



Prüfbericht-Nr.: <i>Test report no.:</i>	CN23GVRS 001	Auftrags-Nr.: <i>Order no.:</i>	48217232	Seite 1 von 33 Page 1 of 33
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2023-07-17	
Auftraggeber: <i>Client:</i>	Nutek Corporation No.167, Lane 235, Bauchiau Rd., Xindian District, New Taipei City 23145, Taiwan			
Prüfgegenstand: <i>Test item:</i>	Remote Engine Start ECU			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	4361013			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15C Test report			
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.247			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2023-09-22			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003568207-003 A003568207-004			
Prüfzeitraum: <i>Testing period:</i>	2023-10-16 - 2023-12-04			
Ort der Prüfung: <i>Place of testing:</i>	EMC/RF Taipei Testing Site			
Prüflaboratorium: <i>Testing laboratory:</i>	Taipei Testing Laboratories			
Prüfergebnis*: <i>Test result*:</i>	Pass			
zusammengestellt von: <i>compiled by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i> 2023-12-07	 Ethan Shao		 Brenda Chen	
Stellung / Position:	Assistant Project Engineer	Ausstellungsdatum: <i>Issue date:</i> 2023-12-07	Senior Project Manager	
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/T = nicht getestet
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

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Anmerkungen
Remarks

1	<p>Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben.</p> <p>Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</p> <p><i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i></p>
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3	<p>Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben.</p> <p>Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.</p> <p><i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i></p> <p><i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i></p>
4	<p>Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019.</p> <p><i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i></p>

TEST SUMMARY

Report Section	FCC Clause	Test Item	Result
5.1.1	15.247(b) & 15.203	Antenna Requirement	Pass
5.1.2	15.247(b)(2)	Peak Output Power	Pass
5.1.3	15.247(a)(1)	20 dB Bandwidth	Pass
5.1.3	2.1049	99% Occupied Bandwidth	Pass
5.1.4	15.247(d)	Conducted Spurious Emission and Band Edges	Pass
5.1.5	15.247(d) & 15.205 & 15.209	Radiated Spurious Emissions and Band Edges	Pass
5.1.6	15.247(a)(1)	Hopping Channel Separation	Pass
5.1.7	15.247(a)(1) (i)	Number of Hopping Frequency Used	Pass
5.1.8	15.247(a)(1)(i)	Dwell Time on Each Channel	Pass
-	15.207	Mains Conducted Emission	N/A

Note:

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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APPENDIX A - TEST RESULT OF RADIATED EMISSIONS

APPENDIX SP - PHOTOGRAPHS OF TEST SETUP

APPENDIX EP - PHOTOGRAPHS OF EUT

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HISTORY OF THIS TEST REPORT

Revision	Description	Date Issued
R01	Original Release	2023-12-07

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A - Test Result of Radiated Emissions

Appendix SP - Photographs of Test Setup

Appendix EP - Photographs of EUT

Applied Standard and Test Levels

Radio
FCC 47CFR Part 15: Subpart C Section 15.247
FCC 47CFR Part 2: Subpart J Section 2.1049
ANSI C63.10:2013
KDB 558074 D01 15.247 Meas Guidance v05r02

1.2 Decision Rule of Conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2. Test Sites

2.1 Test Laboratory

Taipei Testing Laboratories

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.2 Test Facility

Taipei Testing Laboratories

No.458-18, Sec. 2, Fenliao Rd., Linkou Dist.,
New Taipei City 244
Taiwan (R.O.C.)
FCC Registration No.: 180491
ISED Registration No.: 25563

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

All measurement uncertainty values are shown with a coverage factor of $k=2$ to indicate a 95% level of confidence.

Emission Measurement Uncertainty

Parameter	Uncertainty
Radiated Emission (9 kHz ~ 30 MHz)	± 1.15 dB
Radiated Emission (30 MHz ~ 200 MHz)	± 1.32 dB
Radiated Emission (200 MHz ~ 1 GHz)	± 1.31 dB
Radiated Emission (1 GHz ~ 18 GHz)	± 1.53 dB
Radiated Emission (18 GHz ~ 40 GHz)	± 2.50 dB
Mains Conducted Emission	± 1.65 dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a Remote Engine Start ECU. It contains a wireless chip enabling the user to communicate data through a Wireless interface.

For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	Remote Engine Start ECU
Type Identification	4361013
FCC ID	ELVATRWA

Technical Specification of EUT

Item	EUT information
Operating Frequency	904 – 924 MHz
Channel Spacing	400 kHz
Channel Number	50
Operation Voltage	9Vdc - 16Vdc
Modulation	GFSK
Maximum Output Power (mW)	52.12
Antenna Information	Refer to 5.1.1
Accessory Device	Refer to 4.4

3.3 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.4 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The test modes were adapted accordingly in reference to the instructions for use.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output expected by the customer and is going to be fixed on the firmware of the final end product.

Table for Parameters of Test Software Setting

Mode	Channel Frequency (MHz)		
	Low Channel	Middle Channel	High Channel
	904	913.6	923.6
GFSK	48	48	48

4.2 Carrier Frequency and Channel

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	904.0	17	910.8	34	917.6
1	904.4	18	911.2	35	918.0
2	904.8	19	911.6	36	918.4
3	905.2	20	912.0	37	918.8
4	905.6	21	912.4	38	919.2
5	906.0	22	912.8	39	919.6
6	906.4	23	913.2	40	920.0
7	906.8	24	913.6	41	920.4
8	907.2	25	914.0	42	920.8
9	907.6	26	914.4	43	921.2
10	908.0	27	914.8	44	921.6
11	908.4	28	915.2	45	922.0
12	908.8	29	915.6	46	922.4
13	909.2	30	916.0	47	922.8
14	909.6	31	916.4	48	923.2
15	910.0	32	916.8	49	923.6
16	910.4	33	917.2		

4.3 Test Operation and Test Software

Setup for testing: Test samples are provided with a USB interface which makes it possible to control them through a test software installed on a notebook computer.

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed as below.

Test Software	radio_test.py
---------------	---------------

The samples were used as follows:

A003568207-003

A003568207-004

Full test was applied on all test modes, but only worst case was shown.

EUT Configure Mode	Applicable To				Description
	Antenna Port Conducted Measurement	Radiated Spurious Emissions above 1 GHz	Radiated Spurious Emissions below 1 GHz	Mains Conducted Emission	
-	√	√	√	-	-

Note:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when position on **Z-plane**.
2. "-" means no effect.

Antenna Port Conducted Measurement

- Pre-Scan full test was applied on all test modes, but only worst case was shown.
- Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Modulation Type
-	904 to 923.6	904, 913.6, 923.6	GFSK

Radiated Spurious Emissions (Above 1 GHz)

- Pre-Scan full test was applied on all test modes, but only worst case was shown.
- Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Modulation Type
-	904 to 923.6	904, 913.6, 923.6	GFSK

Radiated Spurious Emissions (Below 1 GHz)

- Pre-Scan full test was applied on all test modes, but only worst case was shown.
- Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Frequency (MHz)	Tested Frequency (MHz)	Modulation Type
-	904 to 923.6	904, 913.6, 923.6	GFSK

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
Conducted Measurement	23.8-24.3 °C	55-56 %	Andy Chen & Blake Wang
Radiated Spurious Emissions above 1 GHz	23.7-24.6 °C	52-55 %	Ray Huang
Radiated Spurious Emissions below 1 GHz	23.7-24.6 °C	52-55 %	Ray Huang

