Testing Laboratory 3787

RADIO TEST REPORT

FCC ID	:	UXX-S5A052A
Equipment	:	R1900-5GB
Brand Name	:	Cradlepoint
Model Name	:	S5A052A
Applicant	:	Cradlepoint, Inc. 1111 West Jefferson Street ,Boise ,Idaho,United States 83702
Manufacturer	:	Cradlepoint, Inc. 1111 West Jefferson Street ,Boise ,Idaho,United States 83702
Standard	:	47 CFR FCC Part 15.247

The product was received on Feb. 18, 2022, and testing was started from Feb. 18, 2022 and completed on Apr. 18, 2022. 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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History of this test report

Report No.	Version	Description	Issued Date
FR0N0310-10AA	01	Initial issue of report	Apr. 01, 2022
FR0N0310-10AA	02	Adding test results of Emissions in Restricted Frequency Bands	Apr. 22, 2022

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(b)	Maximum Conducted Output Power	PASS	-
3.2	15.247(d)	Emissions in Restricted Frequency Bands	PASS	-

Declaration of Conformity:
1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results. 2. The measurement uncertainty please refer to report "Measurement Uncertainty".
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen
Report Producer: Wendy Pan

1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	IEEE Std. 802.11	Ch. Frequency (MHz)	Channel Number
2400-2483.5	b, g, n (HT20), VHT20, ax (HEW20)	2412-2462	1-11 [11]
2400-2483.5	n (HT40), VHT40, ax (HEW40)	2422-2452	3-9 [7]

Band	Mode	BWch (MHz)	Nant
2.4-2.4835GHz	802.11b	20	2TX
2.4-2.4835GHz	802.11g	20	2TX
2.4-2.4835GHz	802.11n (HT20)	20	2TX
2.4-2.4835GHz	802.11n (HT20)-BF	20	2TX
2.4-2.4835GHz	VHT 20	20	2TX
2.4-2.4835GHz	VHT 20-BF	20	2TX
2.4-2.4835GHz	802.11ax (HEW20)	20	2TX
2.4-2.4835GHz	802.11ax (HEW20)-BF	20	2TX
2.4-2.4835GHz	802.11n (HT40)	40	2TX
2.4-2.4835GHz	802.11n (HT40)-BF	40	2TX
2.4-2.4835GHz	VHT 40	40	2TX
2.4-2.4835GHz	VHT 40-BF	40	2TX
2.4-2.4835GHz	802.11ax (HEW40)	40	2TX
2.4-2.4835GHz	802.11ax (HEW40)-BF	40	2TX

Note:
- 11b mode uses a combination of DSSS-DBPSK, DQPSK, CCK modulation.
- 11g, HT20 and HT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.
- VHT20, VHT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM modulation.
- HEW20, HEW40 use a combination of OFDMA-BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM modulation.
- BWch is the nominal channel bandwidth.

1.1.2 Antenna Information

Set	Port	Function	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	WLAN	PANORAMA	LG-IN2445	Combination	RP-SMA	Note 1
	2						
	-	GPS					
	-	WWAN					
	-						
	-						
	-						
2	1	WLAN	Cradlepoint	Test antenna 1	Monopole	RP-SMA	Note 1
	2						
3	1	Bluetooth	Master Wave	98242MRSX011	Dipole	RP-SMA	Note 1

Note 1:

Set	Port	Gain (dBi)					Cable loss (dB)		True Gain (dBi)				
		2.4 GHz	5GHz UNII 1	5GHz UNII 2A	5GHz UNII 2C	5GHz UNII 3	2.4 GHz	5GHz	2.4 GHz	5GHz UNII 1	5GHz UNII 2A	5GHz UNII 2C	5GHz UNII 3
1	1	2.1	2.4	2.35	2.25	2	0.7	1.1	1.4	1.3	1.25	1.15	0.9
	2												
2	1	5.5069	5.8125	5.7725	5.7133	5.9957	0.7	1.1	4.8069	4.7125	4.6725	4.6133	4.8957
	2												

Set	GPS Gain (dBi)
1	26

Set	Port	Gain (dBi)	Cable loss (dB)	True Gain (dBi)
		Bluetooth	Bluetooth	Bluetooth
3	1	2.16	0.7	1.46

Set	Brand	Frequency (GHz)	Gain (dBi)	Cable loss (dB)	True Gain (dBi)
1	2	1850-1920	0.25	0.42	-0.17
	4	1710-1785	0.05	0.42	-0.37
	5	807-862	0.80	0.28	0.52
	7	2496-2690	2.00	0.42	1.58
	12	699-714	0.15	0.25	-0.10
	13	777-787	0.85	0.25	0.60
	17	699-714	0.15	0.25	-0.10
	25	1850-1920	0.25	0.42	-0.17
	26	807-862	0.80	0.28	0.52
	30	2300-2400	1.50	0.42	1.08
	38	2496-2690	2.00	0.42	1.58
	41	2496-2690	2	0.42	1.58
	42	3300-3800	2.9	0.81	2.09
	48	3300-3800	2.9	0.81	2.09
	66	1710-1785	0.05	0.42	-0.37
	71	617-698	0.05	0.25	-0.20

Note1: Directional gain information

Type	Maximum Output Power	Power Spectral Density
Non-BF	Directional gain = Max.gain + array gain. For power measurements on IEEE 802.11 devices Array Gain = 0 dB (i.e., no array gain) for N ANT ≤ 4	$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

Ex.

