

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT



Applicant: Aptiv Connection Systems India Pvt Ltd
7/60-A & 60-B, Arakunnam Pulickamaly Road; Arakunnam
P.O., Ernakula, Kerala, India

Manufacturer: Aptiv Connection Systems India Pvt Ltd
7/60-A & 60-B, Arakunnam Pulickamaly Road; Arakunnam
P.O., Ernakula, Kerala, India

Product Name: Wireless Charger

Brand Name: APTIV

Model No.: 35487240

Model Difference: N/A

Report Number: TERF2211002467E2

FCC ID 2A9QJ-35487240

Date of EUT Received: November 23, 2022

Date of Test: November 28, 2022~December 28, 2022

Issue Date: February 8, 2023

Approved By



Jay Lin

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab. 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 comply with FCC rule part §15C.

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

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Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TERF2211002467E2	00	Original	December 16, 2022	Celery Wei	
TERF2211002467E2	01	1. Revise applicant and manufacturer information 2. Revise RF Specification 3. Revise description in section 9.3 4. Revise measurement equipment 5. Revise test data	January 12, 2023	Celery Wei	*
TERF2211002467E2	02	1. Revise applicant and manufacturer information 2. Revise RF Specification 3. Revise typo	January 19, 2023	Celery Wei	*
TERF2211002467E2	03	1. Revise RF Specification 2. Add description of RBW, VBW	February 7, 2023	Celery Wei	*
TERF2211002467E2	04	1. Add description of RBW, VBW 2. Add description of p.16~21	February 8, 2023	Celery Wei	*

Note:

- 1、The remark "*" indicates modification of the report upon requests from certification body.

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Wireless Charger
Brand Name:	APTIV
Model No.:	35487240
Model Difference:	N/A
Hardware Version:	C01
Firmware Version:	N/A
EUT Series No.:	TE_SP_20221108680
Power Supply:	12VDC
Test Software (Name/Version)	Default

1.2 RF Specification

Technology:	Wireless Power Transfer
Operating Frequency	127.7kHz
FCC Transmit Power	8.19dBuV/m at 300m; 88.19dBuV/m at 3m
Number of Channels	1
Antenna Type	Loop

Note: Antenna information is provided by the applicant.

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1.3 Test Methodology

FCC Part 15, Subpart C

ANSI C63.10:2013

1.4 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation number
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	SAC 1 SAC 2 SAC 3 Conduction 1 Conducted 1 Conducted 2 Conducted 3 Conducted 4 Conducted 5 Conducted 6	TW0027
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction C SAC C SAC D SAC G Conducted A Conducted B Conducted C Conducted D Conducted E Conducted F Conducted G	TW0028

Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

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.

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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

The Transmitter was operated in the normal operating mode. The Tx frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 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. 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 radiated emissions, 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.

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

Radiated emission below 30MHz is measured in a 9m*6m*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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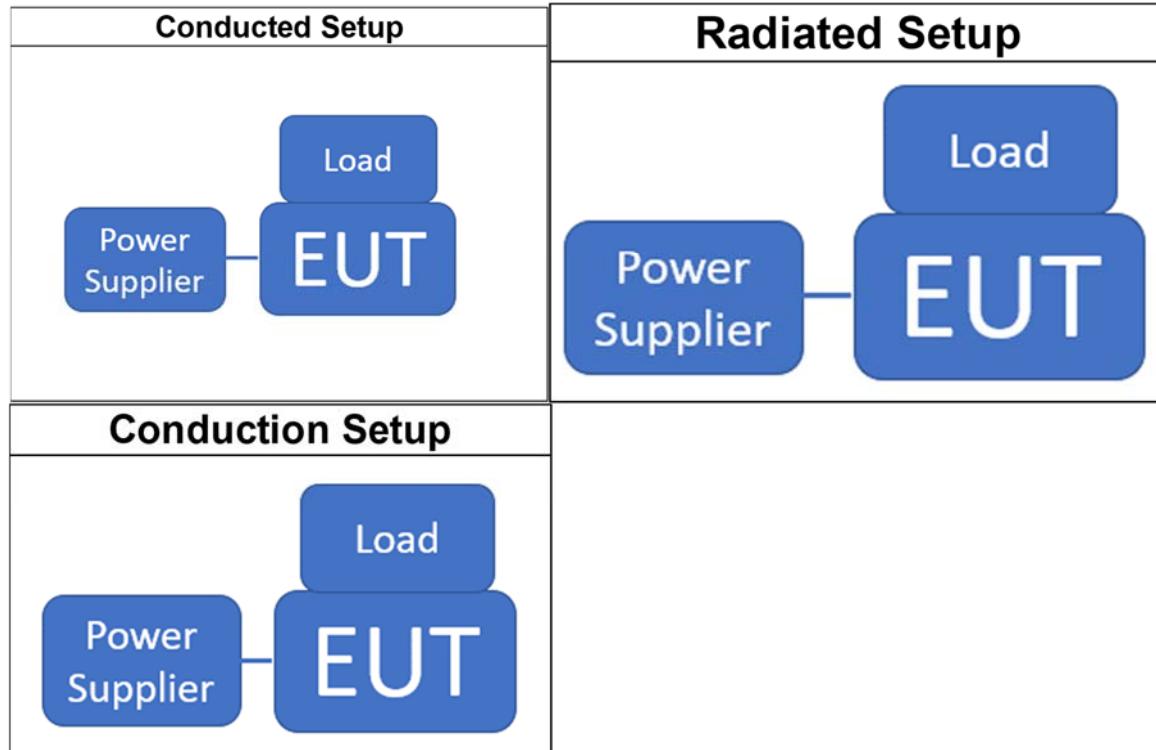
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2.4 Test Configuration



