Signal Communications Corp.

TEST REPORT

SCOPE OF WORK
Emissions Testing on 72-76 MHz Emergency Call Box

REPORT NUMBER
104936117BOX-001c

ISSUE DATE
April 6, 2022

[REVISED DATE]
July 11, 2022

DOCUMENT CONTROL NUMBER
Non-Specific Radio Report Shell Rev. August 2020

EMISSIONS TEST REPORT

(FULL COMPLIANCE)

Report Number: 104936117BOX-001c
Project Number: G104936117

Report Issue Date: April 6, 2022
Report Revision Date: July 11, 2022

Model(s) Tested: 72-76 MHz Emergency Call Box
Model(s) Partially Tested: None
Model(s) Not Tested but declared equivalent by the client: None

Standards: FCC 47CFR Part 90 (03/2022)
FCC 47CFR Part 15.207 (03/2022)

Tested by:
Intertek
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
Signal Communications Corp.
4 Wheeling Avenue
P.O Box 2588
Woburn, MA 01801
USA

Report prepared by

Kouma Sinn / EMC Engineering Supervisor

Report reviewed by

Vathana Ven / EMC Engineering Supervisor

Table of Contents

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	--
6	Output Power FCC Part 90.241 (a) (1)	Pass
7	Occupied Bandwidth and 26 dB Bandwidth FCC Part 2.1049 (c) (1)	Pass
8	Emission Mask FCC Part 90.210 (b) Emission Mask B	Pass
9	Frequency Stability 90.213 (a) Table 1	Pass
10	Antenna Port Conducted and Radiated Spurious Emissions FCC Part 90.210 (b) (3)	Pass
11	AC Mains Conducted Emissions FCC Part 15.207	Pass
12	Revision History	--

3 Client Information

This EUT was tested at the request of:

Client: Signal Communications Corp.
4 Wheeling Avenue
P.O Box 2588
Woburn, MA 01801
USA

Contact: Nadim Farhat
Telephone: 781-569-0820
Fax: None
Email: nfarhat@sigcom.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Signal Communications Corp.
4 Wheeling Avenue
P.O Box 2588
Woburn, MA 01801
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
72-76 MHz Emergency Call Box 72.5 MHz Transmitters	Signal Communications Corp.	72-76 MHz Emergency Call Box	90002479
72-76 MHz Emergency Call Box 75.7 MHz Transmitters	Signal Communications Corp.	72-76 MHz Emergency Call Box	90002480
Call Box	Signal Communications Corp.	72-76 MHz Emergency Call Box	90002483

Receive Date:	02/11/2022 & 03/23/2022
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
The equipment under test is an Emergency Call Box

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
100-240 VAC	1 Amp	50-60 Hz	1

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	The EUT was pre-programmed to transmit at low and high channels

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	None

Radio/Receiver Characteristics	
Frequency Band(s)	72-76 MHz
Modulation Type(s)	GFSK
Maximum Output Power	30.00 dBm (Conducted)
Test Channels	Low (72.5 MHz), High (75.7 MHz)
Occupied Bandwidth	6.056 kHz
MIMO Information (# of Transmit and Receive antenna ports)	One Antenna
Equipment Type	Standalone in a host
Antenna Type and Gain	0 dBi

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

5 System Setup and Method

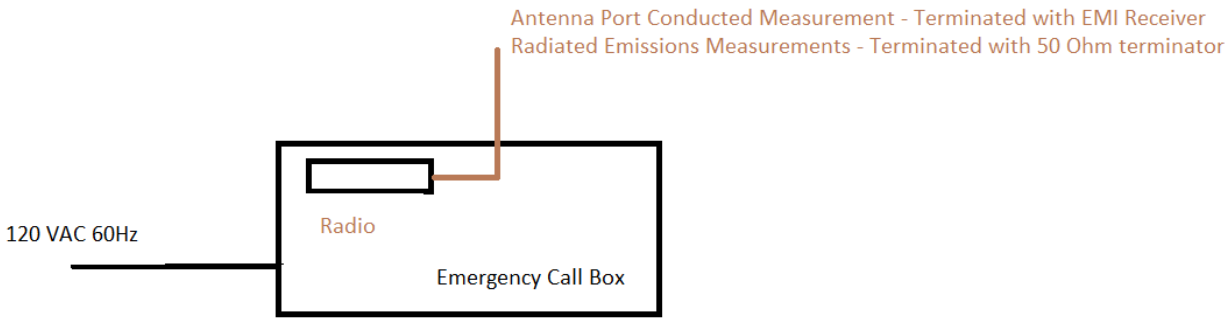
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
--	AC Mains	2	None	None	AC Mains

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None	N/A	N/A	N/A

5.1 Method:

Configuration as required by FCC 47CFR Part 90 (03/2022), FCC 47CFR Part 15.207 (03/2022), ANSI C63.26-2015, and ANSI C63.4-2014.

5.2 EUT Block Diagram:



6 Output Power

6.1 Method

Tests are performed in accordance with ANSI C63.26-2015.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/02/2021	11/02/2022
DAV005'	Weather Station	Davis	6250	MS191218083	02/11/2021	02/11/2023
CBLHF2012-2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/10/2022	02/10/2023
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	11/26/2021	11/26/2022

Software Utilized:

Name	Manufacturer	Version
None	N/A	N/A

6.3 Results:

The sample tested was found to Comply.