Directional Gain (NSS1) formula :

$$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$$

NSS1(g1,1) = $10^{G1/20}$; NSS1(g1,2)= $10^{G2/20}$

gj,k =$(Nss1(g1,1) + Nss1(g1,2))^2$

DG = 10 log[$(Nss1(g1,1) + Nss1(g1,2))^2$ / N_{ANT}] => 10 log[$(10^{G1/20} + 10^{G2/20})^2$ / N_{ANT}]

Where ;

2.4G：G1 = Ant 1 Gain 2.1 dBi ; G2 = Ant 2 Gain 5.5069 dBi

5G B1：G1 = Ant 1 Gain 2.4 dBi ; G2 = Ant 2 Gain 5.8125 dBi

5G B2：G1 = Ant 1 Gain 2.35 dBi ; G2 = Ant 2 Gain 5.7725 dBi

5G B3：G1 = Ant 1 Gain 2.25 dBi ; G2 = Ant 2 Gain 5.7133 dBi

5G B4：G1 = Ant 1 Gain 2 dBi ; G2 = Ant 2 Gain 5.9957 dBi

2.4GHz DG = Ant 1 Gain 4.41 dBi ; G2 = Ant 2 Gain 7.8172 dBi

5Ghz B1 DG = Ant 1 Gain 4.31 dBi ; G2 = Ant 2 Gain 7.7228 dBi

5Ghz B2 DG = Ant 1 Gain 4.26 dBi ; G2 = Ant 2 Gain 7.6828 dBi

5Ghz B3 DG = Ant 1 Gain 4.16 dBi ; G2 = Ant 2 Gain 7.6236 dBi

5Ghz B4 DG = Ant 1 Gain 3.91 dBi ; G2 = Ant 2 Gain 7.9060 dBi

Note2: The above information was declared by manufacturer.

For 2.4GHz function:

For IEEE 802.11b/g/n/VHT/ax (2TX/2RX):

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

For 5GHz function:

For IEEE 802.11a/n/ac/ax (2TX/2RX):

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

For Bluetooth Function:

For Bluetooth mode (1TX/1RX)

Only Port 1 can be use as transmit and receive antenna.

1.1.3 EUT Operational Condition

EUT Power Type	From Adapter or DC PSE switch 6 pin or DC power 4 pin or DC power 8 pin			
Beamforming Function	☒	With beamforming	☐	Without beamforming
	The product has beamforming function for n/VHT/ax in 2.4GHz and n/ac/ax in 5GHz.			
Function	☒	Point-to-multipoint	☐	Point-to-point
Test Software Version	QSPR.exe Version 5.0-00188			

Note1: The above information was declared by manufacturer.
Note2: This device contains WWAN module FCC ID: N7NEM91

1.1.4 Table of WWAN Module Function

Brand Name	Model Name	FCC ID	IC	Function
Sierra	EM9190	N7NEM91	2417C-EM91	3G Band:2,4,5 4G Band:2,4,5,7,12,13,14,17,25,26,30,38,41,42,48,66,71 5G Band:n2,n5,n41,n66,n71 5G EN-DC Band: EN-DC_5A_n2A,EN-DC_12A_n2A,EN-DC_2A_n5A,EN-DC_7A_n5A,EN-DC_30A_n5A,EN-DC_66A_n5A,EN-DC_2A_n41A,EN-DC_66A_n41A,EN-DC_5A_n66A,EN-DC_12A_n66A,EN-DC_13A_n66A,EN-DC_2A_n71A,EN-DC_7A_n71A,EN-DC_66A_n71A

Note: The above information was declared by manufacturer.

1.1.5 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FR0N0310AA

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

Modifications	Performance Checking
Update to the cellular MCC location determining mechanism that is used for automatic region settings.	1.Maximum Conducted Output Power The above test item will be based on the original certificate output power to verify the worst case 802.11b 2437MHz. 2. Emissions in Restricted Frequency Bands

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 662911 D01 v02r01
- FCC KDB 662911 D03 v01
- FCC KDB 414788 D01 v01r01

1.3 Testing Location Information

Testing Location Information	
Test Lab.：Sporton International Inc. Hsinchu Laboratory	
Hsinchu (TAF: 3787)	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.) 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
RF Conducted	TH02-CB	Gino Huang	23.8-24.4 / 62-64	Feb. 18, 2022
Radiated	03CH03-CB	RJ Huang	23.5-24.6 / 55-59	Apr. 18, 2022

