

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT**INTENTIONAL RADIATOR CERTIFICATION TO
FCC PART 15 SUBPART C AND INDUSTRY CANADA RSS 210
REQUIREMENT**

OF

Applicant: Microsoft Corporation
One Microsoft Way, Redmond, WA 98052-6399 USA
Product Name: Portable Computing Device
Brand Name: Microsoft
Model No.: 1927
Model Difference: N/A
FCC ID: C3K1927
IC: 3048A-1927
Report Number: T191120N02
FCC Rule Part: §15.225
IC Rule: RSS-210 issue 10 Annex B B.6 Dec. 2019
Issue Date: Mar. 20, 2020
Date of Test: Nov. 21, 2019
Date of EUT Received: Nov. 20, 2019
We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

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

Ted Huang Leo Wang

Tested By:

Ted Huang / Engineer Leo Wang / Asst. Engineer

Eric Huang

Approved By:

Eric Huang / Section Manager



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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
T191120N02	Rev.00	Initial creation of document	All	Mar. 20, 2020	Gina Lin

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1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	Portable Computing Device	
Brand Name:	Microsoft	
Model No.:	1927	
Model Difference:	N/A	
HW Version (Product)	EV2	
SW Version (Product)	Windows 10 Pro	
HW Version (Radio)	EV2	
SW Version (Radio)	19.43.4.4/99.0.49.7/21.60.1.1	
Radio Test Tool & Version	DRTU 11.1941.0-10270	
Firmware Version (Chip)	1943-95cfa2-c8-00004.05	
NFC Driver Version	12.0.5.0	
Power Supply:	7.66Vdc from Rechargeable Lithium-Ion Polymer Battery or 15V from AC/DC Adapter	
	Battery:	Model No.: DYNU01, Supplier: DYNAPACK
	Adapter:	Model No.: 1735, Supplier: LITEON

Note:

This report is for host FCC ID: C3K1927 which contains the module FCC ID: C3K1956.

This report is for host IC: 3048A-1927 which contains the module IC: 3048A-1956.

NFC:

Operating Frequency:	13.56MHz
Transmit Power:	< 84dBuV/m at 30m.
Number of Channels:	1
Antenna Type:	Loop Antenna
Modulation Type:	ASK

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.225

RSS-210 issue 10 Annex B B.6 Dec. 2019

RSS-Gen. issue 5 Amendment 1, Mar. 2019

ANSI C63.10:2013

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

1.3 Test Facility

Compliance Certification Services Inc. Tainan Laboratory

No.8, Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

OATS: Compliance Certification Services Inc. Tainan Laboratory

No.8, Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

FCC Designation Number: TW1109

ISED#: 2324H

1.4 Special Accessories

AC Adapter is used while the test is conducted and there is no other accessory attached. This is the worst case condition.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT is configured to operate in a continuous transmission mode. EUT placement and various angles were checked to find worst mode where the emission characteristics are maximized.

2.2 EUT Exercise

Enable EUT NFC function via Windows and use a tag next to the EUT NFC antenna to manipulate the EUT into continuous transmit mode.

2.3 Test Procedure

2.3.1 Conducted Emissions

EUT is placed on turn table which is 0.8 m above ground plane. Connected to the public utility (AC) power line, the spacing between EUT is 10cm. Power cable bundle 30 to 40cm and draped over the back edge of test table, and through section 2.2 the EUT is being exercised. 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 according to §15.207. The two LISNs provide 50 ohm/ 50uH 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 which is 0.8 m above ground plane and been measured in the frequency range between 0.009MHz to 30MHz and 30MHz to 1GHz. 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.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission



Fig. 2-2 AC Power Line Conducted Emission

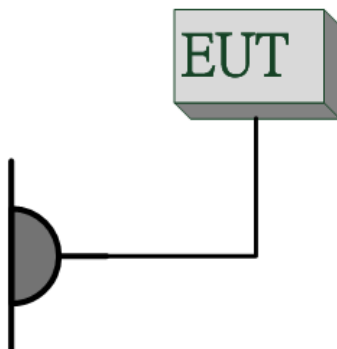


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model / Type No.	Series No.	Data Cable	Power Cord
1.	NFC Test Software	N/A	N/A	N/A	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	IC 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	Radiated Emission	Compliant
§15.209	RSS-Gen § 8.9	Radiated Emission Limits, general requirement	Compliant
§15.225 (e)	RSS-Gen § 8.11	Frequency Stability	Compliant
§2.1049 §15.215 (c)	RSS-Gen § 6.7	20 dB & 99% OCCUPIED BANDWIDTH	Compliant
§15.203	RSS-Gen § 6.8	Antenna Requirement	Compliant

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-OFF/ON	1	1	ASK
FREQUENCY STABILITY			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK
20dB BANDWIDTH			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK

The field strength of spurious radiation emission was measured as EUT stand-up position (H, E1 mode) and lie down position (E2 mode) for NFC Transmitter for channel the worst case H position was reported.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	$\pm 1.6\text{dB}$
Frequency Stability	$\pm 112\text{ Hz}$
20 dB & 99% OCCUPIED BANDWIDTH	$\pm 1.92\text{ Hz}$
Temperature	$\pm 1^{\circ}\text{C}$
Humidity	$\pm 5\%$

Radiated Spurious Emission:

Measurement uncertainty	9kHz - 30MHz: $\pm 2.6\text{dB}$
	30MHz - 200MHz: $\pm 3.1\text{dB}$
	200MHz - 1000MHz: $\pm 2.7\text{dB}$
	1GHz-6GHz: $\pm 2.7\text{dB}$

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable:

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

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

6.2 Measurement Equipment Used:

Conducted Emission room #1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
BNC Coaxial Cable	CCS	BNC50	11	02/25/2019	02/24/2020
EMI Test Receiver	R&S	ESCS 30	100348	02/19/2019	02/18/2020
LISN	SCHWARZBECK	NNLK8130	8130124	01/02/2019	01/01/2020
LISN	FCC	FCC-LISN-50-32-2	08009	06/12/2019	06/11/2020
Pulse Limiter	R&S	ESH3-Z2	100116	02/25/2019	02/24/2020
Software	e3(6.101222)				

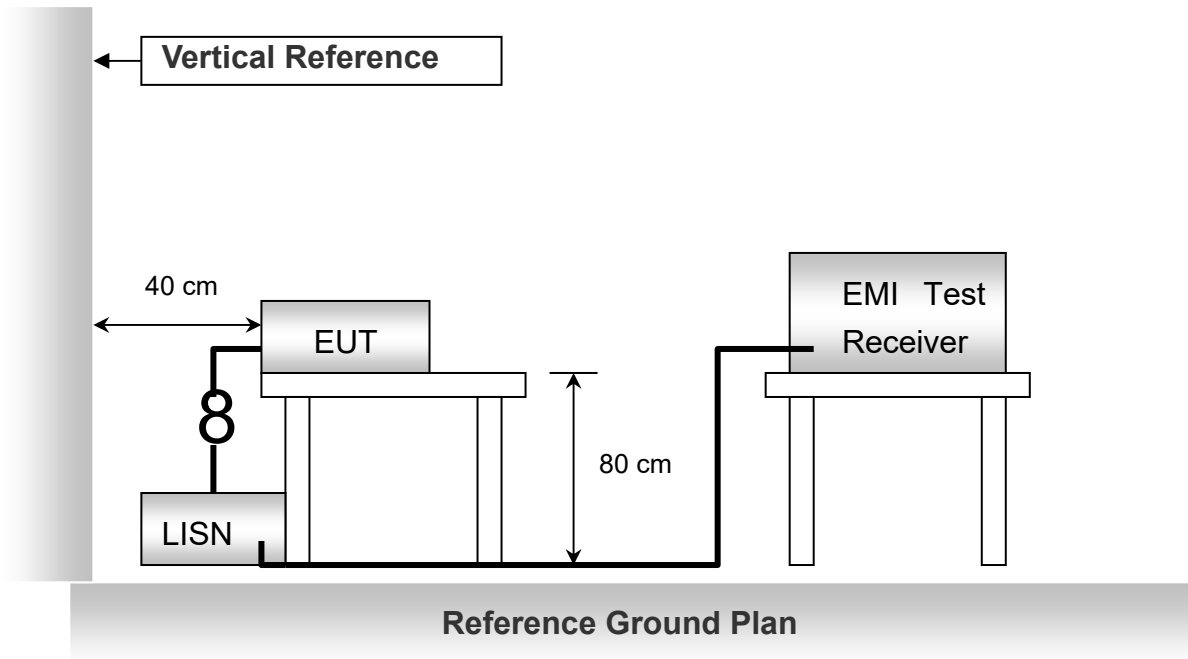
6.3 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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6.4 Test SET-UP (Block Diagram of Configuration)