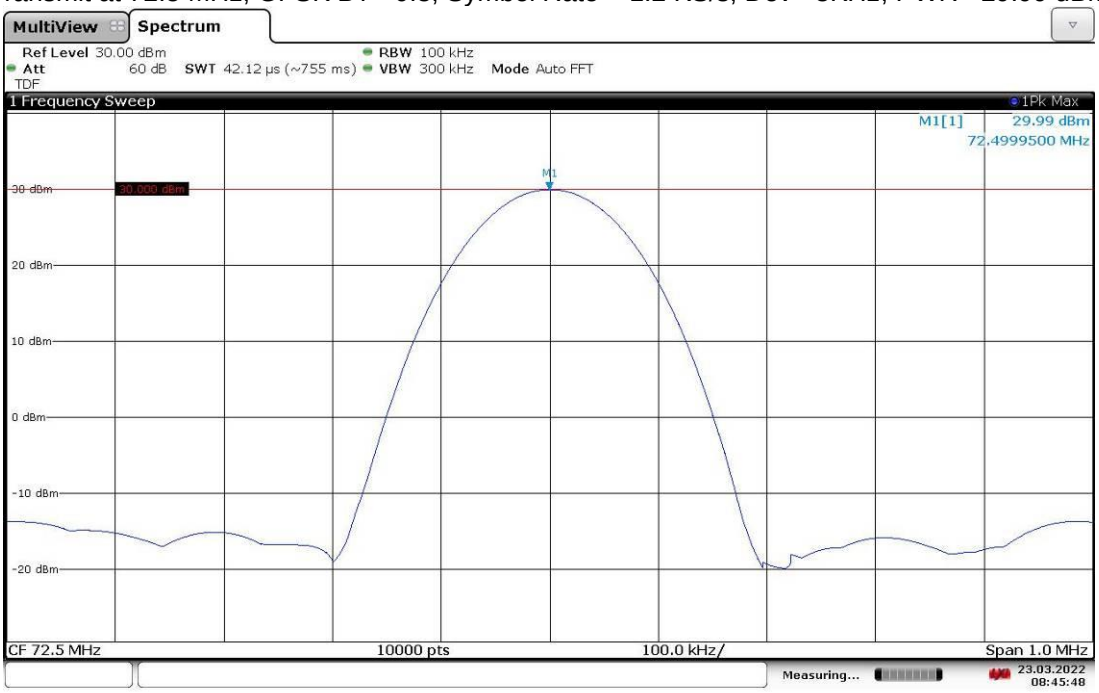
Limits:

FCC Part 90.241 (a) (1) – Maximum transmitter power will be either 2.5 watts plate input to the final stage or 1 watt output.

6.4 Setup Photograph:

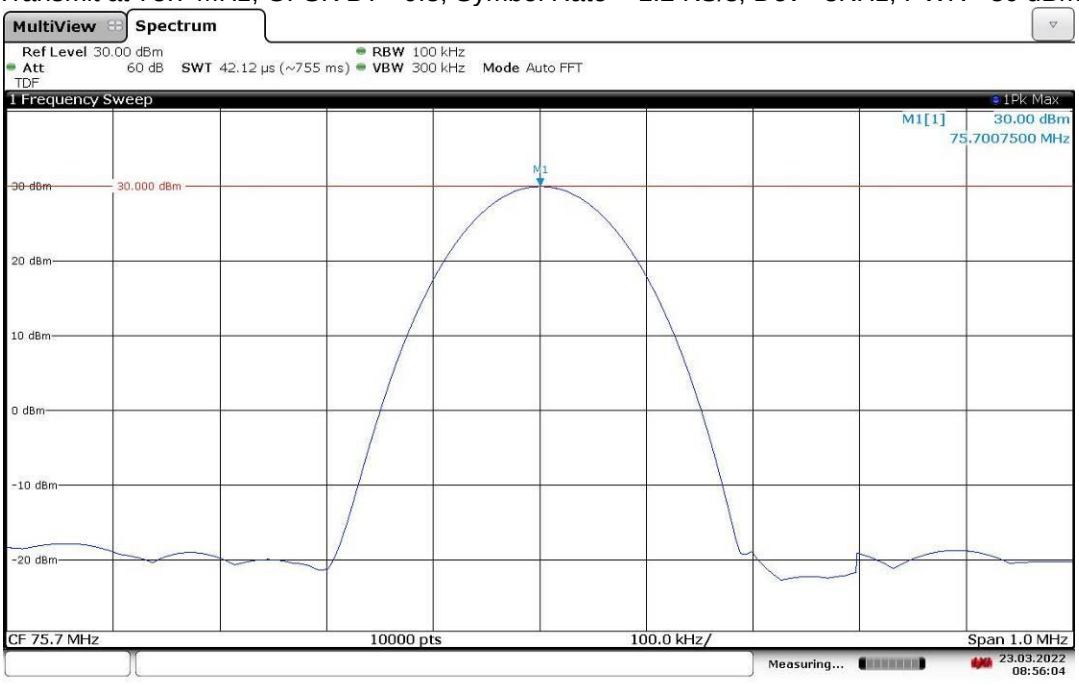
6.5 Plots/Data:

