

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT



Applicant: Dell Inc.
One Dell Way, Round Rock, Texas 78682, USA
Manufacturer: Dell Inc.
One Dell Way, Round Rock, Texas 78682, USA
Product Name: RFID 13.56MHz Wireless Module
Brand Name: DELL
Model No.: DWRFID2401
Report Number: TERF2404001100ER
FCC ID E2K-DWRFID2401
IC: 1514B-DWRFID2401
Date of EUT Received: April 23, 2024
Date of Test: April 24, 2024 ~ May 21, 2024
Issue Date: July 11, 2024

Approved By _____

Jim Chang

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, ISSED 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
TERF2404001100ER	00	Original	Jul. 11, 2024	Candice Li	

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:	RFID 13.56MHz Wireless Module
Brand Name:	DELL
Model No.:	DWRFID2401
Hardware Version:	X00
Firmware Version:	6.0.9.5
EUT Series No.:	60C8BT3
Power Supply:	11.4 Vdc from Rechargeable Li-ion Battery or 5 / 9 / 10 / 12 / 15 / 20 Vdc from AC/DC Adapter
Test Software (Name/Version)	Nfc Spy Version 1.2.0.3
Host Information:	Product Name: Notebook Computer Brand Name: DELL Model No.: P148G002

1.2 RF specification

Radio Technology:	NFC
Operating Frequency	13.56MHz
Transmit Power	Type A: 10.4 dBuV/m at 30m. Type B: 10.26 dBμA/m at 30m. Type F: 8.76 dBμA/m at 30m. Type V: 7.58 dBμA/m at 30m.
Number of Channels	1
Modulation Type	ASK
Antenna Type	Loop

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 Annex B.2 Issue 10 December 20, Amendment (April 2020)19.

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	TW0027	TW3702
		SAC 2		
		SAC 3		
		Conduction 1		
		Conducted 1		
		Conducted 2		
		Conducted 3		
		Conducted 4		
		Conducted 5		
		Conducted 6		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction C	TW0028	
		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
		Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
Conducted G				

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 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.

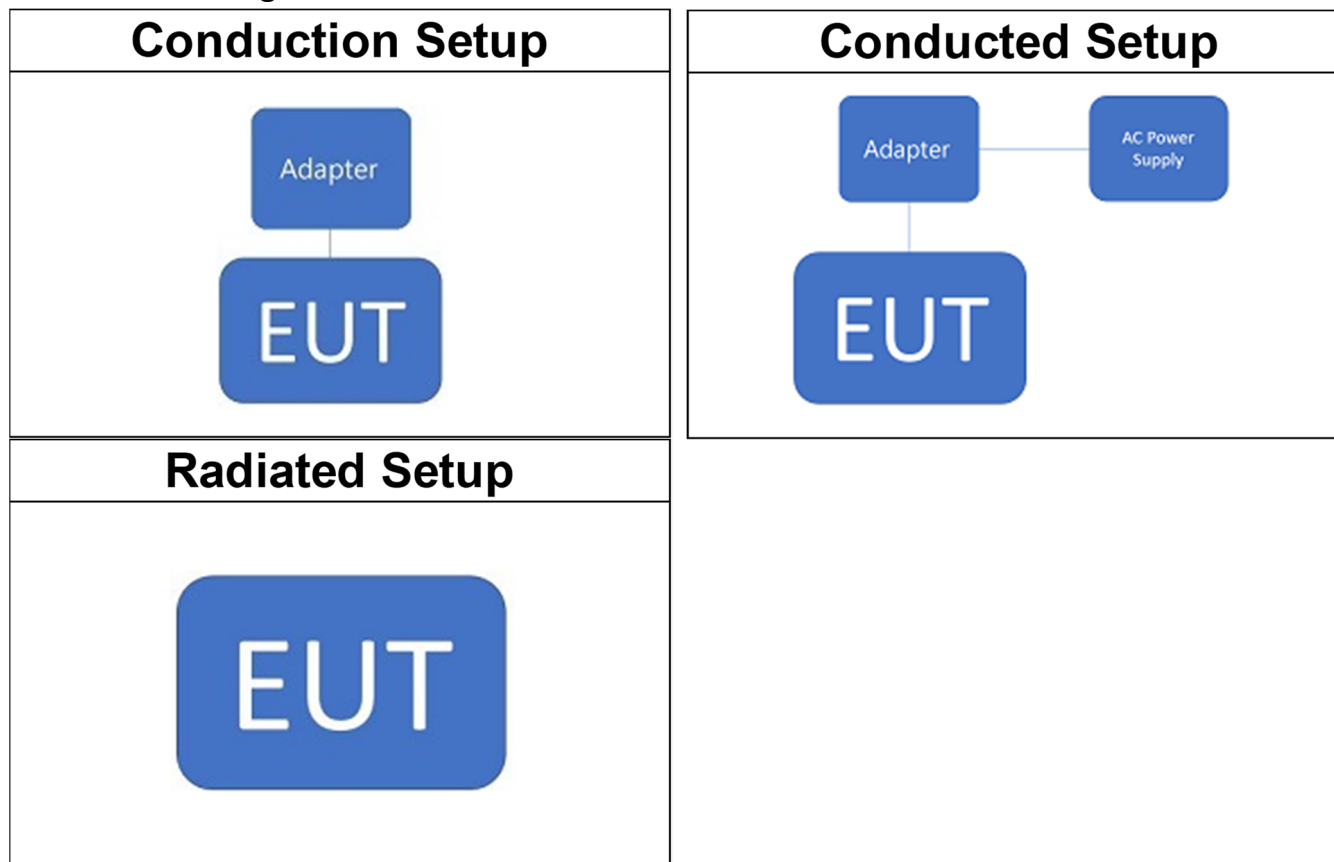
2.3.2 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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2.4 Test Configuration



2.5 Control Unit(s)

AC Power-Line Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
AC Adapter	DELL	HKA65NM200	N/A	N/A	N/A
AC Adapter	DELL	DA65NM190	N/A	N/A	N/A
AC Adapter	DELL	AA65NM220	N/A	N/A	N/A
AC Adapter	DELL	LA65NM190	N/A	N/A	N/A
AC Adapter	DELL	HA65NM190	N/A	N/A	N/A
AC Adapter	DELL	HA100PM240	N/A	N/A	N/A
AC Adapter	DELL	LA100PM220	N/A	N/A	N/A
AC Adapter	DELL	DA100PM220	N/A	N/A	N/A
Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
AC Adapter	Delta Electronics, Inc.	N/A	N/A	N/A	N/A
RFID card	Mifare card	Mifare card	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. Only one configuration is supported/applicable as follows.

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

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	9kHz~30MHz
	+/-	4.15 dB	30MHz - 1000MHz
	+/-	3.43 dB	1GHz - 18GHz
	+/-	3.86 dB	18GHz - 40GHz
Polarization: Horizontal	+/-	1.89 dB	9kHz~30MHz
	+/-	4.02 dB	30MHz - 1000MHz
	+/-	3.43 dB	1GHz - 18GHz
	+/-	3.86 dB	18GHz - 40GHz
Radiated Spurious Emission	+/-	2 dB	33GHz-50GHz
	+/-	1.59 dB	50GHz-60GHz
	+/-	1.7 dB	60GHz-90GHz
	+/-	1.64 dB	90GHz-140GHz
	+/-	3.83 dB	140GHz-220GHz

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.
Test Software	Audix	e3	Ver. 9.210616	N.C.R	N.C.R
LISN	SCHWARZBECK	NSLK 8127	1040	09/06/2023	09/05/2024
Coaxial Cables	EMC Instruments Corp.	EMCCFD300-BM-BM-3000	161207	06/22/2023	06/21/2024
Pulse Limiter	SCHWARZBECK	VTSD 9561F-N	793	06/22/2023	06/21/2024
EMI Test Receiver	R&S	ESCI 7	100759	08/21/2023	08/20/2024

6.2 Conducted Measurement

Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY59071541	07/13/2023	07/12/2024
AC Power Source	Gwinstek	APS-7050E	GEV171679	10/26/2023	10/25/2024
Temperature Chamber	TERCHY	MHG-120LE	1110435	05/24/2023	05/23/2024
H-Loop Near Field Antenna	EMCI	LF-R 400	02-1637	N/A	N/A
DC Block	Mini-Circuits	BLK-18-S+	31129	12/12/2023	12/11/2024

6.3 Radiated Measurement

Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Loop Antenna	COM-POWER	AL-130R	10160104	12/04/2023	12/03/2024
Bi-log Antenna	SCHWARZBECK	VULB9168	378	08/09/2023	08/08/2024
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY63440386	02/06/2024	02/05/2025
Test Software	Audix	e3	Ver. 9.210616	N.C.R	N.C.R
EMI Test Receiver	R&S	ESCI 7	100759	08/21/2023	08/20/2024
Site Cal	SGS	SAC 3	N/A	08/31/2023	08/30/2024
Pre-Amplifier	HP	8447D	2944A07676	08/31/2023	08/30/2024
Coaxial Cables	EMCI+Huber Suhner	EMC107-SM-SM-1000+EMC107-SM-SM-1500+EMC107-SM-SM-8000+SUCOFLEX 104PEA	RX Cable 9K-18G (221110+221106+221212+MY4251/4PEA)	08/31/2023	08/30/2024

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

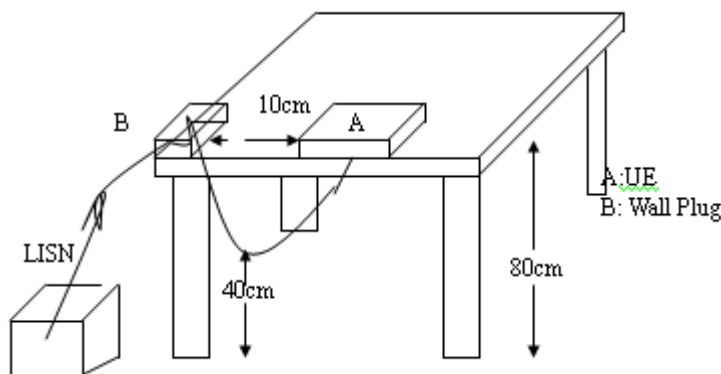
Note

- 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 120-240Vac/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 test data reveals the worst-case results that closest to the limit.

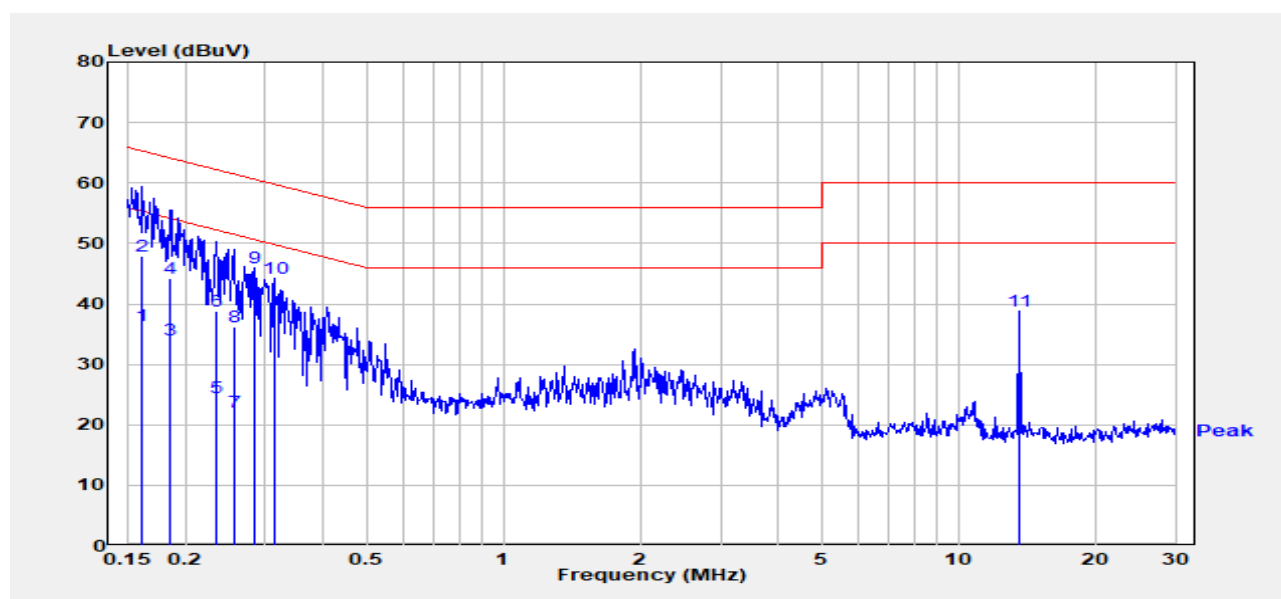
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :TERF2404001100ER
Operation Mode :NFC
Power :120V/60Hz
Probe :L
Note: :adapter(HKA65NM200)

Test Site :Conduction 1
Test Date :2024-05-17
Temp./Humi. :21.8°C/63%
Engineer :Nick Lin



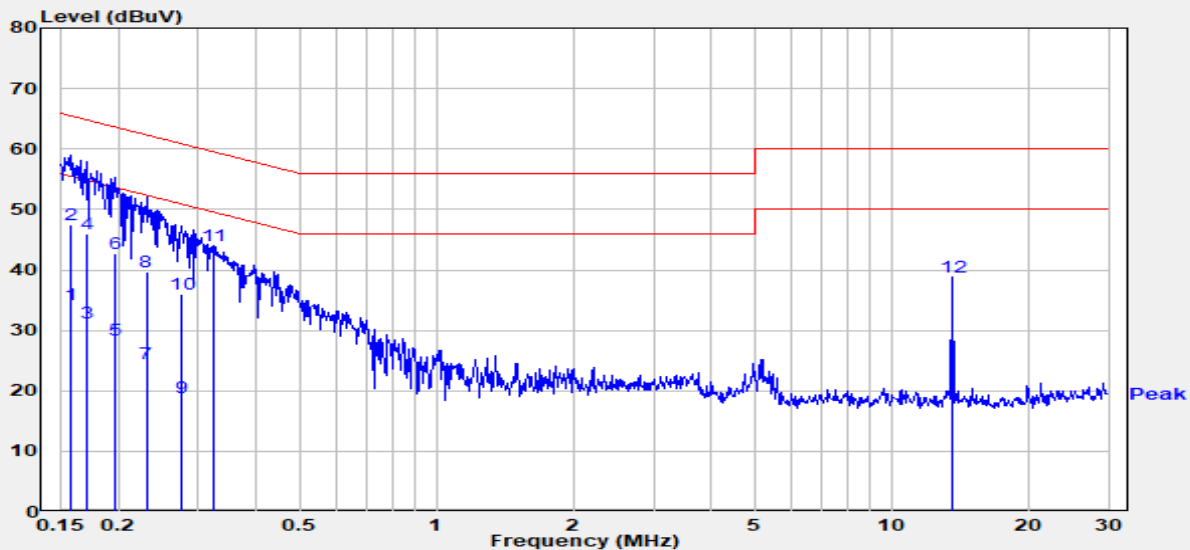
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.161	Average	26.21	10.13	36.34	55.43	-19.09
0.161	QP	37.70	10.13	47.83	65.43	-17.60
0.185	Average	24.01	10.13	34.14	54.24	-20.10
0.185	QP	34.17	10.13	44.30	64.24	-19.94
0.233	Average	14.33	10.13	24.46	52.35	-27.88
0.233	QP	28.64	10.13	38.77	62.35	-23.57
0.256	Average	12.03	10.14	22.17	51.56	-29.39
0.256	QP	26.14	10.14	36.28	61.56	-25.28
0.283	Peak	35.84	10.14	45.98	60.72	-14.74
0.313	Peak	34.13	10.14	44.28	59.88	-15.61
13.560	Peak	28.43	10.45	38.88	60.00	-21.12

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Report Number :TERF2404001100ER
Operation Mode :NFC
Power :120V/60Hz
Probe :N
Note: :adapter(HKA65NM200)

Test Site :Conduction 1
Test Date :2024-05-17
Temp./Humi. :21.8°C/63%
Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.157	Average	24.22	10.12	34.34	55.60	-21.26
0.157	QP	37.31	10.12	47.43	65.60	-18.17
0.170	Average	21.07	10.12	31.19	54.94	-23.75
0.170	QP	35.87	10.12	45.99	64.94	-18.95
0.198	Average	18.24	10.12	28.36	53.71	-25.35
0.198	QP	32.69	10.12	42.81	63.71	-20.90
0.230	Average	14.35	10.13	24.48	52.44	-27.96
0.230	QP	29.58	10.13	39.71	62.44	-22.73
0.274	Average	8.83	10.13	18.96	50.98	-32.02
0.274	QP	25.77	10.13	35.90	60.98	-25.08
0.323	Peak	33.94	10.14	44.08	59.62	-15.54
13.560	Peak	28.33	10.48	38.81	60.00	-21.19

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Report Number :TERF2404001100ER

Test Site :Conduction 1

Operation Mode :NFC

Test Date :2024-05-17

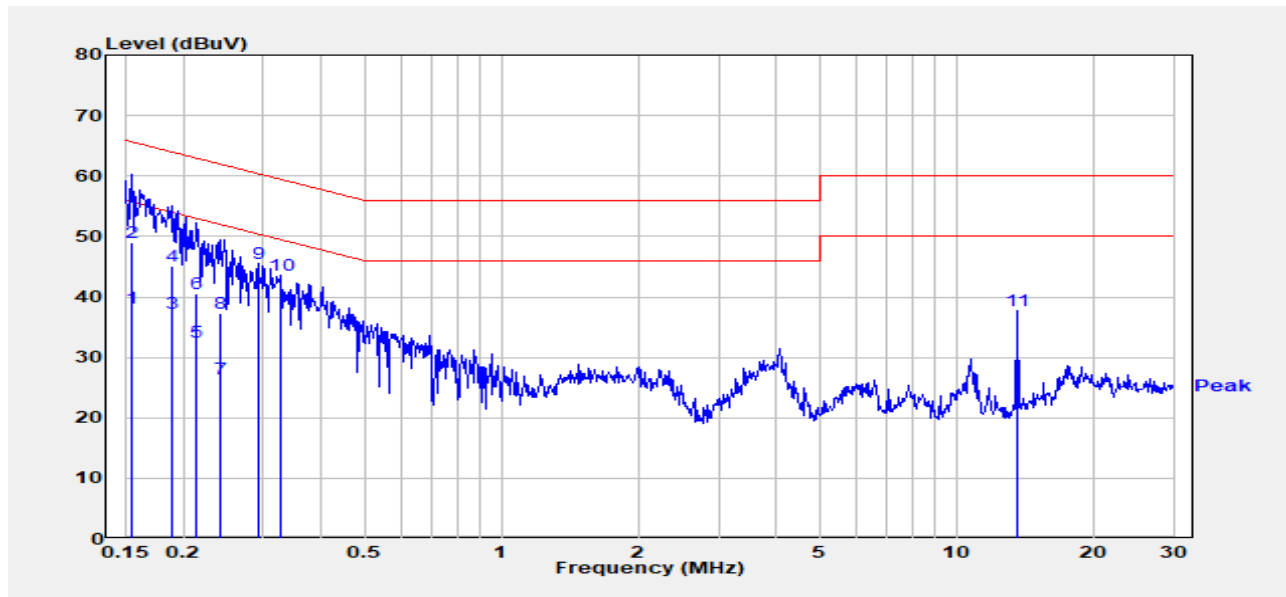
Power :120V/60Hz

Temp./Humi. :21.8°C/63%

Probe :L

Engineer :Nick Lin

Note: :adapter(DA65NM190)