2.5 Control Unit(s)

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Load	KV-OHM	SRV 100	N/A	N.C.R	N.C.R
H-Loop Near Field Antenna	LANGER EMV-Technik	LF-R 400	02-1597	N.C.R	N.C.R
Radiated Emission Test Site: SAC D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Load	KV-OHM	SRV 100	N/A	N.C.R	N.C.R
AC Power-Line Conducted Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Load	KV-OHM	SRV 100	N/A	N.C.R	N.C.R

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	Compliant
§15.209	Radiated Emission Limits, general requirement	Compliant
§15.215 (c)	20 dB OCCUPIED BANDWIDTH	Compliant
§15.203	Antenna Requirement	Compliant

4 DESCRIPTION OF TEST MODES

The EUT stay in continuous transmitting mode. The frequency is the default channel to test, where it is the only manipulative channel as this application supports.

The field strength of radiated emission was measured as the EUT positioned in different orthogonal planes (E1/E2/H) based on actual usage of the EUT to pre-scan the emissions for determining the worst case scenario.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty	
AC Power Line Conducted Emission	+/-	2.34 dB
Frequency Stability	+/-	1.53 Hz
Emission Bandwidth	+/-	1.53 Hz
Temperature	+/-	0.4 °C
Humidity	+/-	3.5 %
DC / AC Power Source	+/-	1 %

Radiated Spurious Emission Measurement Uncertainty			
Polarization: Vertical	+/-	2.57 dB	9kHz~30MHz
	+/-	4.85 dB	30MHz - 1000MHz
	+/-	4.45 dB	1GHz - 18GHz
	+/-	4.24 dB	18GHz - 40GHz
Polarization: Horizontal	+/-	2.57 dB	9kHz~30MHz
	+/-	4.37 dB	30MHz - 1000MHz
	+/-	4.45 dB	1GHz - 18GHz
	+/-	4.24 dB	18GHz - 40GHz

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 MEASUREMENT EQUIPMENT USED

6.1 Conducted AC Power line

AC Power-Line Conducted Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	973	04/13/2022	04/12/2023
DC Power Supply	Agilent	E3640A	MY53130054	09/29/2022	09/28/2023
EMI Test Receiver	R&S	ESCI	101342	04/25/2022	04/24/2023
Coaxial Cable	EC Lab	RF-HY-CAB-250	RF-HY-CAB-250-01	03/27/2022	03/26/2023
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2022	03/26/2023
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R

6.2 Emission Bandwidth

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071574	06/20/2022	06/19/2023
DC Power Supply	DHA	DPS-3003	9411005787	08/22/2022	08/21/2023
DC Block	PASTERNACK	PE8210	RF158	11/16/2022	11/15/2023

6.3 Radiated Measurement

Radiated Emission Test Site: SAC D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-300	11/11/2022	11/10/2023
Loop Antenna	ETS.LINDGREN	6502	143303	05/14/2022	05/13/2023
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120200	03/24/2022	03/23/2023
DC Power Supply	Agilent	E3640A	MY53130054	09/29/2022	09/28/2023
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R
Pre-Amplifier	EMC Instruments	EMC9135	980234	11/16/2022	11/15/2023
Coaxial Cable	Huber+Suhner	RG 214/U	W21.01	11/16/2022	11/15/2023

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7 CONDUCTED EMISSIONS TEST

7.1 Limitation

According to section 15.207(a) Conducted Emission Limits as following.

Frequency range MHz	Limits (dBuV)	
	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

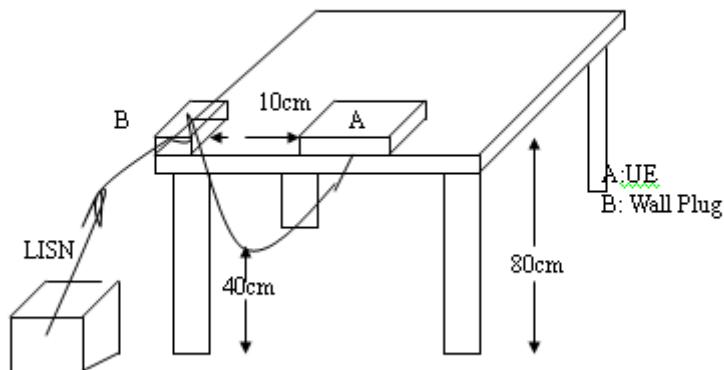
Note

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.

7.2 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.

