



Electromagnetic Compatibility Test Report

Tests Performed on a Fybr
Vehicle Sensor, Model Sensor IV
Radiometrics Document RP-9966



Product Detail:

FCC ID: 2ALBF5040
IC: 22374-5040
Equipment type: DTS Digital Transmission System

Test Standards:

US CFR Title 47, Chapter I, FCC Part 15 Subpart C
FCC Part 15 CFR Title 47: 2024
Canada ISED; RSS-247, Issue 3; 2023
IC RSS-GEN Issue 5: 2018

This report concerns: Original Grant for Certification
FCC Part 15.247

Tests Performed For:

Fybr, LLC
640 Cepi Dr., Suite C
Chesterfield, MO 63005

Test Facility:

Radiometrics Midwest Corporation
12 Devonwood Avenue
Romeoville, IL 60446-1349
(815) 293-0772

Test Date(s):

May 8-14 and October 7, 2024 and January 20, 2025

Document RP-9966 Revisions:

Rev.	Issue Date	Revised By
0	January 7, 2025	
1	January 24, 2025	Joseph Strzelecki



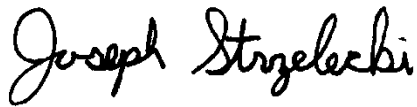
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1.0 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> A Fybr, Vehicle Sensor Model: Sensor IV; Serial Number: SMP1 This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics:</i> April 25, 2024	<i>Test Date(s):</i> May 8-14 and October 7, 2024, and Jan 20, 2025
<i>Test Report Written and Authorized By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> The tests were not witnessed by personnel from Fybr
<i>Radiometrics' Personnel Responsible for Test:</i>  01/07/2025 Date Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	<i>EUT Checked By:</i> Joseph Strzelecki Chris Dalessio Radiometrics

2.0 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Transceiver, Model Sensor IV, manufactured by Fybr. The detailed test results are presented in a separate section. The following is a summary of the test results.

Spread Spectrum Transmitter Requirements

Environmental Phenomena	Frequency Range	FCC Section	RSS- Section	Test Result
6 dB Bandwidth Test	902 to 928 MHz	15.247 a	RSS-247 (5.2)	Pass
Peak Output Power	902 to 928 MHz	15.247 b	RSS-247 (5.4d)	Pass
Spurious Radiated Emissions	30 MHz to 9.3 GHz	15.247 d	RSS-247 (3.3)	Pass
Antenna Port Conducted Unwanted Emissions	30 MHz to 9.3 GHz	15.247 d	RSS-247 (5.5)	Pass
Power Spectral Density	902 to 928 MHz	15.247 e	RSS-247 (5.2b)	Pass

RF AC Mains Conducted Emissions is not required since the EUT is battery powered and there is no means to charge the batteries with AC power.

2.1 RF Exposure Compliance Requirements

The EUT meets the FCC requirement for RF exposure and it is exempt from RSS-102 SAR and RF exposure evaluations. There are no power level adjustments available to the end user. The antenna is permanently attached. The detailed calculations for RF Exposure are presented in a separate document.



3.0 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a vehicle sensor for use in parking lots, Model Sensor IV, manufactured by Fybr. The EUT was in good working condition during the tests, with no known defects. The EUT broadcasts a location ping periodically, in order to facilitate tracking of staff within a facility equipped with one or more tracking receivers.

Type of modulation including the bit rate and symbol rate	LoRA, SF8, 500kHz, 4/5 coding rate.
Name and version of the test software used to exercise the device	Test 1.0
Power settings used for the purpose of exercising the device	15dBm Nominal setting
Firmware number of the transmitter	N/A

The EUT has a modularly approved RF module installed during all tests. It is FCC ID: 2AQ6KA1201 and IC ID: 24388-A121. It operates at 60 GHz. The antenna is in the IC lid.

3.1.1 FCC Section 15.203 & RSS-GEN Antenna Requirements

The antenna is permanently soldered to the printed circuit board. The antenna is internal to the EUT and it is not readily available to be modified by the end user. Therefore, it meets the 15.203 Requirements.

Since the measurements at the antenna port are used to determine the RF output power, RSS-GEN section 6.8 requires that the effective gain of the products antenna be stated. The Antenna peak gain is 1.0 dBi, based on the antenna's manufacturer.

4.0 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm or 150 cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. The EUT was tested as a stand-alone device. Power was supplied with a new battery.

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Transceiver	E	Fybr, LLC	Sensor IV	SMP1

* Type: E = EUT, P = Peripheral, S = Support Equipment; H = Host Computer

4.2 EUT Operating Modes

The transmit mode for all tests was continuous. The EUT was in its normal GFSK modulation during the tests. It was tested as a stand-alone, battery powered device, since that is the configuration in the final installation.

4.3 Special Accessories

No special accessories were used during the tests in order to achieve compliance.



4.4 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5.0 TEST SPECIFICATIONS

Document	Date	Title
FCC CFR Title 47	2024	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
IC RSS-247 Issue 3	2023	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices
IC RSS-Gen Issue 5	2018	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen) Amd 1 (2019) & Amd 2 (2021)

6.0 TEST PROCEDURE DOCUMENTS

The tests were performed using the procedures from the following specifications:

Document	Date	Title
ANSI C63.4-2014	2014	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	2013	American National Standard for Testing Unlicensed Wireless Devices
FCC KDB 558074 D01	2019	Guidance For Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, And Hybrid System Devices Operating Under § 15.247 Of The FCC Rules; v05r02

7.0 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 2017 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).

The following is a list of shielded enclosures located in Romeoville, Illinois used during the tests:

Chamber E: Is a custom-made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorbers. Pro-shield of Collinsville, Oklahoma manufactured the chamber. The floor has a 9' x 9' section of microwave absorber for testing above 1 GHz.

A separate ten-foot long, brass plated, steel ground rod attached via a 6-inch copper braid grounds the above chamber. The enclosure is also equipped with low-pass power line filters.

The FCC has accepted this site as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as site number IC 3124A-1.



A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance with ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

8.0 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

9.0 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification and the data contained herein was taken with calibrated test equipment. The results relate only to the EUT listed herein.

10.0 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	01/31/24
AMP-59	Amplitech	Pre-amplifier	APTMP44	AMP-59	18-26 GHz	12 Mo.	01/31/24
ANT-48	RMC	Std Gain Horn	HW2020	1001	18-26 GHz	36 Mo.	11/23/22
ANT-66	ETS-Lindgren	Horn Antenna	3115	62580	1.0-18GHz	24 Mo.	03/16/23
ANT-68	EMCO	Log-Periodic Ant.	93146	9604-4456	200-1000MHz	24 Mo.	01/30/24
ANT-80	AH Systems	Bicon Antenna	SAS-540	294	20-330MHz	24 Mo.	01/26/23
ATT-53	Weinschel	Attenuator (20 dB)	23-20-34	CG7857	DC-18 GHz	24 Mo.	05/03/24
CAB-114G	Teledyne	Coaxial Cable	N/A	N/A	DC-25 GHz	24 Mo.	12/18/23
CAB-160B	Teledyne	Coaxial Cable	N/A	N/A	DC-25 GHz	24 Mo.	12/18/23
CAB-507A	Teledyne	Coaxial Cable	N/A	N/A	DC-25 GHz	24 Mo.	12/18/23
HPF-07	Mini-Circuits	High Pass Filter	VHF-1500+	31121	1.7-10 GHz	24 Mo.	05/22/24
REC-21	Agilent	Spectrum Analyzer	E7405A	MY45118341	9Hz-26.5 GHz	24 Mo.	04/24/24
REC-44	Agilent	Spectrum Analyzer	E4440A	US40420673	3Hz-26.5GHz	24 Mo.	07/18/24
THM-02	Fluke	Temp/Humid Meter	971	93490471	N/A	24 Mo.	11/22/22
THM-03	Fluke	Temp/Humid Meter	971	95850465	N/A	24 Mo.	04/14/23

REC-44 was only used after July 24, 2024.

THM-02 was only used before November 21, 2024.

Note: All calibrated equipment is subject to periodic checks.

Software Company	Test Software Name	Version	Applicable Tests
Radiometrics	REREC11D	07.21.22	RF Radiated Emissions (FCC Part 15 & EN 55032)
Agilent	PSA/ESA-E/L/EMC	2.4.0.42	Bandwidth and screen shots

11.0 TEST SECTIONS

11.1 Occupied Bandwidth

The test procedures were in accordance to FCC DTS Measurement Guideline 558074 D01, Section 8.1.

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize.



The marker-to-peak function was set to the peak of the emission. Then the marker-delta function was used to measure 6 or 20 dB down one side of the emission. The marker-delta function was reset and then moved to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the bandwidth of the emission.

Tested by: Joseph Strzelecki

Test Date: May 8, 2024 and January 20, 2025

Occupied Bandwidth

Channel	6 dB EBW kHz	99% EBW kHz	Minimum 6 dB EBW kHz
903	636.2	517.9	500
915	637.5	519.1	500
927	635.5	519.5	500

The 6 dB bandwidth is greater than 500 kHz.