Transmit at 72.5 MHz, GFSK BT= 0.3, Symbol Rate = 1.2 KS/s, Dev= 3KHz, PWR= 29.99 dBm



08:45:49 23.03.2022

Transmit at 75.7 MHz, GFSK BT= 0.3, Symbol Rate = 1.2 KS/s, Dev= 3KHz, PWR= 30 dBm



08:56:04 23.03.2022

Test Personnel:	Kouma Sinn KPS	Test Date:	03/23/2022
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 90	Limit Applied:	See Report Section 6.3
Input Voltage:	120VAC 60Hz	Ambient Temperature:	24 ºC
Pretest Verification w/ BB Source:	N/A	Relative Humidity:	26 %
		Atmospheric Pressure:	1004 mbars

Deviations, Additions, or Exclusions: None

7 Occupied Bandwidth and 26 dB Bandwidth

7.1 Method

Tests are performed in accordance with ANSI C63.26-2015 and FCC Part 2.1049 (c) (1).

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/02/2021	11/02/2022
DAV005'	Weather Station	Davis	6250	MS191218083	02/11/2021	02/11/2023
CBLHF2012-2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/10/2022	02/10/2023
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	11/26/2021	11/26/2022

Software Utilized:

Name	Manufacturer	Version
None	N/A	N/A

7.3 Results:

The sample tested was found to Comply.

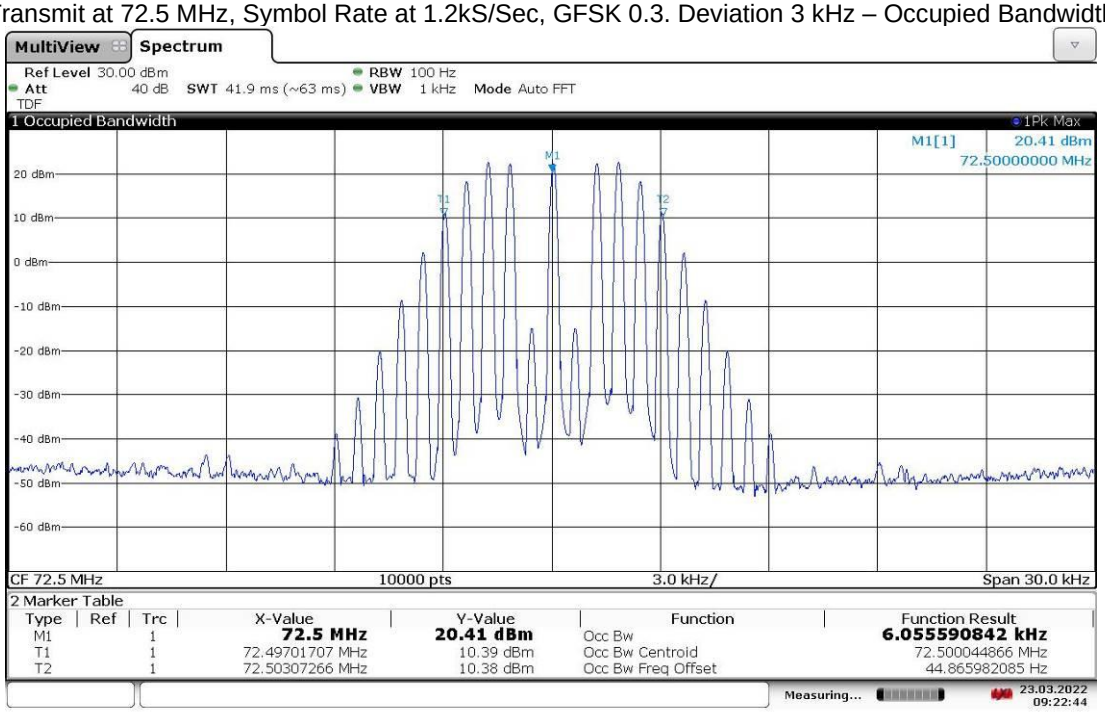
Limits:

FCC Part 90.209 Table 1 – The occupied bandwidth shall not be greater than 20 kHz of the authorized bandwidth.

