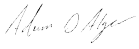
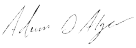
Test Report # 3584 G (Simultaneous Transmit)

Equipment Under Test:	A700x Series Devices (A710x, A720x, A730x)
Requirement(s):	FCC 15.247 / 15.209, RSS-247 / RSS-GEN
Test Date(s):	May 31st – June 2nd , 2022
Prepared for:	Honeywell International Inc. Attn: Gretchen Bullen 9680 Old Bailes Road Fort Mill, SC 29707

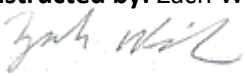
Report Issued by: Adam Alger, Laboratory Manager

Signature:  Date: 9/15/2022

Report Reviewed by: Adam Alger, Laboratory Manager

Signature:  Date: 7/6/2022

Report Constructed by: Zach Wilson, EMC Engineer

Signature:  Date: 7/5/2022

CONTENTS

Laird Connectivity Test Services in Review

The Laird Connectivity, Inc. laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:

Certificate #1255.01

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025:2017 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

Scope of accreditation includes all test methods listed herein unless otherwise noted

---

Federal Communications Commission (FCC) – USA

Accredited Test Firm Registration Number: 953492

Recognition of two 3 meter Semi-Anechoic Chambers

Innovation, Science and Economic Development Canada

Accredited U.S. Identification Number: US0218

Recognition of two 3 meter Semi-Anechoic Chambers

1 TEST REPORT SUMMARY

During **May 31st - June 2nd , 2022** the Equipment Under Test (EUT), **A700x Series Devices (A710x, 720x, 730x)**, as provided by **Honeywell International Inc.** was tested to the following requirements **Federal Communications Commission and Innovation, Science and Economic Development Canada**:

FCC 15.247, RSS-247

Requirement	Description	Specification	Method	Result
FCC: 15.247 (d) IC: RSS-GEN 8.10	Spurious Radiated Emissions in Restricted Bands	FCC 15.209 RSS-GEN 8.9	ANSI C63.10	Pass

Notice:

The results relate only to the item tested as configured and described in this report. Any additional configurations, modes of operation, or modifications made to the equipment under test after the specified test date(s) are at the decision of the client and may not apply to the data seen in this test report.

The decision rule for Pass / Fail assessment to the specification or standard listed in this test report has been agreed upon by the client and laboratory to be as follows:

Measurement Type	Rule
Emissions – Amplitude	1 dB below specified limit
Emissions – Frequency	1% less than the specification
Immunity	Tested at specified level

2 CLIENT INFORMATION

Company Name	Honeywell International Inc.
Contact Person	Gretchen Bullen
Address	9680 Old Bailes Road Fort Mill, SC 29707

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	A700x Series Devices (A710x, 720x, 730x)
Model Number	TAP1010-02, TAP1020-02, TAP1030-02
Serial Number	Engineering Sample
FCC ID	HD5-TAP1000-02
IC ID	1693B-TAP100002

2.2 Product Description

The EUT is a handheld communication device consisting of the Laird SU60-SIPT WLAN 2.4/5 GHz and BLE/BT module. The EUT also contains the NXP PN7150BOHN/C110xx NFC radio. The EUT was powered by a 3.7 VDC battery. The WLAN operates in SISO mode only.

The EUT has three different models:

- A710x - Contains the basic wireless functionality
- A720x - Contains an end cap with two external proprietary connectors that add on the ability to connect a wired headset and a peripheral device such as a printer or scanner.
- A730x - Contains an imager end cap that adds scanning functionality.

All models use identical radios and circuit boards in the “base unit” and the different A700x versions add additional (non-radio) capabilities through different, factory configurable “end caps”.

All conducted testing was completed on the A710x model. Radiated measurements completed for all three models.

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Simultaneous Transmission

The EUT radio combinations that are capable of simultaneous transmission are shown below:

- WLAN 5 GHz + BT/BLE + NFC
- WLAN 2.4 GHz + NFC

2.6 Radio Programming

The WLAN radios were programmed using the Laird Regulatory Tool v 9.32.0.6. BLE and BT radios were programmed using default HCI commands via the windows command prompt. The NFC radio was programmed using Honeywell's CBOB program V1.0.