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
Conducted Emission	2.5 dB	Confidence levels of 95%
Output Power Measurement	1.3 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	4.2 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	5.5 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	4.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	4.2 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	Maximum Conducted Output Power
Test Condition	Conducted measurement at transmit chains
1	CTX – EUT with Antenna Set 1

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.
1. The EUT was performed at Y axis and Z axis position, and the worst case was found at Z axis. So the measurement will follow this same test configuration. 2. The antenna Set 1 was performed at Y axis and Z axis position, and the worst case was found at Z axis. So the measurement will follow this same test configuration. 3. The testing was performed at SIM Slot 1, SIM Slot 2, and the worst case was found at SIM Slot 2. So the measurement will follow this same test configuration. 4. The testing was performed powered from DC PSE switch 6 pin, Adapter 1, DC power 4 pin, DC power 8 pin, Adapter 2, and the worst case was found at Adapter 2. So the measurement will follow this same test configuration. 5. The testing was performed 3G Band 2, 4G Band 2, 5G EN-DC Band DC_5A_n2A, and the worst case was found at 3G Band 2. So the measurement will follow this same test configuration.	
Operating Mode < 1GHz	Normal Link
1	EUT at Z axis + Set 1 antenna at Z axis + WLAN (3G Band 2) + Bluetooth + GPS + WWAN + SIM Slot 2 + Adapter 2
Operating Mode > 1GHz	Normal Link
1	EUT at Z axis + Set 1 antenna at Z axis + WLAN (3G Band 2) + Bluetooth + GPS + WWAN + SIM Slot 2 + Adapter 2

Note: The following support unit for measurement only, would not be marketed.

Support Unit	Brand Name	Model Name
Adapter 1	APD	WA-36N12R
Adapter 2	Ktec	KSA-36W-120300D5

2.2 EUT Operation during Test

For CTX Mode:

The EUT was programmed to be in continuously transmitting mode.

For Normal Link Mode:

During the test, the EUT operation to normal function.

2.3 Accessories

DC power cable 4 pin*1, non-shielded, 3m

2.4 Support Equipment

For Radiated:

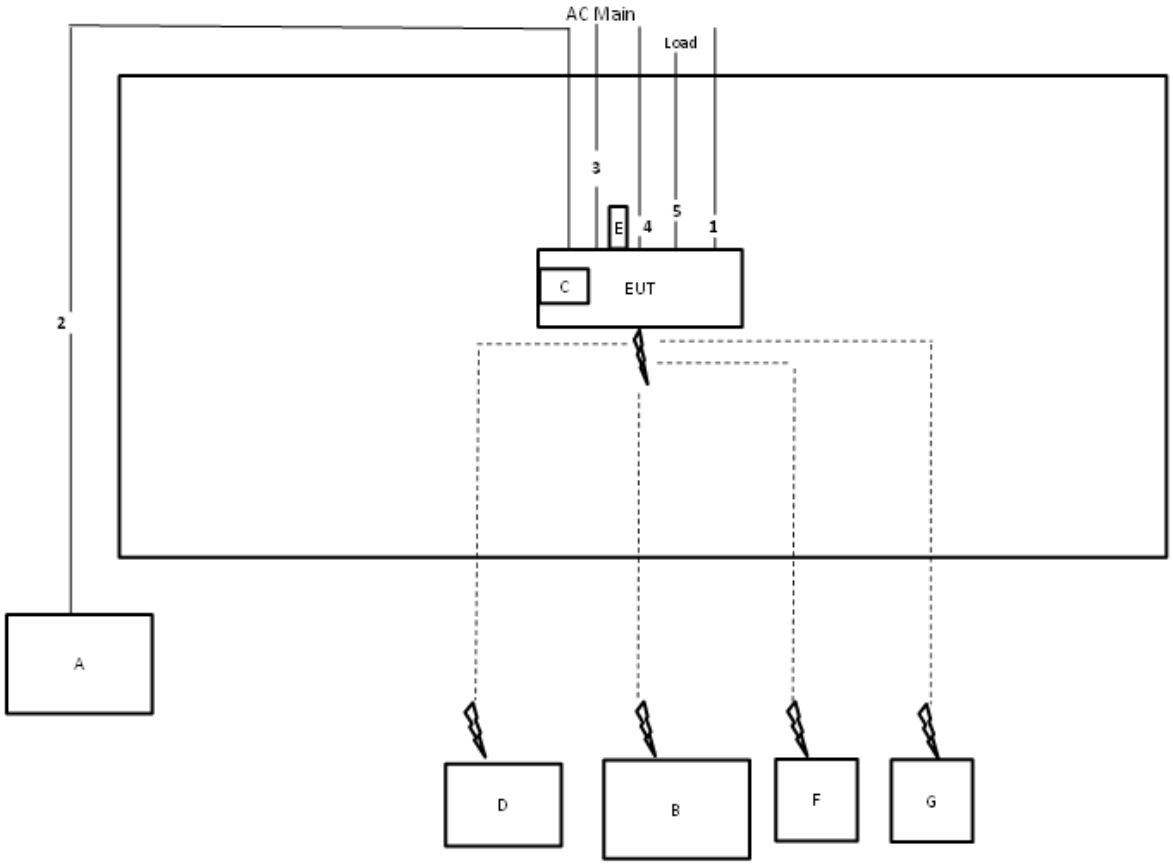
Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
A	Notebook(LAN NB)	DELL	E4300	N/A
B	Base station	Anritsu	MT8820C	N/A
C	SIM Card	Anritsu	N/A	N/A
D	Notebook(2.4G NB)	DELL	E4300	N/A
E	Flash disk3.0	Transcend	JetFlash-700	N/A
F	Notebook(5G NB)	DELL	E4300	N/A
G	GPS Simulator	WELNAVIGATE	GS-100	N/A
H	Adapter 2	Ktec	KSA-36W-120300D5	N/A

