Prüfbericht-Nr.: *Test report no.*:	**CN24DWWF 001**	**Auftrags-Nr.:** *Order no.*:	168493211	Seite 1 von 23 *Page 1 of 23*
Kunden-Referenz-Nr.: *Client reference no.*:	N/A	**Auftragsdatum:** *Order date:*	2024-07-08	
Auftraggeber: *Client*:	Sensitech Inc. 800 Cummings Center Suite 258X, Beverly MA 01915-6197 USA			
Prüfgegenstand: *Test item*:	Sensor			
Bezeichnung / Typ-Nr.: *Identification / Type no.*:	T11013320			
Auftrags-Inhalt: *Order content*:	Test Report			
Prüfgrundlage: *Test specification*:	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.209 CFR47 FCC Part 2: Section 2.1093 RSS-247-Issue 3 August 2023 RSS-Gen Issue 5 March 2019 RSS-102 Issue 5 March 2015			

Wareneingangsdatum: *Date of sample receipt*:	2024-07-10
Prüfmuster-Nr.: *Test sample no:*	A003760136-005
Prüfzeitraum: *Testing period*:	2024-07-23 - 2024-07-24
Ort der Prüfung: *Place of testing*:	Shanghai ATBL Technology Co., Ltd.
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland (Shenzhen) Co., Ltd.
Prüfergebnis*: *Test result**:	Pass

geprüft von: tested by:	x Lin Lin	**genehmigt von:** *authorized by*:	x Hardy Suo
Datum: *Date:*	2024-11-05	**Ausstellungsdatum:** *Issue date:*	2024-11-05
Stellung / Position:	Sachverständige(r)/Expert	**Stellung** / Position:	Sachverständige(r)/Expert

Sonstiges / *Other*: FCC ID: SRMT11013320
IC: 6654A-T11013320 HVIN: T11013320

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery*: Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged*

* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
** Legend:*	*P(ass) = passed a.m. test specification(s)*	*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Anmerkungen
Remarks

1	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. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. *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.*
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3	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. *Test clauses with remark of * are subcontracted to qualified subcontractors and descripted under the respective test clause in the report.* *Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.*
4	Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnisen 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 bezueglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019. *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.*

Test Summary

5.1.1 ANTENNA REQUIREMENT
RESULT: Pass

5.1.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER
RESULT: Pass

5.1.3 20DB&99% BANDWIDTH
RESULT: Pass

5.1.4 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHZ BANDWIDTH
RESULT: Pass

5.1.5 RADIATED SPURIOUS EMISSION
RESULT: Pass

5.1.6 CARRIER FREQUENCY SEPARATION
RESULT: Pass

5.1.7 NUMBER OF HOPPING FREQUENCY
RESULT: Pass

5.1.8 TIME OF OCCUPANCY
RESULT: Pass

6.1.1 ELECTROMAGNETIC FIELDS
RESULT: Pass

Contents

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: Photographs of the Test Set-up

Appendix B: Test Results.

2 Test Sites

2.1 Test Facilities

Shanghai ATBL Technology Co., Ltd.

5-6/F., Unit 1, No 8, Free Trade One Life Science and Sci-Tech Industrial Park,No.160, Basheng Road, Pudong New District,Shanghai City, China

FCC Registration No.: 0031025281

ISED Company No: 27371

Note: TÜV Rheinland (Shenzhen) Co., Ltd. subcontracts all tests to Shanghai ATBL Technology Co., Ltd. The tests at the test sites have been conducted under the supervision of a TÜV engineer.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Shanghai ATBL Technology Co., Ltd.

Radio Conducted Test

Equipment Name	Manufacturer	Model	Serial No.	Equipment No.	Calibrated until
Power meter	Anritsu	ML2496A	1935001	SHATBL-W030	2025.07.17
Power sensor	Anritsu	MA2411B	1911006	SHATBL-W031	2025.07.17
Adjustable Attenuator	Agilent	8494B	MY42144015	SHATBL-W009	2025.07.17
Environmental Test Chamber	KSON	THS-B6C-150	9159K	SHATBL-W019	2025.03.27
Spectrum analyzer	R&S	FSV40-N	101761	SHATBL-W036	2025.07.17
Thermometer	DeLi	N/A	N/A	SHATBL-W012	2025.07.17
Test Software	FALA	LZ-RF	N/A	SHATBL-W020	2025.07.17

Radiated Spurious Emissions

Equipment Name	Manufacturer	Model	Serial No.	Equipment No.	Calibrated until
Signal analyzer	Agilent	N9020A	MY50200811	SHATBL-E017	2025.03.27
Amplifier	JPT	JPA0118-55-303A	1910001800055000	SHATBL-E006	2025.03.27
Amplifier	JPT	JPA-10M1G32	21010100035001	SHATBL-E005	2025.03.27
Antenna/Turn table Controller	Brilliant	N/A	N/A	SHATBL-E007	N/A
Loop Antenna(9kHz-30MHz)	Daze	ZN30900C	20077	SHATBL-E042	2025.05.16
Bilog Antenna	SCHWARZBECK	VULB 9168	01174	SHATBL-E008	2025.05.16
Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120D	02334	SHATBL-E009	2025.05.16
Horn Antenna	COM-POWER	AH-1840	10100008	SHATBL-E043	2025.07.18
Thermometer	DeLi	N/A	N/A	SHATBL-E015	2025.07.17
Test Software	FALA	EMC-RI(Ver.4A2)	N/A	N/A	N/A

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally, all equipment is verified for proper performance on a regular basics using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

Parameter	Uncertainty
Conducted Output Power	1.266dB
Power spectral density	1.282dB
Conducted spurious emissions	1.73dB
Radiated Spurious Emission 9KHz-30MHz	2.35dB
Radiated Spurious Emission 30MHz-1GHz	3.60dB
Radiated Spurious Emission 1GHz-18GHz	5.40dB

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) Co., Ltd. file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The **Shanghai ATBL Technology Co., Ltd.** 5-6/F., Unit 1, No 8, Free Trade One Life Science and Sci-Tech Industrial Park,No.160, Basheng Road, Pudong New District,Shanghai City, China is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3 General Product Information

3.1 Product Function and Intended Use

The 11013320 (sensor) support the 915MHz wireless technology to communicate with the Gateway.

For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	Sensor
Type Designation	T11013320
FCC ID	SRMT11013320
ISED Certification Number	6654A-T11013320
HVIN	T11013320
Operating Voltage	Non-rechargeable Battery Pack, 3.0V
Testing Voltage	Battery (Full of electricity)
Antenna Type	Integral Antenna
Antenna Gain	-7.73 dBi (Max)

Technical Specification of FHSS	
Frequency Range	902.306 - 922.396MHz
Type of Modulation	GFSK
Data Rate	Up to 250Kbps
Channel Number	50 channels
Channel Separation	410 KHz

Table 3: RF Channel and Frequency of Lora FHSS

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
1	**902.306**	17	908.866	33	915.426	49	921.986
2	902.716	18	909.276	34	915.836	**50**	**922.396**
3	903.126	19	909.686	35	916.246		
4	903.536	20	910.096	36	916.656		
5	903.946	21	910.506	37	917.066		
6	904.356	22	910.916	38	917.476		
7	904.766	23	911.326	39	917.886		
8	905.176	24	911.736	40	918.296		
9	905.586	**25**	912.146	41	918.706		
10	905.996	26	912.556	42	919.116		
11	906.406	27	912.966	43	919.526		
12	906.816	28	913.376	44	919.936		
13	907.226	29	913.786	45	920.346		
14	907.636	30	914.196	46	920.756		
15	908.046	31	914.606	47	921.166		
16	908.456	32	915.016	48	921.576		

3.3 Independent Operation Modes

The basic operation modes are:

A. On, transmitting mode
    1) Low Channel
    2) Middle Channel
    3) High Channel
B. On, Transmitting on Hopping channel
C. On, Normal Operation (Radio Link)
D. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- ID Label and Location Info
- User Manual

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All tests were performed according to the procedures in ANSI C63.10: 2013.

4.3 Special Accessories and Auxiliary Equipment

Table 4: Auxiliary Equipment Used during Test

Description	Manufacturer	Model	S/N	Rating
--	--	--	--	--

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 30MHz)

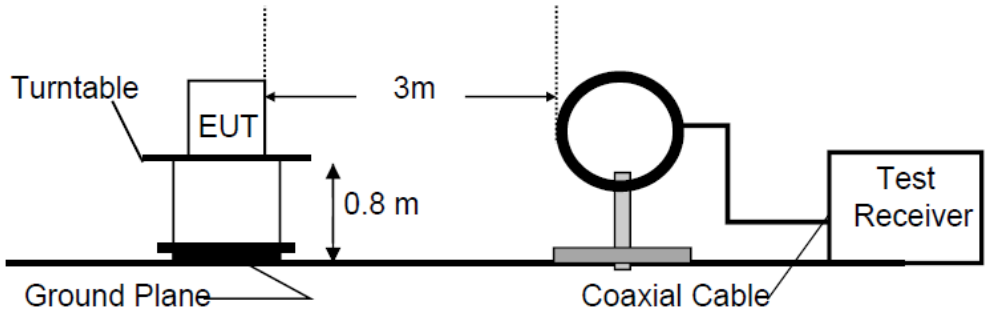


Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

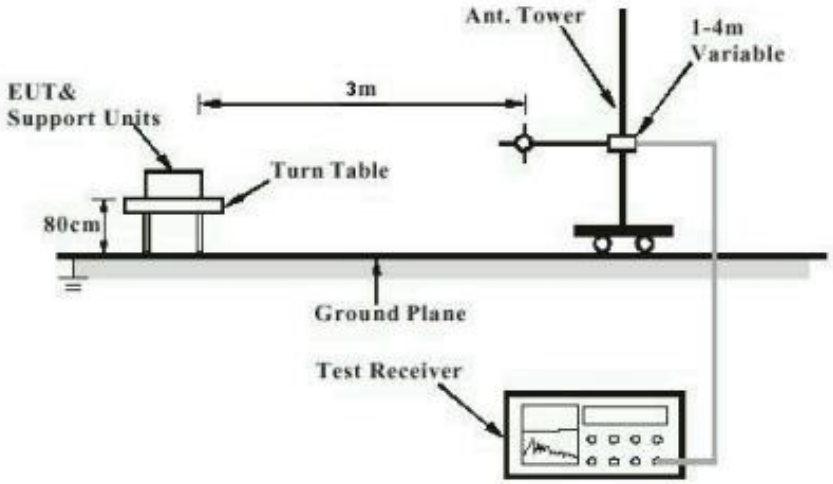


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

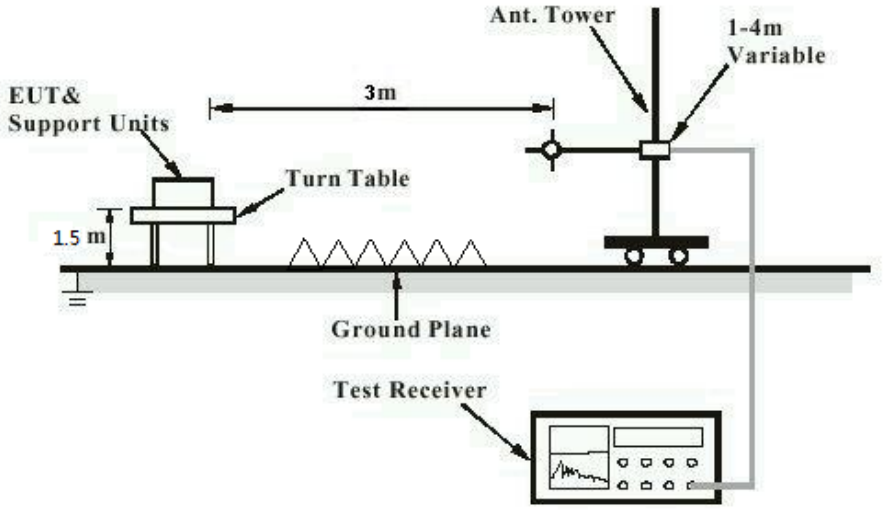
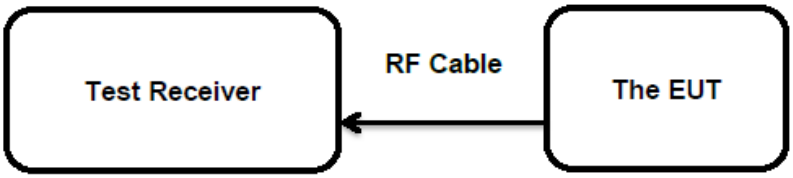