7.3 Test SET-UP (Block Diagram of Configuration)



7.4 Measurement Procedure

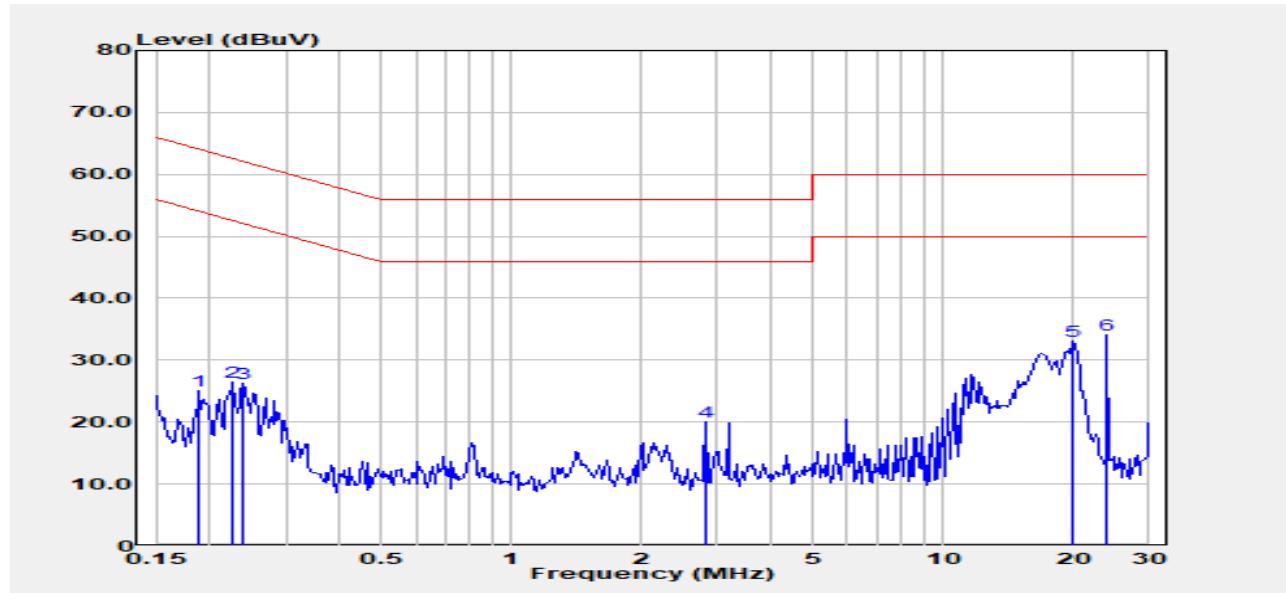
1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

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7.5 Measurement Result:

Report Number	:TERF2211002467E2	Test Site	:Conduction C
Test Mode	:WPC	Test Date	:2022-11-28
Power	:120V/60Hz	Temp./Humi.	:24.5/58
Probe	:L1	Engineer	:Huang Howard



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V	Limit dB μ V	Margin dB
0.189	Peak	14.86	10.27	25.13	64.06	-38.93
0.227	Peak	16.19	10.28	26.47	62.57	-36.10
0.239	Peak	15.94	10.28	26.22	62.13	-35.91
2.824	Peak	9.07	10.93	20.00	56.00	-36.00
20.056	Peak	22.18	10.87	33.05	60.00	-26.95
24.015	Peak	23.05	10.98	34.03	60.00	-25.97

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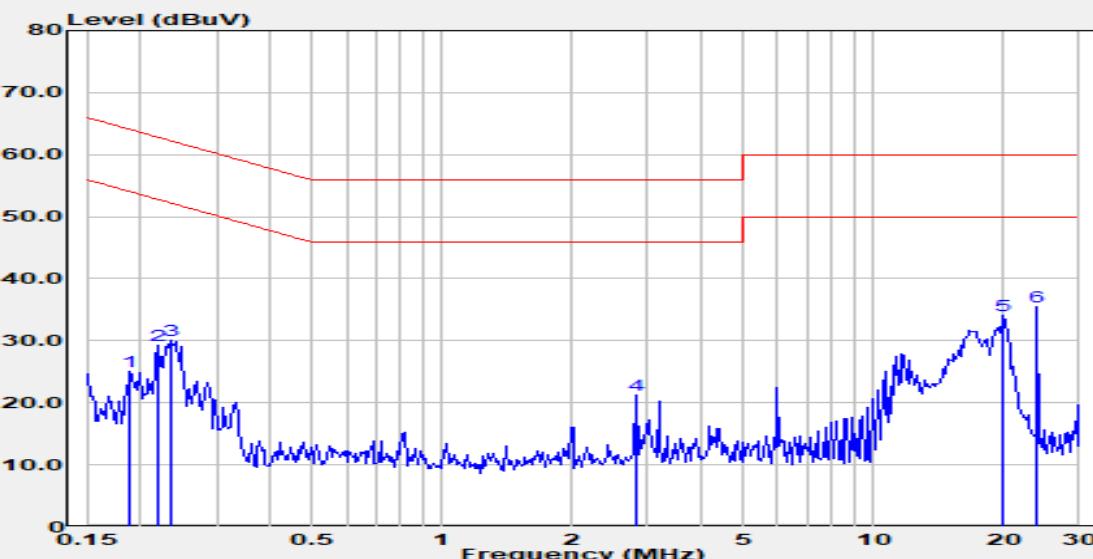
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Report Number :TERF2211002467E2
 Test Mode :WPC
 Power :120V/60Hz
 Probe :N