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS		
	PK/QP/AV	dBμV	dB	dBμV	dBμV	dB
0.154	Average	27.92	10.13	38.05	55.78	-17.73
0.154	QP	38.78	10.13	48.91	65.78	-16.87
0.188	Average	27.22	10.13	37.35	54.11	-16.76
0.188	QP	34.93	10.13	45.06	64.11	-19.05
0.214	Average	22.37	10.13	32.50	53.05	-20.55
0.214	QP	30.41	10.13	40.54	63.05	-22.51
0.242	Average	16.41	10.14	26.55	52.04	-25.49
0.242	QP	27.23	10.14	37.37	62.04	-24.67
0.292	Peak	35.31	10.14	45.45	60.46	-15.01
0.327	Peak	33.48	10.14	43.62	59.53	-15.91
13.560	Peak	27.28	10.45	37.72	60.00	-22.28

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Report Number :TERF2404001100ER

Operation Mode :NFC

Power :120V/60Hz

Probe :N

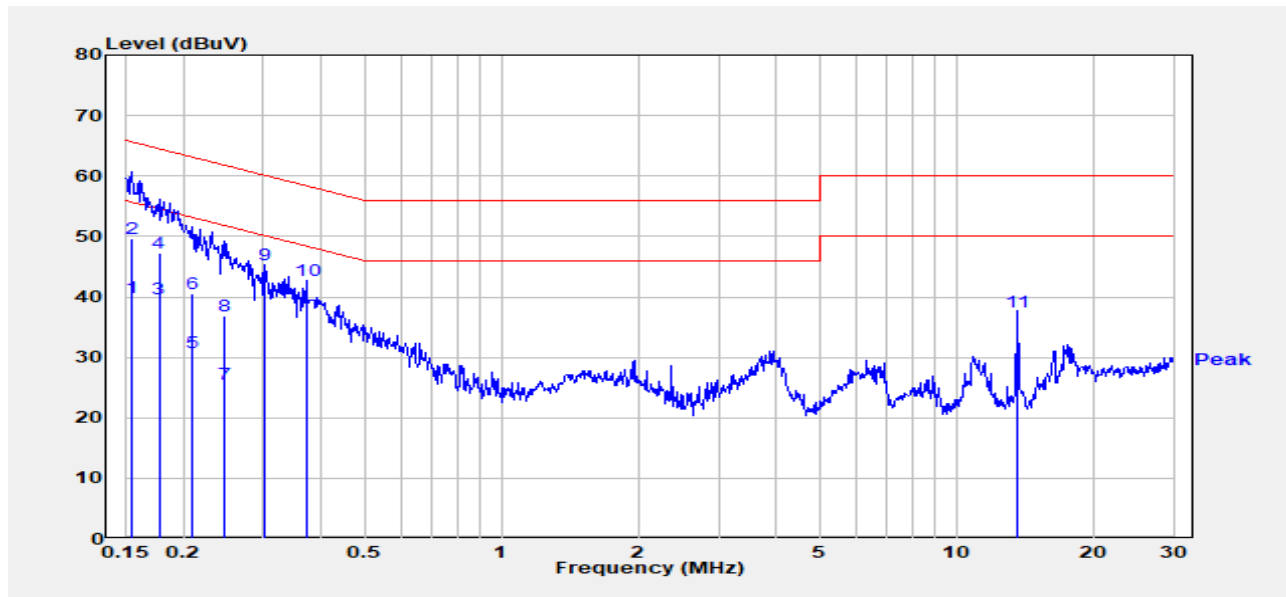
Note: :adapter(DA65NM190)

Test Site :Conduction 1

Test Date :2024-05-17

Temp./Humi. :21.8°C/63%

Engineer :Nick 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
0.154	Average	29.81	10.12	39.93	55.78	-15.85
0.154	QP	39.48	10.12	49.60	65.78	-16.18
0.177	Average	29.57	10.12	39.69	54.64	-14.95
0.177	QP	37.18	10.12	47.30	64.64	-17.34
0.209	Average	20.61	10.12	30.73	53.23	-22.50
0.209	QP	30.37	10.12	40.49	63.23	-22.74
0.247	Average	15.44	10.13	25.57	51.86	-26.29
0.247	QP	26.73	10.13	36.86	61.86	-25.00
0.302	Peak	35.07	10.14	45.20	60.19	-14.99
0.373	Peak	32.61	10.15	42.75	58.43	-15.68
13.560	Peak	27.09	10.48	37.58	60.00	-22.42

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Report Number :TERF2404001100ER

Operation Mode :NFC

Power :120V/60Hz

Probe :L

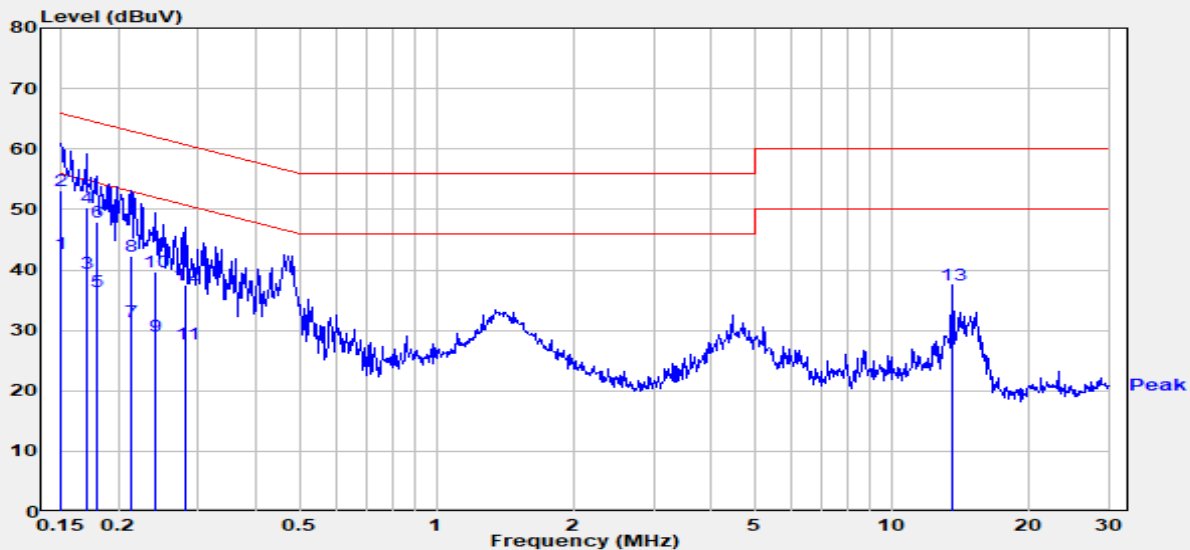
Note: :adapter(AA65NM220)

Test Site :Conduction 1

Test Date :2024-05-17

Temp./Humi. :21.8°C/63%

Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.150	Average	32.51	10.13	42.64	56.00	-13.36
0.150	QP	42.93	10.13	53.06	66.00	-12.94
0.170	Average	29.33	10.13	39.46	54.94	-15.48
0.170	QP	40.17	10.13	50.30	64.94	-14.64
0.180	Average	26.33	10.13	36.46	54.50	-18.04
0.180	QP	37.88	10.13	48.01	64.50	-16.49
0.213	Average	21.23	10.13	31.36	53.10	-21.73
0.213	QP	32.07	10.13	42.20	63.10	-20.89
0.240	Average	18.83	10.14	28.97	52.08	-23.12
0.240	QP	29.44	10.14	39.58	62.08	-22.51
0.282	Average	17.71	10.14	27.85	50.76	-22.91
0.282	QP	27.31	10.14	37.45	60.76	-23.31
13.560	Peak	27.08	10.45	37.52	60.00	-22.48

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Report Number :TERF2404001100ER

Operation Mode :NFC

Power :120V/60Hz

Probe :N

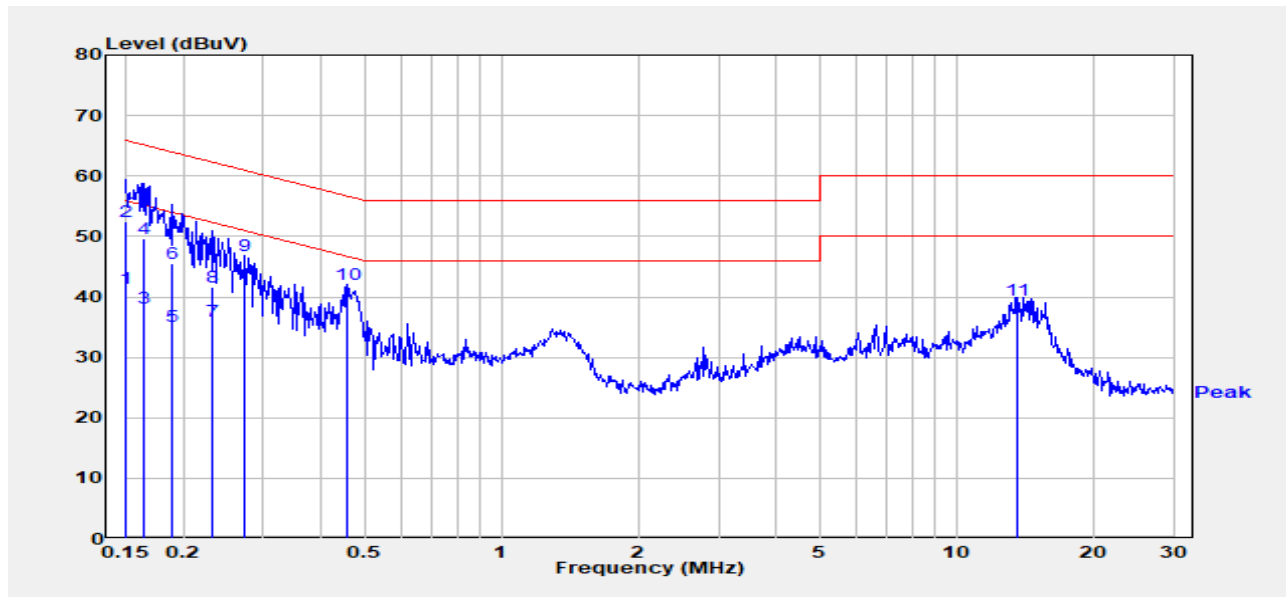
Note: :adapter(AA65NM220)

Test Site :Conduction 1

Test Date :2024-05-17

Temp./Humi. :21.8°C/63%

Engineer :Nick 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	Average	31.22	10.12	41.34	56.00	-14.66
0.150	QP	42.27	10.12	52.39	66.00	-13.61
0.163	Average	28.04	10.12	38.16	55.30	-17.14
0.163	QP	39.62	10.12	49.74	65.30	-15.56
0.189	Average	25.03	10.12	35.15	54.06	-18.91
0.189	QP	35.38	10.12	45.50	64.06	-18.56
0.232	Average	25.81	10.13	35.94	52.39	-16.46
0.232	QP	31.47	10.13	41.60	62.39	-20.80
0.273	Peak	36.68	10.13	46.82	61.03	-14.21
0.456	Peak	31.95	10.16	42.11	56.76	-14.65
13.560	Peak	28.97	10.48	39.46	60.00	-20.54

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Report Number :TERF2404001100ER

Test Site :Conduction 1

Operation Mode :NFC

Test Date :2024-05-17

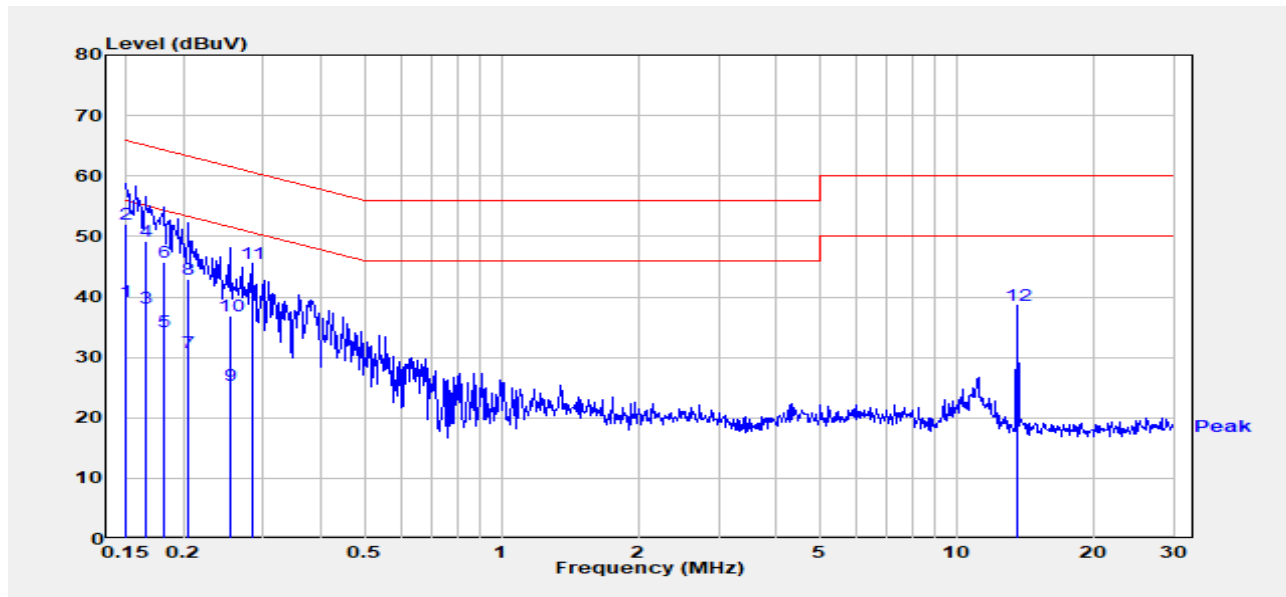
Power :120V/60Hz

Temp./Humi. :21.8°C/63%

Probe :L

Engineer :Nick Lin

Note: :adapter(LA65NM190)



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.150	Average	29.11	10.13	39.24	56.00	-16.76
0.150	QP	41.83	10.13	51.96	66.00	-14.04
0.165	Average	28.04	10.13	38.17	55.21	-17.04
0.165	QP	38.99	10.13	49.12	65.21	-16.09
0.182	Average	24.22	10.13	34.35	54.42	-20.07
0.182	QP	35.66	10.13	45.79	64.42	-18.63
0.205	Average	20.55	10.13	30.68	53.40	-22.72
0.205	QP	32.77	10.13	42.90	63.40	-20.50
0.253	Average	15.19	10.14	25.33	51.64	-26.32
0.253	QP	26.66	10.14	36.80	61.64	-24.85
0.283	Peak	35.47	10.14	45.61	60.72	-15.11
13.560	Peak	28.16	10.45	38.61	60.00	-21.39

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Report Number :TERF2404001100ER

Operation Mode :NFC

Power :120V/60Hz

Probe :N

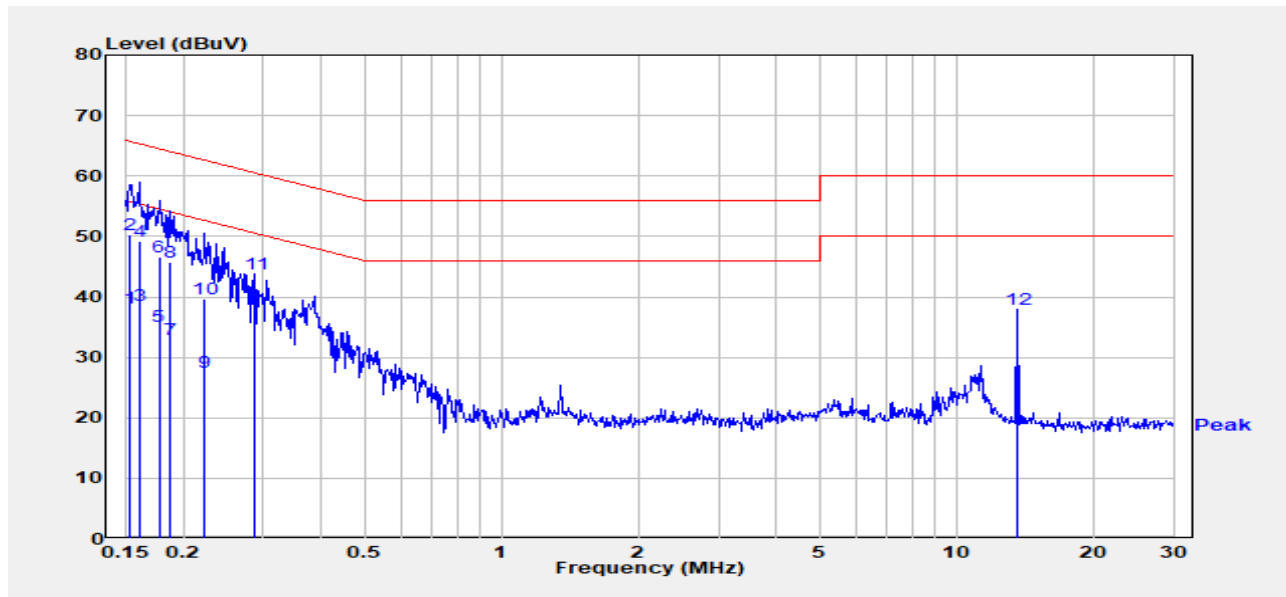
Note: :adapter(LA65NM190)