Judgement: Pass

6 dB Bandwidth; Low Frequency

6 dB OBW

Mkr1 Δ 636.212 kHz

0.015 dB

Ref 10 dBm

Atten 20 dB

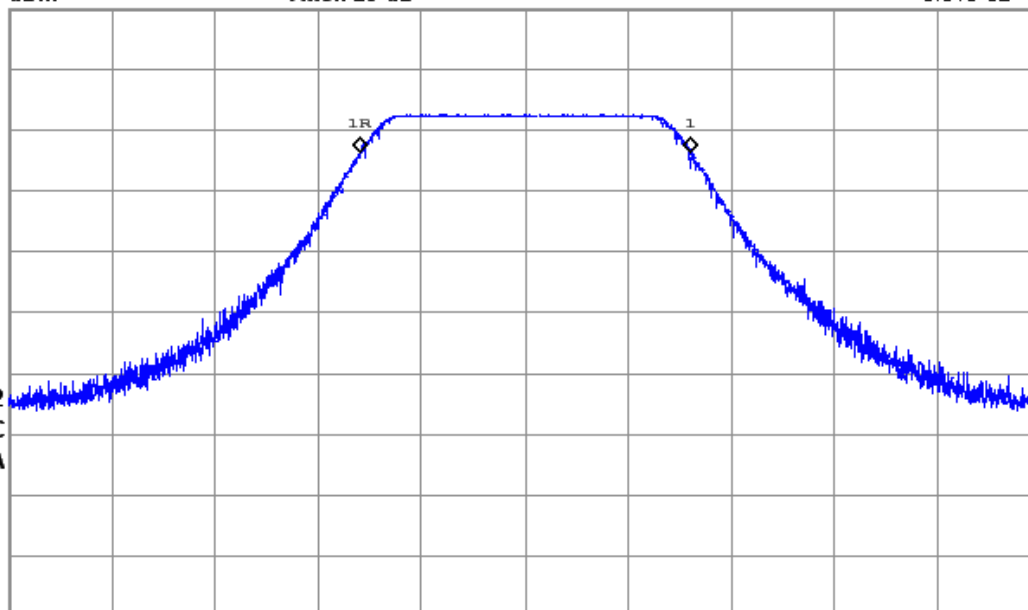
Peak

Log

10

dB/

V1 S2
S3 FC
AA



Center 903 MHz

Span 2 MHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 29.99 ms (3000 pts)



6 dB Bandwidth; Middle Frequency

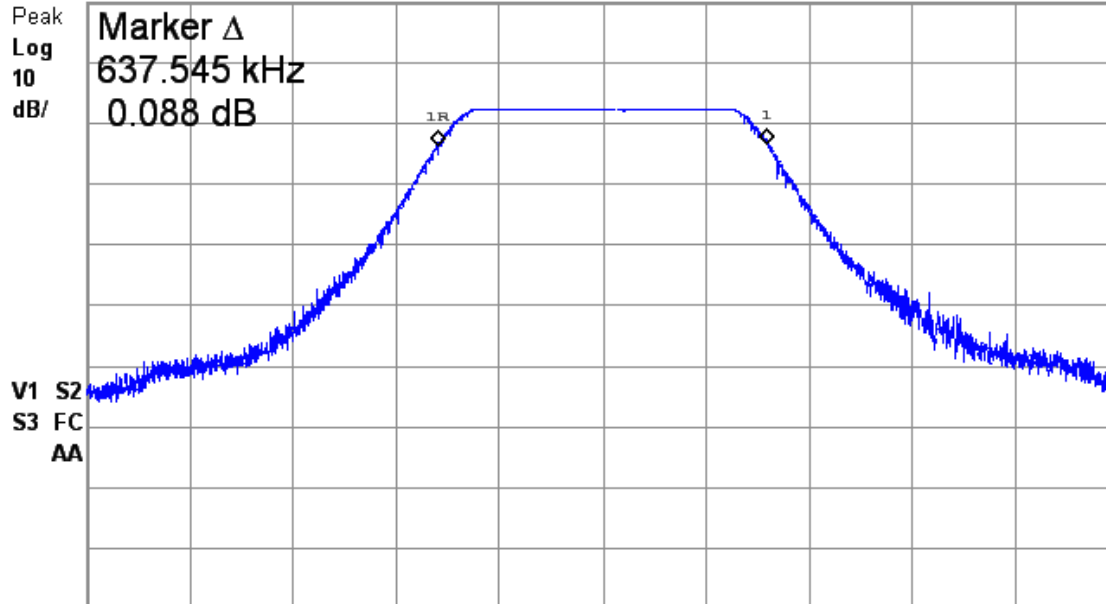
6 dB OBW

Ref 10 dBm

Atten 20 dB

Mkr1 Δ 637.545 kHz

0.088 dB



Center 915 MHz

Span 2 MHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 29.99 ms (3000 pts)