Diagram of Measurement Configuration for Conducted Transmitter Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT: **Pass**

Test Specification

Test standard : FCC Part 15.247(b)(4) and Part 15.203
RSS-Gen Clause 6.8

According to the manufacturer declared, the EUT has an integral antenna, the directional gain of antenna is -7.73 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

5.1.2 Maximum Peak Conducted Output Power

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(b)(2) RSS-247 Clause 5.4(b)
Basic standard	:	ANSI C63.10: 2013
Limits	:	Not more than 1Watt(30dBm) for FHSS with at least 50 hopping channels in the band 902-928MHz < 4 W (e.i.r.p.)
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2024-07-23
Input voltage	:	Fully charged battery
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	25.4 ℃
Relative humidity	:	52.5 %
Atmospheric pressure	:	101 kPa

Table 5: Test Result of Maximum Peak Conducted Output Power, Lora FHSS

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(W)	
A	902.306	13.83	0.0242	< 1W
	912.146	13.72	0.0236	
	922.396	13.53	0.0225	
Max. Measured Value		13.83	0.0242	

Note:
1) The cable loss is taken into account in results.
2) Antenna gain(G): -7.73 dBi, max.e.i.r.p. = 13.83 + (-7.73) = 11.1dBm =0.0129W < 4W

5.1.3 20dB&99% Bandwidth

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(a)(1) (i) RSS-Gen Clause 6.7
Basic standard	:	ANSI C63.10: 2013
Limits	:	< 250KHz for at least 50 hopping frequencies >=250KHz for at least 25 hooping frequencies
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2024-07-23
Input voltage	:	Fully charged battery
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	25.4 ℃
Relative humidity	:	52.5 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix B.

Table 6: Test Result of 20dB Bandwidth

Test Mode	Channel Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit (MHz)
A	902.306	192.2	175.1	<250KHz
	912.146	242.9	193.0	
	922.396	192.8	179.5	

Note: The fundamental emissions stay within the allocated band 902-928MHz.

5.1.4 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(d) RSS-247 Clause 5.5
Basic standard	:	ANSI C63.10: 2013
Limits	:	20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power); In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2024-07-23
Input voltage	:	Fully charged battery
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	25.4 ℃
Relative humidity	:	52.5 %
Atmospheric pressure	:	101 kPa

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to test plots, and compliance is achieved as well.

For the measurement records, refer to the appendix B.

5.1.5 Radiated Spurious Emission

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(d) & FCC Part 15.205 RSS-247 Clause 3.3
Basic standard	:	ANSI C63.10: 2013
Limits	:	Refer to 15.209(a) of FCC part 15.247(d) RSS-Gen Table 6 & Table 7
Kind of test site	:	3m Semi-anechoic Chamber

Test Setup

Date of testing	:	2024-07-24
Input voltage	:	Fully charged battery
Operation mode	:	A, B
Test channel	:	Low / Middle / High
Ambient temperature	:	Refer to test result
Relative humidity	:	Refer to test result
Atmospheric pressure	:	101 kPa

Remark:
Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst-case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix B.

5.1.6 Carrier Frequency Separation

RESULT: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(a)(1) RSS-247 Clause 5.1(b)
Basic standard	:	ANSI C63.10: 2013
Limits	:	≥ 25kHz or 20dB bandwidth, whichever is greater
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2024-07-23
Input voltage	:	Fully charged battery
Operation mode	:	B
Test channel	:	Low / Middle / High
Ambient temperature	:	25.4 ℃
Relative humidity	:	52.5 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix B.

Table 7: Test Result of Carrier Frequency Separation

Test Mode	Channel	Channel Frequency (MHz)	Measured Channel Separation (KHz)	Limit (kHz)	Result
Hopping	Low Channel	902.306	360.9	≥ 20dB bandwidth	Pass
	Adjacency Channel	902.716			
	Middle Channel	912.146	408.7		Pass
	Adjacency Channel	912.556			
	High Channel	921.986	462.3		Pass
	Adjacency Channel	922.396			

Note:

The limit is maximum 2/3 of the 20 dB bandwidth: 161.9 KHz.

5.1.7 Number of Hopping Frequency

RESULT: **Pass**

Test Specification

Test standard	:	FCC part 15.247(a)(1)(iii) RSS-247 Clause 5.1(d)
Basic standard	:	ANSI C63.10: 2013
Limits	:	≥ 50 non-overlapping channels
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2024-07-24
Input voltage	:	Fully charged battery
Operation mode	:	B
Ambient temperature	:	25.4 ℃
Relative humidity	:	52.5 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix B.

Table 8: Test result of hopping channel number

Test Mode	20dB Bandwidth(kHz)	Hopping frequencies	Limit
Hopping	20dB Bandwidth < 250	50	≥50

5.1.8 Time of Occupancy

RESULT: **Pass**

Test Specification

Test standard	:	FCC part 15.247(a)(1)(iii) RSS-247 Clause 5.1(d)
Basic standard	:	ANSI C63.10: 2013
Limits	:	< 0.4s
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2024-07-24
Input voltage	:	Fully charged battery
Operation mode	:	B
Test channel	:	Low / Middle / High
Ambient temperature	:	25.4 ℃
Relative humidity	:	52.5 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix B.

Table 9: Test result of Channel Occupancy

Test Mode	20dB Bandwidth(kHz)	Period (s)	Channel Occupancy Time (ms)	Limit (ms)
Hopping	20dB Bandwidth < 250	20	31.88	400

6 Safety Human Exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT: **Pass**

Test Specification

Test standard : CFR47 FCC Part 2: Section 2.1091
CFR47 FCC Part 1: Section 1.1310
FCC KDB Publication 447498 v06
FCC KDB Publication 865664 D02 v01r02
RSS-102 Issue 5 March 2015

FCC Requirement: Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 20cm normally can be maintained between the user and the device.

MPE Calculation Method

Power Density: $S_{(mW/cm^2)}= PG/4\pi R^2$ or $EIRP/4\pi R^2$

Where:

S = power density (mW/cm^2)

P = power input to the antenna (mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (cm)

The maximum conducted output power specified:
15.00 dBm

From the peak RF output power, the minimum mobile separation distance, d=20 cm, as well as the antenna gain (-7.73dBi), the RF power density can be calculated as below:

$S_{(mW/cm^2)}= PG/4\pi R^2 < 0.01$ mW/cm^2

Limits for Maximum Permissible Exposure (MPE) according to FCC Part 1.1310: 1.0 mW/cm^2

"RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons."

ISED Requirement:

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz[6] and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2}\ f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

The maximum conducted output power specified:
15.00 dBm and the max. antenna gain is -7.73dBi

The maximum Conducted Output Power (0.32W) and E.I.R.P.(0.05W) are less than the Exemption Limit 1.37W, so RF exposure evaluation is not required.

Conclusion
Therefore, the maximum calculations result of above comply with the requirement of Radio Frequency Exposure.

"RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons."

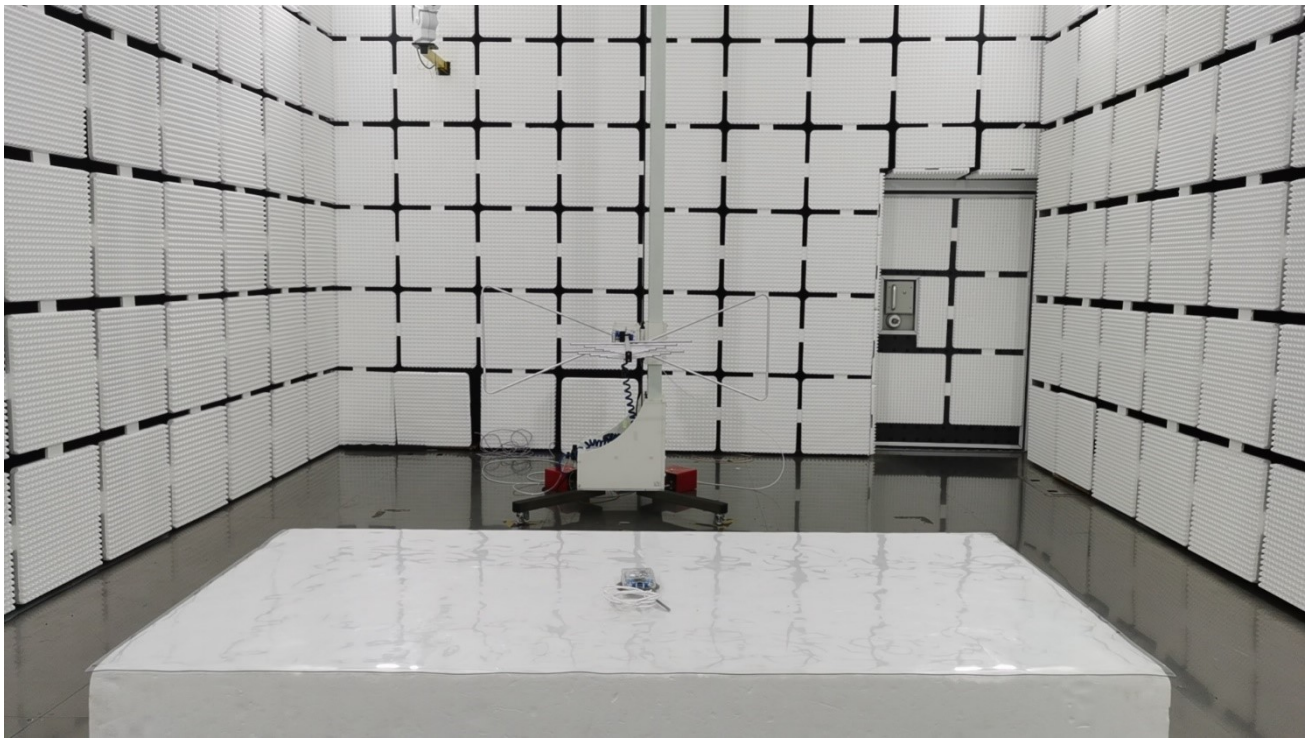
7 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix A.

8 List of Tables

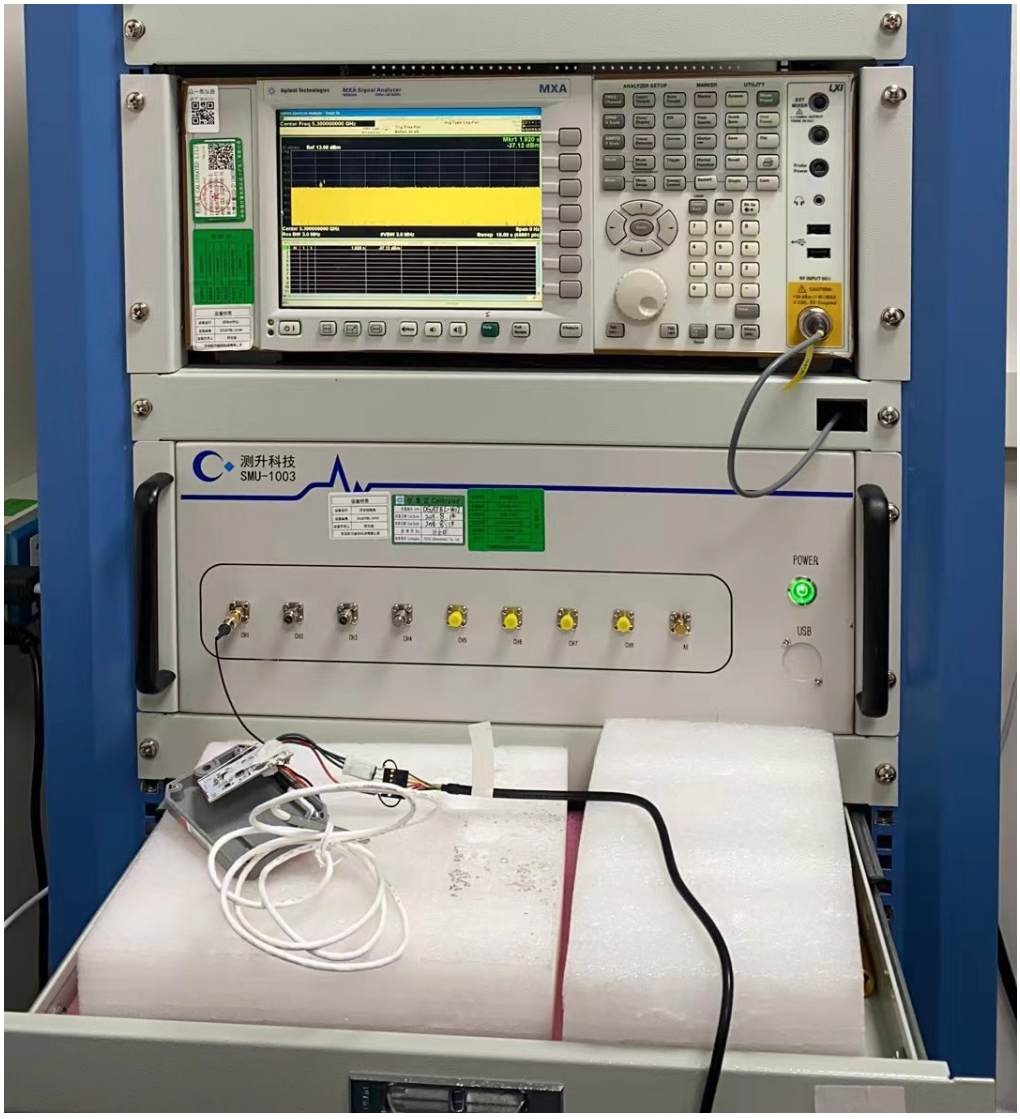
Appendix A: Photographs of the Test Set-Up

