

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

PARTIAL REPORT

OF

Applicant: CALAMP WIRELESS NETWORKS CORPORATION
2200 Faraday Ave, Suite 220, Carlsbad, CA 92008

Product Name: LMU5541 Broadband Router/Tracker

Brand Name: CalAmp

Model No.: LMU5541LW

Model Difference: N/A

Report Number: ER/2019/C0114

FCC ID: APV-5541LW

IC: 5843C-5541LW

FCC Rule Part: §15.247, Cat: DSS

IC RSS: RSS-247 issue 2 Feb 2017

Issue Date: Jan. 15, 2020

Date of Test: Dec. 13, 2019 ~ Jan. 07, 2020

Date of EUT Received: Dec. 13, 2019

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.

Approved By: _____



Vito Pei / Asst. Supervisor



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f (886-2) 2298-0488

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Revision History

Report Number	Revision	Description	Issue Date	Remark
ER/2019/C0114	Rev.00	Original.	Jan. 15, 2020	Revised By: Stefanie Yu

Note:

Test data is referenced from cross authorization(s)

Measurement results in the original test report 2323ERM.005A1 under FCC ID: R17WE866C3 / IC: 5131A-WE866C3 are partially leveraged in this test report with Radiated Emission Test check to demonstrate compliance.

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1 GENERAL INFORMATION

1.1 Product description

Product Name:	LMU5541 Broadband Router/Tracker	
Brand Name:	CalAmp	
Model No.:	LMU5541LW	
Model Difference:	N/A	
Hardware Version:	Rev E	
Software Version:	LMU,166 V4.1a	
Power Supply:	12Vdc from Car Battery & 3.7Vdc from Rechargeable Li-ion Battery	
	Battery:	Model No.: GSP633248, Supplier: N/A

Radio Technology:	Bluetooth BR+EDR
Channel number:	79 channels
Modulation type:	GFSK + $\pi/4$ DQPSK + 8DPSK
Transmit Power:	-0.99 dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	$\leq 0.4s$

BT Modular Report

BT:	Test Lab: DEKRA Certification. Inc. Applicant: Telit Communication s.p.a Model Number: WE866C3-P Report Number: 2323ERM.005A1
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1.2 Antenna Designation

Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)
PIFA	TAOGLAS	MA284.LBIC.001	2402-2480	-2.21

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1.3 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247
KDB 558074 D01 v05 DSS Meas. Guidance
RSS-247 issue 2 Feb. 2017
RSS-Gen. issue 5, Amendment 1, March 2019
ANSI C63.10:2013

1.4 Test Facility

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

FCC Designation number: TW0001

ISED CAB identifier: TW0513

1.5 Special Accessories

There is no special accessory used while test was conducted.

1.6 Equipment Modifications

There was no modification incorporated into the EUT.

1.7 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*9m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

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

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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. 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.

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 Configuration of Tested System

Fig. 2-1 Radiated Emission

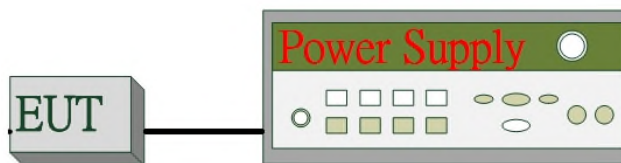


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	DC Power Supply	Agilent	E3640A	MY52410006	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	IC Rules	Description Of Test	Result
§15.247(b)(1)	RSS-247 §5.4 b	Peak Output Power	Compliant
§15.205 §15.209 §15.247(d)	RSS-247 §5.5 RSS-Gen §8.9 RSS-Gen §8.10	Conducted & Radiated Band Edge and Spurious Emission	Compliant
§15.203	N/A	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

79 channels are provided for Bluetooth

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

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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.
- 3 Investigation has been done on all the possible configurations for searching the worst case.

MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION	PACKET TYPE
RADIATED EMISSION TEST (BELOW 1 GHz)				
Bluetooth	2402 to 2480	2402, 2441, 2480	GFSK	DH5
RADIATED EMISSION TEST (ABOVE 1 GHz)				
Bluetooth	2402 to 2480	2402, 2441, 2480	GFSK	DH5
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 BR+EDR Transmitter for channel Low, Mid and High, the worst case E2 position was reported.				

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 0.84 dB
20dB Bandwidth	+/- 51.33 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB
Frequency Separation	+/- 51.33 Hz
Number of hopping frequency	+/- 51.33 Hz
Time of Occupancy	+/- 51.33 Hz
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: +/-2.3dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB
Polarization: Horizontal	9kHz~30MHz: +/-2.3dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable

Frequency within 150 kHz 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

- 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.

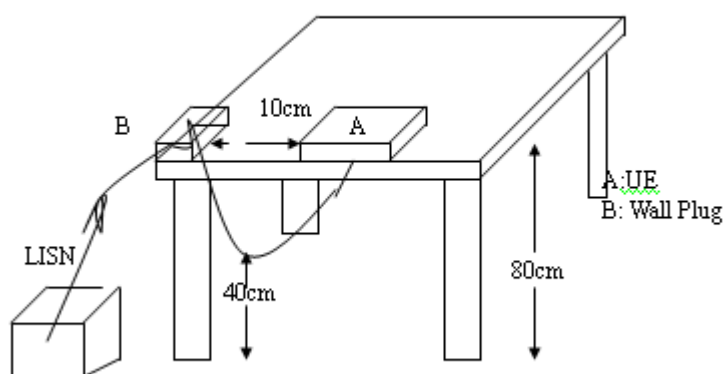
6.2 Measurement Equipment Used

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 63.10:2013.
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.

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 plan.

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2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

6.6 Measurement Result

N/A, powered from car battery.

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7 PEAK OUTPUT POWER MEASUREMENT

7.1 Standard Applicable

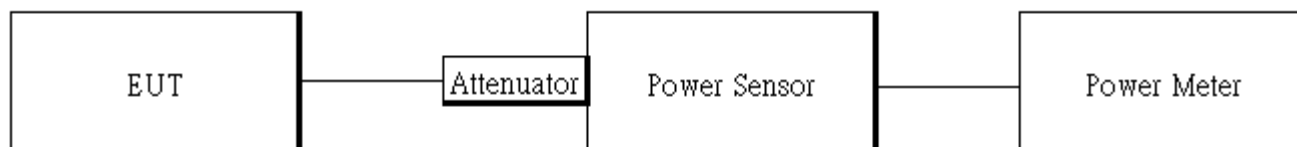
For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: The Limit: 0.125 Watts. The power limit for 1Mbps is 1 watt, and 2Mbps, 3Mbps and AFH mode are 0.125 watts.

The e.i.r.p. shall not exceed 4 W. (ISED)

7.2 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2496A	1804001	02/13/2019	02/12/2020
Power Sensor	Anritsu	MA2411B	1726104	02/13/2019	02/12/2020
Power Sensor	Anritsu	MA2411B	1726107	02/13/2019	02/12/2020
Attenuator	Mini-Circuit	BW-S10W2+	4	01/02/2019	01/01/2020
Attenuator	Mini-Circuit	BW-S10W2+	4	01/02/2020	01/01/2021

7.3 Test Set-up:



7.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10 Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Max Hold, Detector = Peak, RBW >=20dB bandwidth)
4. Record the max. reading.
5. Repeat above procedures until all default test channel is completed.

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7.5 Peak & Average Power Measurement Result

1M BR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	-1.12	0.773	1000
Mid	2441	-0.99	0.796	1000
High	2480	-1.14	0.769	1000

CH	Freq. (MHz)	Max. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	-1.42	0.722	1000
Mid	2441	-1.39	0.727	1000
High	2480	-1.45	0.717	1000

2M EDR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	-2.08	0.619	125
Mid	2441	-1.85	0.653	125
High	2480.00	-2.11	0.62	125

2M EDR mode (Average):

CH	Freq. (MHz)	Max. Avg. Out-put include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	-4.57	0.349	125
Mid	2441	-4.14	0.386	125
0.8	2480	-4.56	0.350	125

3M EDR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	-1.65	0.684	125
Mid	2441	-1.43	0.719	125
High	2480	-1.62	0.689	125

3M EDR mode (Average):

CH	Freq. (MHz)	Max. Avg. Out-put include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	-4.58	0.349	125
Mid	2441	-4.12	0.388	125
High	2480	-4.53	0.353	125

NOTE: cable loss as 0dB that offsets in the spectrum

***Note:** Max. Output include tune up tolerance Power measured by using average detector.

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7.6 EIRP Measurement Result

1M BR mode EIRP

Channel	Frequency (MHz)	Max. Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	-1.42	-2.21	0.434	4000
Mid	2441	-1.39	-2.21	0.437	4000
High	2480	-1.45	-2.21	0.431	4000

2M EDR mode EIRP

Channel	Frequency (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	-4.57	-2.21	0.210	4000
Mid	2441	-4.14	-2.21	0.232	4000
High	2480	-4.56	-2.21	0.211	4000

3M EDR mode EIRP

Channel	Frequency (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	-4.58	-2.21	0.210	4000
Mid	2441	-4.12	-2.21	0.233	4000
High	2480	-4.53	-2.21	0.212	4000

* **Note:** EIRP = Average Power + Gain

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8 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

8.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 limit as below.

