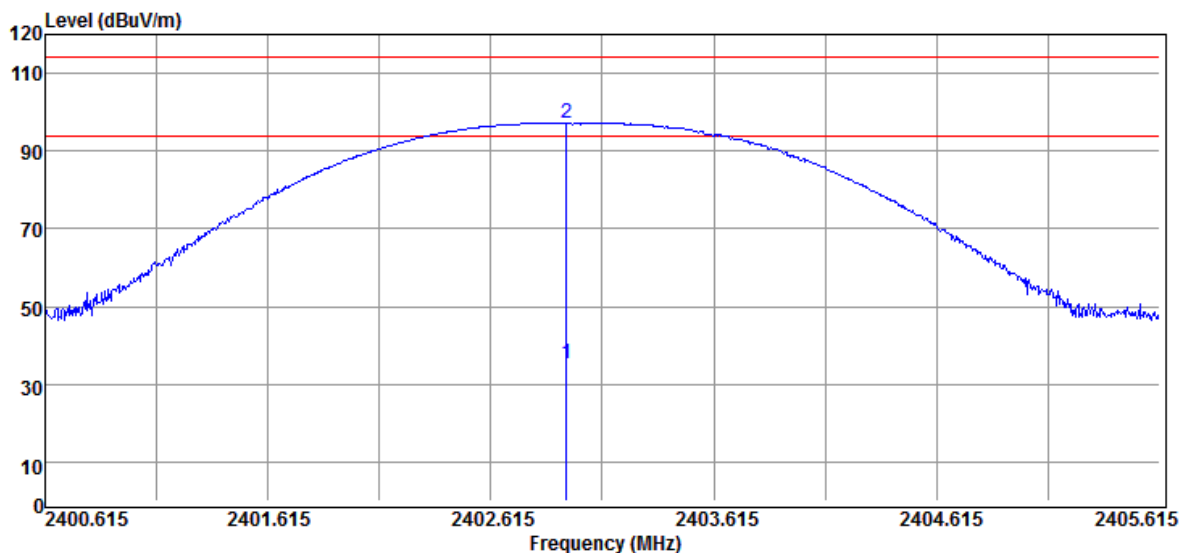
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7.4 Measurement Result

Radiated Spurious Emission Measurement Result (MAIN)

Operation Mode	:ANT+	Test Date	:2018-11-12
Test Mode	:Main CH LOW	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2403 MHz	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
2402.96	Average	41.05	-5.56	35.49	94.00	-58.51
2402.96	Peak	102.64	-5.56	97.08	114.00	-16.92

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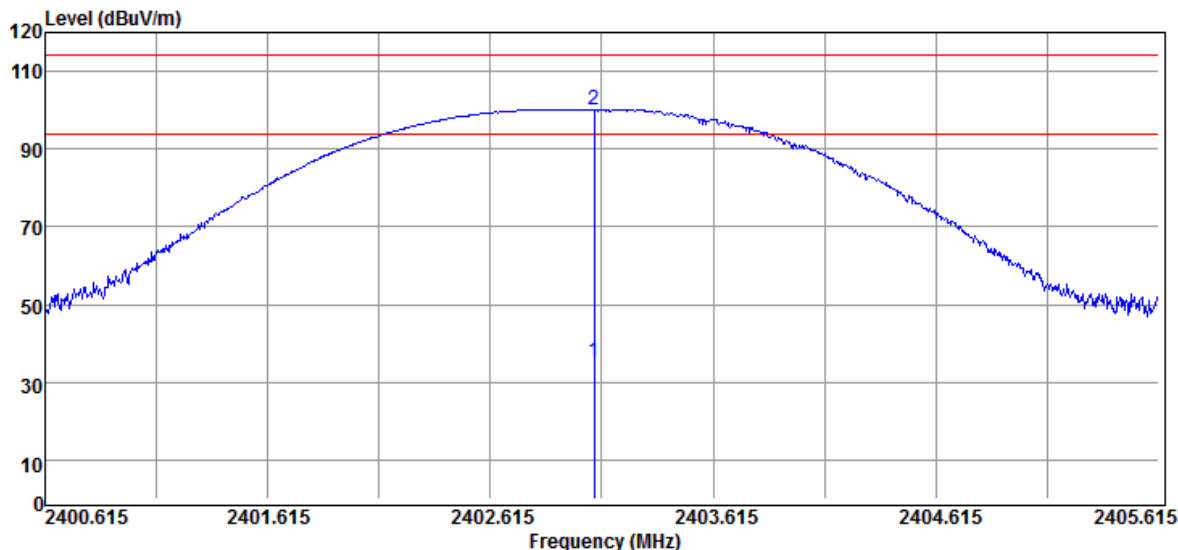
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Operation Mode	:ANT+	Test Date	:2018-11-12
Test Mode	:Main CH LOW	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2403 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2403.08	Average	41.00	-5.56	35.44	94.00	-58.56
2403.08	Peak	105.81	-5.56	100.25	114.00	-13.75

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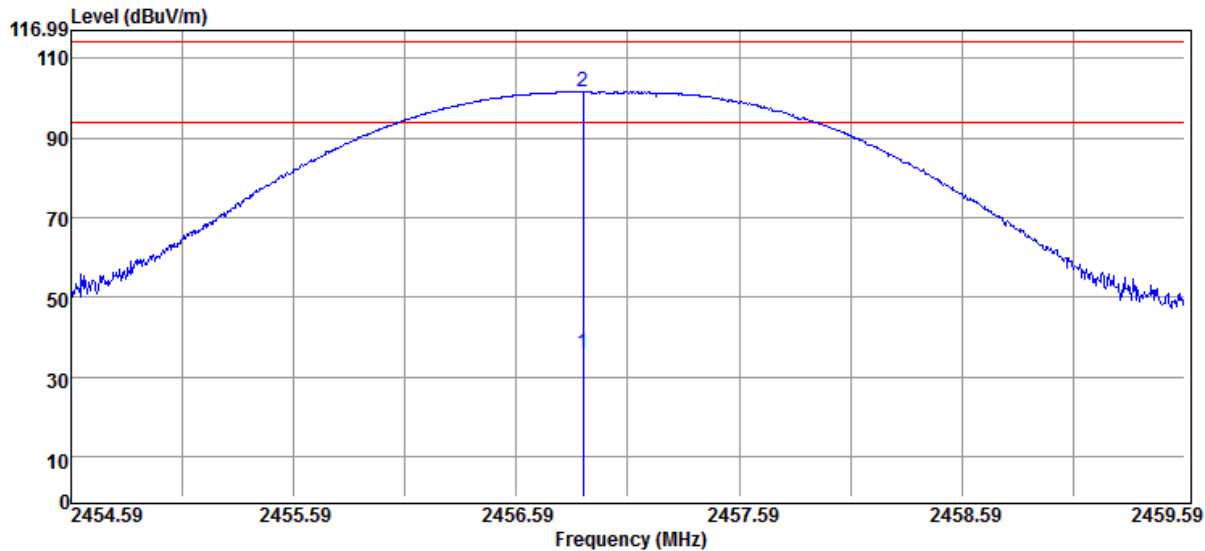
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Operation Mode	:ANT+	Test Date	:2018-11-12
Test Mode	:Main CH MID	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2457 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2456.89	Average	41.10	-5.12	35.98	94.00	-58.02
2456.89	Peak	106.62	-5.12	101.50	114.00	-12.50