Test Site :Conduction C
 Test Date :2022-11-28
 Temp./Humi. :24.5/58
 Engineer :Huang Howard



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V	Limit dB μ V	Margin dB
0.189	Peak	14.77	10.27	25.04	64.06	-39.02
0.220	Peak	19.02	10.27	29.29	62.83	-33.54
0.237	Peak	19.72	10.28	29.99	62.22	-32.22
2.824	Peak	10.39	10.89	21.28	56.00	-34.72
20.056	Peak	23.19	10.84	34.03	60.00	-25.97
24.015	Peak	24.55	10.97	35.51	60.00	-24.49

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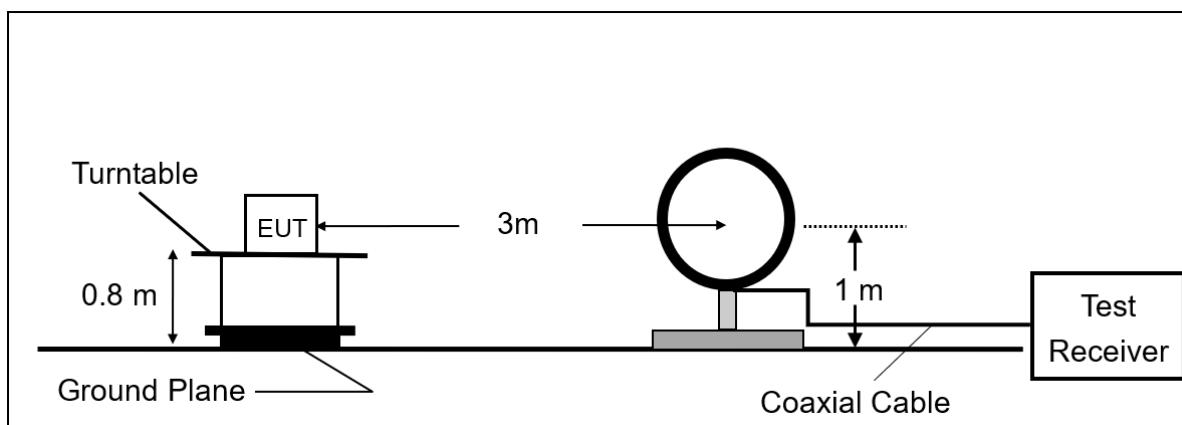
8 RADIATED EMISSION TEST

8.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m 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.

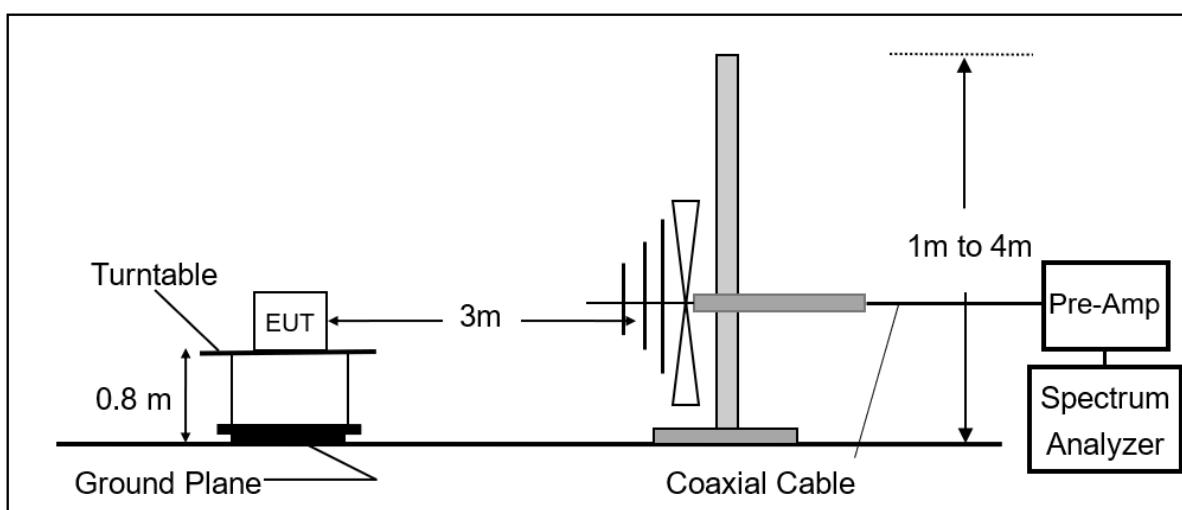
8.2 Test Setup

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



RBW=100kHz; VBW=300kHz

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



RBW=10kHz; VBW=10kHz

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8.3 Applicable Standard

The field strength of any emissions appearing outside of operation frequency shall not exceed the general radiated emission limits in section 15.209 as below.