For RF Conducted:

Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
A	Notebook	DELL	E4300	N/A
B	Adapter 1	APD	WA-36N12R	N/A

2.5 Test Setup Diagram

Test Setup Diagram - Radiated Test



Item	Connection	Shielded	Length	Remark
1	Ground cable	No	1.5m	-
2	RJ-45 cable	No	10m	-
3	Power cable	No	1.5m	-
4	RS-232 cable	Yes	1.7m	-
5	RJ-45 cable	No	1.5m	Load*2

3 Transmitter Test Result

3.1 Maximum Conducted Output Power

3.1.1 Maximum Conducted Output Power Limit

Maximum Conducted Output Power Limit		
	▪ If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 W)	
	▪ Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)$ dBm	
	▪ Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)/3$ dBm	
	▪ Smart antenna system (SAS):	
		- Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)/3$ dBm
		- Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)/3$ dBm
		- Aggregate power on all beams: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)/3 + 8$dB dBm
P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, **G_{TX}** = the maximum transmitting antenna directional gain in dBi.		

3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

Test Method	
▪ Maximum Peak Conducted Output Power	
	☐ Refer as FCC KDB 558074, clause 8.3.1.1 & C63.10 clause 11.9.1.1 (RBW ≥ EBW method).
	☐ Refer as FCC KDB 558074, clause 8.3.1.3 & C63.10 clause 11.9.1.3 (peak power meter).
▪ Maximum Conducted Output Power	
	[duty cycle ≥ 98% or external video / power trigger]
	☐ Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.2 Method AVGSA-1.
	☐ Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.3 Method AVGSA-1A. (alternative)
	duty cycle < 98% and average over on/off periods with duty factor
	☐ Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.4 Method AVGSA-2.
	☐ Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.5 Method AVGSA-2A (alternative)
	☐ Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.6 Method AVGSA-3
	☐ Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.7 Method AVGSA-3A (alternative)
	Measurement using a power meter (PM)
	☐ Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.1 Method AVGPM (using an RF average power meter).
	☒ Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.2 Method AVGPM-G (using an gate RF average power meter).
▪ For conducted measurement.	
	▪ If the EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.
	▪ If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + \ldots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$

3.1.4 Test Setup

Maximum Conducted Output Power (Power Meter)


3.1.5 Test Result of Maximum Conducted Output Power

Refer as Appendix A

3.2 Emissions in Restricted Frequency Bands

3.2.1 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.

