

ELECTROMAGNETIC EMISSIONS
COMPLIANCE REPORT

FCC Applicant: TSC Auto ID Technology Co., Ltd.
No. 35, Sec. 2, Ligong 1st Rd., Wujie Town, I Lan Hsien, 268, Taiwan

ISED Applicant: TSC Auto ID Technology Co., Ltd.
9 F., No. 95, Minquan Rd., Xindian Dist., New Taipei City 231023, Taiwan

Manufacturer: TSC Auto ID Technology Co., Ltd.
9 F., No. 95, Minquan Rd., Xindian Dist., New Taipei City 231023, Taiwan

Product Name: 13.56MHz NFC Antenna Module

Brand Name: TSC AUTO ID TECHNOLOGY CO., LTD

Model No. /ISED HVIN: RF-NR30N

ISED PMN: RF-NR30N

Report Number: TERF2410002993ER

FCC ID VTV-RFNR30N

IC: 10524A-RFNR30N

Date of EUT Received: October 8, 2024

Date of Test: October 9, 2024~ November 1, 2024

Issue Date: November 4, 2024

Approved By CHUN-CHIEH, CHEN
Chun Chieh Chen

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 §15.225, ISED RSS-210.

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
TERF2410002993ER	00	Original	October 25, 2024	Karen Huang	
TERF2410002993ER	01	Add measurement data	November 4, 2024	Karen Huang	*

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:	13.56MHz NFC Antenna Module
Brand Name:	TSC AUTO ID TECHNOLOGY CO., LTD
Model No. /ISED HVIN:	RF-NR30N
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	34/24
Power Supply:	5Vdc
Test Software (Name/Version)	QCOM_V1.6(15.01.16.10.00)

1.2 RF specification

Radio Technology:	NFC
Operating Frequency	13.56MHz
Transmit Power	< 20.74dBuV/m at 30m. (AM) < 19.27dBuV/m at 30m. (OOK)
Number of Channels	1
Modulation Type	AM / OOK
Antenna Type	PCB Loop Antenna

Note: Antenna information is provided by the applicant.

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1.3 Test Methodology

FCC Part 15, Subpart C §15.225

RSS-Gen, Issue 5 April 2018, Amendment 2 (February 2021)

RSS-210, Issue 11 June 2024

ANSI C63.10:2013.

1.4 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation number	IC CAB identifier
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	TW3702
	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 other accessory attached. This is the worst case condition.

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 Conducted Emissions

The EUT is a 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 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/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 Radiated Emissions

The EUT is a 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.

2.3.3 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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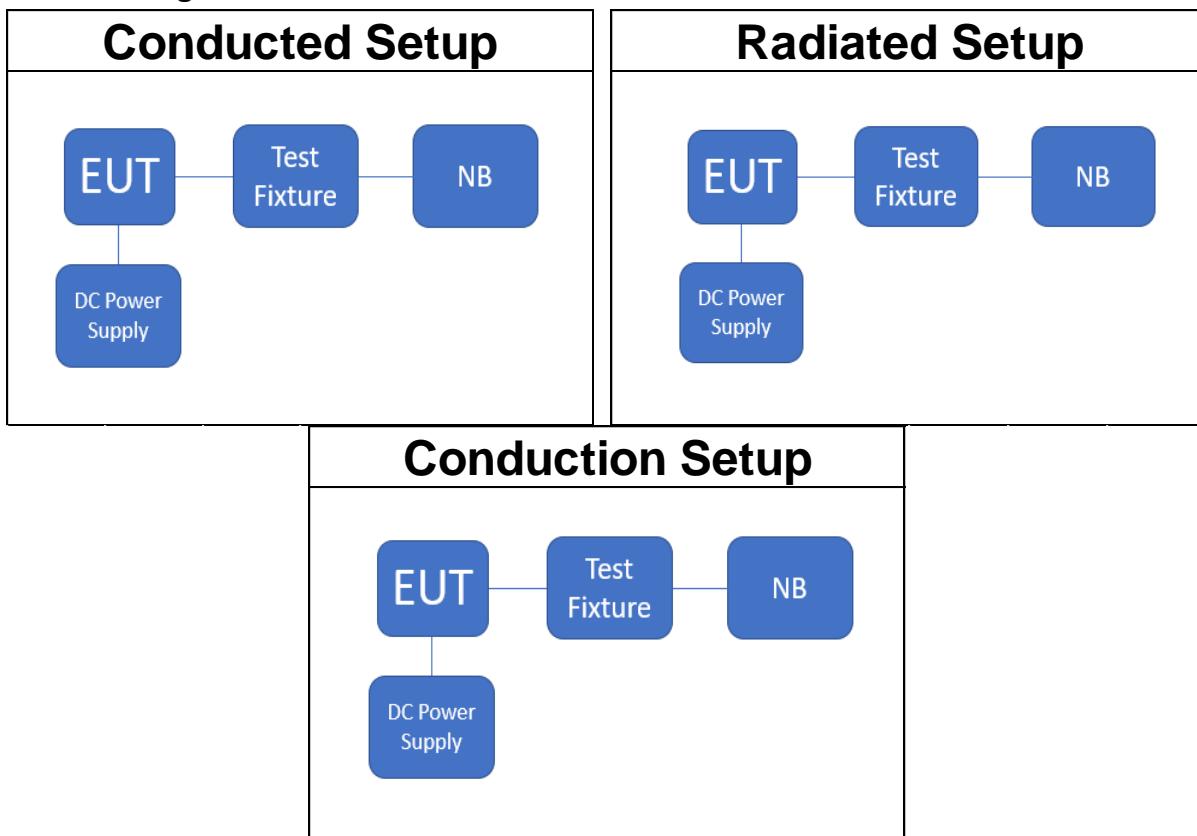
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2.4 Test Configuration



2.5 Control Unit(s)

Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	T440P	PB-03ECDS 14/08	N/A	N/A
Test Fixture	TSC	CP20102	N/A	N/A	N/A
USB(Male) to USB(Female)	MAGIC	UF3AMAF018K	N/A	N/A	N/A
Radiated Emission Test Site: SAC 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	T440P	PB-03ECDS 14/08	N/A	N/A
Test Fixture	TSC	CP2102	N/A	N/A	N/A
AC Power-Line Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	T440P	PB-03ECDS 14/08	N/A	N/A
Test Fixture	TSC	CP2102	N/A	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	ISED Rules	Description Of Test	Result
§15.207	RSS-Gen § 8.8	AC Power Line Conducted Emission	Compliant
§15.225 (a)-(d)	RSS210 Annex B B.6 (a)	Radiated Emission	Compliant
§15.209	RSS-Gen § 8.9	Radiated Emission Limits, general requirement	Compliant
§15.225 (e)	RSS210 Annex B B.6 (b)	Frequency Stability	Compliant
§2.1049 §15.215 (c)	RSS-Gen § 6.7	Emission Bandwidth	Compliant
§15.203	N/A	Antenna Requirement	Compliant
§15.205	RSS-Gen § 8.10	Restricted Bands	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 The Worst Test Modes and Channel Details

1. The EUT stay in continuous transmission mode.
2. The frequency 13.56 MHz is the default channel to test, where it is the only manipulative channel as this application supports.
3. The EUT supports 26.48kb/s, 106kb/s, 212kb/s data rates, and all possible configurations are studied to find the worst case scenario.
4. Only one configuration is supported/applicable as follows.

RADIATED EMISSION TEST			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	AM / OOK
FREQUENCY STABILITY			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	AM / OOK
20dB and 99% BANDWIDTH			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	AM / OOK

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	+/-	1.54	dB
Frequency Stability	+/-	1.48	Hz
Emission Bandwidth	+/-	1.38	Hz
Temperature	+/-	0.6	°C
Humidity	+/-	3	%
DC / AC Power Source	+/-	1	%

Radiated Spurious Emission Measurement Uncertainty			
Polarization: Vertical	+/-	1.89	dB
	+/-	4.15	dB
	+/-	3.43	dB
	+/-	3.86	dB
Polarization: Horizontal	+/-	1.89	dB
	+/-	4.02	dB
	+/-	3.43	dB
	+/-	3.86	dB
Radiated Spurious Emission	+/-	2	dB
	+/-	1.59	dB
	+/-	1.7	dB
	+/-	1.64	dB
	+/-	3.83	dB

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 Emission from AC power line

AC Power-Line Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Coaxial Cables	EMC Instruments Corp.	EMCCFD300-BM-BM-3000	161207	06/22/2024	06/21/2025
DC Power Supply	Gwinstek	SPS-3610	GEV856750	08/14/2024	08/13/2025
EMI Test Receiver	R&S	ESCI 7	100759	08/28/2024	08/27/2025
LISN	SCHWARZBECK	NSLK 8127	1040	09/07/2024	09/06/2025
Pulse Limiter	SCHWARZBECK	VTSD 9561F-N	793	06/22/2024	06/21/2025
Test Software	Audix	e3	Ver. 9.210616	N.C.R	N.C.R

6.2 Conducted Measurement

Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
DC Block	Mini-Circuits	BLK-18-S+	31129	12/12/2023	12/11/2024
DC Power Supply	Gwinstek	SPS-3610	GEV856750	08/14/2024	08/13/2025
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY59071541	07/08/2024	07/07/2025
H-Loop Near Field Antenna	EMCI	LF-R 400	02-1637	N/A	N/A
Temperature Chamber	TERCHY	MHG-120LE	1110435	06/05/2024	06/04/2025

6.3 Radiated Measurement

Radiated Emission Test Site: SAC 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Bi-log Antenna	TESEO	CBL 6112D	35242 & AT-N0555	12/18/2023	12/17/2024
Coaxial Cable	EMCI	EMC104-SM-SM-8000+EMC106-SM-SM-7600	RX Cable 9K-18G(160125+150817)	08/30/2024	08/29/2025
DC Power Supply	Gwinstek	SPS-3610	GEV856750	08/14/2024	08/13/2025
EMI Test Receiver	R&S	ESCI 7	100759	08/28/2024	08/27/2025
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY60242081	10/17/2023	10/16/2024
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY60242392	12/22/2023	12/21/2024
Loop Antenna	COM-POWER	AL-130R	10160104	12/04/2023	12/03/2024
Pre-Amplifier	HP	8447D	2944A09469	08/30/2024	08/29/2025
Site Cal	SGS	SAC 1	N/A	08/30/2024	08/29/2025
Test Software	Audix	e3	Ver. 9.210616	N.C.R	N.C.R

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

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7 CONDUCTED EMISSIONS TEST

7.1 Standard Applicable

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

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

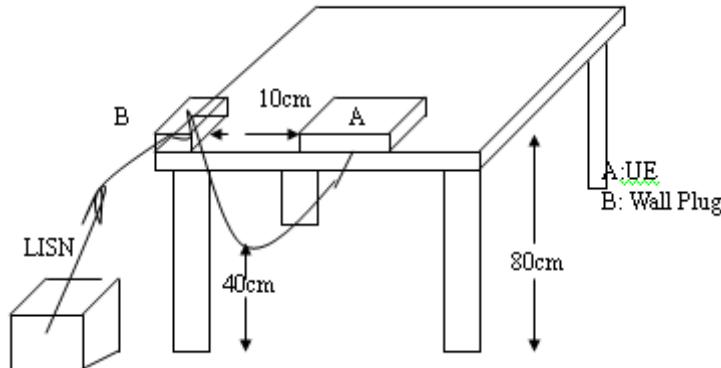
Note

- 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.

7.5 Measurement Result

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

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

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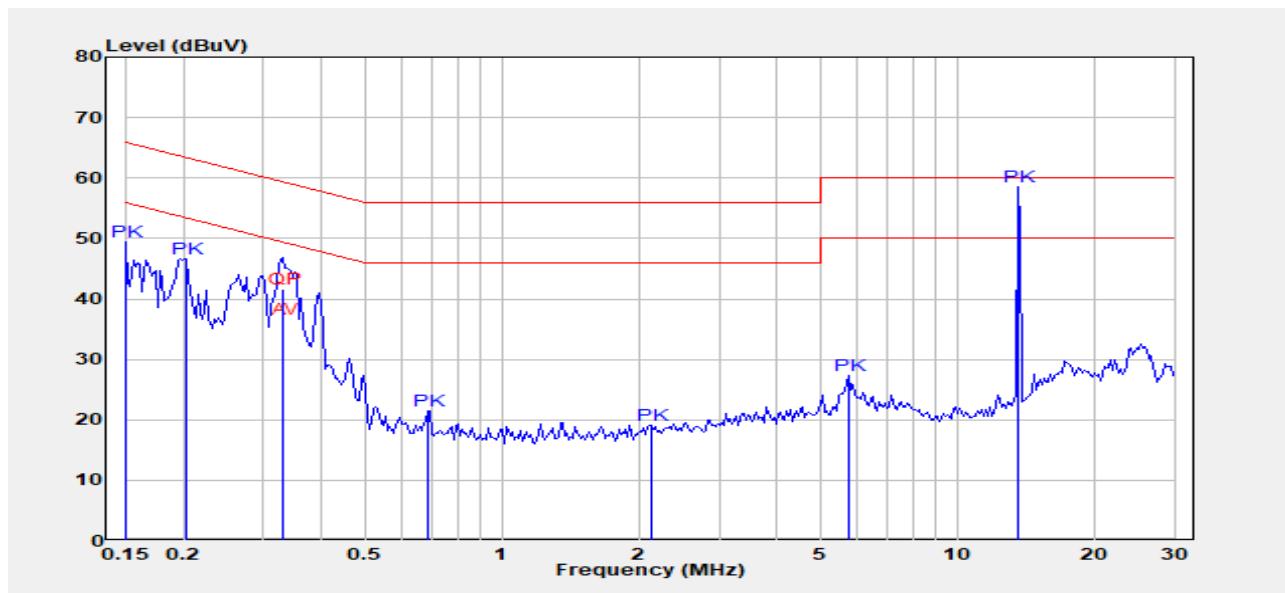
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :TERF2410002993ER
Operation Mode :NFC(AM)
Power :120V/60Hz
Probe :L

Test Site :Conduction 1
Test Date :2024-10-15
Temp./Humi. :24.7°C/57%
Engineer :WJ Lin



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
0.150	Peak	39.32	10.13	49.45	66.00	-16.55
0.202	Peak	36.48	10.13	46.61	63.54	-16.93
0.332	Average	26.40	10.14	36.54	49.40	-12.85
0.332	QP	31.40	10.14	41.54	59.40	-17.85
0.690	Peak	11.25	10.18	21.43	56.00	-34.57
2.121	Peak	8.94	10.20	19.14	56.00	-36.86
5.805	Peak	17.00	10.35	27.35	60.00	-32.65
13.560	Peak	48.14	10.45	58.59	-	-