4.4 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

Accessory of EUT

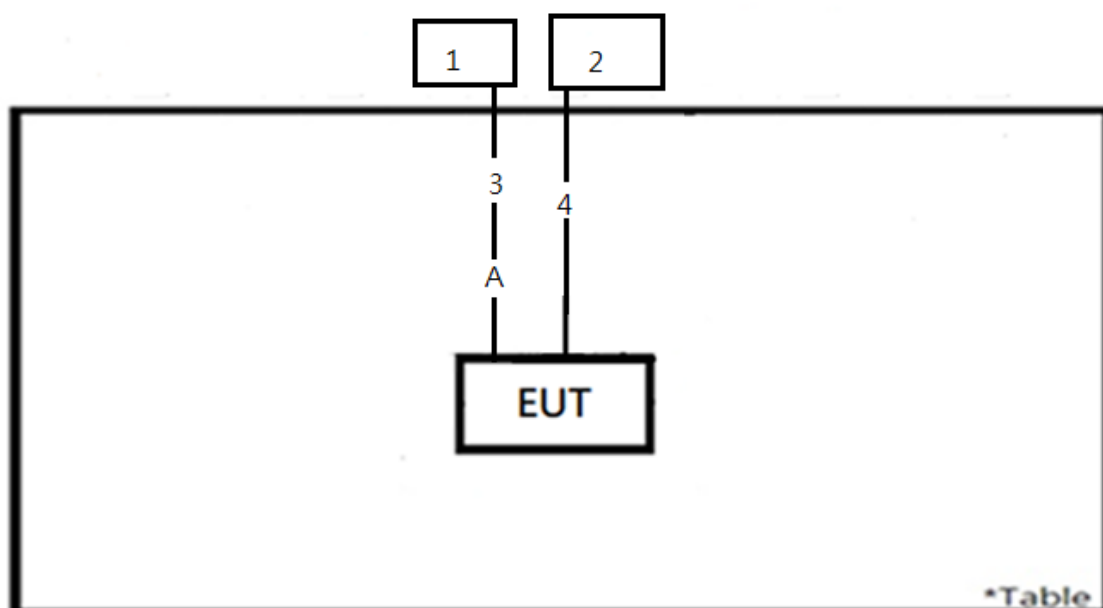
None.

Support Unit

No.	Description	Brand	Model	S/N	Remark
Radiated Test					
A	Micro USB Cable	NUTEK	UART cable	--	100cm non-shielded cable w/o core A003568207-006
1	Notebook	HP	15-da1046TX	CND9111RJB	--
2	DC Power Supply	Gwinstek	GPS-3030	--	--
3	USB to USB	TUV	TUV-01	--	--
4	DC cable	TUV	TUV-02	--	--
Conducted Test					
-	Notebook	HP	TPN-C139	CND93662VF	--

4.5 Test Setup Diagram

<Radiated Spurious Emissions Mode>



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

Requirement Use of approved antennas only.

According to the manufacturer declaration, the EUT has an antenna with a directional gain of -1.58 dBi. The antenna is a printed PCB trace with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision. Refer to EUT photo for details.

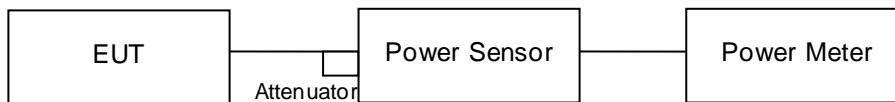
5.1.2 Peak Output Power

Limit

1 watt for systems employing at least 50 hopping channels; and 0.25 watts for systems employing less than 50 hopping channels.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Power Meter	Anritsu	ML2495A	1901008	2023/3/17	2024/3/16	2023/10/16	2023/12/4
Power Sensor	Anritsu	MA2411B	1725269	2023/3/17	2024/3/16	2023/10/16	2023/12/4

Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

Test Result
Peak Output Power

Channel	Channel Frequency	Peak Output Power		Limit
	(MHz)	(dBm)	(mW)	(mW)
Low Channel	904.00	17.04	50.58	1000.00
Middle Channel	913.60	17.11	51.40	1000.00
High Channel	923.60	17.17	52.12	1000.00

Average Power

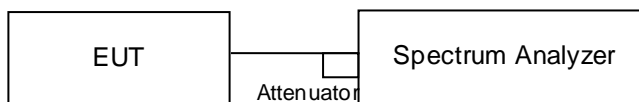
Channel	Channel Frequency	Average Power	
	(MHz)	(dBm)	(mW)
Low Channel	904.00	16.97	49.77
Middle Channel	913.60	17.05	50.70
High Channel	923.60	17.09	51.17

5.1.3 20 dB Bandwidth and 99% Occupied Bandwidth

Limit

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Kind of Test Site Shielded room

Test Setup

Test Instruments

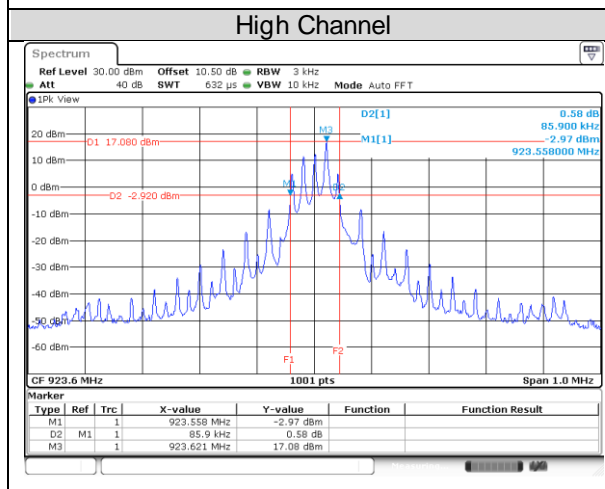
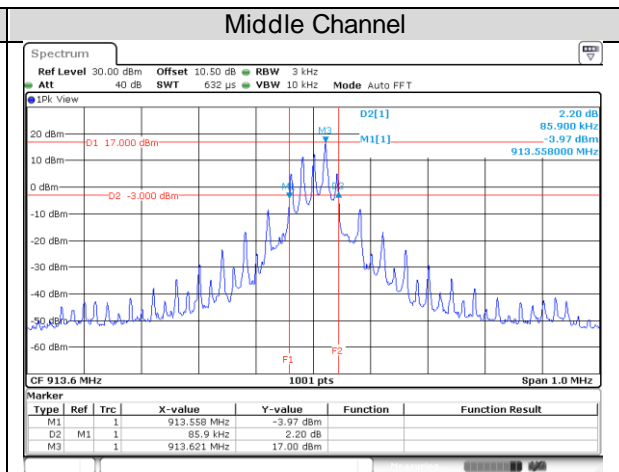
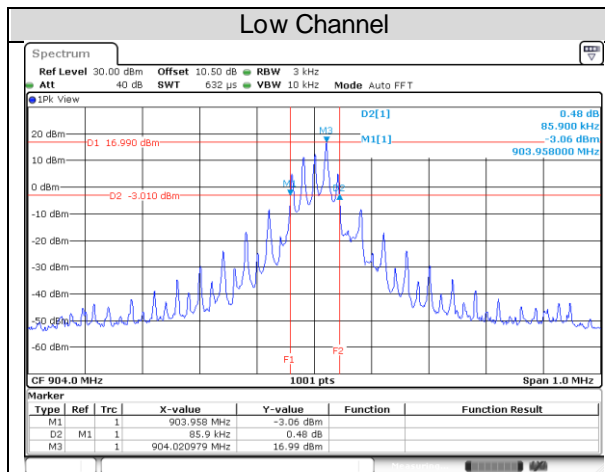
Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV	101513	2023/05/10	2024/05/09	2023/10/16	2023/12/4

Test Procedure

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- c. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- d. Repeat above procedures until all frequencies measured were complete.
- e. The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1 % to 5 % of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to PEAK. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