7.4 Setup Photograph:

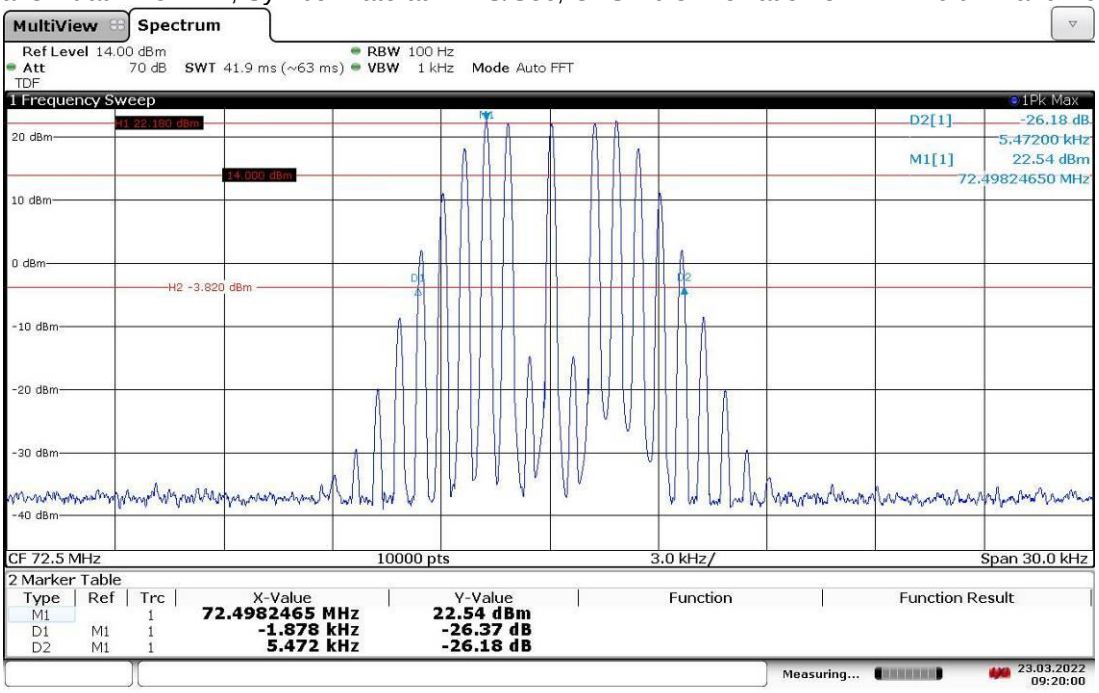
7.5 Plots/Data:

Transmit at 72.5 MHz, Symbol Rate at 1.2kS/Sec, GFSK 0.3. Deviation 3 kHz – Occupied Bandwidth



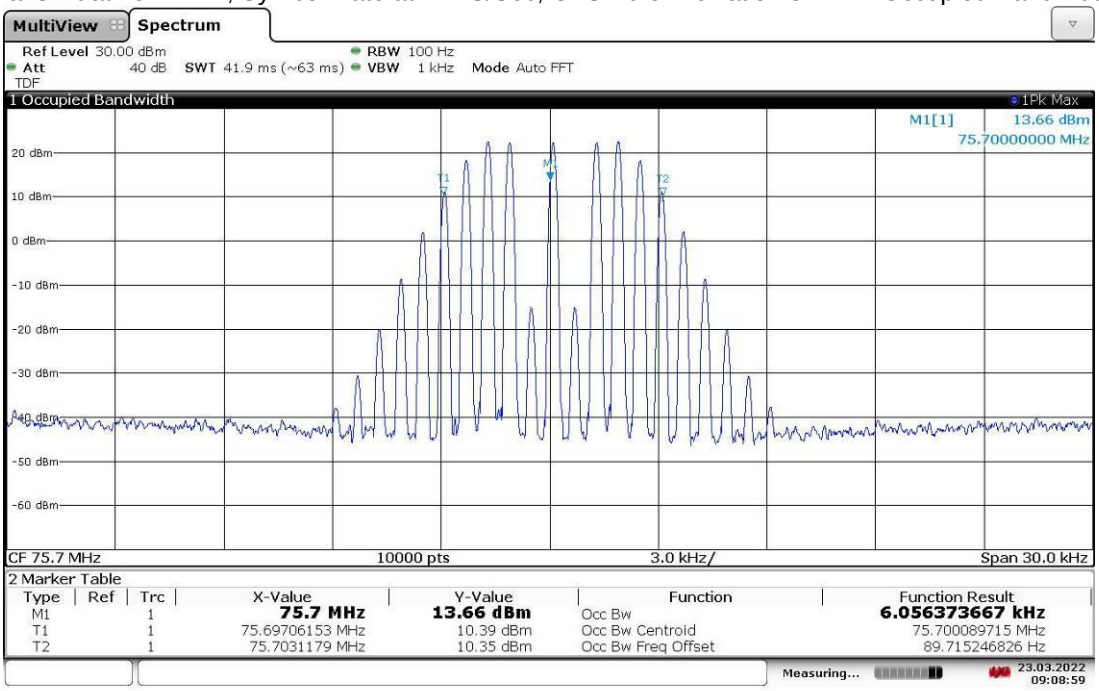
09:22:44 23.03.2022

Transmit at 72.5 MHz, Symbol Rate at 1.2kS/Sec, GFSK 0.3. Deviation 3 kHz – 26 dB Bandwidth