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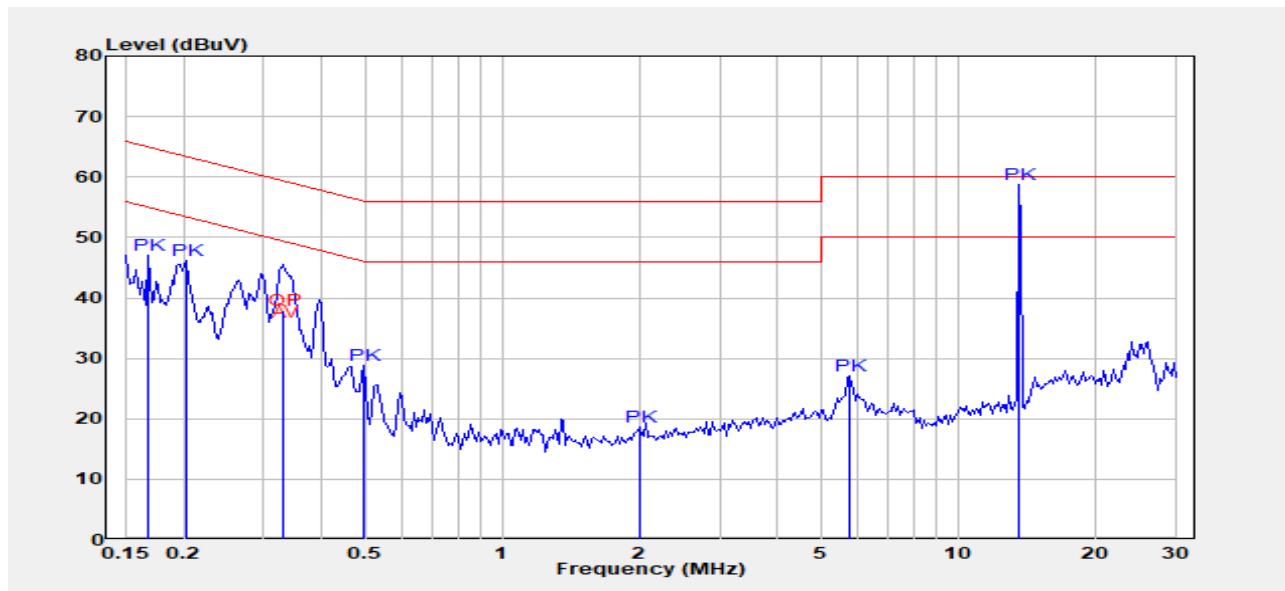
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Report Number :TERF2410002993ER
Operation Mode :NFC(AM)
Power :120V/60Hz
Probe :N

Test Site :Conduction 1
Test Date :2024-10-15
Temp./Humi. :24.7°C/57%
Engineer :WJ Lin



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
0.167	Peak	36.90	10.12	47.02	65.12	-18.10
0.202	Peak	36.09	10.12	46.21	63.54	-17.33
0.332	Average	25.94	10.14	36.08	49.40	-13.32
0.332	QP	27.83	10.14	37.97	59.40	-21.43
0.497	Peak	18.74	10.16	28.90	56.05	-27.15
2.012	Peak	8.41	10.19	18.61	56.00	-37.39
5.805	Peak	16.84	10.36	27.20	60.00	-32.80
13.560	Peak	48.17	10.48	58.65	-	-

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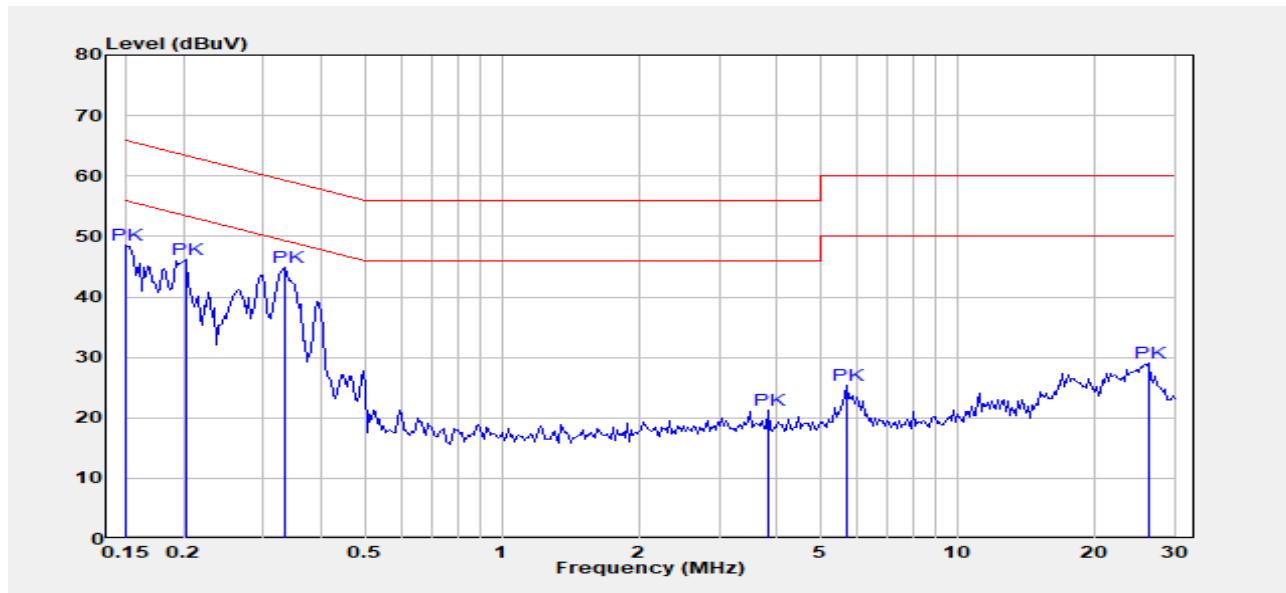
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Report Number :TERF2410002993ER
Operation Mode :NFC(AM)
Power :120V/60Hz
Probe :L

Test Site :Conduction 1
Test Date :2024-10-15
Temp./Humi. :24.7°C/57%
Engineer :WJ Lin



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
0.150	Peak	38.46	10.13	48.59	66.00	-17.41
0.202	Peak	35.99	10.13	46.12	63.54	-17.41
0.336	Peak	34.75	10.15	44.90	59.31	-14.41
3.840	Peak	10.93	10.29	21.22	56.00	-34.78
5.744	Peak	15.08	10.35	25.43	60.00	-34.57
26.418	Peak	18.45	10.54	28.99	60.00	-31.01

Remark: Results obtained using a suitable dummy antenna.

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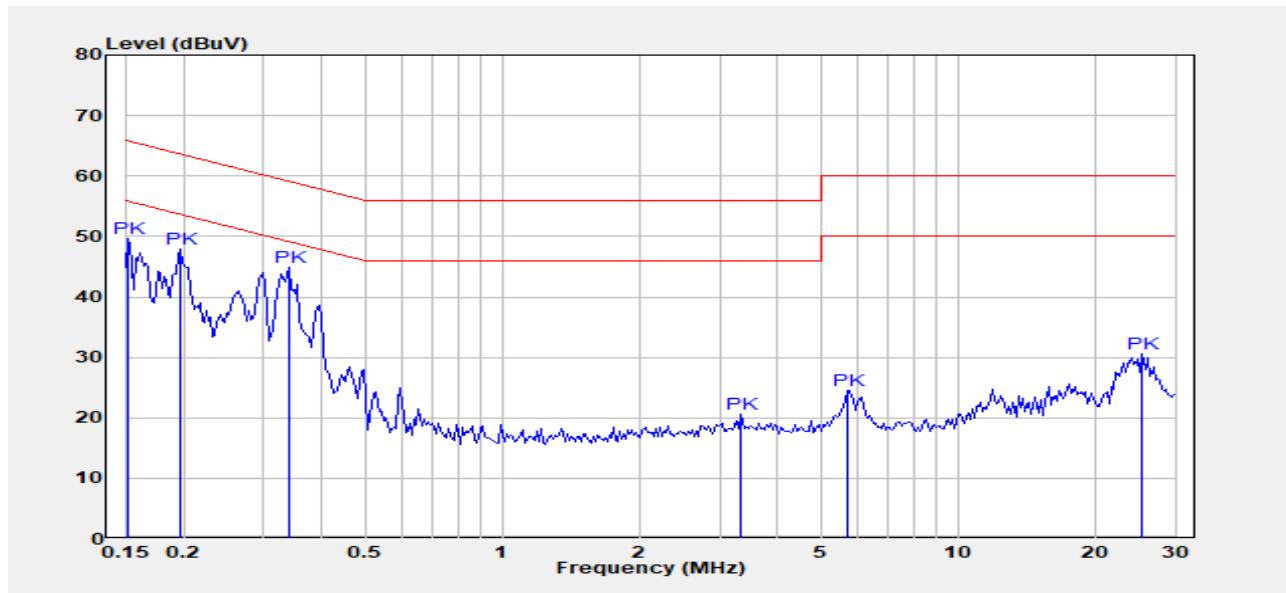
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Report Number :TERF2410002993ER
Operation Mode :NFC(AM)
Power :120V/60Hz
Probe :N

Test Site :Conduction 1
Test Date :2024-10-15
Temp./Humi. :24.7°C/57%
Engineer :WJ Lin



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
0.152	Peak	39.45	10.12	49.57	65.91	-16.34
0.198	Peak	37.74	10.12	47.86	63.71	-15.85
0.339	Peak	34.78	10.14	44.92	59.22	-14.30
3.346	Peak	10.24	10.28	20.52	56.00	-35.48
5.744	Peak	14.21	10.36	24.57	60.00	-35.43
25.321	Peak	19.85	10.63	30.48	60.00	-29.52

Remark: Results obtained using a suitable dummy antenna.

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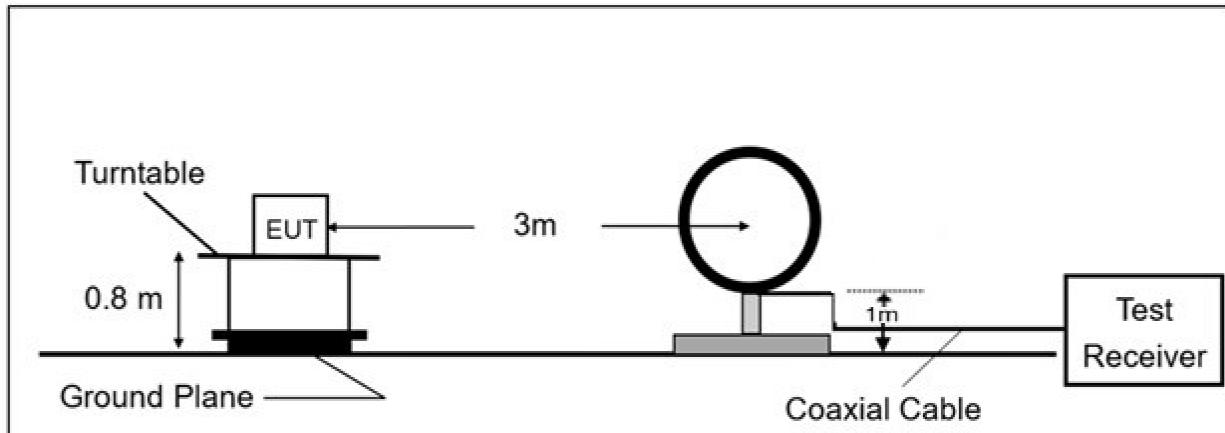
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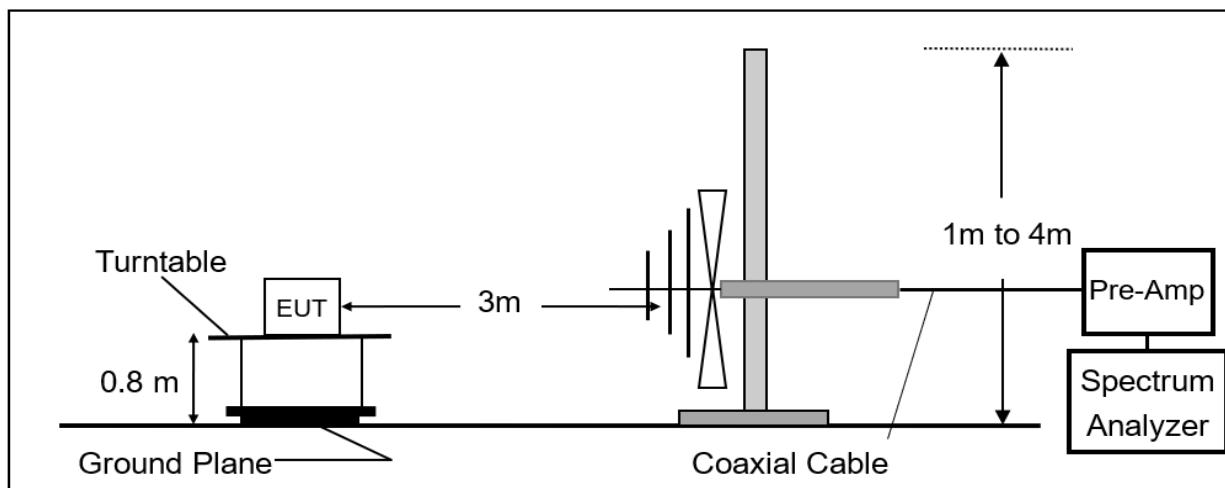
8 RADIATED EMISSION TEST

8.1 Test SET-UP (Block Diagram of Configuration)

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



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



8.2 Measurement Procedure

1. Configure the EUT according to ANSI C63.10.
2. The EUT was placed on a turn table which is 0.8m above ground plane and been measured in the frequency range between 0.009MHz to 30MHz and 30MHz to 1GHz.
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 emission.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all default test channel measured were complete.

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8.3 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:

$$\mathbf{FS = RA + AF + CL - AG}$$

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

8.4 Field Strength of Fundamental Emission

8.4.1 Applicable standard

Rules and specifications	CFR 47 Part 15 section 15.225(a)-(d)	
Frequency of Emission (MHz)	Field Strength (μ V/m) at 30m	Field Strength (dB μ V/m) at 30m
1.705~13.110	30	29.5
13.110~13.410	106	40.5
13.410~13.553	334	50.5
13.553~13.567	15848	84
13.567~13.710	334	50.5
13.710~14.010	106	40.5
14.010~30.00	30	29.5

Radiated Mask per ISED RSS 210 Annex B B6

- (a) 15.848 millivolts/m (84 dB μ V/m) at 30 m, within the band 13.553-13.567 MHz.
- (b) 334 microvolts/m (50.5 dB μ V/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz.
- (c) 106 microvolts/m (40.5 dB μ V/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz.
- (d) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz

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8.4.2 Distance Extrapolation Factor

30m to 3m

Distance extrapolation = $40 * \log (30/3) = 40$ dB

30m to 10m

Distance extrapolation = $40 * \log (30/10) = 19.08$ dB

10m to 3m

Distance extrapolation = $40 * \log (10/3) = 20.92$ dB

Note:

1. Distance extrapolation factor = $40 \log (\text{required distance} / \text{test distance})$ (dB)
2. The lower limit shall apply at the transition frequencies.
3. KDB 414788 D01 OATS and 3m semi-anechoic chamber Justification:
Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. OATS and 3m SAC chamber testing had been performed and 3m SAC measured test result is the worst case test result.

Actual FS(dB μ V/m) = Spectrum. Reading level(dB μ V) + Factor(dB)

Below 30 MHz of Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Distance Factor (dB)

Above 30 MHz of Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amp Gain (dB)

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

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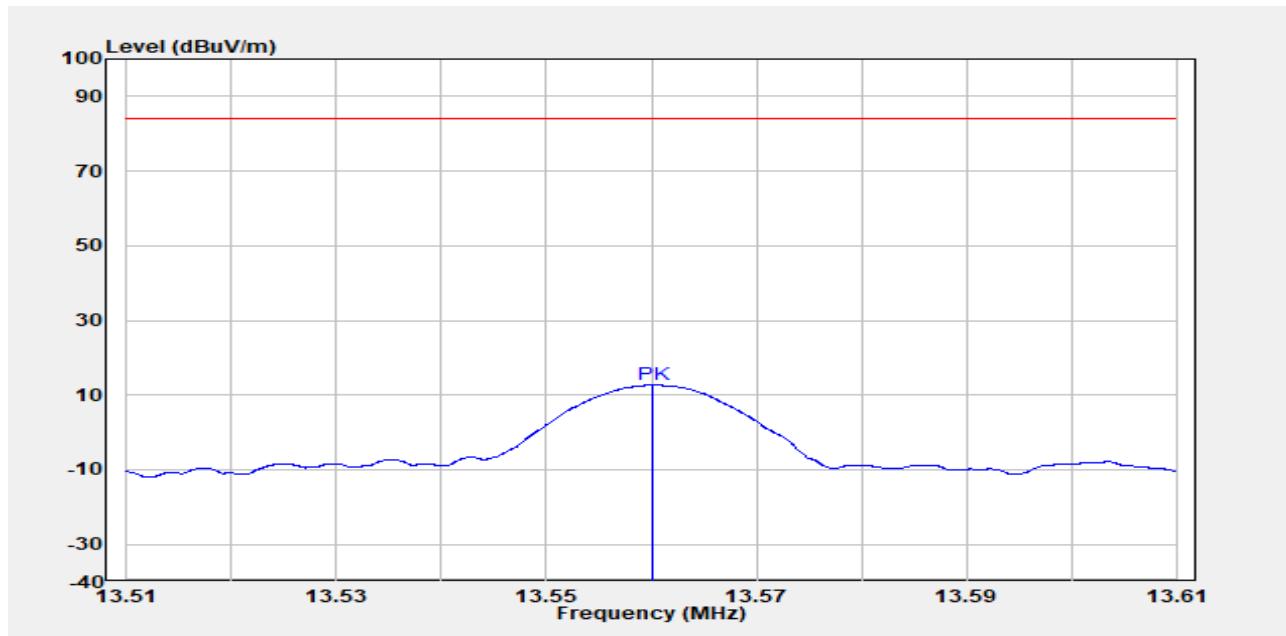
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8.4.3 Field Strength of Fundamental Emission Measurement Result

Mode: AM

Report Number	:TERF2410002993ER	Test Site	:SAC 1
Operation Mode	:NFC	Test Date	:2024-10-17
Test Frequency	:13.56 MHz	Temp./Humi.	:23.7°C/70%
Test Mode	:Main	Antenna Pol.	:Parallel
EUT Pol	:E1 Plane	Engineer	:WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
13.56	Peak	37.57	-24.94	12.63	84.00	-71.37

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.