And according to §15.33(a) (1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (dBμV/m)

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8.2 Measurement Equipment Used

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Horn Antenna	Schwarzbeck	BBHA9170	184	12/25/2019	12/24/2020
Horn Antenna	Schwarzbeck	BBHA9120D	D803	12/20/2019	12/19/2020
Bi-log Antenna	TESEO	CBL 6112D	35242 & AT-N0555	01/10/2019	01/09/2020
Loop Antenna	ETS.LINDGREN	6502	148045	10/15/2019	10/14/2020
DC Power Supply	Agilent	E3640A	MY52410006	12/10/2019	12/09/2020
EMI Test Receiver	R&S	ESCI 7	1166.5950.07	07/04/2019	07/03/2020
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	07/15/2019	07/14/2020
Pre-Amplifier	EMC Instruments	EMC184045B	980135	01/02/2019	01/01/2020
Pre-Amplifier	EMC Instruments	EMC184045B	980135	01/02/2020	01/01/2021
Pre-Amplifier	EMC Instruments	EMC051825	980152	01/02/2019	01/01/2020
Pre-Amplifier	EMC Instruments	EMC051825	980152	01/02/2020	01/01/2021
Pre-Amplifier	HP	8447D	2944A09469	01/02/2019	01/01/2020
Pre-Amplifier	HP	8447D	2944A09469	01/02/2020	01/01/2021
Attenuator	Mini-Circuit	BW-S10W2+	4	01/02/2019	01/01/2020
Attenuator	Mini-Circuit	BW-S10W2+	4	01/02/2020	01/01/2021
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M1	01/02/2019	01/01/2020
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M1	01/02/2020	01/01/2021
High Pass Filter	WI	WHKX4.0/18G-10SS	22	01/02/2019	01/01/2020
High Pass Filter	WI	WHKX4.0/18G-10SS	22	01/02/2020	01/01/2021
Coaxial Cable	Huber Suhner	succoflex 102	MY2622/2	01/02/2019	01/01/2020
Coaxial Cable	Huber Suhner	succoflex 102	MY2622/2	01/02/2020	01/01/2021
Coaxial Cable	Huber Suhner	succoflex 104A	800086/4a	01/02/2019	01/01/2020
Coaxial Cable	Huber Suhner	succoflex 104A	800086/4a	01/02/2020	01/01/2021
Coaxial Cable	Huber Suhner	EMC 104-SM-SM-2000	160123	01/02/2019	01/01/2020
Coaxial Cable	Huber Suhner	EMC 104-SM-SM-2000	160123	01/02/2020	01/01/2021

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

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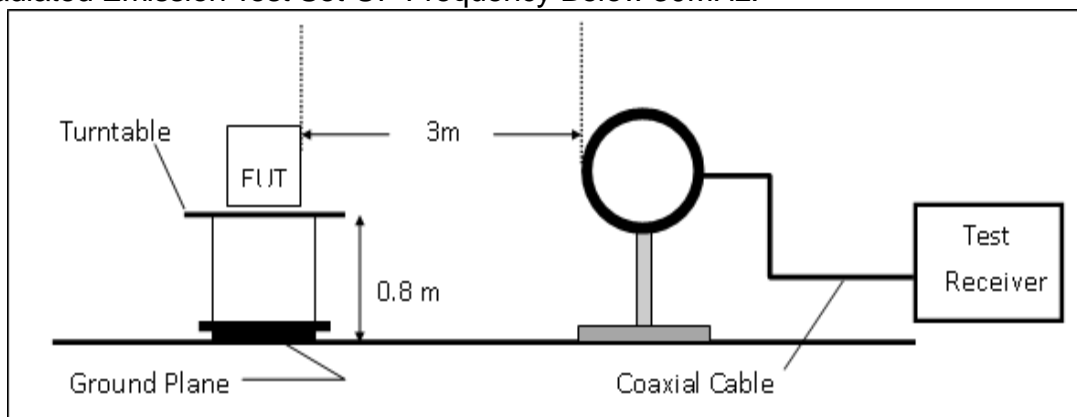
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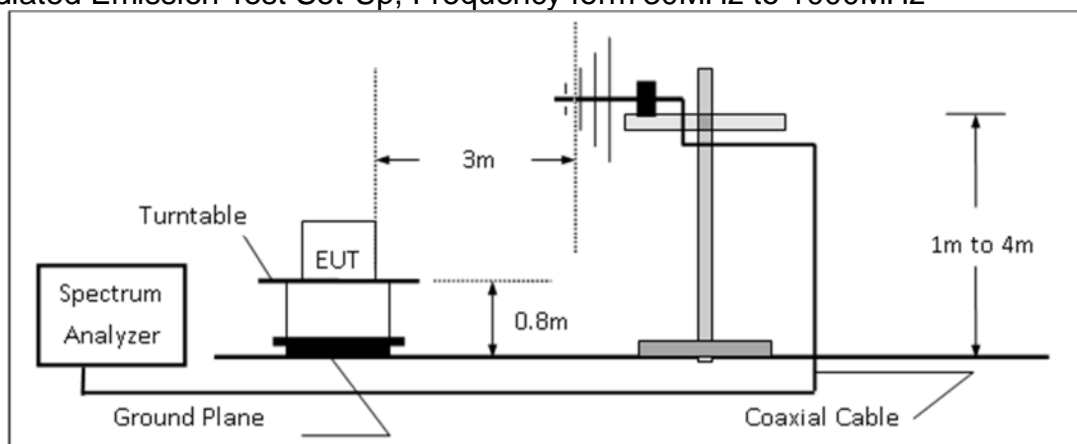
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8.3 Test SET-UP

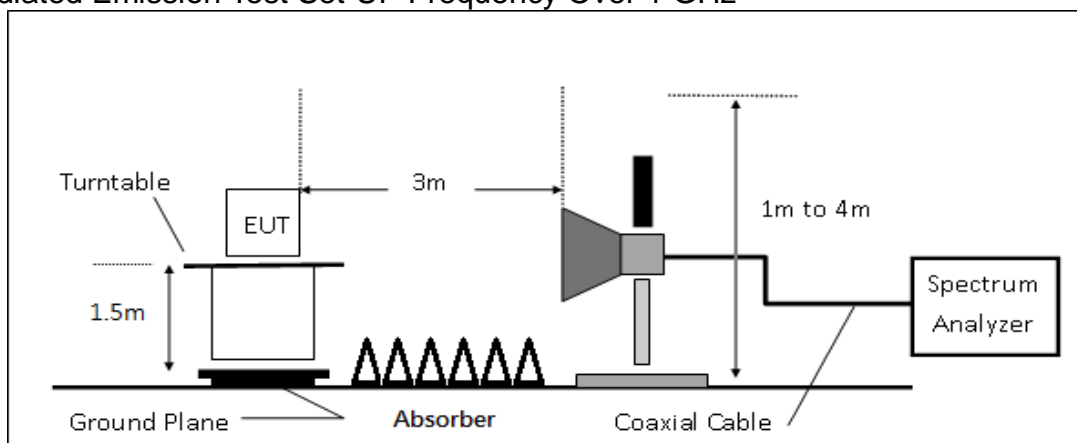
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(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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8.4 Measurement Procedure

8.4.1 Radiated Emission

1. The testing follows the Measurement Procedure of ANSI C63.10:2013.
2. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 1.5m for frequency > 1GHz above ground plan.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
6. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
8. When 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.
9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
11. Repeat above procedures until all default test channel measured were complete.

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8.5 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

The limit of the emission level is expressed in dBuV/m, which converts $20 \cdot \log(uV/m)$

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

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

8.6 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) & RSS-GEN §6.13.2 was not reported.

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8.7 Measurement Result:

8.7.1 Radiated Bandedge Result (Hopping Mode)

Report Number :ER/2019/C0114

Test Date :2020-01-07

Operation Mode :BR Hopping

Temp./Humi. :22.6/69

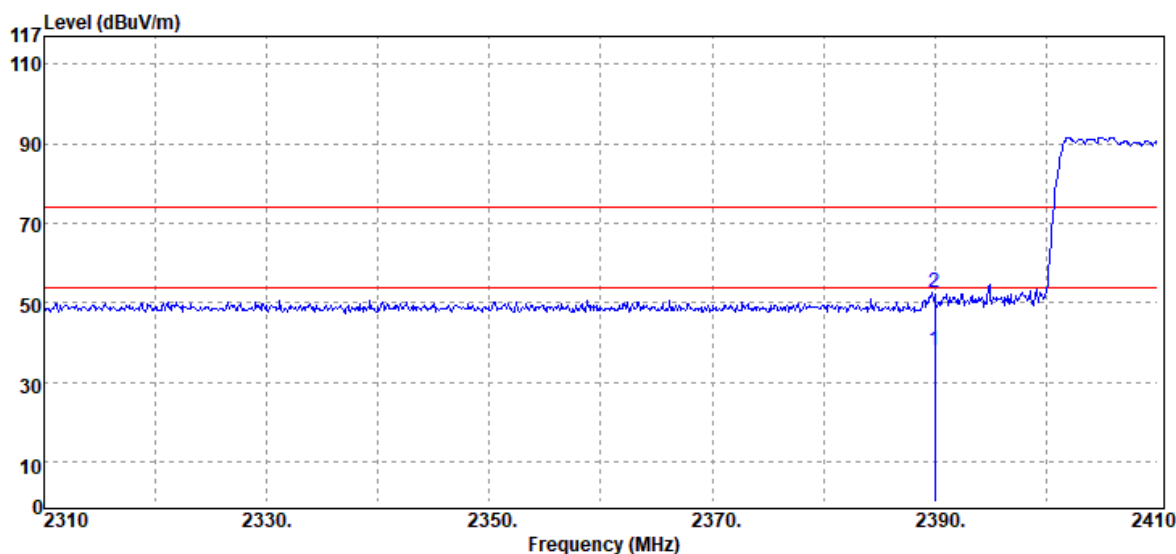
Test Channel :2402 MHz

Antenna Pol. :VERTICAL

Test Mode :Bandedge CH Low

Engineer :Thomas

EUT Pol :E2 Plane



Freq. MHz	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
2390.00	Average	30.55	7.57	38.12	54.00	-15.88
2390.00	Peak	45.13	7.57	52.70	74.00	-21.30