Test Site :Conduction 1

Test Date :2024-05-17

Temp./Humi. :21.8°C/63%

Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.153	Average	28.06	10.12	38.18	55.82	-17.64
0.153	QP	40.17	10.12	50.29	65.82	-15.53
0.160	Average	28.44	10.12	38.56	55.47	-16.91
0.160	QP	38.99	10.12	49.11	65.47	-16.36
0.177	Average	25.07	10.12	35.19	54.64	-19.45
0.177	QP	36.55	10.12	46.67	64.64	-17.97
0.186	Average	22.73	10.12	32.85	54.20	-21.35
0.186	QP	35.55	10.12	45.67	64.20	-18.53
0.223	Average	17.42	10.12	27.54	52.70	-25.15
0.223	QP	29.64	10.12	39.76	62.70	-22.93
0.288	Peak	33.65	10.14	43.78	60.59	-16.81
13.560	Peak	27.56	10.48	38.04	60.00	-21.96

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Report Number :TERF2404001100ER

Operation Mode :NFC

Power :120V/60Hz

Probe :L

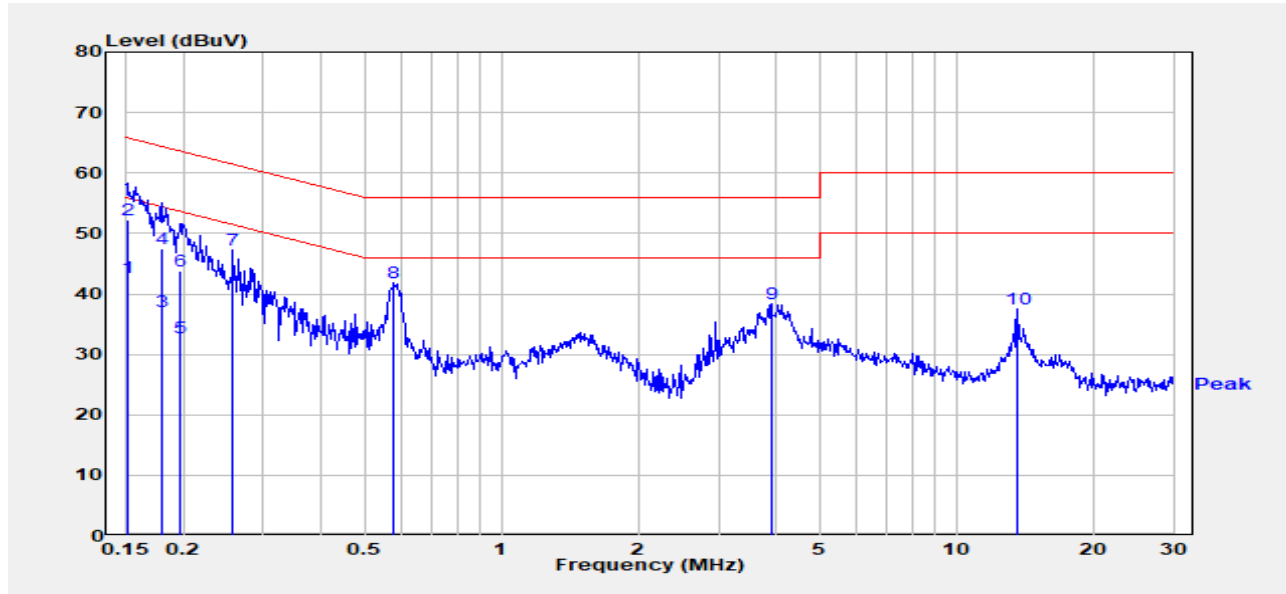
Note: :adapter(HA65NM190)

Test Site :Conduction 1

Test Date :2024-05-17

Temp./Humi. :21.8°C/63%

Engineer :Nick Lin



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS		
	PK/QP/AV	dBμV	dB	dBμV	dBμV	dB
0.151	Average	32.63	10.13	42.76	55.96	-13.20
0.151	QP	42.11	10.13	52.24	65.96	-13.72
0.179	Average	26.94	10.13	37.07	54.55	-17.48
0.179	QP	37.31	10.13	47.44	64.55	-17.11
0.198	Average	22.64	10.13	32.77	53.71	-20.94
0.198	QP	33.57	10.13	43.70	63.71	-20.01
0.258	Peak	37.05	10.14	47.18	61.51	-14.33
0.579	Peak	31.68	10.17	41.85	56.00	-14.15
3.922	Peak	28.11	10.29	38.41	56.00	-17.59
13.560	Peak	26.98	10.45	37.42	60.00	-22.58

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Report Number :TERF2404001100ER

Test Site :Conduction 1

Operation Mode :NFC

Test Date :2024-05-17

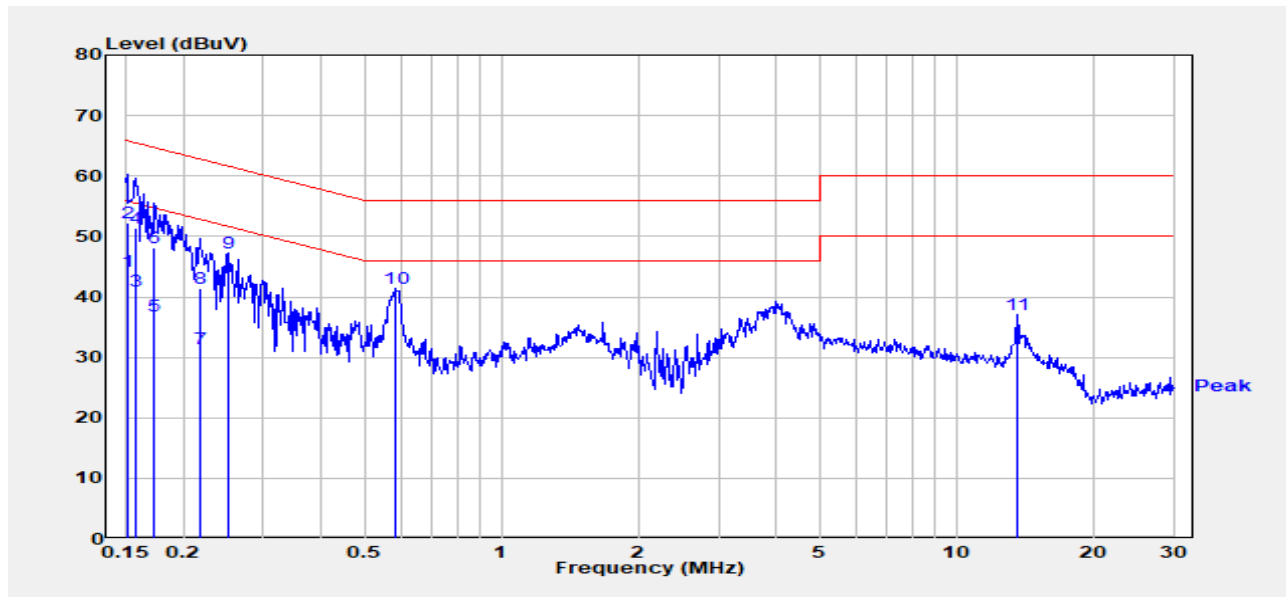
Power :120V/60Hz

Temp./Humi. :21.8°C/63%

Probe :N

Engineer :Nick Lin

Note: :adapter(HA65NM190)



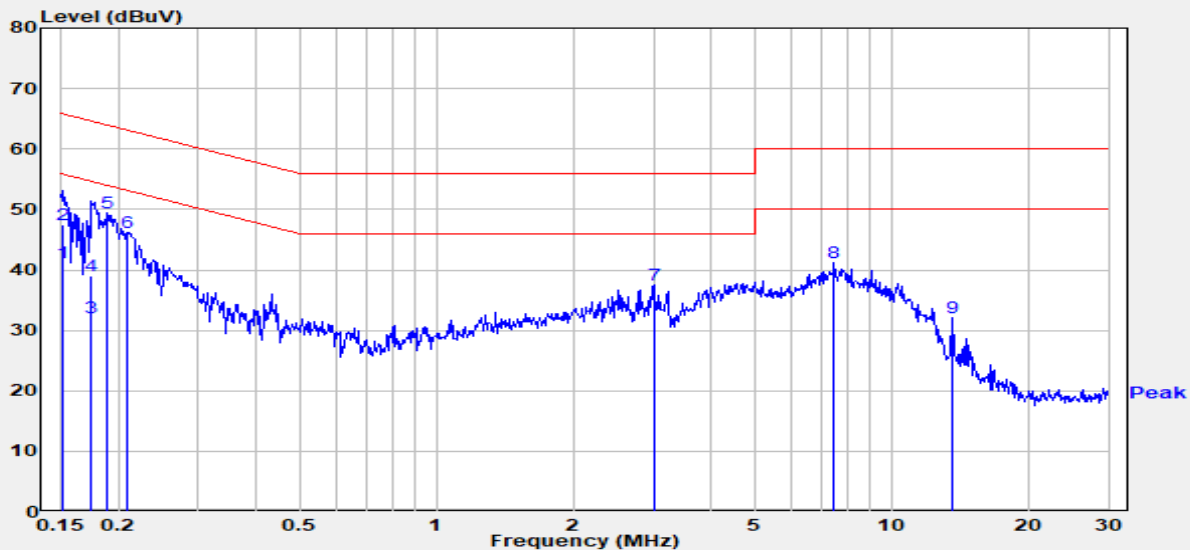
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS		
	PK/QP/AV	dBμV	dB	dBμV	dBμV	dB
0.151	Average	34.17	10.12	44.29	55.96	-11.67
0.151	QP	42.22	10.12	52.34	65.96	-13.62
0.157	Average	30.82	10.12	40.94	55.60	-14.66
0.157	QP	41.33	10.12	51.45	65.60	-14.15
0.173	Average	26.79	10.12	36.91	54.81	-17.90
0.173	QP	37.92	10.12	48.04	64.81	-16.77
0.217	Average	21.29	10.12	31.41	52.92	-21.51
0.217	QP	31.31	10.12	41.43	62.92	-21.49
0.252	Peak	37.10	10.13	47.23	61.69	-14.45
0.585	Peak	31.24	10.17	41.41	56.00	-14.59
13.560	Peak	26.56	10.48	37.04	60.00	-22.96

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Report Number :TERF2404001100ER
Operation Mode :NFC
Power :120V/60Hz
Probe :L
Note: :adapter(HA100PM240)

Test Site :Conduction 1
Test Date :2024-05-17
Temp./Humi. :21.8°C/63%
Engineer :Nick Lin



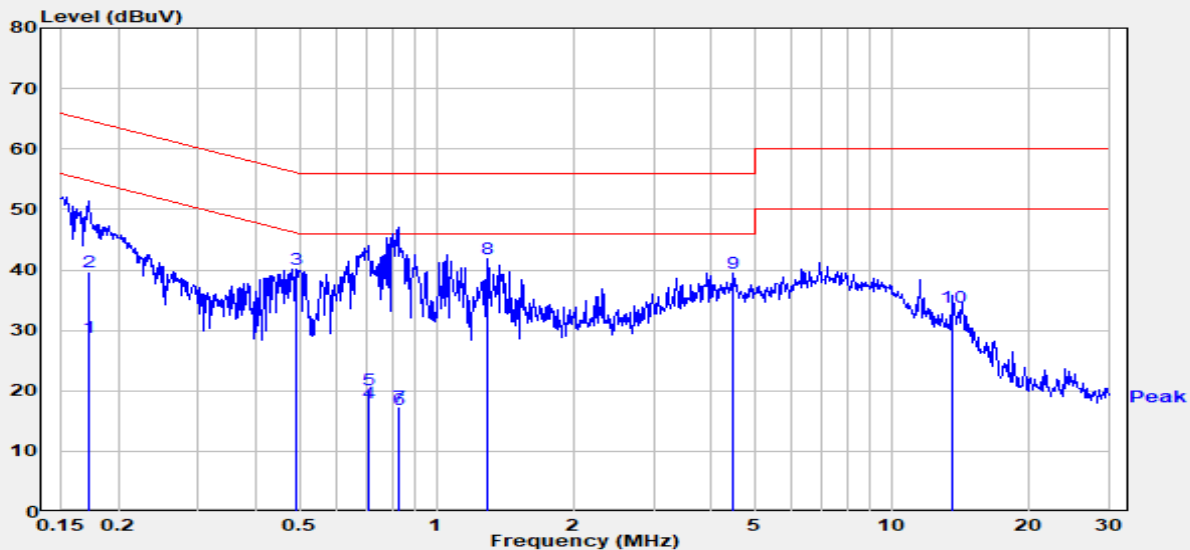
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.151	Average	31.02	10.13	41.15	55.96	-14.81
0.151	QP	37.44	10.13	47.57	65.96	-18.39
0.175	Average	22.02	10.13	32.15	54.72	-22.57
0.175	QP	28.94	10.13	39.07	64.72	-25.65
0.188	Peak	39.37	10.13	49.50	64.11	-14.61
0.208	Peak	36.11	10.13	46.24	63.27	-17.03
3.009	Peak	27.23	10.25	37.49	56.00	-18.51
7.486	Peak	30.77	10.36	41.14	60.00	-18.86
13.560	Peak	21.62	10.45	32.07	60.00	-27.93

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Report Number :TERF2404001100ER
Operation Mode :NFC
Power :120V/60Hz
Probe :N
Note: :adapter(HA100PM240)

Test Site :Conduction 1
Test Date :2024-05-17
Temp./Humi. :21.8°C/63%
Engineer :Nick Lin



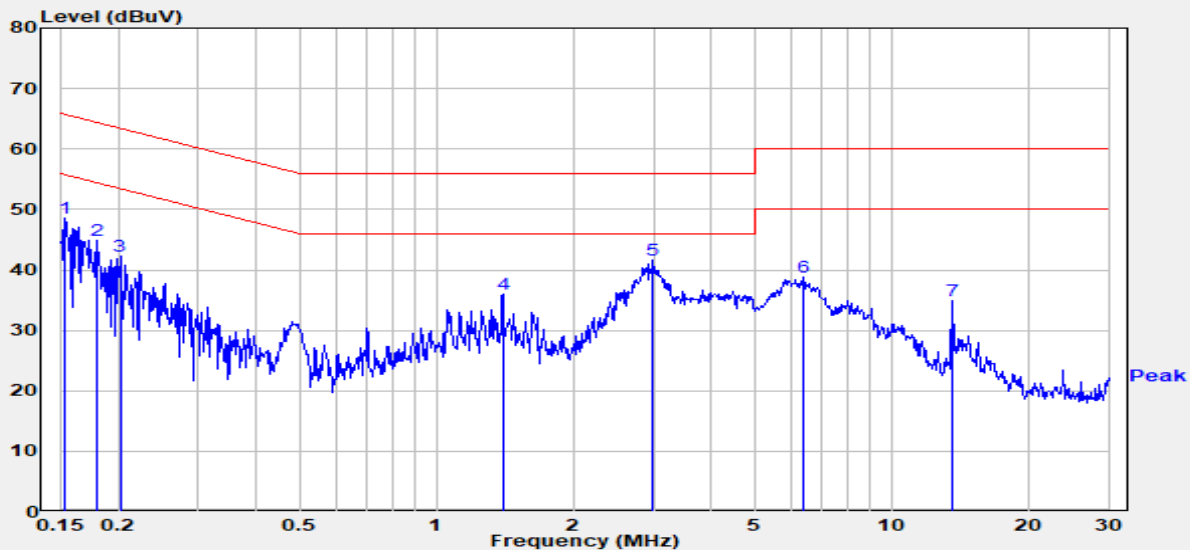
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.172	Average	18.78	10.12	28.90	54.86	-25.96
0.172	QP	29.63	10.12	39.75	64.86	-25.11
0.494	Peak	30.02	10.16	40.18	56.10	-15.92
0.712	Average	7.81	10.18	17.99	46.00	-28.01
0.712	QP	10.01	10.18	20.19	56.00	-35.81
0.826	Average	6.71	10.18	16.89	46.00	-29.11
0.826	QP	7.22	10.18	17.40	56.00	-38.60
1.296	Peak	31.69	10.19	41.88	56.00	-14.12
4.501	Peak	29.18	10.33	39.51	56.00	-16.49
13.560	Peak	23.32	10.48	33.81	60.00	-26.19

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Report Number :TERF2404001100ER
Operation Mode :NFC
Power :120V/60Hz
Probe :L
Note: :adapter(LA100PM220)

Test Site :Conduction 1
Test Date :2024-05-17
Temp./Humi. :21.8°C/63%
Engineer :Nick Lin



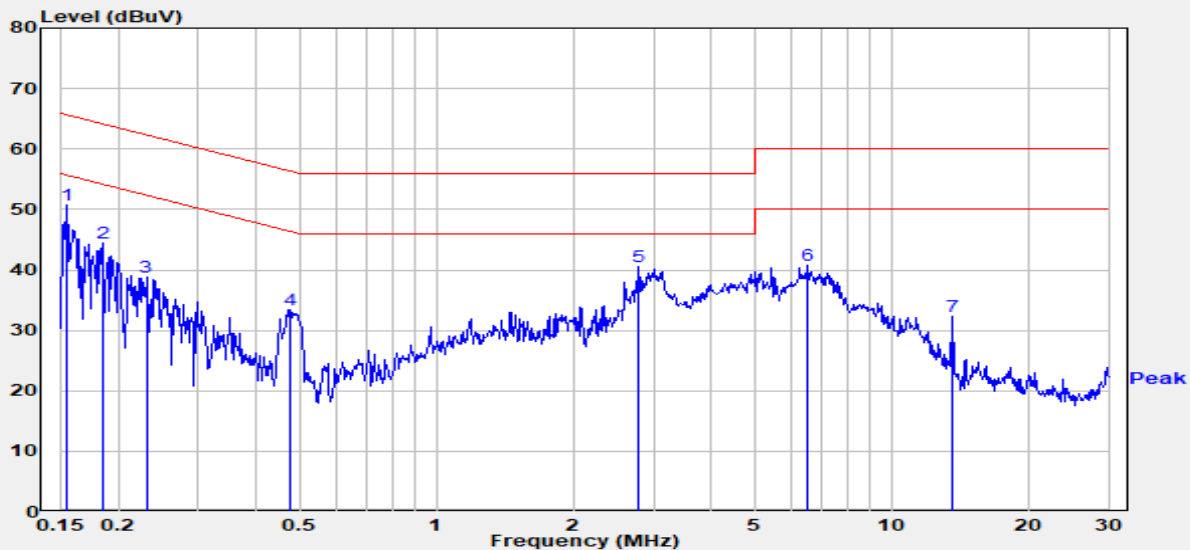
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V	Limit dB μ V	Margin dB
0.153	Peak	38.49	10.13	48.62	65.82	-17.21
0.180	Peak	34.69	10.13	44.82	64.50	-19.68
0.202	Peak	32.04	10.13	42.17	63.54	-21.36
1.403	Peak	25.81	10.20	36.01	56.00	-19.99
2.993	Peak	31.46	10.25	41.71	56.00	-14.29
6.386	Peak	28.54	10.36	38.90	60.00	-21.10
13.560	Peak	24.51	10.45	34.96	60.00	-25.04