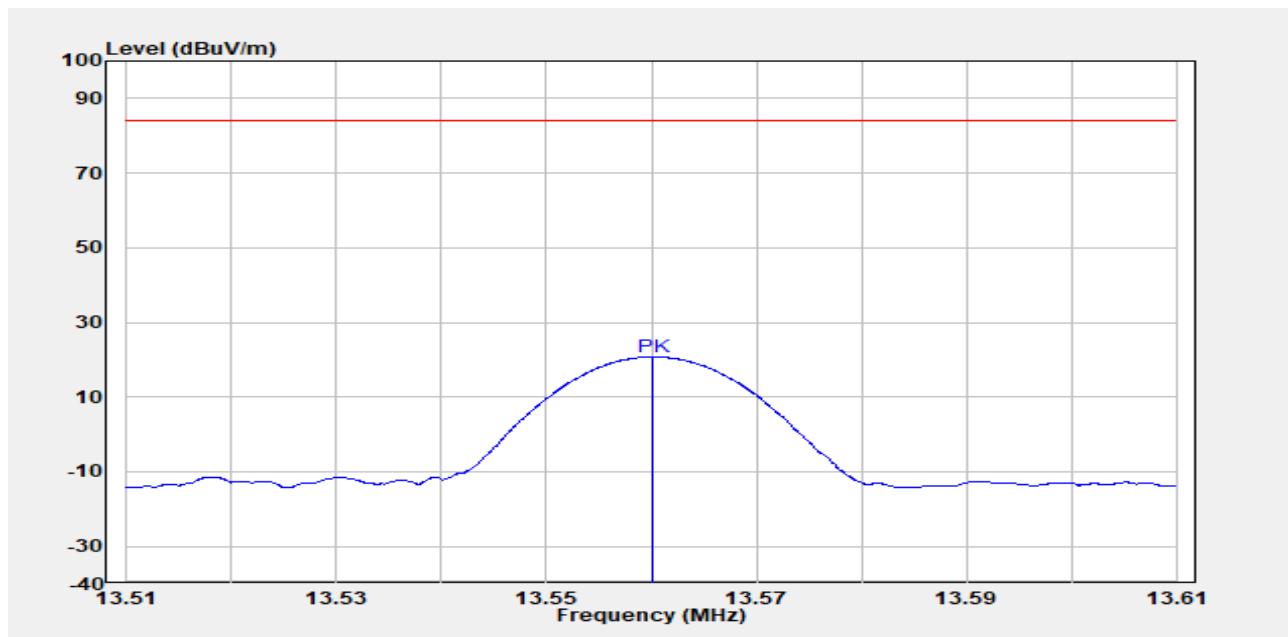
Field strength (dB μ V/m) at 30m,within the band 490 kHz - 30 MHz.

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Report Number :TERF2410002993ER Test Site :SAC 1
Operation Mode :NFC Test Date :2024-10-17
Test Frequency :13.56 MHz Temp./Humi. :23.7°C/70%
Test Mode :Main Antenna Pol. :Ground Parallel
EUT Pol :E1 Plane Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
13.56	Peak	45.68	-24.94	20.74	84.00	-63.26

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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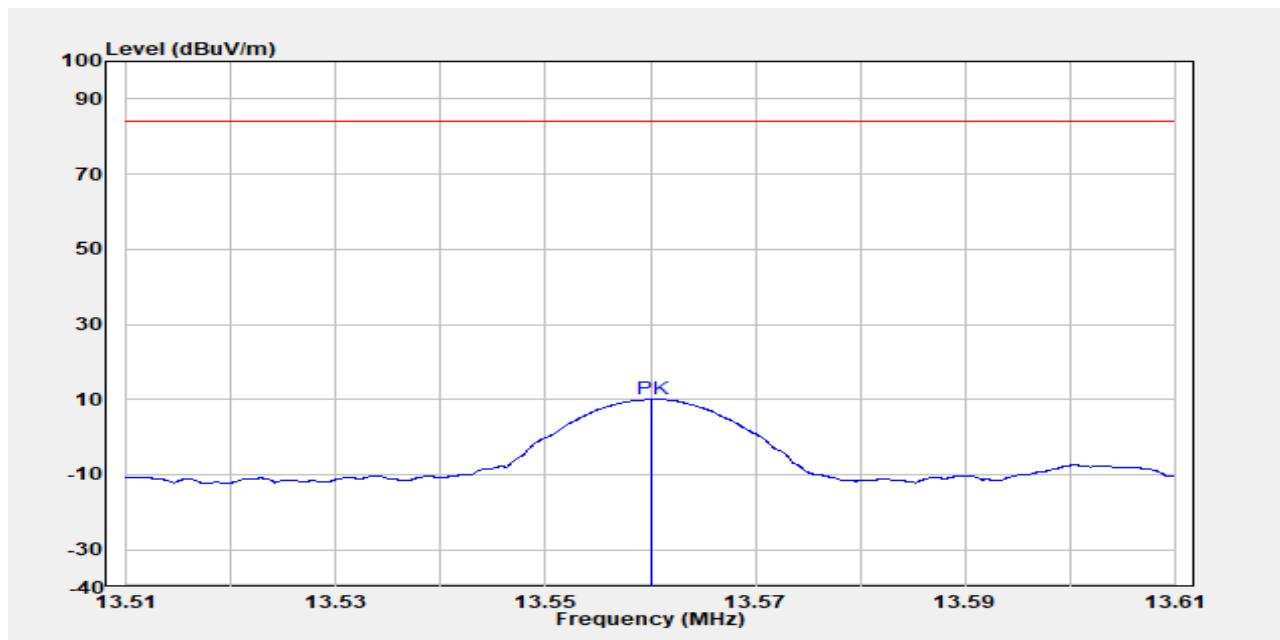
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Report Number :TERF2410002993ER Test Site :SAC 1
 Operation Mode :NFC Test Date :2024-11-01
 Test Frequency :13.56 MHz Temp./Humi. :22.4°C/72%
 Test Mode :Main Antenna Pol. :Perpendicular
 EUT Pol :E1 Plane Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
13.560	Peak	34.96	-24.94	10.02	84.00	-73.98

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.

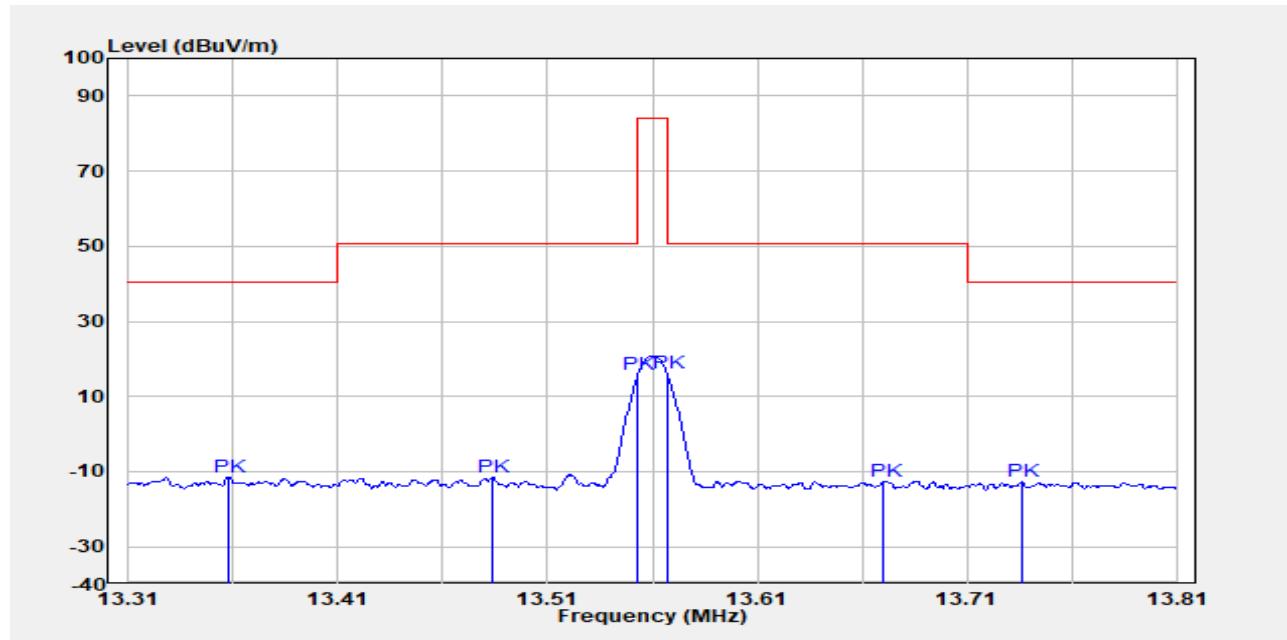
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Report Number	:TERF2410002993ER	Test Site	:SAC 1
Operation Mode	:NFC	Test Date	:2024-10-15
Test Frequency	:13.56 MHz	Temp./Humi.	:21.9°C/68%
Test Mode	:Mask	Antenna Pol.	:Ground Parallel
EUT Pol	:E1 Plane	Engineer	:WJ Lin



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
13.358	Peak	13.47	-24.90	-11.43	40.50	-51.93
13.484	Peak	13.29	-24.92	-11.63	50.50	-62.13
13.553	Peak	40.55	-24.94	15.62	50.50	-34.88
13.567	Peak	41.18	-24.94	16.24	50.50	-34.26
13.671	Peak	12.42	-24.96	-12.54	50.50	-63.04
13.736	Peak	12.11	-24.97	-12.86	40.50	-53.36

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_μV/m) at 300m,within the band 9 kHz -490 kHz.

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

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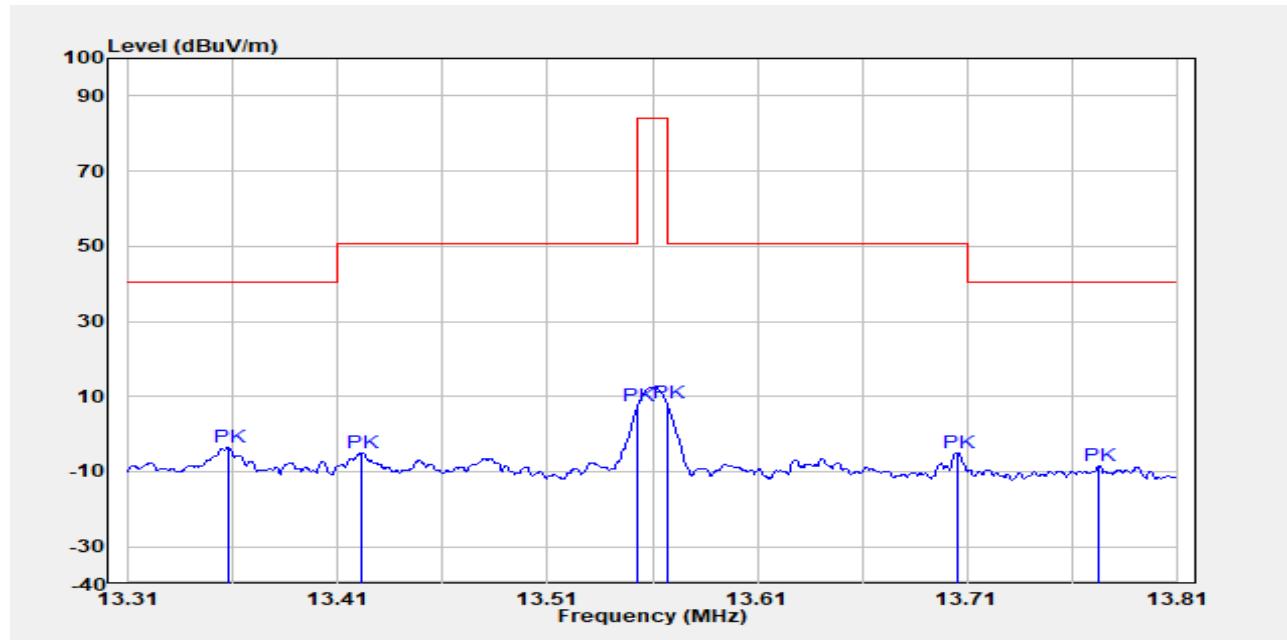
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Report Number	:TERF2410002993ER	Test Site	:SAC 1
Operation Mode	:NFC	Test Date	:2024-10-15
Test Frequency	:13.56 MHz	Temp./Humi.	:21.9°C/68%
Test Mode	:Mask	Antenna Pol.	: Parallel
EUT Pol	:E1 Plane	Engineer	:WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB _u V	Factor dB	Actual FS dB _u V/m	Limit @3m dB _u V/m	Margin dB
13.358	Peak	21.20	-24.90	-3.70	40.50	-44.20
13.422	Peak	19.84	-24.91	-5.08	50.50	-55.58
13.553	Peak	32.51	-24.94	7.57	50.50	-42.93
13.567	Peak	33.08	-24.94	8.14	50.50	-42.36
13.706	Peak	20.04	-24.97	-4.92	50.50	-55.42
13.773	Peak	16.44	-24.98	-8.54	40.50	-49.04

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_uV/m) at 300m,within the band 9 kHz -490 kHz.