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

6.5 Measurement Procedure:

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

6.6 Measurement Result:

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

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

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	NFC mode	Test By:	Leo Wang
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Site: CON 1

Test Voltage: 120Vac/60Hz

M/N: 1927

Mode: NFC ON

POL: LINE

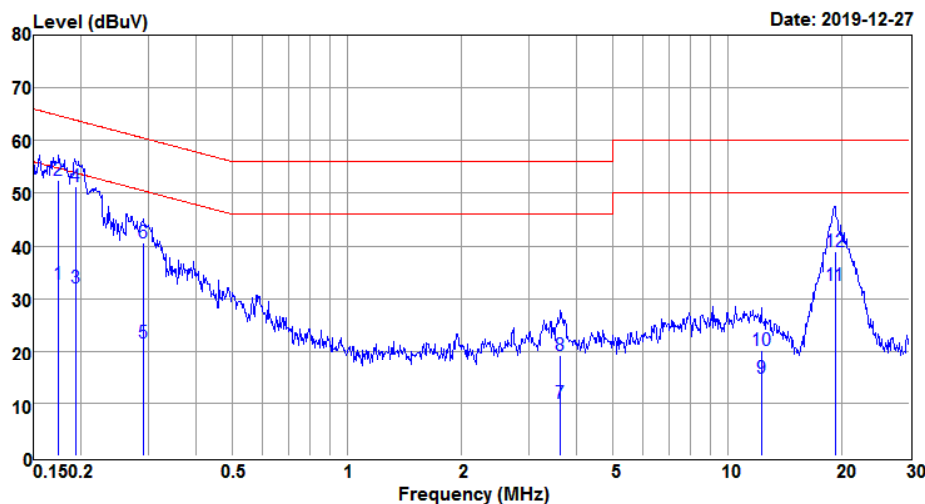
Engineer: Leo Wang

Temp: 24.8

Humidity: 66%

REMARK:

Data: 5 File: C:\Users\Weici_Lo.TW\PCCTP0001224\Desktop\3\Test Data\報告\TE\SGS\C3K1927.EM6 (



Freq MHz	Reading Level dBuV	C.F dB	Result dBuV	Limit dBuV	Over Limit dB	Detector
0.175	24.04	8.79	32.83	54.72	-21.89	Average
0.175	43.56	8.79	52.35	64.72	-12.37	QP
0.194	23.31	8.81	32.12	53.88	-21.76	Average
0.194	42.54	8.81	51.35	63.88	-12.53	QP
0.292	12.67	8.87	21.54	50.46	-28.92	Average
0.292	31.70	8.87	40.57	60.46	-19.89	QP
3.642	0.60	9.39	9.99	46.00	-36.01	Average
3.642	9.95	9.39	19.34	56.00	-36.66	QP
12.253	4.88	9.79	14.67	50.00	-35.33	Average
12.253	10.34	9.79	20.13	60.00	-39.87	QP
19.122	22.47	9.99	32.46	50.00	-17.54	Average
19.122	28.97	9.99	38.96	60.00	-21.04	QP

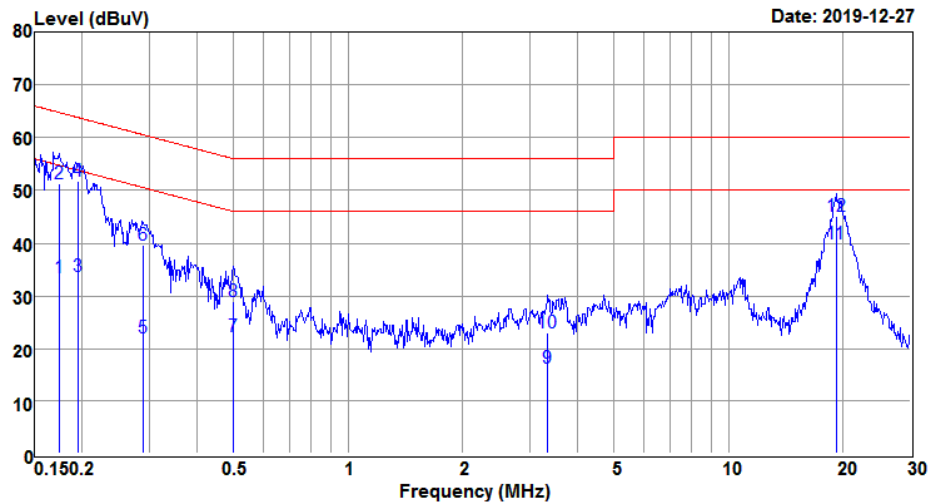
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Site: CON 1 Test Voltage: 120Vac/60Hz
M/N: 1927 Mode: NFC ON
POL: NEUTRAL Engineer: Leo Wang Temp: 24.8 Humidity: 66%
REMARK:

Data: 6 File: C:\Users\Weici_Lo.TW\PC\TP0001224\Desktop\3\Test Data\報告\ITE\SGS\C3K1927.EM6 (



Freq	Reading	C.F	Result	Limit	Over	Detector
MHz	dBuV	dB	dBuV	dBuV	Limit	
0.175	24.80	8.79	33.59	54.72	-21.13	Average
0.175	42.57	8.79	51.36	64.72	-13.36	QP
0.195	24.96	8.81	33.77	53.80	-20.03	Average
0.195	42.91	8.81	51.72	63.80	-12.08	QP
0.289	13.27	8.87	22.14	50.55	-28.41	Average
0.289	30.85	8.87	39.72	60.55	-20.83	QP
0.499	13.37	8.98	22.35	46.01	-23.66	Average
0.499	20.11	8.98	29.09	56.01	-26.92	QP
3.346	6.82	9.36	16.18	46.00	-29.82	Average
3.346	13.70	9.36	23.06	56.00	-32.94	QP
19.122	29.87	9.99	39.86	50.00	-10.14	Average
19.122	35.11	9.99	45.10	60.00	-14.90	QP

CON

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Site: CON 1

Test Voltage: 120Vac/60Hz

M/N: 1927

Mode: NFC OFF

POL: LINE

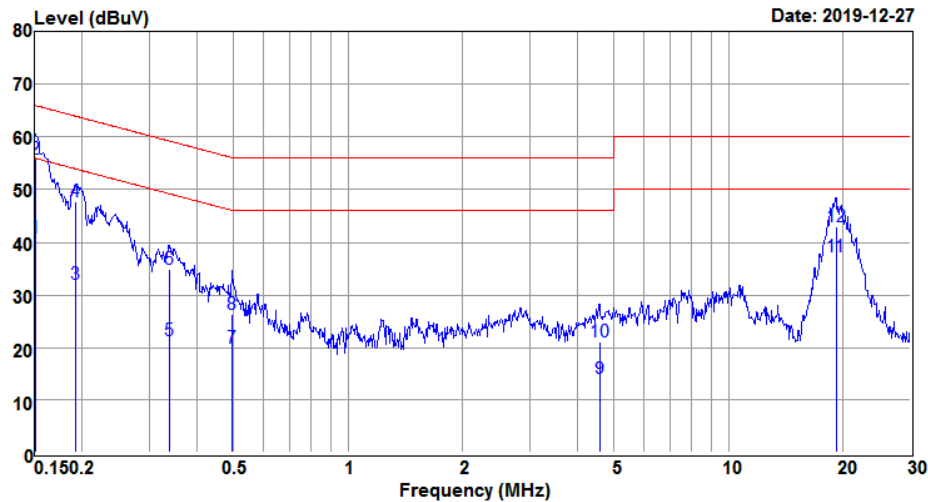
Engineer: Leo Wang

Temp: 24.8

Humidity: 66%

REMARK:

Data: 8 File: C:\Users\Weici_Lo.TW\PC\TP0001224\Desktop\3\Test Data\報告\ITE\SGS\C3K1927.EM6 (