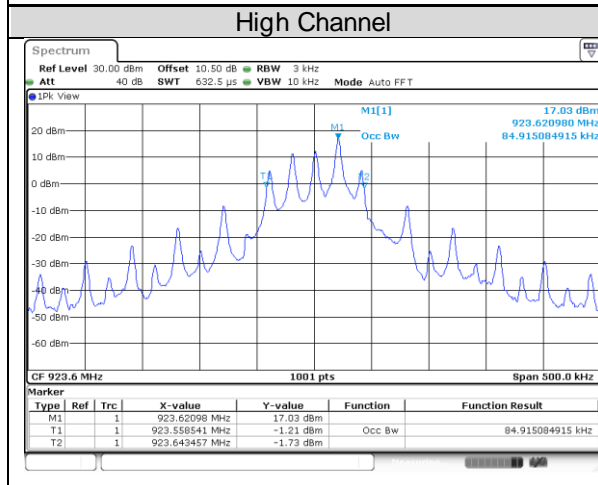
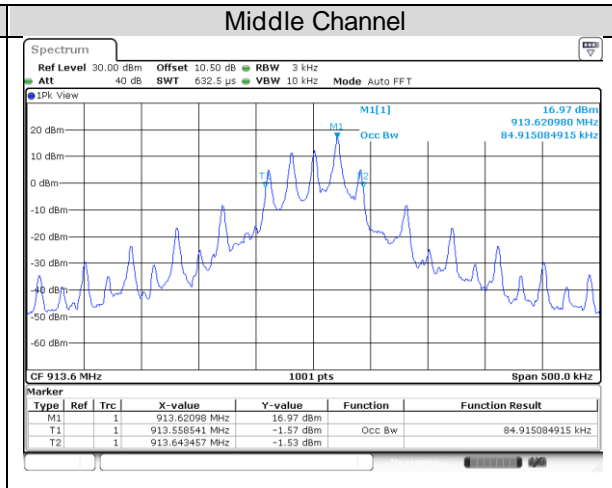
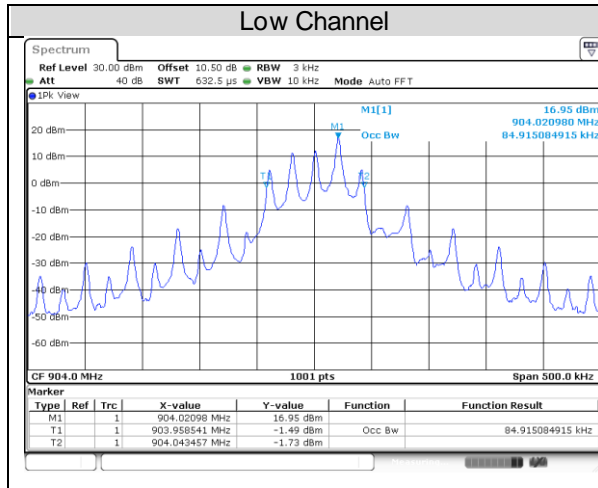
Test Results
<20 dB Bandwidth>

Channel	Channel Frequency (MHz)	20 dB Bandwidth (kHz)	Result
Low Channel	904.00	85.9	Pass
Middle Channel	913.60	85.9	Pass
High Channel	923.60	85.9	Pass



<99% Occupied Bandwidth>

Channel	Channel Frequency (MHz)	99% Occupied Bandwidth (kHz)
Low Channel	904.00	84.92
Middle Channel	913.60	84.92
High Channel	923.60	84.92

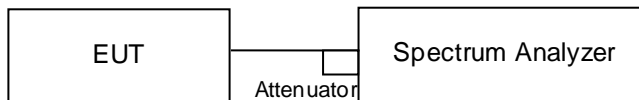


5.1.4 Conducted Spurious Emissions and Frequency Band Edges Measured in 100 kHz Bandwidth

Limit

20 dB (below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.)

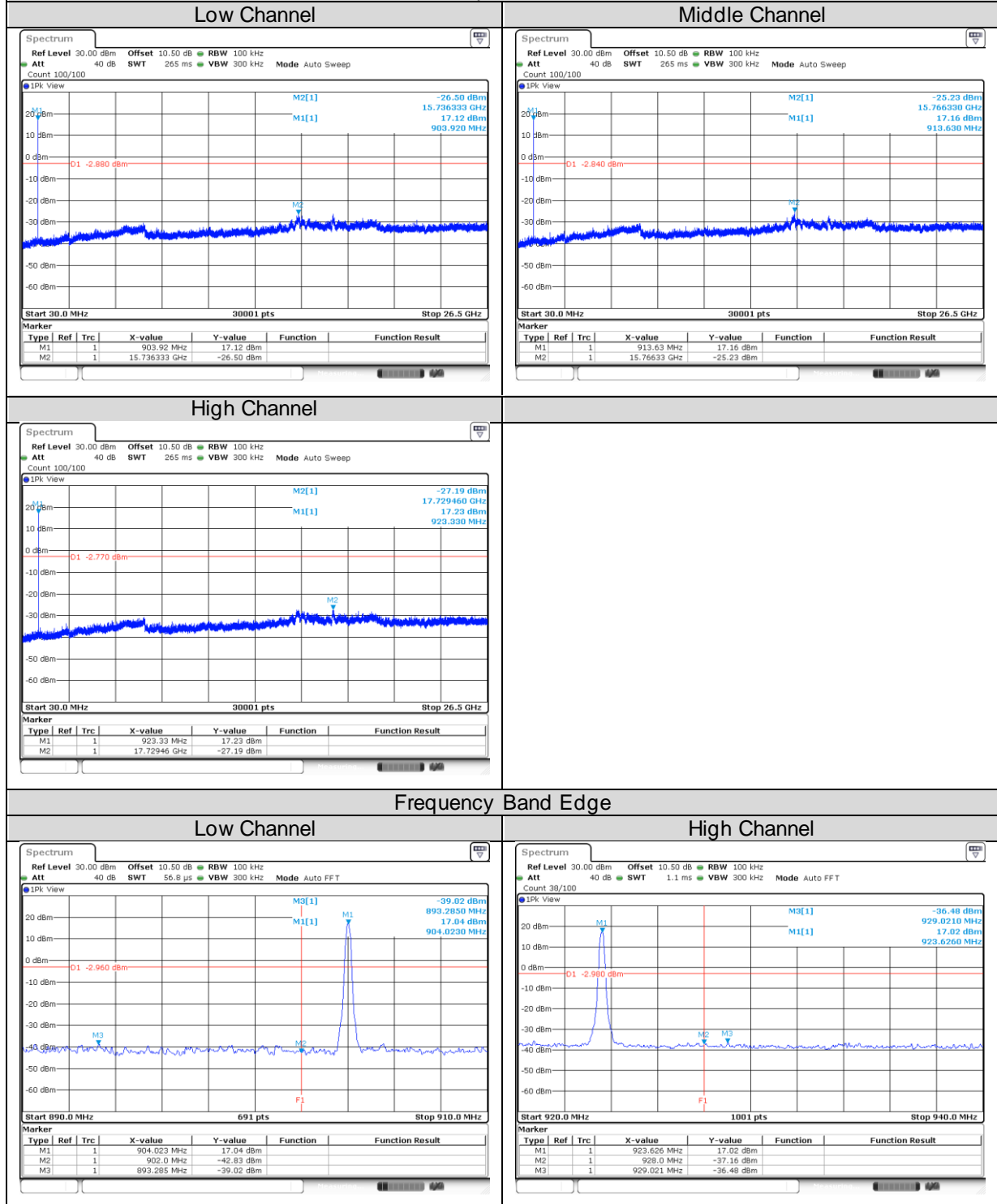
Kind of Test Site Shielded room

Test Setup

Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV	101513	2023/05/10	2024/05/09	2023/10/16	2023/12/4

Test Procedure

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set both RBW and VBW of spectrum analyzer to 100 kHz and 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

Test Results
Conducted Spurious Emissions


5.1.5 Radiated Spurious Emissions and Band Edges

Limit

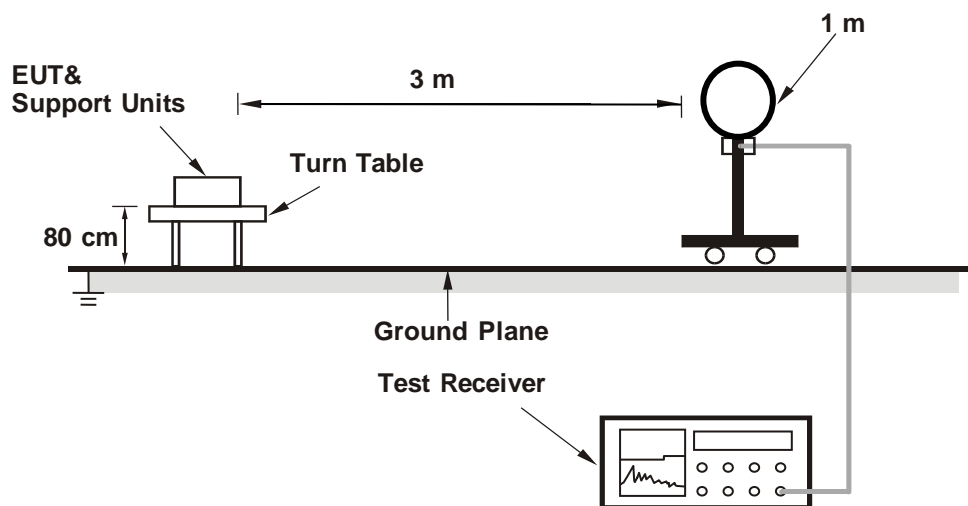
Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

Emissions radiated outside the restricted and authorized frequency bands must either comply with the radiated emission limits specified for the restricted bands or in §15.247(d).

