



RADIO TEST REPORT

FCC ID : 2A74O-8A7DD6
Equipment : Wi-Fi Halow Module
Brand Name : Morse Micro
Model Name : MM6108-MF08251, MM6108-MF08551
Applicant : Morse Micro Pty Ltd
Level 8, 10-14 Waterloo Street, Surry Hills, NSW 2010
Manufacturer : Morse Micro Pty Ltd
Level 8, 10-14 Waterloo Street, Surry Hills, NSW 2010
Standard : 47 CFR FCC Part 15.247

The product was received on Apr. 11, 2023, and testing was started from Apr. 20, 2023 and completed on Apr. 20, 2023. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory

No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)



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TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB-A10_1 Ver1.3



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	-
3.1	15.247(d)	Emissions in Restricted Frequency Bands	PASS	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacture who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the chapter "Measurement Uncertainty".

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sam Chen**Report Producer: Sandy Chuang**



1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range	Modulation	Ch. Frequency (MHz)	Channel Spacing (MHz)	Channel Number
902-928 MHz	OFDM	903.5-927.5	1	25
		905-927	2	12
		906-926	4	6
		908-924	8	3

Band	Mode	BWch (MHz)	Nant
902-928MHz	OFDM_1M	1	1TX
902-928MHz	OFDM_2M	2	1TX
902-928MHz	OFDM_4M	4	1TX
902-928MHz	OFDM_8M	8	1TX

Note:

- ♦ 902-928 MHz Band uses a combination of OFDM modulation.
- ♦ BWch is the nominal channel bandwidth.

1.1.2 Antenna Information

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	PulseLarsen	W1063	Dipole	Reversed-SMA	1

Note: The above information was declared by manufacturer.

1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) $\geq 1/T$
OFDM_1M	0.897	0.47	3.403m	300
OFDM_2M	0.798	0.98	1.563m	1k
OFDM_4M	0.696	1.57	880u	3k
OFDM_8M	0.596	2.25	562.5u	3k

Note:

- ♦ DC is Duty Cycle.
- ♦ DCF is Duty Cycle Factor.

1.1.4 EUT Operational Condition

EUT Power Type	DC power from Adapter		
Beamforming Function	<input type="checkbox"/> With beamforming	<input checked="" type="checkbox"/> Without beamforming	
Test Software Version	rf_tester.exe (v1.1)		

Note: The above information was declared by manufacturer.

1.1.5 Table for Multiple Listing

EUT	Model Name	Description
1	MM6108-MF08251	<p>The difference between these two models as below.</p> <p>The modification is based on the original model (MM6108-MF08251)</p> <p>(1. Add 1x 10k Ohm resistor (Panasonic ERJ-1GNF1002C)</p> <p>(2. Add 1x 0R resistor (Panasonic ERJ-1GE0R00C)</p> <p>(3. Add 1x RF Switch (Richwave RTC6608OU)</p> <p>(4. Add 2x 100pF Capacitors (Murata GRM0335C1H101GA01D)</p> <p>(5. Move the components (resistance) that near the antenna to back side of the board.</p>
2	MM6108-MF08551	

Note 1: From the above models, EUT 2 (Model Name: MM6108-MF08551) was selected as representative model for the test and its data was recorded in this report.

Note 2: The above information was declared by manufacturer.



1.1.6 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FR262109-01.

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
Adding the second source for EUT 2 (Model Name: MM6108-MF08551): (1. Add 1x 10k Ohm resistor (Panasonic ERJ-1GNF1002C) (2. Add 1x 0R resistor (Panasonic ERJ-1GE0R00C) (3. Add 1x RF Switch (Richwave RTC6608OU) (4. Add 2x 100pF Capacitors (Murata GRM0335C1H101GA01D) (5. Move the components (resistance) that near the antenna to back side of the board. Please refer to section 1.1.5 for EUT information.	Based on original output power to measure below test item: Emissions in Restricted Frequency Bands <below 1GHz>

Note: This modification does not affect the RF relevant portion, so it's not necessary to evaluate Intentional test.



1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR FCC Part 15.247
- ♦ ANSI C63.10-2013

The following reference test guidance is not within the scope of accreditation of TAF.