Freq	Reading	C.F	Result	Limit	Over	Detector
MHz	Level				Limit	
	dBuV	dB	dBuV	dBuV	dB	
0.151	32.02	8.78	40.80	55.96	-15.16	Average
0.151	46.97	8.78	55.75	65.96	-10.21	QP
0.192	23.23	8.81	32.04	53.93	-21.89	Average
0.192	38.84	8.81	47.65	63.93	-16.28	QP
0.339	12.41	8.90	21.31	49.22	-27.91	Average
0.339	26.03	8.90	34.93	59.22	-24.29	QP
0.497	11.05	8.98	20.03	46.05	-26.02	Average
0.497	17.49	8.98	26.47	56.05	-29.58	QP
4.574	4.48	9.48	13.96	46.00	-32.04	Average
4.574	11.56	9.48	21.04	56.00	-34.96	QP
19.122	27.18	9.99	37.17	50.00	-12.83	Average
19.122	32.95	9.99	42.94	60.00	-17.06	QP

CON

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Site: CON 1

Test Voltage: 120Vac/60Hz

M/N: 1927

Mode: NFC OFF

POL: NEUTRAL

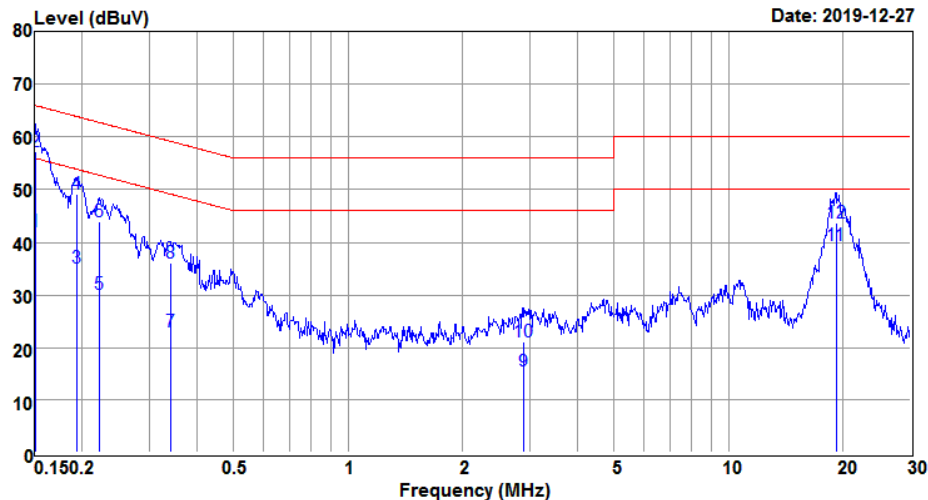
Engineer: Leo Wang

Temp: 24.8

Humidity: 66%

REMARK:

Data: 7 File: C:\Users\Weici_Lo.TW\PC\TP0001224\Desktop\le3\Test Data\報告\ITE\SGS\C3K1927.EM6 (



Freq MHz	Reading Level dBuV	C.F dB	Result dBuV	Limit dBuV	Over Limit dB	Detector
0.151	33.15	8.78	41.93	55.96	-14.03	Average
0.151	48.49	8.78	57.27	65.96	-8.69	QP
0.194	26.36	8.81	35.17	53.84	-18.67	Average
0.194	40.28	8.81	49.09	63.84	-14.75	QP
0.222	21.40	8.83	30.23	52.74	-22.51	Average
0.222	35.13	8.83	43.96	62.74	-18.78	QP
0.341	14.08	8.90	22.98	49.18	-26.20	Average
0.341	27.12	8.90	36.02	59.18	-23.16	QP
2.884	6.20	9.29	15.49	46.00	-30.51	Average
2.884	11.80	9.29	21.09	56.00	-34.91	QP
19.122	29.41	9.99	39.40	50.00	-10.60	Average
19.122	33.68	9.99	43.67	60.00	-16.33	QP

CON

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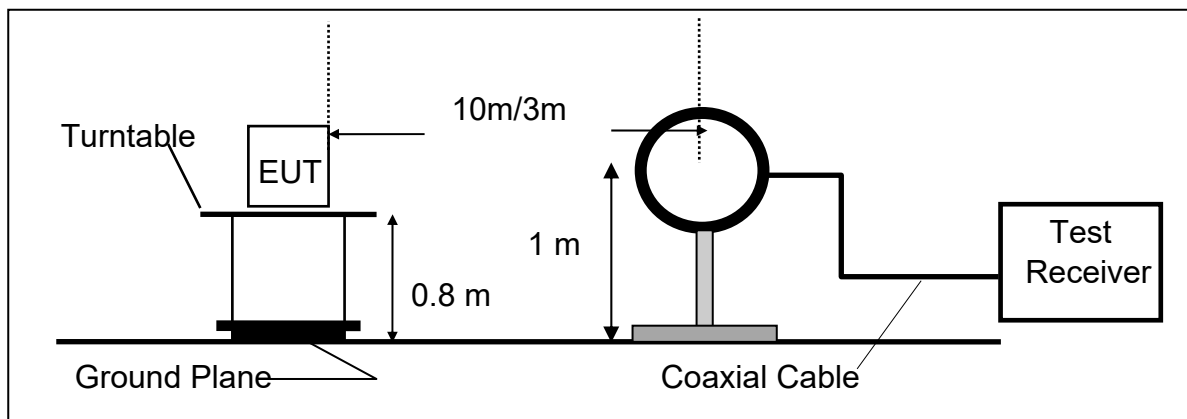
7 RADIATED TEST ITEMS

7.1 Measurement Procedure

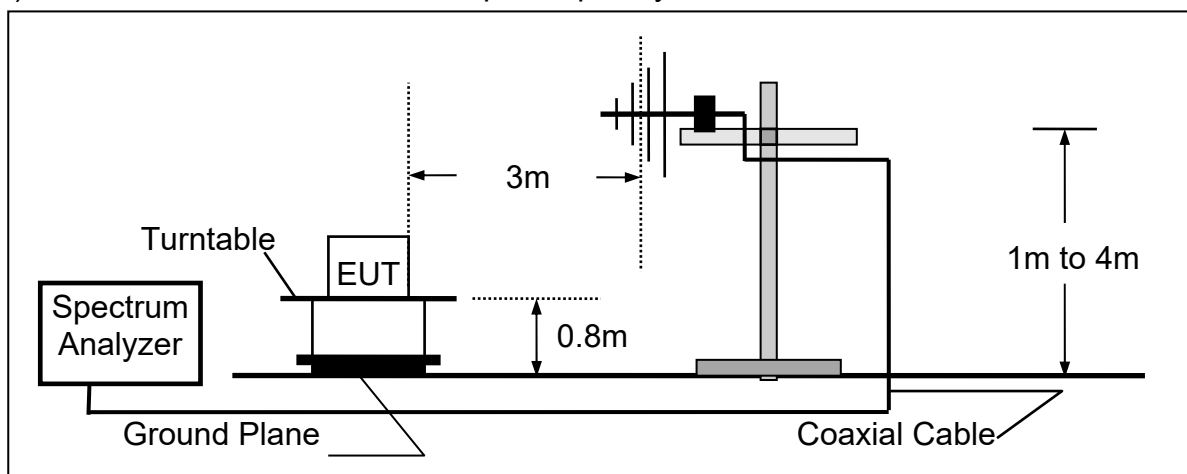
1. Configure the EUT according to ANSI C63.10.
2. The EUT was placed on a turn table which is 0.8m above ground plane and been measured in the frequency range between 0.009MHz to 30MHz and 30MHz to 1GHz.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which 9k-30MHz constant 1m height , 30M-1GHz 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.

7.2 Test SET-UP

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



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



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7.3 Measurement Equipment Used

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Active Loop Antenna	ETS-LINDREN	6502	8905-2356	08/02/2019	08/01/2021
Amplifier	EMC	EMC330N	980691	10/28/2019	10/27/2020
Bi-log Antenna	Sunol	JB1	A031905	08/26/2019	08/25/2020
Cable	CCS	CCS	CB966B-1	05/28/2019	05/27/2020
EMI Test Receiver	R&S	ESCI	100221	05/06/2019	05/05/2020
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/18/2019	07/17/2020
Software	e3 V6.101222				

OATS6					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Active Loop Antenna	ETS-LINDREN	6502	8905-2356	08/02/2019	08/01/2021
Bi-Log Antenna	Sunol	JB1	A070506-2	08/26/2019	08/25/2020
EMI Test Receiver	R&S	ESCI	100221	05/06/2019	05/05/2020
Type N coaxial cable	Suhner	CHA9513	6	01/25/2019	01/24/2020
Software	e3 V6.101222				

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

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7.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

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

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

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

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

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

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7.5 Field Strength of Fundamental Emissions and Mask Measurement

7.5.1 Standard Applicable

Limit:

Rules and specifications	CFR 47 Part 15 section 15.225(a)-(d)		
Frequency of Emission (MHz)	Field Strength ($\mu\text{V/m}$) at 30m	Field Strength (dB $\mu\text{V/m}$) at 30m	Field Strength (dB $\mu\text{V/m}$) at 3m
1.705~13.110	30	29.5	69.5
13.110~13.410	106	40.5	80.5
13.410~13.553	334	50.5	90.47
13.553~13.567	15848	84	124
13.567~13.710	334	50.5	90.47
13.710~14.010	106	40.5	80.5
14.010~30.00	30	29.5	69.5

Field strength of fundamental emissions limit:

The field strength of fundamental emissions shall not exceed 15848 micorvolts/meter at 30 meters. The Limit is converted to 124.00dBuV/m by offsetting the distance extrapolation factor as measurement distance is taken place at 3 meters.