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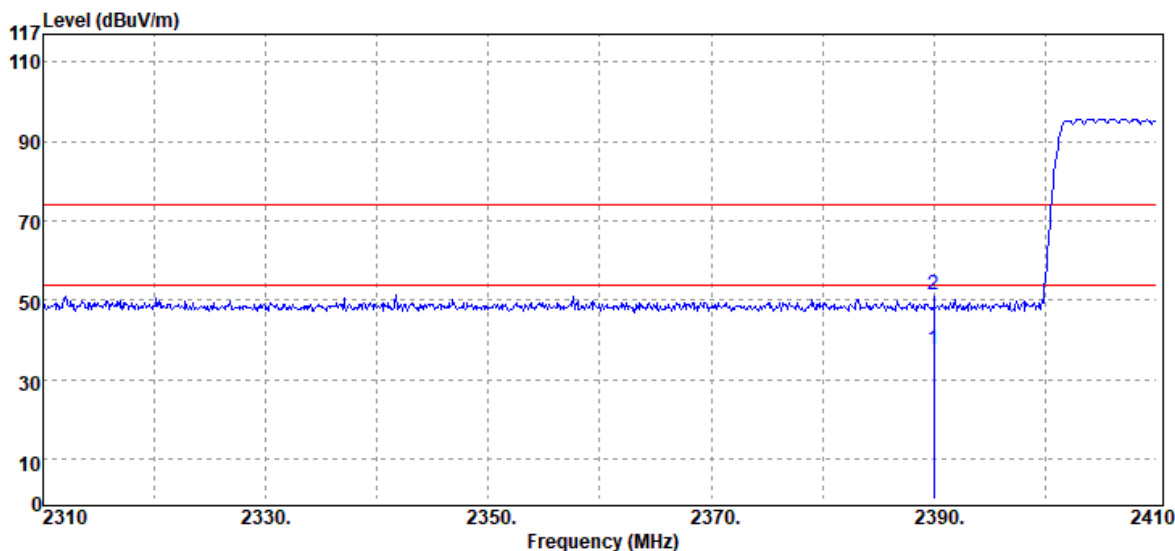
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Report Number :ER/2019/C0114
Operation Mode :BR Hopping
Test Channel :2402 MHz
Test Mode :Bandedge CH Low
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :HORIZONTAL
Engineer :Thomas



Freq. MHz	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
2390.00	Average	29.96	7.57	37.53	54.00	-16.47
2390.00	Peak	43.79	7.57	51.36	74.00	-22.64

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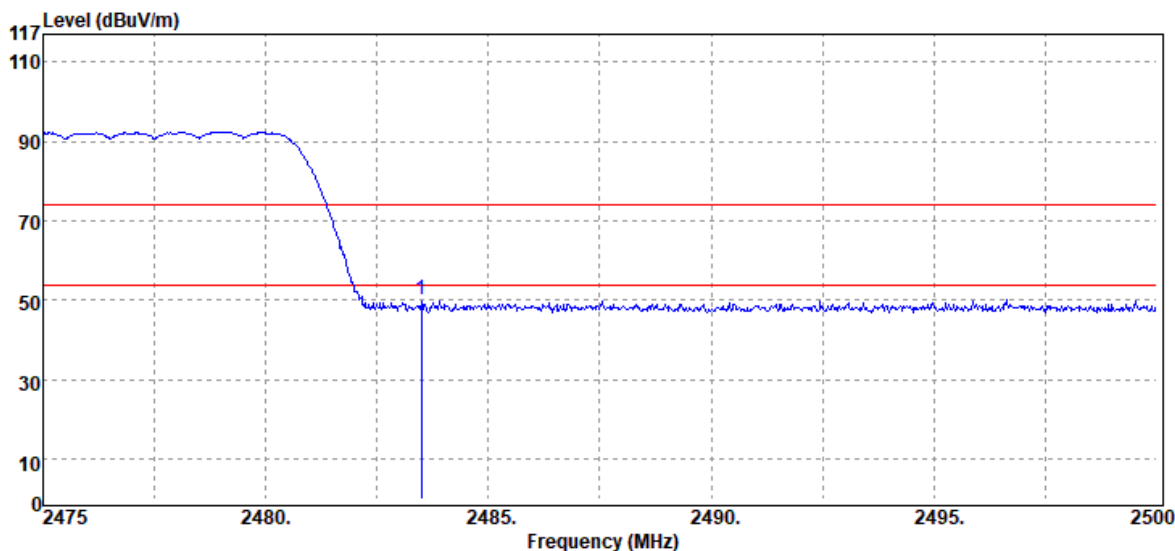
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Report Number :ER/2019/C0114
Operation Mode :BR Hopping
Test Channel :2480 MHz
Test Mode :Bandedge CH High
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :VERTICAL
Engineer :Thomas



Freq. MHz	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
2483.50	Peak	43.31	6.94	50.25	74.00	-23.75

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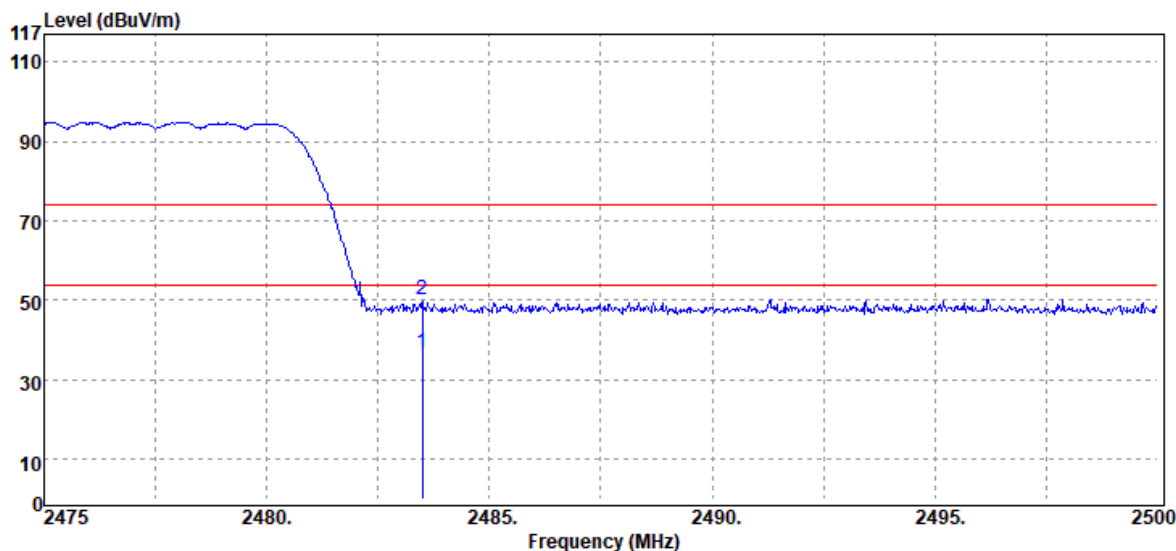
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Report Number :ER/2019/C0114
Operation Mode :BR Hopping
Test Channel :2480 MHz
Test Mode :Bandedge CH High
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :HORIZONTAL
Engineer :Thomas



Freq. MHz	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
2483.50	Average	29.79	6.94	36.73	54.00	-17.27
2483.50	Peak	43.37	6.94	50.31	74.00	-23.69

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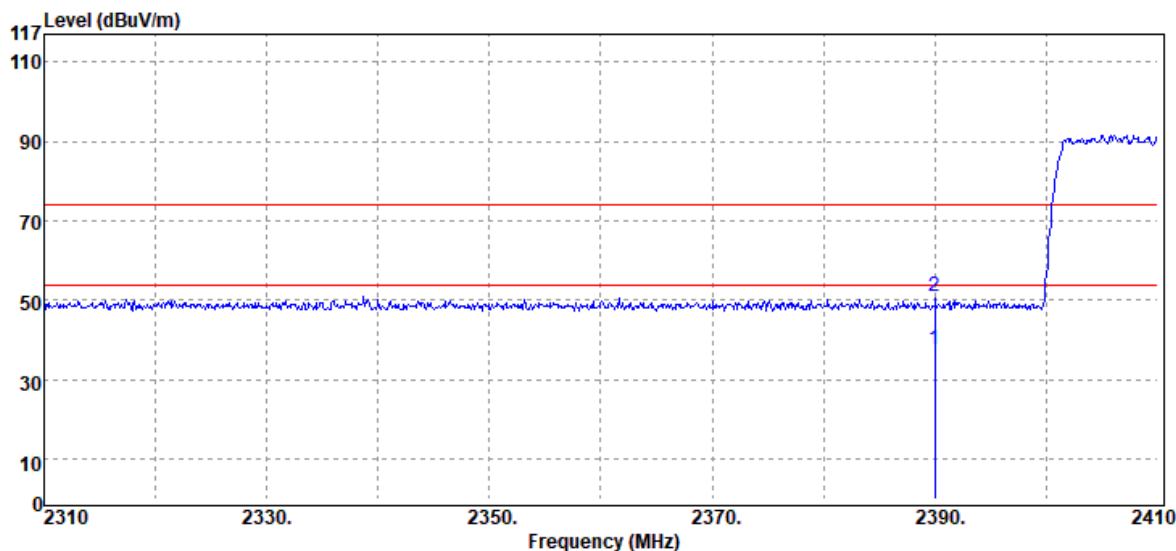
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Report Number :ER/2019/C0114
Operation Mode :EDR Hopping
Test Channel :2402 MHz
Test Mode :Bandedge CH Low
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :VERTICAL
Engineer :Thomas