Frequency (MHz)	Field strength (μ V/m)	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. Emission level in $\text{dB}\mu\text{V}/\text{m} = 20 \log (\mu\text{V}/\text{m})$
2. Distance extrapolation factor = $40 \log (\text{required distance} / \text{test distance})$ (dB)
3. $20 \log (30 \mu\text{V}/\text{m}) + 40 \text{dB} = 69.54 \text{ dB}\mu\text{V}/\text{m}$
4. The lower limit shall apply at the transition frequencies.
5. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.
6. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of §15.205.
7. The general radiated emission limits in §15.209 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.
8. Actual $\text{FS}(\text{dB}\mu\text{V}/\text{m}) = \text{Spectrum. Reading level}(\text{dB}\mu\text{V}) + \text{Factor(dB)}$
 $\text{Factor(dB)} = \text{Antenna Factor(dB)} + \text{Cable Loss(dB)} - \text{Pre_Amplifier Gain(dB)}$

Note:

1. The more stringent limit applies at the transition frequency.
2. Measurements are demonstrated in SAC with distance at 3m.
1. Actual $\text{FS}(\text{dB}\mu\text{V}/\text{m}) = \text{Spectrum. Reading level}(\text{dB}\mu\text{V}) + \text{Factor(dB)}$
 $\text{Factor(dB)} = \text{Antenna Factor(dB)} + \text{Cable Loss(dB)} - \text{Pre_Amplifier Gain(dB)}$

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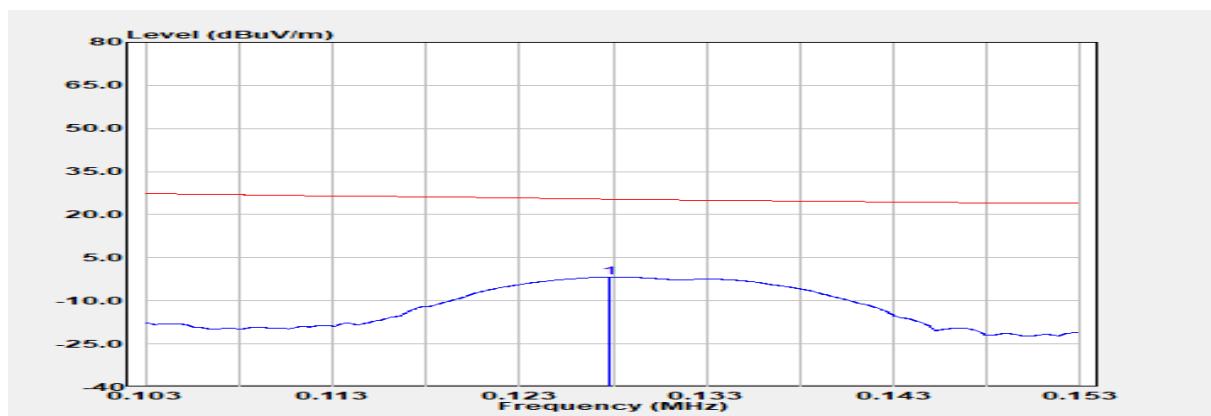
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8.4 Test Result (Worst case)

8.4.1 Field Strength of Fundamental Emission

Report Number	:TERF2211002467E2	Test Site	:SAC D
Operation Mode	:WPC	Test Date	:2022-11-28
Test Frequency	:127.7 kHz	Temp./Humi.	:21.3/67
Test Mode	:Main	Antenna Pol.	:VERTICAL
EUT Pol	:E2 Plane	Engineer	:Howard Huang



Freq. kHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual dB μ V/m	Limit @300m dB μ V/m	Margin dB
127.8	Peak	67.43	-69.21	-1.77	25.47	-27.24

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dB μ V/m) at 300m, within the band 9 kHz - 490 kHz.

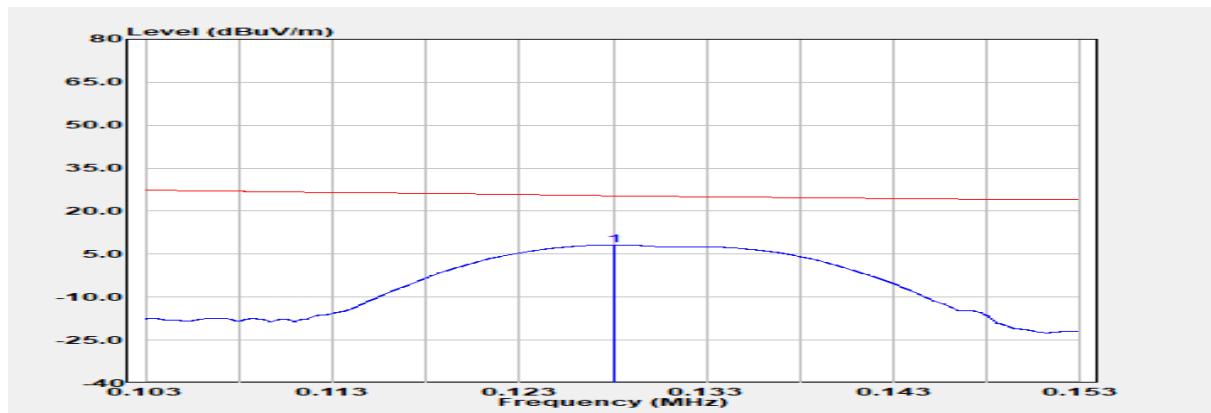
Field strength (dB μ V/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number	:TERF2211002467E2	Test Site	:SAC D
Operation Mode	:WPC	Test Date	:2022-11-28
Test Frequency	:127.7 kHz	Temp./Humi.	:21.3/67
Test Mode	:Main	Antenna Pol.	:HORIZONTAL
EUT Pol	:E2 Plane	Engineer	:Howard Huang