1. Emission level in dBuV/m=20 log ($\mu\text{V/m}$)
2. Distance extrapolation factor = 40 log (required distance/ test distance) (dB)
3. The lower limit shall apply at the transition frequencies.
4. The measurement was undertaken in closer distance below 30MHz at 10m and 3m and above 30MHz at 3m, where extrapolation factor is offset to convert the limit of the measurement.
5. 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.
6. Emission level in dBuV/m=20 log ($\mu\text{V/m}$)
7. Distance extrapolation factor = 40 log (required distance/ test distance) (dB)
8. The lower limit shall apply at the transition frequencies.
9. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.

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Radiated Mask for 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.

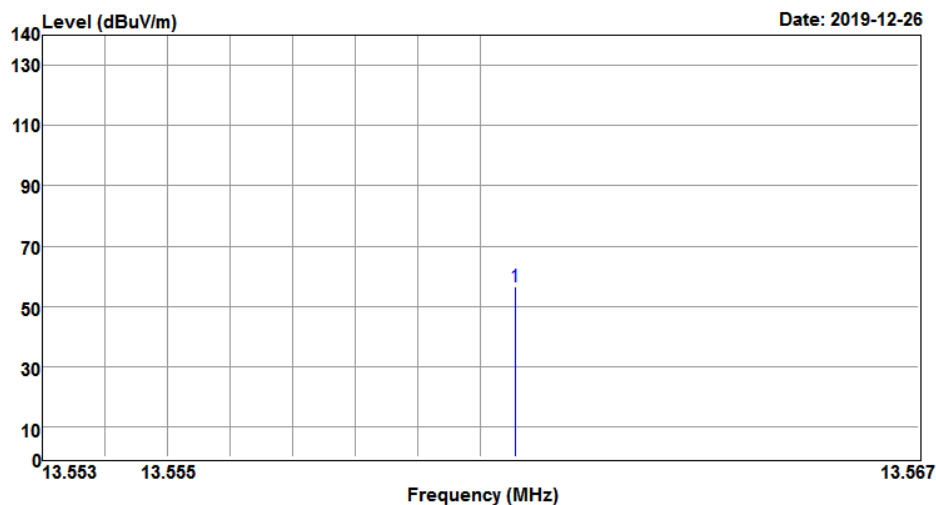
Distance extrapolation = $40 \cdot \log(30/3) = 40$ dB

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7.5.2 Field Strength of Fundamental Emission Measurement Result 3m Chamber

EUT/Model No.:1927
Test Mode :NFC-ON
Polarity :
Standard :
Remark1 :X
Remark2 :
Remark3 :
Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



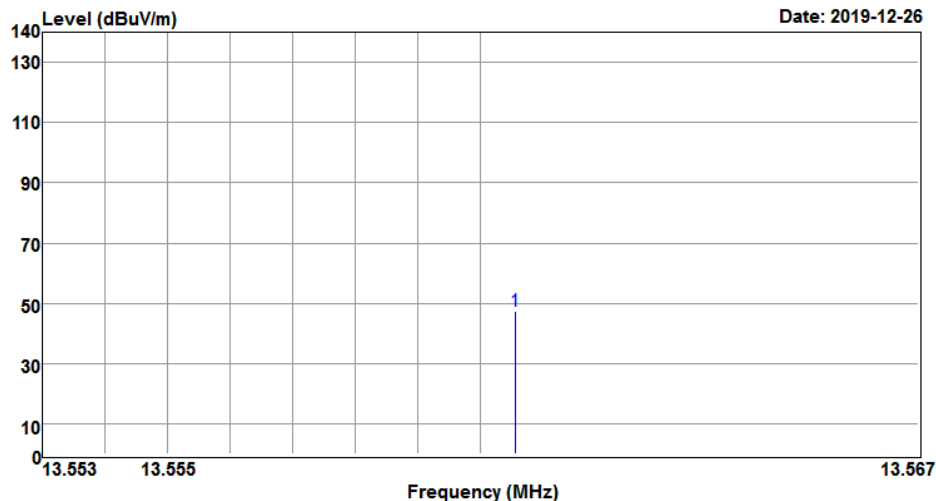
Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
13.56	44.52	12.13	56.65	-----	-----	Peak

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EUT/Model No.:1927
Test Mode :NFC-ON
Polarity :
Standard :
Remark1 :Y
Remark2 :
Remark3 :

Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
13.56	35.26	12.13	47.39	-----	-----	Peak

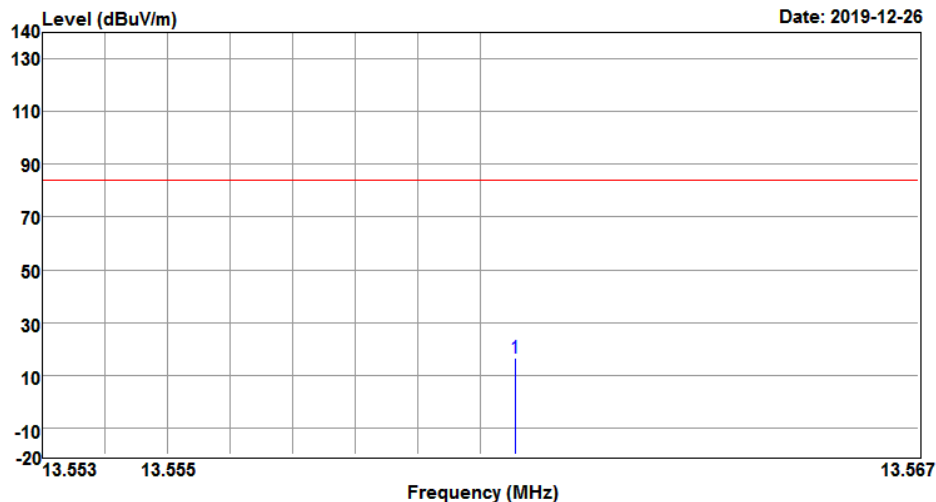
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Standard distance

EUT/Model No.:1927
Test Mode :NFC-ON
Polarity :
Standard :
Remark1 :X
Remark2 :
Remark3 :

Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



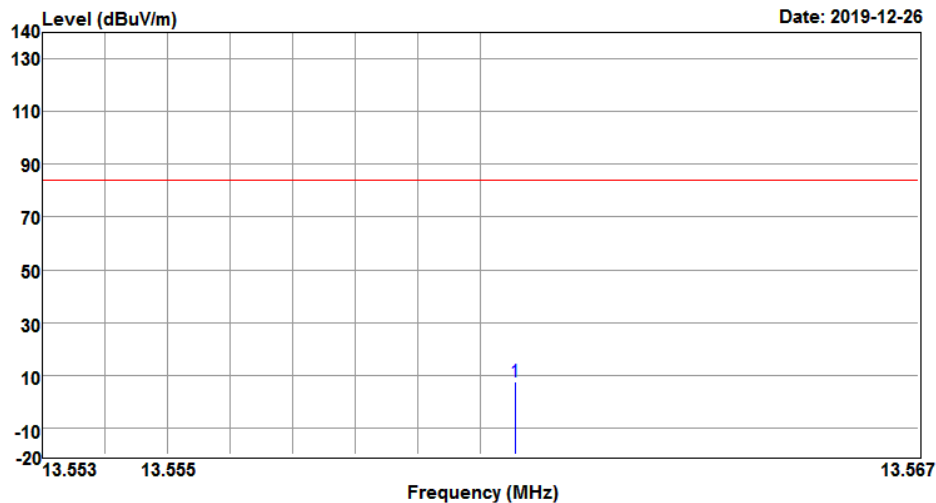
Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
13.56	4.52	12.13	16.65	84.00	-67.35	Peak