Freq. MHz	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
2390.00	Average	30.00	7.57	37.57	54.00	-16.43
2390.00	Peak	43.28	7.57	50.85	74.00	-23.15

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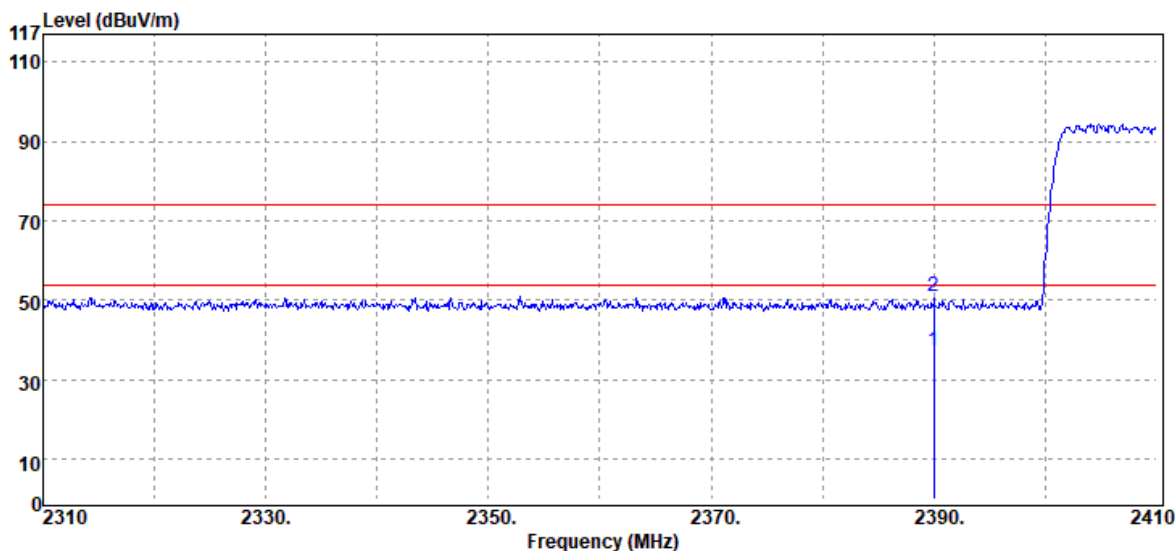
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Report Number :ER/2019/C0114
Operation Mode :EDR Hopping
Test Channel :2402 MHz
Test Mode :Bandedge CH Low
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :HORIZONTAL
Engineer :Thomas



Freq. MHz	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
2390.00	Average	29.67	7.57	37.24	54.00	-16.76
2390.00	Peak	43.46	7.57	51.03	74.00	-22.97

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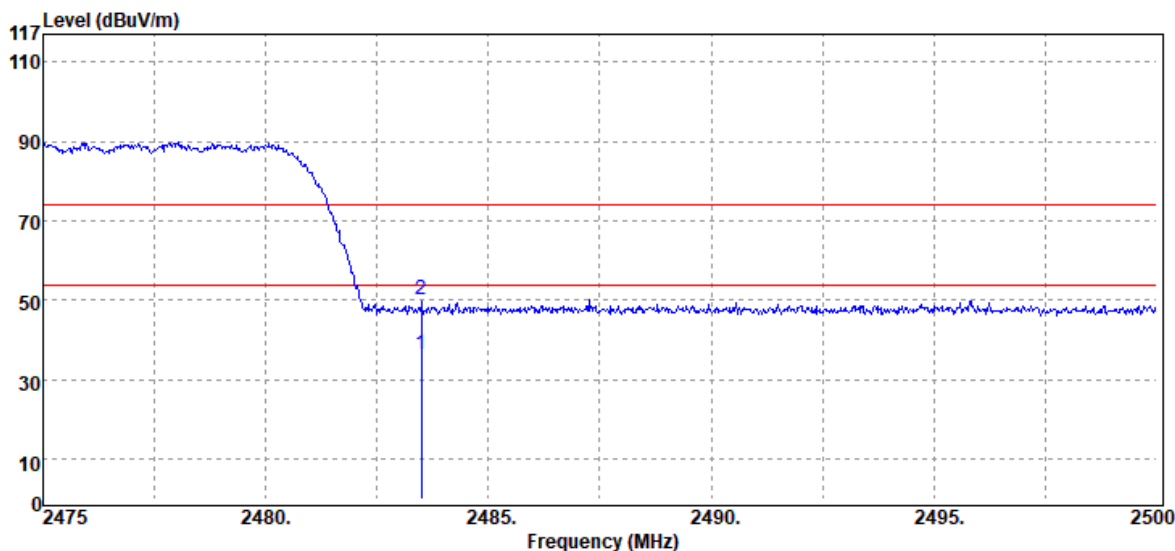
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Report Number :ER/2019/C0114
Operation Mode :EDR Hopping
Test Channel :2480 MHz
Test Mode :Bandedge CH High
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :VERTICAL
Engineer :Thomas



Freq. MHz	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
2483.50	Average	29.63	6.94	36.57	54.00	-17.43
2483.50	Peak	43.16	6.94	50.10	74.00	-23.90

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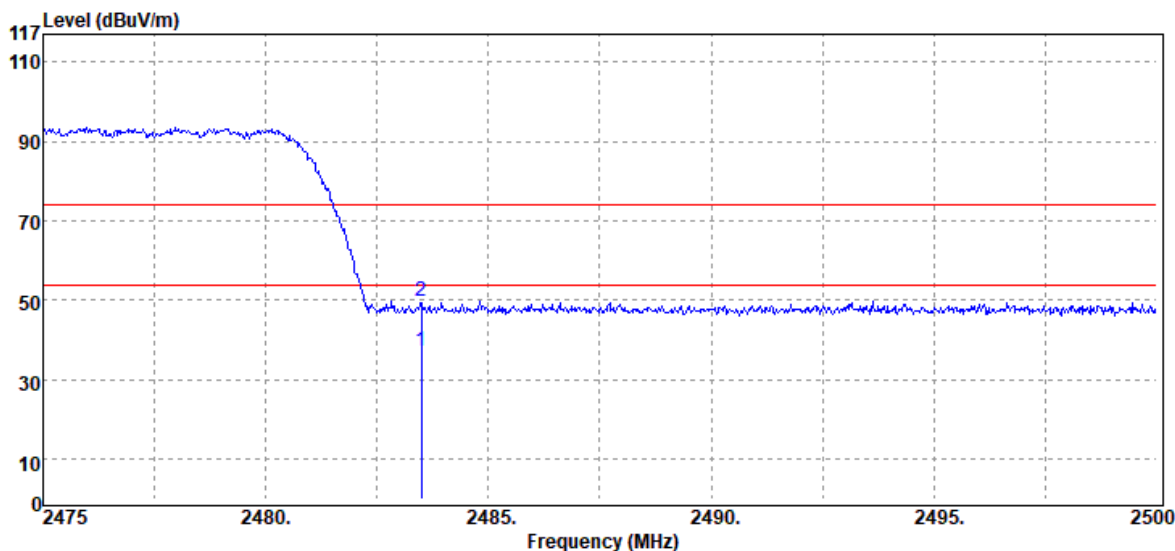
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Report Number :ER/2019/C0114
Operation Mode :EDR Hopping
Test Channel :2480 MHz
Test Mode :Bandedge CH High
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :HORIZONTAL
Engineer :Thomas



Freq. MHz	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
2483.50	Average	30.22	6.94	37.16	54.00	-16.84
2483.50	Peak	43.04	6.94	49.98	74.00	-24.02

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8.7.2 Radiated Bandedge Result (Non-Hopping Mode)

Report Number :ER/2019/C0114

Test Date :2020-01-07

Operation Mode :BR(1M)

Temp./Humi. :22.6/69

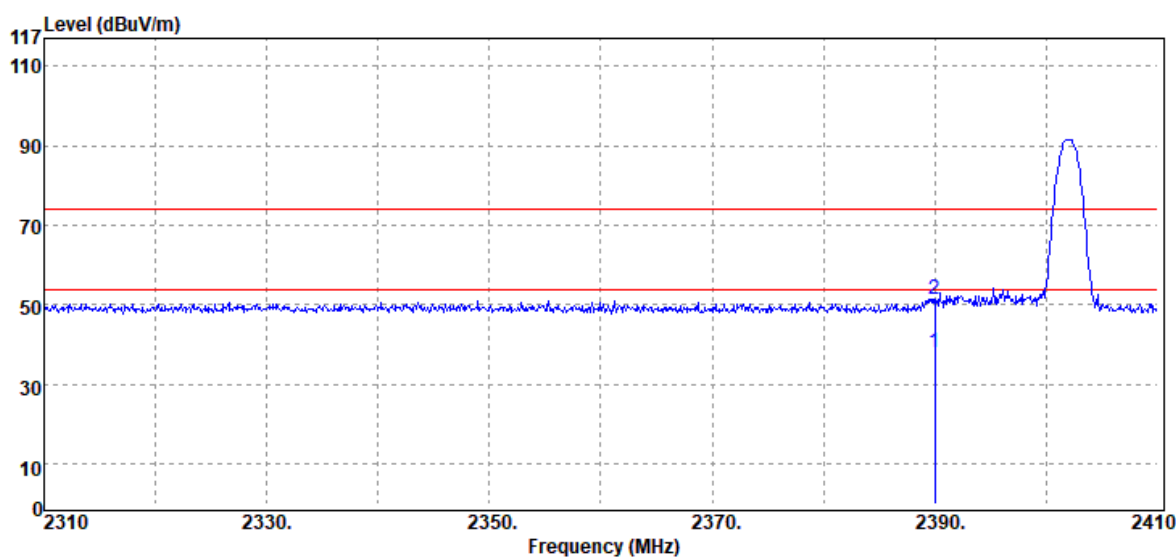
Test Channel :2402 MHz

Antenna Pol. :VERTICAL

Test Mode :Bandedge CH Low

Engineer :Thomas

EUT Pol :E2 Plane



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	30.61	7.57	38.18	54.00	-15.82
2390.00	Peak	43.96	7.57	51.53	74.00	-22.47