Photograph 1: Set-up for Radiated Spurious Emission, Below 1GHz



Photograph 2: Set-up for Radiated Spurious Emission, Above 1GHz

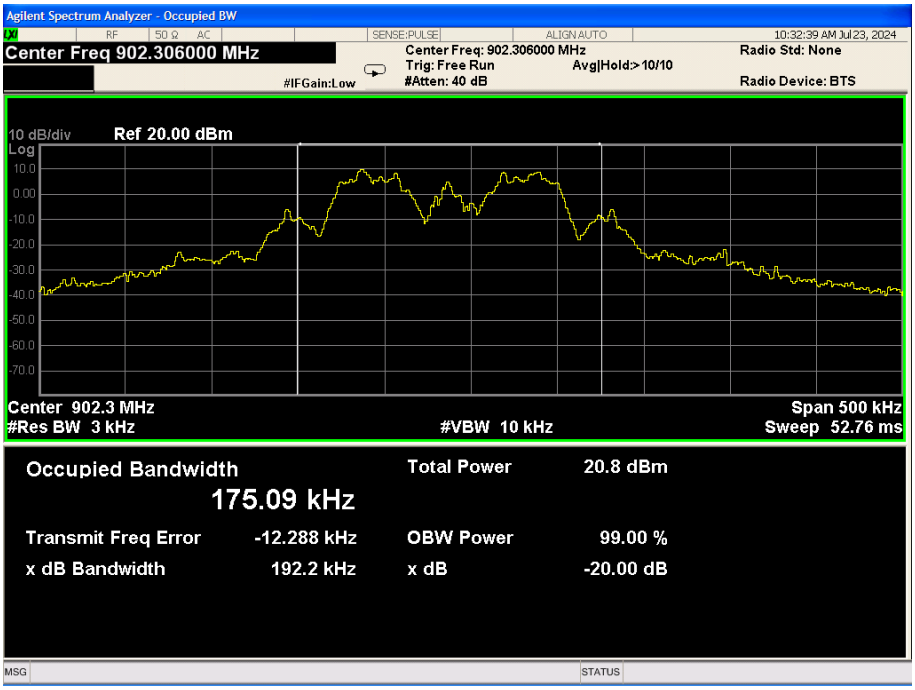
Photograph 3: Set-up for Conducted Test



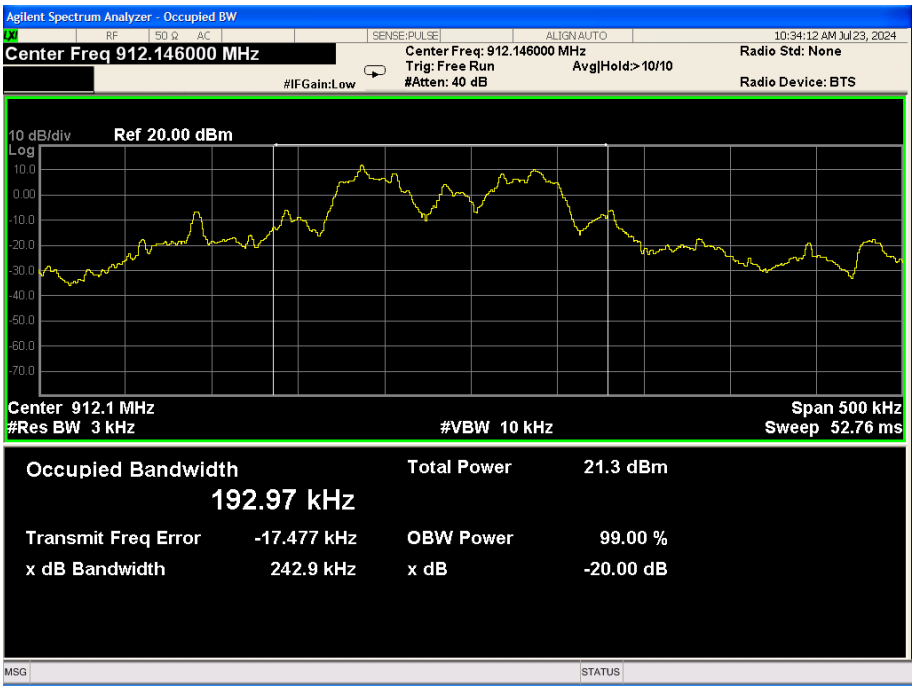
Appendix B: Test Results

Appendix B.1: 20dB & 99% Bandwidth

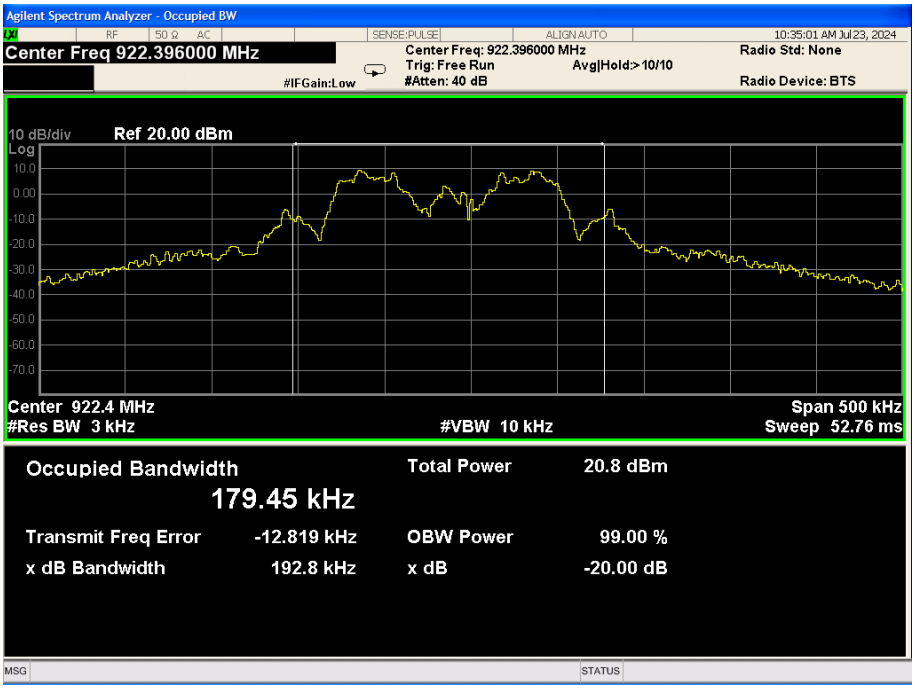
Low Channel



Middle Channel

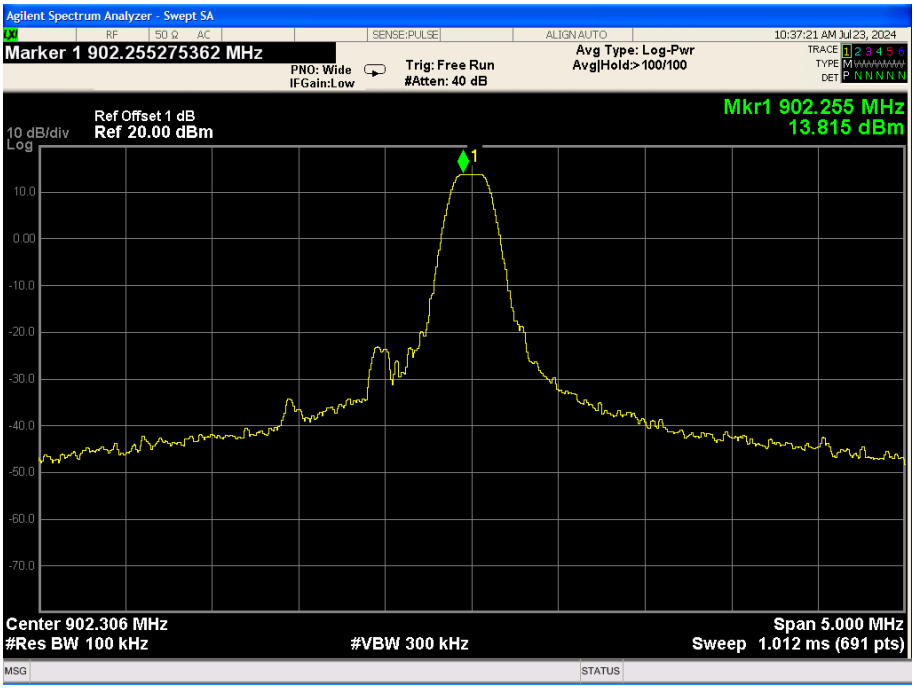


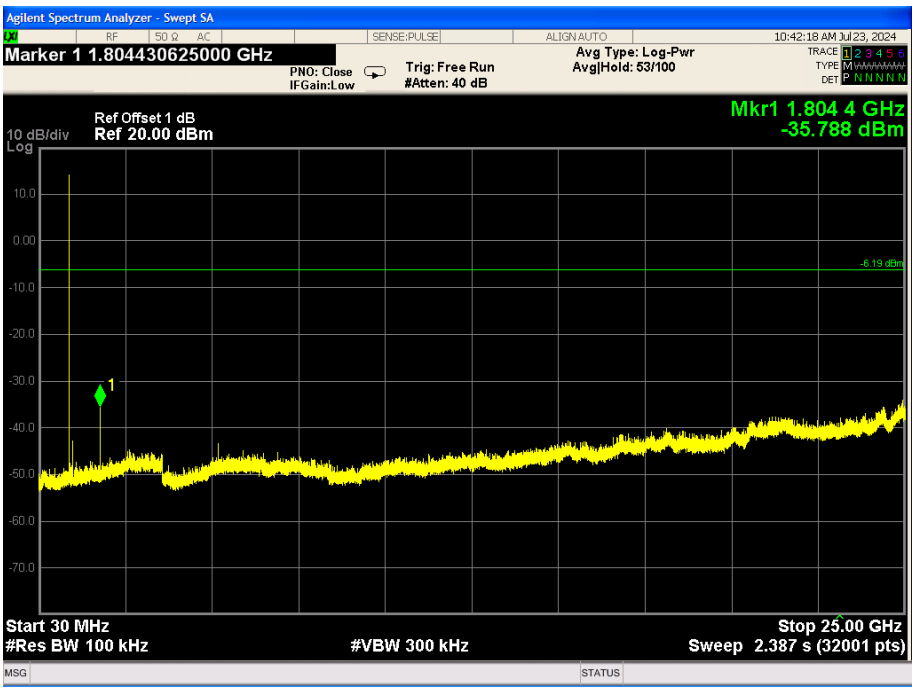
High Channel



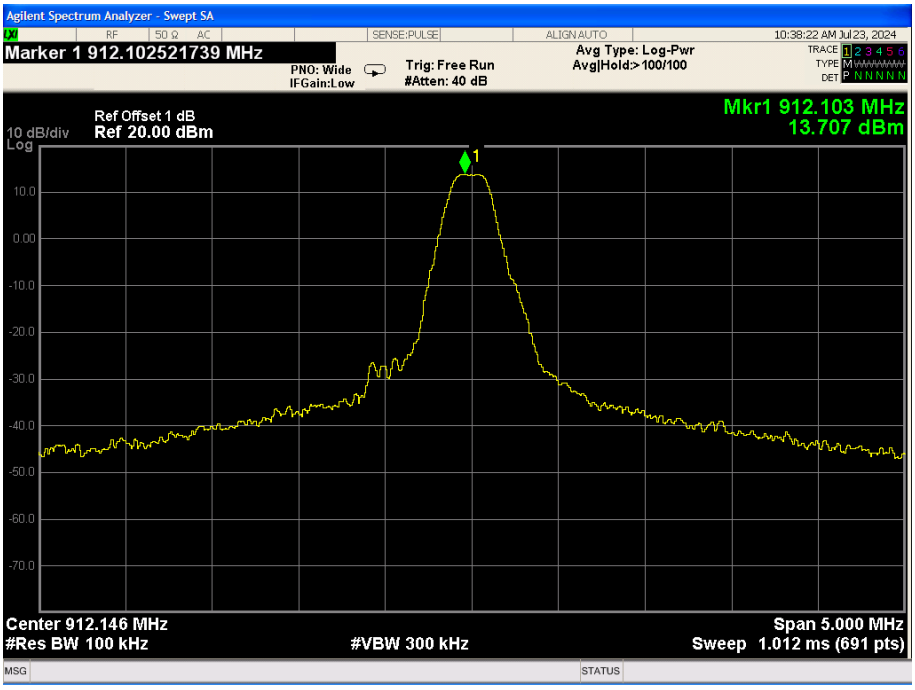
Appendix B.2: Conducted Spurious Emissions Measured in 100 kHz Bandwidth