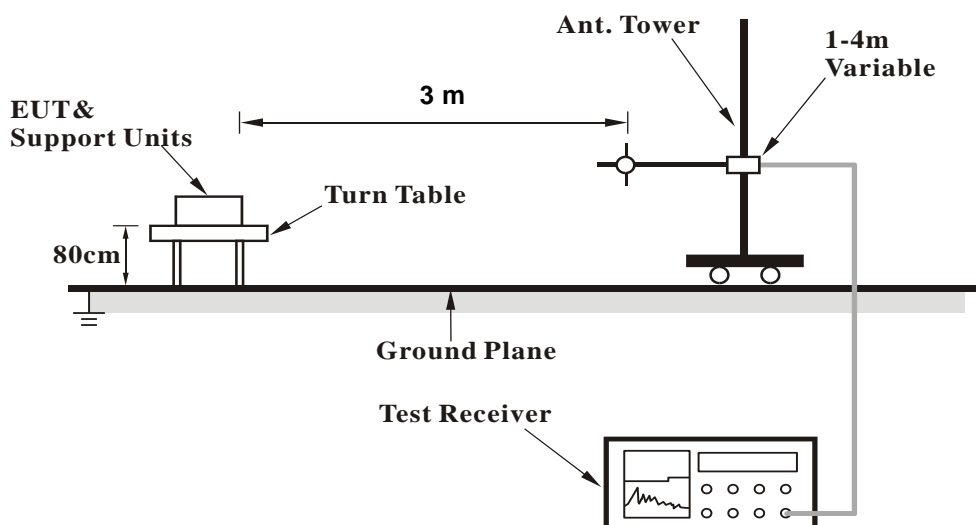
Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

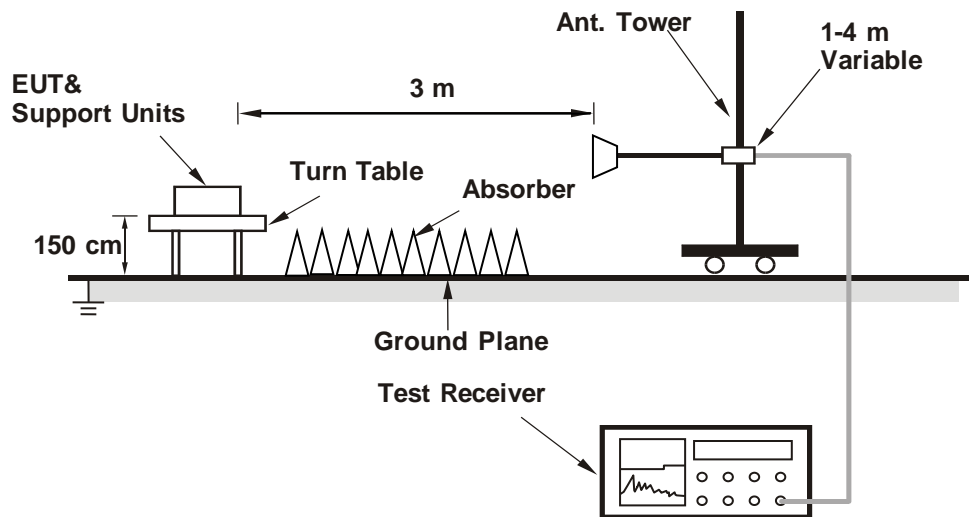
<Radiated Emissions below 30 MHz>



<Radiated Emissions 30 MHz to 1 GHz>



<Radiated Emissions above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

Test Instruments

Test Date: 2023/11/24 ~ 2023/11/27

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Above 1GHz					
Signal Analyzer	R&S	FSV40	101509	2023/4/26	2024/4/24
Horn Antenna	ETS-Lindgren	3117	218931	2023/2/24	2024/2/23
HF-AMP + AC source	EMCI	EMC051845SE	980635	2023/2/16	2024/2/15
Test Software	Audix E3	15914a_20191106 tuv	PK-001087	N/A	N/A
30MHz ~ 1GHz					
Receiver	R&S	ESR7	102109	2023/2/24	2024/2/23
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2023/3/31	2024/3/29
LF-AMP	Agilent	8447D	2944A107722	2023/3/22	2024/3/20
Test Software	Audix E3	15914a_20191106 tuv	PK-001087	N/A	N/A
Below 1GHz					
Receiver	R&S	ESR7	102109	2023/2/24	2024/2/23
Loop Antenna	SCHWARZBECK	FMZB 1519B	00215	2023/1/4	2024/1/3
Test Software	Audix E3	15914a_20191106 tuv	PK-001087	N/A	N/A

Test Procedures**For Radiated Emissions below 30 MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel (OPEN), perpendicular (CLOSE), and ground-parallel (GROUND) orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated Emissions above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The Radiated Emissions testing was performed in the X(E1), Y(H) and Z(E2) axis orientation. The worst-case Axis orientation is recorded in this test report.
6. The emission levels of other frequencies (including the 10th harmonic of the highest fundamental frequency) are very lower than the limit and are not shown in the test report.

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Test Results

Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)

Level (dBuV/m) = Reading (dBuV) + Factor (dB/m)

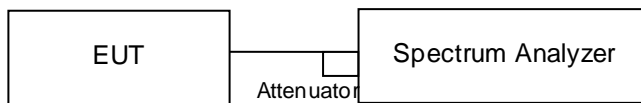
Please refer to Appendix A.

5.1.6 Hopping Channel Separation

Limit ≥ 25 kHz or 20 dB bandwidth, whichever is greater

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV	101513	2023/05/10	2024/05/09	2023/10/16	2023/12/4

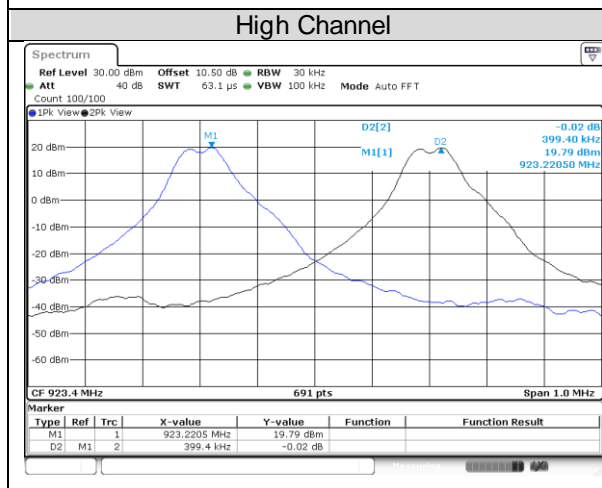
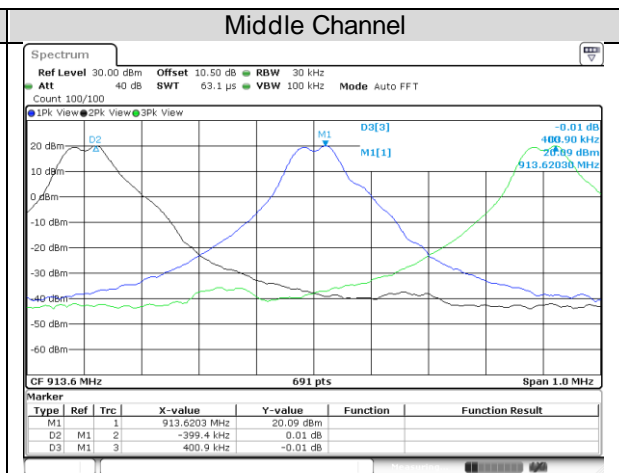
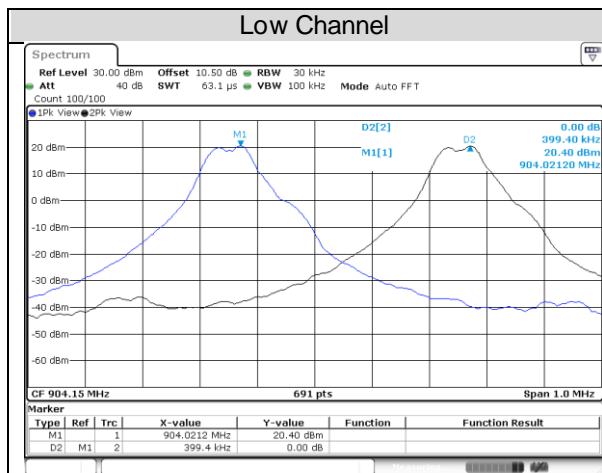
Test Procedure

Measurement Procedure REF

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
- c. By using the MaxHold function record the separation of two adjacent channels.
- d. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
- e. Repeat above procedures until all frequencies measured were complete.