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Report Number :TERF2404001100ER
Operation Mode :NFC
Power :120V/60Hz
Probe :N
Note: :adapter(LA100PM220)

Test Site :Conduction 1
Test Date :2024-05-17
Temp./Humi. :21.8°C/63%
Engineer :Nick Lin



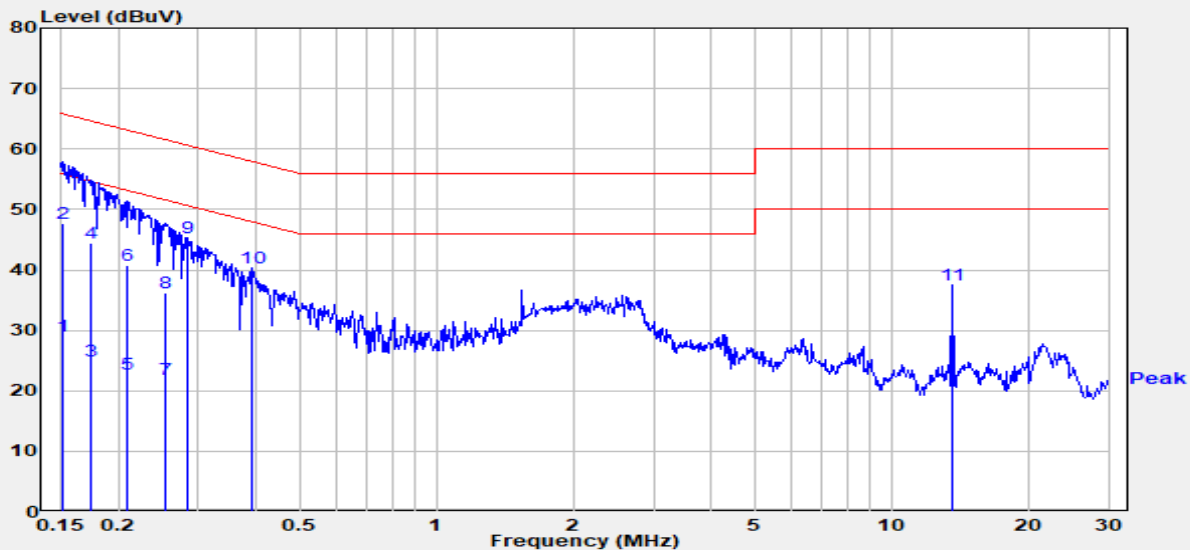
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.154	Peak	40.66	10.12	50.78	65.78	-15.00
0.184	Peak	34.27	10.12	44.39	64.28	-19.89
0.230	Peak	28.60	10.13	38.72	62.44	-23.71
0.479	Peak	23.25	10.16	33.41	56.36	-22.96
2.779	Peak	30.21	10.24	40.45	56.00	-15.55
6.557	Peak	30.35	10.37	40.73	60.00	-19.27
13.560	Peak	21.89	10.48	32.38	60.00	-27.62

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Report Number :TERF2404001100ER
Operation Mode :NFC
Power :120V/60Hz
Probe :L
Note: :adapter(DA100PM220)

Test Site :Conduction 1
Test Date :2024-05-17
Temp./Humi. :21.8°C/63%
Engineer :Nick Lin



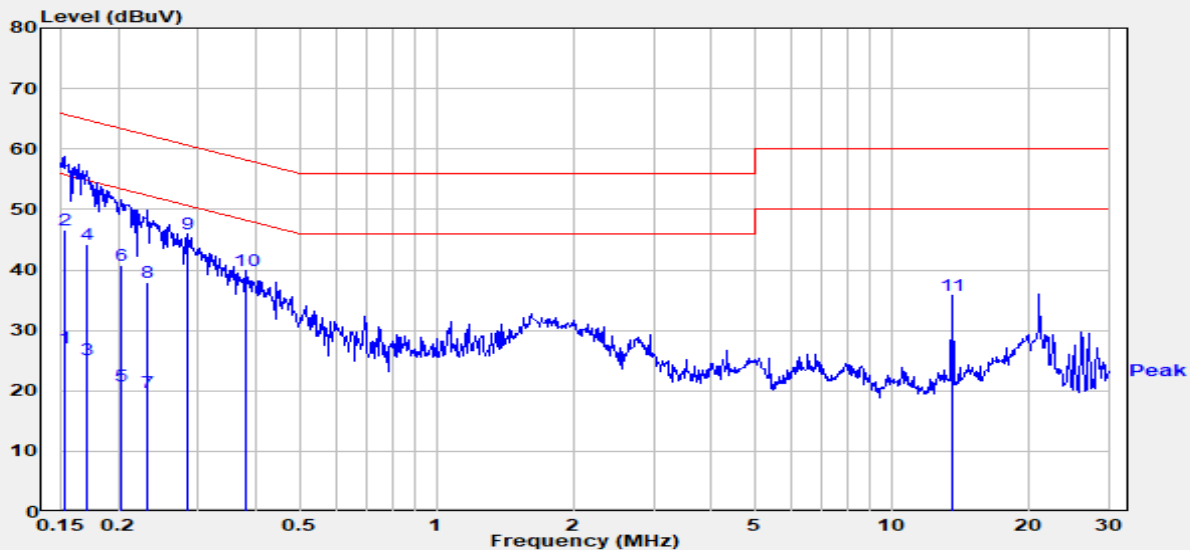
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS		
	PK/QP/AV	dBμV	dB	dBμV	dBμV	dB
0.152	Average	18.97	10.13	29.10	55.91	-26.81
0.152	QP	37.58	10.13	47.71	65.91	-18.20
0.175	Average	14.75	10.13	24.88	54.72	-29.84
0.175	QP	34.41	10.13	44.54	64.72	-20.18
0.209	Average	12.55	10.13	22.68	53.23	-30.55
0.209	QP	30.63	10.13	40.76	63.23	-22.47
0.253	Average	11.72	10.14	21.86	51.64	-29.79
0.253	QP	26.13	10.14	36.27	61.64	-25.38
0.283	Peak	35.20	10.14	45.34	60.72	-15.38
0.393	Peak	30.16	10.15	40.31	57.99	-17.68
13.560	Peak	27.02	10.45	37.46	60.00	-22.54

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Report Number :TERF2404001100ER
Operation Mode :NFC
Power :120V/60Hz
Probe :N
Note: :adapter(DA100PM220)

Test Site :Conduction 1
Test Date :2024-05-17
Temp./Humi. :21.8°C/63%
Engineer :Nick 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	Average	17.07	10.12	27.19	55.87	-28.68
0.152	QP	36.44	10.12	46.56	65.87	-19.31
0.170	Average	15.07	10.12	25.19	54.94	-29.75
0.170	QP	34.11	10.12	44.23	64.94	-20.71
0.203	Average	10.73	10.12	20.85	53.49	-32.64
0.203	QP	30.63	10.12	40.75	63.49	-22.74
0.232	Average	9.52	10.13	19.65	52.39	-32.75
0.232	QP	27.78	10.13	37.91	62.39	-24.49
0.283	Peak	35.75	10.14	45.88	60.72	-14.84
0.383	Peak	29.75	10.15	39.90	58.21	-18.31
13.560	Peak	25.18	10.48	35.67	60.00	-24.33

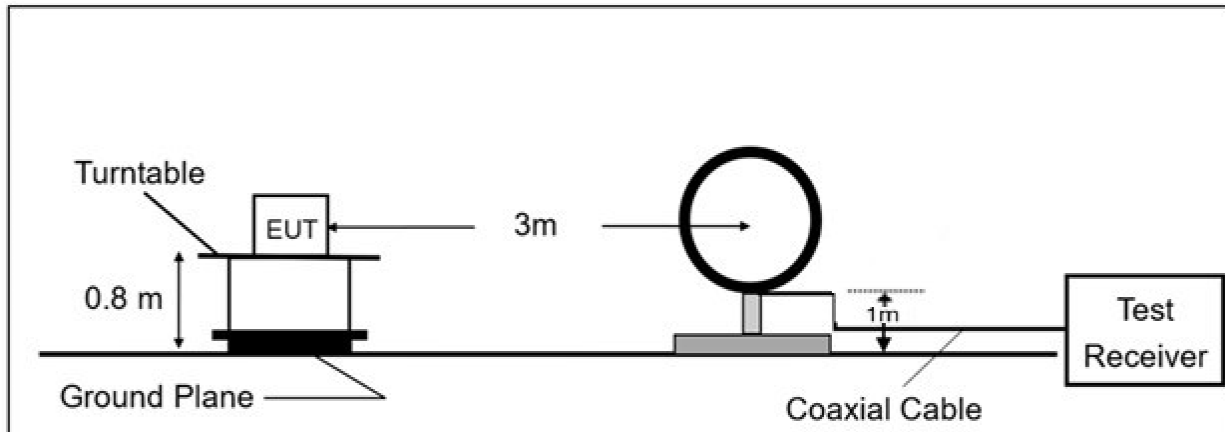
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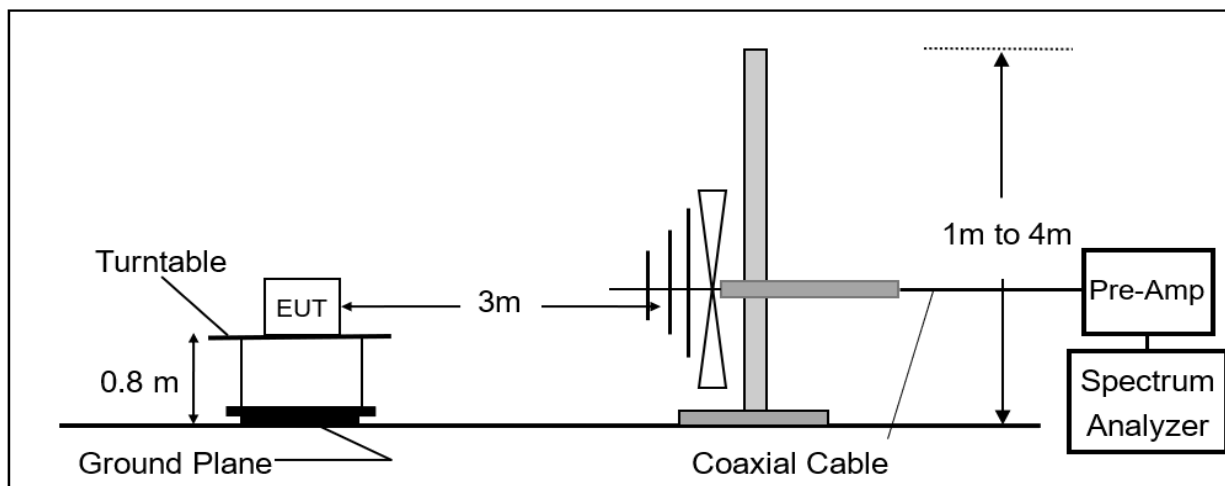
8 RADIATED EMISSION TEST

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:

$$FS = RA + AF + CL - AG$$

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 (μV/m) at 30m	Field Strength (dBμV/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 ISSED RSS 210 Annex B B6

- (a) 15.848 millivolts/m (84 dBμV/m) at 30 m, within the band 13.553-13.567 MHz.
- (b) 334 microvolts/m (50.5 dBμV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz.
- (c) 106 microvolts/m (40.5 dBμV/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 = $40 \cdot \log(30/3) = 40 \text{ dB}$

30m to 10m

Distance extrapolation = $40 \cdot \log(30/10) = 19.08 \text{ dB}$

10m to 3m

Distance extrapolation = $40 \cdot \log(10/3) = 20.92 \text{ dB}$

Note:

1. Distance extrapolation factor = $40 \log(\text{required distance} / \text{test distance}) \text{ (dB)}$
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(dBμV/m) = Spectrum. Reading level(dBμV) + Factor(dB)

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

Above 30 MHz of Factor(dB) = Antenna Factor(dBμV/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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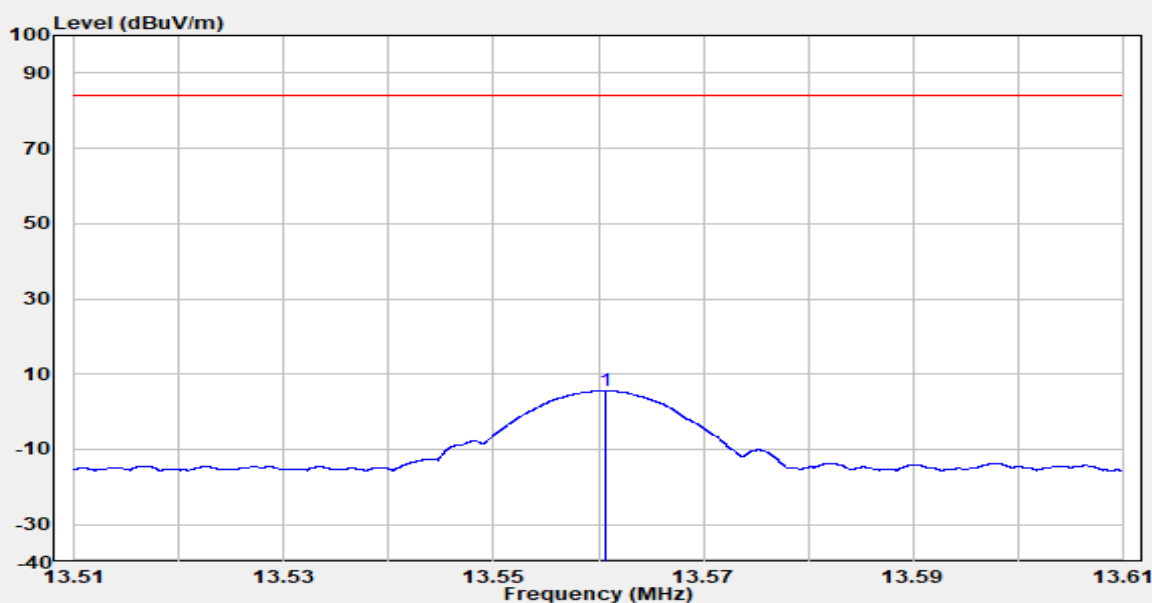
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8.4.3 Field Strength of Fundamental Emission Measurement Result

Report Number :TERF2404001100ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Main
 EUT Pol :NB Plane
 Note. :type A

Test Site :SAC 3
 Test Date :2024-05-15
 Temp./Humi. :22.5°C/63%
 Antenna Pol. :Vertical
 Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
13.561	Peak	30.34	-24.83	5.51	84.00	-78.49

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

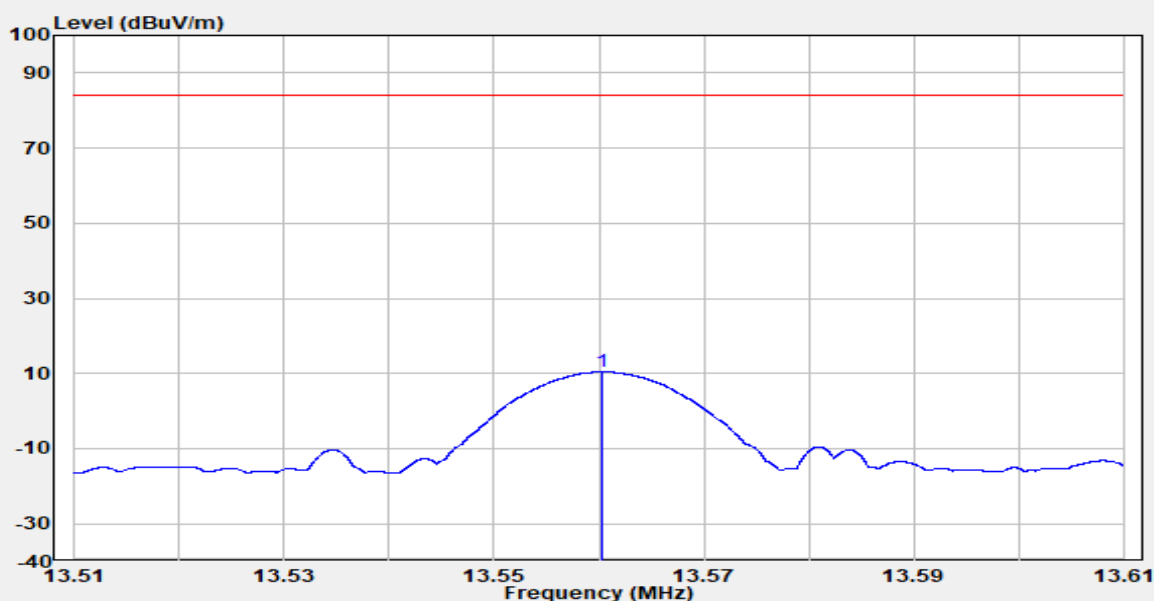
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Main
 EUT Pol :NB Plane
 Note. :type A

Test Site :SAC 3
 Test Date :2024-05-15
 Temp./Humi. :22.5°C/63%
 Antenna Pol. :Horizontal
 Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
13.560	Peak	35.23	-24.83	10.40	84.00	-73.60