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

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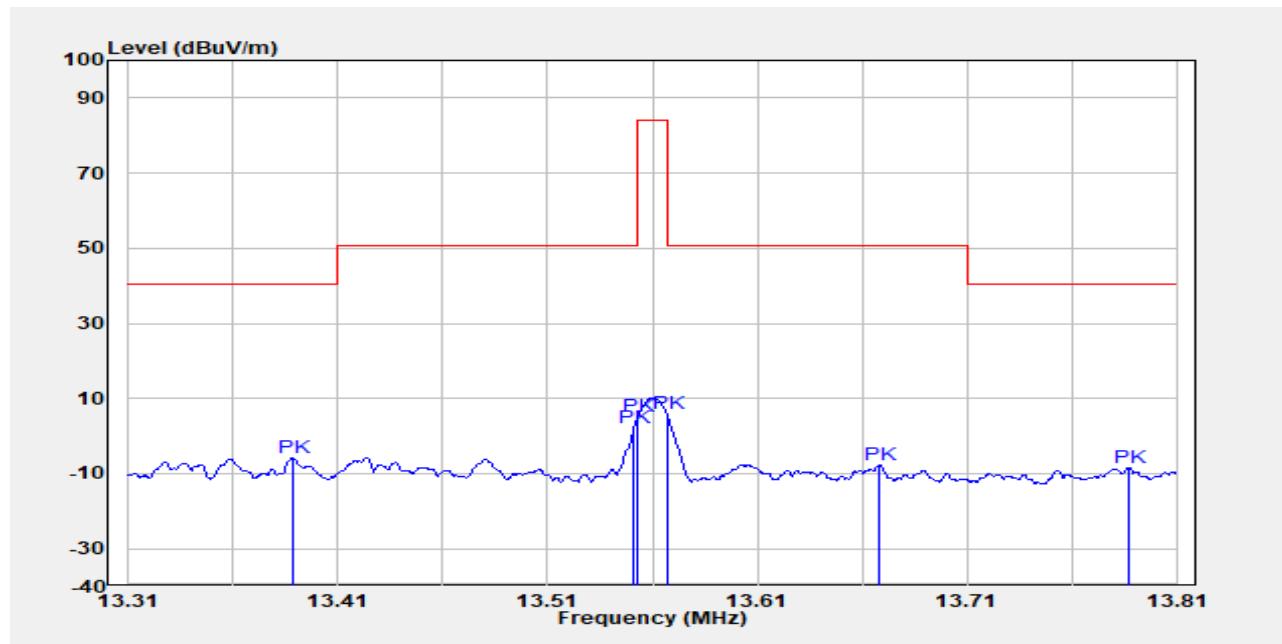
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Report Number :TERF2410002993ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Mask
 EUT Pol :E1 Plane

Test Site :SAC 1
 Test Date :2024-11-01
 Temp./Humi. :22.4°C/72%
 Antenna Pol. :Perpendicular
 Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
13.388	Peak	18.97	-24.91	-5.94	40.50	-46.44
13.551	Peak	26.92	-24.94	1.98	50.50	-48.52
13.553	Peak	29.94	-24.94	5.01	50.50	-45.49
13.567	Peak	30.75	-24.94	5.81	50.50	-44.69
13.669	Peak	17.18	-24.96	-7.78	50.50	-58.28
13.788	Peak	16.52	-24.98	-8.46	40.50	-48.96

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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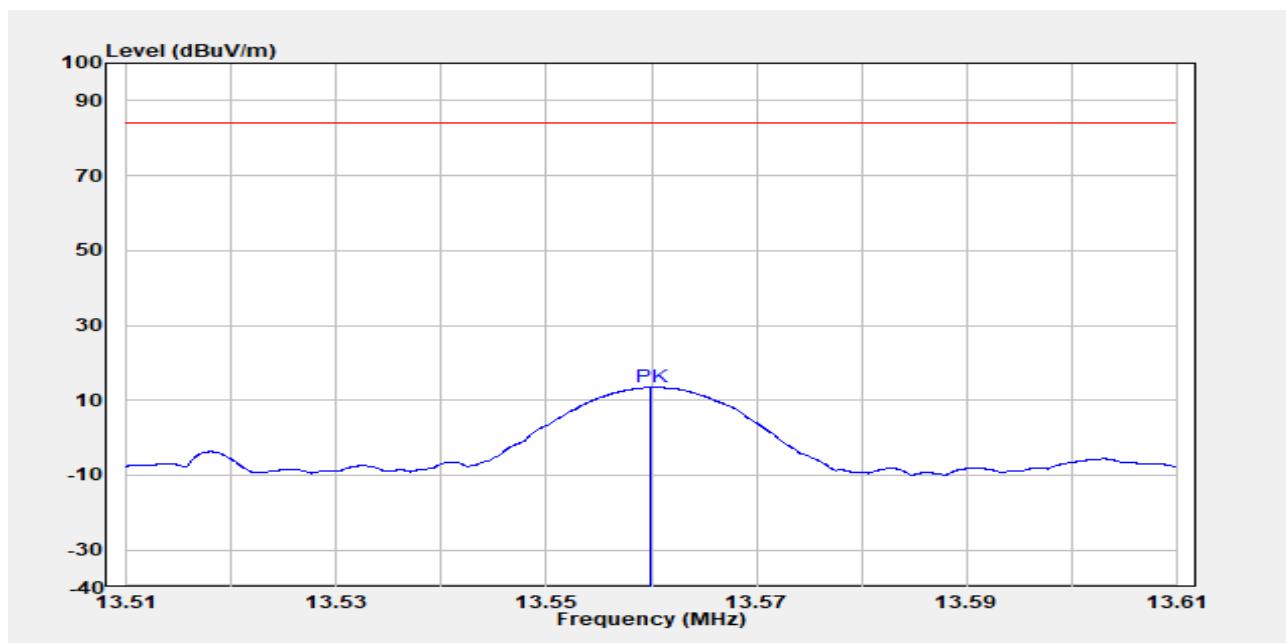
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Mode: OOK

Report Number :TERF2410002993ER
Operation Mode :NFC
Test Frequency :13.56 MHz
Test Mode :Main
EUT Pol :E1 Plane

Test Site :SAC 1
Test Date :2024-10-15
Temp./Humi. :21.9°C/68%
Antenna Pol. :Ground Parallel
Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
13.56	Peak	38.31	-24.94	13.37	84.00	-70.63

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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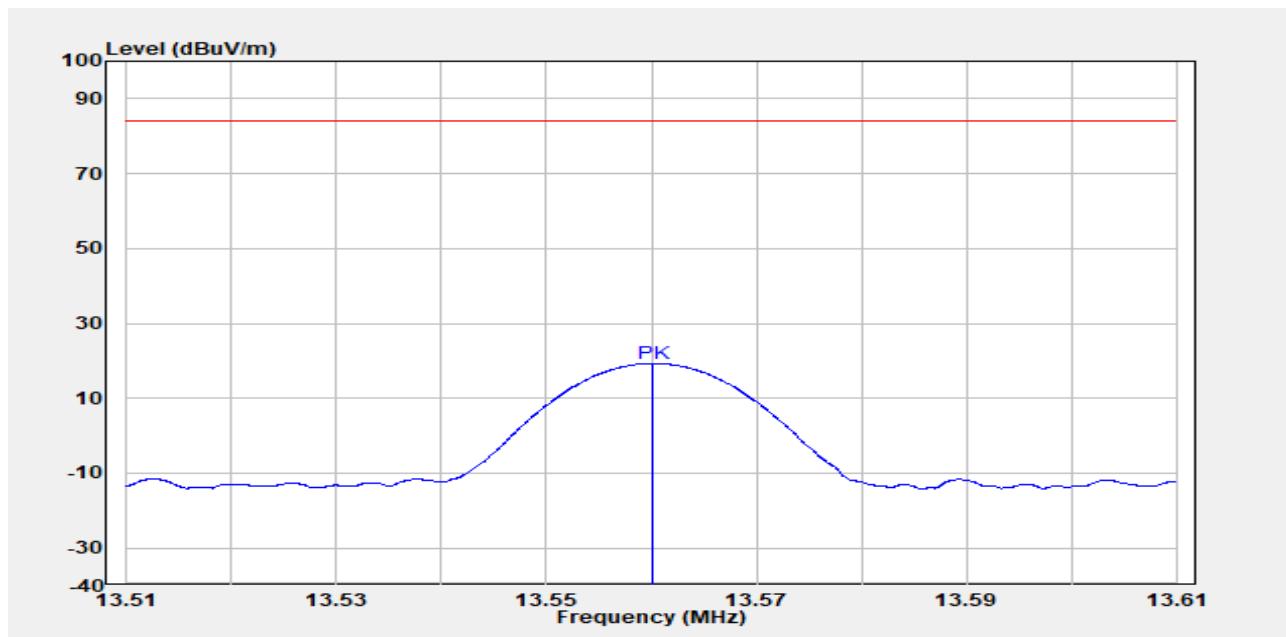
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Report Number :TERF2410002993ER Test Site :SAC 1
Operation Mode :NFC Test Date :2024-10-15
Test Frequency :13.56 MHz Temp./Humi. :21.9°C/68%
Test Mode :Main Antenna Pol. :Parallel
EUT Pol :E1 Plane Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
13.56	Peak	44.21	-24.94	19.27	84.00	-64.73

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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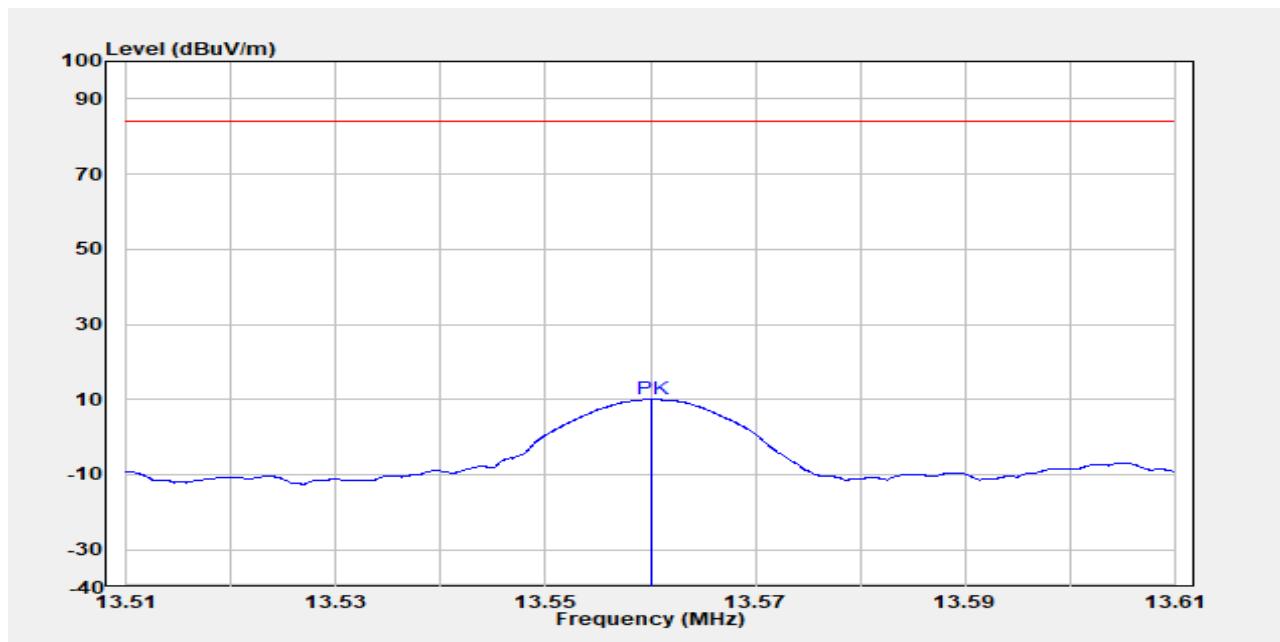
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Report Number :TERF2410002993ER Test Site :SAC 1
 Operation Mode :NFC Test Date :2024-11-01
 Test Frequency :13.56 MHz Temp./Humi. :22.4°C/72%
 Test Mode :Main Antenna Pol. :Perpendicular
 EUT Pol :E1 Plane Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
13.560	Peak	34.93	-24.94	9.99	84.00	-74.01

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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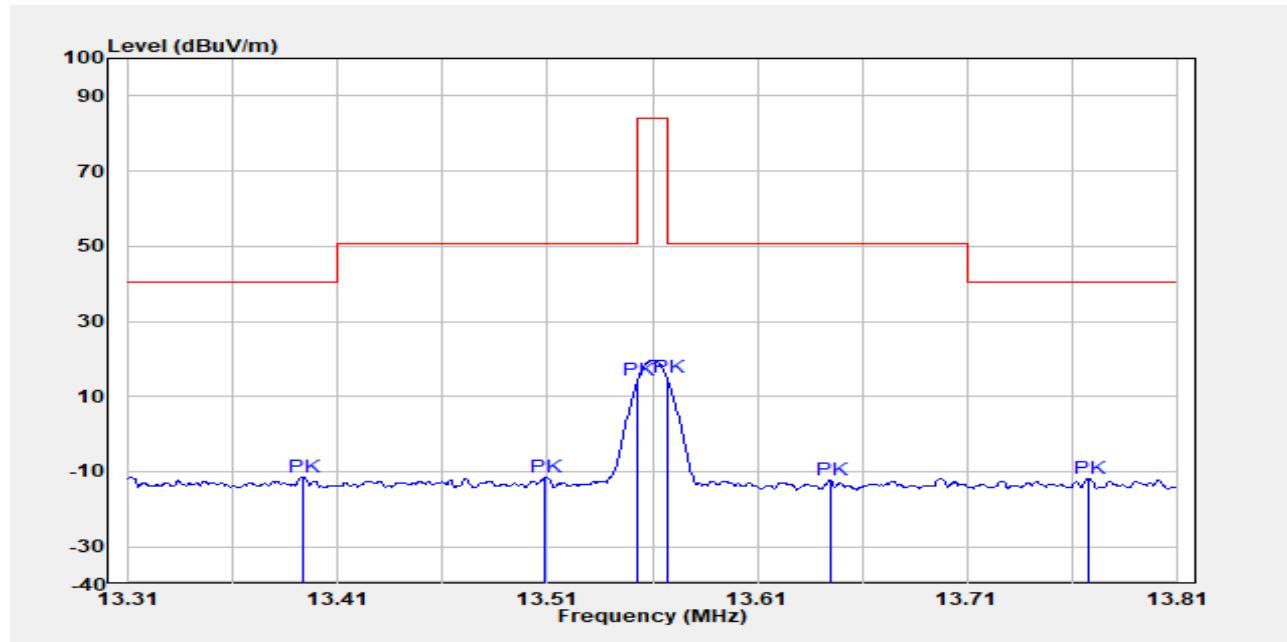
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Report Number :TERF2410002993ER
Operation Mode :NFC
Test Frequency :13.56 MHz
Test Mode :Mask
EUT Pol :E1 Plane

Test Site :SAC 1
Test Date :2024-10-15
Temp./Humi. :21.9°C/68%
Antenna Pol. :Parallel
Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
13.393	Peak	13.36	-24.91	-11.55	40.50	-52.05
13.509	Peak	13.30	-24.93	-11.63	50.50	-62.13
13.553	Peak	39.35	-24.94	14.41	50.50	-36.09
13.567	Peak	39.95	-24.94	15.01	50.50	-35.49
13.645	Peak	12.65	-24.95	-12.30	50.50	-62.80
13.769	Peak	13.17	-24.98	-11.81	40.50	-52.31

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.