2.7 Antennas

The device contains three antennas:

- Custom dual band PCB inverted F type antenna with a peak gain of
  - +4.7 dBi in 2400-2484 MHz
  - +6.4 dBi in 5150-5350 MHz
  - +6.9 dBi in 5470-5725 MHz
  - +7.3 dBi in 5725-5850 MHz
- Custom PCB inverted F type antenna with a peak gain of +0.2 dBi for the BT/BLE radios.
- Flex circuit magnetic loop antenna, P/N 1002403 for the NFC radio.

3 REFERENCES

Publication	Edition	Date	AMD 1	AMD 2
FCC eCFR	-	2022	-	-
RSS-247	2	2017	-	-
RSS-Gen	5	2018	2019	2021
ANSI C63.10	-	2013	-	-

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k = 2.

References	Version / Date
CISPR 16-4-1	Ed. 2 (2009-02)
CISPR 16-4-2	Ed. 2 (2011-06)
CISPR 32	Ed. 1 (2012-01)
ANSI C63.23	2012
A2LA P103	February 4, 2016
A2LA P103c	August 10, 2015
ETSI TR 100-028	V1.3.1 (2001-03)

Measurement Type	Configuration	Uncertainty ±
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

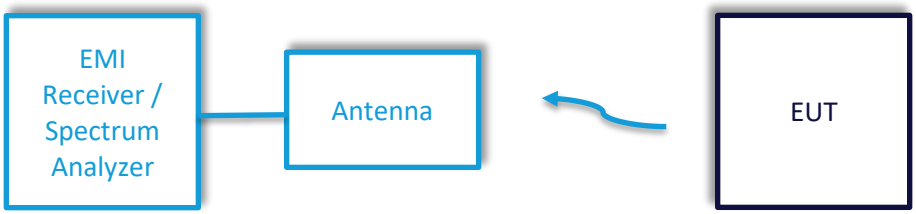
Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Radiated Emissions

Description of Measurement	The frequency spectrum is investigated for intentional and / or unintentional signals emanating from the EUT by use of a standardized test site and measurement antenna. The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed allowing the data to be gathered and reported as corrected values. The maximum emissions from the EUT are determined by turn-table azimuth rotation (360°) and scanning of the measurement antenna. Maximized levels are noted at degree values of azimuth, measurement antenna height, and measurement antenna polarity.
Example Calculations	Measurement (dBµV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBµV/m) Margin (dB) = Limit (dBµV/m) - Corrected Reading (dBµV/m) Example at 4000 MHz: Reading = 40 dBµV + 3.4 dB + 0.9 dB + 6.5 dB/m = 50.8 dBµV/m Average Limit = 20 log (500) = 54 dBµV/m Margin = 54 dBµV/m - 50.8 dBµV/m = 3.2 dB

Block Diagram



5.1.1 Radiated Emissions

Operator	Jon Dilley | Ivan Alvarez	**QA**	Alec Krabbe | Braden Smith
Temperature	21.6°C to 25.3°C	**R.H. %**	45.9% to 56.0%
Test Date	5/31 – 6/2, 2022	**Location**	Chamber 5, Chamber 3
Requirement	FCC 15.209	**Method**	ANSI C63.10

Limits:

Frequency (MHz)	Quasi-Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Peak Limit (dBµV/m)
30-88	40.0	-	-
88-216	43.5	-	-
216-960	46.0	-	-
960-1000	54.0	-	-
1000-25000	-	54.0	74.0

Test Parameters

Frequency	30 MHz to 25 GHz	**Distance**	3m
Detector(s)	Quasi peak detector for measurements under 1 GHz. Average measurements made with a reduced VBW of 16 kHz. Max peak hold for plots.	**Table height**	80cm (below 1 GHz) 150cm (above 1 GHz)
RBW	120 kHz (below 1 GHz) 1 MHz (above 1 GHz)	**VBW**	1.2 MHz (below 1 GHz) 3 MHz (above 1 GHz peak) 16 kHz (above 1 GHz average) 30 kHz for emission identification
Plots	Worst case plots shown.	**EUT Orientations**	Flat, Vertical, Horizontal

Note: No additional spurious, intermodulation, or other emissions found as a result of simultaneous transmission configurations.