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

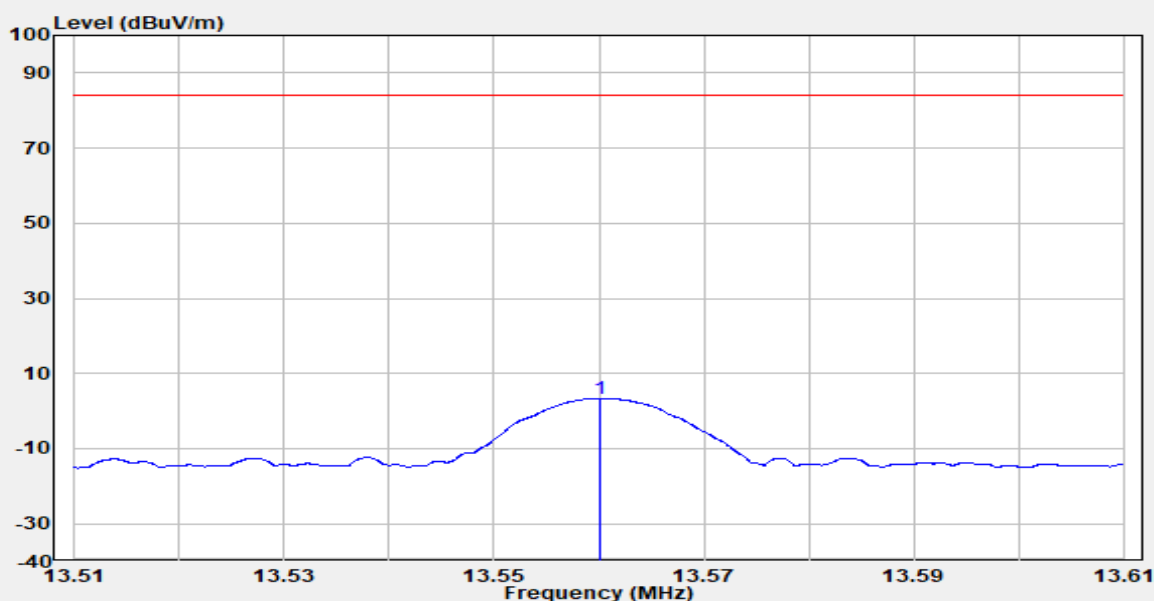
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Main
 EUT Pol :NB Plane
 Note. :type B

Test Site :SAC 3
 Test Date :2024-05-15
 Temp./Humi. :22.5°C/63%
 Antenna Pol. :Vertical
 Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
13.560	Peak	28.23	-24.83	3.40	84.00	-80.60

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

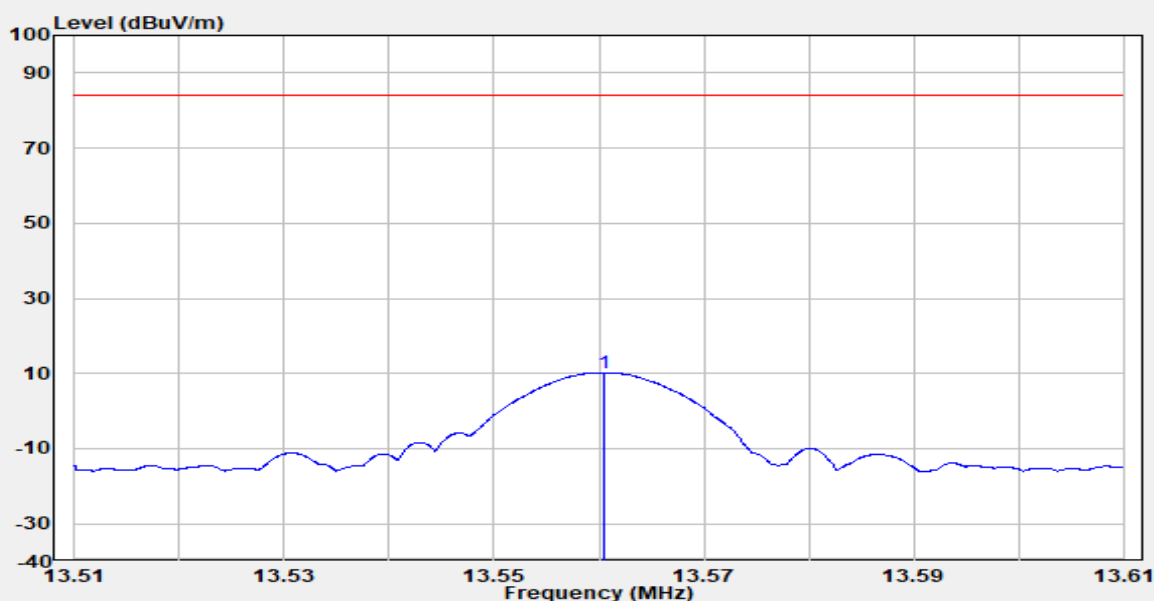
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
Operation Mode :NFC
Test Frequency :13.56 MHz
Test Mode :Main
EUT Pol :NB Plane
Note. :type B

Test Site :SAC 3
Test Date :2024-05-15
Temp./Humi. :22.5°C/63%
Antenna Pol. :Horizontal
Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
13.560	Peak	35.09	-24.83	10.26	84.00	-73.74

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

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

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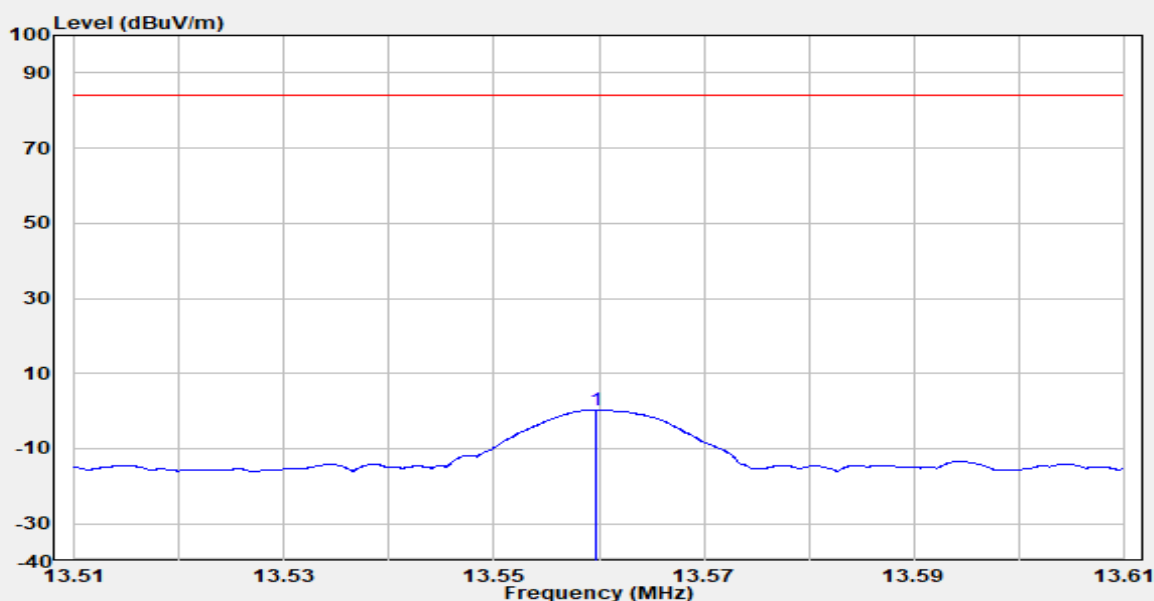
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Report Number :TERF2404001100ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Main
 EUT Pol :NB Plane
 Note. :type F

Test Site :SAC 3
 Test Date :2024-05-15
 Temp./Humi. :22.5°C/63%
 Antenna Pol. :Vertical
 Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
13.560	Peak	25.19	-24.83	0.35	84.00	-83.65

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

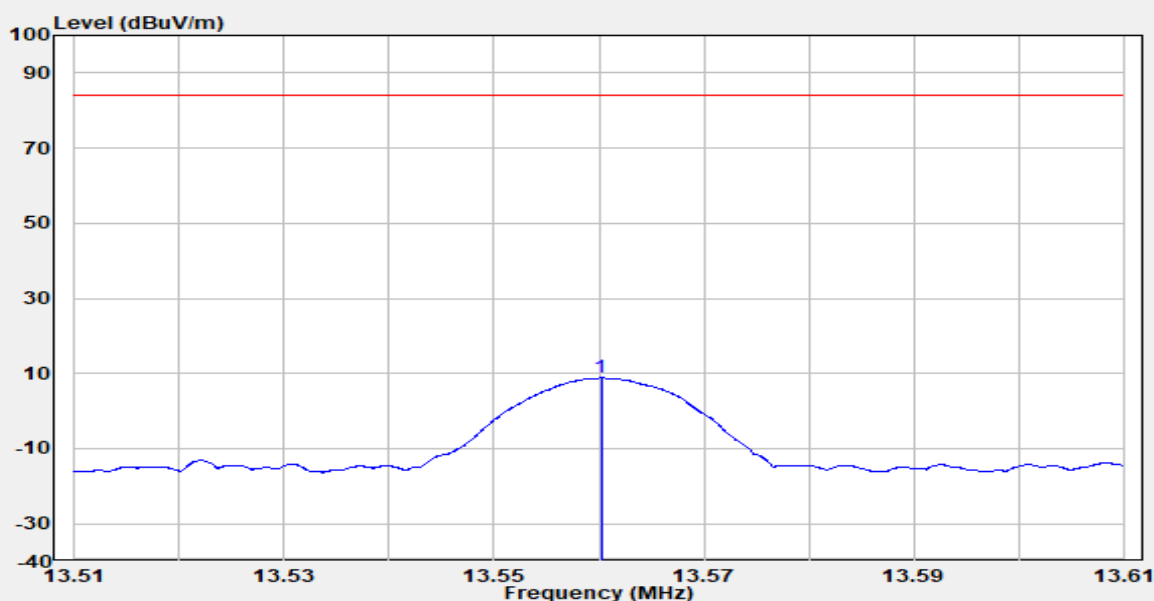
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
Operation Mode :NFC
Test Frequency :13.56 MHz
Test Mode :Main
EUT Pol :NB Plane
Note. :type F

Test Site :SAC 3
Test Date :2024-05-15
Temp./Humi. :22.5°C/63%
Antenna Pol. :Horizontal
Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
13.560	Peak	33.59	-24.83	8.76	84.00	-75.24

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

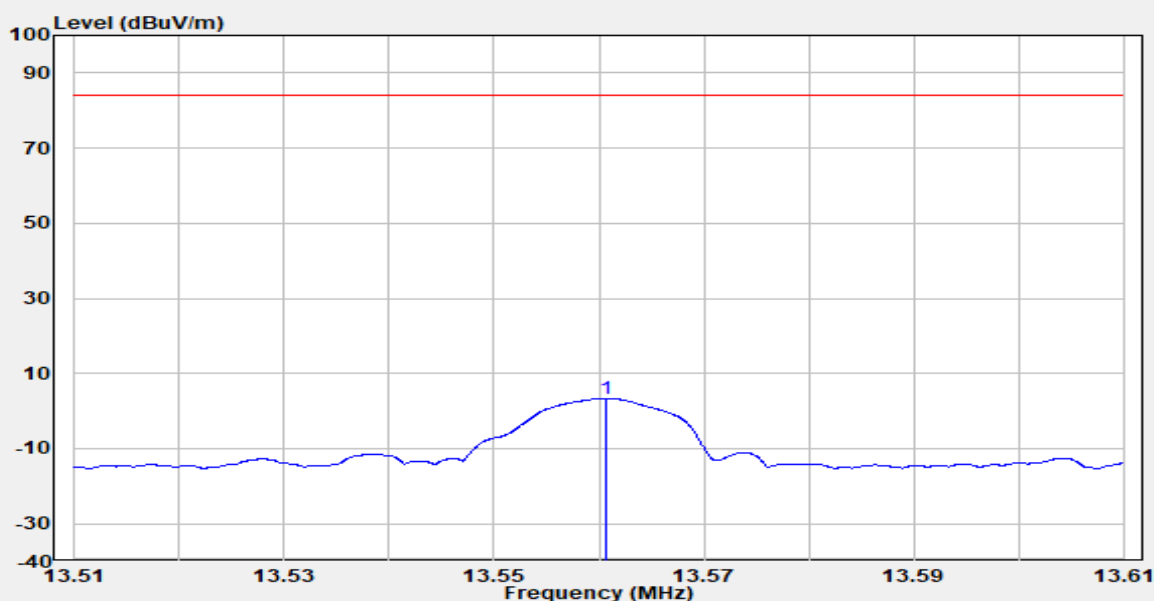
Field strength (dBuV/m) at 30m,within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Main
 EUT Pol :NB Plane
 Note. :type V

Test Site :SAC 3
 Test Date :2024-05-15
 Temp./Humi. :22.5°C/63%
 Antenna Pol. :Vertical
 Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit dBUV/m	Margin dB
13.561	Peak	28.18	-24.83	3.34	84.00	-80.66

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

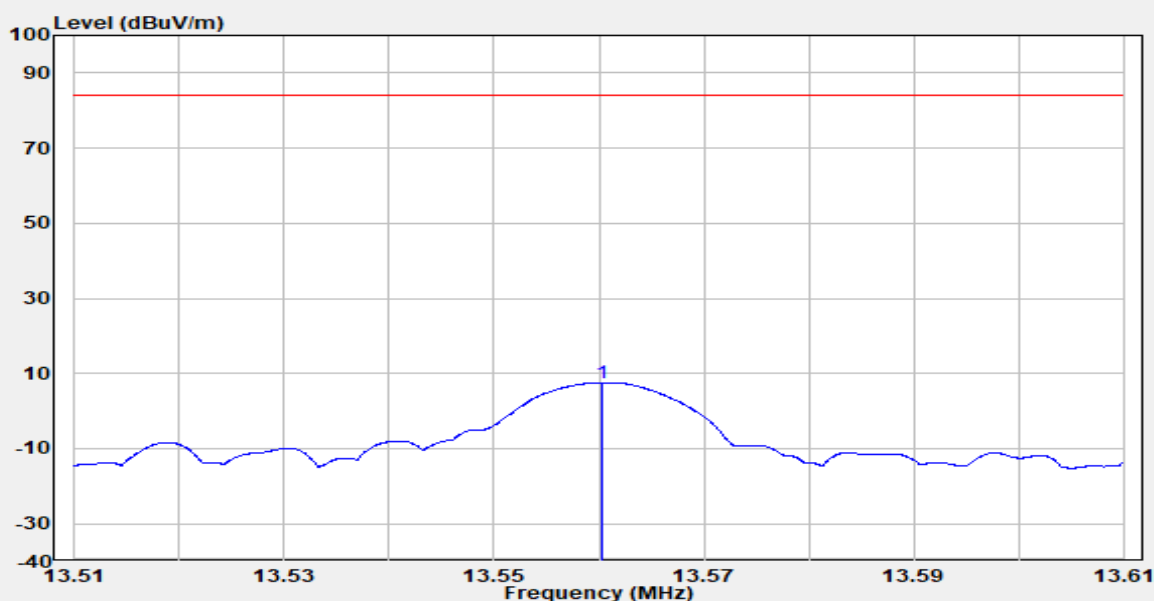
Field strength (dBUV/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Main
 EUT Pol :NB Plane
 Note. :type V

Test Site :SAC 3
 Test Date :2024-05-15
 Temp./Humi. :22.5°C/63%
 Antenna Pol. :Horizontal
 Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
13.560	Peak	32.41	-24.83	7.58	84.00	-76.42

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

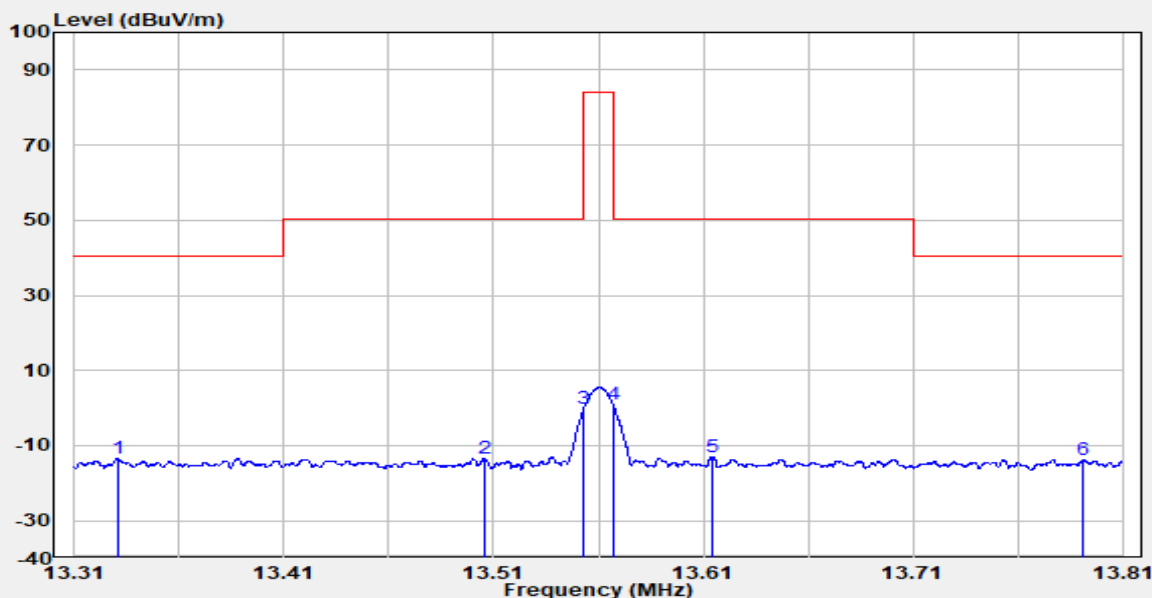
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
Operation Mode :NFC
Test Frequency :13.56 MHz
Test Mode :Mask
EUT Pol :NB Plane
Note. :type A

Test Site :SAC 3
Test Date :2024-05-15
Temp./Humi. :22.5°C/63%
Antenna Pol. :Vertical
Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit dBuV/m	Margin dB
13.331	Peak	11.21	-24.79	-13.58	40.50	-54.08
13.506	Peak	11.32	-24.82	-13.50	50.47	-63.97
13.553	Peak	24.79	-24.83	-0.04	50.47	-50.51
13.567	Peak	25.73	-24.83	0.90	50.47	-49.57
13.614	Peak	11.77	-24.84	-13.07	50.47	-63.54
13.791	Peak	11.02	-24.88	-13.86	40.50	-54.36