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EUT/Model No.:1927
Test Mode :NFC-ON
Polarity :
Standard :
Remark1 :Y
Remark2 :
Remark3 :

Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
13.56	-4.74	12.13	7.39	84.00	-76.61	Peak

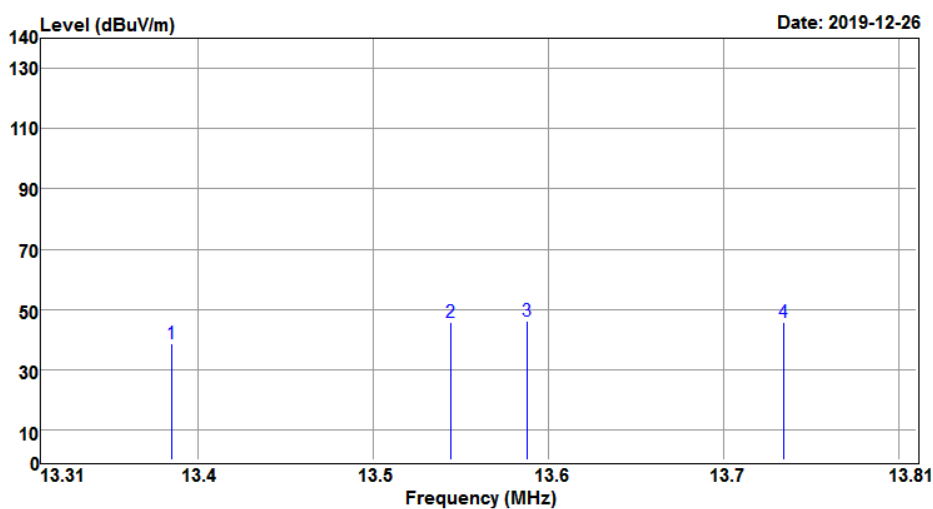
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7.5.3 Mask Measurement Result 3m Chamber

EUT/Model No.:1927
Test Mode :NFC-ON
Polarity :
Standard :
Remark1 :X
Remark2 :
Remark3 :

Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
13.39	26.59	12.14	38.73	-----	-----	Peak
13.54	33.75	12.13	45.88	-----	-----	Peak
13.59	34.12	12.13	46.25	-----	-----	Peak
13.73	33.69	12.11	45.80	-----	-----	Peak

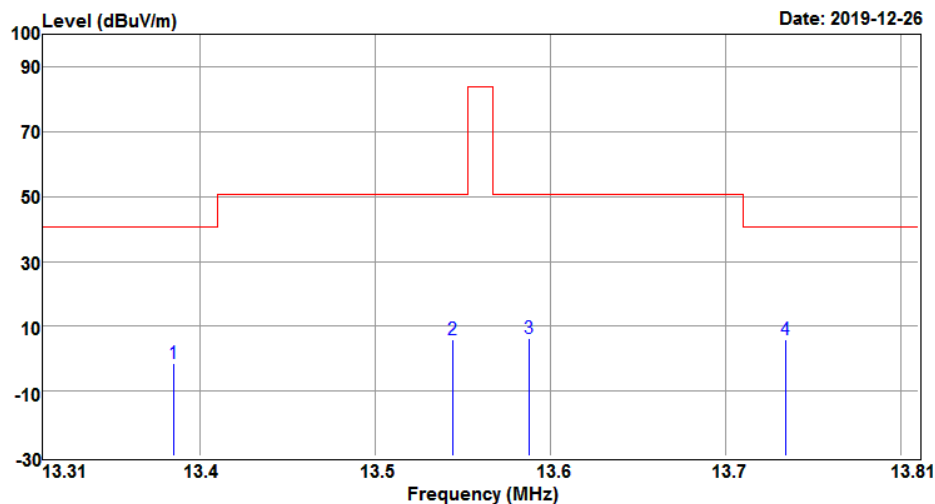
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Standard distance

EUT/Model No.:1927
Test Mode :NFC-ON
Polarity :
Standard :
Remark1 :X
Remark2 :
Remark3 :

Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
13.39	-13.41	12.14	-1.27	40.50	-41.77	Peak
13.54	-6.25	12.13	5.88	50.50	-44.62	Peak
13.59	-5.89	12.13	6.24	50.50	-44.26	Peak
13.73	-6.31	12.11	5.80	40.50	-34.70	Peak

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7.6 Radiated Emission Measurement

7.6.1 Standard Applicable

The field strength of any emission which appear outside of 13.553~13.567MHz Band shall not exceed the general radiated emissions limits.

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 dBμV/m=20 log (μV/m)
2. Distance extrapolation factor = 40 log (required distance/ test distance) (dB)
3. The lower limit shall apply at the transition frequencies.
4. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.

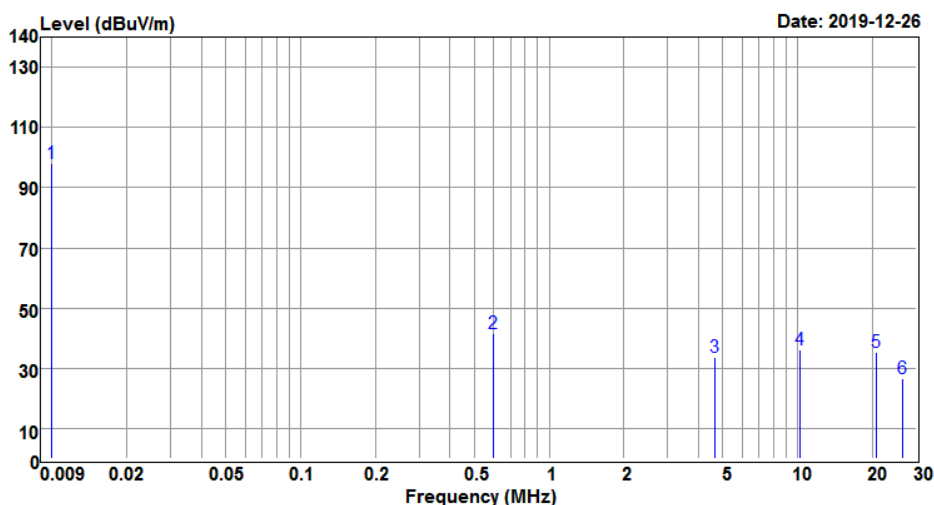
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Radiated Emission Measurement 3m Chamber

EUT/Model No.:1927
Test Mode :NFC-ON
Polarity :
Standard :
Remark1 :X
Remark2 :
Remark3 :

Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



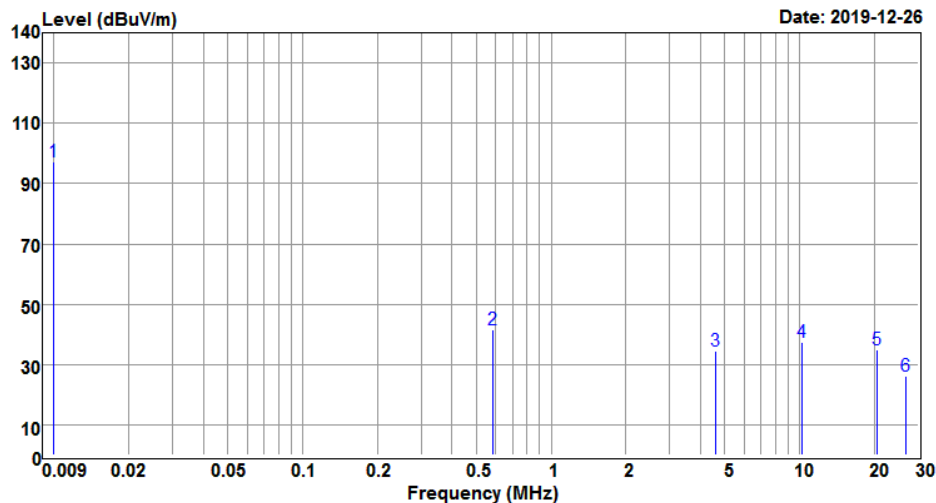
Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
0.01	78.22	19.65	97.87	-----	-----	Peak
0.60	30.96	10.79	41.75	-----	-----	Peak
4.64	22.52	11.04	33.56	-----	-----	Peak
10.25	23.86	12.43	36.29	-----	-----	Peak
20.59	23.68	11.55	35.23	-----	-----	Peak
26.48	16.24	10.26	26.50	-----	-----	Peak

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EUT/Model No.:1927
Test Mode :NFC-OFF
Polarity :
Standard :
Remark1 :X
Remark2 :
Remark3 :

Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
0.01	77.58	19.65	97.23	-----	-----	Peak
0.59	30.59	10.77	41.36	-----	-----	Peak
4.58	23.65	11.02	34.67	-----	-----	Peak
10.22	24.85	12.44	37.29	-----	-----	Peak
20.45	23.29	11.58	34.87	-----	-----	Peak
26.75	15.86	10.20	26.06	-----	-----	Peak

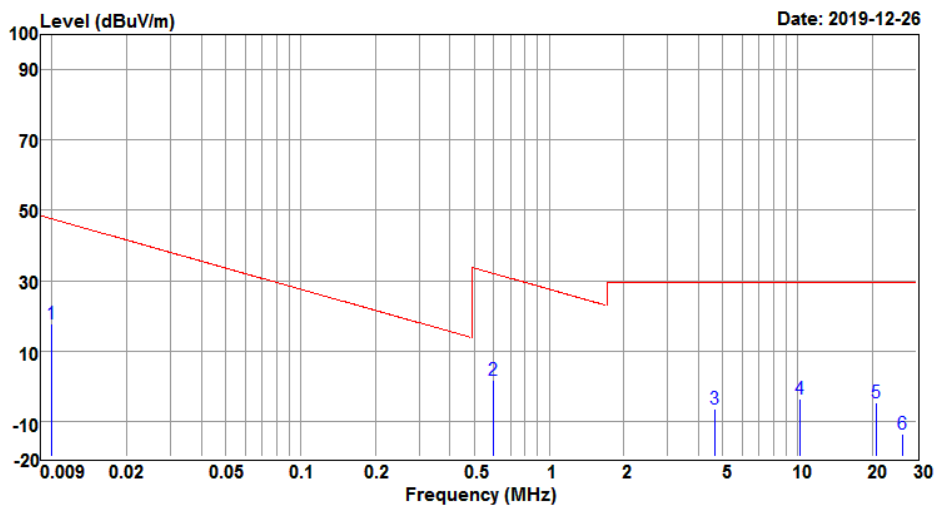
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Standard distance

EUT/Model No.:1927
Test Mode :NFC-ON
Polarity :
Standard :
Remark1 :X
Remark2 :
Remark3 :

Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



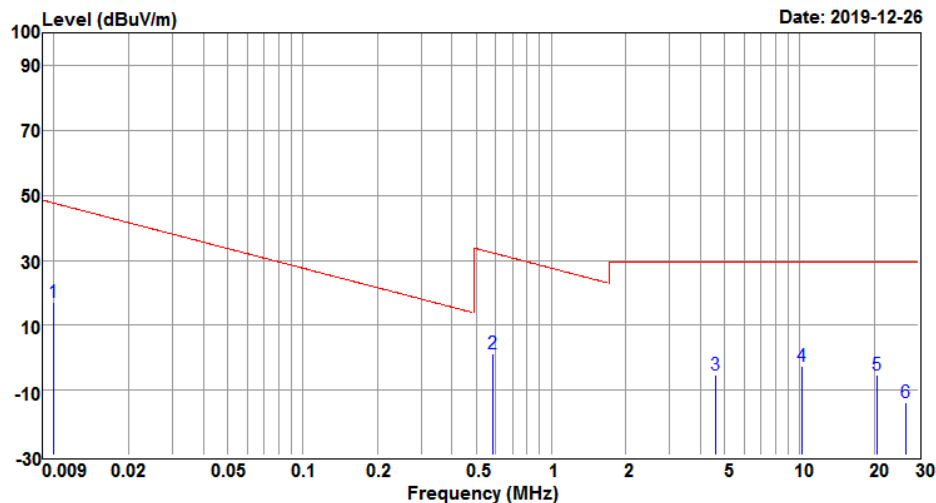
Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
0.01	-1.78	19.65	17.87	47.61	-29.74	Peak
0.60	-9.04	10.79	1.75	32.07	-30.32	Peak
4.64	-17.48	11.04	-6.44	29.54	-35.98	Peak
10.25	-16.14	12.43	-3.71	29.54	-33.25	Peak
20.59	-16.32	11.55	-4.77	29.54	-34.31	Peak
26.48	-23.76	10.26	-13.50	29.54	-43.04	Peak

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EUT/Model No.:1927
Test Mode :NFC-OFF
Polarity :
Standard :
Remark1 :X
Remark2 :
Remark3 :

Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



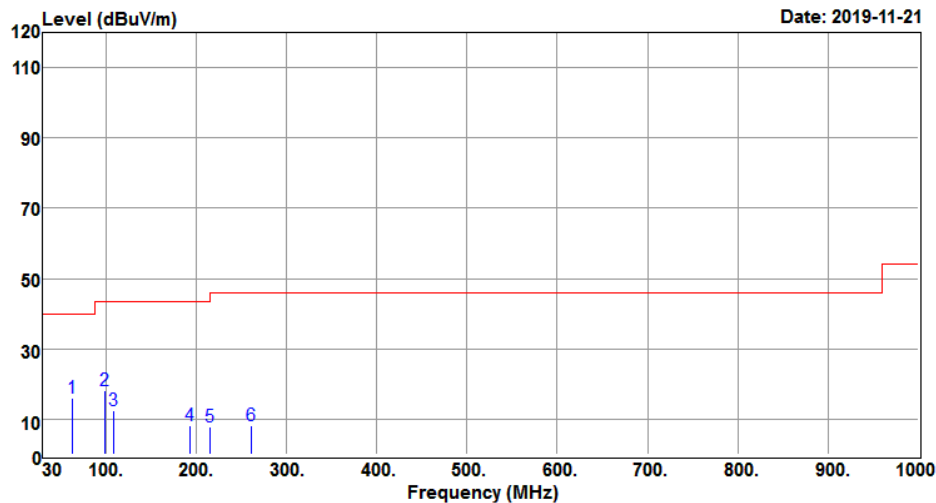
Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
0.01	-2.42	19.65	17.23	47.61	-30.38	Peak
0.59	-9.41	10.77	1.36	32.25	-30.89	Peak
4.58	-16.35	11.02	-5.33	29.54	-34.87	Peak
10.22	-15.15	12.44	-2.71	29.54	-32.25	Peak
20.45	-16.71	11.58	-5.13	29.54	-34.67	Peak
26.75	-24.14	10.20	-13.94	29.54	-43.48	Peak

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EUT/Model No.:1927
 Test Mode :NFC-ON
 Polarity :HORIZONTAL
 Standard :
 Remark1 :
 Remark2 :
 Remark3 :

Site :Chamber 966B
 Temp/Humi:24.5/56%
 Tested by:Ted.Huang



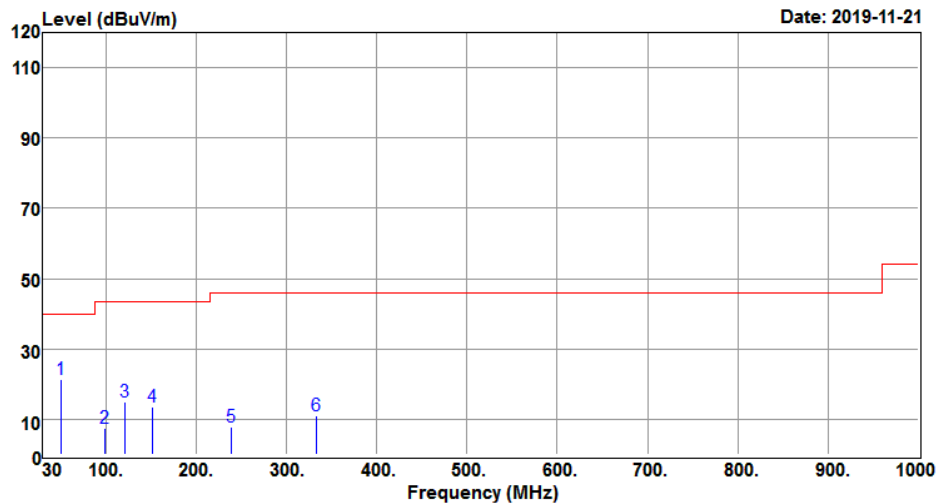
Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
63.33	46.90	-30.70	16.20	40.00	-23.80	QP
98.57	48.45	-30.44	18.01	43.50	-25.49	QP
108.57	42.91	-30.31	12.60	43.50	-30.90	QP
192.96	37.55	-29.51	8.04	43.50	-35.46	QP
215.27	37.11	-29.36	7.75	43.50	-35.75	QP
260.86	37.28	-29.08	8.20	46.00	-37.80	QP