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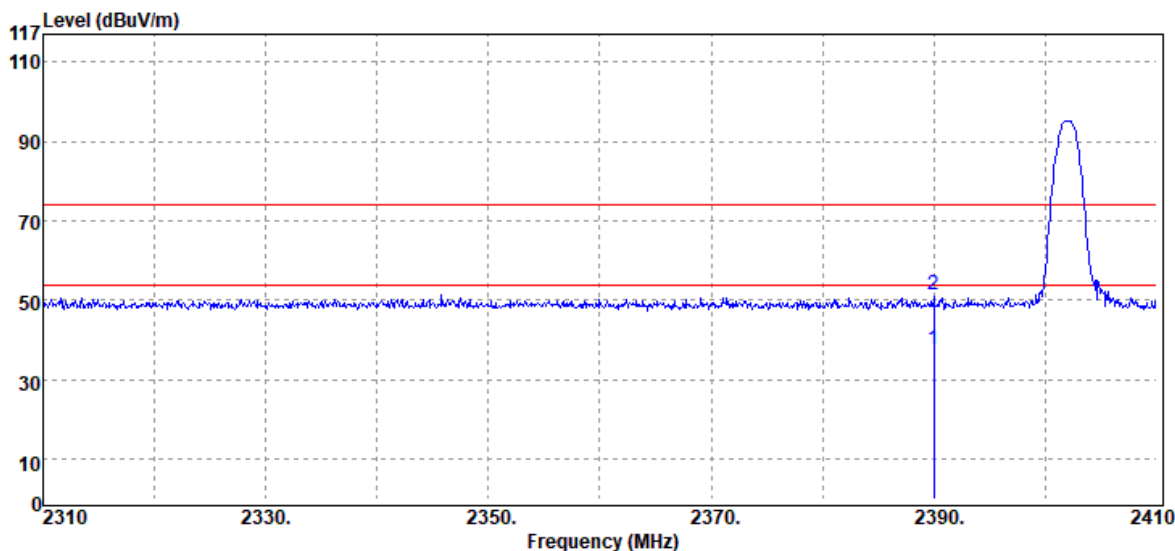
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Report Number :ER/2019/C0114
Operation Mode :BR(1M)
Test Channel :2402 MHz
Test Mode :Bandedge CH Low
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :HORIZONTAL
Engineer :Thomas



Freq. MHz	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
2390.00	Average	30.03	7.57	37.60	54.00	-16.40
2390.00	Peak	43.71	7.57	51.28	74.00	-22.72

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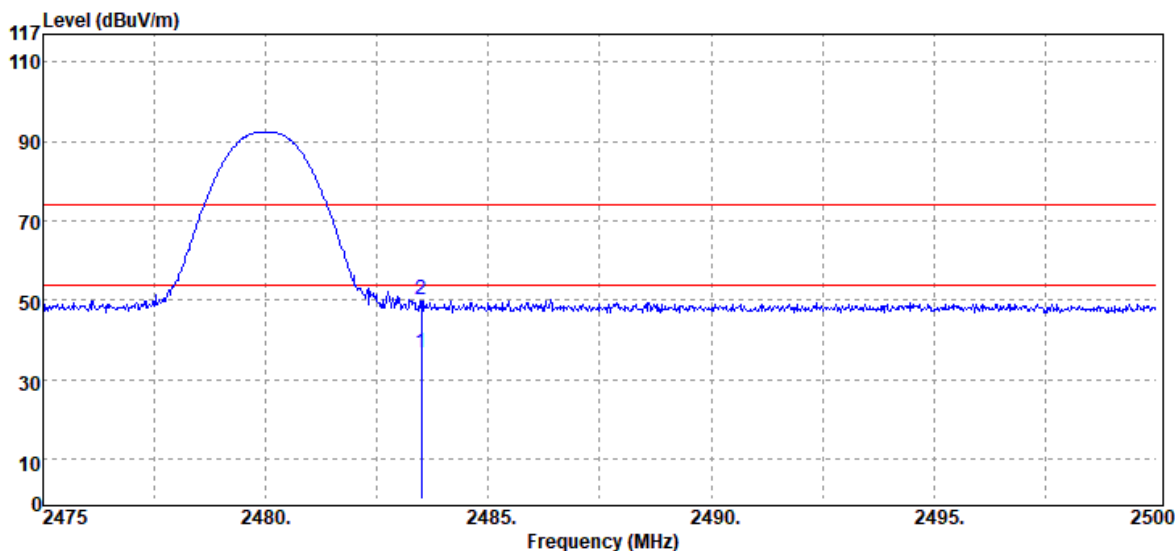
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Member of SGS Group

Report Number :ER/2019/C0114
Operation Mode :BR(1M)
Test Channel :2480 MHz
Test Mode :Bandedge CH High
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :VERTICAL
Engineer :Thomas



Freq. MHz	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
2483.50	Average	30.04	6.94	36.98	54.00	-17.02
2483.50	Peak	43.13	6.94	50.07	74.00	-23.93

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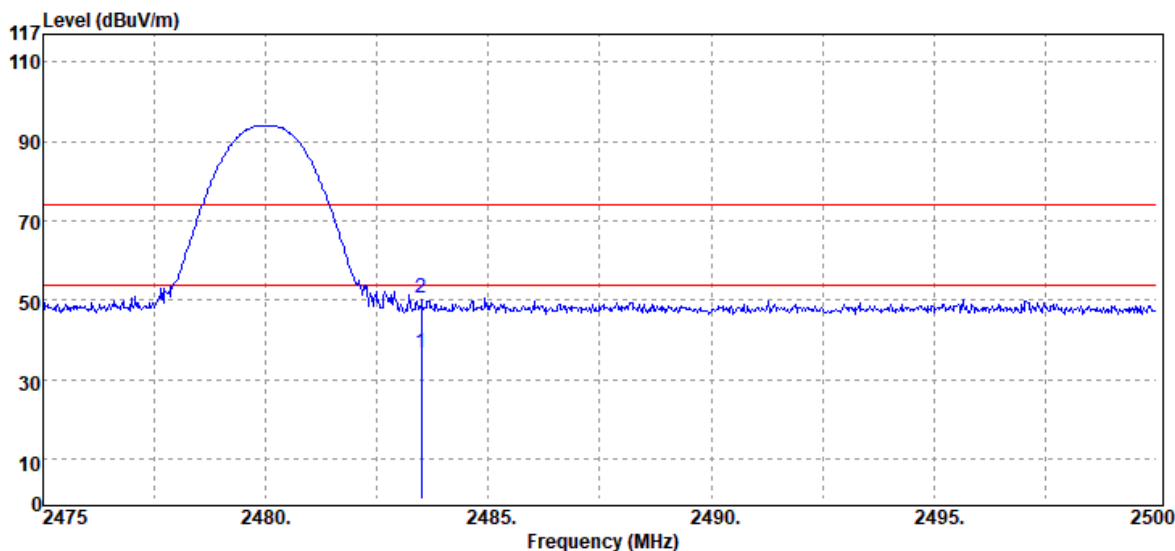
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Report Number :ER/2019/C0114
Operation Mode :BR(1M)
Test Channel :2480 MHz
Test Mode :Bandedge CH High
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :HORIZONTAL
Engineer :Thomas



Freq. MHz	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
2483.50	Average	29.91	6.94	36.85	54.00	-17.15
2483.50	Peak	43.51	6.94	50.45	74.00	-23.55

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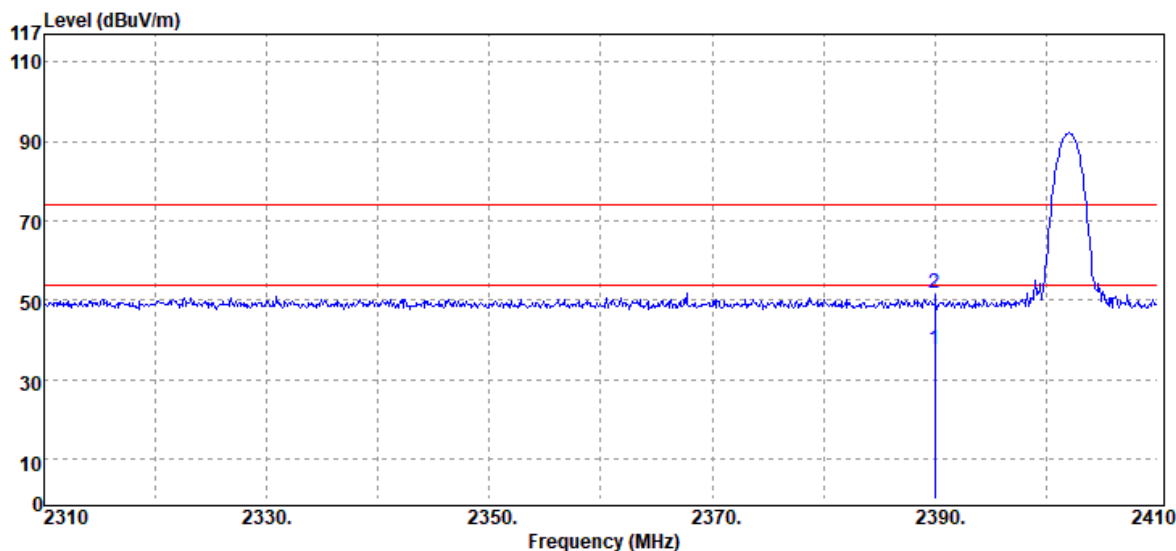
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Report Number :ER/2019/C0114
Operation Mode :EDR(3M)
Test Channel :2402 MHz
Test Mode :Bandedge CH Low
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :VERTICAL
Engineer :Thomas