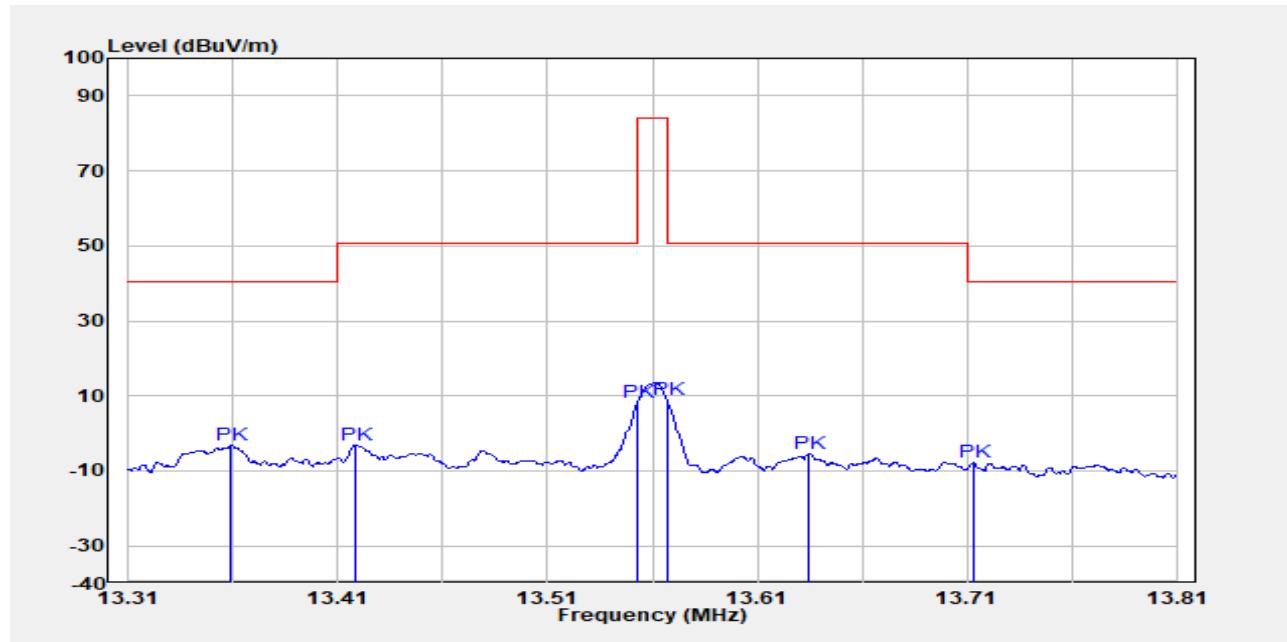
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Report Number :TERF2410002993ER
Operation Mode :NFC
Test Frequency :13.56 MHz
Test Mode :Mask
EUT Pol :E1 Plane

Test Site :SAC 1
Test Date :2024-10-15
Temp./Humi. :21.9°C/68%
Antenna Pol. :Ground Parallel
Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
13.359	Peak	21.61	-24.90	-3.29	40.50	-43.79
13.418	Peak	21.81	-24.91	-3.10	50.50	-53.60
13.553	Peak	33.12	-24.94	8.19	50.50	-42.31
13.567	Peak	33.82	-24.94	8.88	50.50	-41.62
13.635	Peak	19.34	-24.95	-5.61	50.50	-56.11
13.713	Peak	17.03	-24.97	-7.93	40.50	-48.43

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.

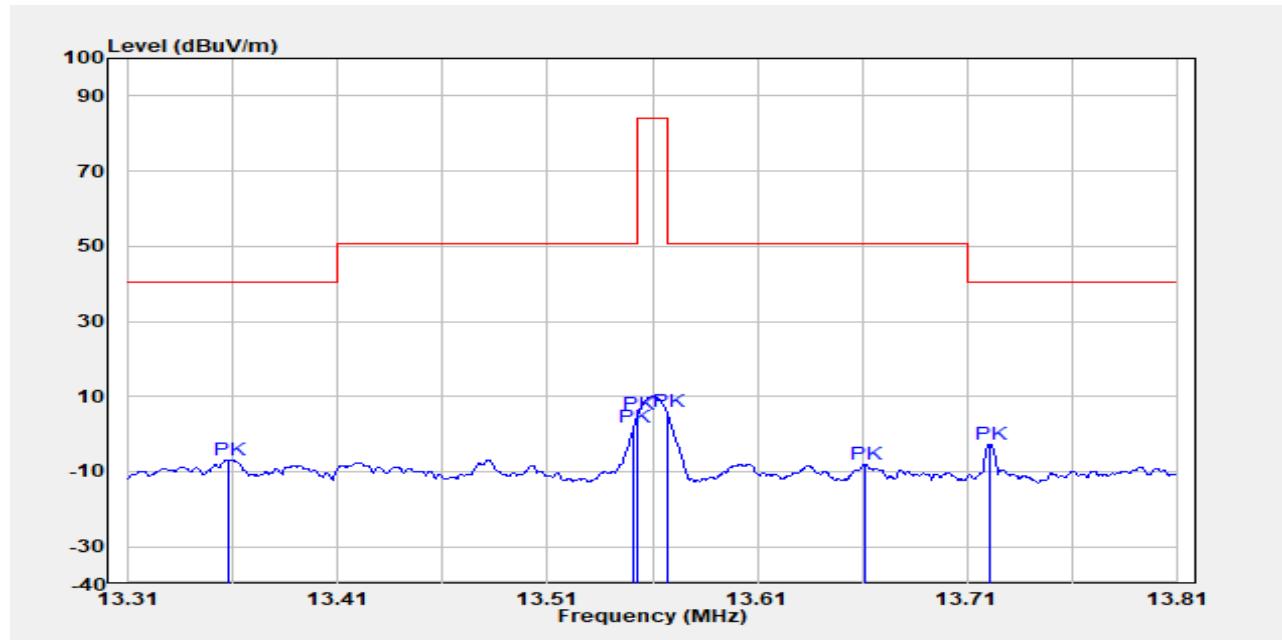
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Report Number :TERF2410002993ER
Operation Mode :NFC
Test Frequency :13.56 MHz
Test Mode :Mask
EUT Pol :E1 Plane

Test Site :SAC 1
Test Date :2024-11-01
Temp./Humi. :22.4°C/72%
Antenna Pol. :Perpendicular
Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
13.358	Peak	17.93	-24.90	-6.97	40.50	-47.47
13.551	Peak	26.59	-24.94	1.65	50.50	-48.85
13.553	Peak	30.03	-24.94	5.09	50.50	-45.41
13.567	Peak	30.75	-24.94	5.81	50.50	-44.69
13.662	Peak	16.80	-24.96	-8.16	50.50	-58.66
13.721	Peak	22.14	-24.97	-2.83	40.50	-43.33

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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8.5 Radiated Spurious Emission Measurement

8.5.1 Standard Applicable

The field strength of any emissions appearing outside of the 13.110-14.010 MHz shall not exceed the general radiated emission limits 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. $20 * \log(30\mu\text{V}/\text{m}) = 29.54 \text{ dB}\mu\text{V}/\text{m}$
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 and RSS-Gen §8.10.
7. The general radiated emission limits in §15.209 and RSS-Gen §8.9 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.

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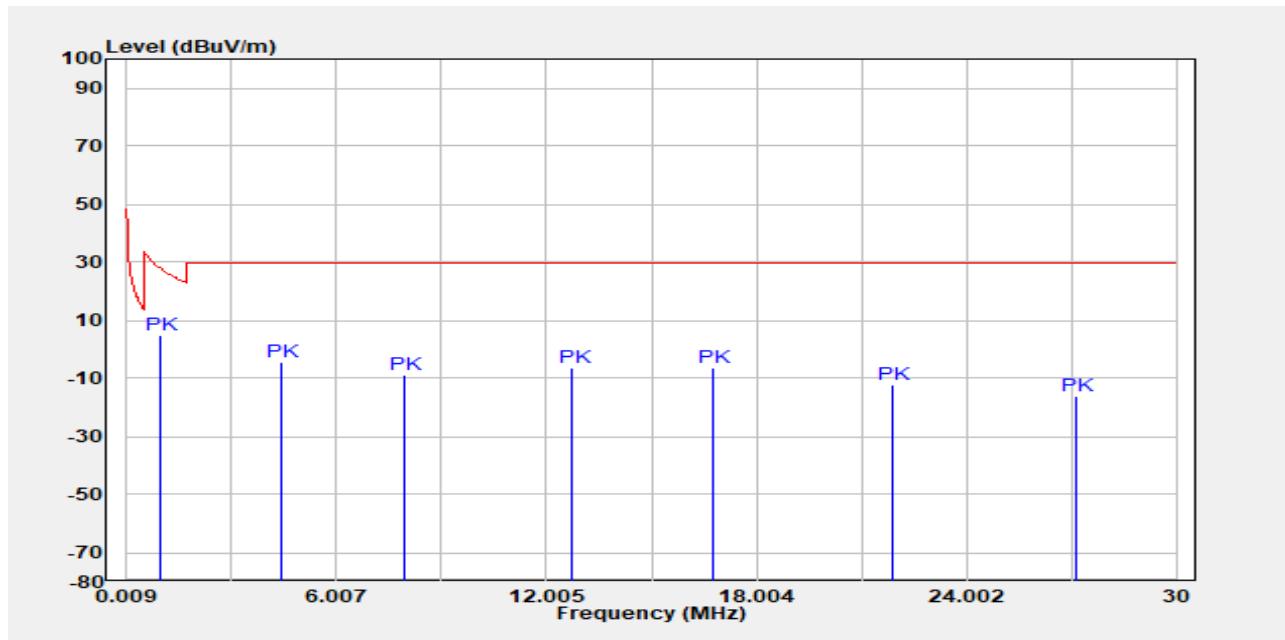
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8.5.2 Radiated Spurious Emission Measurement Result

Mode: AM

Report Number	:TERF2410002993ER	Test Site	:SAC 1
Operation Mode	:NFC	Test Date	:2024-10-17
Test Frequency	:13.56 MHz	Temp./Humi.	:23.7°C/70%
Test Mode	:Tx	Antenna Pol.	:Ground Parallel
EUT Pol	:E1 Plane	Engineer	:WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB _μ V	Factor dB	Actual FS dB _μ V/m	Limit dB _μ V/m	Margin dB
0.96871	Peak	31.13	-26.38	4.75	27.88	-23.13
4.418	Peak	20.82	-25.40	-4.58	29.54	-34.12
7.927	Peak	16.39	-25.07	-8.68	29.54	-38.22
12.755	Peak	18.48	-24.72	-6.24	29.54	-35.78
16.774	Peak	18.09	-24.44	-6.35	29.54	-35.89
21.902	Peak	13.50	-25.77	-12.27	29.54	-41.81
27.12	Peak	9.98	-25.90	-15.92	29.54	-45.46

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_μV/m) at 300m,within the band 9 kHz - 490 kHz.Field strength (dB_μV/m) at 30m,within the band 490 kHz - 30 MHz.

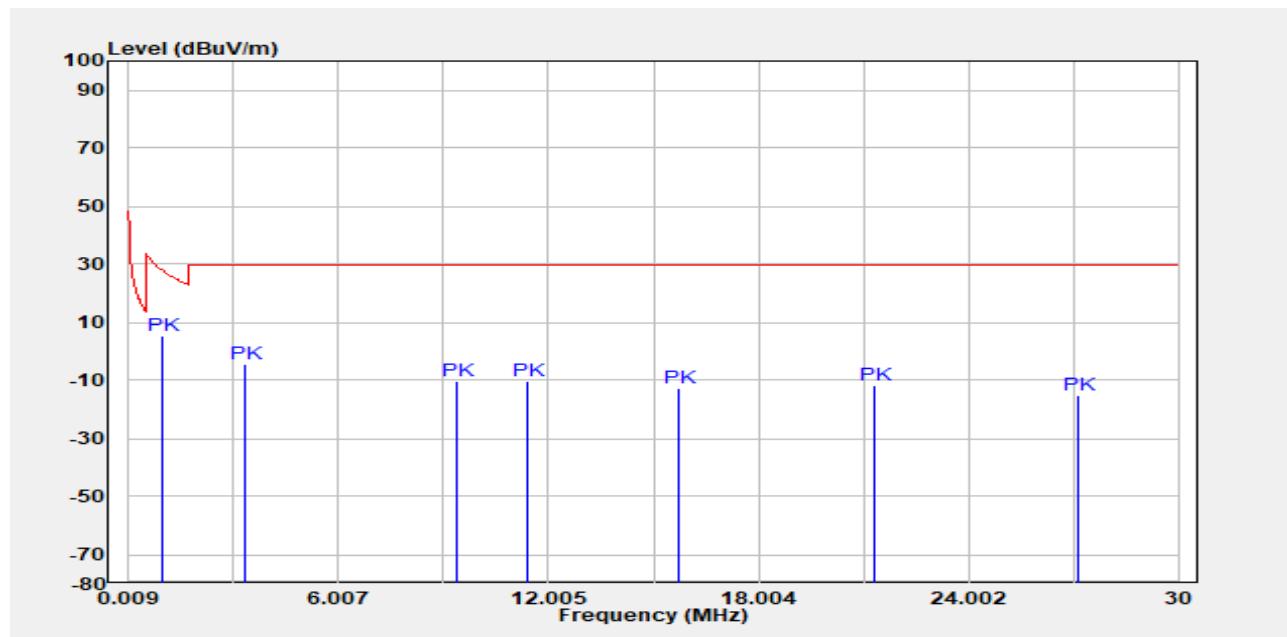
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Report Number :TERF2410002993ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Tx
 EUT Pol :E1 Plane

Test Site :SAC 1
 Test Date :2024-10-17
 Temp./Humi. :23.7°C/70%
 Antenna Pol. :Parallel
 Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
0.96871	Peak	31.87	-26.38	5.49	27.88	-22.39
3.338	Peak	21.46	-25.71	-4.25	29.54	-33.79
9.396	Peak	14.51	-24.94	-10.43	29.54	-39.97
11.406	Peak	13.95	-24.35	-10.40	29.54	-39.94
15.724	Peak	12.21	-24.71	-12.50	29.54	-42.04
21.333	Peak	13.91	-25.43	-11.52	29.54	-41.06
27.12	Peak	11.00	-25.90	-14.90	29.54	-44.44

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.

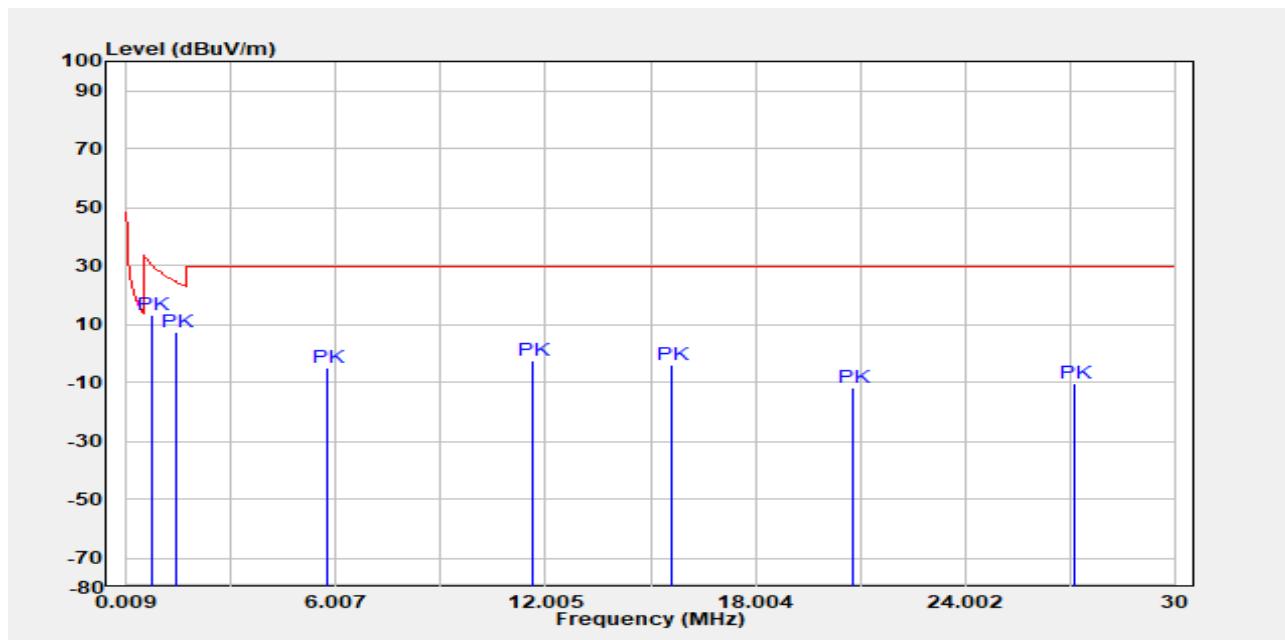
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Report Number :TERF2410002993ER Test Site :SAC 1
Operation Mode :NFC Test Date :2024-11-01
Test Frequency :13.56 MHz Temp./Humi. :22.4°C/72%
Test Mode :Tx Antenna Pol. :Perpendicular
EUT Pol :E1 Plane Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
0.729	Peak	39.71	-26.52	13.19	30.35	-17.17
1.449	Peak	33.37	-26.28	7.09	24.39	-17.30
5.737	Peak	19.85	-24.73	-4.88	29.54	-34.42
11.646	Peak	21.72	-24.35	-2.63	29.54	-32.17
15.634	Peak	20.83	-24.75	-3.92	29.54	-33.46
20.793	Peak	13.59	-25.12	-11.53	29.54	-41.07
27.120	Peak	15.51	-25.90	-10.39	29.54	-39.93