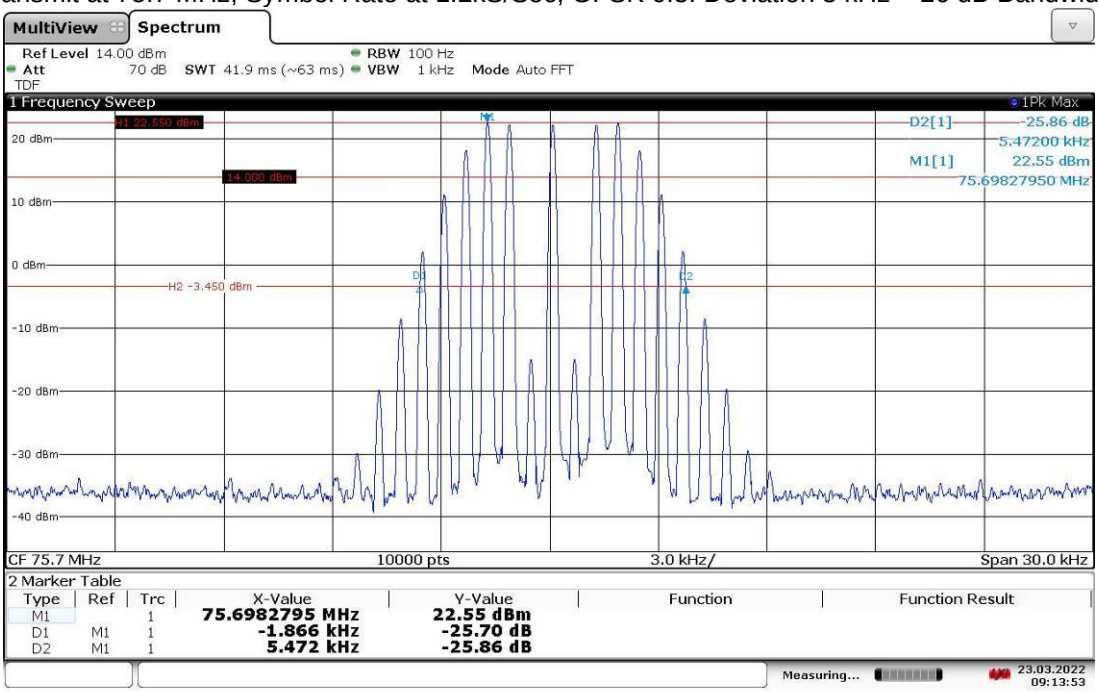
09:20:00 23.03.2022

Transmit at 75.7 MHz, Symbol Rate at 1.2kS/Sec, GFSK 0.3. Deviation 3 kHz – Occupied Bandwidth



09:09:00 23.03.2022

Transmit at 75.7 MHz, Symbol Rate at 1.2kS/Sec, GFSK 0.3. Deviation 3 kHz – 26 dB Bandwidth



09:13:54 23.03.2022

Test Personnel:	Kouma Sinn KPS	Test Date:	03/23/2022
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 90	Limit Applied:	See Report Section 7.3
Input Voltage:	120VAC 60Hz	Ambient Temperature:	24 ºC
Pretest Verification w/ BB Source:	N/A	Relative Humidity:	26 %
		Atmospheric Pressure:	1004 mbars

Deviations, Additions, or Exclusions: None

8 Emission Mask

8.1 Method

Tests are performed in accordance with ANSI C63.26-2015.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/02/2021	11/02/2022
DAV005'	Weather Station	Davis	6250	MS191218083	02/11/2021	02/11/2023
CBLHF2012-2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/10/2022	02/10/2023
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	11/26/2021	11/26/2022

Software Utilized:

Name	Manufacturer	Version
None	N/A	N/A

8.3 Results:

The sample tested was found to Comply.

Limits:

FCC Part 90.210 (b) *Emission Mask B.* For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

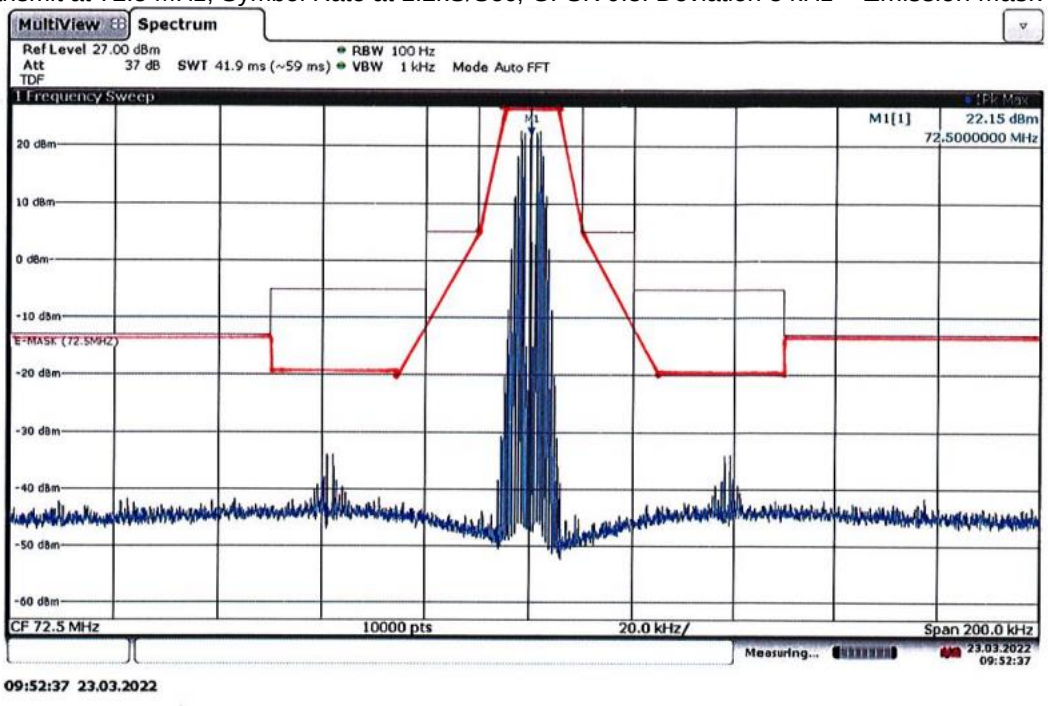
(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