- ♦ FCC KDB 558074 D01 v05r02
- ♦ FCC KDB 414788 D01 v01r01

1.3 Testing Location Information

Testing Location Information				
Test Lab. : Sporton International Inc. Hsinchu Laboratory				
Hsinchu ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)				
(TAF: 3787) TEL: 886-3-656-9065 FAX: 886-3-656-9085				
Test site Designation No. TW3787 with FCC.				
Conformity Assessment Body Identifier (CABID) TW3787 with ISED				

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
Radiated Emissions Below 1 GHz	03CH05-CB	Richard Pai	20.2-21.3 / 56-57	Apr. 20, 2023

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Test Items	Uncertainty	Remark
Radiated Emission (9kHz ~ 30MHz)	3.4 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	5.6 dB	Confidence levels of 95%



2 Test Configuration of EUT

2.1 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emissions in Restricted Frequency Bands
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.
Operating Mode < 1GHz	CTX
The Y axis generated the worst case from the original report, so the measurement will follow this same test configuration.	
1	EUT 2 in Y axis + Adapter

Note: The Adapter is for measurement only, would not be marketed.

Adapter information as below:

Power	Brand	Model
Adapter	STONTRONICS	RPI-18PFCA-05

2.2 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

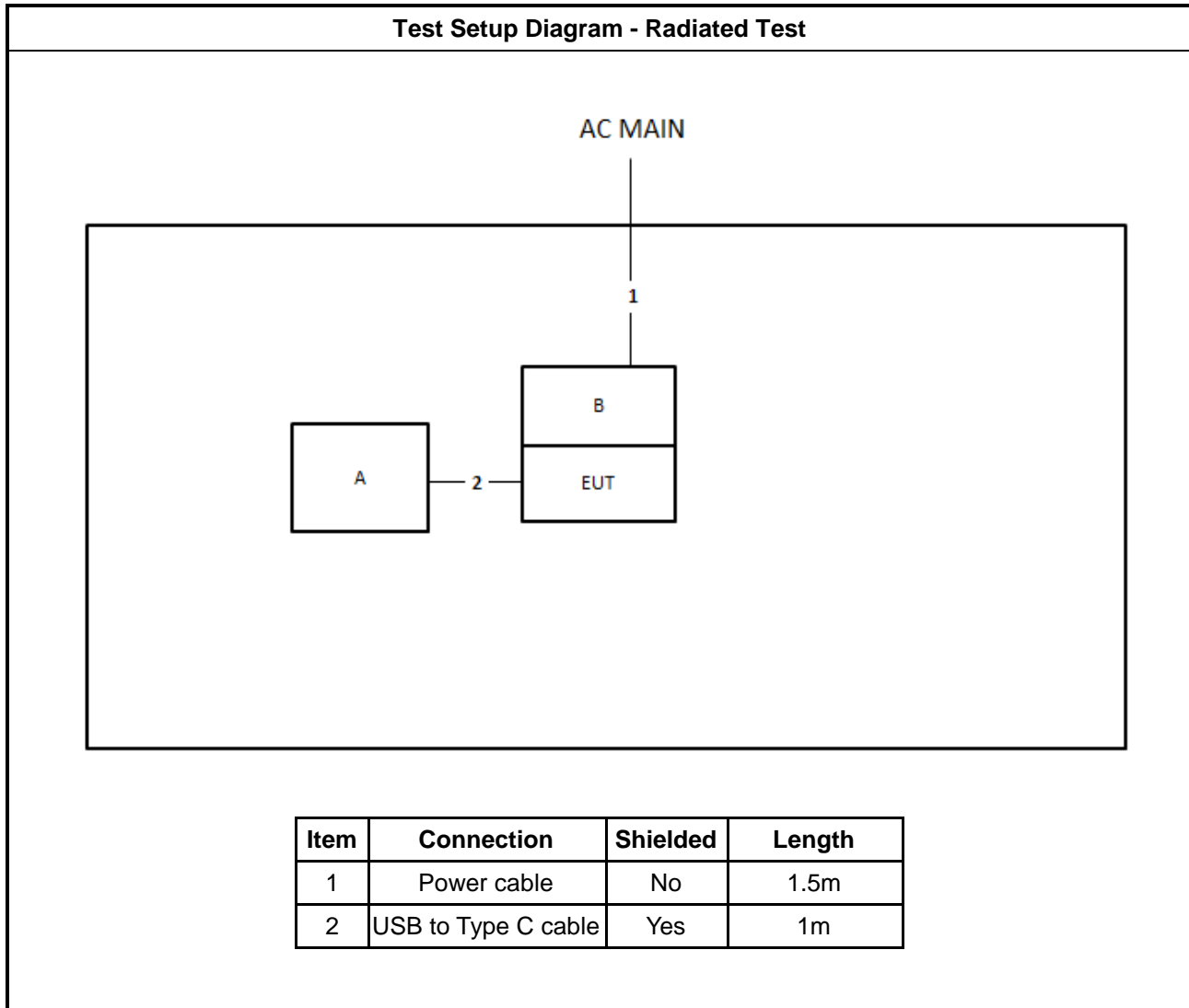
2.3 Accessories

N/A

2.4 Support Equipment

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	Notebook	DELL	E4300	N/A
B	Fixture	FTDI	MM_DEBUG	N/A
C	Adapter	STONTRONICS	RPI-18PFCA-05	N/A