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

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

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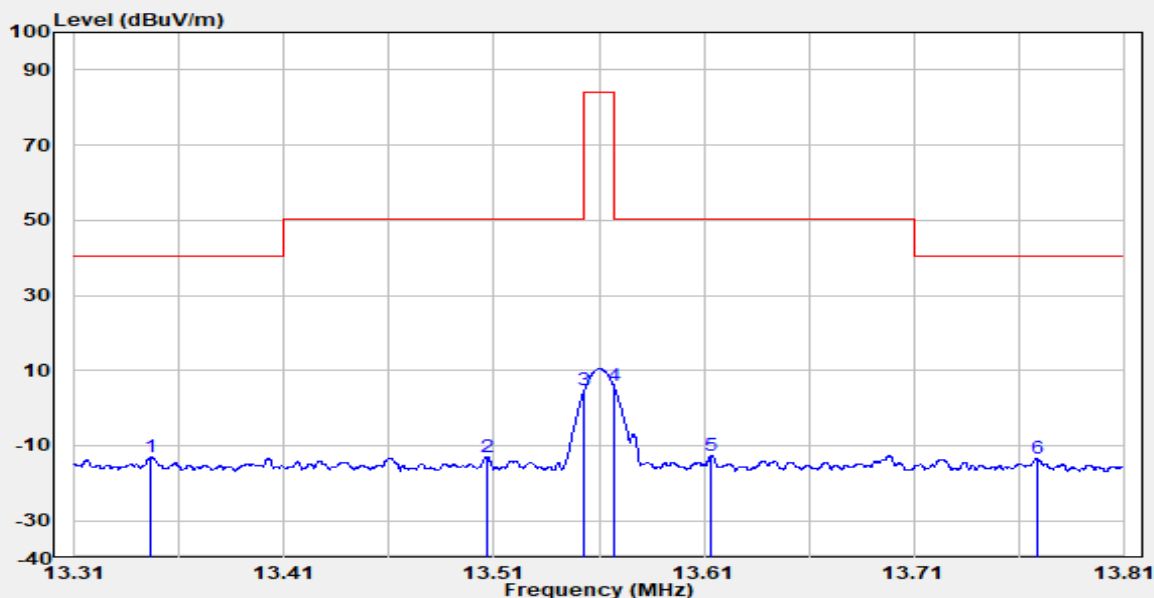
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Report Number :TERF2404001100ER
Operation Mode :NFC
Test Frequency :13.56 MHz
Test Mode :Mask
EUT Pol :NB Plane
Note. :type A

Test Site :SAC 3
Test Date :2024-05-15
Temp./Humi. :22.5°C/63%
Antenna Pol. :Horizontal
Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
13.346	Peak	11.67	-24.79	-13.12	40.50	-53.62
13.506	Peak	11.92	-24.82	-12.91	50.47	-63.38
13.553	Peak	29.55	-24.83	4.72	50.47	-45.75
13.567	Peak	30.74	-24.83	5.91	50.47	-44.56
13.614	Peak	12.11	-24.84	-12.74	50.47	-63.21
13.769	Peak	11.34	-24.87	-13.53	40.50	-54.03

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

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

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台灣檢驗科技股份有限公司

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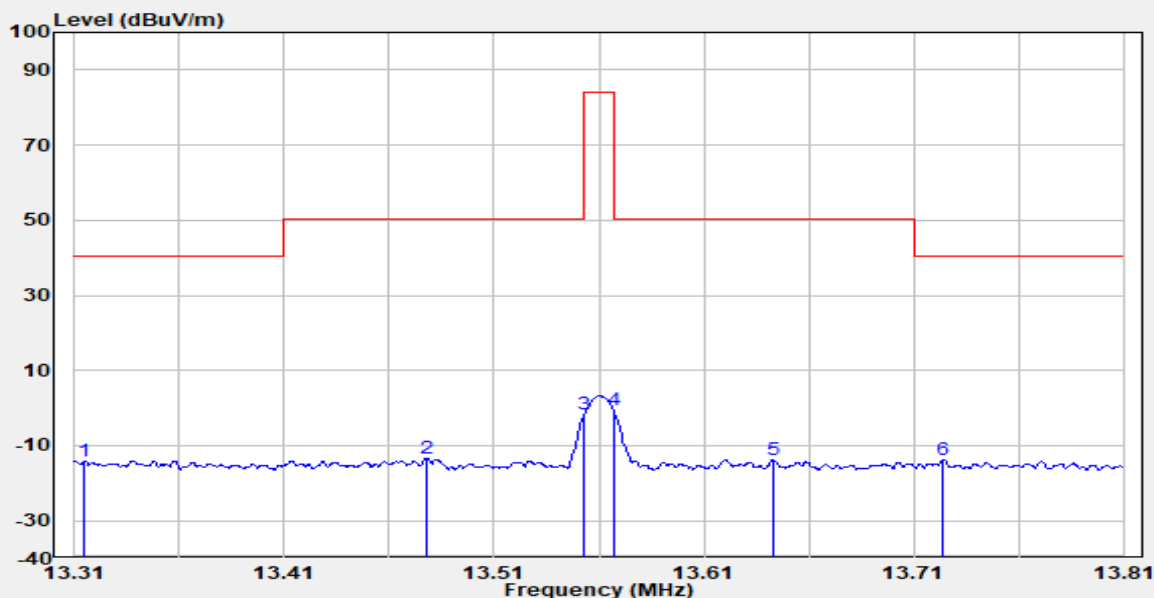
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Report Number :TERF2404001100ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Mask
 EUT Pol :NB Plane
 Note. :type B

Test Site :SAC 3
 Test Date :2024-05-15
 Temp./Humi. :22.5°C/63%
 Antenna Pol. :Vertical
 Engineer :Nick 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
13.315	Peak	10.71	-24.79	-14.07	40.50	-54.57
13.478	Peak	11.39	-24.82	-13.43	50.47	-63.90
13.553	Peak	23.11	-24.83	-1.72	50.47	-52.19
13.567	Peak	24.21	-24.83	-0.62	50.47	-51.09
13.643	Peak	10.93	-24.85	-13.92	50.47	-64.39
13.724	Peak	11.07	-24.87	-13.79	40.50	-54.29

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

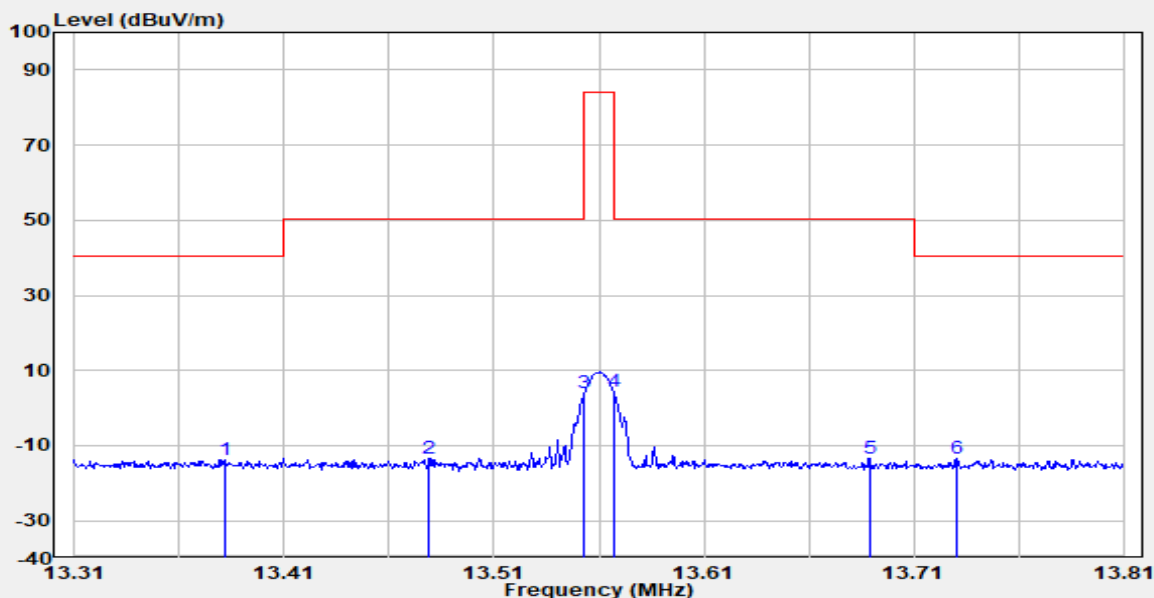
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Mask
 EUT Pol :NB Plane
 Note. :type B

Test Site :SAC 3
 Test Date :2024-05-15
 Temp./Humi. :22.5°C/63%
 Antenna Pol. :Horizontal
 Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
13.382	Peak	11.12	-24.80	-13.68	40.50	-54.18
13.479	Peak	11.55	-24.82	-13.27	50.47	-63.74
13.553	Peak	28.68	-24.83	3.85	50.47	-46.62
13.567	Peak	29.12	-24.83	4.29	50.47	-46.18
13.689	Peak	11.56	-24.86	-13.30	50.47	-63.77
13.731	Peak	11.27	-24.87	-13.60	40.50	-54.10

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

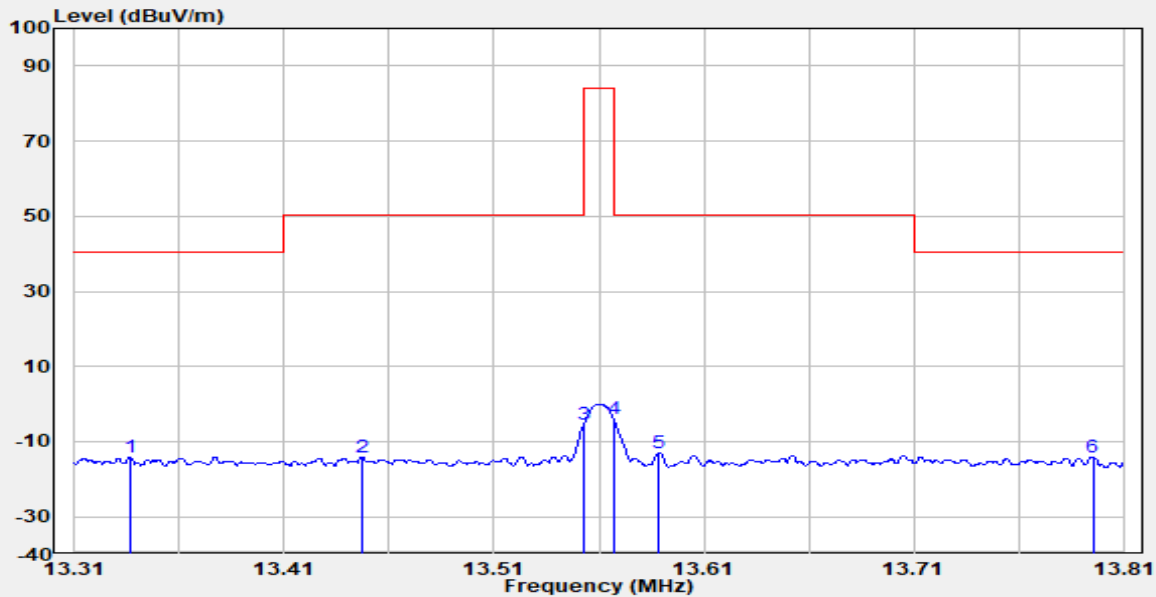
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Mask
 EUT Pol :NB Plane
 Note. :type F

Test Site :SAC 3
 Test Date :2024-05-15
 Temp./Humi. :22.5°C/63%
 Antenna Pol. :Vertical
 Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
13.337	Peak	10.71	-24.79	-14.08	40.50	-54.58
13.447	Peak	10.63	-24.81	-14.18	50.47	-64.65
13.553	Peak	19.53	-24.83	-5.30	50.47	-55.77
13.567	Peak	20.73	-24.83	-4.11	50.47	-54.58
13.589	Peak	11.90	-24.84	-12.94	50.47	-63.41
13.796	Peak	10.63	-24.88	-14.25	40.50	-54.75

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

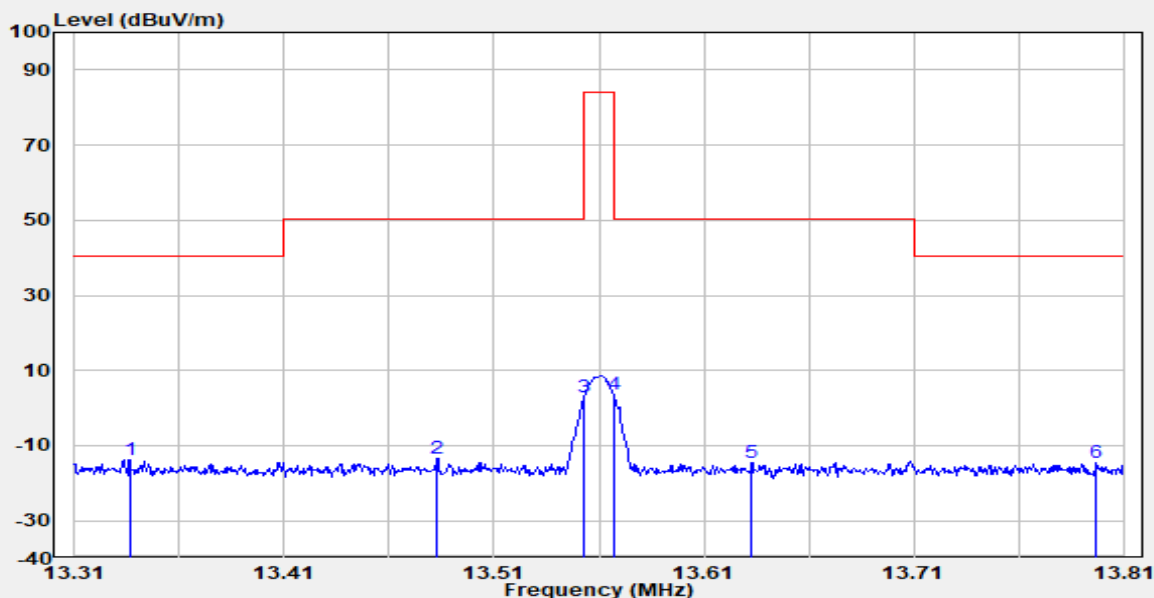
Field strength (dBuV/m) at 30m,within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
Operation Mode :NFC
Test Frequency :13.56 MHz
Test Mode :Mask
EUT Pol :NB Plane
Note. :type F

Test Site :SAC 3
Test Date :2024-05-15
Temp./Humi. :22.5°C/63%
Antenna Pol. :Horizontal
Engineer :Nick 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
13.337	Peak	11.08	-24.79	-13.71	40.50	-54.21
13.483	Peak	11.26	-24.82	-13.56	50.47	-64.03
13.553	Peak	27.60	-24.83	2.77	50.47	-47.70
13.567	Peak	28.50	-24.83	3.66	50.47	-46.81
13.633	Peak	10.34	-24.85	-14.51	50.47	-64.98
13.797	Peak	10.22	-24.88	-14.65	40.50	-55.15

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

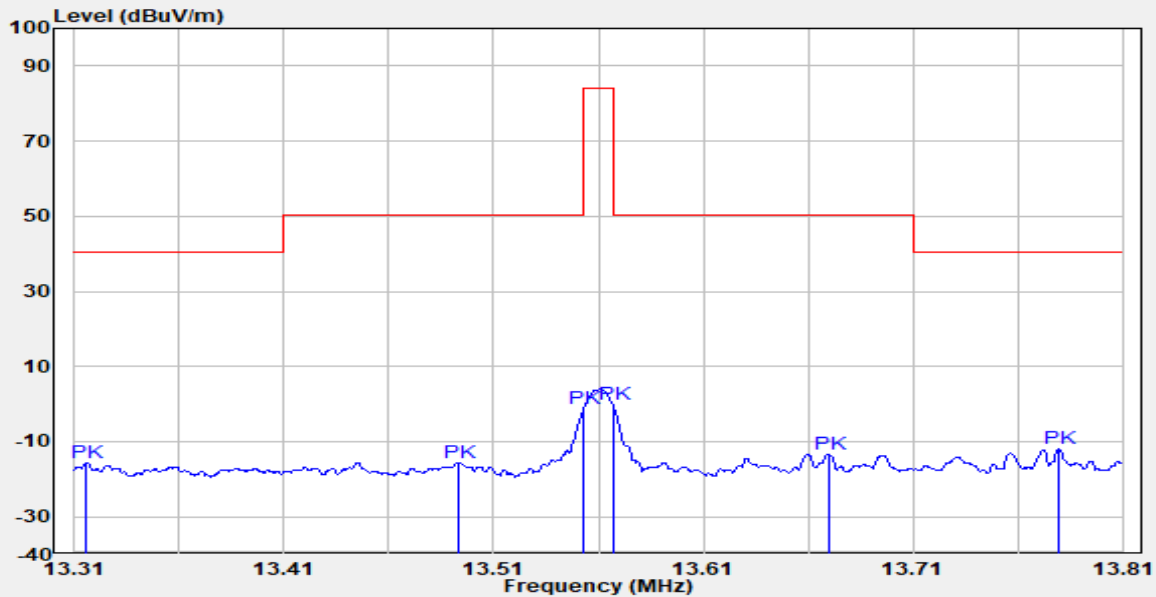
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Mask
 EUT Pol :NB Plane
 Note. :type V

Test Site :SAC 3
 Test Date :2024-05-15
 Temp./Humi. :22.5°C/63%
 Antenna Pol. :Vertical
 Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
13.316	Peak	9.19	-24.79	-15.59	40.50	-56.09
13.493	Peak	9.11	-24.82	-15.71	50.47	-66.18
13.553	Peak	23.43	-24.83	-1.40	50.47	-51.87
13.567	Peak	24.49	-24.83	-0.34	50.47	-50.81
13.670	Peak	11.59	-24.85	-13.26	50.47	-63.73
13.780	Peak	12.77	-24.88	-12.10	40.50	-52.60