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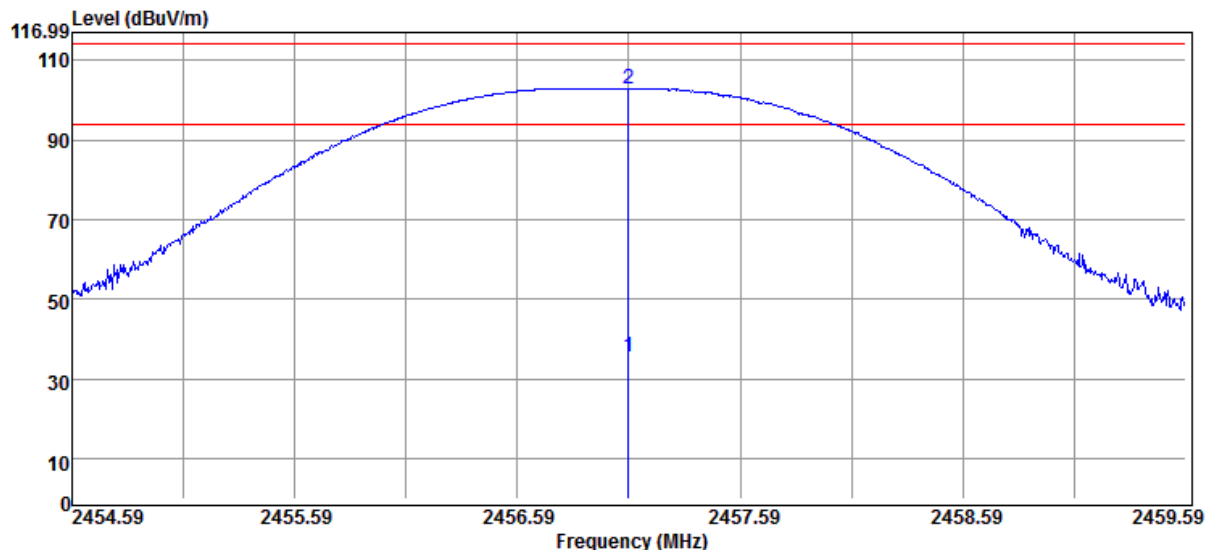
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Operation Mode :ANT+
Test Mode :Main CH MID
EUT Pol :H Plan
Test Channel :2457 MHz

Test Date :2018-11-12
Temp./Humi. :25/60
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
2457.09	Average	40.72	-5.12	35.60	94.00	-58.40
2457.09	Peak	108.14	-5.12	103.02	114.00	-10.98

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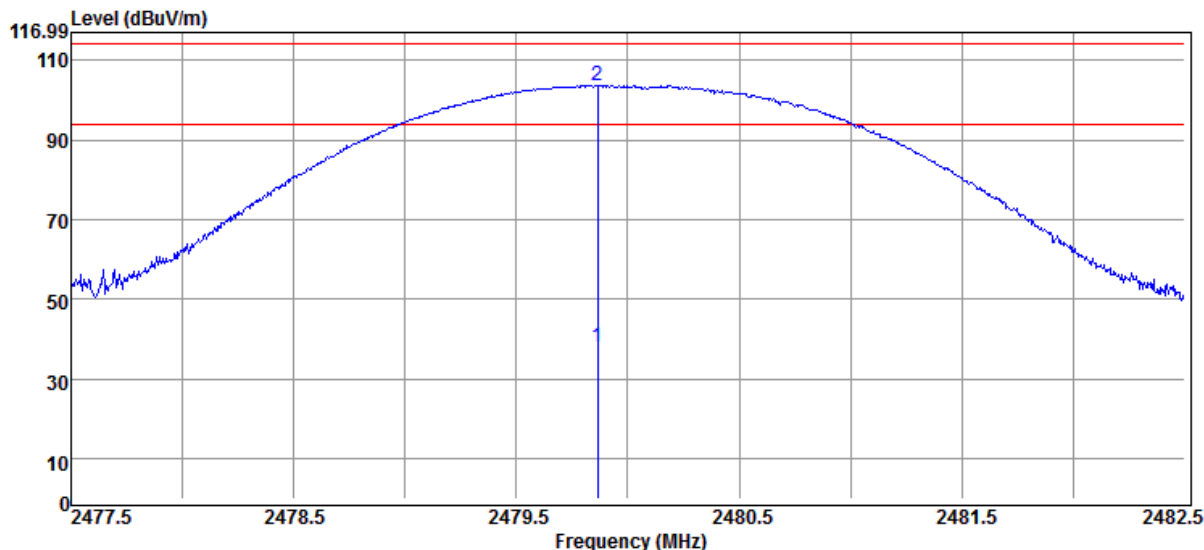
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Operation Mode	:ANT+	Test Date	:2018-11-12
Test Mode	:Main CH HIGH	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2480 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2479.87	Average	42.82	-4.93	37.89	94.00	-56.11
2479.87	Peak	108.49	-4.93	103.56	114.00	-10.44

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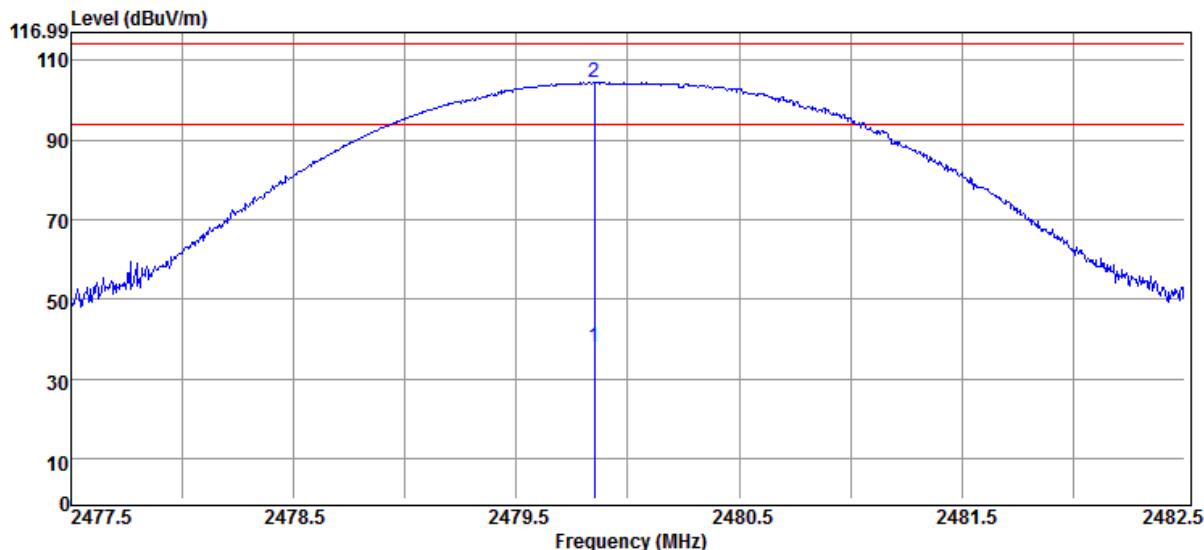
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Operation Mode	:ANT+	Test Date	:2018-11-12
Test Mode	:Main CH HIGH	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2480 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2479.85	Average	42.86	-4.93	37.93	94.00	-56.07
2479.85	Peak	109.27	-4.93	104.34	114.00	-9.66