Freq. kHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual dB μ V/m	Limit @300m dB μ V/m	Margin dB
127.8	Peak	77.40	-69.20	8.19	25.45	-17.26

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dB μ V/m) at 300m, within the band 9 kHz - 490 kHz.

Field strength (dB μ V/m) at 30m, within the band 490 kHz - 30 MHz.

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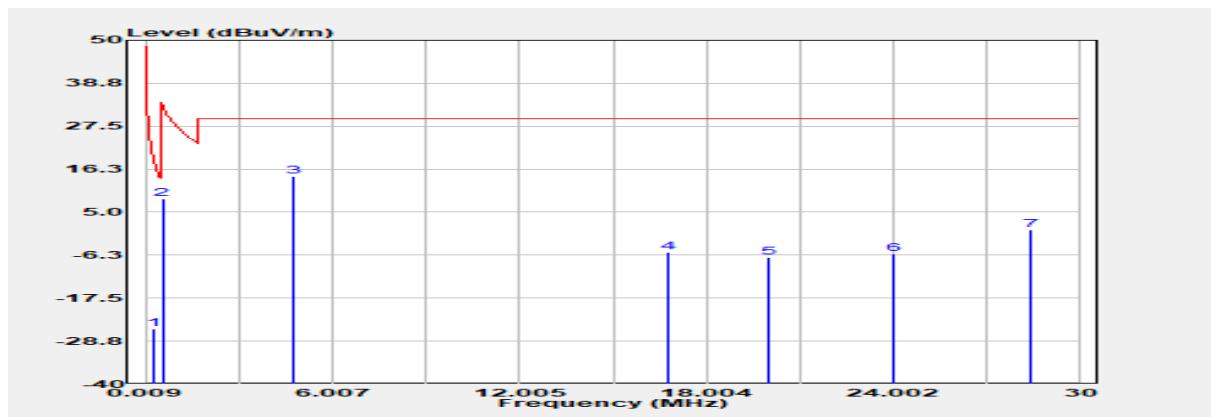
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8.4.2 Below 30 MHz test result

Report Number	:TERF2211002467E2	Test Site	:SAC D
Operation Mode	:WPC	Test Date	:2022-11-28
Test Frequency	:127.8kHz	Temp./Humi.	:21.3/67
Test Mode	:Tx	Antenna Pol.	:VERTICAL
EUT Pol	:E2 Plane	Engineer	:Howard Huang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual dB μ V/m	Limit @30m dB μ V/m	Margin dB
0.256	Peak	43.07	-68.74	-25.66	19.44	-45.11
0.549	Peak	37.01	-28.61	8.40	32.82	-24.42
4.778	Peak	43.36	-28.93	14.43	29.54	-15.11
16.744	Peak	22.91	-28.48	-5.57	29.54	-35.11
20.013	Peak	21.92	-28.68	-6.76	29.54	-36.30
24.002	Peak	23.58	-29.52	-5.94	29.54	-35.48
28.410	Peak	30.41	-30.14	0.27	29.54	-29.27

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre_Amplifier Gain — distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dB μ V/m) at 300m, within the band 9 kHz - 490 kHz.

Field strength (dB μ V/m) at 30m, within the band 490 kHz - 30 MHz.