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

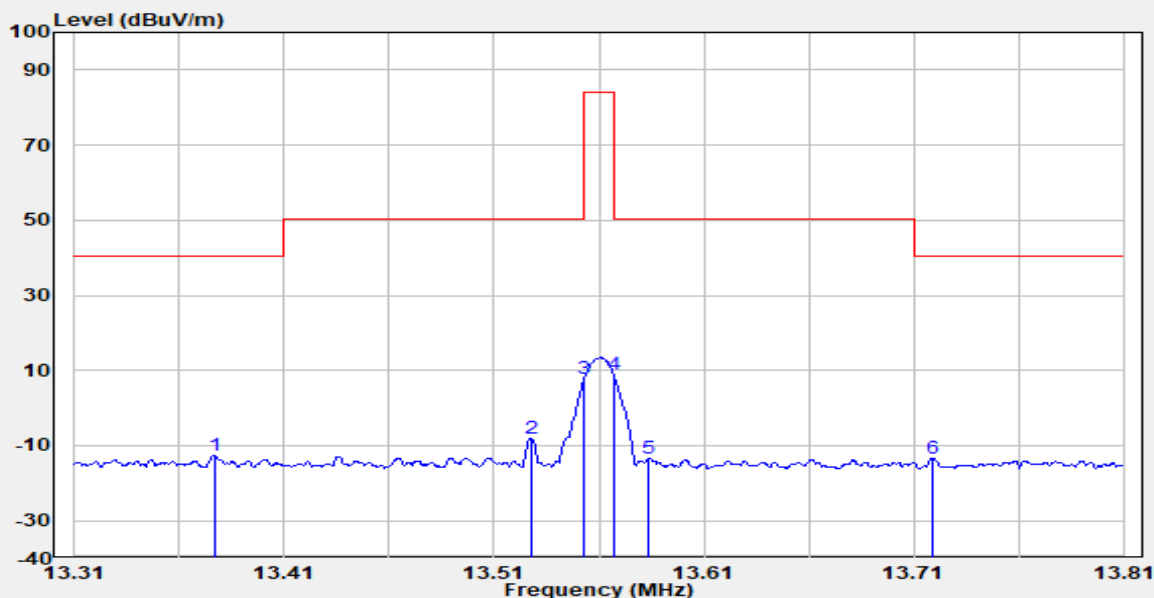
Field strength (dBuV/m) at 30m,within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Mask
 EUT Pol :NB Plane
 Note. :type V

Test Site :SAC 3
 Test Date :2024-05-15
 Temp./Humi. :22.5°C/63%
 Antenna Pol. :Horizontal
 Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
13.377	Peak	12.11	-24.80	-12.69	40.50	-53.19
13.528	Peak	16.71	-24.83	-8.11	50.47	-58.58
13.553	Peak	32.66	-24.83	7.83	50.47	-42.64
13.567	Peak	33.82	-24.83	8.98	50.47	-41.49
13.584	Peak	11.26	-24.84	-13.57	50.47	-64.04
13.720	Peak	11.50	-24.86	-13.37	40.50	-53.87

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

Field strength (dBuV/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 (μV/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 $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$
2. Distance extrapolation factor = $40 \log (\text{required distance/ test distance})$ (dB)
3. $20 * \log(30 \mu\text{V/m}) = 29.54 \text{ dBuV/m}$
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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8.5.2 Radiated Spurious Emission Measurement Result

Report Number :TERF2404001100ER

Operation Mode :NFC

Test Frequency :13.56 MHz

Test Mode :Tx

EUT Pol :NB Plane

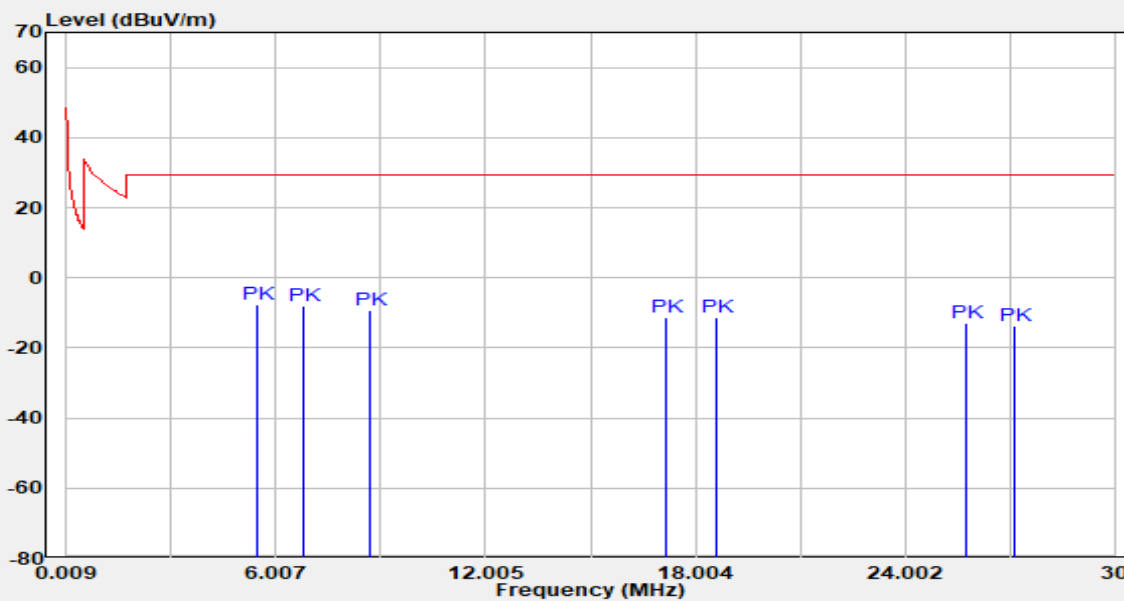
Test Site :SAC 3

Test Date :2024-05-15

Temp./Humi. :22.5°C/63%

Antenna Pol. :Vertical

Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit dBμV/m	Margin dB
5.479	Peak	17.32	-24.79	-7.46	29.54	-37.00
6.789	Peak	16.64	-24.60	-7.95	29.54	-37.49
8.679	Peak	15.69	-25.01	-9.33	29.54	-38.87
17.150	Peak	12.80	-24.29	-11.49	29.54	-41.03
18.600	Peak	12.79	-24.26	-11.47	29.54	-41.01
25.740	Peak	12.93	-25.83	-12.90	29.54	-42.44
27.120	Peak	11.99	-25.92	-13.93	29.54	-43.47

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

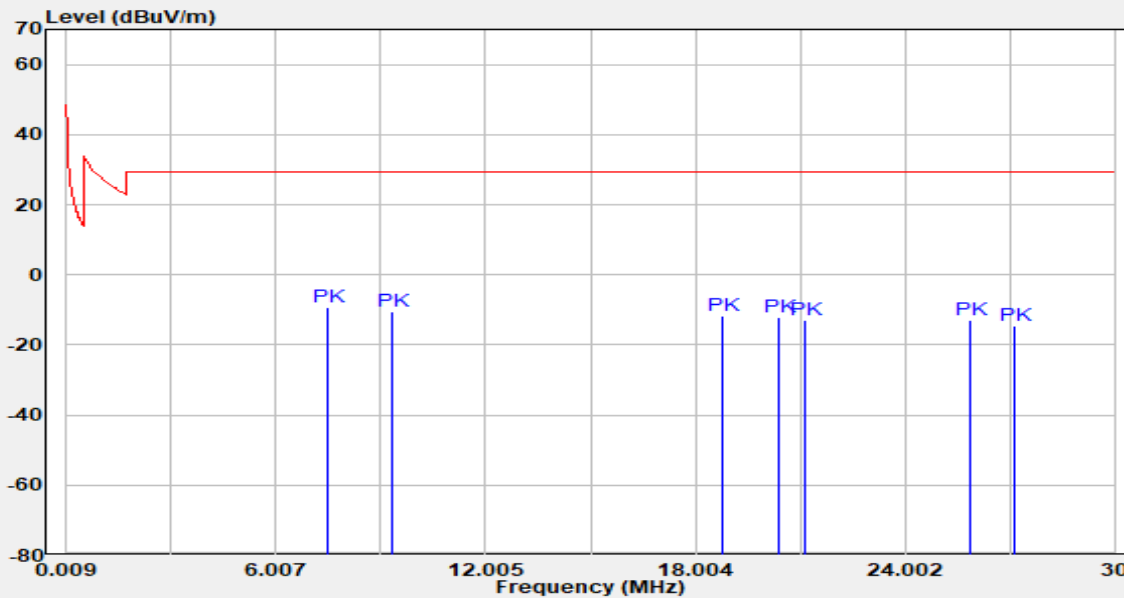
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Tx
 EUT Pol :NB Plane

Test Site :SAC 3
 Test Date :2024-05-15
 Temp./Humi. :22.5°C/63%
 Antenna Pol. :Horizontal
 Engineer :Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level d μ V	Factor dB	Actual FS d μ V/m	Limit d μ V/m	Margin dB
7.499	Peak	15.61	-24.80	-9.20	29.54	-38.74
9.329	Peak	14.47	-24.84	-10.38	29.54	-39.92
18.790	Peak	12.50	-24.28	-11.78	29.54	-41.32
20.370	Peak	12.86	-24.82	-11.96	29.54	-41.50
21.120	Peak	12.14	-25.27	-13.12	29.54	-42.66
25.870	Peak	12.79	-25.91	-13.12	29.54	-42.66
27.120	Peak	11.35	-25.92	-14.57	29.54	-44.11

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

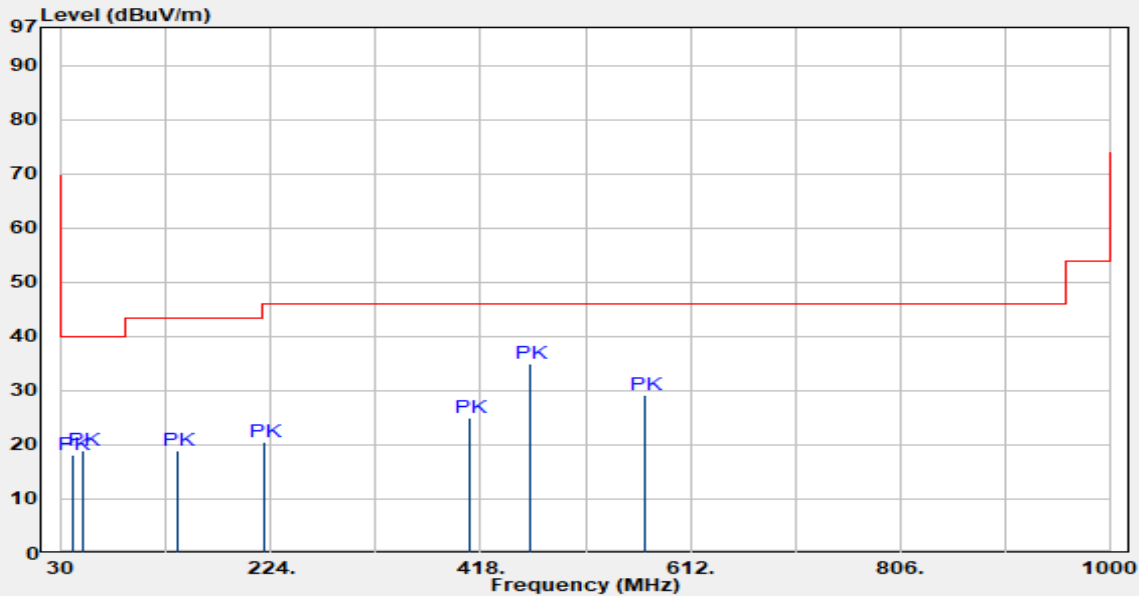
Field strength (d μ V/m) at 30m,within the band 490 kHz - 30 MHz.

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Report Number :TERF2404001100ER
Operation Mode :NFC
Test Frequency :13.56 MHz
Test Mode :Tx
EUT Pol :NB Plane

Test Site :SAC 3
Test Date :2024-05-15
Temp./Humi. :22.5°C/63%
Antenna Pol. :Vertical
Engineer :Nick Lin



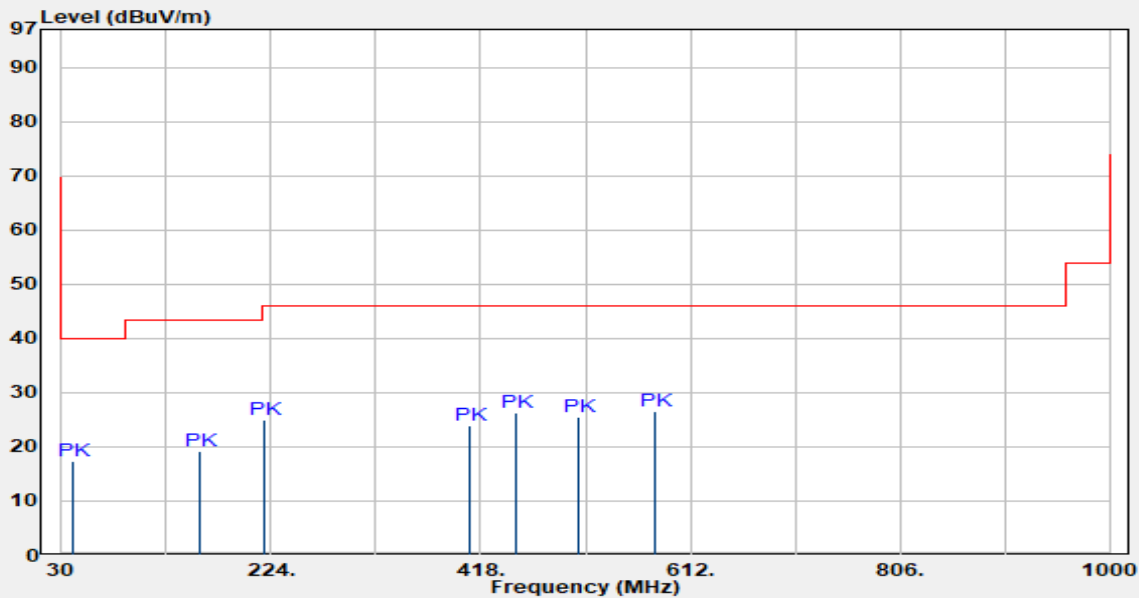
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit dB μ V/m	Margin dB
40.680	Peak	27.59	-9.44	18.14	40.00	-21.86
50.053	Peak	27.56	-8.50	19.06	40.00	-20.94
137.383	Peak	28.02	-9.05	18.97	43.50	-24.53
216.949	Peak	30.58	-10.15	20.43	46.00	-25.57
407.779	Peak	29.89	-4.88	25.01	46.00	-20.99
463.411	Peak	38.67	-3.63	35.04	46.00	-10.96
569.823	Peak	31.17	-1.87	29.30	46.00	-16.70

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Report Number :TERF2404001100ER
Operation Mode :NFC
Test Frequency :13.56 MHz
Test Mode :Tx
EUT Pol :NB Plane

Test Site :SAC 3
Test Date :2024-05-15
Temp./Humi. :22.5°C/63%
Antenna Pol. :Horizontal
Engineer :Nick 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
40.680	Peak	26.71	-9.44	17.27	40.00	-22.73
158.083	Peak	27.29	-8.03	19.26	43.50	-24.24
216.949	Peak	35.19	-10.15	25.04	46.00	-20.96
407.779	Peak	28.83	-4.88	23.95	46.00	-22.05
451.120	Peak	29.88	-3.72	26.16	46.00	-19.84
508.046	Peak	28.59	-3.09	25.50	46.00	-20.50
579.850	Peak	28.17	-1.50	26.67	46.00	-19.33

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9 FREQUENCY STABILITY

9.1 Applicable Standard

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ 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.

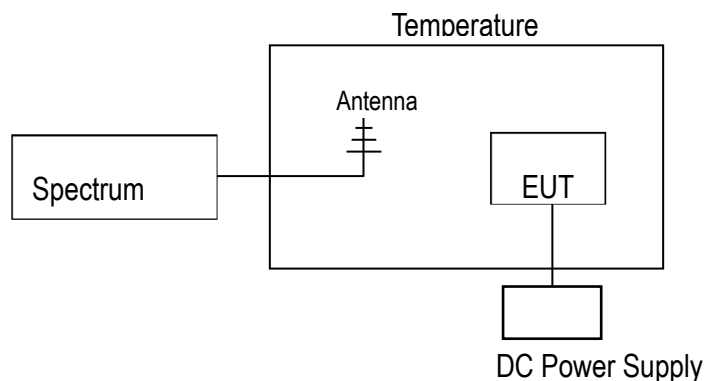
Carrier frequency stability shall be maintained to $\pm 0.01\%$ (± 100 ppm).

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

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

Startup

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
120	-20	13.5601466	0.14660	+/- 1.356
120	-10	13.56016	0.16000	+/- 1.356
120	0	13.5601591	0.15910	+/- 1.356
120	10	13.5601596	0.15960	+/- 1.356
120	20	13.56015	0.15000	+/- 1.356
120	30	13.5601469	0.14690	+/- 1.356
120	40	13.5601414	0.14140	+/- 1.356
120	50	13.5601598	0.15980	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
138	20	13.5601558	0.15580	+/- 1.356
120	20	13.56015	0.15000	+/- 1.356
102	20	13.5601448	0.14480	+/- 1.356

2 minutes

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
120	-20	13.5601433	0.14330	+/- 1.356
120	-10	13.5601486	0.14860	+/- 1.356
120	0	13.5601408	0.14080	+/- 1.356
120	10	13.5601555	0.15550	+/- 1.356
120	20	13.560155	0.15500	+/- 1.356
120	30	13.5601497	0.14970	+/- 1.356
120	40	13.5601496	0.14960	+/- 1.356
120	50	13.5601541	0.15410	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
138	20	13.5601522	0.15220	+/- 1.356
120	20	13.560155	0.15500	+/- 1.356
102	20	13.5601548	0.15480	+/- 1.356

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5 minutes

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
120	-20	13.5601548	0.15480	+/- 1.356
120	-10	13.5601515	0.15150	+/- 1.356
120	0	13.560148	0.14800	+/- 1.356
120	10	13.5601562	0.15620	+/- 1.356
120	20	13.5601499	0.14990	+/- 1.356
120	30	13.5601555	0.15550	+/- 1.356
120	40	13.5601563	0.15630	+/- 1.356
120	50	13.5601517	0.15170	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
138	20	13.5601531	0.15310	+/- 1.356
120	20	13.5601499	0.14990	+/- 1.356
102	20	13.5601423	0.14230	+/- 1.356

10 minutes

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
120	-20	13.5601575	0.15750	+/- 1.356
120	-10	13.5601578	0.15780	+/- 1.356
120	0	13.5601553	0.15530	+/- 1.356
120	10	13.560142	0.14200	+/- 1.356
120	20	13.5601509	0.15090	+/- 1.356
120	30	13.5601561	0.15610	+/- 1.356
120	40	13.5601512	0.15120	+/- 1.356
120	50	13.5601508	0.15080	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
138	20	13.5601445	0.14450	+/- 1.356
120	20	13.5601509	0.15090	+/- 1.356
102	20	13.5601492	0.14920	+/- 1.356

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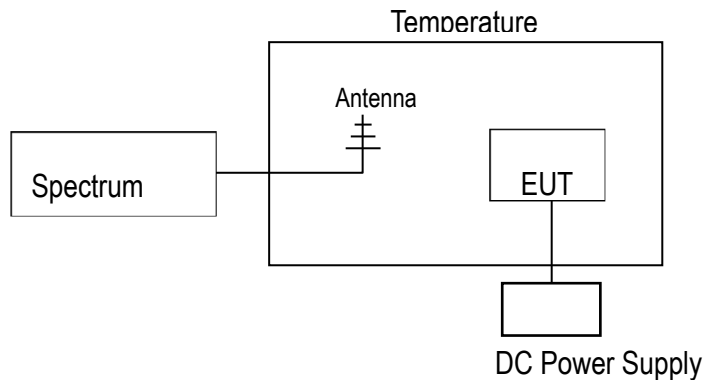
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10 EMISSION BANDWIDTH MEASUREMENT

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.