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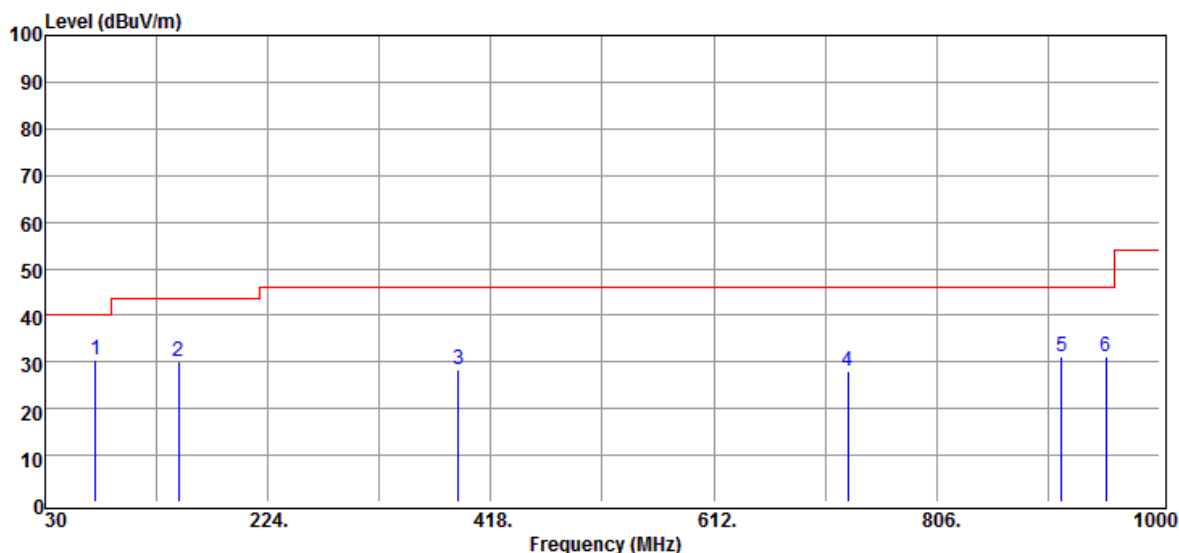
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Radiated Spurious Emission Measurement Result

Operation Mode	:ANT+	Test Date	:2018-10-24
Test Mode	:Tx CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2403 MHz	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
73.65	Peak	50.57	-20.23	30.34	40.00	-9.66
146.40	Peak	46.51	-16.28	30.23	43.50	-13.27
389.87	Peak	41.26	-13.05	28.21	46.00	-17.79
728.40	Peak	35.48	-7.36	28.12	46.00	-17.88
914.64	Peak	35.82	-4.55	31.27	46.00	-14.73
953.44	Peak	35.78	-4.48	31.30	46.00	-14.70

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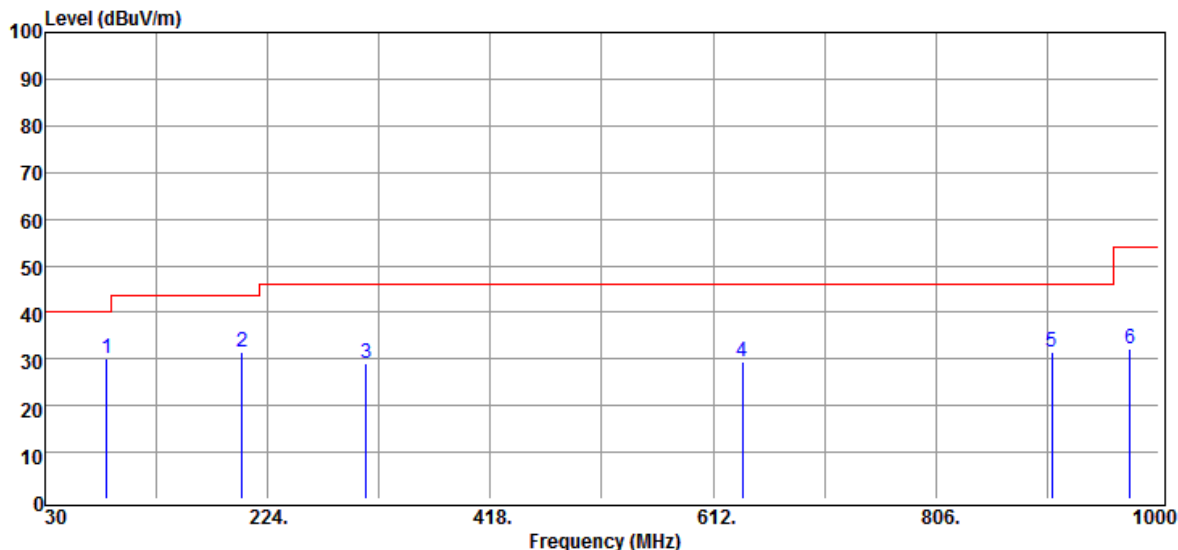
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Operation Mode :ANT+
Test Mode :Tx CH Low
EUT Pol :H Plan
Test Channel :2403 MHz

Test Date :2018-10-24
Temp./Humi. :25/60
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
83.35	Peak	53.35	-23.22	30.13	40.00	-9.87
201.69	Peak	50.03	-18.65	31.38	43.50	-12.12
309.36	Peak	45.11	-15.95	29.16	46.00	-16.84
637.22	Peak	37.46	-8.12	29.34	46.00	-16.66
906.88	Peak	36.38	-4.95	31.43	46.00	-14.57
974.78	Peak	35.44	-3.38	32.06	54.00	-21.94

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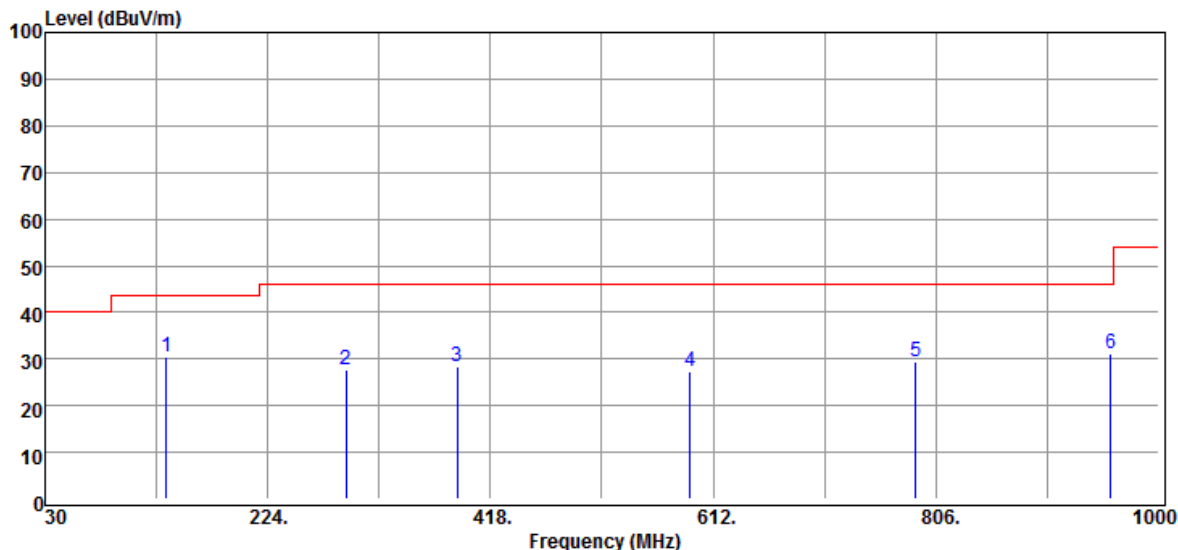
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Operation Mode	:ANT+	Test Date	:2018-10-24
Test Mode	:Tx CH Mid	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2457 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
135.73	Peak	47.60	-17.12	30.48	43.50	-13.02
291.90	Peak	43.28	-15.50	27.78	46.00	-18.22
388.90	Peak	41.57	-13.07	28.50	46.00	-17.50
591.63	Peak	36.13	-8.77	27.36	46.00	-18.64
788.54	Peak	36.33	-6.96	29.37	46.00	-16.63
958.29	Peak	35.21	-4.19	31.02	46.00	-14.98