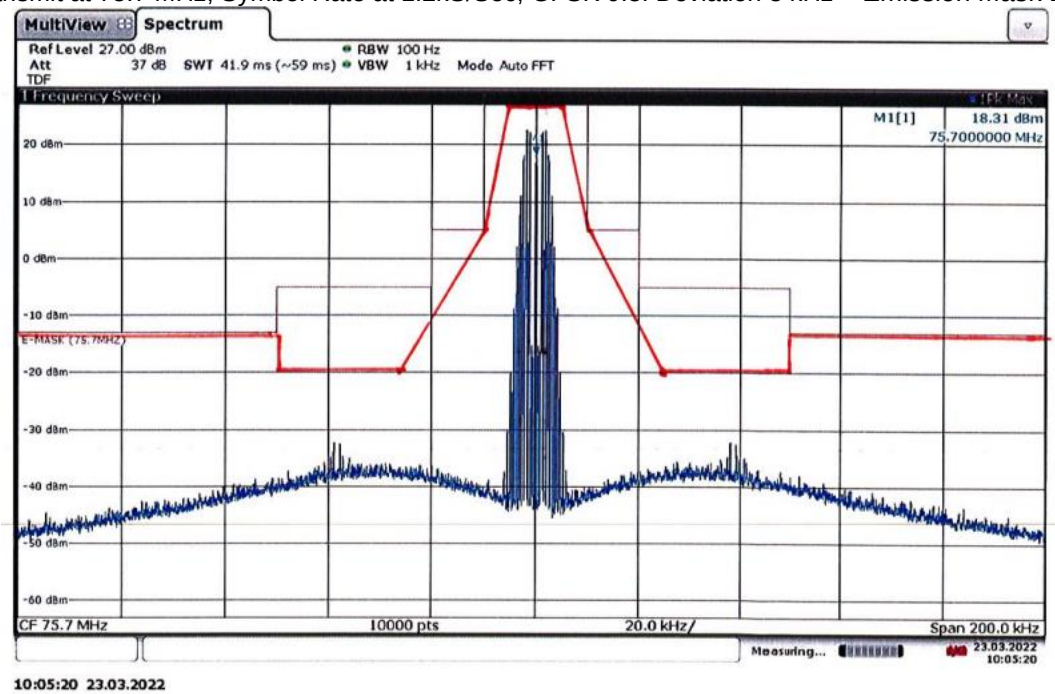
8.4 Setup Photograph:

8.5 Plots/Data:

Transmit at 72.5 MHz, Symbol Rate at 1.2kS/Sec, GFSK 0.3. Deviation 3 kHz – Emission Mask B/C



Transmit at 75.7 MHz, Symbol Rate at 1.2kS/Sec, GFSK 0.3. Deviation 3 kHz – Emission Mask B/C



Test Personnel:	Kouma Sinn KPS	Test Date:	03/23/2022
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 90	Limit Applied:	See Report Section 8.3
Input Voltage:	120VAC 60Hz	Ambient Temperature:	24 ºC
Pretest Verification w/ BB Source:	N/A	Relative Humidity:	26 %
		Atmospheric Pressure:	1004 mbars

Deviations, Additions, or Exclusions: None

9 Frequency Stability

9.1 Method

Tests are performed in accordance with ANSI C63.26-2015.

TEST SITE: Safety Lab

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/02/2021	11/02/2022
DAV005'	Weather Station	Davis	6250	MS191218083	02/11/2021	02/11/2023
CBLHF2012-2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/10/2022	02/10/2023
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	11/26/2021	11/26/2022
148012'	Temp/Humidity Chamber	Envirotronics	SH27C	08015563S11263	11/22/2021	11/18/2022
SAF430	AC Power Source	California Instr. Co	1251RP-1F	09544	09/24/2012	Verified
FLU13'	Digital Multimeter	Fluke	87-5	23500632	11/16/2021	11/16/2022

Software Utilized:

Name	Manufacturer	Version
None	N/A	N/A

9.3 Results:

The sample tested was found to Comply.

Limits:
90.213 (a) Table 1 – Must have a frequency stability of 50 ppm.