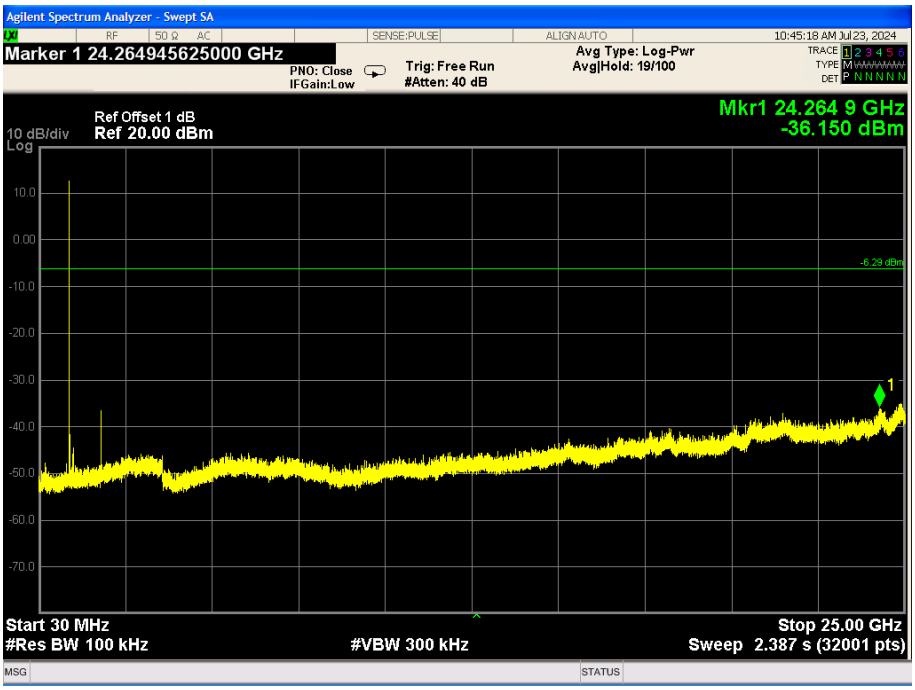
Low Channel



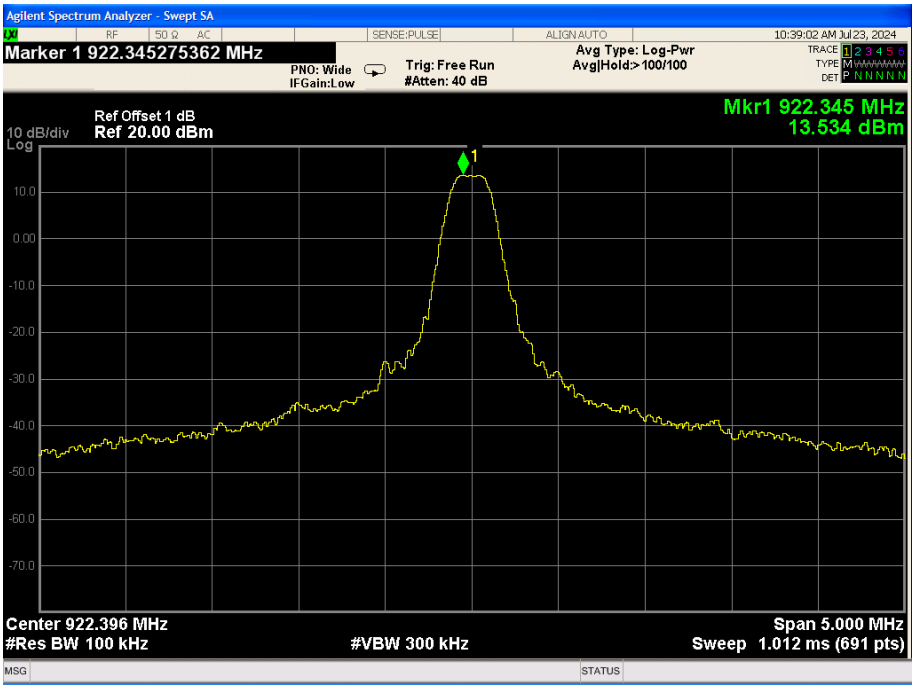


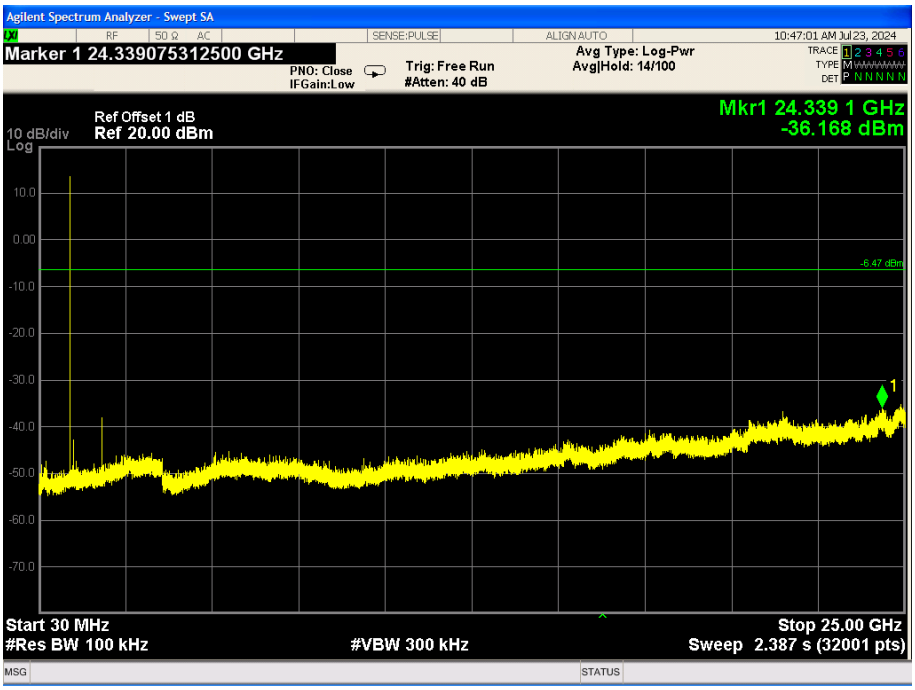
Middle Channel



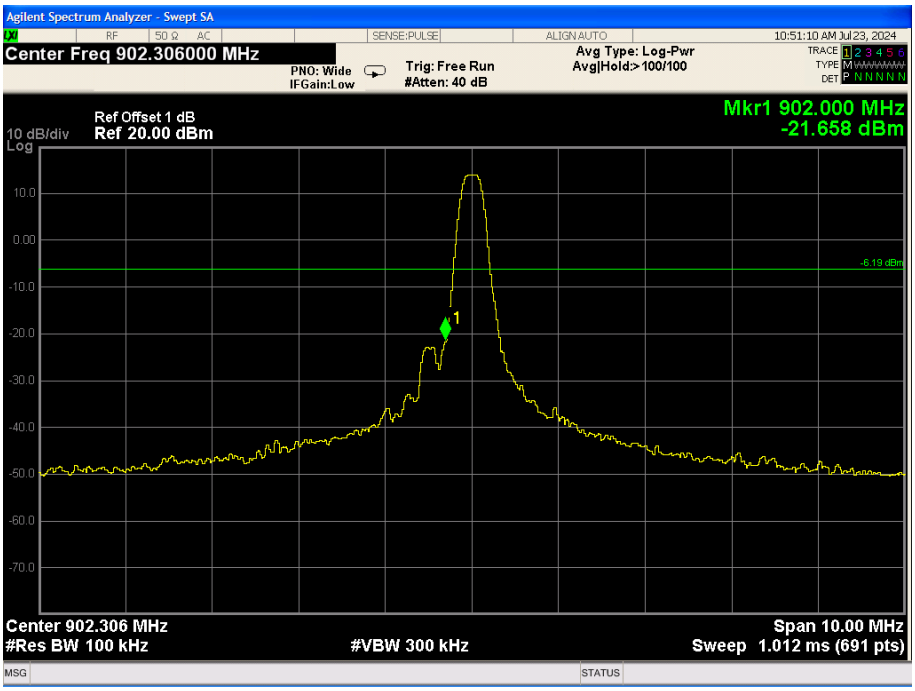


High Channel

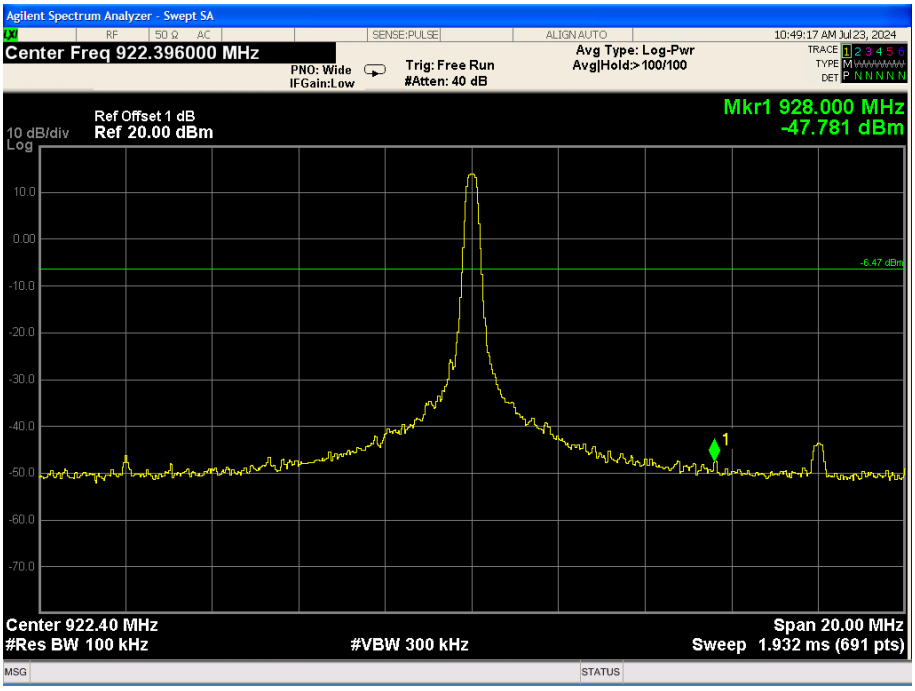




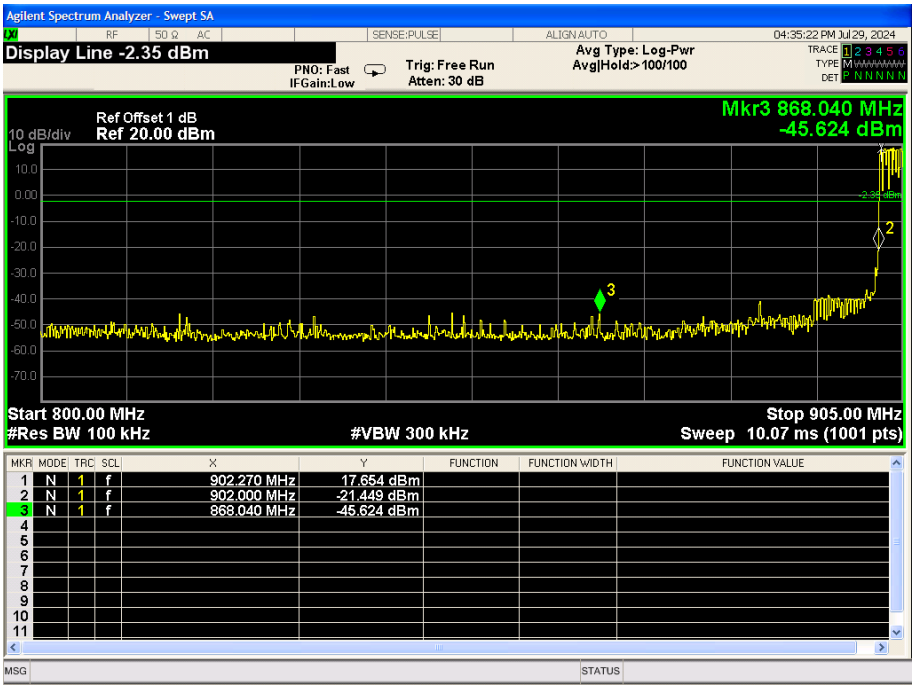
Band Edge
Low Channel

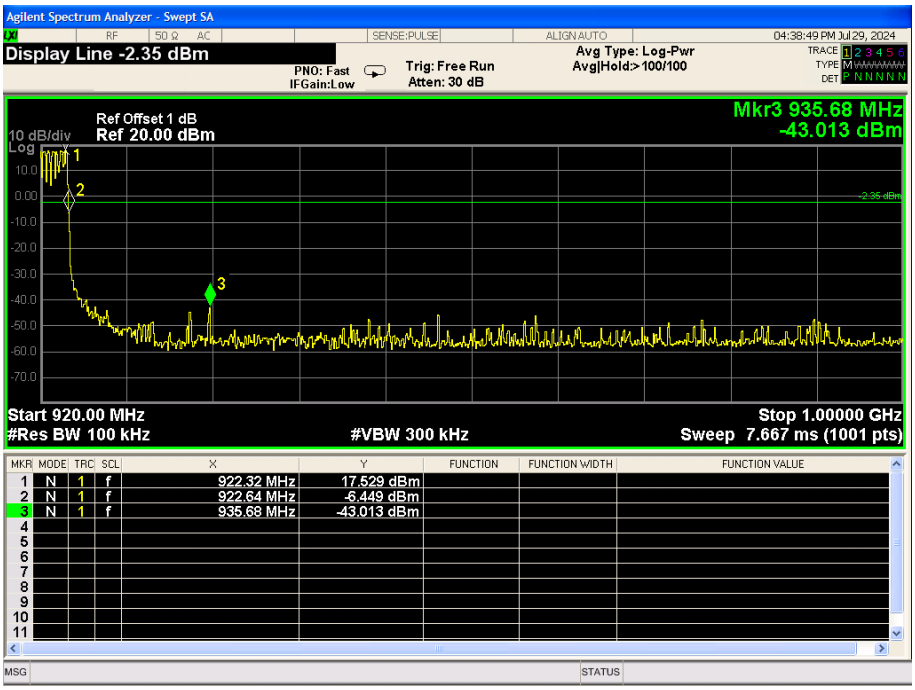


High Channel



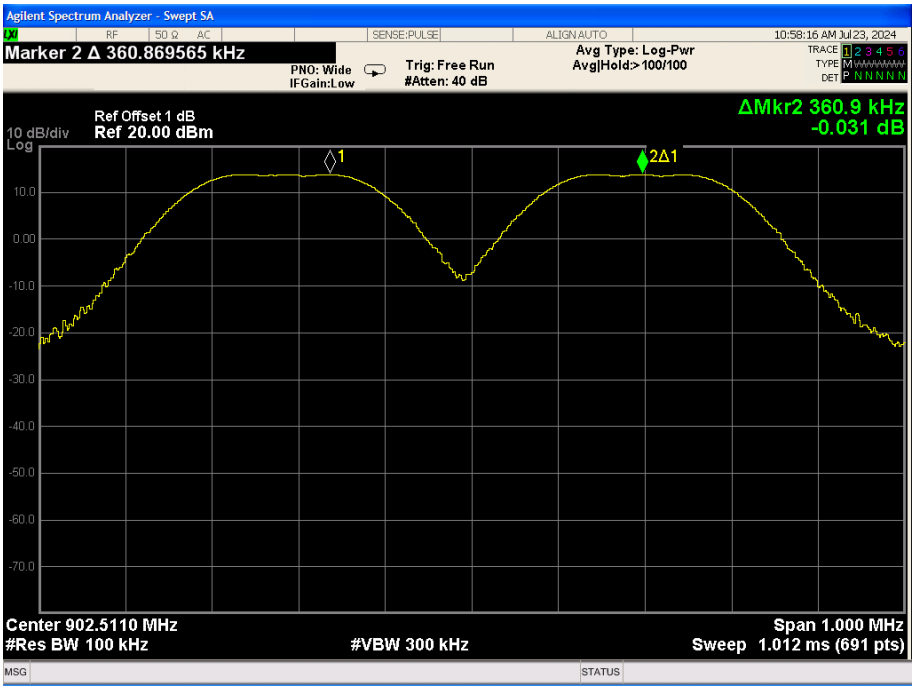
hopping, Band Edge



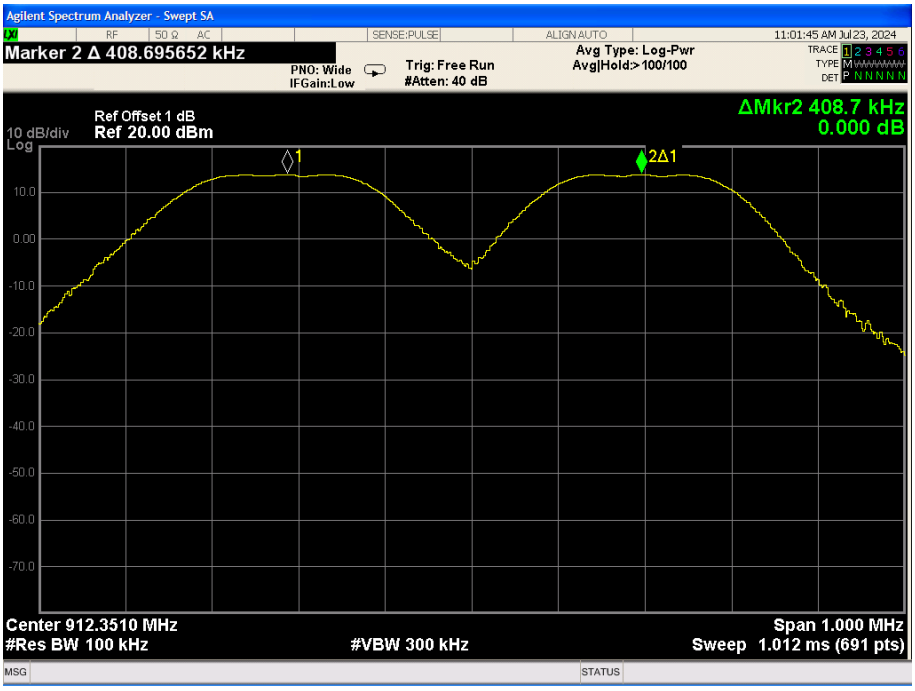


Appendix B.3: Carrier Frequency Separation

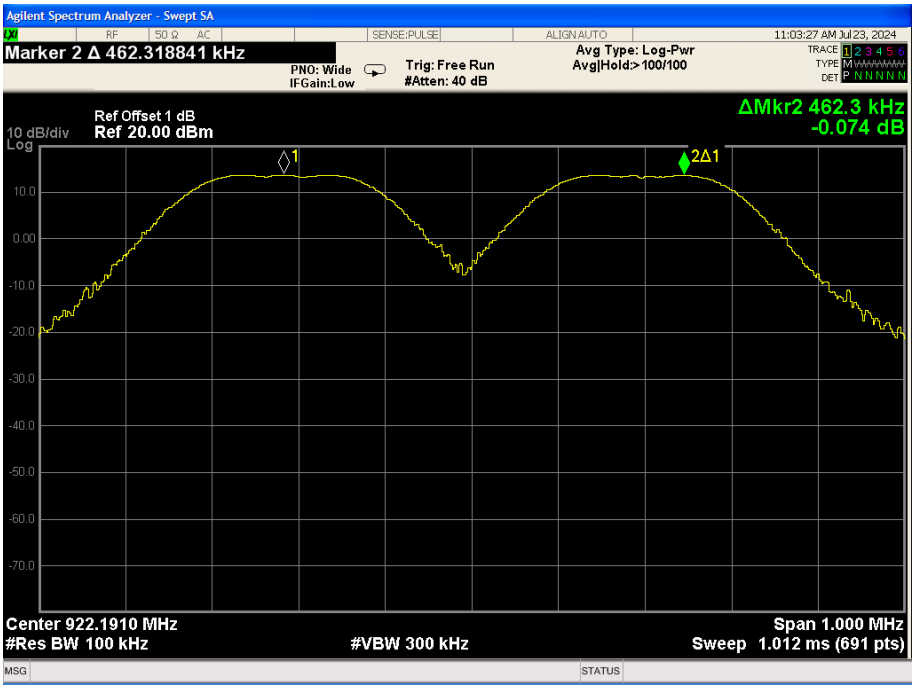
Low Channel



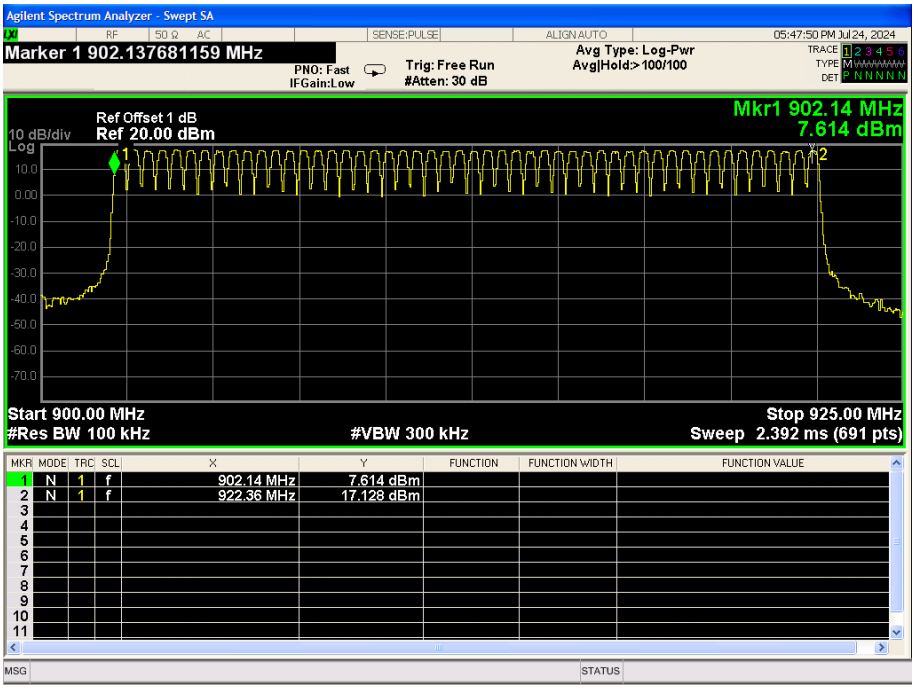
Middle Channel



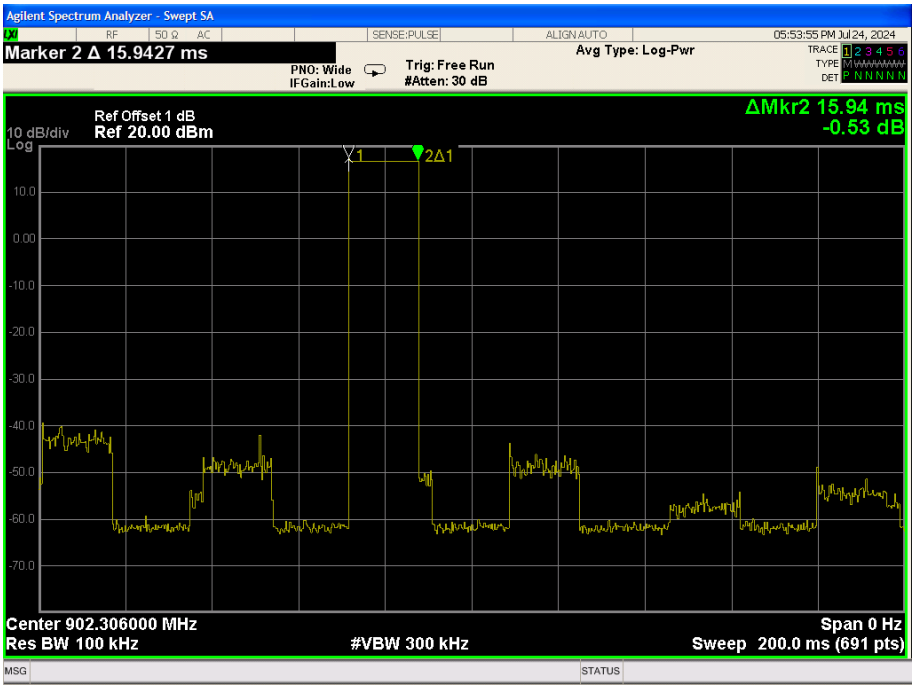
High Channel

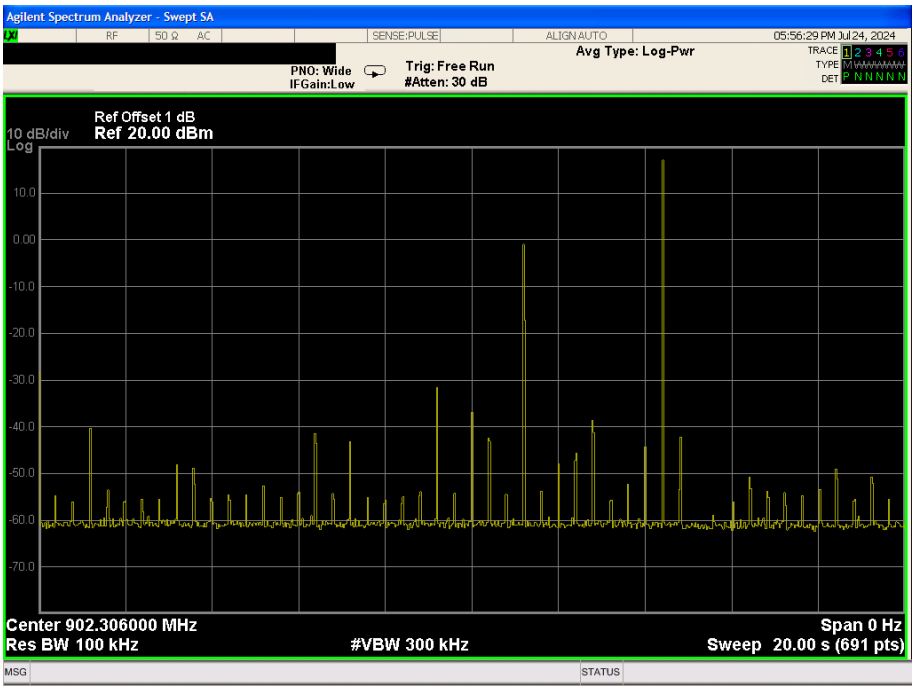


Appendix B.4: Number of Hopping Frequency



Appendix B.5: Time of Occupancy



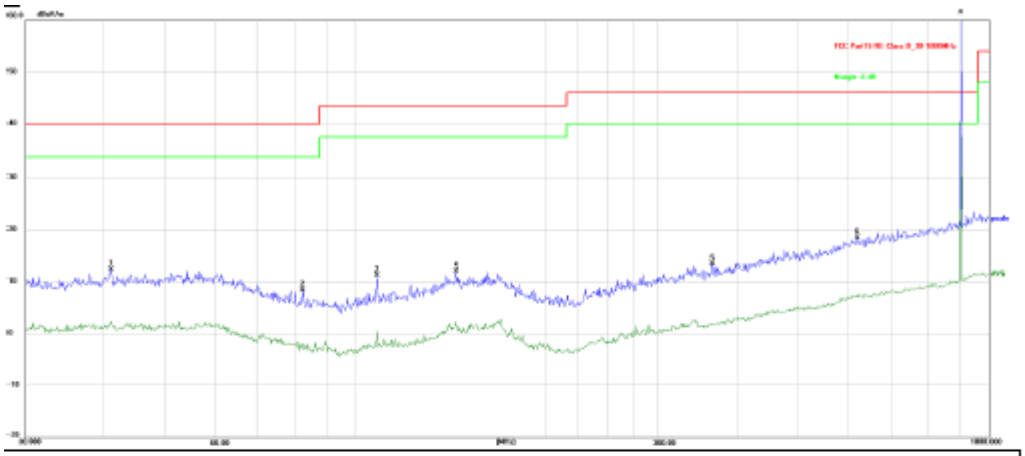


Appendix B.6: Test Results of Radiated Spurious Emissions