Freq. MHz	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
2390.00	Average	30.16	7.57	37.73	54.00	-16.27
2390.00	Peak	44.22	7.57	51.79	74.00	-22.21

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Report Number :ER/2019/C0114

Operation Mode :EDR(3M)

Test Channel :2402 MHz

Test Mode :Bandedge CH Low

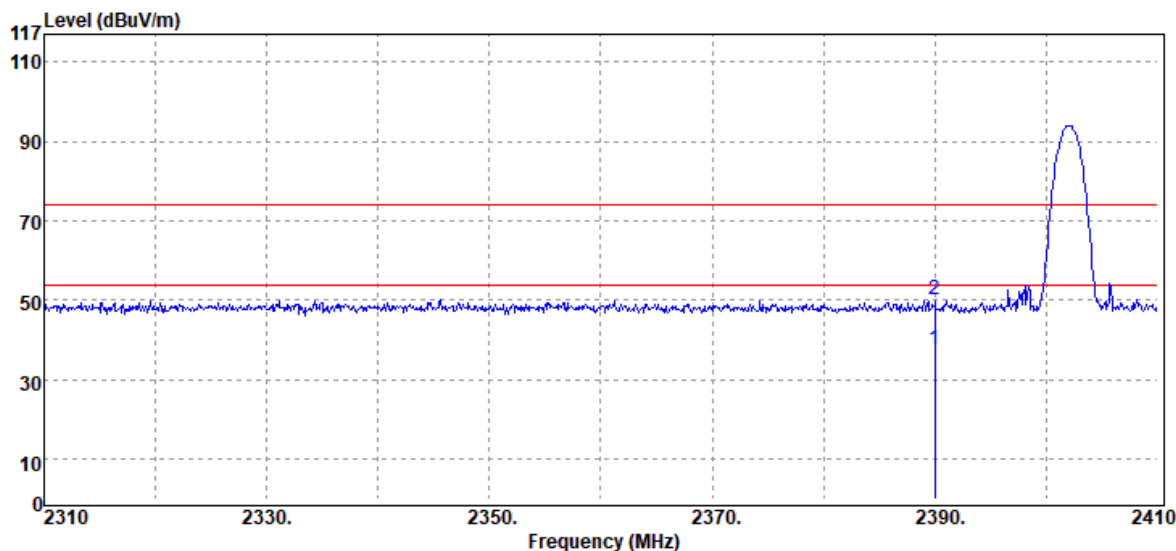
EUT Pol :E2 Plane

Test Date :2020-01-07

Temp./Humi. :22.6/69

Antenna Pol. :HORIZONTAL

Engineer :Thomas



Freq. MHz	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
2390.00	Average	29.96	7.57	37.53	54.00	-16.47
2390.00	Peak	42.62	7.57	50.19	74.00	-23.81

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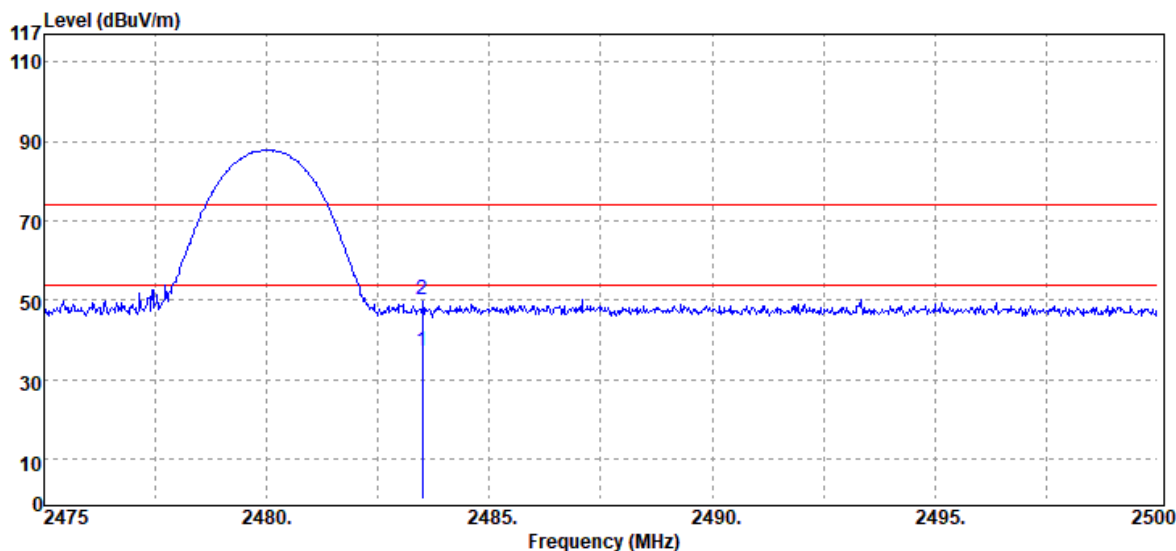
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Report Number :ER/2019/C0114
Operation Mode :EDR(3M)
Test Channel :2480 MHz
Test Mode :Bandedge CH High
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :VERTICAL
Engineer :Thomas



Freq. MHz	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
2483.50	Average	30.19	6.94	37.13	54.00	-16.87
2483.50	Peak	43.36	6.94	50.30	74.00	-23.70

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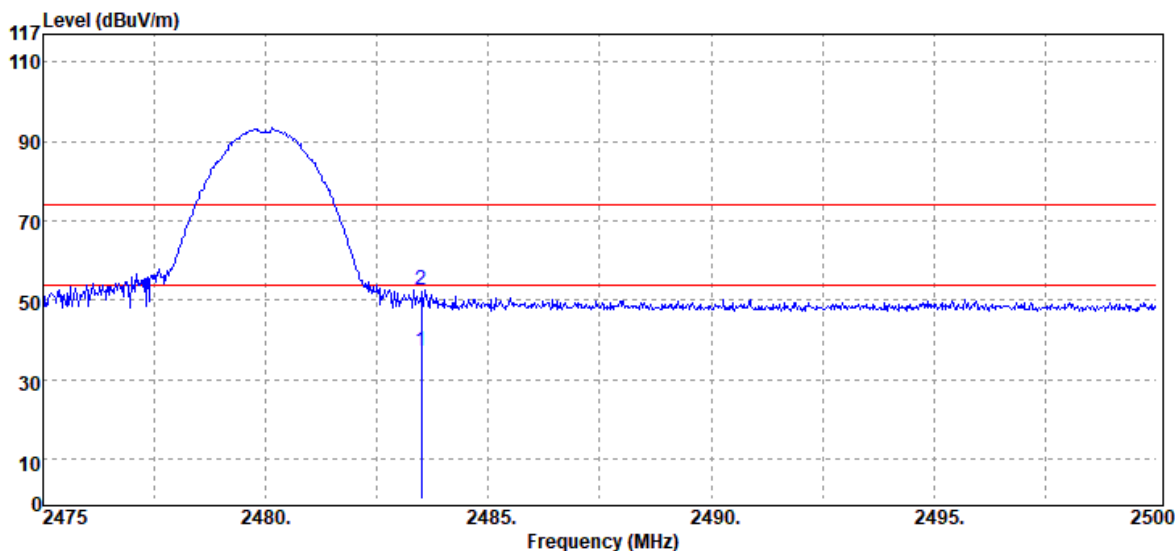
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Report Number :ER/2019/C0114
Operation Mode :EDR(3M)
Test Channel :2480 MHz
Test Mode :Bandedge CH High
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :HORIZONTAL
Engineer :Thomas



Freq. MHz	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
2483.50	Average	30.31	6.94	37.25	54.00	-16.75
2483.50	Peak	45.64	6.94	52.58	74.00	-21.42

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8.7.3 Radiated Spurious Emission form 30MHz to 1000MHz:

Report Number :ER/2019/C0114

Test Date :2020-01-07

Operation Mode :BR(1M)