2.5 Test Setup Diagram





3 Transmitter Test Result

3.1 Emissions in Restricted Frequency Bands

3.1.1 Emissions in Restricted Frequency Bands Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

3.1.2 Measuring Instruments

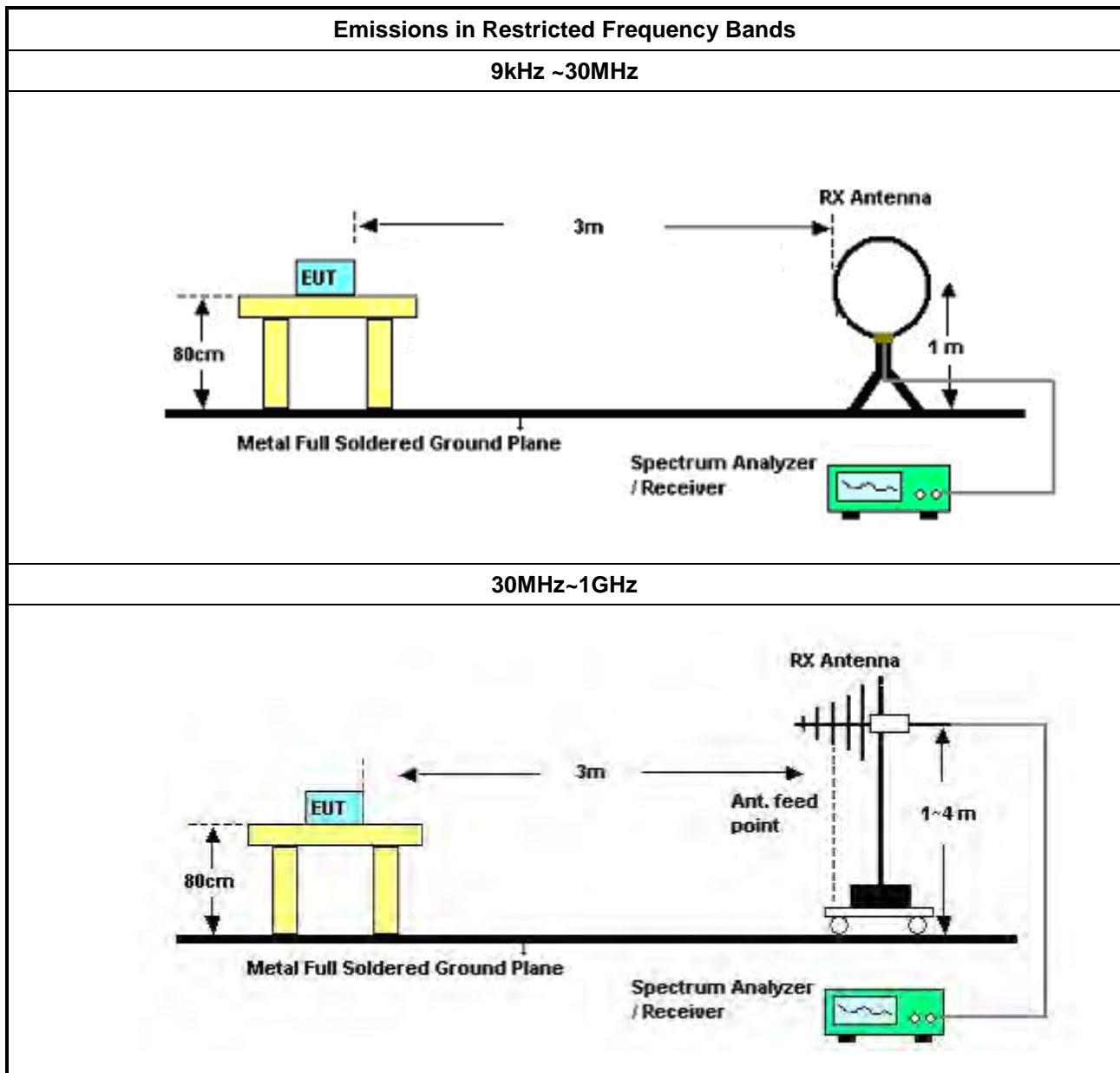
Refer a test equipment and calibration data table in this test report.