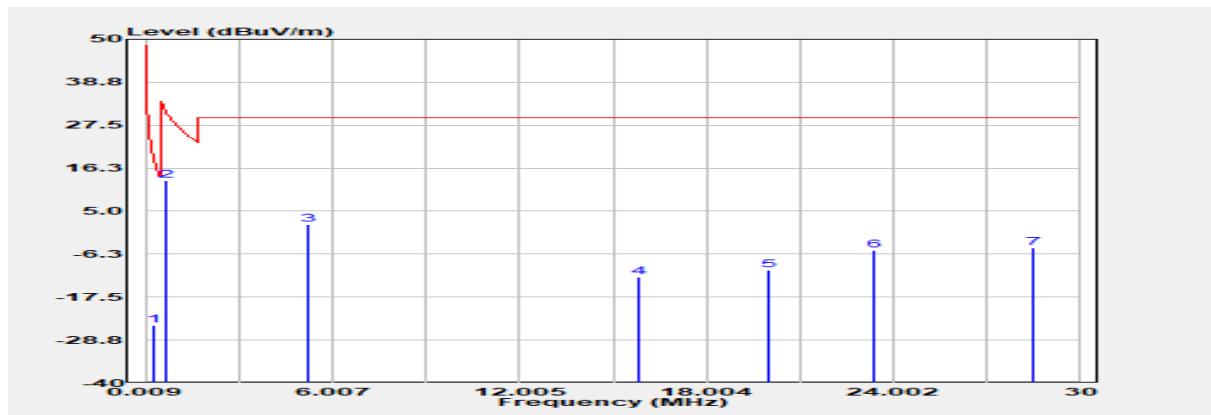
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Report Number	:TERF2211002467E2	Test Site	:SAC D
Operation Mode	:WPC	Test Date	:2022-11-28
Test Frequency	:127.8kHz	Temp./Humi.	:21.3/67
Test Mode	:Tx	Antenna Pol.	:HORIZONTAL
EUT Pol	:E2 Plane	Engineer	:Howard Huang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual dB μ V/m	Limit @30m dB μ V/m	Margin dB
0.256	Peak	43.92	-68.74	-24.81	19.44	-44.25
0.639	Peak	41.69	-28.60	13.09	31.50	-18.41
5.227	Peak	30.28	-28.86	1.42	29.54	-28.12
15.844	Peak	16.27	-28.42	-12.14	29.54	-41.68
20.013	Peak	18.29	-28.68	-10.39	29.54	-39.93
23.402	Peak	24.10	-29.41	-5.30	29.54	-34.84
28.500	Peak	25.58	-30.15	-4.57	29.54	-34.11

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dB μ V/m) at 300m, within the band 9 kHz - 490 kHz.

Field strength (dB μ V/m) at 30m, within the band 490 kHz - 30 MHz.

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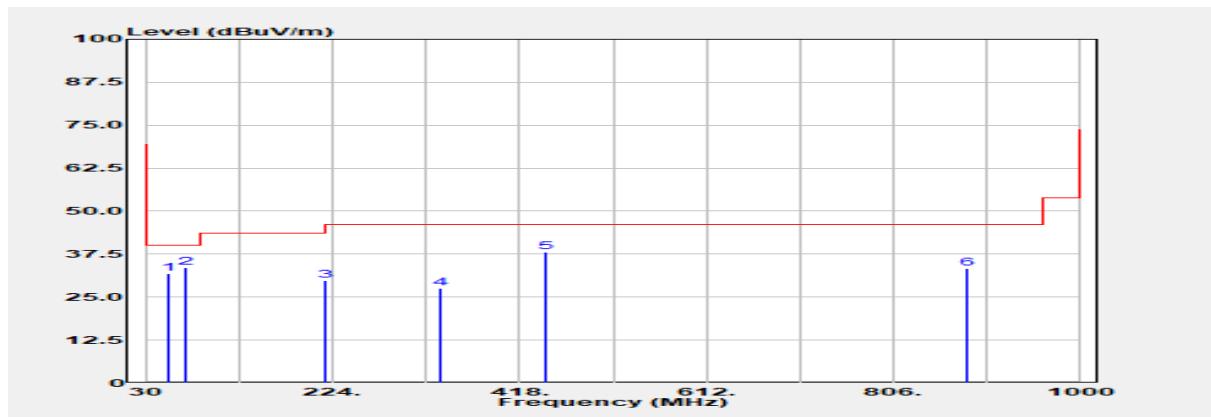
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8.4.3 Above 30MHz test result

Report Number	:TERF2211002467E2	Test Site	:SAC D
Operation Mode	:WPC	Test Date	:2022-11-28
Test Frequency	:127.8kHz	Temp./Humi.	:21.3/67
Test Mode	:Tx	Antenna Pol.	:VERTICAL
EUT Pol	:E2 Plane	Engineer	:Howard Huang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual dB μ V/m	Limit @3m dB μ V/m	Margin dB
53.280	Peak	49.23	-17.44	31.80	40.00	-8.20
71.710	Peak	53.27	-19.74	33.53	40.00	-6.47
216.240	Peak	49.68	-19.95	29.73	46.00	-16.27
335.550	Peak	42.84	-15.35	27.49	46.00	-18.51
444.190	Peak	50.17	-12.05	38.12	46.00	-7.88
882.630	Peak	38.70	-5.46	33.23	46.00	-12.77