Temp./Humi. :22.6/69

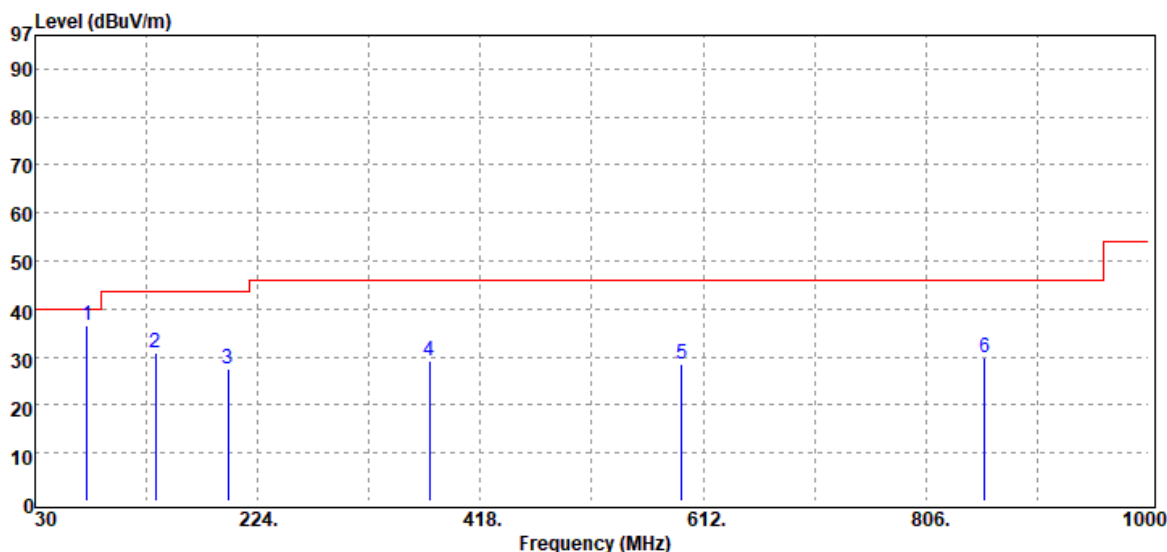
Test Channel :2441 MHz

Antenna Pol. :VERTICAL

Test Mode :Tx CH Mid

Engineer :Thomas

EUT Pol :E2 Plane



Freq. MHz	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
75.59	Peak	53.43	-16.74	36.69	40.00	-3.31
134.76	Peak	42.37	-11.60	30.77	43.50	-12.73
197.81	Peak	40.01	-12.59	27.42	43.50	-16.08
373.38	Peak	36.26	-6.97	29.29	46.00	-16.71
593.57	Peak	32.20	-3.54	28.66	46.00	-17.34
857.41	Peak	29.95	-0.13	29.82	46.00	-16.18

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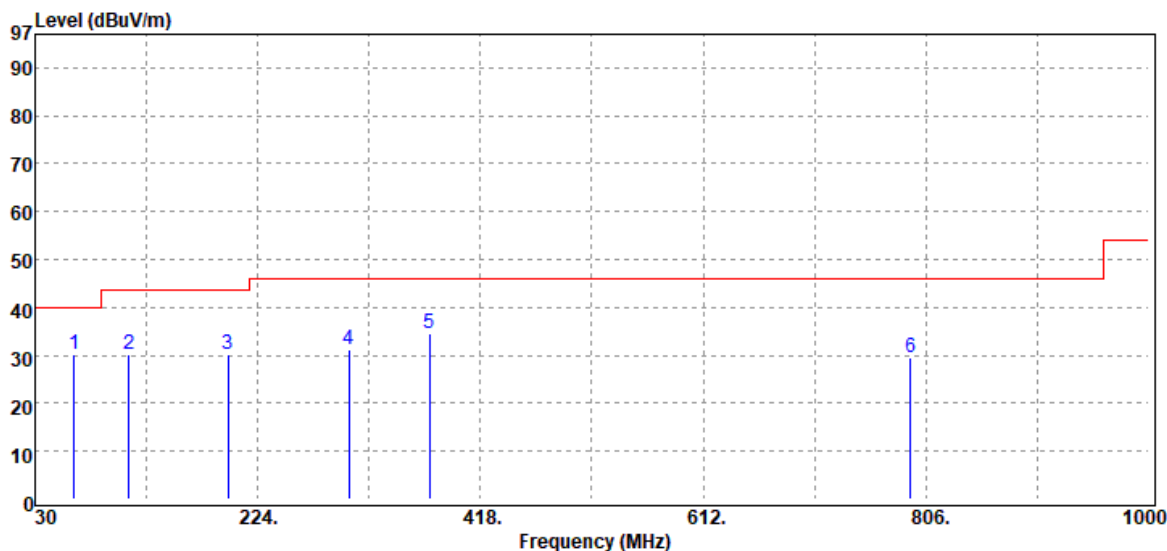
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Report Number :ER/2019/C0114
Operation Mode :BR(1M)
Test Channel :2441 MHz
Test Mode :Tx CH Mid
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :HORIZONTAL
Engineer :Thomas


Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
63.95	Peak	47.52	-17.39	30.13	40.00	-9.87
111.48	Peak	41.76	-11.57	30.19	43.50	-13.31
197.81	Peak	42.72	-12.59	30.13	43.50	-13.37
303.54	Peak	39.01	-7.95	31.06	46.00	-14.94
373.38	Peak	41.65	-6.97	34.68	46.00	-11.32
792.42	Peak	30.59	-1.08	29.51	46.00	-16.49

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8.7.4 Radiated Spurious Emission above 1 GHz:

Report Number :ER/2019/C0114

Test Date :2020-01-07

Operation Mode :BR(1M)

Temp./Humi. :22.6/69

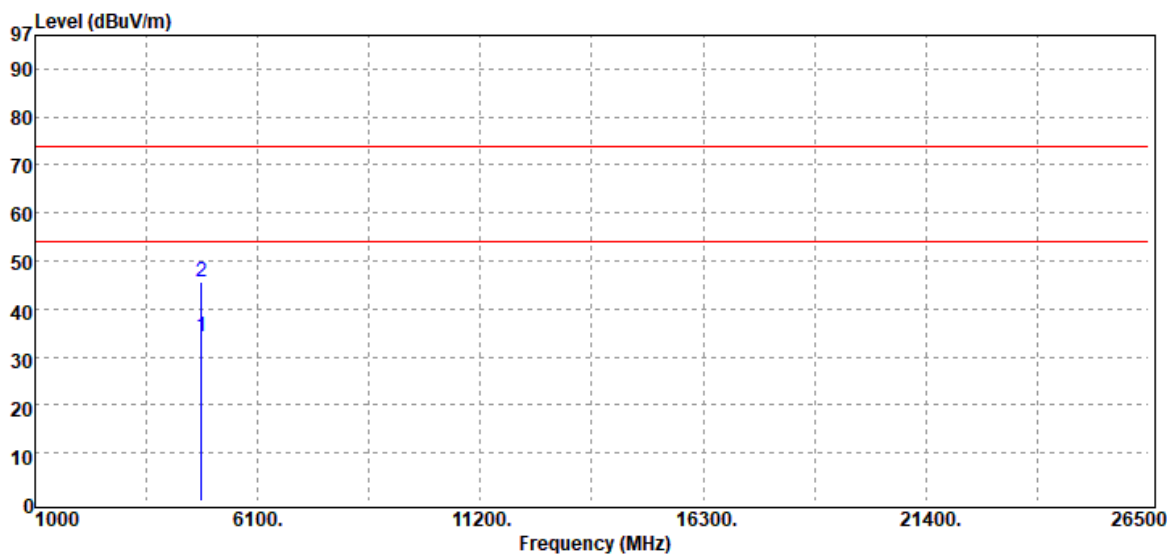
Test Channel :2402 MHz

Antenna Pol. :VERTICAL

Test Mode :Tx CH Low

Engineer :Thomas

EUT Pol :E2 Plane



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4804.00	Average	19.82	14.57	34.39	54.00	-19.61
4804.00	Peak	31.18	14.57	45.75	74.00	-28.25

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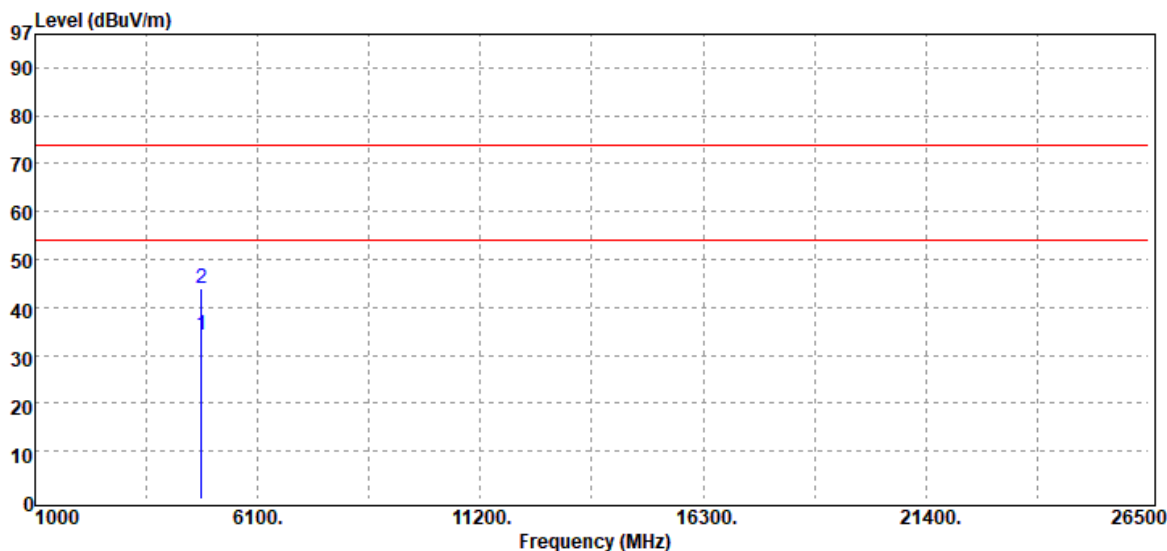
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Report Number :ER/2019/C0114
Operation Mode :BR(1M)
Test Channel :2402 MHz
Test Mode :Tx CH Low
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :HORIZONTAL
Engineer :Thomas



Freq. MHz	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
4804.00	Average	19.56	14.57	34.13	54.00	-19.87
4804.00	Peak	29.24	14.57	43.81	74.00	-30.19