6 dB Bandwidth; High Frequency

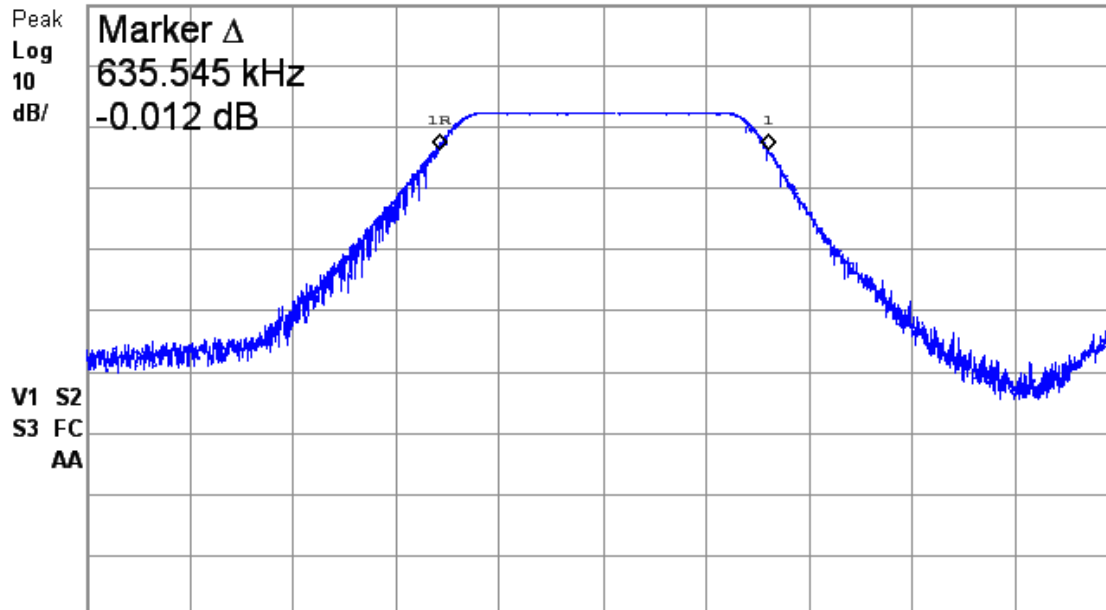
6 dB OBW

Ref 10 dBm

Atten 20 dB

Mkr1 Δ 635.545 kHz

-0.012 dB



Center 927 MHz

Span 2 MHz

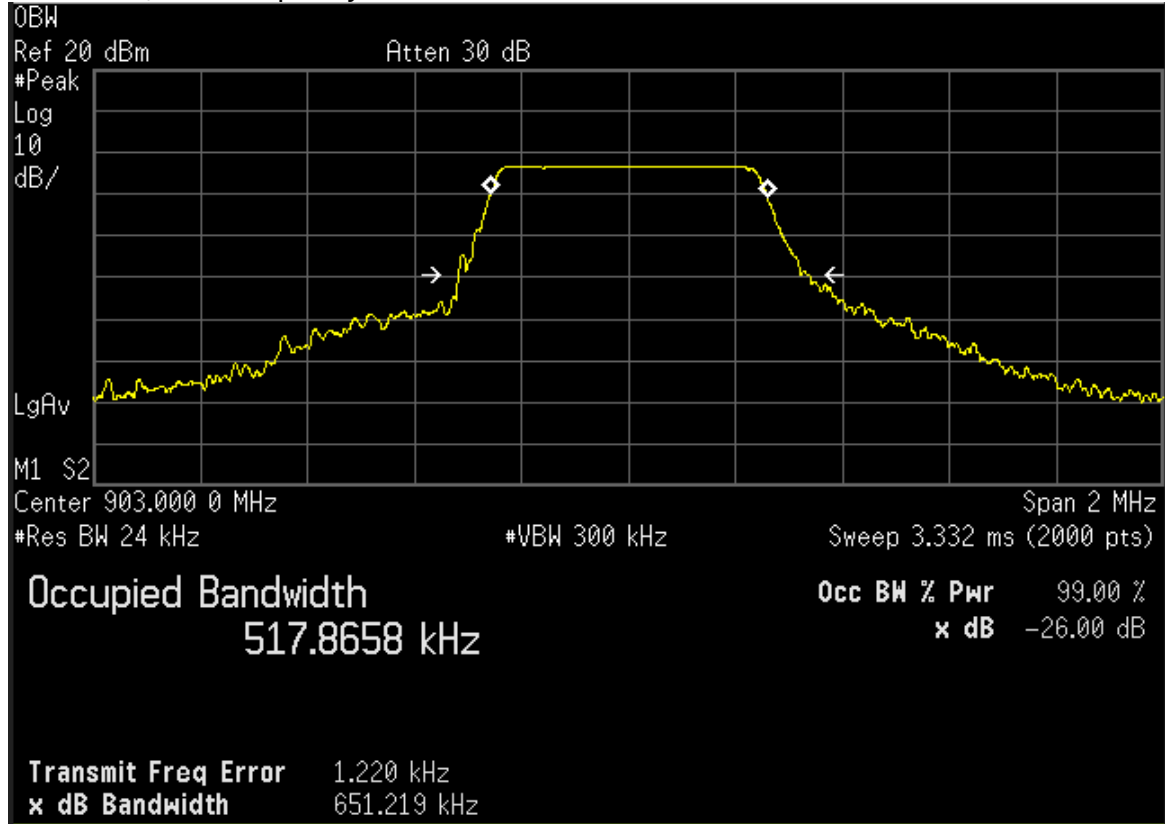
#Res BW 100 kHz

#VBW 300 kHz

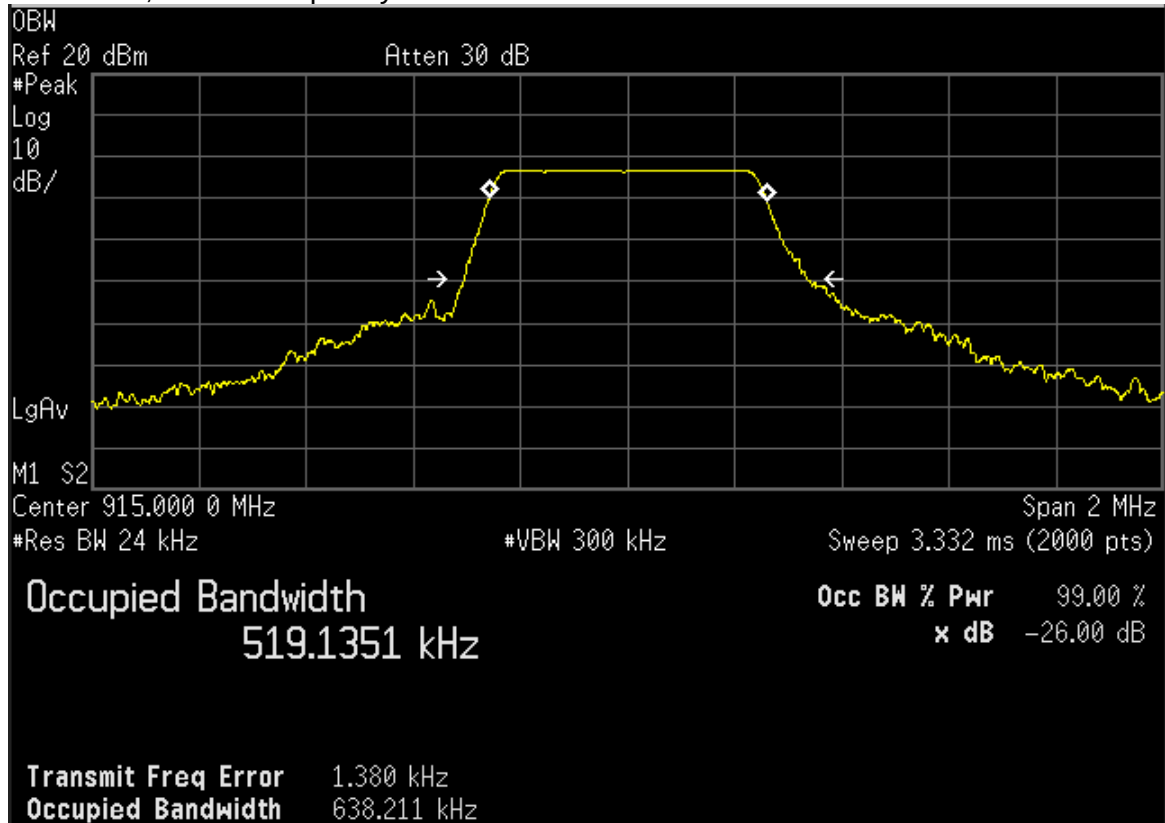
Sweep 29.99 ms (3000 pts)



99% OBW; Low Frequency

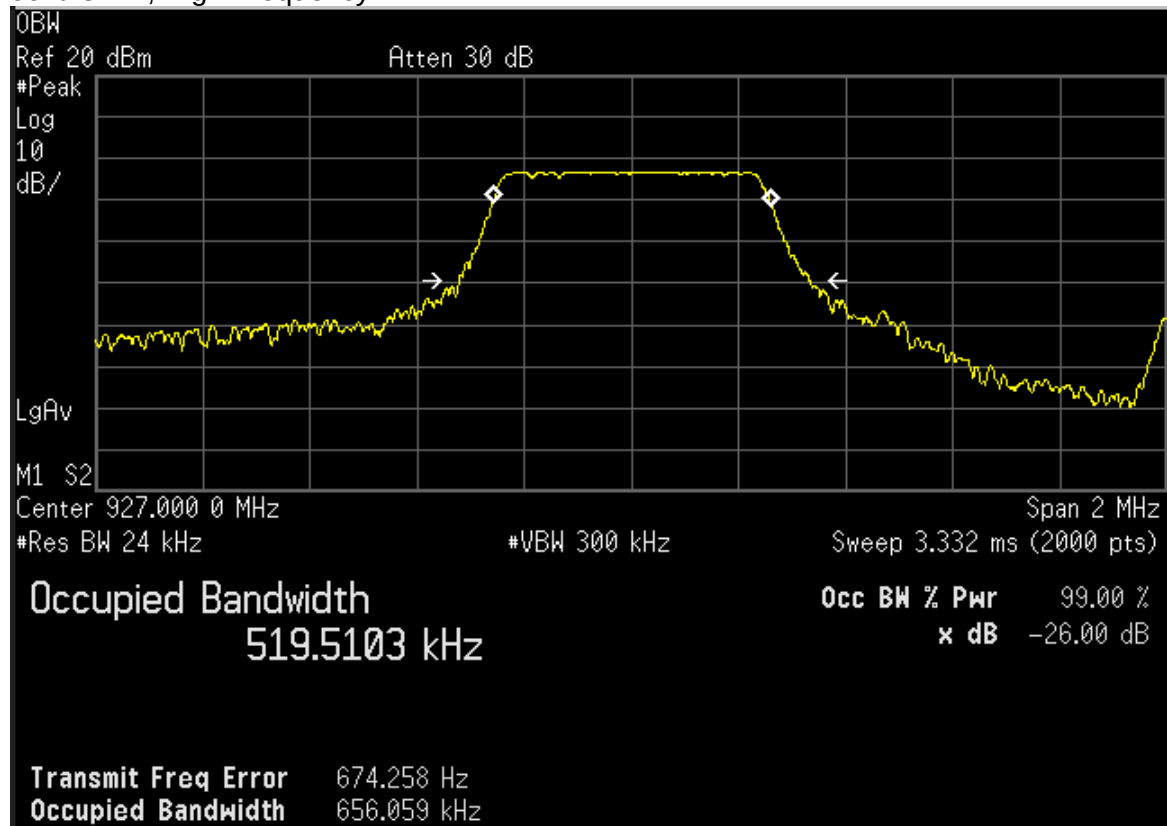


99% OBW; Middle Frequency





99% OBW; High Frequency



11.2 Peak Output Power

The power output test method from ANSI C63.10 section 11.9.1.1 was used for this test. The spectrum analyzer was set to the following settings:

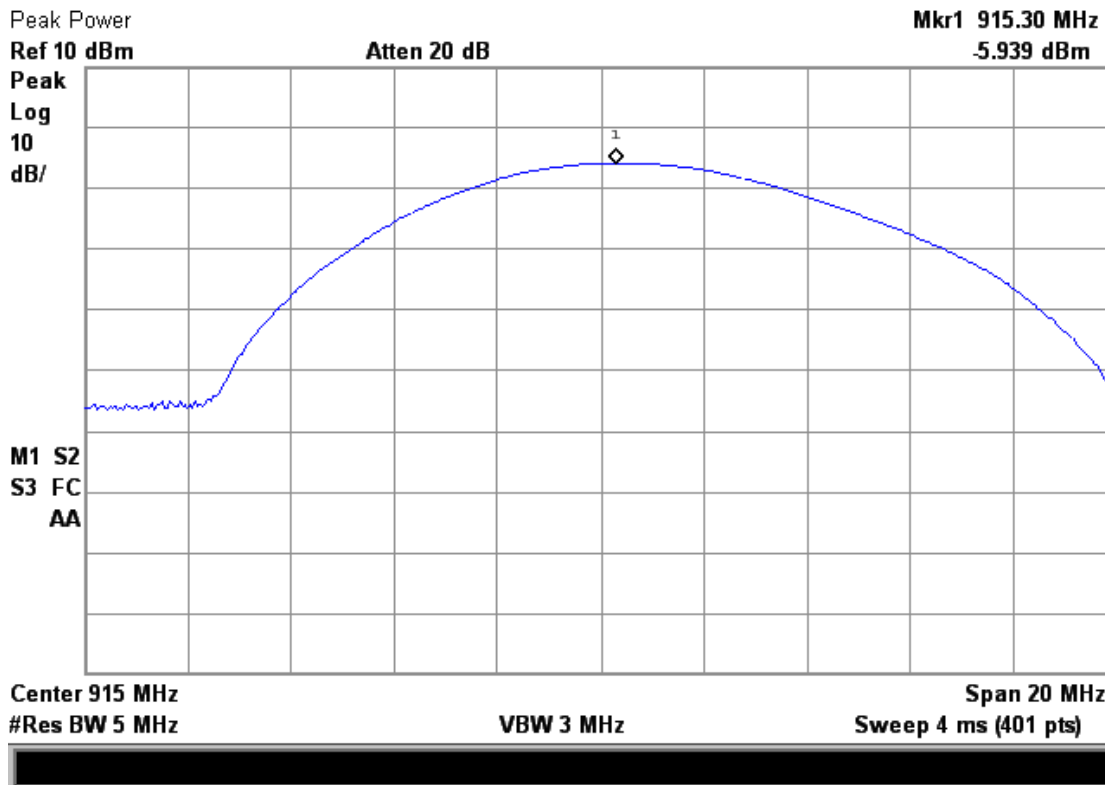
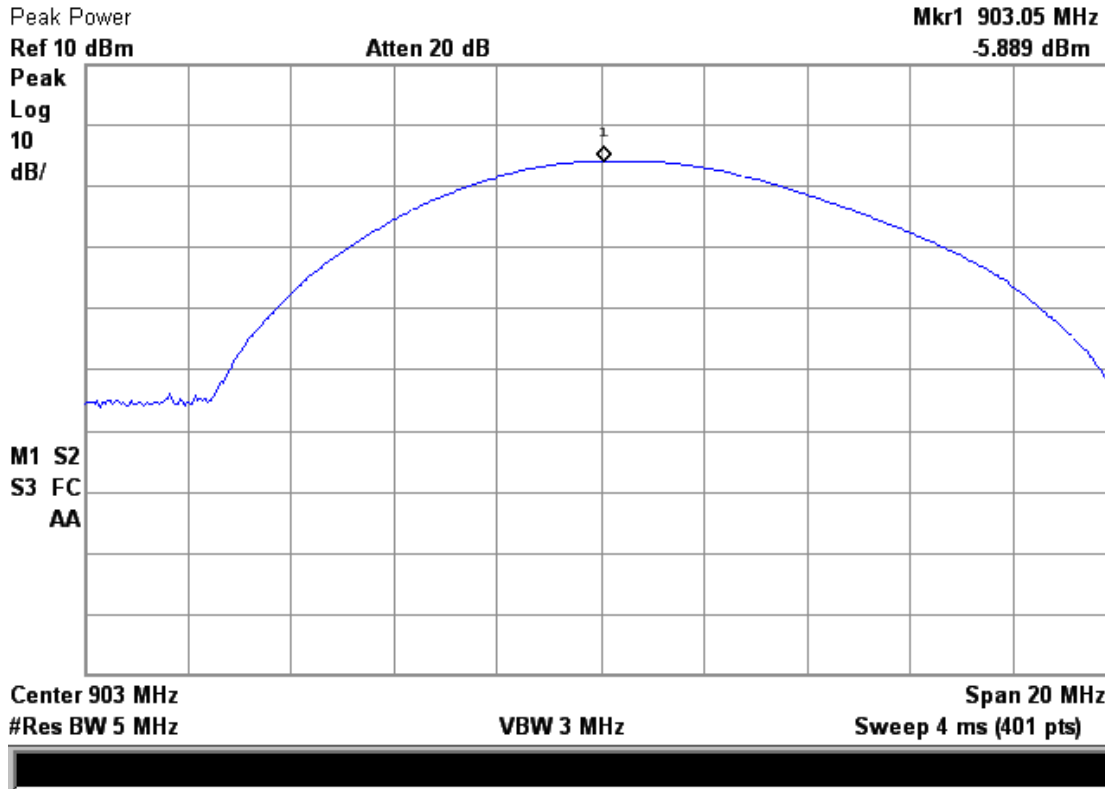
Span = 20 MHz
RBW = 5 MHz
VBW = 3 MHz
Sweep = auto
Detector function = peak
Trace = max hold