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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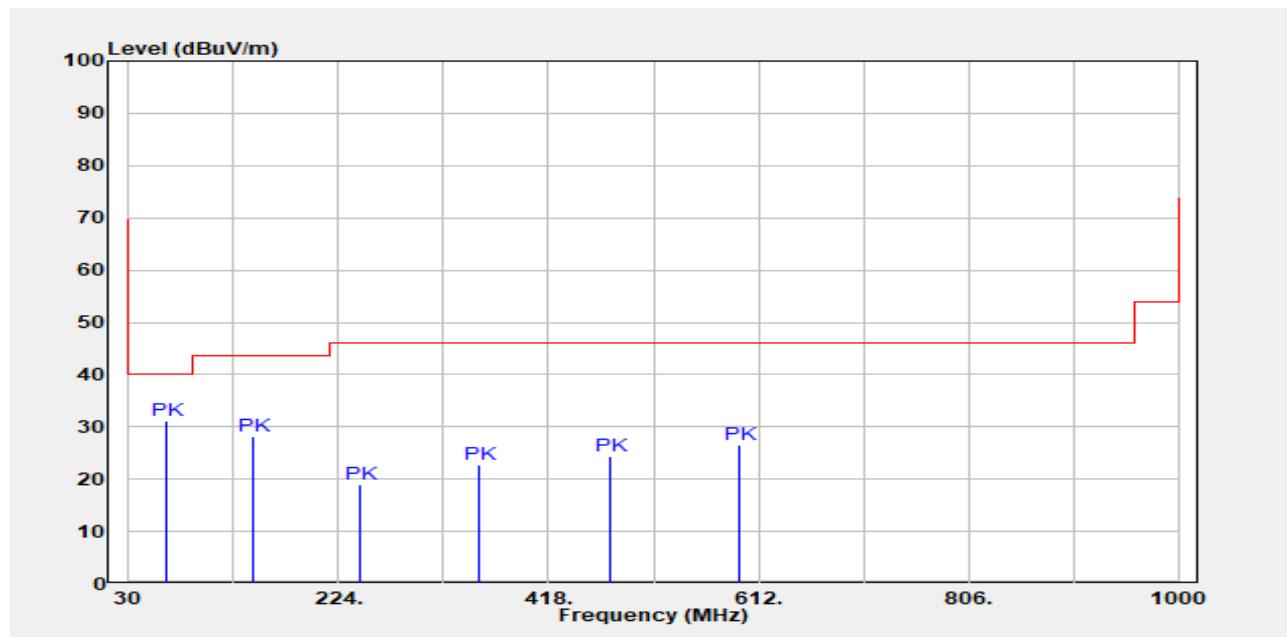
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Report Number :TERF2410002993ER Test Site :SAC 1
Operation Mode :NFC Test Date :2024-10-17
Test Frequency :13.56 MHz Temp./Humi. :23.7°C/70%
Test Mode :Tx Antenna Pol. :Vertical
EUT Pol :E1 Plane Engineer :WJ Lin



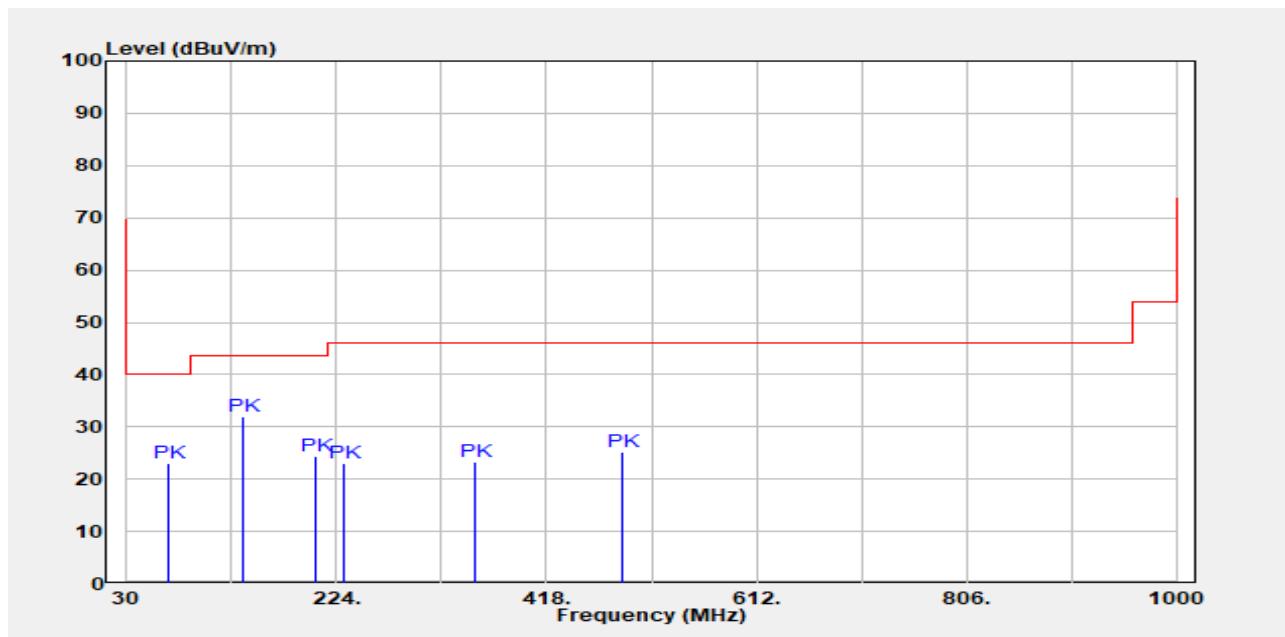
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
64.92	Peak	48.99	-17.78	31.21	40.00	-8.79
144.46	Peak	40.34	-12.10	28.24	43.50	-15.26
244.37	Peak	28.95	-10.06	18.89	46.00	-27.11
353.01	Peak	30.05	-7.25	22.80	46.00	-23.20
474.26	Peak	29.16	-4.83	24.33	46.00	-21.67
593.57	Peak	29.39	-2.95	26.44	46.00	-19.56

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Report Number :TERF2410002993ER Test Site :SAC 1
 Operation Mode :NFC Test Date :2024-10-17
 Test Frequency :13.56 MHz Temp./Humi. :23.7°C/70%
 Test Mode :Tx Antenna Pol. :Horizontal
 EUT Pol :E1 Plane Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
67.83	Peak	40.63	-17.47	23.16	40.00	-16.84
137.67	Peak	43.97	-11.86	32.11	43.50	-11.39
203.63	Peak	37.34	-12.98	24.36	43.50	-19.14
230.79	Peak	34.86	-11.80	23.06	46.00	-22.94
351.07	Peak	30.71	-7.37	23.34	46.00	-22.66
488.81	Peak	29.93	-4.64	25.29	46.00	-20.71

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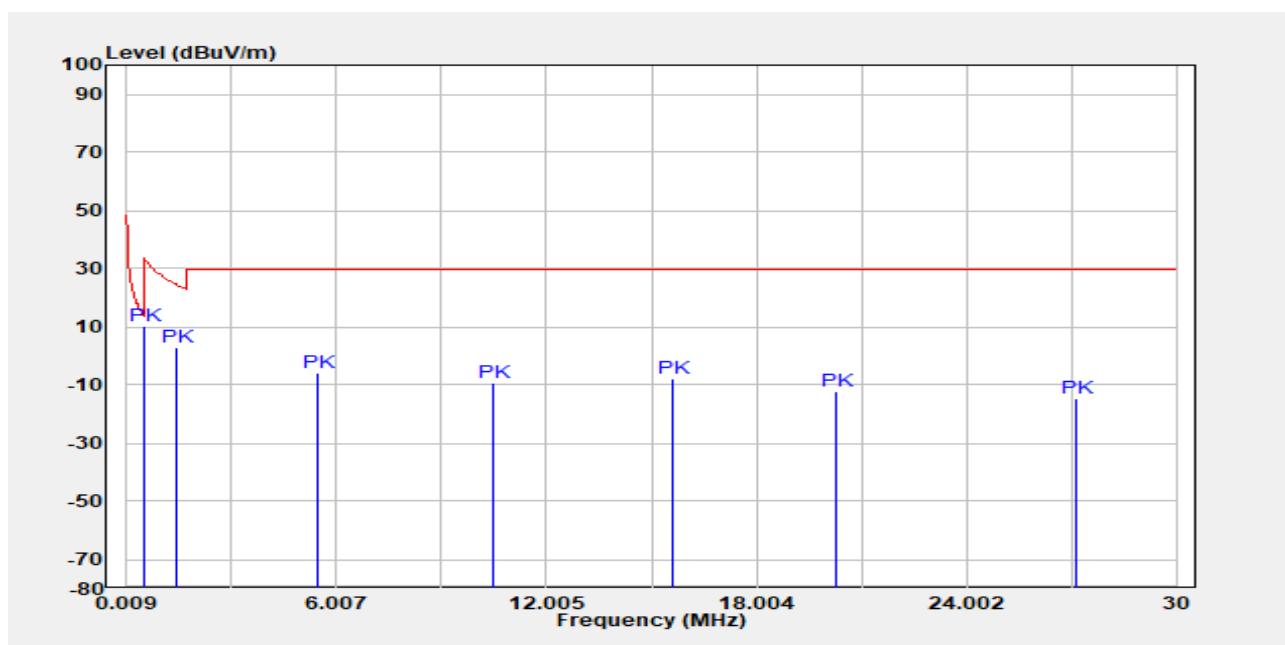
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Mode: OOK

Report Number	:TERF2410002993ER	Test Site	:SAC 1
Operation Mode	:NFC	Test Date	:2024-10-15
Test Frequency	:13.56 MHz	Temp./Humi.	:21.9°C/68%
Test Mode	:Tx	Antenna Pol.	:Ground Parallel
EUT Pol	:E1 Plane	Engineer	:WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
0.51885	Peak	36.77	-26.62	10.15	33.31	-23.16
1.419	Peak	29.21	-26.29	2.92	24.57	-21.65
5.467	Peak	18.93	-24.95	-6.02	29.54	-35.56
10.476	Peak	15.38	-24.46	-9.08	29.54	-38.62
15.634	Peak	16.71	-24.75	-8.04	29.54	-37.58
20.253	Peak	12.78	-24.80	-12.02	29.54	-41.56
27.12	Peak	11.48	-25.90	-14.42	29.54	-43.96

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.

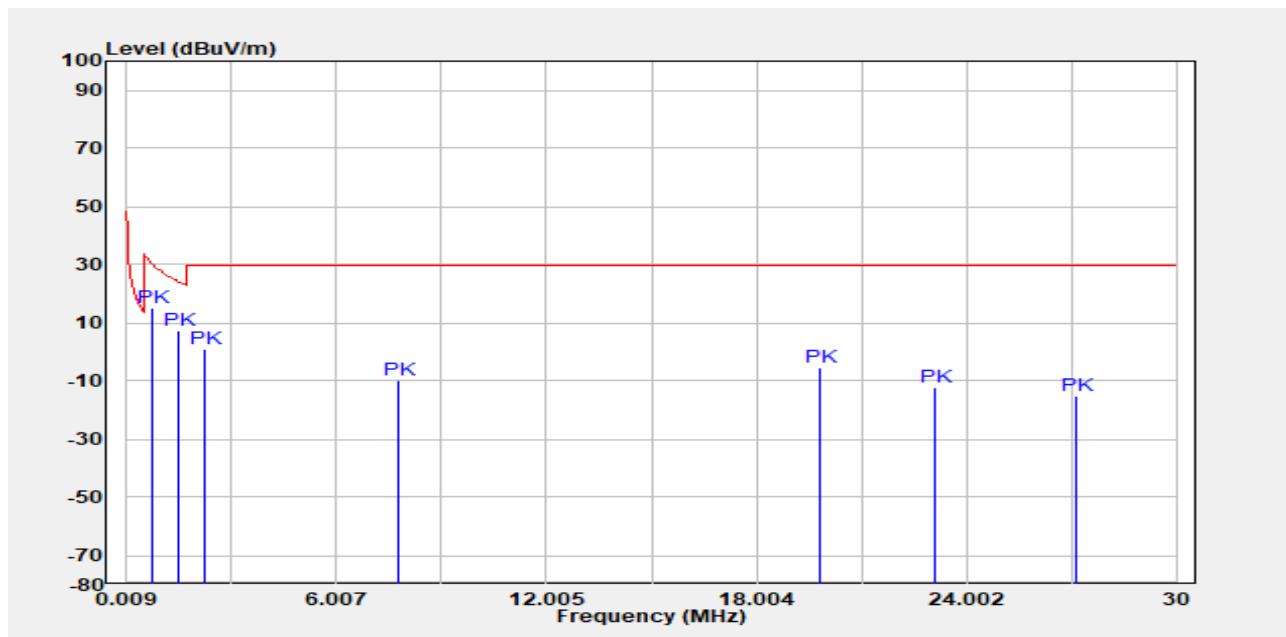
 Field strength (dB μ V/m) at 30m,within the band 490 kHz - 30 MHz.

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Report Number :TERF2410002993ER Test Site :SAC 1
 Operation Mode :NFC Test Date :2024-10-15
 Test Frequency :13.56 MHz Temp./Humi. :21.9°C/68%
 Test Mode :Tx Antenna Pol. :Parallel
 EUT Pol :E1 Plane Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
0.72878	Peak	41.78	-26.52	15.26	30.35	-15.09
1.479	Peak	33.76	-26.27	7.49	24.21	-16.72
2.228	Peak	27.31	-26.09	1.22	29.54	-28.32
7.747	Peak	15.04	-25.02	-9.98	29.54	-39.52
19.803	Peak	19.19	-24.59	-5.40	29.54	-34.94
23.102	Peak	14.30	-26.30	-12.00	29.54	-41.54
27.12	Peak	10.73	-25.90	-15.17	29.54	-44.71

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.