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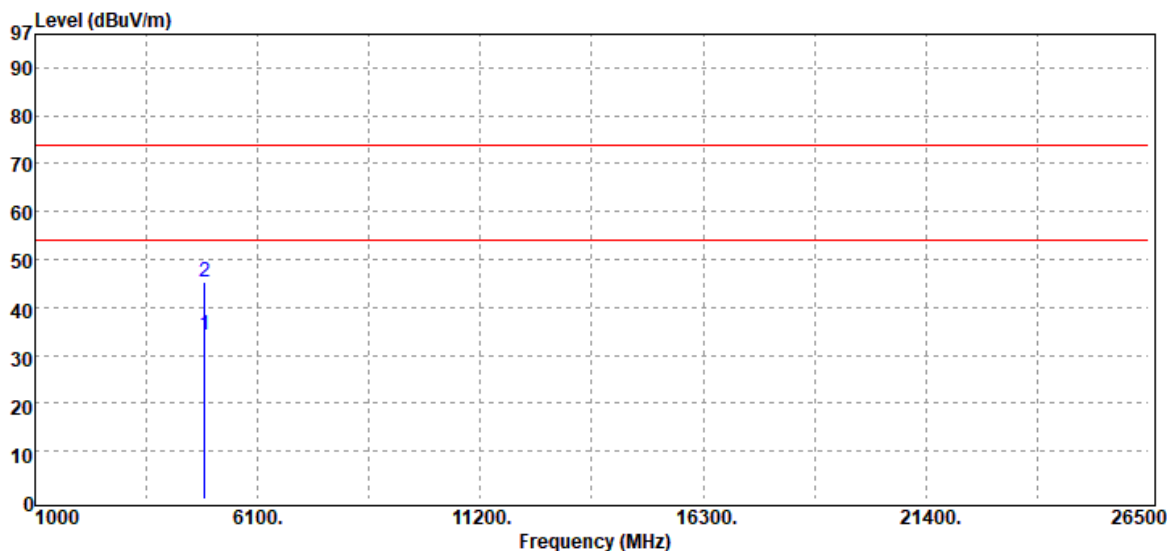
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Report Number :ER/2019/C0114
Operation Mode :BR(1M)
Test Channel :2441 MHz
Test Mode :Tx CH Mid
EUT Pol :E2 Plane

Test Date :2019-12-31
Temp./Humi. :22.5/61
Antenna Pol. :VERTICAL
Engineer :Thomas



Freq. MHz	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
4882.00	Average	19.28	15.08	34.36	54.00	-19.64
4882.00	Peak	30.37	15.08	45.45	74.00	-28.55

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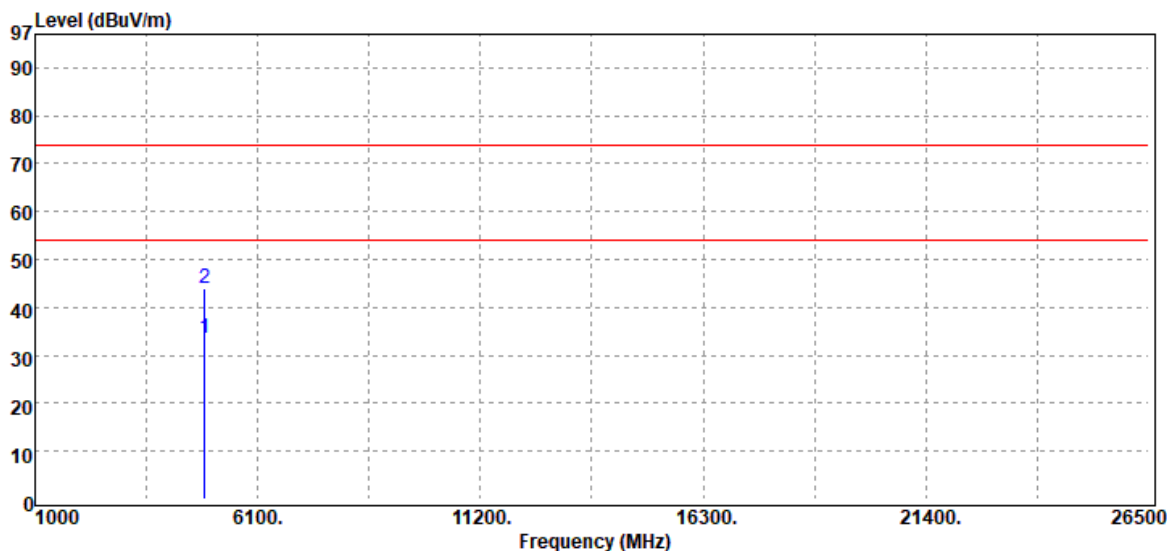
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Report Number :ER/2019/C0114
Operation Mode :BR(1M)
Test Channel :2441 MHz
Test Mode :Tx CH Mid
EUT Pol :E2 Plane

Test Date :2019-12-31
Temp./Humi. :22.5/61
Antenna Pol. :HORIZONTAL
Engineer :Thomas



Freq. MHz	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
4882.00	Average	18.39	15.08	33.47	54.00	-20.53
4882.00	Peak	28.98	15.08	44.06	74.00	-29.94

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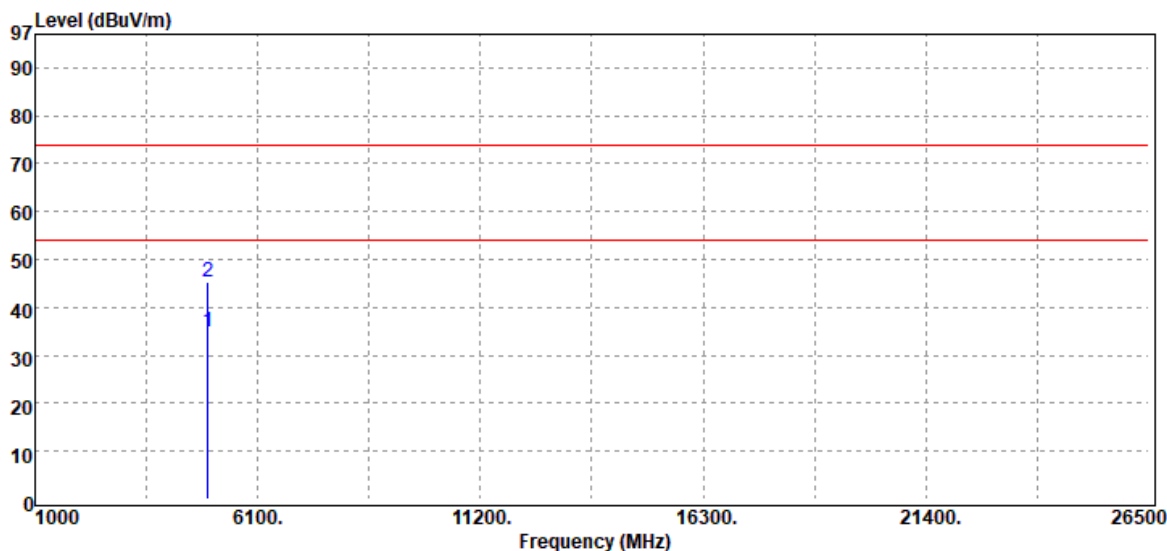
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Report Number :ER/2019/C0114
Operation Mode :BR(1M)
Test Channel :2480 MHz
Test Mode :Tx CH High
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :VERTICAL
Engineer :Thomas



Freq. MHz	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
4960.00	Average	19.87	15.13	35.00	54.00	-19.00
4960.00	Peak	30.20	15.13	45.33	74.00	-28.67

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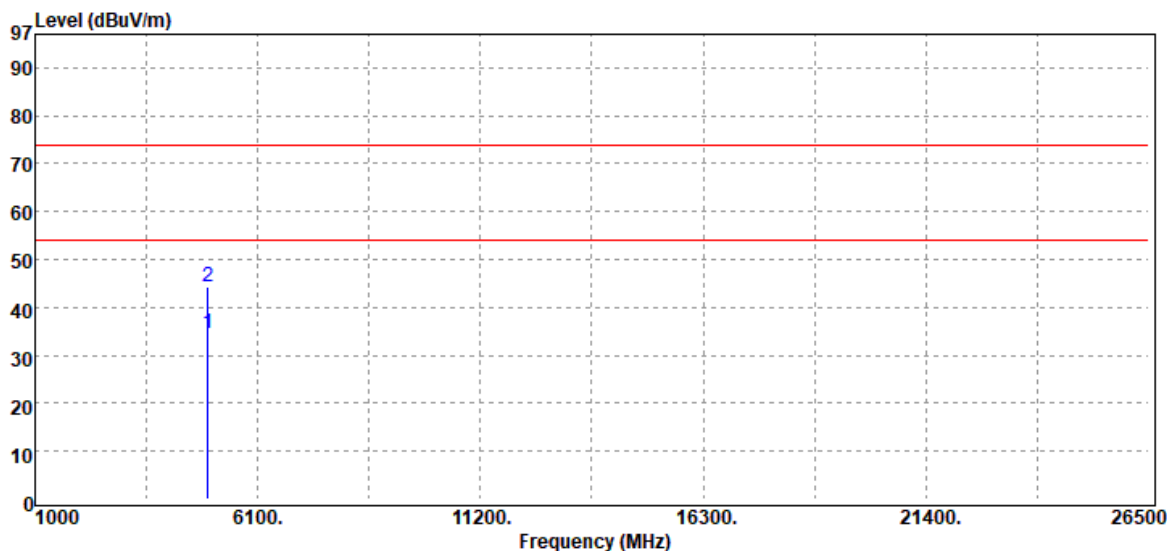
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Report Number :ER/2019/C0114
Operation Mode :BR(1M)
Test Channel :2480 MHz
Test Mode :Tx CH High
EUT Pol :E2 Plane

Test Date :2020-01-07
Temp./Humi. :22.6/69
Antenna Pol. :HORIZONTAL
Engineer :Thomas



Freq. MHz	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
4960.00	Average	19.42	15.13	34.55	54.00	-19.45
4960.00	Peak	29.26	15.13	44.39	74.00	-29.61

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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.

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

9.2 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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