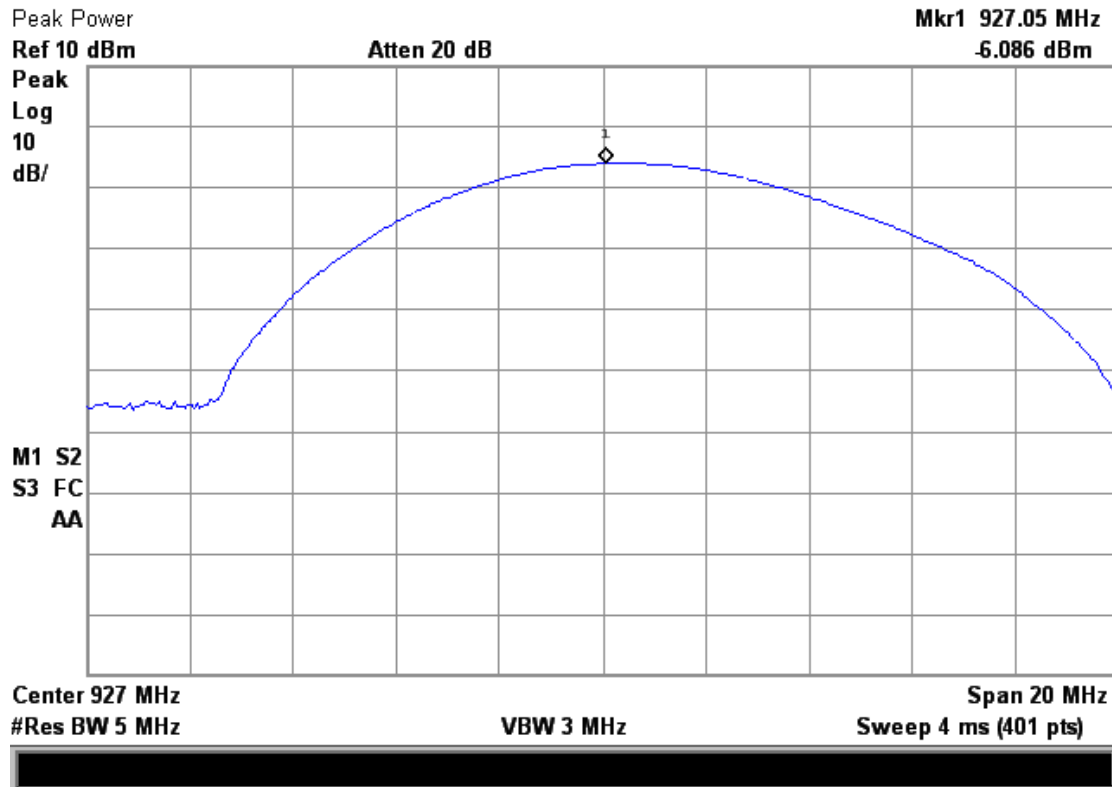
The trace was allowed to stabilize. The indicated level is the peak output power. Since the gain of the antenna is always less than 6 dB, the limit is not reduced. The EUT antenna port was connected to the Spectrum analyzer Via a coaxial cable.

Tested by: Joseph Strzelecki
Test Date: 05/14/2024

Frequency (MHz)	Reading (dBm)	Cable & Atten Loss (dB)	Total Power (dBm)		Limit (dBm)
			dBm	milliwatts	
903	-5.9	20.5	14.6	28.8	30
915	-5.9	20.5	14.6	28.8	30
927	-6.1	20.5	14.4	27.5	30

Judgment: Passed by 15.6 dB





11.3 Power Spectral Density

The PSD test method from ANSI C63.10 section 11.10.2 and FCC DTS Measurement Guideline 558074 D01, Section 10.2. The spectrum analyzer was set to the following settings:

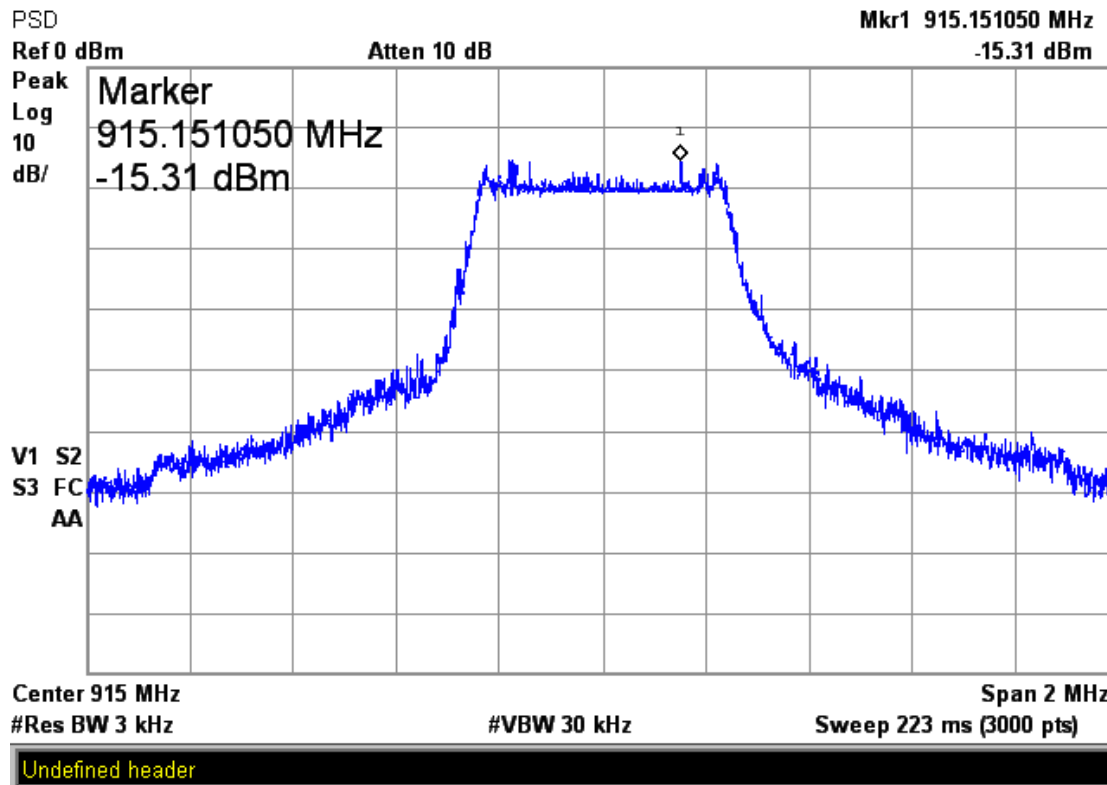
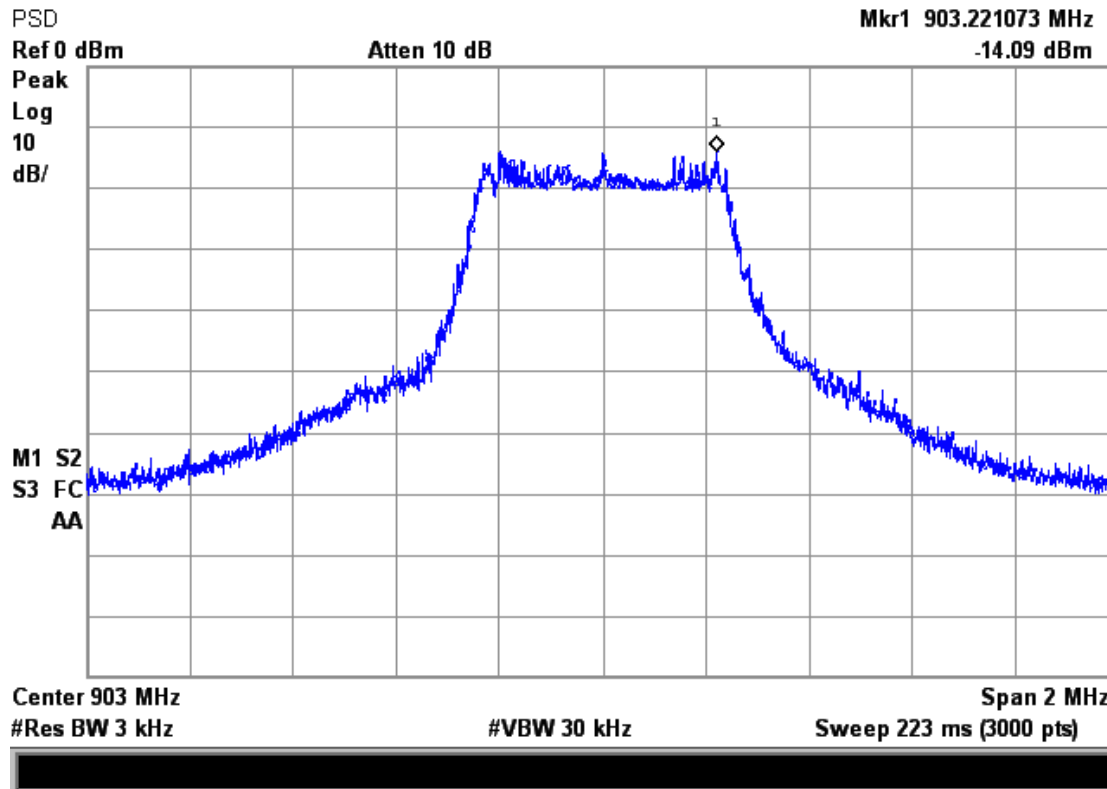
Span = 3 MHz; RBW = 3 kHz; VBW = 30 kHz