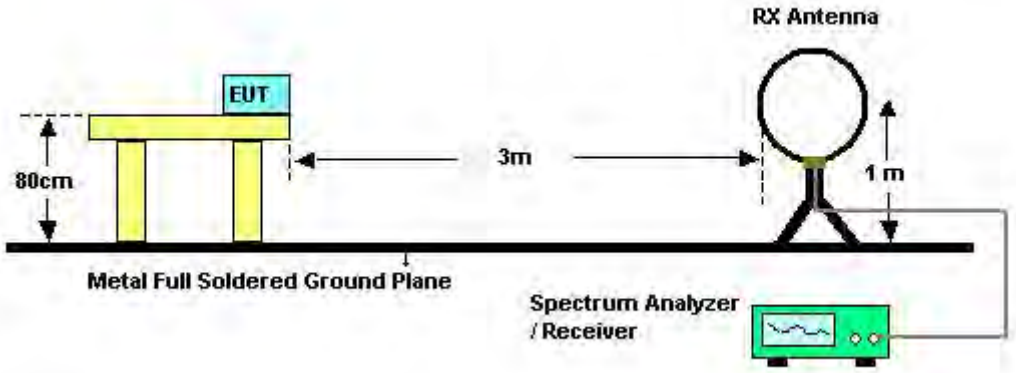
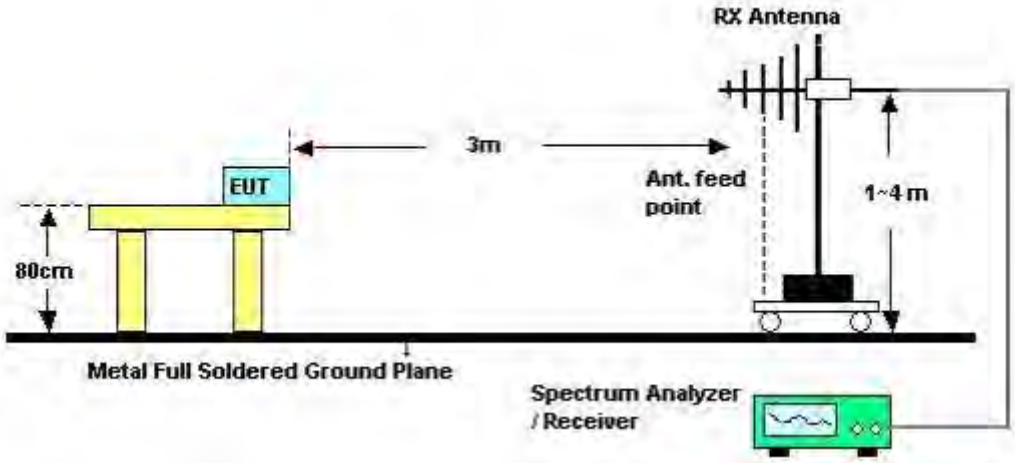
3.2.2 Measuring Instruments

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

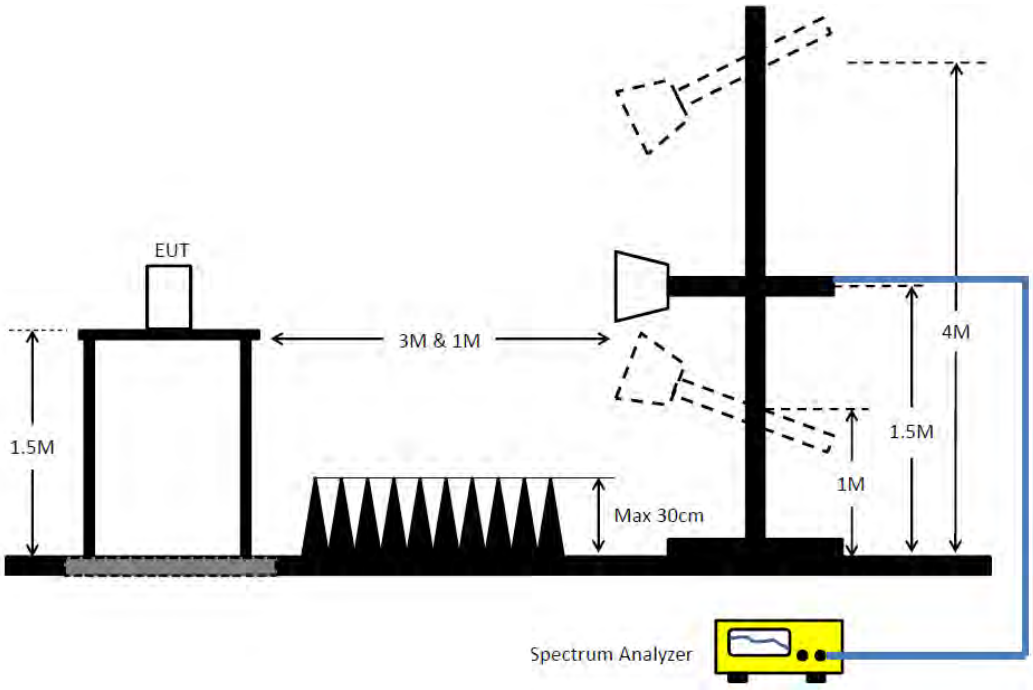
3.2.3 Test Procedures

Test Method		
▪ The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].		
▪ 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.		
▪ For the transmitter unwanted emissions shall be measured using following options below:		
	▪ Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands.	
		☐ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.1(trace averaging for duty cycle ≥98%).
		☐ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.2(trace averaging + duty factor).
		☒ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.3(Reduced VBW≥1/T).
		☐ Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW ≥ 1/T, where T is pulse time.
		☐ Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions.
		☒ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.4 measurement procedure peak limit.
▪ For the transmitter band-edge emissions shall be measured using following options below:		
	▪ 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.	
	▪ Refer as FCC KDB 558074, clause 8.7 (ANSI C63.10, clause 6.10.6) for marker-delta method for band-edge measurements.	
	▪ 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).	
	▪ 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	
	▪ 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.	

3.2.4 Test Setup

Radiated - Emissions in Restricted Frequency Bands
9kHz ~30MHz

30MHz~1GHz


Above 1GHz



3.2.5 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.

3.2.6 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.