Test Results

Channel	Channel Frequency (MHz)	Adjacent Channel Separation (MHz)	20 dB Bandwidth (kHz)	Minimum Limit (MHz)	Result
Low Channel	904.00	0.40	0.086	0.086	Pass
Middle Channel	913.60	0.40	0.086	0.086	Pass
High Channel	923.60	0.40	0.086	0.086	Pass



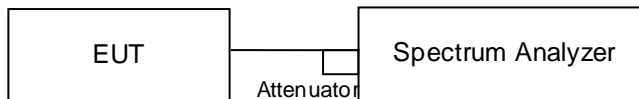
5.1.7 Number of Hopping Frequency

Limit

If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies.

Kind of Test Site Shielded room

Test Setup



Test Instruments

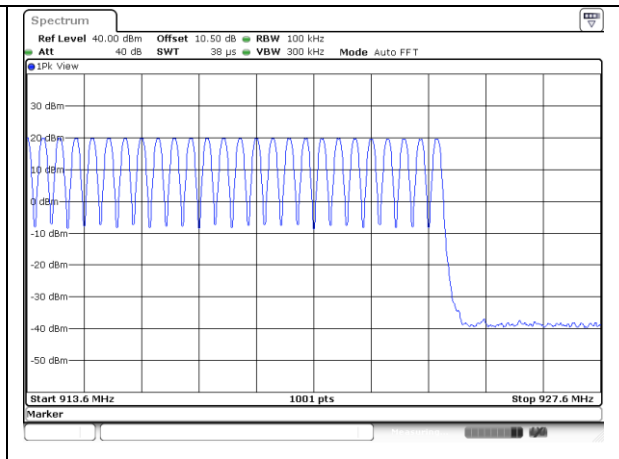
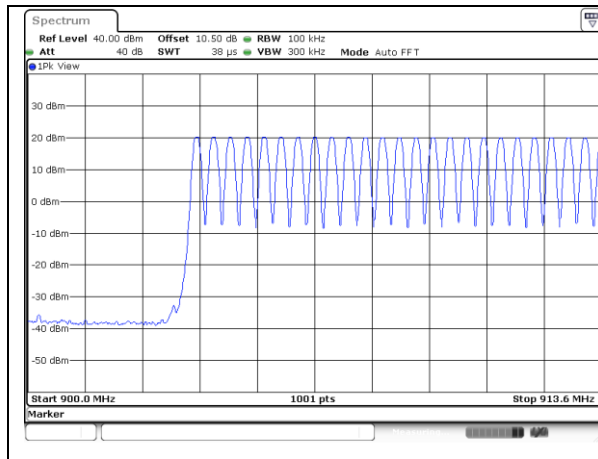
Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV	101513	2023/05/10	2024/05/09	2023/10/16	2023/12/4

Test Procedure

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- Set the SA on View mode and then plot the result on SA screen.
- Repeat above procedures until all frequencies measured were complete.

Test Results

Frequency Range	Measured Quantity of Hopping Channel	Min. Limit (Channels)	Result
904 to 923.6 MHz	50	50	Pass



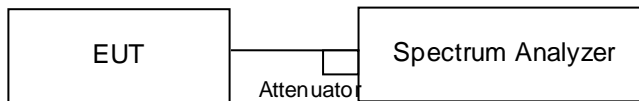
5.1.8 Dwell Time

Limit

If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

Kind of Test Site Shielded room

Test Setup



Test Instruments

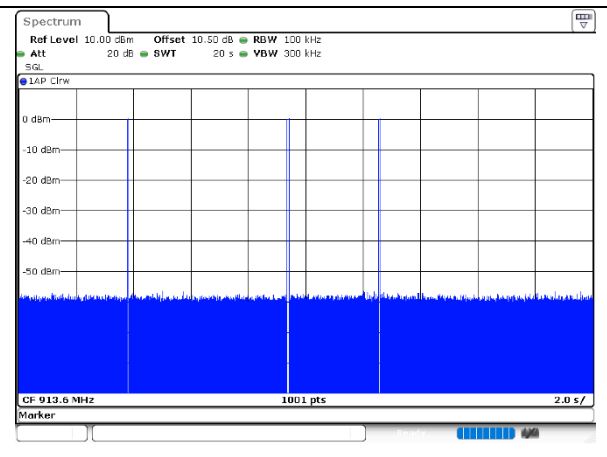
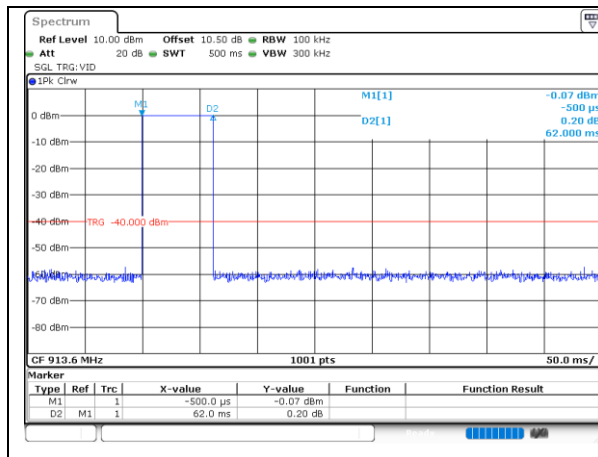
Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV	101513	2023/05/10	2024/05/09	2023/10/16	2023/12/4

Test Procedures

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Adjust the center frequency of SA on any frequency to be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- Repeat above procedures until all different time-slot modes have been completed.

Test Results

Number of transfer in a 20 (50Hopping*0.4s)	Package transfer time (msec)	Dwell time (ms)	Limit (ms)	Result
3 (times / 20 sec) * 1 = 3 times	62.00	186.00	400	Pass



Appendix A: Test Results of Radiated Spurious Emissions

Spurious Emissions, Tx Mode, 9kHz ~ 30MHz

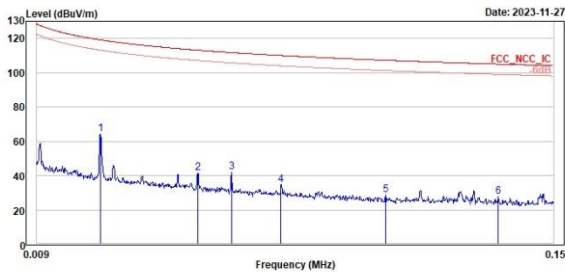
904MHz

CH0 (Open) 9kHz~150kHz

CH0 (Open) 150kHz~30MHz



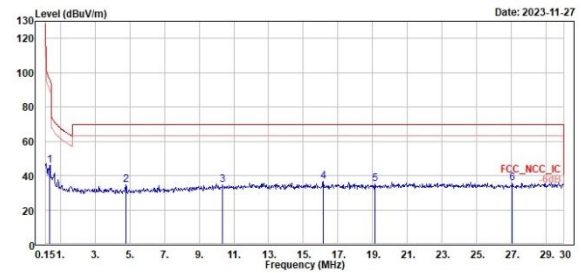
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Peak	Freq (MHz)	Level (dBuV/m)	Read Level (dBuV)	Level Factor (dB/m)	Limit Line (dBuV/m)	Over Limit (dB)	APos (cm)	TPos (deg)	Remark	Pol/Phase	Note
1	0.03	64.40	45.53	18.95	119.13	-54.65	100	209	Peak	Open	
2	0.05	41.38	22.34	19.04	113.11	-71.73	100	50	Peak	Open	
3	0.06	41.00	22.98	18.02	111.72	-69.92	100	353	Peak	Open	
4	0.08	34.40	15.90	18.50	110.01	-75.61	100	69	Peak	Open	
5	0.10	28.43	10.49	17.94	107.24	-78.81	100	276	Peak	Open	
6	0.13	27.56	9.50	18.06	105.00	-77.44	100	223	Peak	Open	