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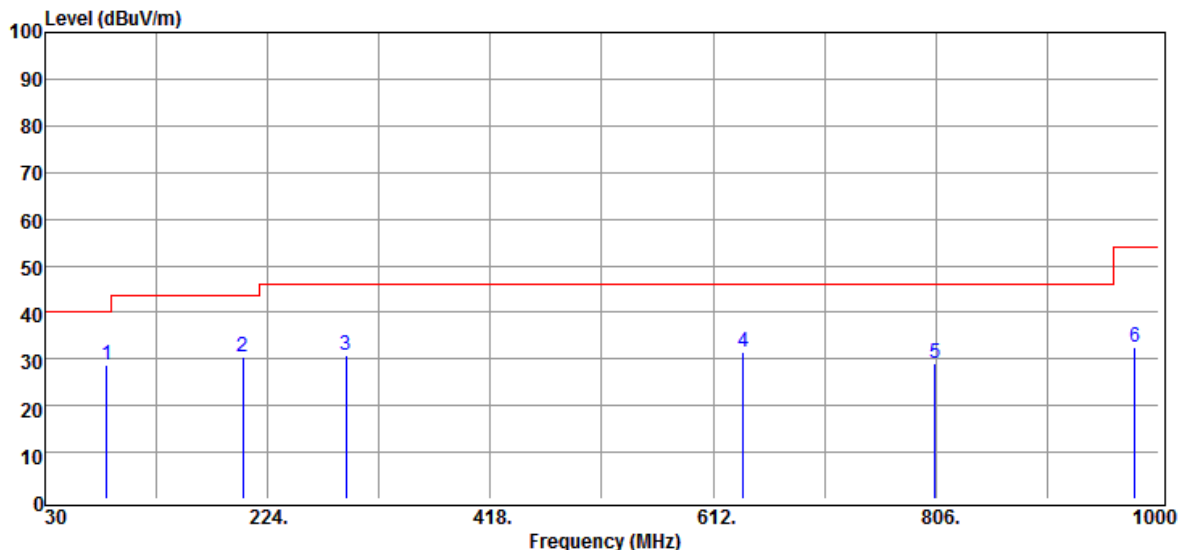
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Operation Mode :ANT+
Test Mode :Tx CH Mid
EUT Pol :H Plan
Test Channel :2457 MHz

Test Date :2018-10-24
Temp./Humi. :25/60
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
83.35	Peak	52.03	-23.22	28.81	40.00	-11.19
202.66	Peak	49.28	-18.66	30.62	43.50	-12.88
291.90	Peak	47.46	-16.49	30.97	46.00	-15.03
638.19	Peak	39.65	-8.12	31.53	46.00	-14.47
805.03	Peak	35.43	-6.20	29.23	46.00	-16.77
979.63	Peak	35.98	-3.47	32.51	54.00	-21.49

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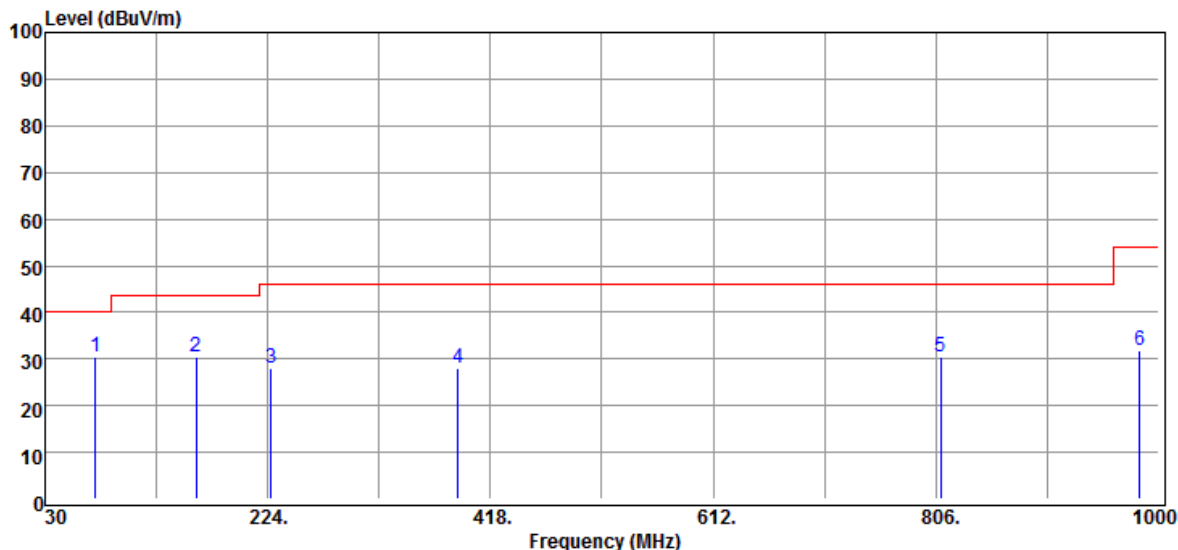
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Operation Mode :ANT+
Test Mode :Tx CH High
EUT Pol :H Plan
Test Channel :2480 MHz

Test Date :2018-10-24
Temp./Humi. :25/60
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
73.65	Peak	50.52	-20.23	30.29	40.00	-9.71
161.92	Peak	46.70	-16.26	30.44	43.50	-13.06
226.91	Peak	46.36	-18.20	28.16	46.00	-17.84
389.87	Peak	41.23	-13.05	28.18	46.00	-17.82
809.88	Peak	36.45	-5.96	30.49	46.00	-15.51
983.51	Peak	35.41	-3.62	31.79	54.00	-22.21