3.1.3 Test Procedures

Test Method	
<ul style="list-style-type: none"> The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor]. 	
<ul style="list-style-type: none"> Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band. 	
<ul style="list-style-type: none"> For the transmitter unwanted emissions shall be measured using following options below: 	
	<ul style="list-style-type: none"> Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands.
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.1(trace averaging for duty cycle $\geq 98\%$).
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.2(trace averaging + duty factor).
<input checked="" type="checkbox"/>	Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.3(Reduced VBW $\geq 1/T$).
<input type="checkbox"/>	Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW $\geq 1/T$, where T is pulse time.
<input type="checkbox"/>	Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions.
<input checked="" type="checkbox"/>	Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.4 measurement procedure peak limit.
<ul style="list-style-type: none"> For the transmitter band-edge emissions shall be measured using following options below: 	
	<ul style="list-style-type: none"> Refer as FCC KDB 558074 clause 8.7 & c63.10 clause 11.13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.
	<ul style="list-style-type: none"> Refer as FCC KDB 558074, clause 8.7 (ANSI C63.10, clause 6.10.6) for marker-delta method for band-edge measurements.
	<ul style="list-style-type: none"> Refer as FCC KDB 558074, clause 8.7 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).
	<ul style="list-style-type: none"> For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add 10 log(N) dB
	<ul style="list-style-type: none"> For FCC KDB 662911 The methodology described here may overestimate array gain, thereby resulting in apparent failures to satisfy the out-of-band limits even if the device is actually compliant. In such cases, compliance may be demonstrated by performing radiated tests around the frequencies at which the apparent failures occurred.

3.1.4 Test Setup





3.1.5 Measurement Results Calculation

The measured Level is calculated using:

Corrected Reading: Antenna factor (AF) + Cable loss (CL) + Read level (Raw) - Preamp factor (PA)(if applicable) = Level.

3.1.6 Emissions in Restricted Frequency Bands (Below 30MHz)

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to KDB414788 Radiated Test Site, and the result came out very similar.

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10th harmonic or 40 GHz, whichever is appropriate.

3.1.7 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix A



4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	May 14, 2022	May 13, 2023	Radiation (03CH05-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH05-CB	30 MHz ~ 1 GHz	Aug. 03, 2022	Aug. 02, 2023	Radiation (03CH05-CB)
Bilog Antenna with 6dB Attenuator	TESEQ & EMCI	CBL 6112D & N-6-06	35236 & AT-N0610	30MHz ~ 2GHz	Mar. 24, 2023	Mar. 23, 2024	Radiation (03CH05-CB)
Pre-Amplifier	EMCI	EMC330N	980331	20MHz ~ 3GHz	Apr. 26, 2022	Apr. 25, 2023	Radiation (03CH05-CB)
Spectrum Analyzer	R&S	FSP40	100304	9kHz ~ 40GHz	Apr. 18, 2023	Apr. 17, 2024	Radiation (03CH05-CB)
EMI Test Receiver	R&S	ESCS	826547/017	9kHz ~ 2.75GHz	Jun. 17, 2022	Jun. 16, 2023	Radiation (03CH05-CB)
RF Cable-low	Woken	RG402	Low Cable-04+23	30MHz~1GHz	Oct. 03, 2022	Oct. 02, 2023	Radiation (03CH05-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH05-CB)

Note: Calibration Interval of instruments listed above is one year.

NCR means Non-Calibration required.