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960007	Antenna - Double Ridge Horn	EMCO	3115	9311-4138	8/23/2021	8/23/2022	Active Calibration
AA 960158	Antenna - Double Ridge Horn	ETS Lindgren	3117	109300	9/27/2021	9/27/2022	Active Calibration
AA 960162	Cable	MegaPhase	EM2-S1S1-120	51503501 001	3/22/2022	3/22/2023	Active Verification
AA 960174	Antenna - Small Horn	ETS Lindgren	3116C-PA	00206880	9/1/2021	9/1/2022	Active Calibration
AA 960176	Cable	A.H. Systems, Inc.	SAC-26G-6	395	3/22/2022	3/22/2023	Active Verification
EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/11/2022	4/11/2023	Active Calibration
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/12/2022	4/12/2023	Active Calibration
EE 960161	Antenna - Low Noise Amplifier	Ducommun Technologies	ALN-33144030-01	1003717-01	8/16/2021	8/16/2022	Active Calibration
EE 960203	Analyzer - EMI Receiver	Keysight	N9038A	MY56400072	4/13/2022	4/13/2023	Active Calibration
LSC-300	Cable	Chamber 3 Emissions	-	-	4/26/2022	4/26/2023	Active Verification
LSC-500	Cable	Chamber 5 Emissions	-	-	4/25/2022	4/25/2023	Active Verification
AA 960150	Antenna - Biconical	ETS Lindgren	3110B	0003-3346	10/7/2021	10/7/2022	Active Calibration
AA 960151	Antenna - Small Bicon	Schwarzbeck	SBA 9112	SBA 9112-158	7/1/2020	7/1/2023	Active Calibration

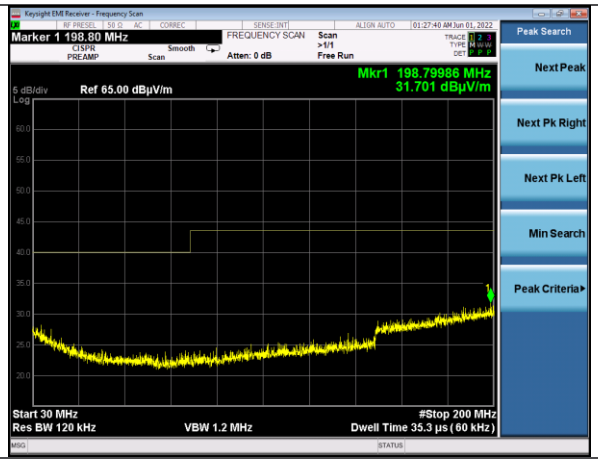
Data Tables

Frequency (MHz)	Antenna Polarity	EUT Orientation	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Quasi-Peak Margin (dB)
190.9	Vertical	Vertical	100	0	25.1	43.5	18.4
191.8	Horizontal	Vertical	100	0	25.1	43.5	18.4
988.3	Horizontal	Vertical	100	0	30.3	54.0	23.7
880.4	Vertical	Vertical	100	0	29.4	54.0	24.6

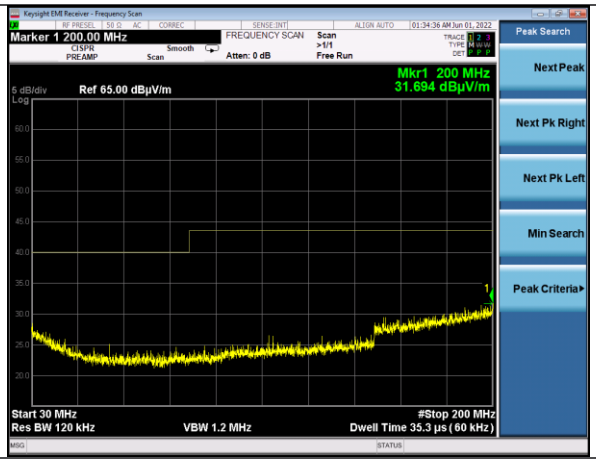
Frequency (MHz)	Antenna Polarity	EUT Orientation	Height (cm)	Azimuth (degree)	Average Reading (dBµV/m)	Peak Reading (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)	Peak Limit (dBµV/m)	Peak Margin (dB)
2296.1	V	V	150	0	39.9	50.1	54.0	14.1	74.0	23.9
3613.7	H	V	150	0	40.8	51.2	54.0	13.2	74.0	22.8

Note: Tabular data is measurement of system noise floor.