3.2.7 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix B

4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Spectrum analyzer	R&S	FSV40	101027	9kHz~40GHz	Aug. 02, 2021	Aug. 01, 2022	Conducted (TH02-CB)
Power Sensor	Anritsu	MA2411B	1126203	300MHz~40GHz	Oct. 25, 2021	Oct. 24, 2022	Conducted (TH02-CB)
Power Meter	Anritsu	ML2495A	1210004	300MHz~40GHz	Oct. 25, 2021	Oct. 24, 2022	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-01	1 GHz – 18 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-02	1 GHz – 18 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-03	1 GHz – 18 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-04	1 GHz – 18 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-05	1 GHz – 18 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH02-CB)
Switch	SPTCB	SP-SWI	SWI-02	1 GHz –26.5 GHz	Dec. 13, 2021	Dec. 12, 2022	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	SWI-02-P1	1 GHz –26.5 GHz	Dec. 13, 2021	Dec. 12, 2022	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	SWI-02-P2	1 GHz –26.5 GHz	Dec. 13, 2021	Dec. 12, 2022	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	SWI-02-P3	1 GHz –26.5 GHz	Dec. 13, 2021	Dec. 12, 2022	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	SWI-02-P4	1 GHz –26.5 GHz	Dec. 13, 2021	Dec. 12, 2022	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	SWI-02-P5	1 GHz –26.5 GHz	Dec. 13, 2021	Dec. 12, 2022	Conducted (TH02-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conducted (TH02-CB)
Loop Antenna	Teseq	HLA 6120	31244	9kHz - 30 MHz	Mar. 18, 2022	Mar. 17, 2023	Radiation (03CH03-CB
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH03-CB	30 MHz ~ 1 GHz	Jan. 26, 2022	Jan. 25, 2023	Radiation (03CH03-CB)
3m Semi Anechoic Chamber VSWR	TDK	SAC-3M	03CH03-CB	1GHz ~18GHz 3m	May 06, 2021	May 05, 2022	Radiation (03CH03-CB)
Bilog Antenna with 6 dB attenuator	Schaffner & EMCI	CBL6112B & N-6-06	2928 & AT-N0608	20MHz ~ 2GHz	Feb. 21, 2022	Feb. 20, 2023	Radiation (03CH03-CB)
Horn Antenna	ETS・Lindgren	3115	6821	750MHz~18GHz	Jan. 21, 2022	Jan. 20, 2023	Radiation (03CH03-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Aug. 05, 2021	Aug. 04, 2022	Radiation (03CH03-CB)

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Pre-Amplifier	Agilent	8447D	2944A10259	9kHz ~ 1.3GHz	Jan. 10, 2022	Jan. 09, 2023	Radiation (03CH03-CB)
Pre-Amplifier	Agilent	8449B	3008A02097	1GHz ~ 26.5GHz	Jul. 02, 2021	Jul. 01, 2022	Radiation (03CH03-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jul. 13, 2021	Jul. 12, 2022	Radiation (03CH03-CB)
Spectrum Analyzer	R&S	FSP40	100019	9kHz ~ 40GHz	Jun. 04, 2021	Jun. 03, 2022	Radiation (03CH03-CB)
EMI Test Receiver	R&S	ESCS	826547/017	9kHz ~ 2.75GHz	Jun. 21, 2021	Jun. 20, 2022	Radiation (03CH03-CB)
RF Cable-low	Woken	RG402	Low Cable-02+29	30MHz ~ 1GHz	Oct. 04, 2021	Oct. 03, 2022	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-20+29	1GHz ~ 18GHz	Oct. 04, 2021	Oct. 03, 2022	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-29	1GHz ~ 18GHz	Oct. 04, 2021	Oct. 03, 2022	Radiation (03CH03-CB)
High Cable	Woken	WCA0929M	40G#5+7	1GHz ~ 40 GHz	Dec. 14, 2021	Dec. 13, 2022	Radiation (03CH03-CB)
High Cable	Woken	WCA0929M	40G#5	1GHz ~ 40 GHz	Dec. 08, 2021	Dec. 07, 2022	Radiation (03CH03-CB)
High Cable	Woken	WCA0929M	40G#7	1GHz ~ 40 GHz	Dec. 14, 2021	Dec. 13, 2022	Radiation (03CH03-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH03-CB)

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

N.C.R. means Non-Calibration required.