Note 1: Testing was carried out within frequency range 9 kHz to the tenth harmonics. The measurement results below 30MHz were greater than 20dB below the limit, so only the radiated spurious emissions from 30MHz to 10GHz were reported.

30MHz - 1GHz

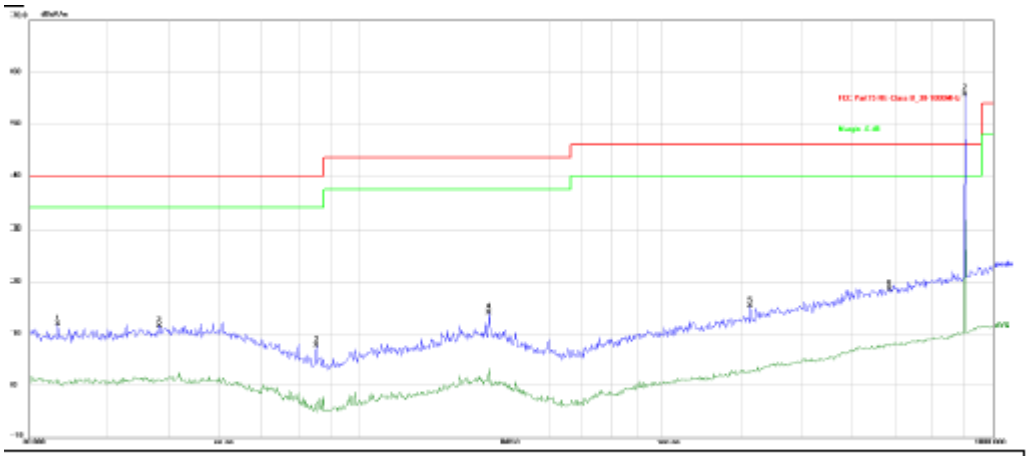
Low Channel



Site:		**Antenna:Horizontal**	**Temperature(℃):22(℃)**
Limit:	**FCC Part15 RE-Class B_30-1000MHz**		**Humidity(%):52.5%**
EUT:	**Quarterback Sensor**	**Test Time:**	**2024/7/24 11:02:06**
M/N.:	**T11013320**	**Power Rating:**	**Battery (Full of electricity)**
Mode:	**902.306**		
Note:	**The Emission exceed the limit is fundamental emission.**		

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)	Remark
1	40.9881	41.71	-29.33	12.38	40.00	-27.62	peak	150	0	
2	82.3588	43.00	-34.58	8.42	40.00	-31.58	peak	150	0	
3	107.8877	43.77	-32.50	11.27	43.50	-32.23	peak	150	0	
4	143.8295	41.60	-29.47	12.13	43.50	-31.37	peak	150	0	
5	365.5391	40.58	-27.12	13.46	46.00	-32.54	peak	150	0	
6	618.5369	39.12	-20.68	18.44	46.00	-27.56	peak	150	0	