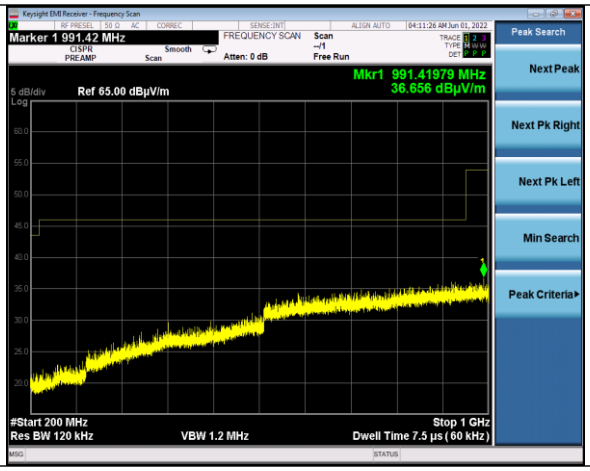
Spurious Plots (WLAN5, BT Hopping, NFC)



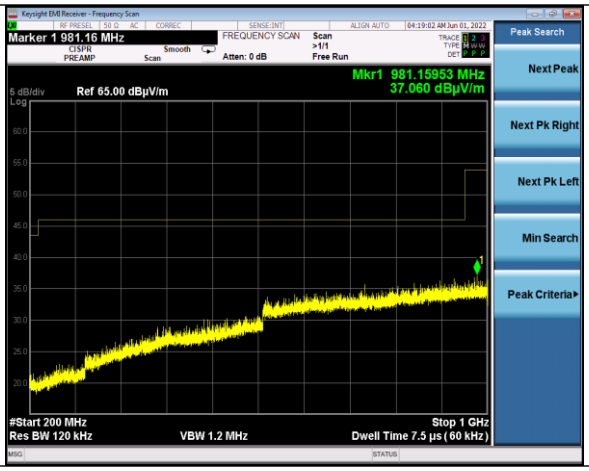
30-200 MHz Horizontal



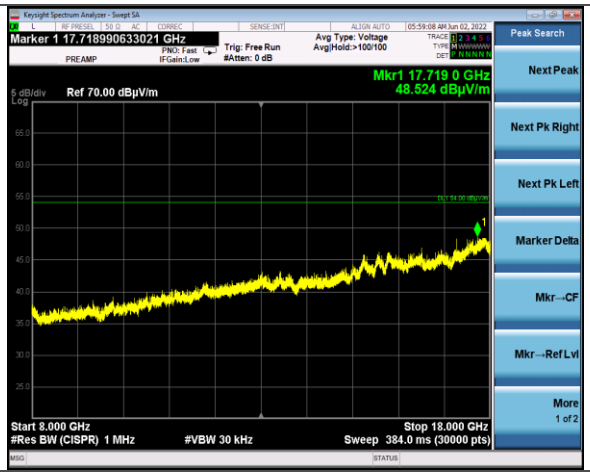
30-200 MHz Vertical



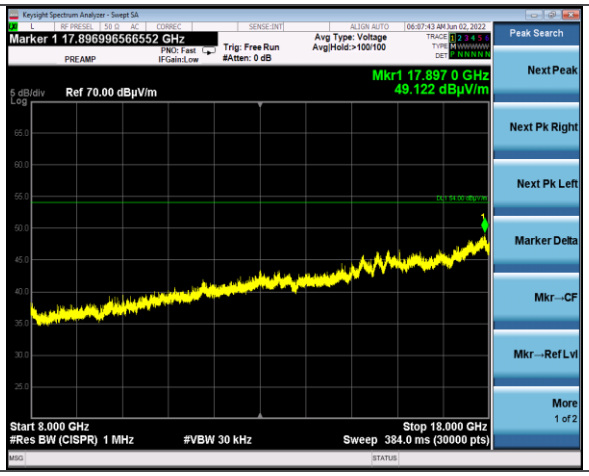
200-1000 MHz Horizontal