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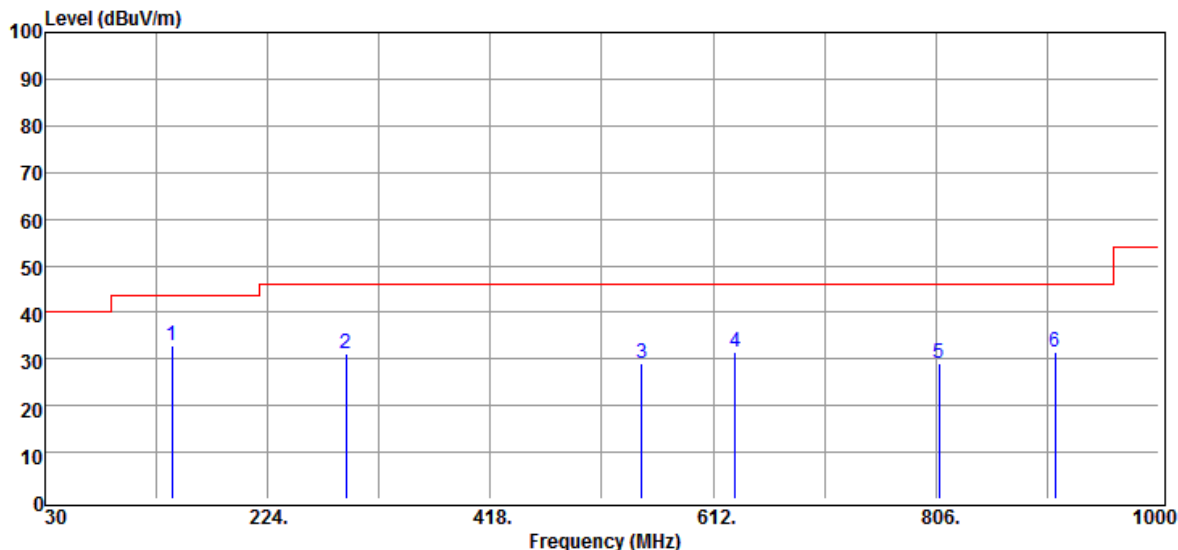
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Operation Mode :ANT+
Test Mode :Tx CH High
EUT Pol :H Plan
Test Channel :2480 MHz

Test Date :2018-10-24
Temp./Humi. :25/60
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
140.58	Peak	49.71	-16.91	32.80	43.50	-10.70
291.90	Peak	47.56	-16.49	31.07	46.00	-14.93
549.92	Peak	39.32	-10.36	28.96	46.00	-17.04
631.40	Peak	39.51	-8.12	31.39	46.00	-14.61
808.91	Peak	34.94	-6.01	28.93	46.00	-17.07
909.79	Peak	36.05	-4.68	31.37	46.00	-14.63

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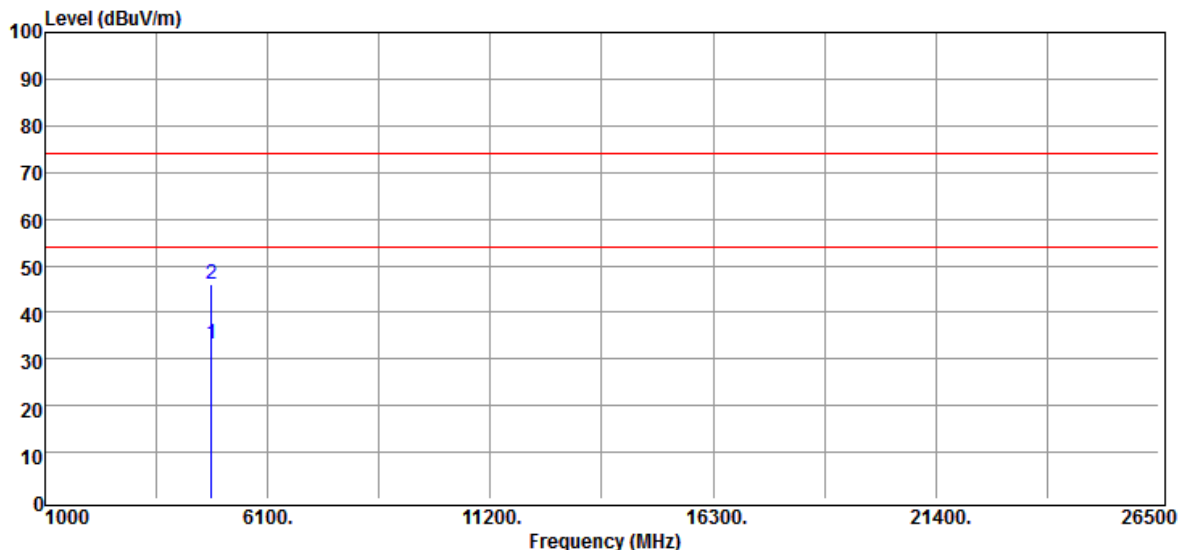
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Operation Mode	:ANT+	Test Date	:2018-10-24
Test Mode	:Tx CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2403 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4806.00	Average	32.88	0.28	33.16	54.00	-20.84
4806.00	Peak	45.65	0.28	45.93	74.00	-28.07

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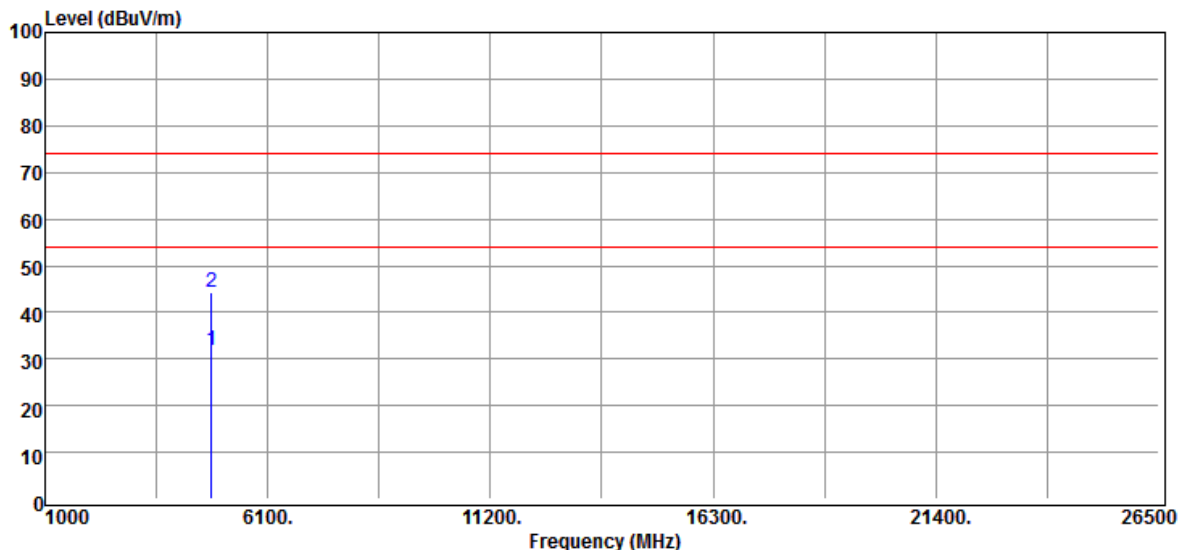
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Operation Mode	:ANT+	Test Date	:2018-10-24
Test Mode	:Tx CH Low	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2403 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4806.00	Average	31.55	0.28	31.83	54.00	-22.17
4806.00	Peak	43.86	0.28	44.14	74.00	-29.86