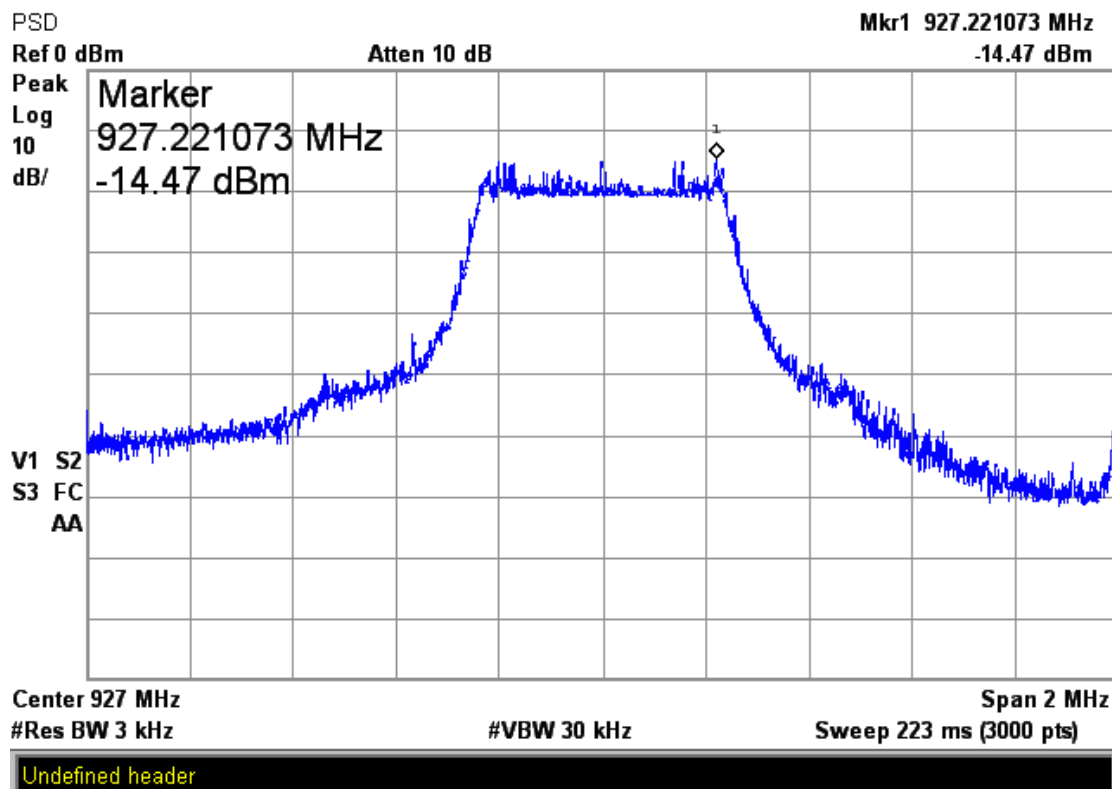
Tested by: Joseph Strzelecki

Test Date: 05/08/2024

Frequency (MHz)	Reading dBm	Cable Loss (dB)	3 kHz Spectral Density (dBm)	Limit (dBm)
902	-14.0	20.5	6.5	8.0
915	-15.3	20.5	5.2	8.0
927	-14.5	20.5	6.0	8.0

Judgment: Passed by 1.5 dB





11.4 Band-edge Compliance of RF Conducted Emissions

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation at the band-edge, with the EUT set to the lowest or highest frequency. The trace was allowed to stabilize.

Tested by: Joseph Strzelecki
Test Date: May 8, 2024

Channel	Reading at Band Edge		Minimum Allowed
	Freq. (MHz)	Delta (dB)	dB
903 Lower Band edge	902	46.2	20
927 Upper Band edge	928	36.1	20

Judgment: Passed by at least 20 dB



Lower Band Edge

Mkr1 Δ 993.7 kHz

Ref 0 dBm

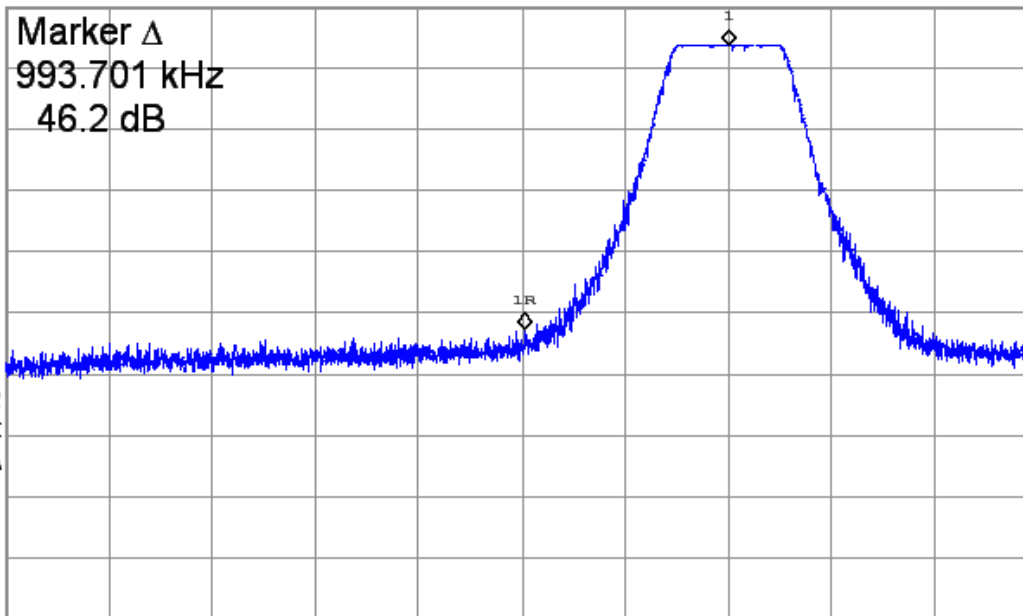
Atten 10 dB

46.2 dB

Peak
Log
10
dB/

Marker Δ
993.701 kHz
46.2 dB

V1 S2
S3 FC
AA



Center 902 MHz

Span 5 MHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 29.99 ms (3000 pts)

Upper Band Edge

Mkr1 Δ 1.1087 MHz

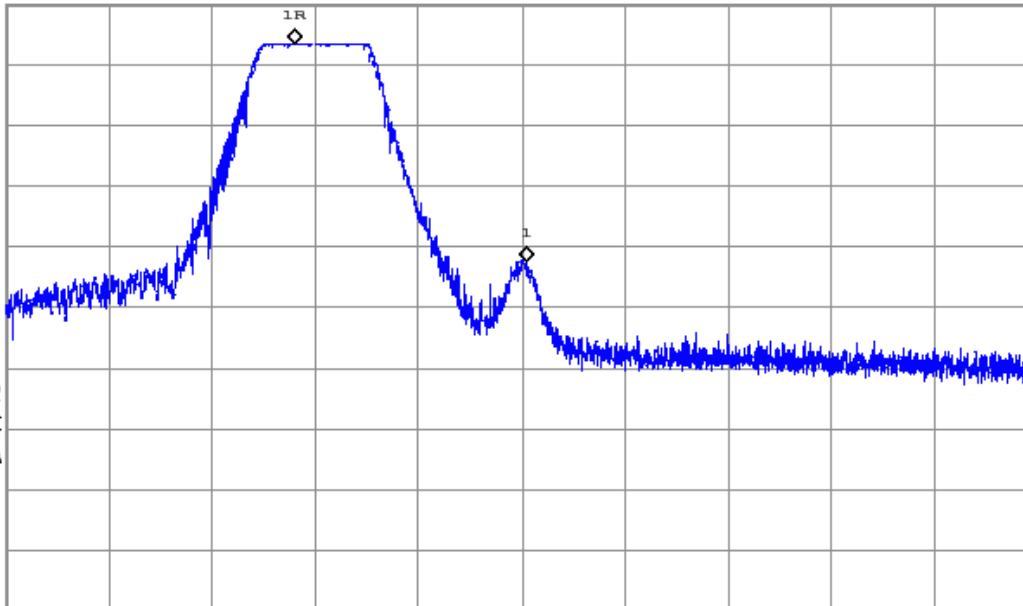
Ref 0 dBm

Atten 10 dB

-36.09 dB

Peak
Log
10
dB/

V1 S2
S3 FC
AA



Center 928 MHz

Span 5 MHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 29.99 ms (3000 pts)



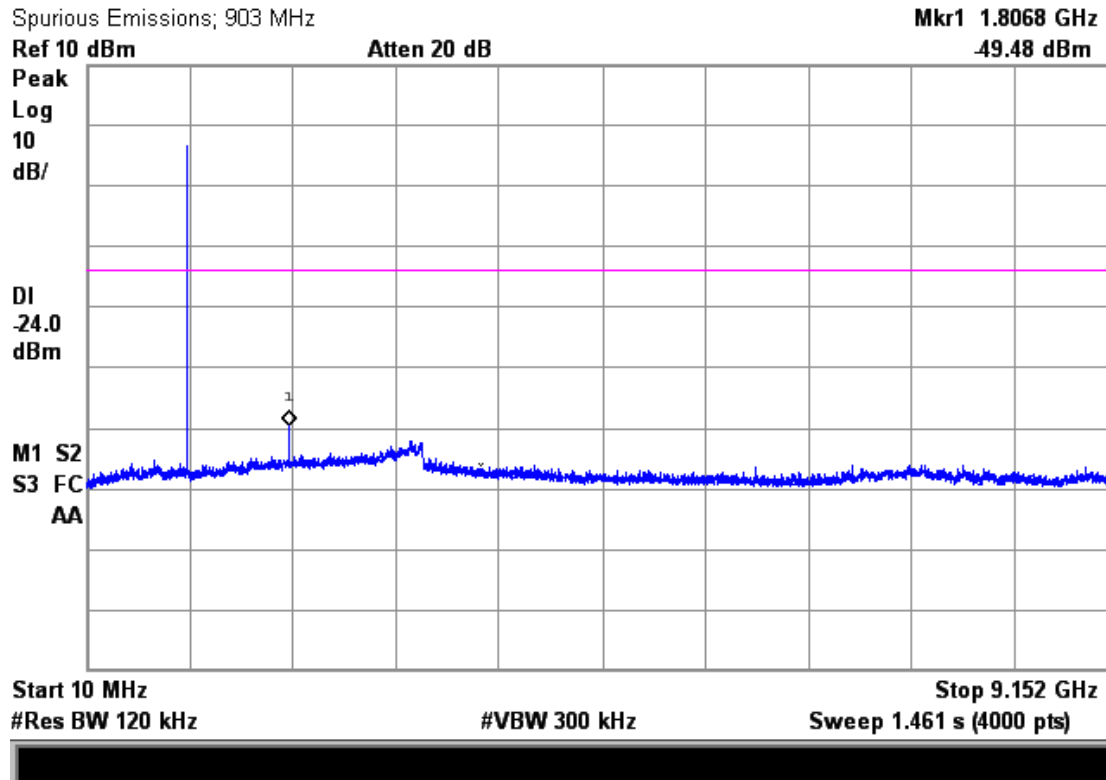
11.5 Spurious RF Conducted Emissions at Antenna Port

The spectrum analyzer was set to the MAX HOLD mode to record all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic. The trace was allowed to stabilize. The first two plots were made while stepping through three frequencies (Low middle and high). Each frequency was on for at least 30 seconds.