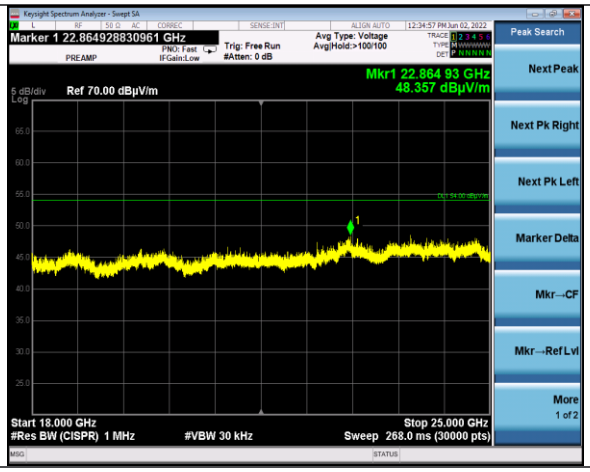
200-1000 MHz Vertical



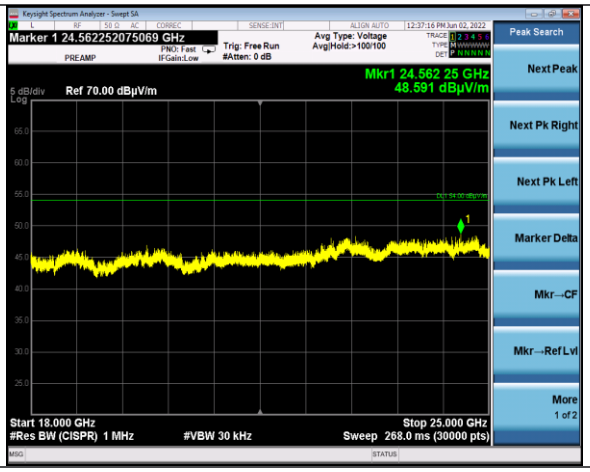
8-18 GHz Horizontal



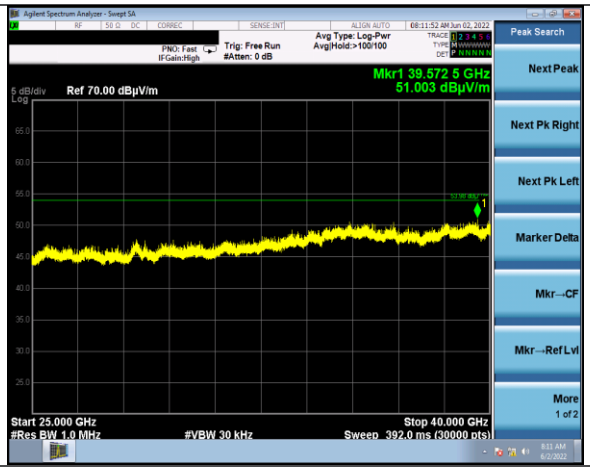
8-18 GHz Vertical



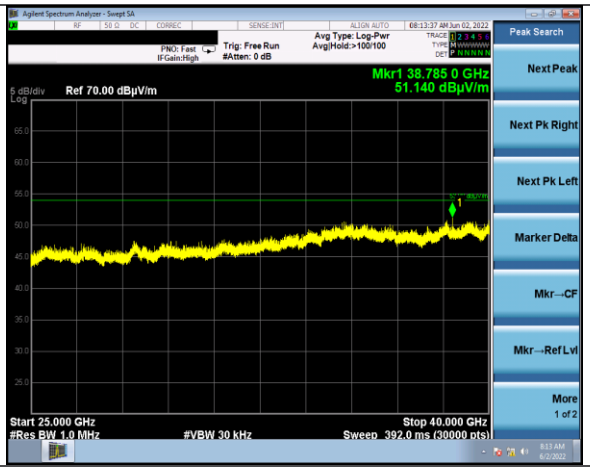
18-25 GHz Horizontal