7 *	903.3094	78.53	-16.80	61.73	46.00	15.73	peak	150	0	

Note: The Emissions exceed the limit are fundamental emissions.

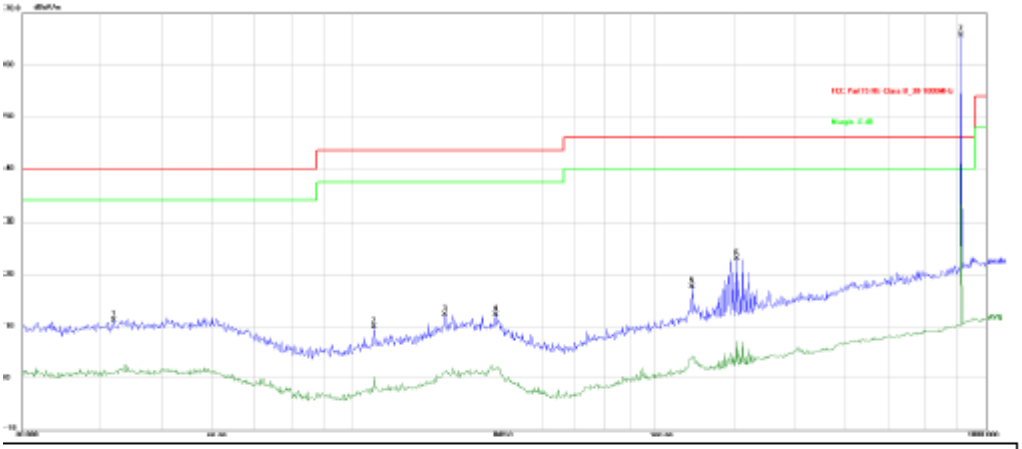


Site:		**Antenna:Vertical**	**Temperature(℃):22(℃)**
Limit:	**FCC Part15 RE-Class B_30-1000MHz**		**Humidity(%):52.5%**
EUT:	**Quarterback Sensor**	**Test Time:**	**2024/7/24 11:16:25**
M/N.:	**T11013320**	**Power Rating:**	**Battery (Full of electricity)**
Mode:	**902.306**		
Note:	**The Emission exceed the limit is fundamental emission.**		

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)	Remark
1	33.3278	41.60	-29.72	11.88	40.00	-28.12	peak			
2	48.1625	40.49	-28.93	11.56	40.00	-28.44	peak			
3	85.2980	42.88	-35.07	7.81	40.00	-32.19	peak			
4	159.7844	43.09	-29.02	14.07	43.50	-29.43	peak			
5	413.2706	41.03	-25.73	15.30	46.00	-30.70	peak			
6	684.7453	38.38	-19.75	18.63	46.00	-27.37	peak			
7 *	903.3093	72.55	-16.80	55.75	46.00	9.75	peak			

Note: The Emissions exceed the limit are fundamental emissions.