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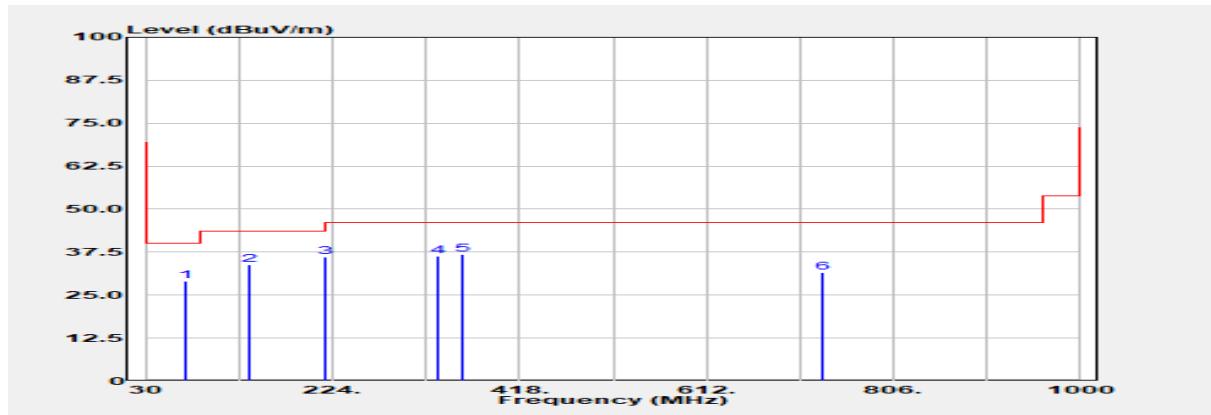
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Report Number :TERF2211002467E2 Test Site :SAC D
Operation Mode :WPC Test Date :2022-11-28
Test Frequency :127.8kHz Temp./Humi. :21.3/67
Test Mode :Tx Antenna Pol. :HORIZONTAL
EUT Pol :E2 Plane Engineer :Howard Huang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual dB μ V/m	Limit @3m dB μ V/m	Margin dB
71.710	Peak	48.83	-19.74	29.09	40.00	-10.91
137.670	Peak	51.51	-17.78	33.73	43.50	-9.77
216.240	Peak	55.99	-19.95	36.04	46.00	-9.96
332.640	Peak	51.50	-15.20	36.30	46.00	-9.70
359.800	Peak	51.00	-14.25	36.75	46.00	-9.25
732.280	Peak	38.50	-7.02	31.48	46.00	-14.52

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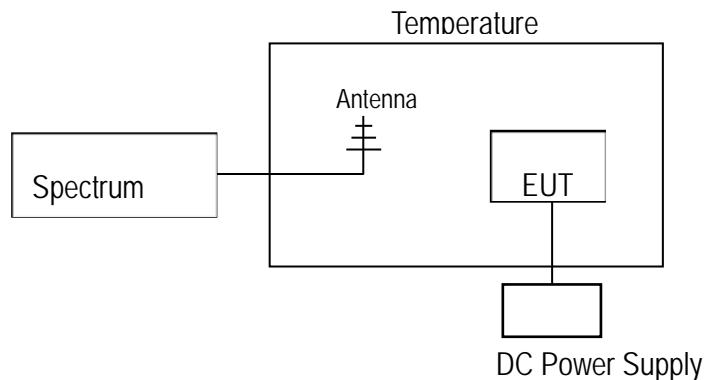
9 20 dB OCCUPIED BANDWIDTH MEASUREMENT

9.1 Standard Applicable:

§2.1049 & §15.215 (c)

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

9.2 Test SET-UP (Block Diagram of Configuration)



9.3 Measurement Procedure

20dB bandwidth

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak mode.
2. 20dB Bandwidth the resolution bandwidth shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW.
3. Measured the spectrum width with power higher than 20dB below carrier.

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9.4 Measurement Result

-20dB Bandwidth

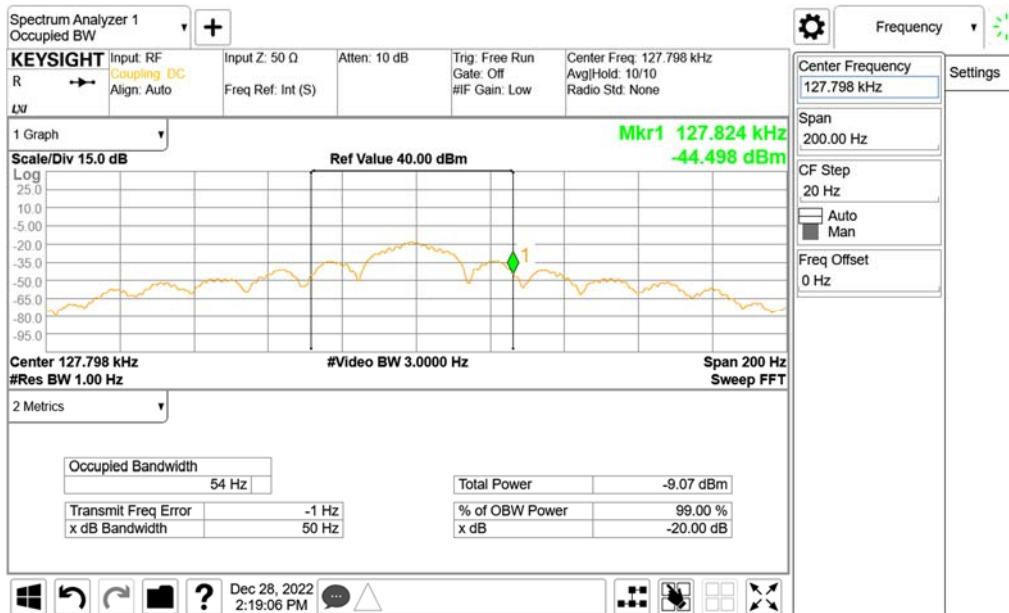
20dB Bandwidth

50 Hz

Left



Right



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10 ANTENNA REQUIREMENT

10.1 Standard Applicable:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

10.2 Antenna Connected Construction:

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

~ End of Report ~

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