Summary

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
802.11b_Nss1,(1Mbps)_2TX	26.55	0.45186

Result

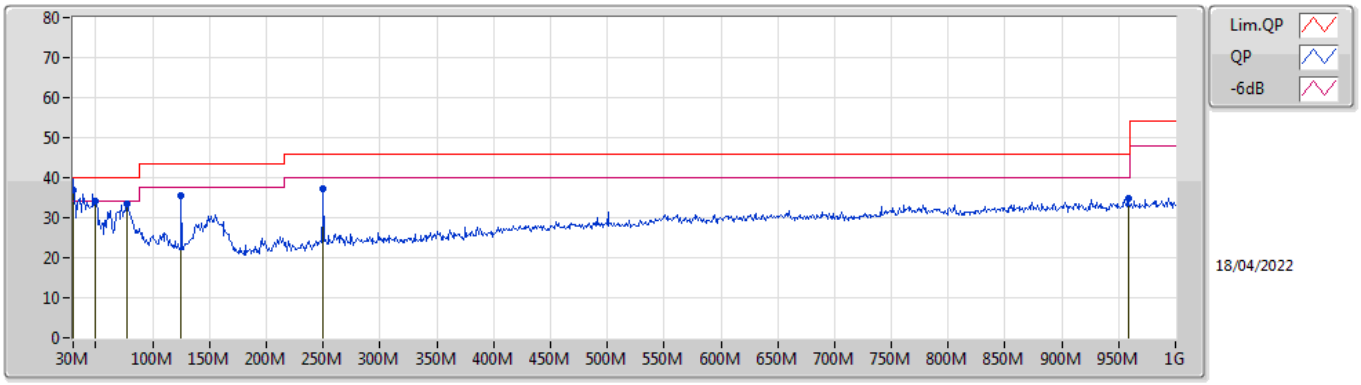
Mode	Result	DG (dBi)	Port 1 (dBm)	Port 2 (dBm)	Total Power (dBm)	Power Limit (dBm)
802.11b_Nss1,(1Mbps)_2TX	-	-	-	-	-	-
2437MHz	Pass	1.40	24.29	22.64	26.55	30.00

DG = Directional Gain; Port X = Port X output power

Summary

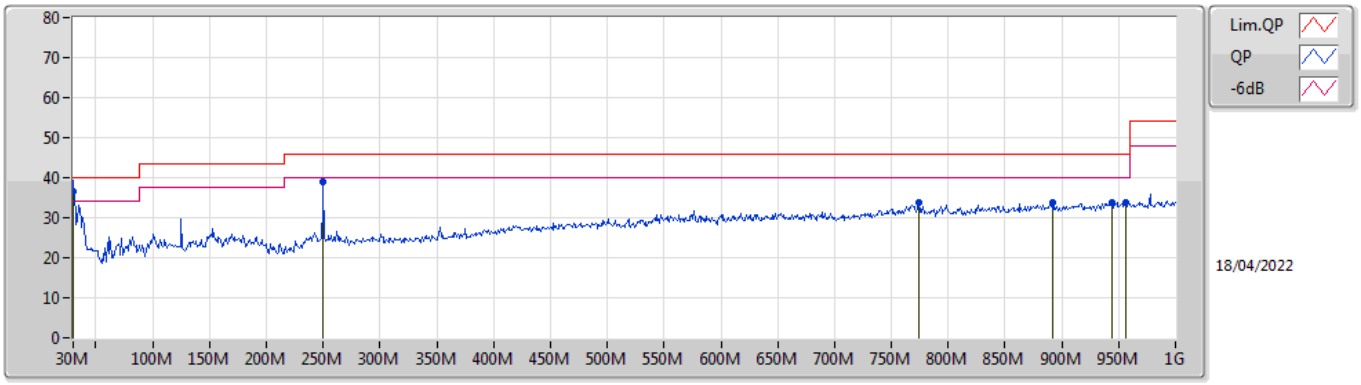
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 1	Pass	QP	30M	36.85	40.00	-3.15	Vertical

Mode 1



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB/m)	(m)		(°)	(m)		(dBuV/m)	(dB/m)	(dB)	(dB)
QP	30M	36.85	40.00	-3.15	-2.07	3	Vertical	95	3.00	"Worst"	38.92	25.20	1.20	28.47
PK	49.4M	34.10	40.00	-5.90	-12.65	3	Vertical	360	1.25	-	46.75	14.52	1.31	28.48
PK	77.53M	33.54	40.00	-6.46	-14.18	3	Vertical	247	1.00	-	47.72	12.92	1.45	28.55
PK	125.06M	35.63	43.50	-7.87	-8.85	3	Vertical	216	1.00	-	44.48	17.74	1.70	28.29
PK	250.19M	37.25	46.00	-8.75	-7.35	3	Vertical	148	1.00	-	44.60	18.24	2.20	27.79
PK	958.29M	34.94	46.00	-11.06	2.43	3	Vertical	177	1.00	-	32.51	26.83	4.12	28.52