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10.4 Measurement Result

FCC

20dB BW (kHz)
2.699

Operation range	Frequency (MHz)	Limit (MHz)
Low	13.559000	>13.11
High	13.561300	<14.01

IC

99% BW (kHz)
2.292

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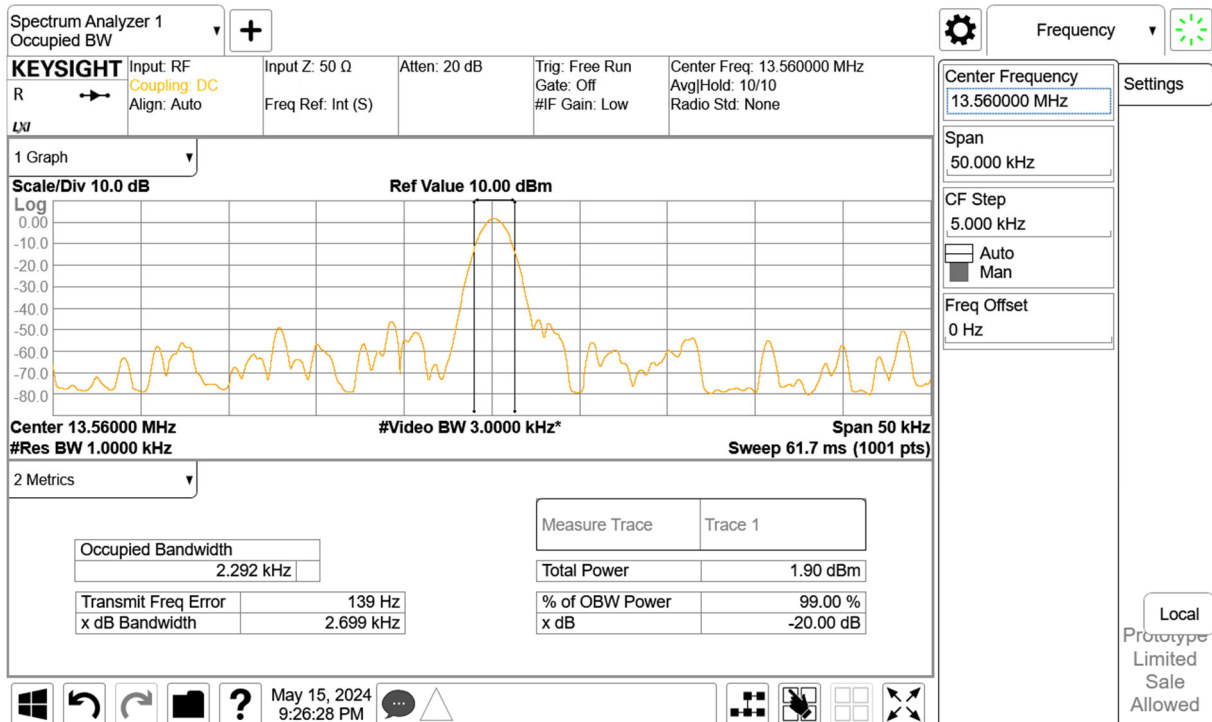
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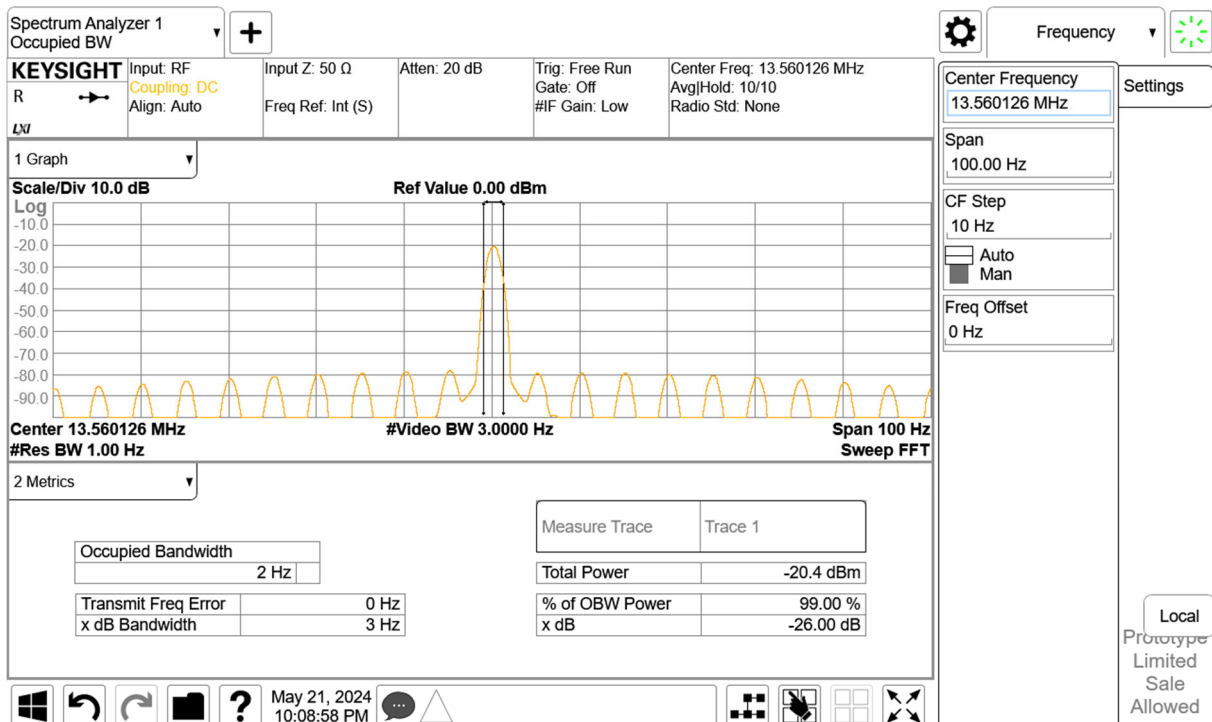
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Bandwidth



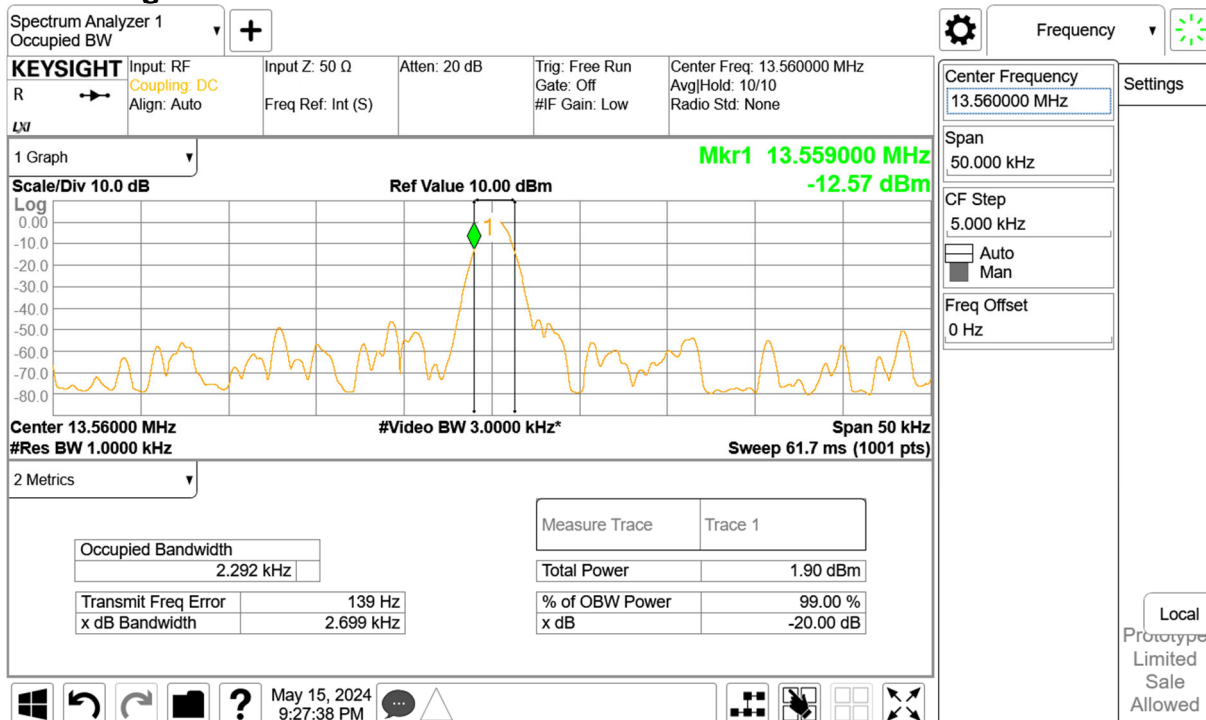
Bandwidth(1Hz~3Hz)



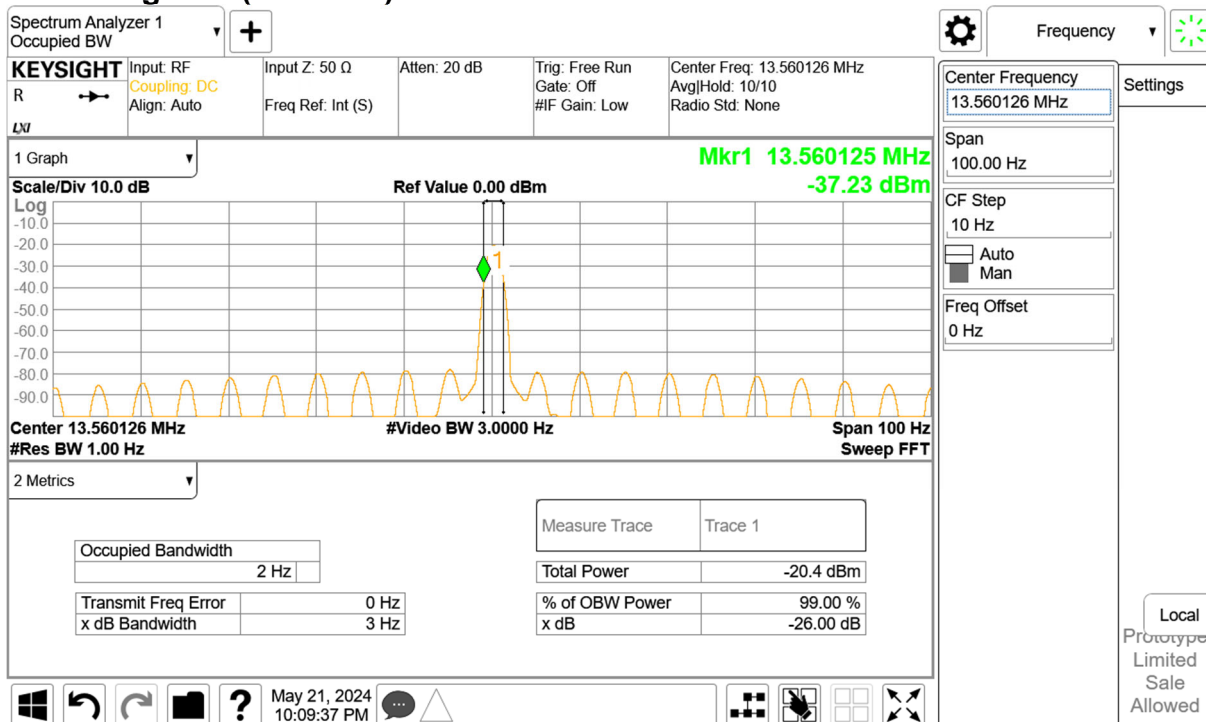
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Operation range low



Operation range low(1Hz~3Hz)



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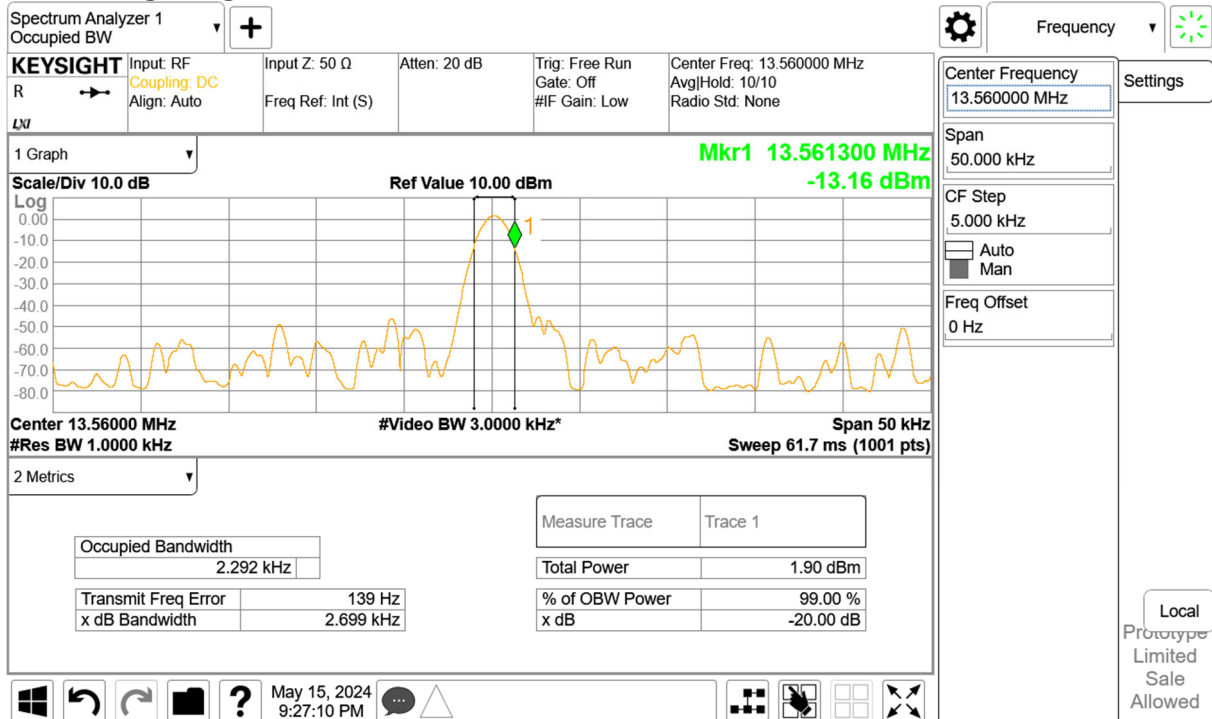
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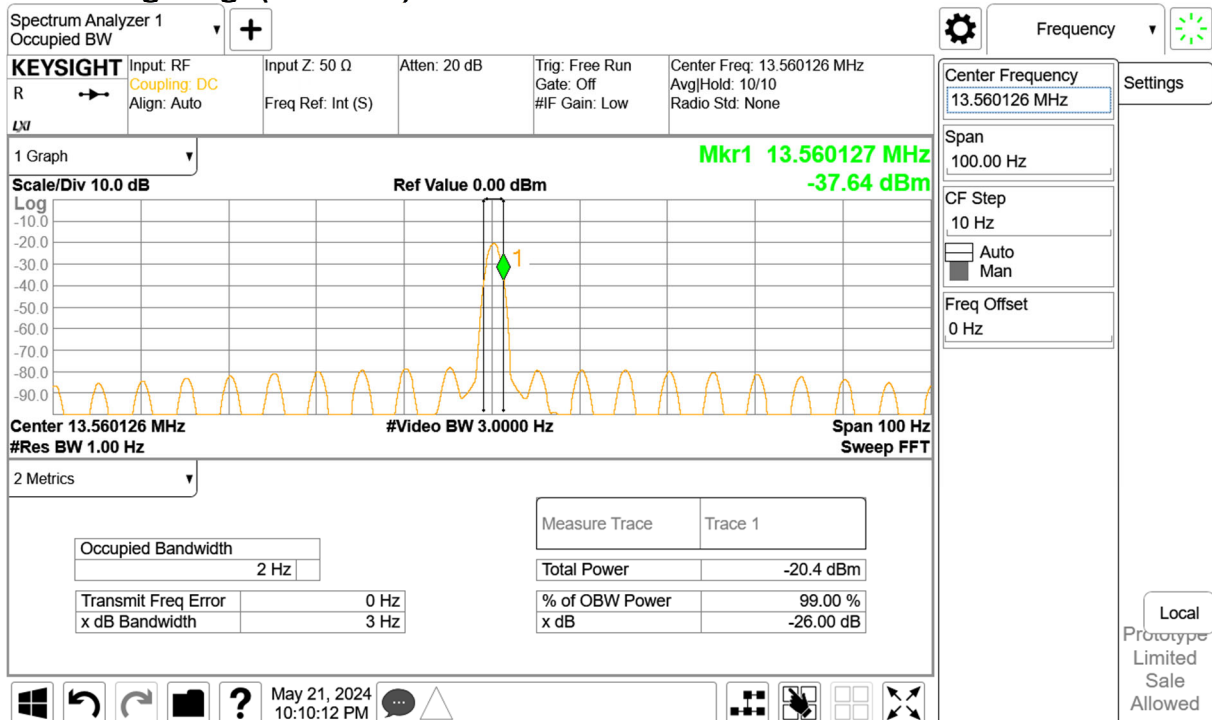
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Operation range High



Operation range High(1Hz~3Hz)



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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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