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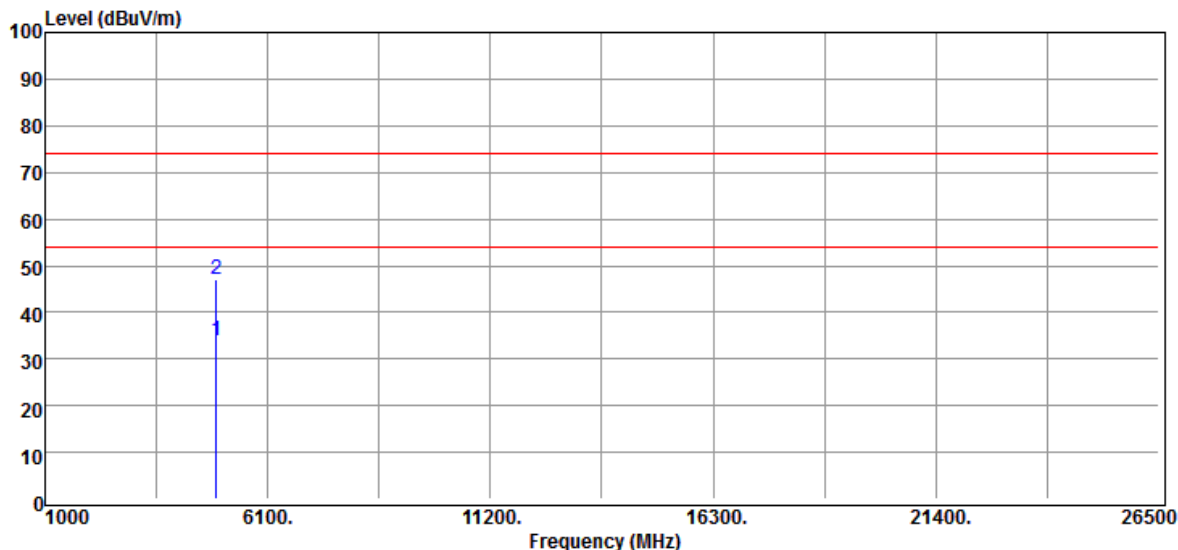
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Operation Mode	:ANT+	Test Date	:2018-10-24
Test Mode	:Tx CH Mid	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2457 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4914.00	Average	33.09	0.91	34.00	54.00	-20.00
4914.00	Peak	46.31	0.91	47.22	74.00	-26.78

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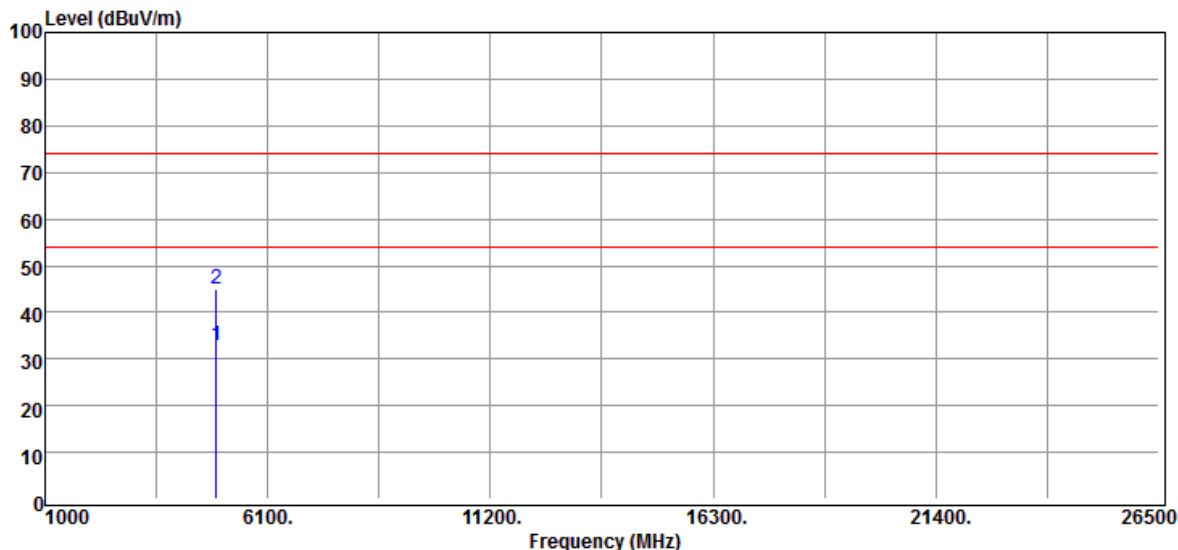
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Operation Mode	:ANT+	Test Date	:2018-10-24
Test Mode	:Tx CH Mid	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2457 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4914.00	Average	31.82	0.91	32.73	54.00	-21.27
4914.00	Peak	43.96	0.91	44.87	74.00	-29.13

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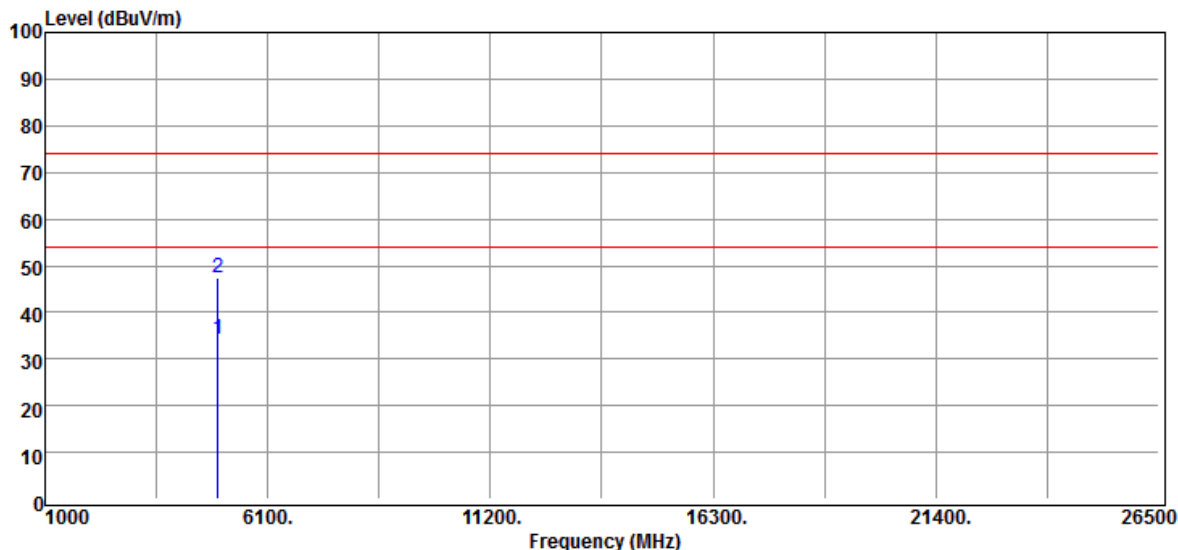
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Operation Mode	:ANT+	Test Date	:2018-10-24
Test Mode	:Tx CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:VERTICAL
Test Channel	:2480 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4960.00	Average	33.15	1.24	34.39	54.00	-19.61
4960.00	Peak	46.02	1.24	47.26	74.00	-26.74