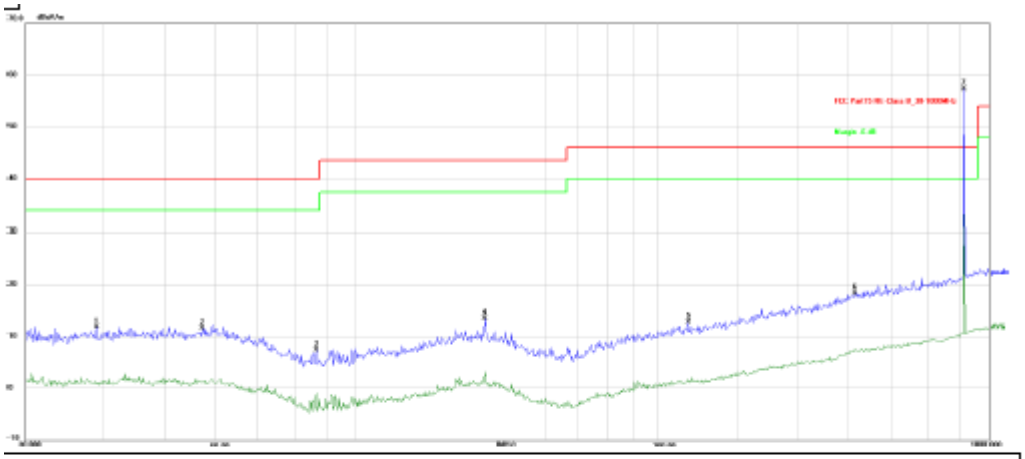
Middle Channel



Site:		**Antenna:Horizontal**	**Temperature(℃):22(℃)**
Limit:	**FCC Part15 RE-Class B_30-1000MHz**		**Humidity(%):52.5%**
EUT:	**Quarterback Sensor**	**Test Time:**	**2024/7/24 11:23:51**
M/N.:	**T11013320**	**Power Rating:**	
Mode:	**912.146**		
Note:	**The Emission exceed the limit is fundamental emission.**		

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)	Remark
1	41.8596	40.61	-29.30	11.31	40.00	-28.69	peak	100	360	
2	107.8877	42.45	-32.50	9.95	43.50	-33.55	peak	100	360	
3	139.8508	42.07	-29.79	12.28	43.50	-31.22	peak	100	360	
4	167.8243	41.80	-29.49	12.31	43.50	-31.19	peak	100	360	
5	343.1800	45.30	-27.65	17.65	46.00	-28.35	peak	100	360	
6	403.2500	49.05	-25.98	23.07	46.00	-22.93	peak	100	360	
7 *	912.8620	82.48	-16.72	65.76	46.00	19.76	peak	100	360	

Note: The Emissions exceed the limit are fundamental emissions.

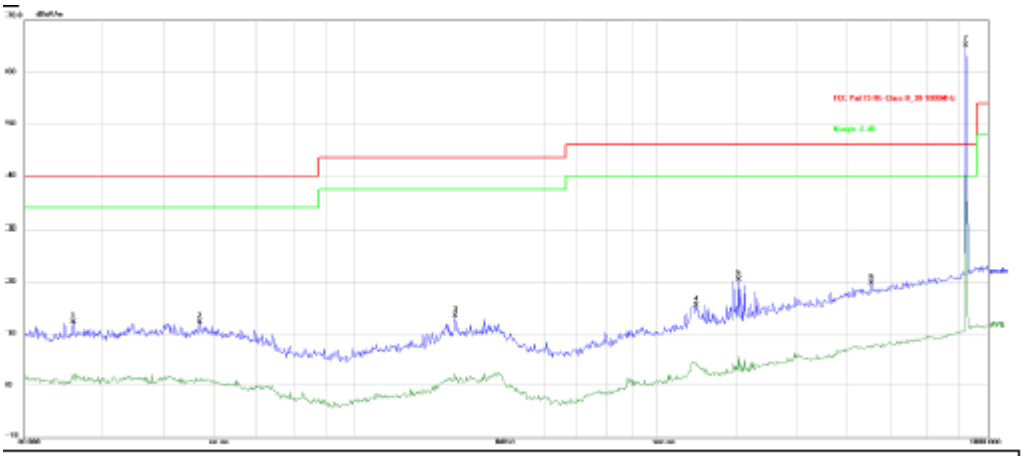


Site:		**Antenna:Vertical**	**Temperature(℃):22(℃)**
Limit:	**FCC Part15 RE-Class B_30-1000MHz**		**Humidity(%):52.5%**
EUT:	**Quarterback Sensor**	**Test Time:**	**2024/7/24 11:21:48**
M/N.:	**T11013320**	**Power Rating:**	
Mode:	**912.146**		
Note:	**The Emission exceed the limit is fundamental emission.**		

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)	Remark
1	38.8878	41.34	-29.48	11.86	40.00	-28.14	peak	100	0	
2	57.1914	40.69	-29.08	11.61	40.00	-28.39	peak	100	0	
3	86.5029	42.60	-35.14	7.46	40.00	-32.54	peak	100	0	
4	159.7844	42.51	-29.02	13.49	43.50	-30.01	peak	100	0	
5	334.8589	40.54	-27.65	12.89	46.00	-33.11	peak	100	0	
6	614.2142	39.08	-20.66	18.42	46.00	-27.58	peak	100	0	
7 *	912.8620	74.08	-16.72	57.36	46.00	11.36	peak	100	0	

Note: The Emissions exceed the limit are fundamental emissions.

High Channel



Site:		**Antenna:Horizontal**	**Temperature(℃):22(℃)**
Limit:	**FCC Part15 RE-Class B_30-1000MHz**		**Humidity(%):52.5%**
EUT:	**Quarterback Sensor**	**Test Time:**	**2024/7/24 11:29:59**
M/N.:	**T11013320**	**Power Rating:**	
Mode:	**922.396**		
Note:	**The Emission exceed the limit is fundamental emission.**		

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)	Remark
1	35.8746	41.87	-29.56	12.31	40.00	-27.69	peak	100	0	
2	56.7917	41.28	-29.02	12.26	40.00	-27.74	peak	100	0	
3	143.8295	42.96	-29.47	13.49	43.50	-30.01	peak	100	0	
4	345.5952	43.26	-27.66	15.60	46.00	-30.40	peak	100	0	
5	403.2500	46.45	-25.98	20.47	46.00	-25.53	peak	100	0	
6	654.2318	40.28	-20.42	19.86	46.00	-26.14	peak	100	0	
7 *	922.5157	81.77	-16.51	65.26	46.00	19.26	peak	100	0	

Note: The Emissions exceed the limit are fundamental emissions.

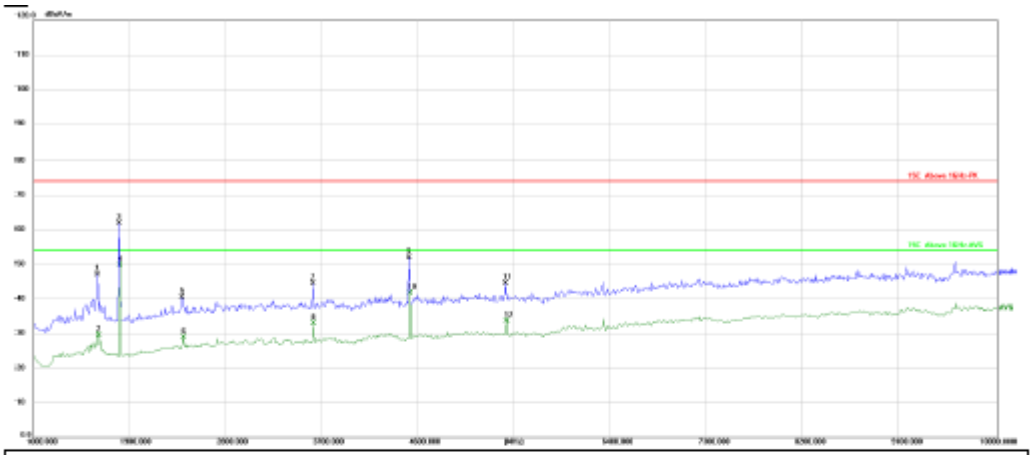
Site:		**Antenna:Vertical**	**Temperature(℃):22(℃)**
Limit:	**FCC Part15 RE-Class B_30-1000MHz**		**Humidity(%):52.5%**
EUT:	**Quarterback Sensor**	**Test Time:**	**2024/7/24 11:31:50**
M/N.:	**T11013320**	**Power Rating:**	
Mode:	**922.396**		
Note:	**The Emission exceed the limit is fundamental emission.**		

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Height (cm)	Azimuth (deg)	Remark
1	42.6000	40.08	-29.23	10.85	40.00	-29.15	peak	100	360	
2	91.8163	43.94	-34.81	9.13	43.50	-34.37	peak	100	360	
3	159.7844	43.01	-29.02	13.99	43.50	-29.51	peak	100	360	
4	348.0274	43.03	-27.71	15.32	46.00	-30.68	peak	100	360	
5	403.2500	43.82	-25.98	17.84	46.00	-28.16	peak	100	360	
6	691.9867	39.00	-19.51	19.49	46.00	-26.51	peak	100	360	
7 *	922.5157	77.45	-16.51	60.94	46.00	14.94	peak	100	360	

Note: The Emissions exceed the limit are fundamental emissions.

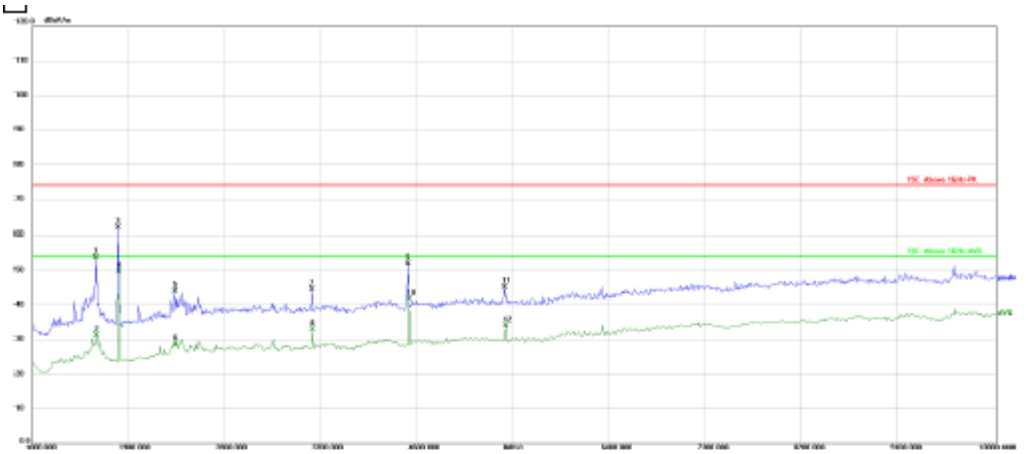
1GHz - 10GHz

Low Channel



Site:		**Antenna:Horizontal**	**Temperature(℃):22(℃)**
Limit:	**15C Above 1GHz-PK**		**Humidity(%):52.5**
EUT:	**Quarterback Sensor**	**Test Time:**	**2024/7/24 9:42:54**
M/N.:	**T11013320**	**Power Rating:**	**Battery (Full of electricity)**
Mode:	**902.306**		
Note:			

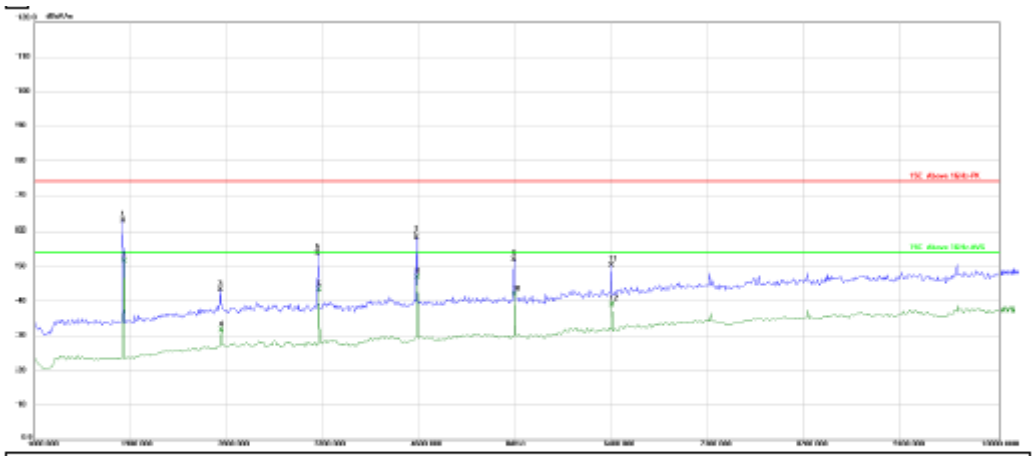
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	1603.000	65.78	-18.72	47.06	74.00	-26.94	peak
2	1612.000	48.20	-18.68	29.52	54.00	-24.48	AVG
3	1801.000	80.06	-18.05	62.01	74.00	-11.99	peak
4 *	1810.000	67.81	-18.00	49.81	54.00	-4.19	AVG
5	2386.000	55.63	-15.09	40.54	74.00	-33.46	peak
6	2404.000	43.86	-15.03	28.83	54.00	-25.17	AVG
7	3610.000	55.43	-10.84	44.59	74.00	-29.41	peak
8	3619.000	43.79	-10.77	33.02	54.00	-20.98	AVG
9	4510.000	59.07	-7.00	52.07	74.00	-21.93	peak
10	4519.000	48.68	-6.98	41.70	54.00	-12.30	AVG
11	5410.000	49.67	-5.05	44.62	74.00	-29.38	peak
12	5419.000	38.61	-5.06	33.55	54.00	-20.45	AVG