18-25 GHz Vertical

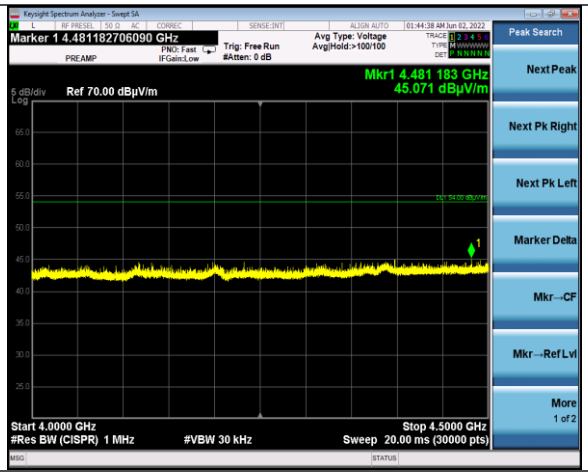


25-40 GHz Horizontal

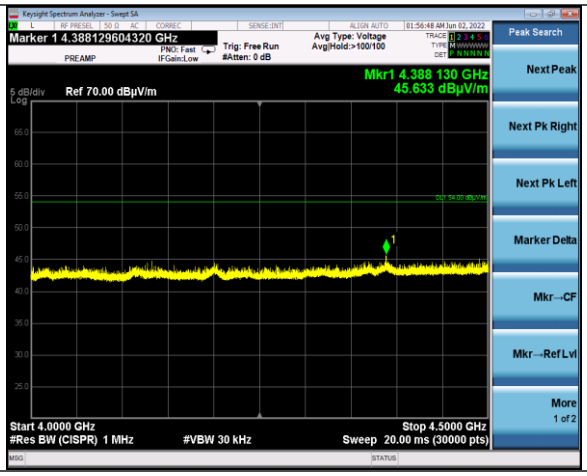


25-40 GHz Vertical

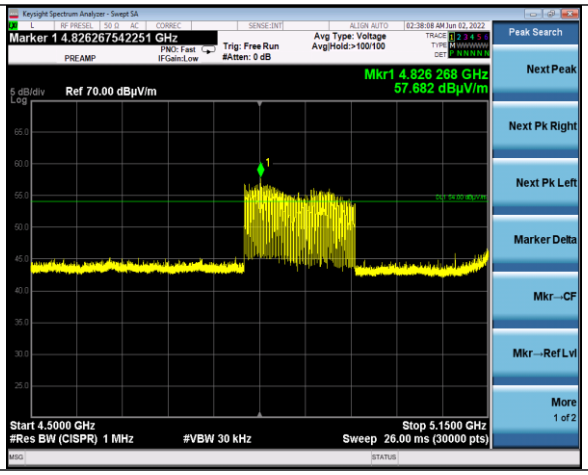
Near authorized band plots (intermodulation investigation) WLAN5, BT Hopping, NFC