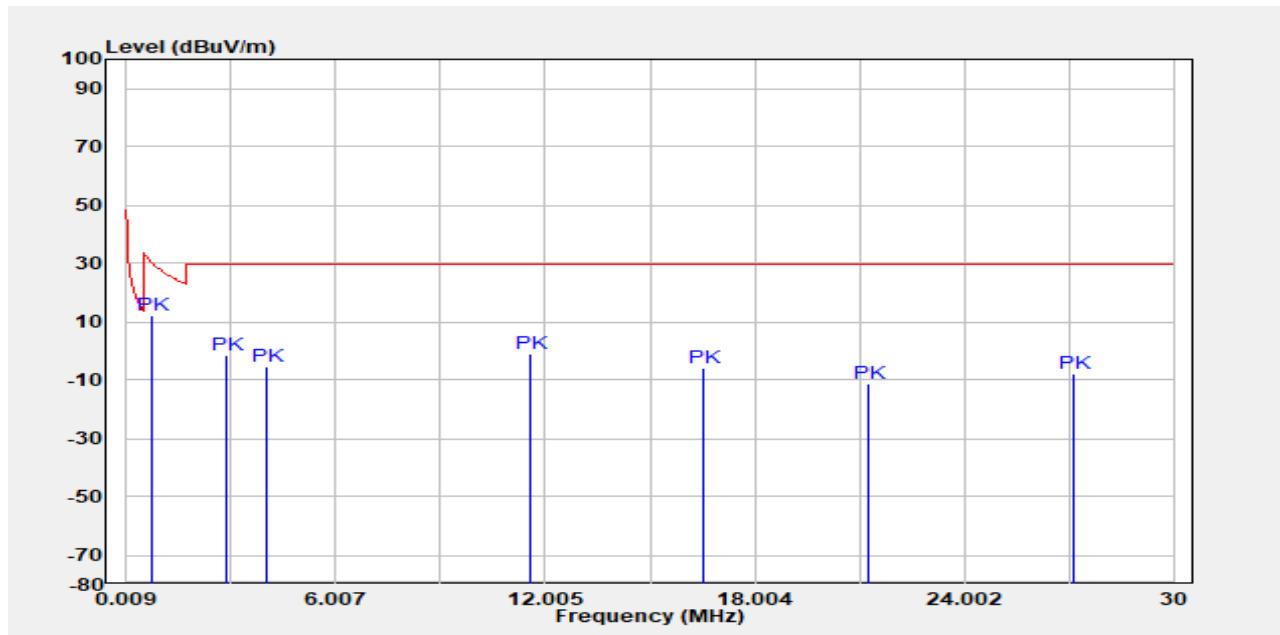
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Report Number :TERF2410002993ER Test Site :SAC 1
Operation Mode :NFC Test Date :2024-11-01
Test Frequency :13.56 MHz Temp./Humi. :22.4°C/72%
Test Mode :Tx Antenna Pol. :Perpendicular
EUT Pol :E1 Plane Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
0.729	Peak	38.84	-26.52	12.32	30.35	-18.04
2.858	Peak	24.61	-25.90	-1.29	29.54	-30.83
4.028	Peak	19.85	-25.44	-5.59	29.54	-35.13
11.586	Peak	23.49	-24.35	-0.86	29.54	-30.40
16.504	Peak	18.42	-24.49	-6.07	29.54	-35.61
21.273	Peak	14.41	-25.40	-10.99	29.54	-40.53
27.120	Peak	18.20	-25.90	-7.70	29.54	-37.24

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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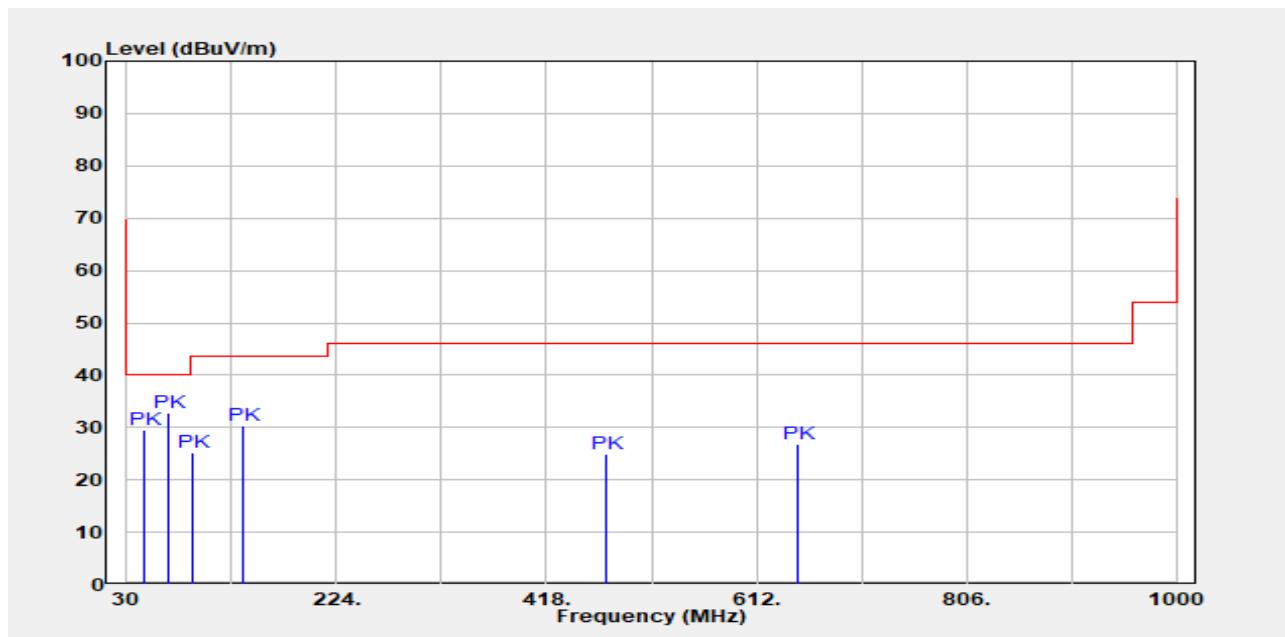
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Report Number :TERF2410002993ER Test Site :SAC 1
 Operation Mode :NFC Test Date :2024-10-15
 Test Frequency :13.56 MHz Temp./Humi. :21.9°C/68%
 Test Mode :Tx Antenna Pol. :Vertical
 EUT Pol :E1 Plane Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
45.52	Peak	43.06	-13.39	29.67	40.00	-10.33
68.80	Peak	50.57	-17.65	32.92	40.00	-7.08
90.14	Peak	39.96	-14.73	25.23	43.50	-18.27
136.70	Peak	42.09	-11.74	30.35	43.50	-13.15
473.29	Peak	29.74	-4.84	24.90	46.00	-21.10
650.80	Peak	29.20	-2.38	26.82	46.00	-19.18

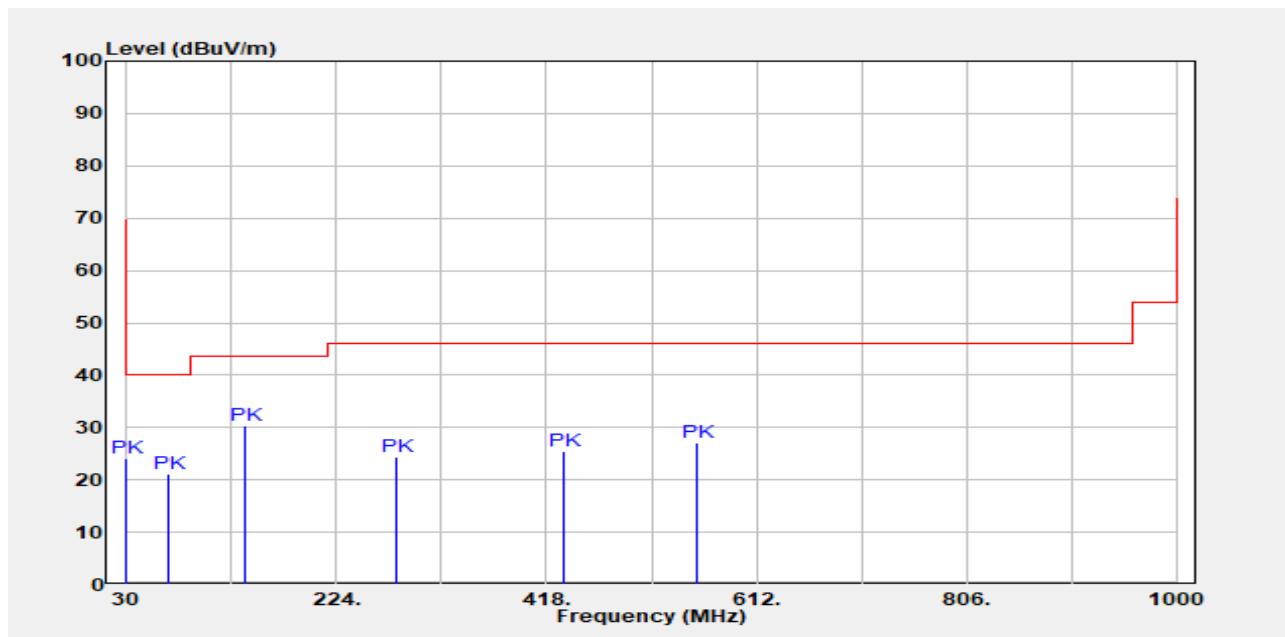
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Report Number :TERF2410002993ER Test Site :SAC 1
Operation Mode :NFC Test Date :2024-10-15
Test Frequency :13.56 MHz Temp./Humi. :21.9°C/68%
Test Mode :Tx Antenna Pol. :Horizontal
EUT Pol :E1 Plane Engineer :WJ Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
30.00	Peak	28.87	-4.71	24.16	40.00	-15.84
67.83	Peak	38.60	-17.47	21.13	40.00	-18.87
139.61	Peak	42.30	-11.89	30.41	43.50	-13.09
278.32	Peak	33.27	-8.97	24.30	46.00	-21.70
433.52	Peak	31.09	-5.50	25.59	46.00	-20.41
557.68	Peak	30.04	-3.06	26.98	46.00	-19.02

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9 FREQUENCY STABILITY

9.1 Applicable Standard

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

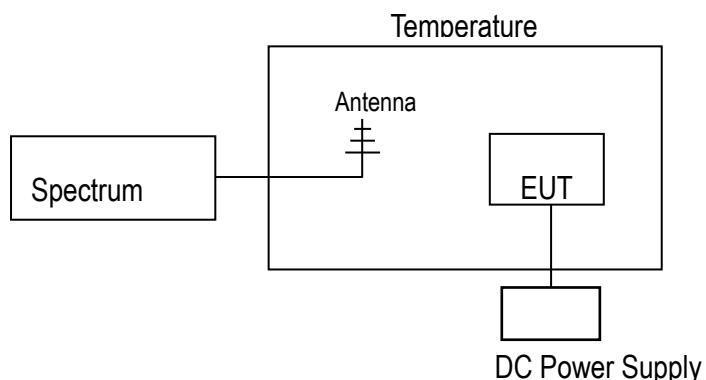
Carrier frequency stability shall be maintained to $\pm 0.01\%$ (± 100 ppm).

For licence-exempt radio apparatus, the frequency stability shall be measured at temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F).

9.2 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 10kHz, Span =100kHz.
4. Set SPA Max hold. Mark peak.

9.3 Test SET-UP (Block Diagram of Configuration)



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9.4 Measurement Results

Mode: AM

Startup

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5	-20	13.5599524	-0.04760	+/- 1.356
5	-10	13.5599672	-0.03280	+/- 1.356
5	0	13.559966	-0.03400	+/- 1.356
5	10	13.5599559	-0.04410	+/- 1.356
5	20	13.559958	-0.04200	+/- 1.356
5	30	13.5599584	-0.04160	+/- 1.356
5	40	13.5599492	-0.05080	+/- 1.356
5	50	13.559965	-0.03500	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5.75	20	13.5599522	-0.04780	+/- 1.356
5	20	13.559958	-0.04200	+/- 1.356
4.25	20	13.5599603	-0.03970	+/- 1.356

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2 minutes**A. Temperature Variation**

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5	-20	13.5599522	-0.04780	+/- 1.356
5	-10	13.5599483	-0.05170	+/- 1.356
5	0	13.5599582	-0.04180	+/- 1.356
5	10	13.559953	-0.04700	+/- 1.356
5	20	13.5599503	-0.04970	+/- 1.356
5	30	13.5599646	-0.03540	+/- 1.356
5	40	13.5599667	-0.03330	+/- 1.356
5	50	13.5599582	-0.04180	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5.75	20	13.559964	-0.03600	+/- 1.356
5	20	13.5599503	-0.04970	+/- 1.356
4.25	20	13.5599611	-0.03890	+/- 1.356

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5 minutes**A. Temperature Variation**

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5	-20	13.5599583	-0.04170	+/- 1.356
5	-10	13.5599535	-0.04650	+/- 1.356
5	0	13.5599527	-0.04730	+/- 1.356
5	10	13.5599487	-0.05130	+/- 1.356
5	20	13.5599524	-0.04760	+/- 1.356
5	30	13.5599509	-0.04910	+/- 1.356
5	40	13.5599647	-0.03530	+/- 1.356
5	50	13.559951	-0.04900	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5.75	20	13.5599678	-0.03220	+/- 1.356
5	20	13.5599524	-0.04760	+/- 1.356
4.25	20	13.5599501	-0.04990	+/- 1.356

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10 minutes**A. Temperature Variation**

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5	-20	13.5599483	-0.05170	+/- 1.356
5	-10	13.5599582	-0.04180	+/- 1.356
5	0	13.559958	-0.04200	+/- 1.356
5	10	13.5599657	-0.03430	+/- 1.356
5	20	13.5599616	-0.03840	+/- 1.356
5	30	13.5599669	-0.03310	+/- 1.356
5	40	13.5599591	-0.04090	+/- 1.356
5	50	13.5599641	-0.03590	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5.75	20	13.5599511	-0.04890	+/- 1.356
5	20	13.5599616	-0.03840	+/- 1.356
4.25	20	13.5599668	-0.03320	+/- 1.356

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Mode: OOK

Startup

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5	-20	13.5599641	-0.03590	+/- 1.356
5	-10	13.559953	-0.04700	+/- 1.356
5	0	13.5599544	-0.04560	+/- 1.356
5	10	13.5599635	-0.03650	+/- 1.356
5	20	13.559958	-0.04200	+/- 1.356
5	30	13.5599593	-0.04070	+/- 1.356
5	40	13.559968	-0.03200	+/- 1.356
5	50	13.5599626	-0.03740	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5.75	20	13.559966	-0.03400	+/- 1.356
5	20	13.559958	-0.04200	+/- 1.356
4.25	20	13.5599593	-0.04070	+/- 1.356

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2 minutes**A. Temperature Variation**

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5	-20	13.5599512	-0.04880	+/- 1.356
5	-10	13.5599527	-0.04730	+/- 1.356
5	0	13.5599486	-0.05140	+/- 1.356
5	10	13.5599612	-0.03880	+/- 1.356
5	20	13.5599519	-0.04810	+/- 1.356
5	30	13.5599534	-0.04660	+/- 1.356
5	40	13.5599558	-0.04420	+/- 1.356
5	50	13.5599588	-0.04120	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5.75	20	13.5599543	-0.04570	+/- 1.356
5	20	13.5599519	-0.04810	+/- 1.356
4.25	20	13.5599614	-0.03860	+/- 1.356

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5 minutes**A. Temperature Variation**

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5	-20	13.559962	-0.03800	+/- 1.356
5	-10	13.5599596	-0.04040	+/- 1.356
5	0	13.5599653	-0.03470	+/- 1.356
5	10	13.5599636	-0.03640	+/- 1.356
5	20	13.5599641	-0.03590	+/- 1.356
5	30	13.5599595	-0.04050	+/- 1.356
5	40	13.5599516	-0.04840	+/- 1.356
5	50	13.5599607	-0.03930	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5.75	20	13.5599529	-0.04710	+/- 1.356
5	20	13.5599641	-0.03590	+/- 1.356
4.25	20	13.5599542	-0.04580	+/- 1.356

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10 minutes**A. Temperature Variation**

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5	-20	13.5599518	-0.04820	+/- 1.356
5	-10	13.5599677	-0.03230	+/- 1.356
5	0	13.5599492	-0.05080	+/- 1.356
5	10	13.5599619	-0.03810	+/- 1.356
5	20	13.5599614	-0.03860	+/- 1.356
5	30	13.5599645	-0.03550	+/- 1.356
5	40	13.5599633	-0.03670	+/- 1.356
5	50	13.5599542	-0.04580	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5.75	20	13.5599642	-0.03580	+/- 1.356
5	20	13.5599614	-0.03860	+/- 1.356
4.25	20	13.5599631	-0.03690	+/- 1.356

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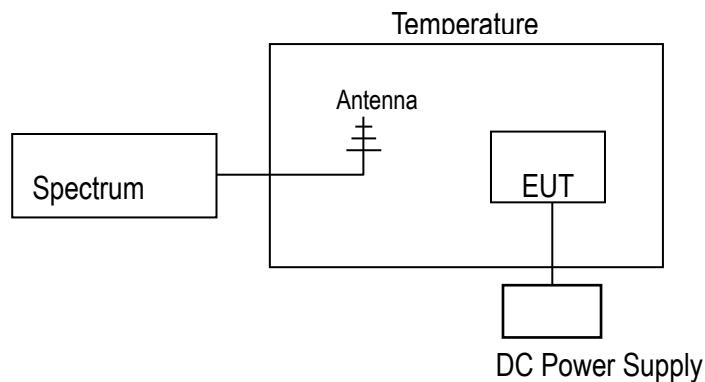
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10 EMISSION BANDWIDTH MEASUREMENT

10.1 Applicable Standard:

The 20 dB and 99% bandwidth shall be specified in operating frequency band.