Site:		**Antenna:Vertical**	**Temperature(℃):22(℃)**
Limit:	**15C Above 1GHz-PK**		**Humidity(%):52.5**
EUT:	**Quarterback Sensor**	**Test Time:**	**2024/7/24 9:49:20**
M/N.:	**T11013320**	**Power Rating:**	**Battery (Full of electricity)**
Mode:	**902.306**		
Note:			

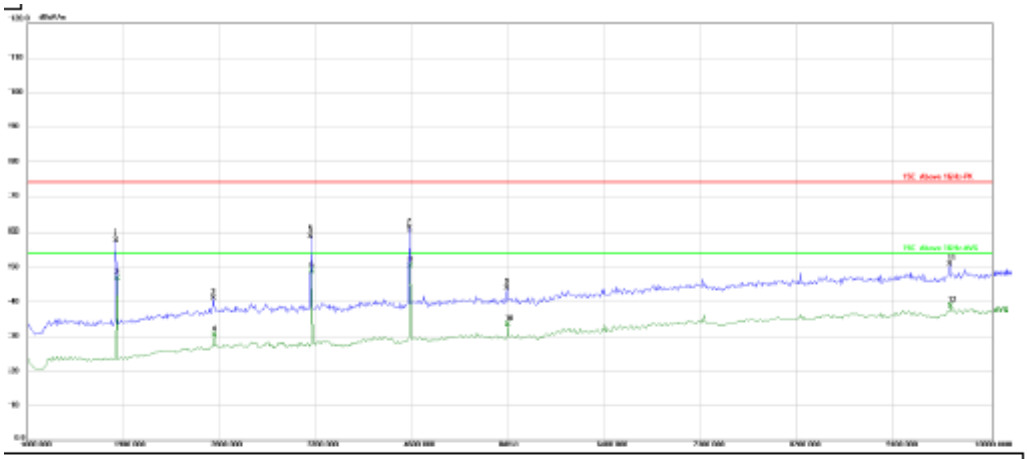
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	1594.000	72.58	-18.73	53.85	74.00	-20.15	peak
2	1603.000	49.99	-18.72	31.27	54.00	-22.73	AVG
3	1801.000	80.06	-18.05	62.01	74.00	-11.99	peak
4 *	1810.000	67.81	-18.00	49.81	54.00	-4.19	AVG
5	2332.000	59.29	-15.27	44.02	74.00	-29.98	peak
6	2341.000	44.06	-15.24	28.82	54.00	-25.18	AVG
7	3610.000	55.43	-10.84	44.59	74.00	-29.41	peak
8	3619.000	43.79	-10.77	33.02	54.00	-20.98	AVG
9	4510.000	59.07	-7.00	52.07	74.00	-21.93	peak
10	4519.000	48.68	-6.98	41.70	54.00	-12.30	AVG
11	5410.000	50.33	-5.05	45.28	74.00	-28.72	peak
12	5419.000	39.02	-5.06	33.96	54.00	-20.04	AVG

Middle Channl



Site:		**Antenna:Horizontal**	**Temperature(℃):22(℃)**
Limit:	**15C Above 1GHz-PK**		**Humidity(%):52.5**
EUT:	**Quarterback Sensor**	**Test Time:**	**2024/7/24 10:36:41**
M/N.:	**T11013320**	**Power Rating:**	**Battery (Full of electricity)**
Mode:	**912.146**		
Note:			

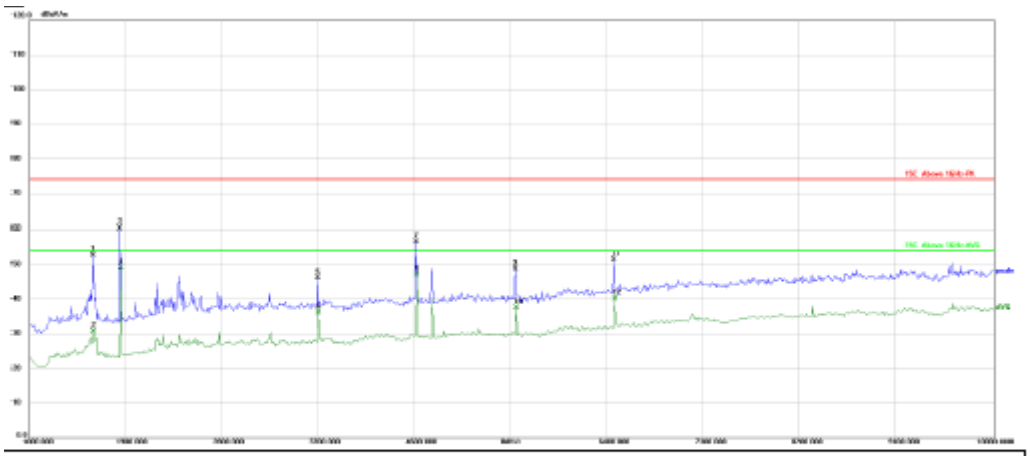
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	1828.000	80.72	-17.92	62.80	74.00	-11.20	peak
2 *	1837.000	69.48	-17.88	51.60	54.00	-2.40	AVG
3	2737.000	56.40	-13.18	43.22	74.00	-30.78	peak
4	2746.000	44.66	-13.12	31.54	54.00	-22.46	AVG
5	3646.000	64.42	-10.58	53.84	74.00	-20.16	peak
6	3655.000	53.74	-10.52	43.22	54.00	-10.78	AVG
7	4564.000	65.41	-6.94	58.47	74.00	-15.53	peak
8	4573.000	53.83	-6.92	46.91	54.00	-7.09	AVG
9	5473.000	57.18	-5.12	52.06	74.00	-21.94	peak
10	5482.000	47.00	-5.13	41.87	54.00	-12.13	AVG
11	6382.000	52.61	-2.21	50.40	74.00	-23.60	peak
12	6391.000	41.17	-2.18	38.99	54.00	-15.01	AVG



Site:		**Antenna:Vertical**	**Temperature(℃):22(℃)**
Limit:	**15C Above 1GHz-PK**		**Humidity(%):52.5**
EUT:	**Quarterback Sensor**	**Test Time:**	**2024/7/24 10:34:33**
M/N.:	**T11013320**	**Power Rating:**	**Battery (Full of electricity)**
Mode:	**912.146**		
Note:			

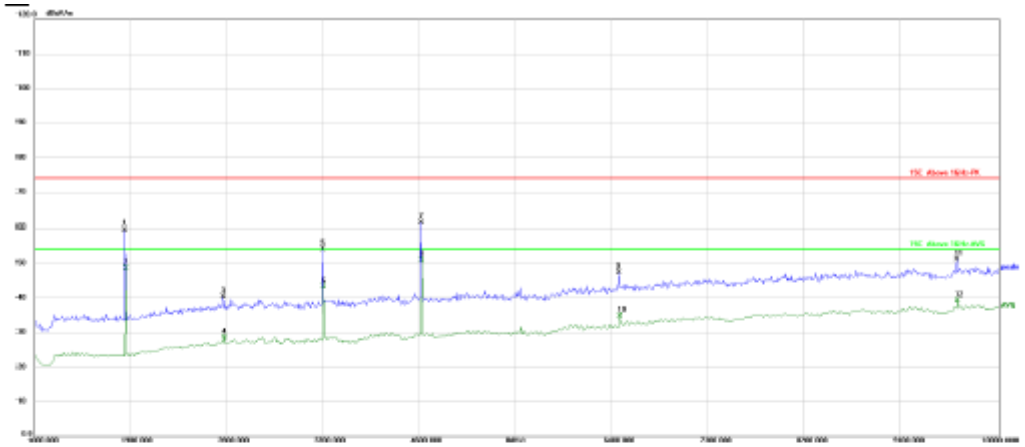
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	1828.000	75.70	-17.92	57.78	74.00	-16.22	peak
2	1837.000	64.73	-17.88	46.85	54.00	-7.15	AVG
3	2737.000	54.39	-13.18	41.21	74.00	-32.79	peak
4	2746.000	43.55	-13.12	30.43	54.00	-23.57	AVG
5	3646.000	69.51	-10.58	58.93	74.00	-15.07	peak
6	3655.000	59.51	-10.52	48.99	54.00	-5.01	AVG
7	4564.000	67.92	-6.94	60.98	74.00	-13.02	peak
8 *	4573.000	57.47	-6.92	50.55	54.00	-3.45	AVG
9	5473.000	49.18	-5.12	44.06	74.00	-29.94	peak
10	5482.000	38.66	-5.13	33.53	54.00	-20.47	AVG
11	9604.000	46.01	4.89	50.90	74.00	-23.10	peak
12	9613.000	33.94	4.92	38.86	54.00	-15.14	AVG

High Channel



Site:		**Antenna:Horizontal**	**Temperature(℃):22(℃)**
Limit:	**15C Above 1GHz-PK**		**Humidity(%):52.5**
EUT:	**Quarterback Sensor**	**Test Time:**	**2024/7/24 10:21:24**
M/N.:	**T11013320**	**Power Rating:**	**Battery (Full of electricity)**
Mode:	**922.396**	**Test Engineer:**	
Note:			

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	1594.000	71.64	-18.73	52.91	74.00	-21.09	peak
2	1603.000	49.41	-18.72	30.69	54.00	-23.31	AVG
3	1846.000	78.12	-17.84	60.28	74.00	-13.72	peak
4 *	1855.000	66.93	-17.79	49.14	54.00	-4.86	AVG
5	3691.000	56.34	-10.27	46.07	74.00	-27.93	peak
6	3700.000	46.37	-10.20	36.17	54.00	-17.83	AVG
7	4609.000	63.37	-6.90	56.47	74.00	-17.53	peak
8	4618.000	54.02	-6.89	47.13	54.00	-6.87	AVG
9	5536.000	53.89	-5.14	48.75	74.00	-25.25	peak
10	5545.000	42.69	-5.14	37.55	54.00	-16.45	AVG
11	6454.000	53.54	-2.02	51.52	74.00	-22.48	peak
12	6463.000	42.21	-1.99	40.22	54.00	-13.78	AVG



Site:		**Antenna:Vertical**	**Temperature(℃):22(℃)**
Limit:	**15C Above 1GHz-PK**		**Humidity(%):52.5**
EUT:	**Quarterback Sensor**	**Test Time:**	**2024/7/24 10:29:52**
M/N.:	**T11013320**	**Power Rating:**	**Battery (Full of electricity)**
Mode:	**922.396**		
Note:			

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	1846.000	77.27	-17.84	59.43	74.00	-14.57	peak
2	1855.000	66.43	-17.79	48.64	54.00	-5.36	AVG
3	2764.000	53.35	-12.99	40.36	74.00	-33.64	peak
4	2773.000	41.48	-12.93	28.55	54.00	-25.45	AVG
5	3691.000	64.42	-10.27	54.15	74.00	-19.85	peak
6	3700.000	53.37	-10.20	43.17	54.00	-10.83	AVG
7	4609.000	68.19	-6.90	61.29	74.00	-12.71	peak
8 *	4618.000	57.87	-6.89	50.98	54.00	-3.02	AVG
9	6454.000	49.41	-2.02	47.39	74.00	-26.61	peak
10	6463.000	36.72	-1.99	34.73	54.00	-19.27	AVG
11	9604.000	46.32	4.89	51.21	74.00	-22.79	peak
12	9613.000	34.21	4.92	39.13	54.00	-14.87	AVG