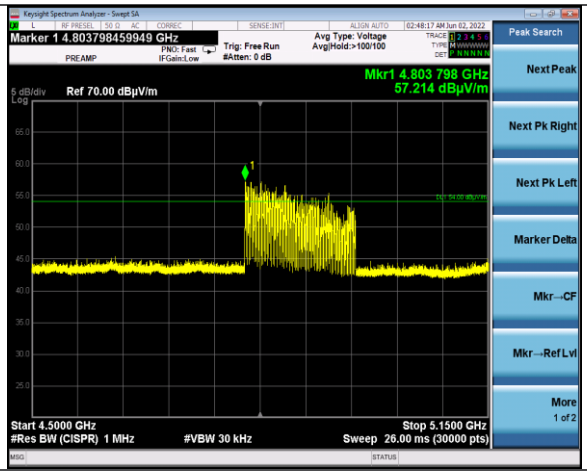
4-4.5 GHz Horizontal



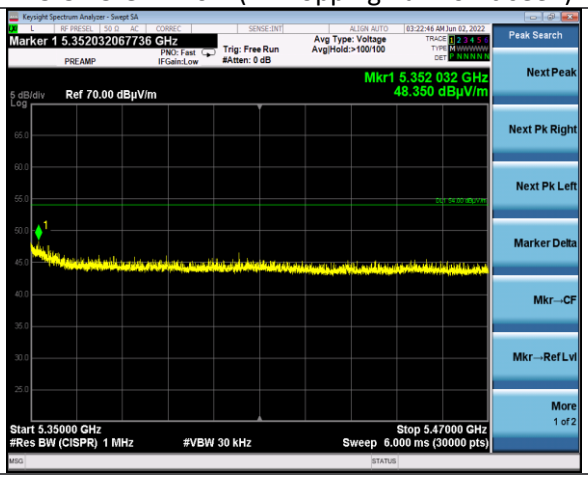
4-4.5 GHz Vertical



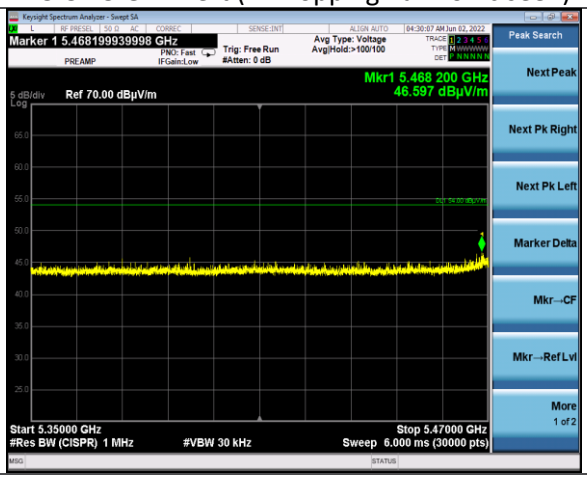
4.5-5.15 GHz Horz (BT hopping harmonic seen)



4.5-5.15 GHz Vert (BT hopping harmonic seen)