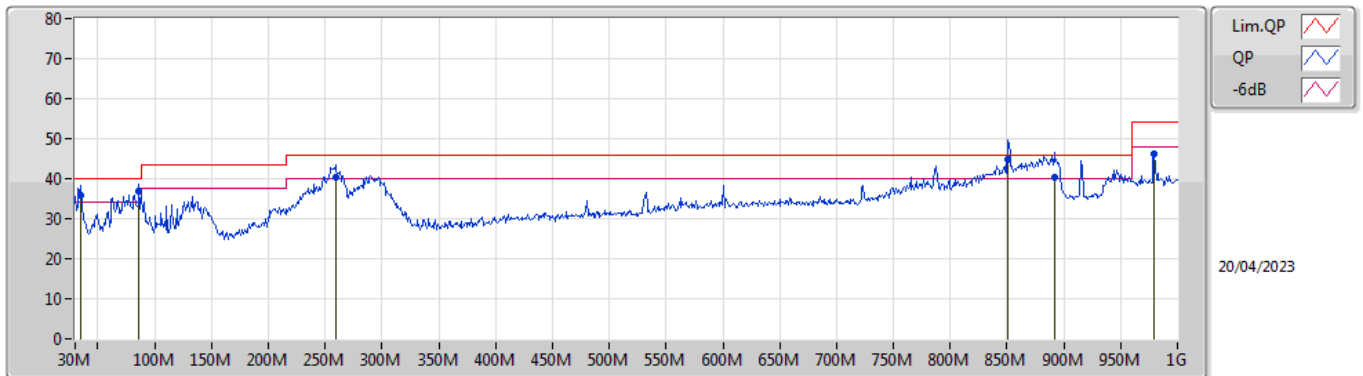
Radiated Emissions below 1GHz

Appendix A

Summary

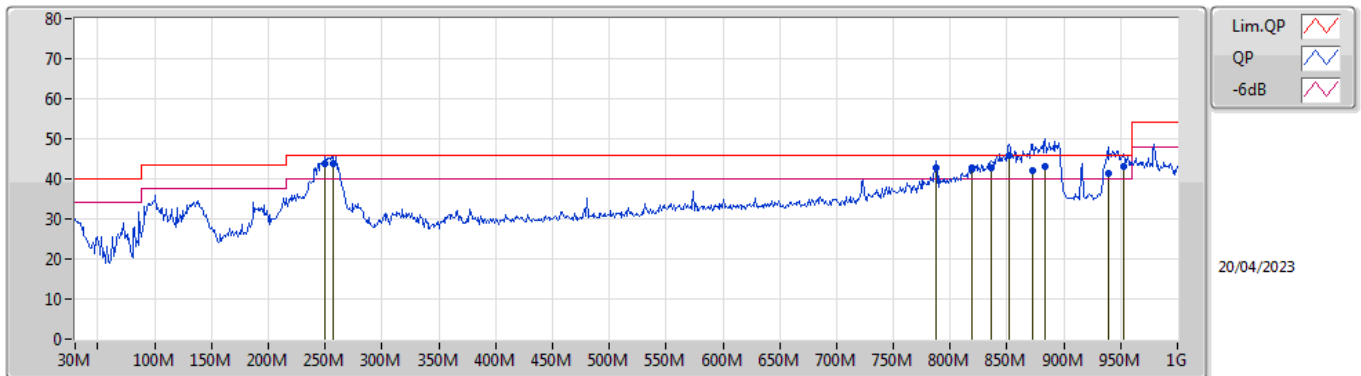
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 1	Pass	QP	851.59M	45.85	46.00	-0.15	Horizontal

Mode 1



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
QP	34.85M	35.74	40.00	-4.26	-31.38	3	Vertical	2	1.00	-	67.12	21.72	1.08	54.18
QP	86.26M	36.75	40.00	-3.25	-38.44	3	Vertical	226	1.25	-	75.19	14.05	1.59	54.08
QP	258.92M	40.49	46.00	-5.51	-31.93	3	Vertical	166	2.00	-	72.42	19.37	2.77	54.07
QP	850.62M	44.73	46.00	-1.27	-21.57	3	Vertical	4	1.00	"Worst"	66.30	25.97	5.40	52.94
QP	891.36M	40.40	46.00	-5.60	-21.01	3	Vertical	353	1.00	-	61.41	26.33	5.62	52.96
PK	979.63M	46.17	54.00	-7.83	-19.95	3	Vertical	24	1.25	-	66.12	27.08	5.80	52.83

Mode 1



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
QP	250.19M	43.75	46.00	-2.25	-33.04	3	Horizontal	310	1.25	-	76.79	18.28	2.72	54.04
QP	256.98M	43.89	46.00	-2.11	-32.19	3	Horizontal	310	1.25	-	76.08	19.12	2.76	54.07
QP	787.57M	42.64	46.00	-3.36	-22.18	3	Horizontal	81	1.00	-	64.82	25.68	5.15	53.01
PK	819.58M	42.62	46.00	-3.38	-22.07	3	Horizontal	98	1.50	-	64.69	25.63	5.28	52.98
QP	836.07M	42.72	46.00	-3.28	-21.81	3	Horizontal	272	1.50	-	64.53	25.81	5.34	52.96
QP	851.59M	45.85	46.00	-0.15	-21.55	3	Horizontal	263	1.50	"Worst"	67.40	25.98	5.41	52.94
QP	872.93M	42.05	46.00	-3.95	-21.30	3	Horizontal	106	1.50	-	63.35	26.13	5.52	52.95
QP	883.6M	43.08	46.00	-2.92	-21.14	3	Horizontal	262	1.25	-	64.22	26.24	5.58	52.96
QP	938.89M	41.43	46.00	-4.57	-20.61	3	Horizontal	289	1.25	-	62.04	26.58	5.69	52.88
QP	952.47M	43.17	46.00	-2.83	-20.41	3	Horizontal	271	1.25	-	63.58	26.74	5.70	52.85