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EUT/Model No.:1927
Test Mode :NFC-ON
Polarity :VERTICAL
Standard :
Remark1 :
Remark2 :
Remark3 :

Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



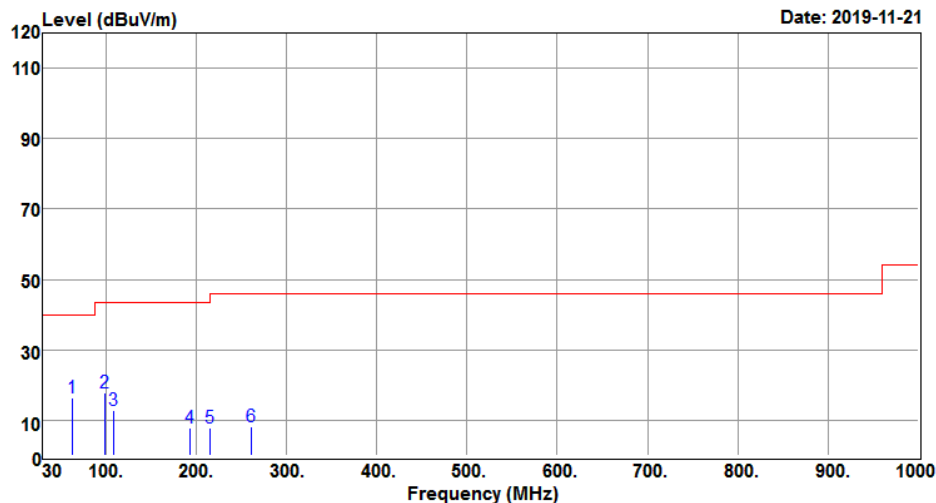
Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
51.34	52.06	-30.86	21.20	40.00	-18.80	QP
99.84	37.90	-30.43	7.47	43.50	-36.03	QP
121.18	45.06	-30.17	14.89	43.50	-28.61	QP
152.22	43.54	-29.84	13.70	43.50	-29.80	QP
239.52	37.08	-29.22	7.86	46.00	-38.14	QP
333.61	39.63	-28.42	11.21	46.00	-34.79	QP

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EUT/Model No.:1927
Test Mode :NFC-OFF
Polarity :HORIZONTAL
Standard :
Remark1 :
Remark2 :
Remark3 :

Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



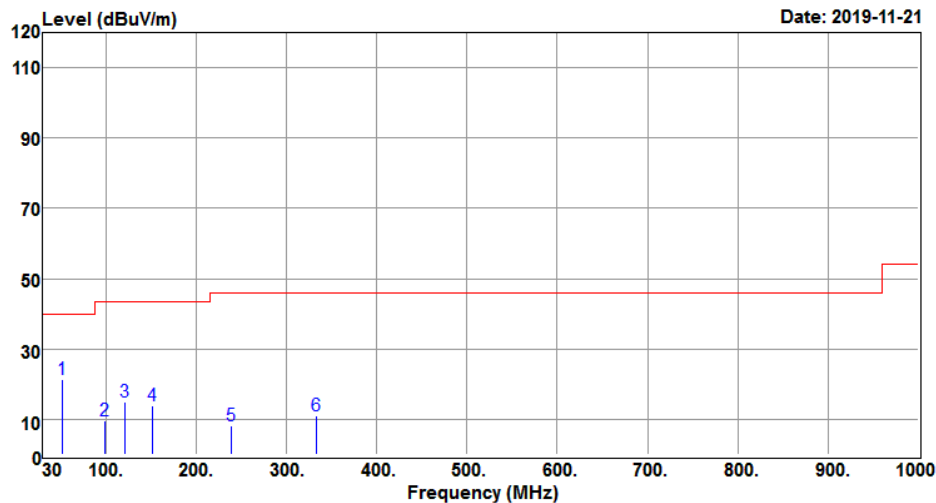
Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
63.35	47.22	-30.70	16.52	40.00	-23.48	QP
98.62	48.23	-30.44	17.79	43.50	-25.71	QP
108.58	43.26	-30.31	12.95	43.50	-30.55	QP
192.98	37.34	-29.51	7.83	43.50	-35.67	QP
215.29	37.23	-29.36	7.87	43.50	-35.63	QP
260.90	37.34	-29.08	8.26	46.00	-37.74	QP

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EUT/Model No.:1927
Test Mode :NFC-OFF
Polarity :VERTICAL
Standard :
Remark1 :
Remark2 :
Remark3 :

Site :Chamber 966B
Temp/Humi:24.5/56%
Tested by:Ted.Huang



Freq MHz	Reading dBuV	C.F dB	Result dBuV	Limit dBuV	Margin dB	Detector
51.45	52.34	-30.86	21.48	40.00	-18.52	QP
99.84	39.90	-30.43	9.47	43.50	-34.03	QP
121.25	45.23	-30.16	15.07	43.50	-28.43	QP
152.25	43.74	-29.84	13.90	43.50	-29.60	QP
239.61	37.33	-29.22	8.11	46.00	-37.89	QP
333.60	39.54	-28.42	11.12	46.00	-34.88	QP

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8 FREQUENCY STABILITY

8.1 Standard Applicable

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.

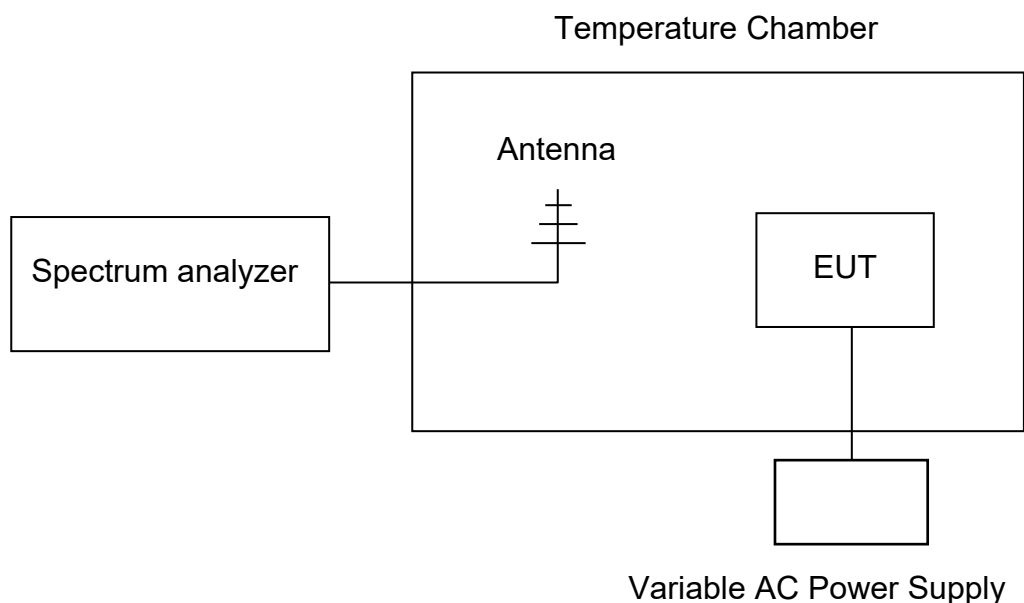
Carrier frequency stability shall be maintained to $\pm 0.01\%$ (± 100 ppm).

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 $+50^{\circ}\text{C}$ ($+122^{\circ}\text{F}$).

8.2 Measurement Procedure

1. The EUT was placed inside temperature chamber and powered by nominal DC voltage.
2. Set EUT as normal operation.
3. Turn the EUT on and couple its output to spectrum.
4. Turn the EUT off and set the chamber to the highest temperature specified.
5. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT and measure the operating frequency.
6. Repeat step with the temperature chamber set to the lowest temperature.
7. Set spectrum Center Frequency = fundamental frequency, RBW, VBW= 10 kHz, Span = 100 kHz, Detector = Max hold, Mark peak.