10.2 Test Set-up



10.3 Measurement Procedure

1. Placed the EUT on the testing table.
2. Set the EUT under transmission condition continuously at specific channel frequency.
3. Set SPA Center Frequency = fundamental frequency, RBW=1% to 5% OBW, VBW=3 x RBW, Span = large enough to capture all products of the modulation process.
4. Measured the spectrum width with power higher than 20dB below carrier and turn on the 99% bandwidth function, max reading.

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10.4 Measurement Result

Mode: AM

FCC

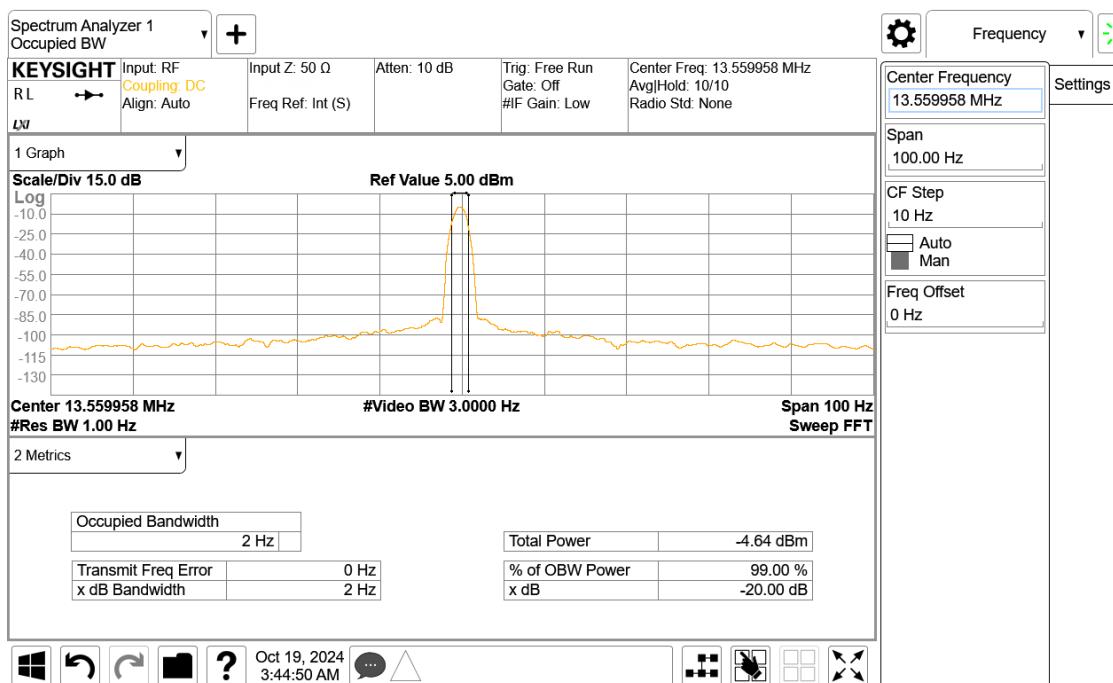
20dB BW (kHz)
0.002

Operation range	Frequency (MHz)	Limit (MHz)
Low	13.559957	>13.11
High	13.559959	<14.01

IC

99% BW (kHz)
0.002

Bandwidth



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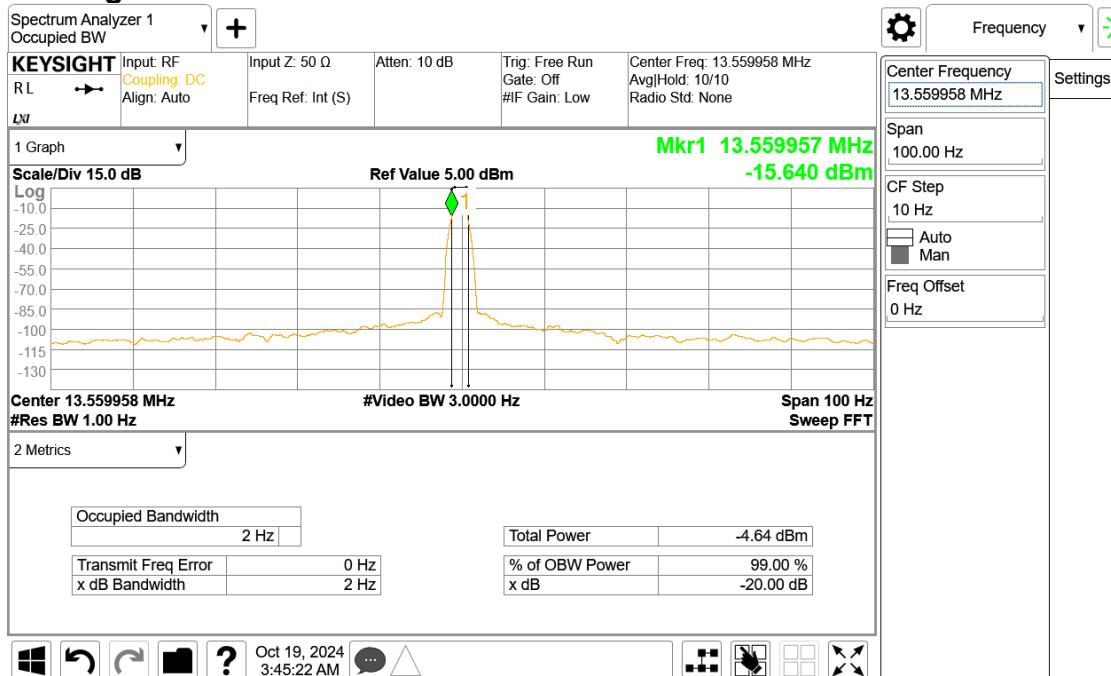
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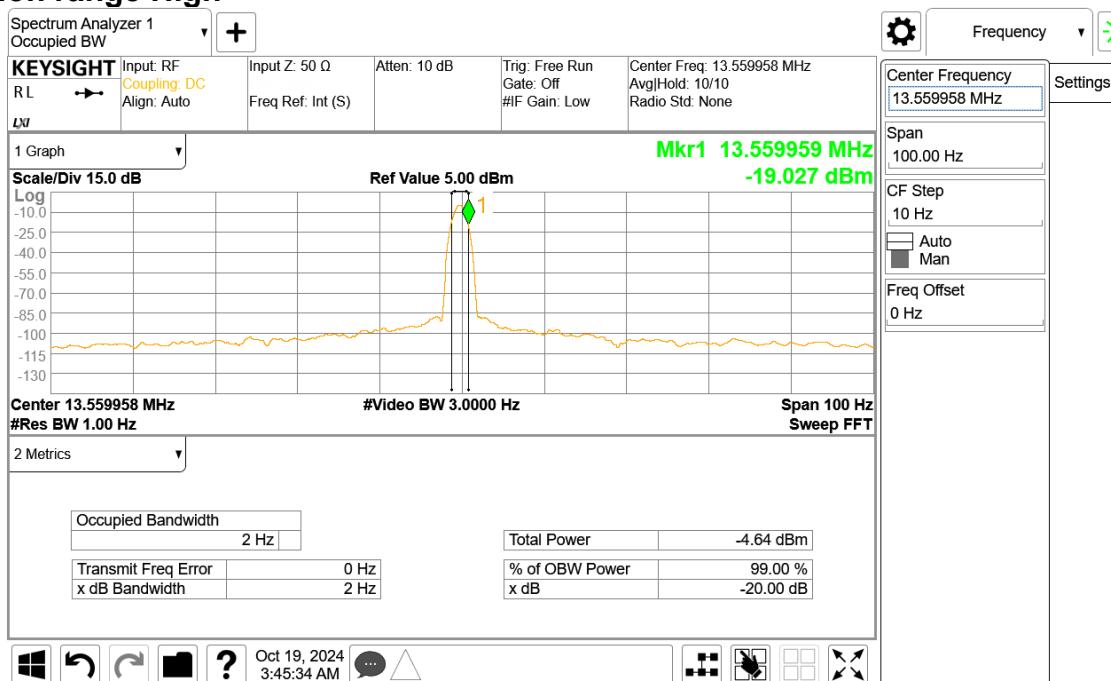
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Operation range low



Operation range High



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Mode: OOK

FCC

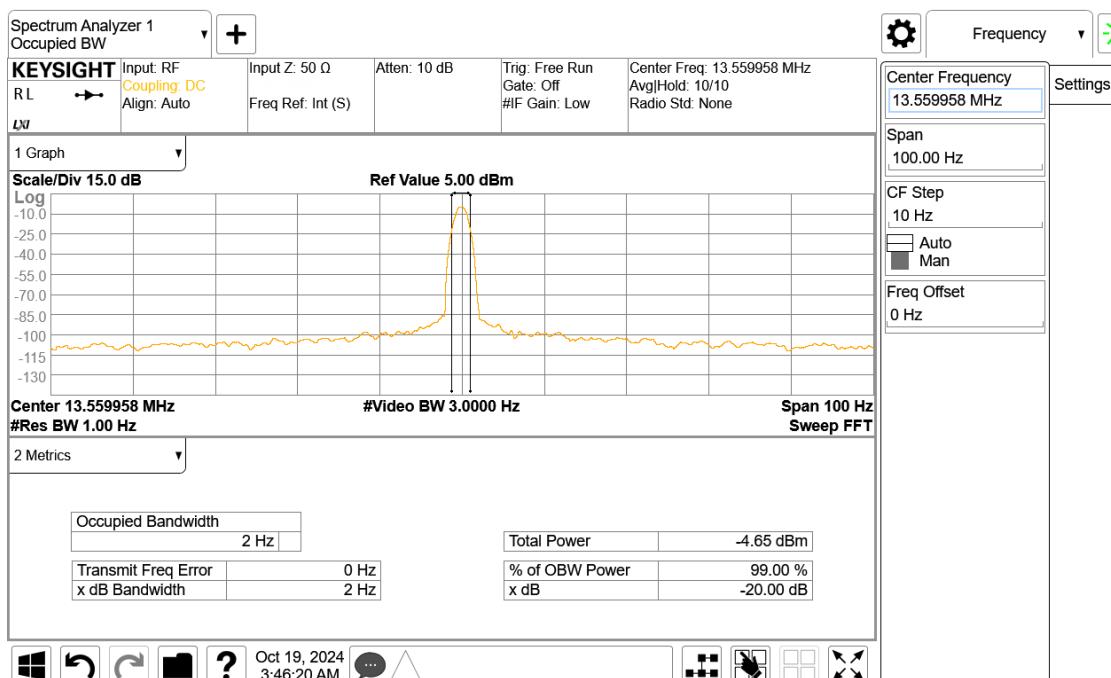
20dB BW (kHz)
0.002

Operation range	Frequency (MHz)	Limit (MHz)
Low	13.559957	>13.11
High	13.559959	<14.01

IC

99% BW (kHz)
0.002

Bandwidth



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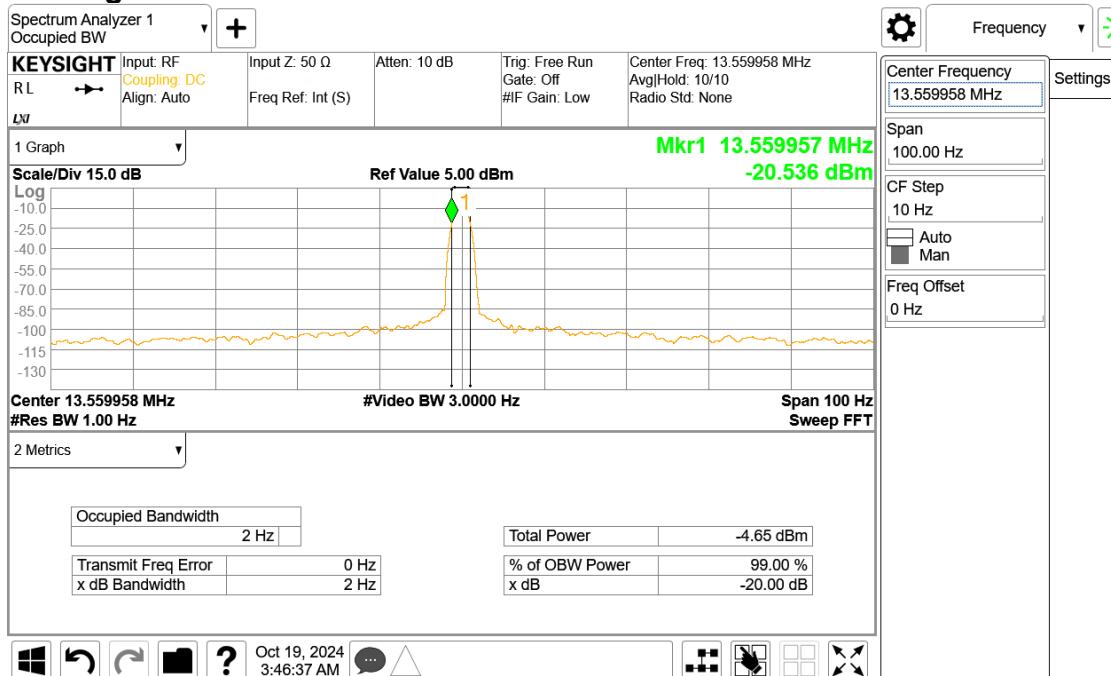
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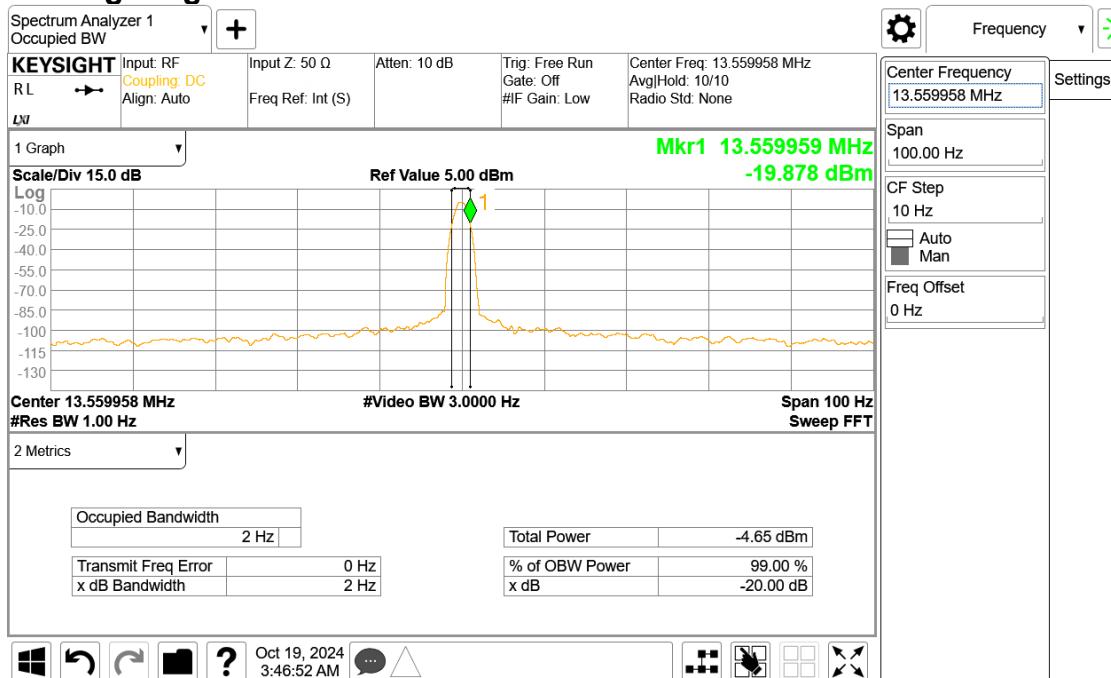
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Operation range low



Operation range High



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11 ANTENNA REQUIREMENT

11.1 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.

11.2 Antenna Connected Construction:

The antenna complies with this requirement and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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