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Peak	Freq (MHz)	Level (dBuV/m)	Read Level (dBuV)	Level Factor (dB/m)	Limit Line (dBuV/m)	Over Limit (dB)	APos (cm)	TPos (deg)	Remark	Pol/Phase	Note
1	0.39	45.83	27.04	18.79	95.61	-49.98	100	156	Peak	Open	
2	4.78	34.69	15.17	19.52	69.50	-34.81	100	184	Peak	Open	
3	10.36	34.73	13.13	21.60	69.50	-34.77	100	213	Peak	Open	
4	16.15	36.45	14.43	22.02	69.50	-33.05	100	351	Peak	Open	
5	19.10	35.22	12.98	22.24	69.50	-34.28	100	156	Peak	Open	
6	27.04	35.42	13.06	22.36	69.50	-34.08	100	327	Peak	Open	

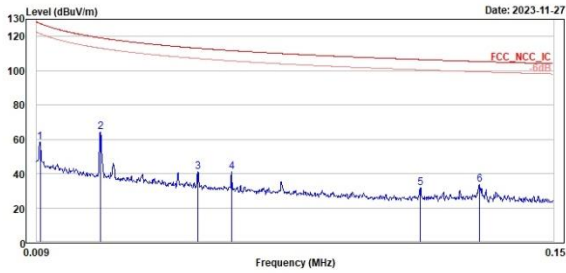
913.6MHz

CH24 (Open) 9kHz~150kHz

CH24 (Open) 150kHz~30MHz



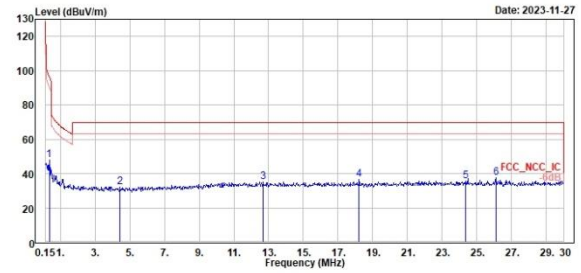
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Peak	Freq (MHz)	Level (dBuV/m)	Read Level (dBuV)	Level Factor (dB/m)	Limit Line (dBuV/m)	Over Limit (dB)	APos (cm)	TPos (deg)	Remark	Pol/Phase	Note
1	0.01	58.48	48.76	17.72	127.50	-69.12	100	166	Peak	Open	
2	0.03	64.32	45.37	18.95	119.13	-54.81	100	48	Peak	Open	
3	0.05	41.13	22.09	19.04	113.11	-71.98	100	343	Peak	Open	
4	0.06	41.14	22.32	18.82	111.72	-70.50	100	360	Peak	Open	
5	0.11	31.48	13.51	17.97	106.49	-75.01	100	101	Peak	Open	
6	0.13	33.49	15.45	18.04	105.34	-71.85	100	168	Peak	Open	



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Peak	Freq (MHz)	Level (dBuV/m)	Read Level (dBuV)	Level Factor (dB/m)	Limit Line (dBuV/m)	Over Limit (dB)	APos (cm)	TPos (deg)	Remark	Pol/Phase	Note
1	0.36	47.96	29.18	18.78	95.50	-48.54	100	189	Peak	Open	
2	4.45	32.35	12.80	19.55	69.50	-37.15	100	302	Peak	Open	
3	12.69	35.21	13.44	21.77	69.50	-34.29	100	345	Peak	Open	
4	18.21	36.37	14.20	22.17	69.50	-33.13	100	73	Peak	Open	
5	24.33	35.58	13.25	22.33	69.50	-33.92	100	195	Peak	Open	
6	26.12	37.52	15.17	22.35	69.50	-31.98	100	178	Peak	Open	

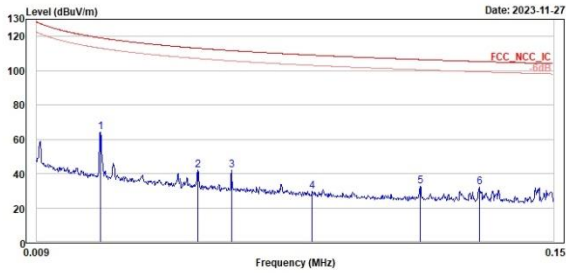
923.6MHz

CH49 (Open) 9kHz~150kHz

CH49 (Open) 150kHz~30MHz



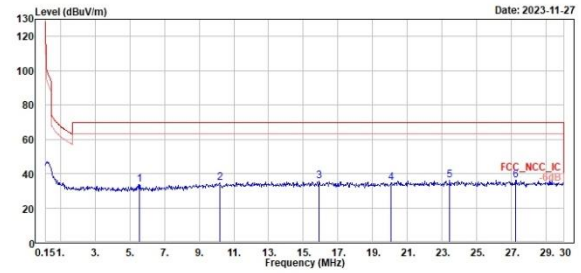
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Peak	Freq (MHz)	Level (dBuV/m)	Read Level (dBuV)	Level Factor (dB/m)	Limit Line (dBuV/m)	Over Limit (dB)	APos (cm)	TPos (deg)	Remark	PoL/Phase	Note
1	0.03	64.36	45.41	18.95	119.13	-54.77	100	304	Peak	Open	
2	0.05	42.04	23.00	19.04	113.11	-71.07	100	360	Peak	Open	
3	0.06	41.92	23.10	18.82	111.72	-69.80	100	21	Peak	Open	
4	0.08	29.65	11.35	18.30	109.09	-79.44	100	138	Peak	Open	
5	0.11	32.82	14.85	17.97	106.49	-73.67	100	360	Peak	Open	
6	0.13	31.89	13.85	18.04	105.34	-73.45	100	211	Peak	Open	



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Peak	Freq (MHz)	Level (dBuV/m)	Read Level (dBuV)	Level Factor (dB/m)	Limit Line (dBuV/m)	Over Limit (dB)	APos (cm)	TPos (deg)	Remark	PoL/Phase	Note
1	5.55	33.39	13.66	19.73	69.50	-36.11	100	59	Peak	Open	
2	10.18	34.51	12.92	21.59	69.50	-34.09	100	214	Peak	Open	
3	15.91	35.40	13.40	22.00	69.50	-34.10	100	249	Peak	Open	
4	20.06	34.84	12.54	22.30	69.50	-34.66	100	156	Peak	Open	
5	23.43	35.89	13.56	22.33	69.50	-33.61	100	298	Peak	Open	
6	27.22	36.11	13.75	22.36	69.50	-33.39	100	90	Peak	Open	

Spurious Emissions, Tx Mode, 30MHz ~ 1GHz

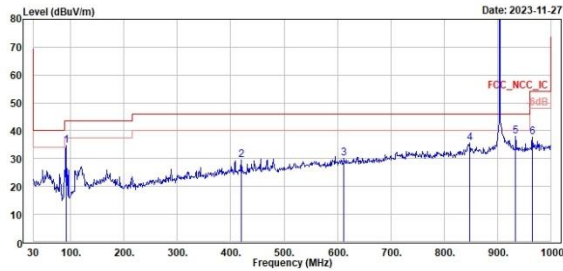
904MHz

CH 0 (Horizontal)

CH 0 (Vertical)



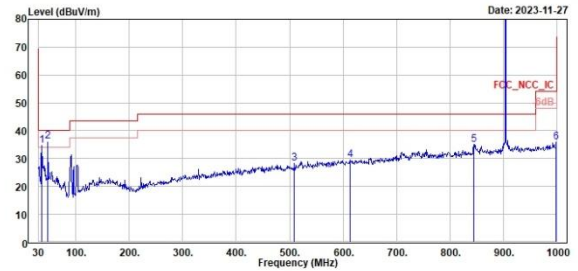
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1	2	3	4	5	6				
91.11	419.94	612.00	848.68	934.04	966.05				
MHz	Level	Read	Limit	Over	APos				
	dBuV/m	Level	Line	Limit	TPos				
		Factor			deg				
		dB/m	dB/m	dBuV/m	cm				
					deg				
1	34.59	46.65	-12.06	43.50	-8.91	200	21	Peak	Horizontal
2	29.49	32.14	-2.65	46.00	-16.51	200	168	Peak	Horizontal
3	30.11	29.58	0.53	46.00	-15.89	200	170	Peak	Horizontal
4	35.60	31.53	4.07	46.00	-10.40	300	60	Peak	Horizontal
5	38.16	32.75	5.41	46.00	-7.84	100	14	Peak	Horizontal
6	37.64	31.91	5.73	54.00	-16.36	100	321	Peak	Horizontal