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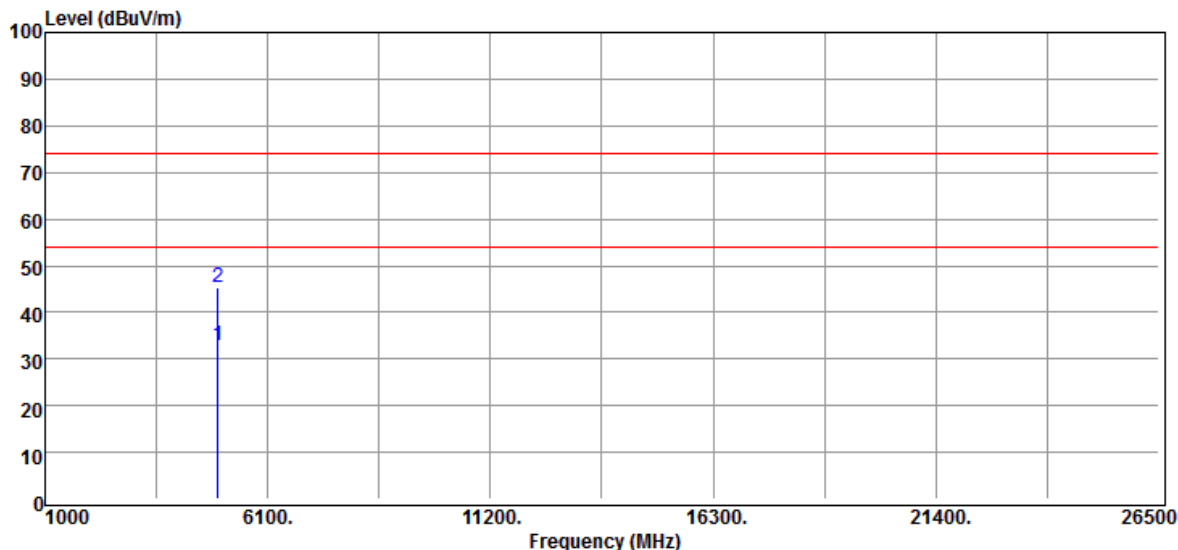
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Test Mode	:Tx CH High	Temp./Humi.	:25/60
EUT Pol	:H Plan	Antenna Pol.	:HORIZONTAL
Test Channel	:2480 MHz	Engineer	:Jerry



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4960.00	Average	31.73	1.24	32.97	54.00	-21.03
4960.00	Peak	43.92	1.24	45.16	74.00	-28.84

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8 DUTY CYCLE OF TEST SIGNAL

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

Formula:

$$\text{Duty Cycle} = T_{on} / (T_{on} + T_{off})$$

Measurement Procedure:

1. Set span = Zero
2. RBW = 8MHz
3. VBW = 8MHz,
4. Detector = Peak

Duty Cycle:

	Duty Cycle (%)	Duty Factor (dB)	1/T (kHz)	VBW setting (kHz)
BLE	0.20	26.99	6.67	7.00

$$\text{Duty Cycle Factor: } 10 \cdot \log(1/(0.2/100)) = 26.99$$

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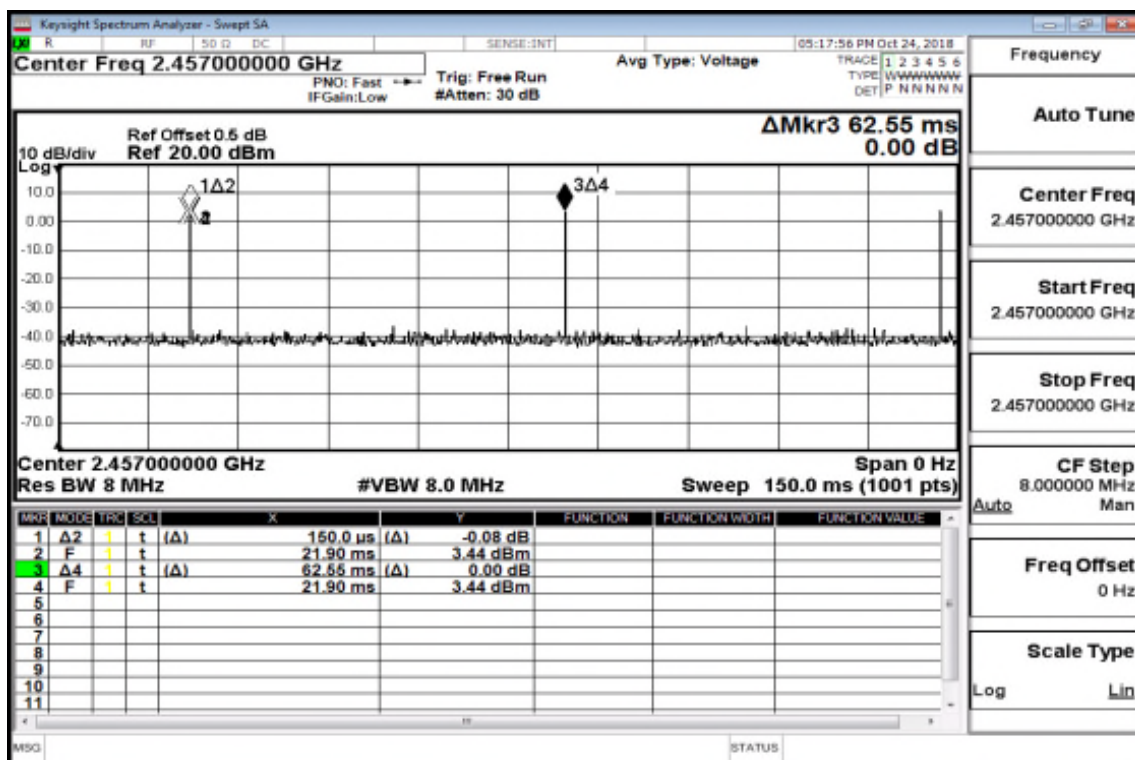
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9 20 DB & 99% BANDWIDTH MEASUREMENT

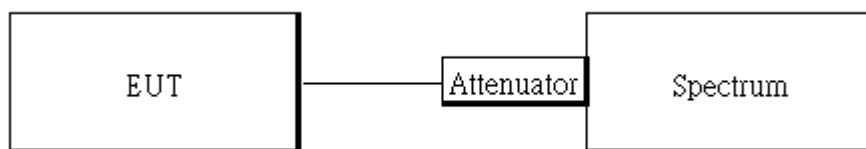
Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. **For 20dB BW measurement:**
Set SPA Center Frequency = fundamental frequency, RBW = 100kHz, VBW = 300kHz, Span = 5MHz and Set SPA Max hold. Mark peak, -20dB.

For 99% BW measurement:

Set the spectrum analyzer as RBW=1% of the approximate emission bandwidth, VBW = 3 times RBW, Span= approximately 20dB below the peak level. Sweep=auto
Turn on the 99% bandwidth function, max reading.