8.3 Test SET-UP



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8.4 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Active Loop Antenna	ETS-LINDREN	6502	8905-2356	08/02/2019	08/01/2021
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/18/2019	07/17/2020
SMA Cable + 10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/25/2019	01/24/2020
Tem/Hum Chamber	K.SON	THS-M1	242	09/24/2019	09/23/2020
Near Field Probe	EMCO	TS-7405	7405-903	N.C.R	N.C.R
Software	Excel(ccs-o6-2019 v1.2)				

8.5 Measurement Results:

Startup:

Test Temp.	Test Voltage	Frequency	Delta	Limit
	(Vdc)	(MHz)	(kHz)	(kHz)
50°C	6.77	13.56053	0.53	±1.356
40°C	6.77	13.56055	0.55	
30°C	6.77	13.56058	0.58	
20°C	8.8	13.56059	0.59	
	6.51	13.56057	0.57	
10°C	6.77	13.5606	0.6	
0°C	6.77	13.5606	0.6	
-10°C	6.77	13.56062	0.62	
-20°C	6.77	13.56055	0.55	

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2 minutes:

Test Temp.	Test Voltage	Frequency	Delta	Limit
	(Vdc)	(MHz)	(kHz)	(kHz)
50°C	6.77	13.56054	0.54	±1.356
40°C	6.77	13.56057	0.57	
30°C	6.77	13.56058	0.58	
20°C	8.8	13.56056	0.56	
	6.51	13.56057	0.57	
10°C	6.77	13.56062	0.62	
0°C	6.77	13.56058	0.58	
-10°C	6.77	13.56062	0.62	
-20°C	6.77	13.56056	0.56	

5 minutes:

Test Temp.	Test Voltage	Frequency	Delta	Limit
	(Vdc)	(MHz)	(kHz)	(kHz)
50°C	6.77	13.56055	0.55	±1.356
40°C	6.77	13.56055	0.55	
30°C	6.77	13.56057	0.57	
20°C	8.8	13.56058	0.58	
	6.51	13.56058	0.58	
10°C	6.77	13.5606	0.6	
0°C	6.77	13.56062	0.62	
-10°C	6.77	13.56061	0.61	
-20°C	6.77	13.56056	0.56	

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10 minutes:

Test Temp.	Test Voltage	Frequency	Delta	Limit
	(Vdc)	(MHz)	(kHz)	(kHz)
50°C	6.77	13.56055	0.55	±1.356
40°C	6.77	13.56058	0.58	
30°C	6.77	13.5606	0.6	
20°C	8.8	13.56059	0.59	
	6.51	13.56055	0.55	
10°C	6.77	13.5606	0.6	
0°C	6.77	13.56063	0.63	
-10°C	6.77	13.56058	0.58	
-20°C	6.77	13.56056	0.56	

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9 20 dB & 99% OCCUPIED BANDWIDTH MEASUREMENT

9.1 Standard Applicable:

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

9.2 Limit:

None

9.3 Test Set-up

Refer to section 7.2 in this report

9.4 Measurement Procedure

1. Placed the EUT on the testing table.
2. Set the EUT under transmission condition continuously at specific channel frequency.
3. 99% Occupied Bandwidth the resolution bandwidth of 51 kHz and the video bandwidth of 200 kHz were used.
4. 20dB Bandwidth the resolution bandwidth of 5.1 Hz and the video bandwidth of 20 Hz were used.
5. Measured the spectrum width with power higher than 20dB below carrier.

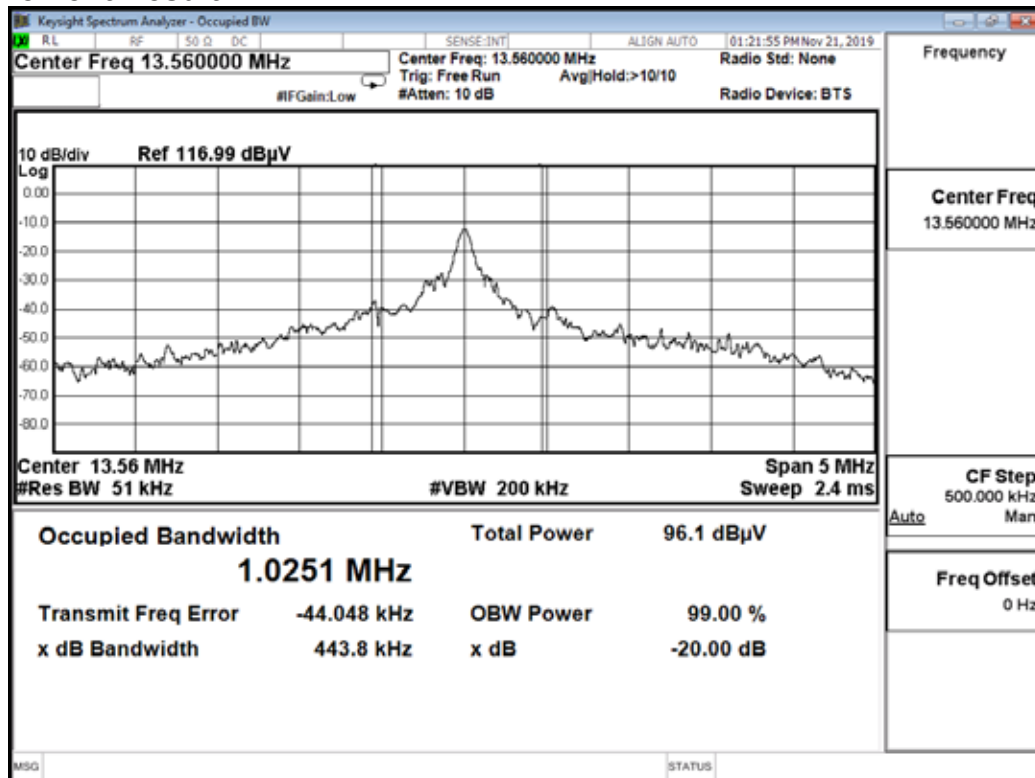
9.5 Measurement Equipment Used

Refer to section 7.3 in this report

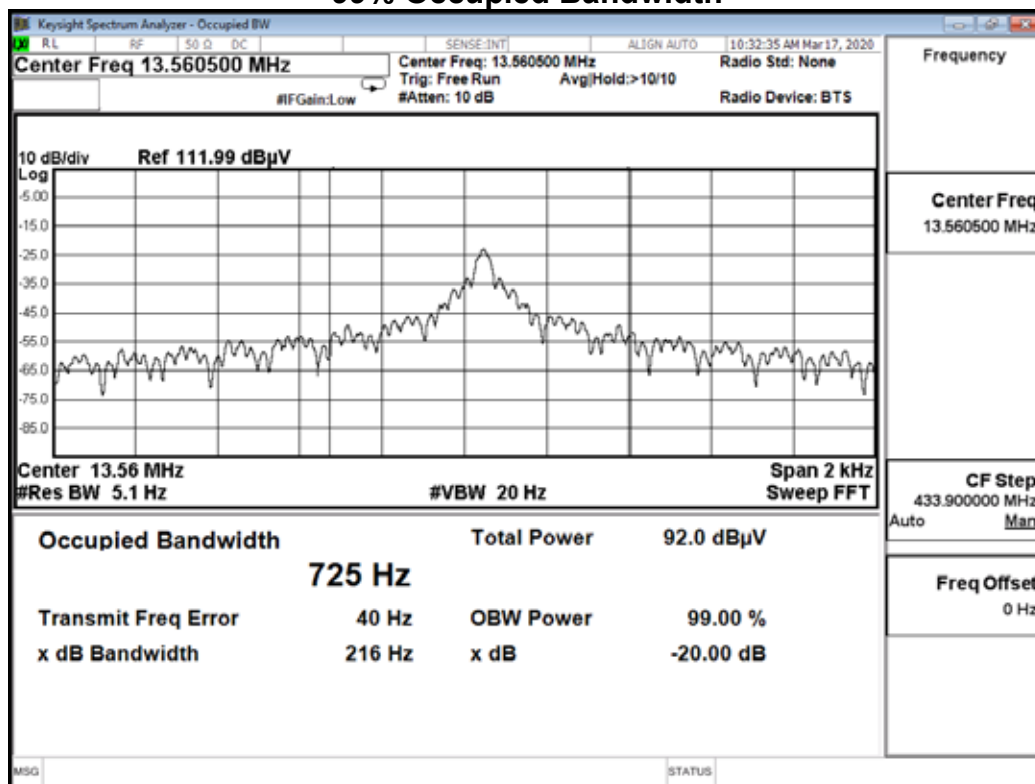
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9.6 Measurement Result:



99% Occupied Bandwidth



20 dB Bandwidth

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10 ANTENNA REQUIREMENT

10.1. Standard Applicable

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. 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 Section 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.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer.

For transmitters of RF output power of 10 milliwatts or less, only the portion of the antenna gain that is in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power to demonstrate compliance with the radiated power limits specified in the applicable standard. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power limits.

According to RSS-GEN 8.3

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.⁹ When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

10.2. Antenna Connected Construction

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

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