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1	2	3	4	5	6				
35.82	47.46	509.18	612.97	844.80	999.03				
MHz	Level	Read	Limit	Over	APos				
	dBuV/m	Level	Line	Limit	TPos				
		Factor			deg				
		dB/m	dB/m	dBuV/m	cm				
					deg				
1	34.58	42.07	-7.49	40.00	-5.42	300	117	Peak	Vertical
2	36.31	42.14	-5.83	40.00	-3.69	100	341	Peak	Vertical
3	28.19	29.52	-1.33	46.00	-17.81	200	225	Peak	Vertical
4	29.37	28.81	0.56	46.00	-16.63	100	262	Peak	Vertical
5	34.94	30.82	4.12	46.00	-11.06	141	0	Peak	Vertical
6	35.87	29.63	6.24	54.00	-18.13	100	352	Peak	Vertical

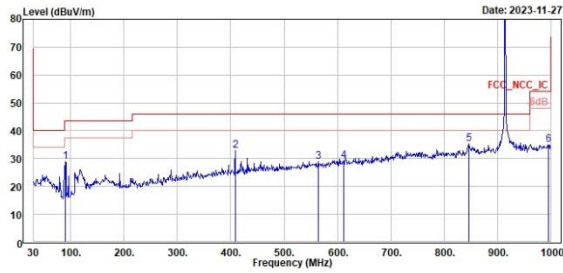
913.6MHz

CH 24 (Horizontal)

CH 24 (Vertical)



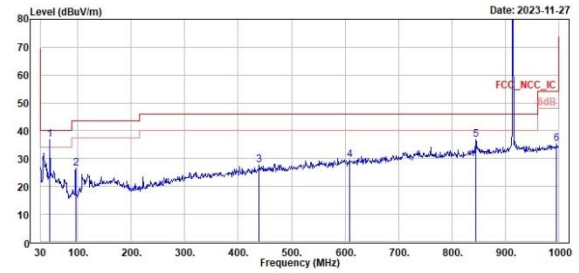
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Peak	Freq (MHz)	Level (dBuV/m)	Read Level (dBuV)	Level Factor (dB/m)	Limit Line (dBuV/m)	Over Limit (dB)	APos (cm)	TPos (deg)	Remark	Pol/Phase	Note
1	98.14	28.98	41.04	-12.06	43.50	-14.52	300	14	Peak	Horizontal	
2	408.30	32.96	35.78	-2.82	46.00	-13.04	100	223	Peak	Horizontal	
3	564.47	28.93	29.33	-0.40	46.00	-17.07	100	230	Peak	Horizontal	
4	612.00	29.22	28.69	0.53	46.00	-16.78	124	44	Peak	Horizontal	
5	846.74	35.39	31.29	4.10	46.00	-10.61	200	284	Peak	Horizontal	
6	996.12	34.92	28.69	6.23	54.00	-19.00	100	201	Peak	Horizontal	



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Peak	Freq (MHz)	Level (dBuV/m)	Read Level (dBuV)	Level Factor (dB/m)	Limit Line (dBuV/m)	Over Limit (dB)	APos (cm)	TPos (deg)	Remark	Pol/Phase	Note
1	47.46	36.74	43.57	-5.83	40.00	-3.26	100	5	Peak	Vertical	
2	95.96	26.45	37.78	-11.33	43.50	-17.05	100	83	Peak	Vertical	
3	439.34	27.71	29.69	-1.98	46.00	-18.29	200	67	Peak	Vertical	
4	608.12	29.47	29.02	0.45	46.00	-16.53	100	48	Peak	Vertical	
5	844.80	36.76	32.64	4.12	46.00	-9.24	100	97	Peak	Vertical	
6	996.12	35.22	28.99	6.23	54.00	-18.78	200	190	Peak	Vertical	

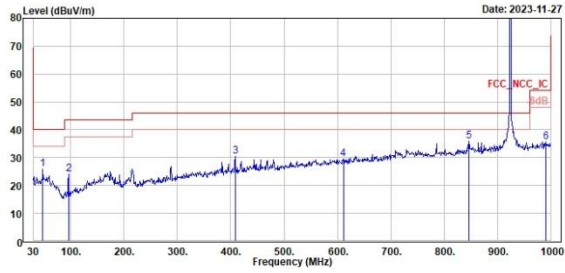
923.6MHz

CH 49 (Horizontal)

CH 49 (Vertical)



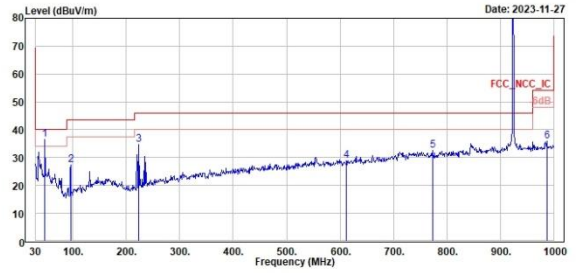
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Peak	Freq	Level	Read	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	47.46	25.93	31.76	-5.83	40.00	-14.07	300	244 Peak	Horizontal	
2	95.96	23.88	35.21	-11.33	43.50	-19.62	200	118 Peak	Horizontal	
3	408.30	30.50	33.32	-2.82	46.00	-15.50	100	177 Peak	Horizontal	
4	611.03	29.50	28.99	0.51	46.00	-16.50	200	225 Peak	Horizontal	
5	846.74	36.01	31.91	4.10	46.00	-9.99	200	286 Peak	Horizontal	
6	990.30	35.62	29.41	6.21	54.00	-18.38	100	325 Peak	Horizontal	



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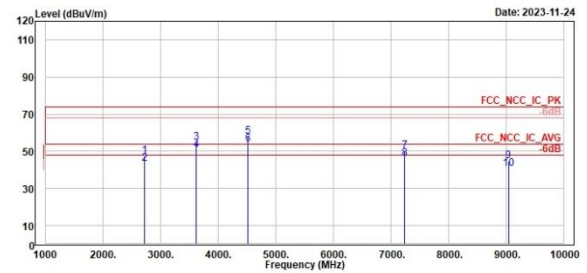
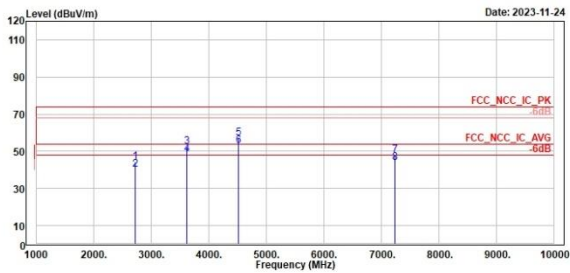
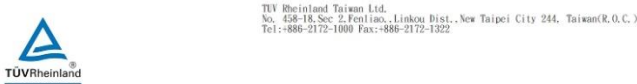
Peak	Freq	Level	Read	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	47.46	36.46	42.29	-5.83	40.00	-3.54	101	0 Peak	Vertical	
2	95.96	27.43	38.76	-11.33	43.50	-16.07	100	113 Peak	Vertical	
3	223.03	34.73	42.77	-8.04	46.00	-11.27	100	360 Peak	Vertical	
4	612.00	28.75	28.22	0.53	46.00	-17.25	200	349 Peak	Vertical	
5	773.02	32.49	29.66	2.83	46.00	-13.51	100	183 Peak	Vertical	
6	987.39	35.81	29.78	6.03	54.00	-18.19	100	89 Peak	Vertical	

Spurious Emissions, Tx Mode, 1GHz ~ 10GHz

904MHz

CH 0 (Horizontal)

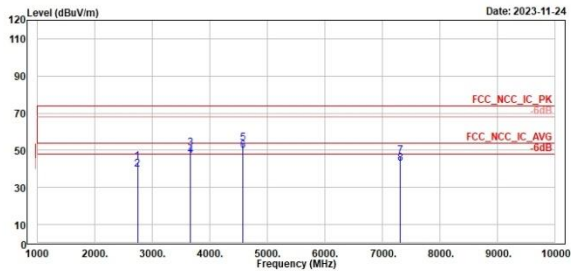
CH 0 (Vertical)