Test SET-UP (Block Diagram of Configuration)



Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY51440113	2018/06/20	2019/06/19
DC Block	PASTERNAK	PE8210	RF81	2017/12/26	2018/12/25
Notebook	Lenovo	L420	S0011721	N/A	N/A

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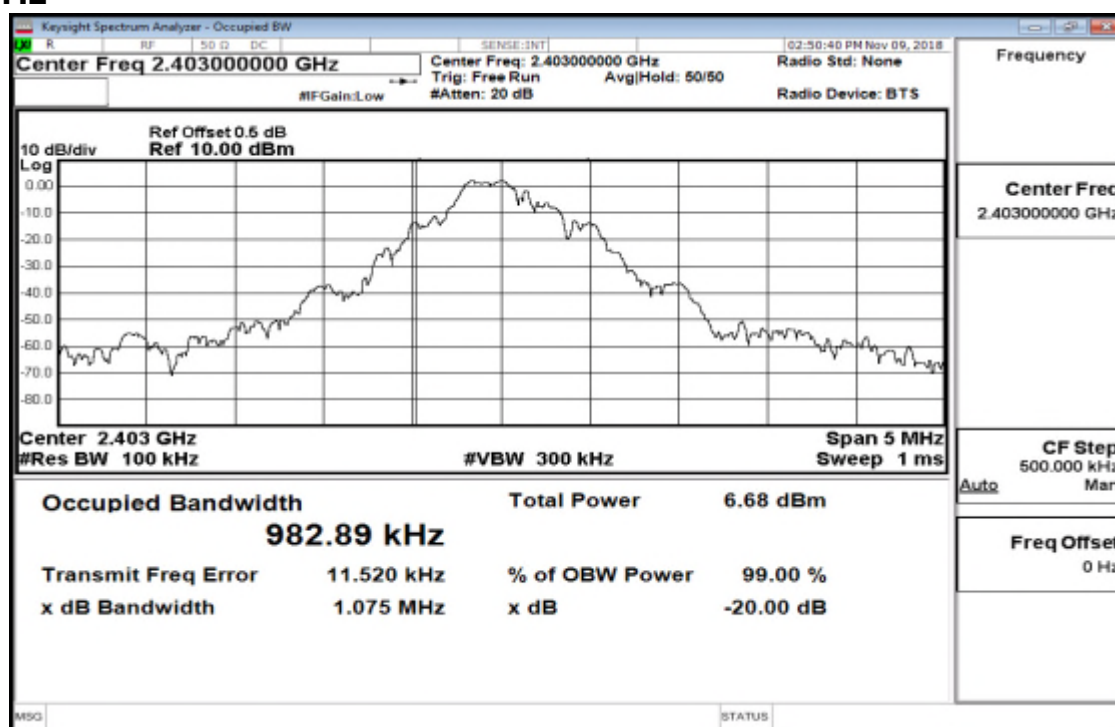
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Measurement Results:

Frequency (MHz)	20dB Bandwidth (kHz)
2403	1075
2457	1120
2480	1093

Refer to attached data chart.

2403MHz



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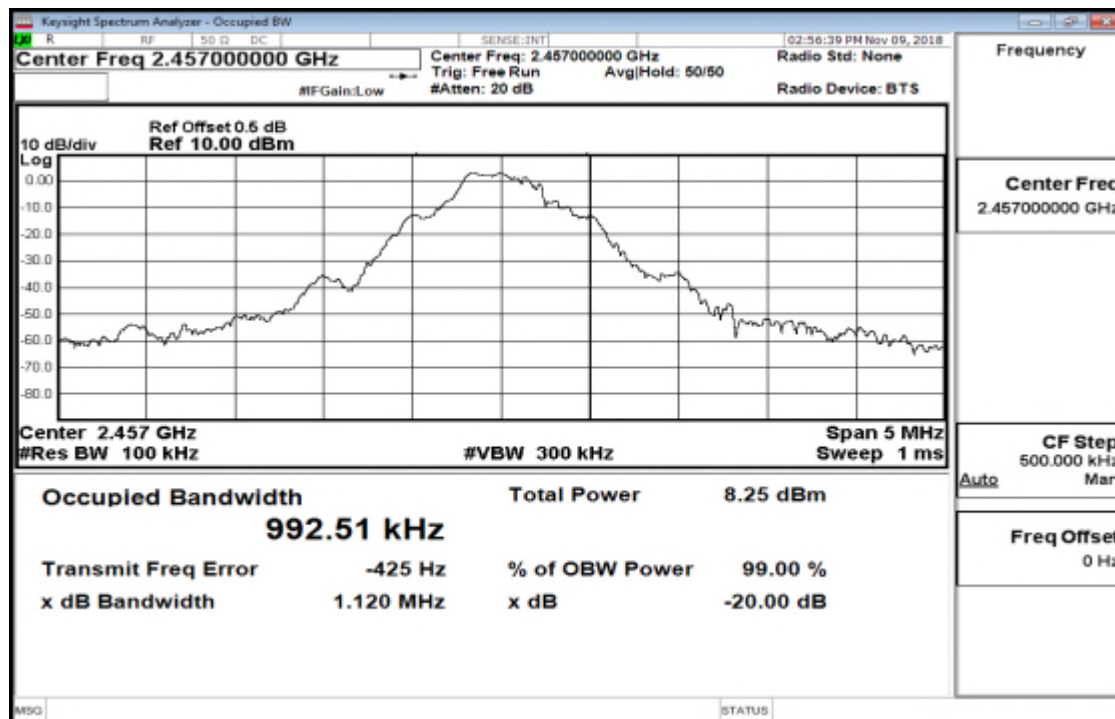
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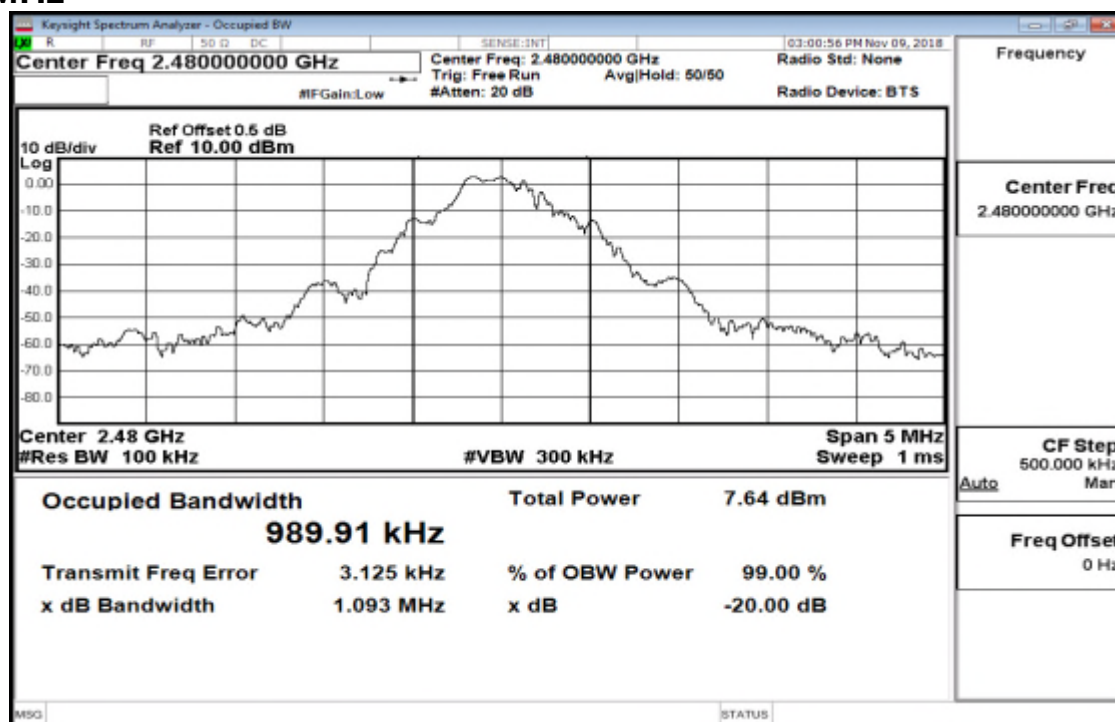
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2457MHz



2480MHz



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10 ANTENNA REQUIREMENT

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.

Antenna Connected Construction:

The antenna is designed with unique RF connector and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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