Tested by: Joseph Strzelecki

Test Date: May 8, 2024

Judgement: Pass by at least 10 dB





Spurious Emissions; 915 MHz

Mkr1 1.8296 GHz

Ref 10 dBm

Atten 20 dB

-49.04 dBm

Peak
Log
10
dB/

DI
-24.0
dBm

M1 S2
S3 FC
AA

Start 10 MHz

#Res BW 120 kHz

#VBW 300 kHz

Stop 9.152 GHz

Sweep 1.461 s (4000 pts)

Spurious Emissions; 927 MHz

Mkr1 1.8548 GHz

Ref 10 dBm

Atten 20 dB

-49.93 dBm

Peak
Log
10
dB/

DI
-24.0
dBm

M1 S2
S3 FC
AA

Start 10 MHz

#Res BW 120 kHz

#VBW 300 kHz

Stop 9.152 GHz

Sweep 1.461 s (4000 pts)



11.6 Spurious Radiated Emissions (Restricted Band)

The procedures were in accordance to FCC DTS Measurement Guideline 558074 D01, Section 12.1 and ANSI C63.10.

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used from 150 kHz to 30 MHz is 9 kHz and the bandwidth from 30 MHz to 1000 MHz is 120 kHz. Above 1 GHz, a 1 MHz bandwidth is used. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists. Figure 4 herein lists the details of the test equipment used during radiated emissions tests.

For tests from 1 to 10 GHz, a high pass filter was used to reduce the fundamental emission. High pass filters were not needed above 10 GHz, since the preamplifiers attenuated the fundamental emission. Figure 4 herein lists the details of the test equipment used during radiated emissions tests. The device was rotated through three orthogonal axes as per ANSI C63.10 during the radiated tests.

Final radiated emissions measurements were performed inside of an anechoic chamber at a test distance of 3 meters. The anechoic chamber is designated as Chamber E. This Chamber meets the Site Attenuation requirements of ANSI C63.4. Chamber E is located at 12 Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 30 to 25,000 MHz was slowly scanned with particular attention paid to those frequency ranges which appeared high. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst-case emissions were recorded. All measurements may be performed using either the peak, average or quasi-peak detector functions. If the peak detector data exceeds or is marginally close to the limits, the measurements are repeated using a quasi-peak detector or average function as required by the specification for final determination of compliance.

The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground.

Radiated Emissions Field Strength Limits

Frequency Range (MHz)	Test Distance (meters)	Class B Limits	
		uV/m	dB(uV/m)
30 - 88	3	100	40.0
88 - 216	3	150	43.5
216 - 960	3	200	46.0
Above 960	3	500	54.0

11.6.1 Radiated Emissions Field Strength Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

HPF = High pass Filter Loss

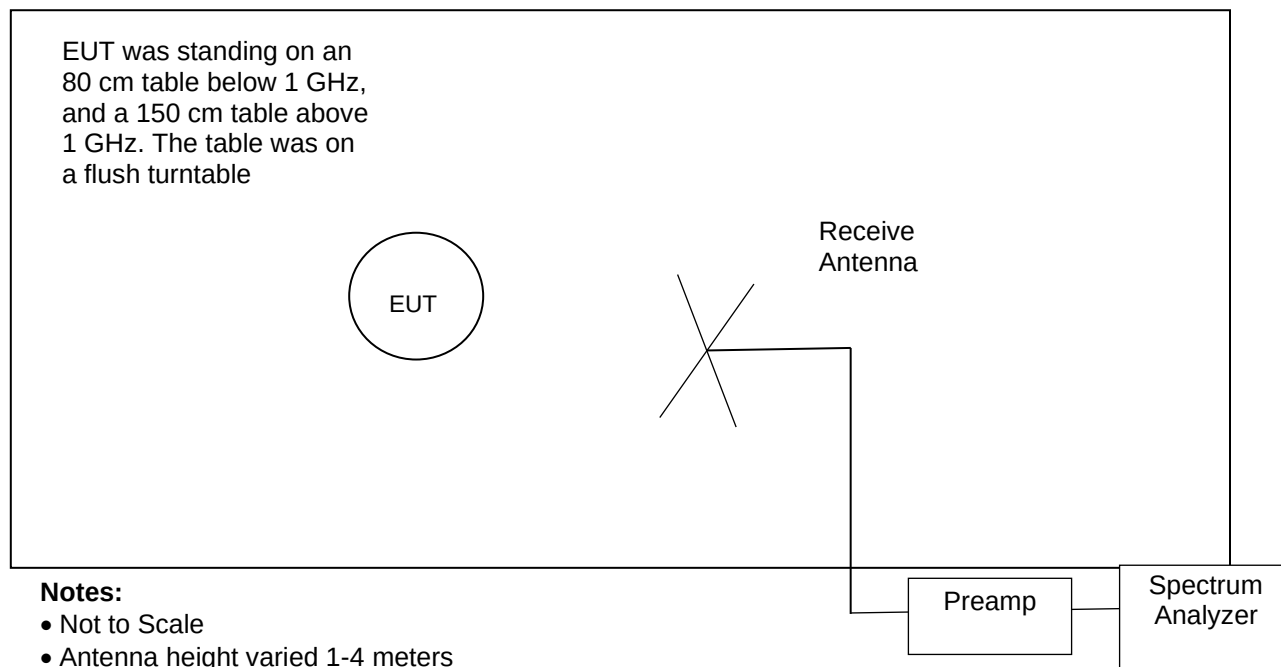


PKA = Peak to Average Factor (This is zero for non-average measurements)

The Peak to average factor is used when average measurements are required. It is calculated by the highest duty cycle in percent over any 100mS transmission. The factor in dB is $20 * \text{Log}(\text{Duty cycle}/100)$.

Figure 1. Drawing of Radiated Emissions Setup

Chamber E, anechoic



Notes:

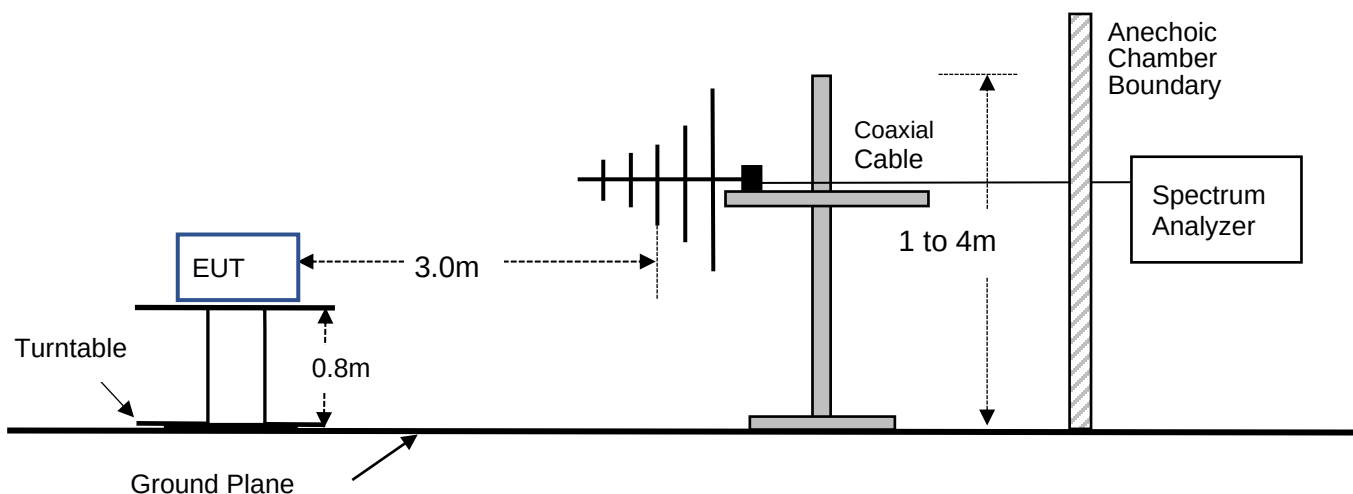
- Not to Scale
- Antenna height varied 1-4 meters
- Distance from antenna to tested system is 3 meters
- AC cords not shown. They are connected to AC outlet with low-pass filter on turntable

Frequency Range	Receive Antenna	Pre-Amplifier	Spectrum Analyzer	High Pass Filter
30 to 200 MHz	ANT-80	None	REC-21	None*
200 to 1000 MHz	ANT-68	None	REC-21	None*
1 to 10 GHz	ANT-66	AMP-05	REC-21	HPF-07

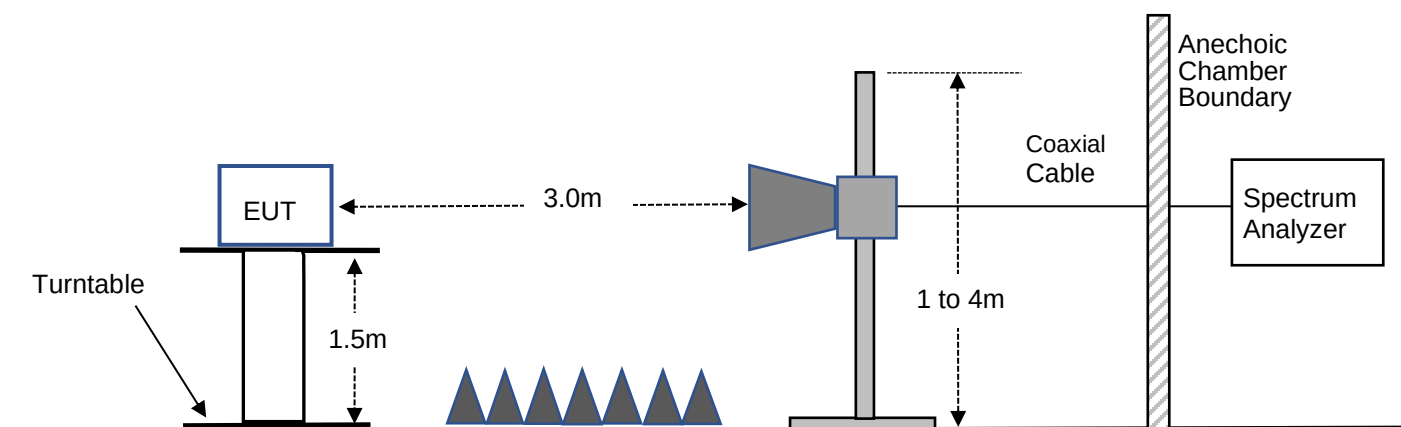
* A high pass filter was not needed since the fundamental frequency was outside of the amplifiers pass band. No High pass filter was used for Receive mode.