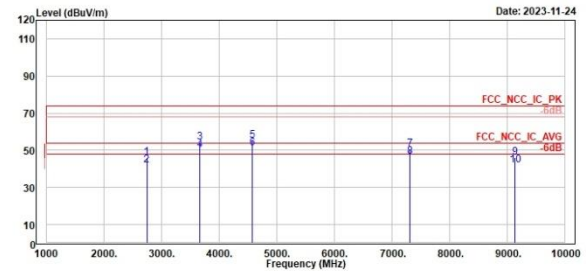
Freq	Level	Read	Level	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	2712.00	44.41	56.84	-12.43	74.00	-29.59	490	360 Peak	Horizontal	
2	2712.00	40.30	52.73	-12.43	54.00	-13.70	490	360 Average	Horizontal	
3	3616.00	52.28	62.92	-10.64	74.00	-21.72	490	360 Peak	Horizontal	
4	3616.00	48.17	58.81	-10.64	54.00	-5.83	490	360 Average	Horizontal	
5	4520.00	57.22	65.76	-8.54	74.00	-16.78	490	360 Peak	Horizontal	
6	4520.00	53.11	61.65	-8.54	54.00	-9.89	490	360 Average	Horizontal	
7	7232.00	47.77	53.49	-5.72	74.00	-26.23	490	360 Peak	Horizontal	
8	7232.00	43.66	49.38	-5.72	54.00	-10.34	490	360 Average	Horizontal	

Freq	Level	Read	Level	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg			
1	2712.00	47.47	59.90	-12.43	74.00	-26.53	490	14 Peak	Vertical	
2	2712.00	43.36	55.79	-12.43	54.00	-10.64	490	14 Average	Vertical	
3	3616.00	54.96	65.60	-10.64	74.00	-19.04	313	224 Peak	Vertical	
4	3616.00	50.85	61.49	-10.64	54.00	-3.15	313	224 Average	Vertical	
5	4520.00	57.91	66.45	-8.54	74.00	-16.09	350	0 Peak	Vertical	
6	4520.00	53.80	62.34	-8.54	54.00	-9.20	350	0 Average	Vertical	
7	7232.00	50.23	55.95	-5.72	74.00	-23.77	490	58 Peak	Vertical	
8	7232.00	46.12	51.84	-5.72	54.00	-7.88	490	58 Average	Vertical	
9	9040.00	44.58	48.62	-4.04	74.00	-29.42	300	360 Peak	Vertical	
10	9040.00	40.47	44.51	-4.04	54.00	-13.53	300	360 Average	Vertical	

913.6MHz
CH 24 (Horizontal)
CH 24 (Vertical)

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Read	Limit	Over	APos	TPos	Remark	Pol/Phase	Note			
Level	Line	Limit	cm	deg						
Factor	dB/m	dB								
dB/m	dB/m	dB	cm	deg						
1	2748.80	43.87	56.37	-12.58	74.00	-38.13	480	165 Peak	Horizontal	
2	2748.80	39.76	52.26	-12.58	54.00	-14.24	480	165 Average	Horizontal	
3	3654.40	51.24	61.76	-10.52	74.00	-22.76	400	43 Peak	Horizontal	
4	3654.40	47.13	57.65	-10.52	54.00	-6.87	400	43 Average	Horizontal	
5	4568.00	53.67	61.99	-8.32	74.00	-20.33	400	30 Peak	Horizontal	
6	4568.00	49.56	57.88	-8.32	54.00	-4.44	400	30 Average	Horizontal	
7	7388.80	47.01	52.88	-5.79	74.00	-26.99	380	28 Peak	Horizontal	
8	7388.80	42.90	48.69	-5.79	54.00	-11.10	380	28 Average	Horizontal	


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Read	Limit	Over	APos	TPos	Remark	Pol/Phase	Note			
Level	Line	Limit	cm	deg						
Factor	dB/m	dB								
dB/m	dB/m	dB	cm	deg						
1	2748.80	46.02	58.52	-12.58	74.00	-27.98	253	360 Peak	Vertical	
2	2748.80	41.91	54.41	-12.58	54.00	-12.09	253	360 Average	Vertical	
3	3654.40	54.49	65.01	-10.52	74.00	-19.51	354	0 Peak	Vertical	
4	3654.40	50.38	60.90	-10.52	54.00	-3.62	354	0 Average	Vertical	
5	4568.00	55.35	63.67	-8.32	74.00	-18.65	371	0 Peak	Vertical	
6	4568.00	51.24	59.56	-8.32	54.00	-2.76	371	0 Average	Vertical	
7	7388.80	50.51	56.38	-5.79	74.00	-23.49	358	0 Peak	Vertical	
8	7388.80	46.40	52.19	-5.79	54.00	-7.60	358	0 Average	Vertical	
9	9136.00	45.87	49.62	-3.75	74.00	-28.13	400	190 Peak	Vertical	
10	9136.00	41.76	45.51	-3.75	54.00	-12.24	400	190 Average	Vertical	

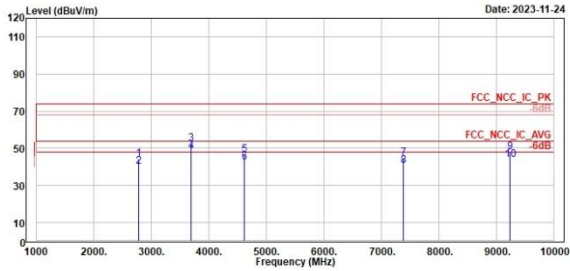
923.6MHz

CH 49 (Horizontal)

CH 49 (Vertical)



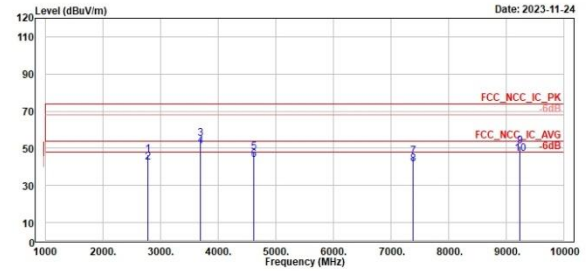
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Line	Freq	Level	Read	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	2770.00	44.41	56.00	-12.39	74.00	-29.59	300	290 Peak	Horizontal	
2	2770.00	40.30	52.69	-12.39	54.00	-13.70	300	290 Average	Horizontal	
3	3694.40	52.68	63.09	-10.41	74.00	-21.32	300	28 Peak	Horizontal	
4	3694.40	48.57	58.98	-10.41	54.00	-5.43	300	28 Average	Horizontal	
5	4618.00	46.46	54.70	-8.24	74.00	-27.54	300	16 Peak	Horizontal	
6	4618.00	42.35	50.59	-8.24	54.00	-11.65	300	16 Average	Horizontal	
7	7388.00	44.83	50.64	-5.81	74.00	-29.17	400	41 Peak	Horizontal	
8	7388.00	40.72	46.53	-5.81	54.00	-13.28	400	41 Average	Horizontal	
9	9236.00	47.96	51.76	-3.80	74.00	-26.04	400	78 Peak	Horizontal	
10	9236.00	43.85	47.65	-3.80	54.00	-10.15	400	78 Average	Horizontal	



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Line	Freq	Level	Read	Limit	Over	APos	TPos	Remark	Pol/Phase	Note
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	2770.00	46.33	50.72	-12.39	74.00	-27.67	100	158 Peak	Vertical	
2	2770.00	42.22	54.61	-12.39	54.00	-11.78	100	158 Average	Vertical	
3	3694.40	55.00	65.41	-10.41	74.00	-19.00	300	0 Peak	Vertical	
4	3694.40	50.89	61.30	-10.41	54.00	-3.11	300	0 Average	Vertical	
5	4618.00	47.00	56.04	-8.24	74.00	-26.20	400	295 Peak	Vertical	
6	4618.00	43.09	51.93	-8.24	54.00	-10.31	400	295 Average	Vertical	
7	7388.00	45.48	51.29	-5.81	74.00	-28.52	300	354 Peak	Vertical	
8	7388.00	41.37	47.18	-5.81	54.00	-12.63	300	354 Average	Vertical	
9	9236.00	51.11	54.91	-3.80	74.00	-22.89	378	0 Peak	Vertical	
10	9236.00	47.00	50.80	-3.80	54.00	-7.00	378	0 Average	Vertical	