Mode 1

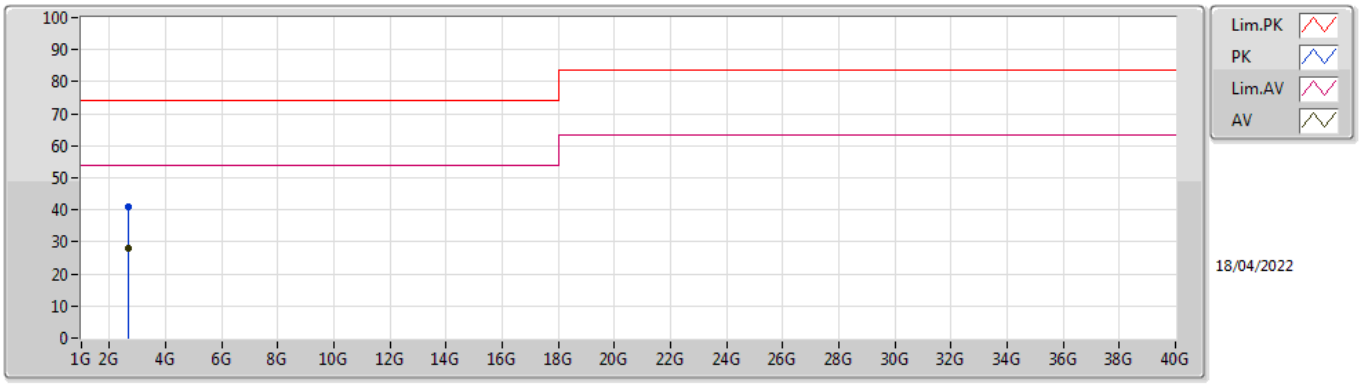


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB/m)	(m)		(°)	(m)		(dBuV/m)	(dB/m)	(dB)	(dB)
QP	30M	36.44	40.00	-3.56	-2.07	3	Horizontal	212	3.00	"Worst"	38.51	25.20	1.20	28.47
PK	250.19M	38.82	46.00	-7.18	-7.35	3	Horizontal	169	1.00	-	46.17	18.24	2.20	27.79
PK	773.99M	33.94	46.00	-12.06	0.61	3	Horizontal	8	1.50	-	33.33	25.88	3.75	29.02
PK	892.33M	33.83	46.00	-12.17	1.70	3	Horizontal	310	1.50	-	32.13	26.39	3.97	28.66
PK	944.71M	33.90	46.00	-12.10	2.17	3	Horizontal	346	2.00	-	31.73	26.67	4.09	28.59
PK	956.35M	33.65	46.00	-12.35	2.39	3	Horizontal	19	3.00	-	31.26	26.82	4.11	28.54

Summary

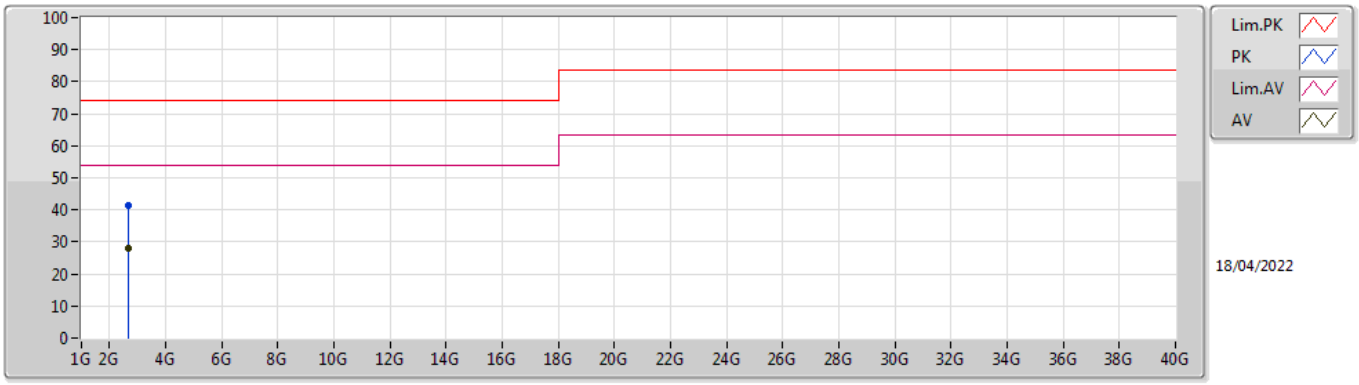
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 1	Pass	AV	2.64923G	28.06	54.00	-25.94	Horizontal

Mode 1



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB/m)	(m)		(°)	(m)		(dBuV/m)	(dB/m)	(dB)	(dB)
PK	2.64923G	40.78	74.00	-33.22	-1.50	3	Vertical	0	0.00	-	42.28	29.00	5.22	35.72
AV	2.64925G	28.04	54.00	-25.96	-1.50	3	Vertical	0	0.00	"Worst"	29.54	29.00	5.22	35.72

Mode 1



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB/m)	(m)		(°)	(m)		(dBuV/m)	(dB/m)	(dB)	(dB)
PK	2.65013G	41.29	74.00	-32.71	-1.49	3	Horizontal	0	0.00	-	42.78	29.00	5.23	35.72
AV	2.64923G	28.06	54.00	-25.94	-1.50	3	Horizontal	0	0.00	"Worst"	29.56	29.00	5.22	35.72