Radiated Emissions Test Setup for Frequencies from 30MHz to 1000MHz (Side View)



Radiated Emissions Test Setup for Frequencies over 1000MHz (Side View)



Receive mode used an 80 cm high test stand and transmit mode used an 150 cm test stand.

11.6.2 Spurious Radiated Emissions Test Results (Restricted Band)

The following spectrum analyzer settings were used.

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

A Video Bandwidth of 10 Hz was used for Average measurements above 1 GHz.

The EUT was in the highest power mode and the highest duty cycle for this test.



Manufacturer	Fybr	Specification	FCC Part 15 Subpart C & RSS-210
Model	Sensor IV	Test Date	May 9-10, 2024
Serial Number	SMP1	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical (ANT-80); LP = Log-Periodic (ANT-68); HN = Horn (ANT-66) P = peak; Q = QP		
Notes	Corr. Factors = Cable Loss – Preamp Gain; External Preamp used above 1 GHz		

The following table includes all emissions except Fundamental, and harmonics emissions. All bands were measured including Non-Restricted band emissions.

Transmit Mode

Freq. MHz	Meter Reading dBuV	Decet.	Ant. Pol.	Ant Factor dB/m	Cable & amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
41.1	9.3	P	H	10.5	0.7	0.0	20.5	40.0	19.5	
59.9	9.8	P	H	8.8	0.8	0.0	19.4	40.0	20.6	
69.4	9.9	P	H	8.9	0.9	0.0	19.7	40.0	20.3	
79.1	11.1	P	H	9.2	1.0	0.0	21.3	40.0	18.7	
90.8	10.7	P	H	9.6	1.0	0.0	21.3	43.5	22.2	
104.1	12.0	P	H	10.4	1.1	0.0	23.5	43.5	20.0	
113.8	10.1	P	H	11.1	1.1	0.0	22.3	43.5	21.2	
124.7	10.5	P	H	11.7	1.2	0.0	23.4	43.5	20.1	
134.2	11.2	P	H	12.1	1.3	0.0	24.6	43.5	18.9	
151.5	10.7	P	H	12.6	1.3	0.0	24.6	43.5	18.9	
172.9	10.4	P	H	13.2	1.4	0.0	25.0	43.5	18.5	
197.7	10.8	P	H	14.2	1.5	0.0	26.5	43.5	17.0	
218.5	10.7	P	H	14.7	1.6	0.0	27.0	46.0	19.0	
238.8	11.4	P	H	15.0	1.7	0.0	28.1	46.0	17.9	
286.6	7.4	P	H	13.8	1.8	0.0	23.0	46.0	23.0	
325.7	8.5	P	H	14.2	2.0	0.0	24.7	46.0	21.3	
374.4	8.8	P	H	14.8	2.1	0.0	25.7	46.0	20.3	
417.2	10.1	P	H	15.6	2.3	0.0	28.0	46.0	18.0	
461.4	9.6	P	H	16.6	2.4	0.0	28.6	46.0	17.4	
553.6	9.2	P	H	18.2	2.6	0.0	30.0	46.0	16.0	
621.6	9.4	P	H	19.3	2.8	0.0	31.5	46.0	14.5	
688.2	10.3	P	H	21.3	2.9	0.0	34.5	46.0	11.5	
739.2	10.7	P	H	21.1	3.1	0.0	34.9	46.0	11.1	
783.8	9.1	P	H	21.2	3.2	0.0	33.5	46.0	12.5	
864.4	8.4	P	H	22.8	3.3	0.0	34.5	46.0	11.5	
964.5	8.5	P	H	23.5	3.5	0.0	35.5	54.0	18.5	
40.6	11.4	P	V	10.5	0.7	0.0	22.6	40.0	17.4	
51.0	10.1	P	V	9.3	0.8	0.0	20.2	40.0	19.8	
67.2	12.5	P	V	9.1	0.9	0.0	22.5	40.0	17.5	
79.1	10.6	P	V	9.2	1.0	0.0	20.8	40.0	19.2	
88.2	13.7	P	V	9.4	1.0	0.0	24.1	43.5	19.4	
95.3	13.7	P	V	9.9	1.0	0.0	24.6	43.5	18.9	
107.2	11.1	P	V	10.7	1.1	0.0	22.9	43.5	20.6	
129.5	10.8	P	V	11.9	1.2	0.0	23.9	43.5	19.6	
153.2	12.2	P	V	12.7	1.3	0.0	26.2	43.5	17.3	
173.8	11.8	P	V	13.2	1.4	0.0	26.4	43.5	17.1	
194.6	10.9	P	V	14.1	1.5	0.0	26.5	43.5	17.0	
216.0	11.1	P	V	14.7	1.6	0.0	27.4	43.5	16.1	
228.9	15.3	P	V	14.9	1.7	0.0	31.9	46.0	14.1	
238.4	15.2	P	V	15.0	1.7	0.0	31.9	46.0	14.1	
286.3	9.2	P	V	13.8	1.8	0.0	24.8	46.0	21.2	
335.3	8.7	P	V	14.2	2.0	0.0	24.9	46.0	21.1	



Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable & amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
377.4	9.3	P	V	14.9	2.1	0.0	26.3	46.0	19.7	
414.5	9.2	P	V	15.6	2.2	0.0	27.0	46.0	19.0	
450.0	9.8	P	V	16.4	2.3	0.0	28.5	46.0	17.5	
473.5	11.8	P	V	17.0	2.4	0.0	31.2	46.0	14.8	
567.1	10.0	P	V	18.3	2.6	0.0	30.9	46.0	15.1	
668.7	9.5	P	V	20.6	2.9	0.0	33.0	46.0	13.0	
748.2	9.5	P	V	21.0	3.1	0.0	33.6	46.0	12.4	
820.8	9.4	P	V	21.7	3.3	0.0	34.4	46.0	11.6	
880.4	9.1	P	V	22.8	3.3	0.0	35.2	46.0	10.8	
958.0	10.7	P	V	23.4	3.5	0.0	37.6	46.0	8.4	
1175.9	42.3	P	V	24.8	-34.2	0.0	32.9	74.0	41.1	1
1490.2	43.6	P	V	25.2	-34.4	0.0	34.4	74.0	39.6	1
1865.6	45.1	P	V	27.0	-34.1	0.0	38.0	74.0	36.0	1
3218.0	41.3	P	V	31.0	-32.7	0.0	39.6	74.0	34.4	1
3508.3	41.2	P	V	31.2	-32.5	0.0	39.9	74.0	34.1	1
3817.6	43.2	P	V	32.7	-32.3	0.0	43.6	74.0	30.4	1
4228.0	41.3	P	V	32.4	-31.8	0.0	41.9	74.0	32.1	1
4499.3	41.8	P	V	32.9	-31.4	0.0	43.3	74.0	30.7	1
4811.6	40.5	P	V	33.4	-31.1	0.0	42.8	74.0	31.2	1

Note 1: The Peak data is under the Average limit, therefore Average measurement not performed.

Judgment: Passed by 8.4 dB

Standby/Receive Mode:

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable & amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
40.6	10.3	P	H	10.5	0.7	0.0	21.5	40.0	18.5	
51.9	9.8	P	H	9.1	0.8	0.0	19.7	40.0	20.3	
57.9	10.9	P	H	9.1	0.8	0.0	20.8	40.0	19.2	
66.7	12.6	P	H	9.1	0.8	0.0	22.5	40.0	17.5	
78.9	10.6	P	H	9.2	1.0	0.0	20.8	40.0	19.2	
88.2	14.0	P	H	9.4	1.0	0.0	24.4	43.5	19.1	
95.5	13.8	P	H	9.9	1.0	0.0	24.7	43.5	18.8	
107.9	11.7	P	H	10.7	1.1	0.0	23.5	43.5	20.0	
128.4	10.5	P	H	12.0	1.2	0.0	23.7	43.5	19.8	
149.5	11.7	P	H	12.6	1.3	0.0	25.6	43.5	17.9	
172.9	11.3	P	H	13.2	1.4	0.0	25.9	43.5	17.6	
191.9	11.7	P	H	13.9	1.5	0.0	27.1	43.5	16.4	
220.0	11.9	P	H	14.8	1.6	0.0	28.3	46.0	17.7	
228.9	16.0	P	H	14.9	1.7	0.0	32.6	46.0	13.4	
238.4	16.2	P	H	15.0	1.7	0.0	32.9	46.0	13.1	
285.8	8.9	P	H	13.8	1.8	0.0	24.5	46.0	21.5	
328.1	8.5	P	H	14.2	2.0	0.0	24.7	46.0	21.3	
373.3	10.6	P	H	14.8	2.1	0.0	27.5	46.0	18.5	
420.2	9.9	P	H	15.7	2.3	0.0	27.9	46.0	18.1	
464.4	10.9	P	H	16.7	2.4	0.0	30.0	46.0	16.0	
589.0	9.0	P	H	18.6	2.7	0.0	30.3	46.0	15.7	
671.0	10.3	P	H	20.8	2.9	0.0	34.0	46.0	12.0	
773.7	9.3	P	H	21.0	3.1	0.0	33.4	46.0	12.6	
859.2	8.1	P	H	22.7	3.3	0.0	34.1	46.0	11.9	
944.3	8.4	P	H	23.2	3.5	0.0	35.1	46.0	10.9	
1153.9	43.8	P	H	24.7	-34.3	0.0	34.2	74.0	39.8	1
1504.3	45.4	P	H	25.2	-34.4	0.0	36.2	74.0	37.8	1
1812.6	45.5	P	H	27.0	-34.2	0.0	38.3	74.0	35.7	1



Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable & amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
2169.9	41.0	P	H	27.7	-34.0	0.0	34.7	74.0	39.3	1
2474.2	42.0	P	H	28.4	-33.7	0.0	36.7	74.0	37.3	1
2884.6	44.2	P	H	29.5	-33.4	0.0	40.3	74.0	33.7	1
3157.9	41.3	P	H	30.7	-32.8	0.0	39.2	74.0	34.8	1
3504.3	41.5	P	H	31.2	-32.5	0.0	40.2	74.0	33.8	1
3823.6	40.8	P	H	32.7	-32.3	0.0	41.2	74.0	32.8	1
4168.9	40.4	P	H	32.4	-31.8	0.0	41.0	74.0	33.0	1
4497.3	40.5	P	H	32.9	-31.4	0.0	42.0	74.0	32.0	1
4825.6	40.4	P	H	33.4	-31.1	0.0	42.7	74.0	31.3	1
41.5	10.6	P	V	10.5	0.7	0.0	21.8	40.0	18.2	
66.5	13.4	P	V	9.1	0.8	0.0	23.3	40.0	16.7	
76.7	10.6	P	V	8.8	0.9	0.0	20.3	40.0	19.7	
88.2	14.4	P	V	9.4	1.0	0.0	24.8	43.5	18.7	
95.5	13.0	P	V	9.9	1.0	0.0	23.9	43.5	19.6	
104.6	11.4	P	V	10.4	1.1	0.0	22.9	43.5	20.6	
114.3	10.4	P	V	11.1	1.1	0.0	22.6	43.5	20.9	
124.7	10.6	P	V	11.7	1.2	0.0	23.5	43.5	20.0	
134.2	11.3	P	V	12.1	1.3	0.0	24.7	43.5	18.8	
151.7	12.0	P	V	12.6	1.3	0.0	25.9	43.5	17.6	
171.6	13.5	P	V	13.1	1.4	0.0	28.0	43.5	15.5	
196.1	11.6	P	V	14.1	1.5	0.0	27.2	43.5	16.3	
218.9	11.3	P	V	14.7	1.6	0.0	27.6	46.0	18.4	
228.9	16.3	P	V	14.9	1.7	0.0	32.9	46.0	13.1	
238.4	15.5	P	V	15.0	1.7	0.0	32.2	46.0	13.8	
289.8	8.3	P	V	14.0	1.9	0.0	24.2	46.0	21.8	
337.2	8.9	P	V	14.2	2.0	0.0	25.1	46.0	20.9	
382.4	9.7	P	V	15.0	2.2	0.0	26.9	46.0	19.1	
419.2	10.2	P	V	15.7	2.3	0.0	28.2	46.0	17.8	
461.3	9.5	P	V	16.6	2.4	0.0	28.5	46.0	17.5	
586.0	10.3	P	V	18.5	2.7	0.0	31.5	46.0	14.5	
674.1	9.5	P	V	21.0	2.9	0.0	33.4	46.0	12.6	
757.6	9.3	P	V	20.9	3.1	0.0	33.3	46.0	12.7	
824.7	9.4	P	V	21.8	3.3	0.0	34.5	46.0	11.5	
922.3	8.7	P	V	23.0	3.4	0.0	35.1	46.0	10.9	
1193.9	42.1	P	V	24.9	-34.2	0.0	32.8	74.0	41.2	1
1491.2	43.2	P	V	25.2	-34.4	0.0	34.0	74.0	40.0	1
1831.6	42.7	P	V	27.0	-34.2	0.0	35.5	74.0	38.5	1
2179.9	40.0	P	V	27.7	-34.0	0.0	33.7	74.0	40.3	1
2513.3	41.7	P	V	28.5	-33.6	0.0	36.6	74.0	37.4	1
2833.6	43.9	P	V	29.3	-33.3	0.0	39.9	74.0	34.1	1
3187.9	41.9	P	V	30.9	-32.7	0.0	40.1	74.0	33.9	1
3502.3	41.1	P	V	31.2	-32.5	0.0	39.8	74.0	34.2	1
3815.6	41.1	P	V	32.7	-32.3	0.0	41.5	74.0	32.5	1
4191.9	40.3	P	V	32.4	-31.8	0.0	40.9	74.0	33.1	1
4495.2	42.0	P	V	32.9	-31.4	0.0	43.5	74.0	30.5	1
4802.6	40.4	P	V	33.4	-31.1	0.0	42.7	74.0	31.3	1

Note 1: The Peak data is under the Average limit, therefore Average measurement not performed.

Judgment: Passed by 10.9 dB

**Radiated emissions (Restricted Band) Transmit Mode**

Fundamental, Harmonic and Band edge emissions

	Tx	Spectrum Analyzer Readings dBuV									EUT	Peak	Ave	Peak	Ave	Margin
harm	Freq	Peak				Ave				Corr.	Emission	Tot. FS		Limit		Under
#	MHz	Vertical Polarization				Horizontal Polarization				Fact dB	Freq MHz	dBuV/m		dBuV/m		Limit dB
		X	Y	Z	Max	X	Y	Z	Max							
3	903	59.7	61.1	59.7	54.2	55.8	59.2	57.9	52.1	-4.0	2709.0	57.1	50.2	74	54	3.8
4	903	56.1	55.6	55.1	48.7	48.9	53.6	52.4	46.3	-0.3	3612.0	55.8	48.4	74	54	5.6
5	903	51.1	47.7	48.0	43.2	47.0	48.1	49.3	41.3	2.8	4515.0	53.9	46.0	74	54	8.0
6	903	45.4	43.2	43.4	37.4	44.7	40.9	44.0	36.9	5.8	5418.0	51.2	43.2	74	54	10.8
8	903	38.5	40.7	39.6	32.7	38.4	42.4	38.2	34.7	10.6	7224.0	53.0	45.3	74	54	8.7
9	903	38.1	37.0	36.2	29.2	36.3	38.4	36.4	29.8	12.9	8127.0	51.3	42.7	74	54	11.3
10	903	36.9	37.8	35.9	29.7	35.4	37.5	36.2	29.3	13.7	9030.0	51.5	43.4	74	54	10.6
3	915	58.5	60.4	57.1	52.7	56.4	57.3	55.6	49.8	-3.9	2745.0	56.5	48.8	74	54	5.2
4	915	52.4	54.0	50.3	46.4	47.5	46.8	49.3	41.6	-0.1	3660.0	53.9	46.3	74	54	7.7
5	915	48.3	47.1	46.0	40.8	48.8	45.3	46.2	41.2	3.0	4575.0	51.8	44.2	74	54	9.8
8	915	42.0	36.9	41.9	34.5	39.2	38.4	37.2	31.1	10.7	7320.0	52.7	45.2	74	54	8.8
9	915	45.8	46.4	40.3	37.3	45.8	45.9	44.3	37.1	12.6	8235.0	59.0	49.9	74	54	4.1
10	915	37.3	37.3	36.5	28.8	36.2	36.0	35.5	27.9	14.0	9150.0	51.3	42.8	74	54	11.2
3	927	58.8	60.3	58.6	52.3	54.0	58.6	56.5	51.3	-3.9	2781.0	56.4	48.4	74	54	5.6
4	927	50.1	53.2	49.4	45.7	47.0	53.6	50.3	46.2	0.2	3708.0	53.8	46.4	74	54	7.6
5	927	43.9	46.7	41.3	38.7	47.8	49.3	44.1	41.5	3.3	4635.0	52.6	44.8	74	54	9.2
8	927	39.1	38.9	37.8	31.1	37.9	38.9	35.1	30.8	11.7	7416.0	50.8	42.8	74	54	11.2
9	927	40.0	40.8	42.6	35.1	44.7	44.2	37.6	36.2	11.8	8343.0	56.5	48.0	74	54	6.0
Column numbers (see below for explanations)																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Column #1. harm = Harmonic; BE = Band Edge emissions

Column #2. Frequency of Transmitter.

Column #3. Uncorrected readings from the spectrum analyzer with First Axis Rotation.

Column #4. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.

Column #5. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.

Column #6. Highest Average Reading for Vertical Polarization.

Column #7. Uncorrected readings from the spectrum analyzer with First Axis Rotation.

Column #8. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.

Column #9. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.

Column #10. Highest Average Reading for Horizontal Polarization.

Column #11. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor + HPF Factor

Column #12. Frequency of Tested Emission

Column #13. Highest peak field strength at listed frequency.

Column #14. Highest Average field strength at listed frequency.

Column #15. Peak Limit.

Column #16. Average Limit.

Column #17. The margin (last column) is the worst-case margin under the peak or average limits for that row.

Overall Judgment: Passed by 3.8 dB

No other Emissions were detected from 30 to 9300 MHz within 10 dB of the limits.



11.6.3 Measurement Instrumentation Uncertainty

Measurement	Uncertainty
Bandwidth using marker delta method at a span of 2 MHz	10 kHz
99% Occupied Bandwidth	1% of frequency span
Amplitude measurement 1-10,000 MHz	2.0 dB
Radiated Emissions, E-field, 3 meters, 30 to 200 MHz	4.8 dB
Radiated Emissions, E-field, 3 meters, 200 to 1000 MHz	4.6 dB
Radiated Emissions, E-field, 3 meters, 1 to 6 GHz	5.0 dB
Radiated Emissions, E-field, 3 meters, 6 to 18 GHz	5.5 dB
Temperature THM-02	0.6 Deg C

The uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2 in accordance with CISPR 16-4-2.

12.0 REVISION HISTORY

RP-9966 Revisions:			
Rev.	Affected Sections	Description	Rationale
1	3.1	Added info about RF module installed	Omitted in original report
	7.0	Removed Reference to AC Conducted test station	Did not use that station
1	11.1	Repeated OBW test with new RBW on analyzer	Error in original test
1	11.2	Changed 10 MHz to 20 MHz	Typographical Error