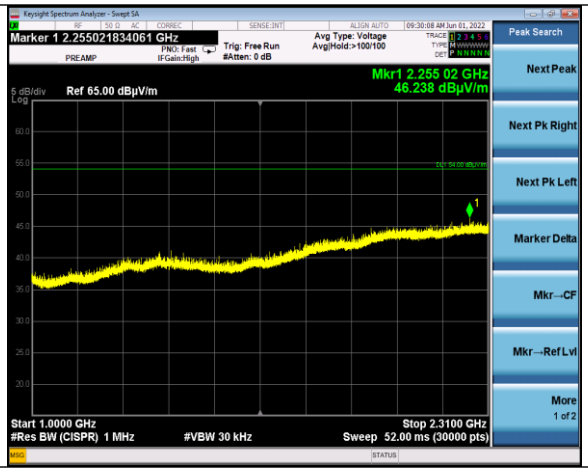


4.35-5.47 GHz Horz Chanel 64

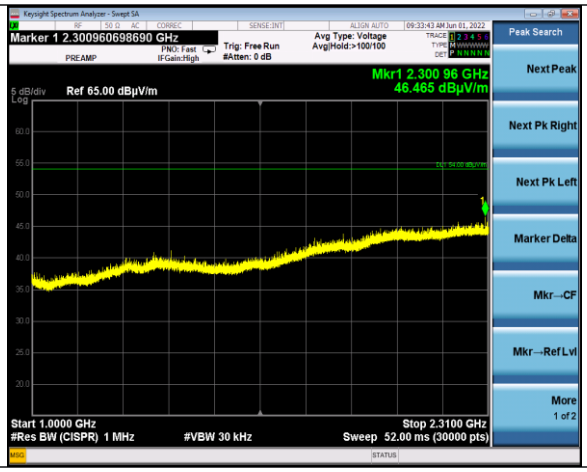


4.35-5.47 GHz Horz Chanel 100

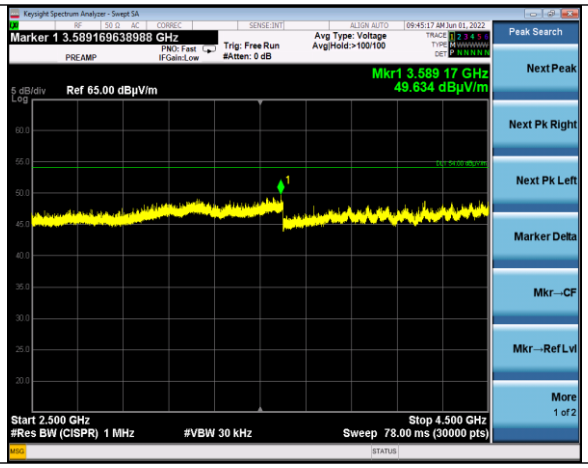
Near authorized band plots (intermodulation investigation) WLAN2.4, NFC



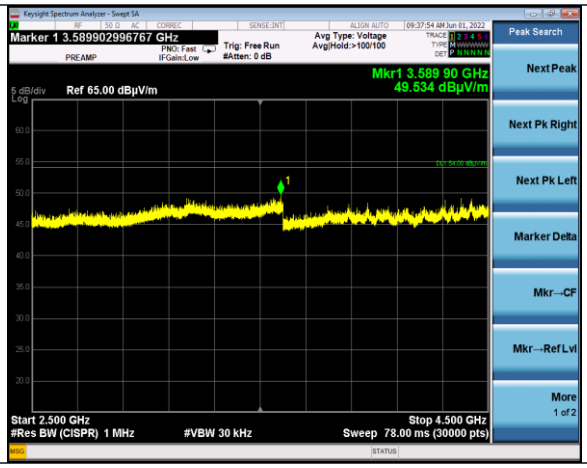
1-2.31 GHz Horizontal



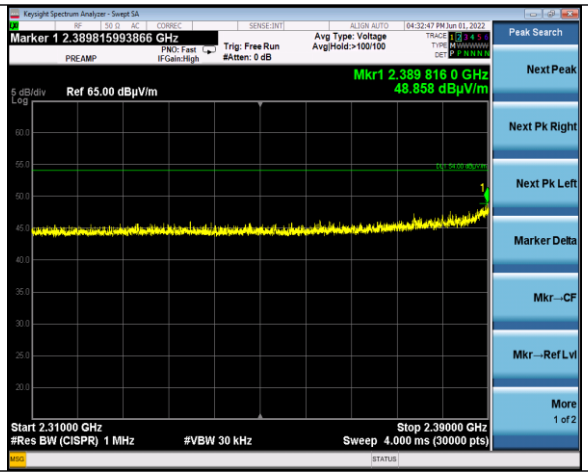
1-2.31 Vertical



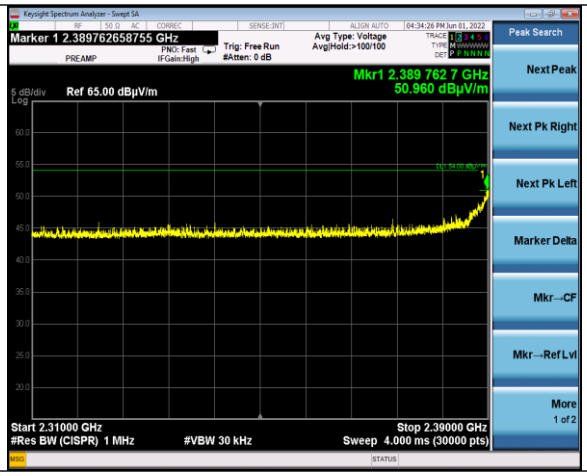
2.5-4.5 GHz Horizontal



2.5-4.5 GHz Vertical



2.31-2.39 GHz Horizontal



2.31-2.39 Vertical

6 Revision History

Version	Date	Notes	Person
0	7/6/2022	Initial Draft	Zach Wilson
1	7/6/2022	Final	Zach Wilson
2	8/11/2022	TCB comments addressed	Adam Alger
3	9/15/2022	Antenna gain updated	Adam Alger

END OF REPORT