9.4 Setup Photographs:

9.5 Test Data:

72.5 MHz Frequency Stability

Company: Signal Communication
Model #: 72-76 MHz Call Box
Serial #: 90002479
Engineer(s): Kouma Sinn
Project #: G104936117
Standard: FCC Part 90

Date(s): 04/01/22

Location: Safety Lab

Test Equipment Used:
ROS005-1 DAV005
CBLHF2012-2M-1
CEN001 148012
SAF430 FLU13

Limit: 50 PPM
Nominal f: 72.5 MHz
Voltage: 120 AC

Notes: Reference to frequency at 20 degrees and nominal voltage at 120VAC 60Hz

%	Voltage Volts	Frequency MHz	Deviation kHz	Limit kHz
-15%	102	72.50000000	0	3.63
+0%	120	72.50000000	0	3.63
+15%	138	72.50000000	0	3.63

*

Temp Celsius	Frequency MHz	Deviation kHz	Limit kHz
-30	72.50001500	-0.02	3.63
-20	72.50000500	-0.03	3.63
-10	72.50000500	-0.03	3.63
0	72.50002500	-0.01	3.63
10	72.50003500	0	3.63
20	72.50003500	0	3.63
30	72.50002500	-0.01	3.63
40	72.50002500	-0.01	3.63
50	72.49999500	-0.04	3.63

Limit: 50 PPM
Nominal f: 72.5 MHz
Voltage: 120 AC

Notes: Reference to manufacturer's declared frequency at 72.500 MHz

%	Voltage Volts	Frequency MHz	Deviation kHz	Limit kHz
-15%	102	72.50000000	0.000	3.63
0%	120	72.50000000	--	--
+15%	138	72.50000000	0.000	3.63

Temp Celsius	Frequency MHz	Deviation kHz	Limit kHz
-30	72.50001500	0.015	3.63
-20	72.50000500	0.005	3.63
-10	72.50000500	0.005	3.63
0	72.50002500	0.025	3.63
10	72.50003500	0.035	3.63
--	72.50000000	--	--
30	72.50002500	0.025	3.63
40	72.50002500	0.025	3.63
50	72.49999500	-0.005	3.63

75.7 MHz Frequency Stability

Company: Signal Communication
Model #: 72-76 MHz Call Box
Serial #: 90002480
Engineer(s): Kouma Sinn
Project #: G104936117
Standard: FCC Part 90

Test Equipment Used:
ROS005-1 DAV005
CBLHF2012-2M-1
Location: Safety Lab CEN001 148012
Date(s): 04/01/22 SAF430 FLU13

Limit: 50 PPM
Nominal f: 75.7 MHz
Voltage: 120 AC

Notes: Reference to frequency at 20 degrees and nominal voltage at 120VAC 60Hz

%	Voltage Volts	Frequency MHz	Deviation kHz	Limit kHz
-15%	102	75.70000000	0	3.79
+0%	120	75.70000000	0	3.79
+15%	138	75.70000000	0	3.79

*

Temp Celsius	Frequency MHz	Deviation kHz	Limit kHz
-30	75.70002500	-0.04	3.79
-20	75.70005500	-0.01	3.79
-10	75.70005500	-0.01	3.79
0	75.70004500	-0.02	3.79
10	75.70002500	-0.04	3.79
20	75.70006500	0	3.79
30	75.70005500	-0.01	3.79
40	75.70001500	-0.05	3.79
50	75.69997500	-0.09	3.79

Limit: 50 PPM
Nominal f: 75.7 MHz
Voltage: 120 AC

Notes: Reference to manufacturer's declared frequency at 75.700 MHz

%	Voltage Volts	Frequency MHz	Deviation kHz	Limit kHz
-15%	102	75.70000000	0.000	3.79
0%	120	75.70000000	--	--
+15%	138	75.70000000	0.000	3.79

Temp Celsius	Frequency MHz	Deviation kHz	Limit kHz
-30	75.70002500	0.025	3.79
-20	75.70005500	0.055	3.79
-10	75.70005500	0.055	3.79
0	75.70004500	0.045	3.79
10	75.70002500	0.025	3.79
--	75.70000000	--	--
30	75.70005500	0.055	3.79
40	75.70001500	0.015	3.79
50	75.69997500	-0.025	3.79

Test Personnel: Kouma Sinn KPS
Supervising/Reviewing Engineer: (Where Applicable) N/A
Product Standard: FCC Part 90
Input Voltage: 120VAC 60Hz
Pretest Verification w/ BB Source: **N/A**

Test Date: 04/01/2022
Limit Applied: See Report Section 9.3
Ambient Temperature: 25 ºC
Relative Humidity: 32 %
Atmospheric Pressure: 988 mbars

Deviations, Additions, or Exclusions: None

10 Antenna Port Conducted and Radiated Emissions

10.1 Method

Tests are performed in accordance with ANSI C63.26-2015 and ANSI C63.4-2014.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	5.0 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.9 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.1 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

10.2 Test Equipment Used:

Test equipment for antenna port measurements

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/02/2021	11/02/2022
DAV005'	Weather Station	Davis	6250	MS191218083	02/11/2021	02/11/2023
CBLHF2012-2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/10/2022	02/10/2023
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	11/26/2021	11/26/2022

Software Utilized:

Name	Manufacturer	Version
None	N/A	N/A

Test equipment used for radiated emissions, 9 kHz-30 MHz

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV007'	Weather Station Vantage Vue	Davis	6250	MS191212003	03/08/2022	03/08/2023
145-414'	Cables 145-400 145-403 145-405 145-409	Huber + Suhner	3m Track A cables	multiple	07/09/2021	07/09/2022
IW001'	2 meter cable	Insulated Wire	2801-NPS	001	09/23/2021	09/23/2022
IW002'	2 meter Armored cable	Insulated Wire	2800-NPS	002	09/23/2021	09/23/2022
CBL051'	9kHz to 1GHz BNC/ BNC Cable	Belden	RG58A/U	none	04/16/2021	04/16/2022
145108'	EMI Test Receiver (20Hz - 40GHz)	Rohde & Schwarz	ESIB40	100209	06/22/2021	06/22/2022
ETS003	9kHz-30MHz Active Loop Antenna	ETS Lindgren	6502	00143396	08/26/2021	08/26/2022

Software Utilized:

Name	Manufacturer	Version
BAT EMC	Nexio	3.18.0.16

Test equipment used for Radiated emissions, 30-1000 MHz

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
IW001'	2 meter cable	Insulated Wire	2801-NPS	001	09/23/2021	09/23/2022
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	07/22/2021	07/22/2022
HS002'	DC-18GHz cable 1.5M long	Huber & Suhner	SucoFlex 106A	HS002	12/06/2021	12/06/2022
IW006'	DC-18GHz cable 8.4m long	Insulated Wire	2800-NPS	IW006	07/22/2021	07/22/2022
PRE11'	50dB gain pre-amp	Pasternack	PRE11	PRE11	09/02/2021	09/02/2022
DAV007'	Weather Station Vantage Vue	Davis	6250	MS191212003	03/08/2022	03/08/2023
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	06/09/2021	06/09/2022
145108'	EMI Test Receiver (20Hz - 40GHz)	Rohde & Schwarz	ESIB40	100209	06/22/2021	06/22/2022

Software Utilized:

Name	Manufacturer	Version
BAT EMC	Nexio	3.18.0.16

10.3 Results:

The sample tested was found to Comply.

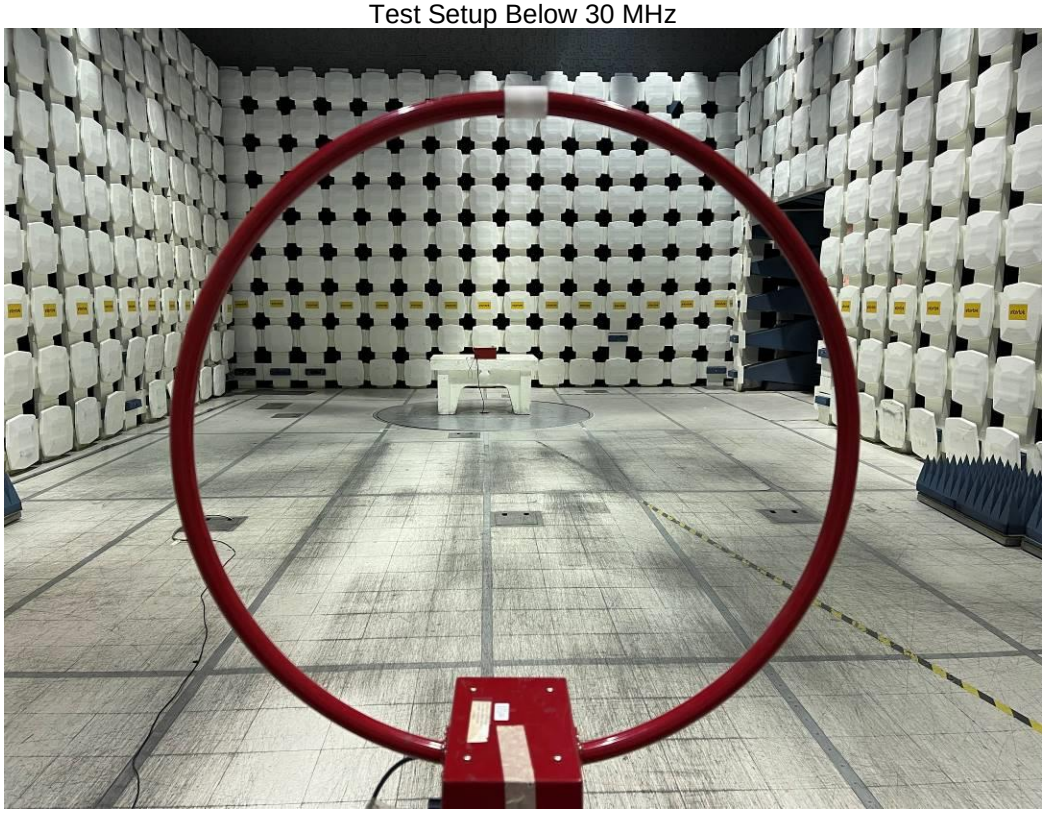
Limits:

FCC Part 90.210 (b) (3) – On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB which is -13 dBm.

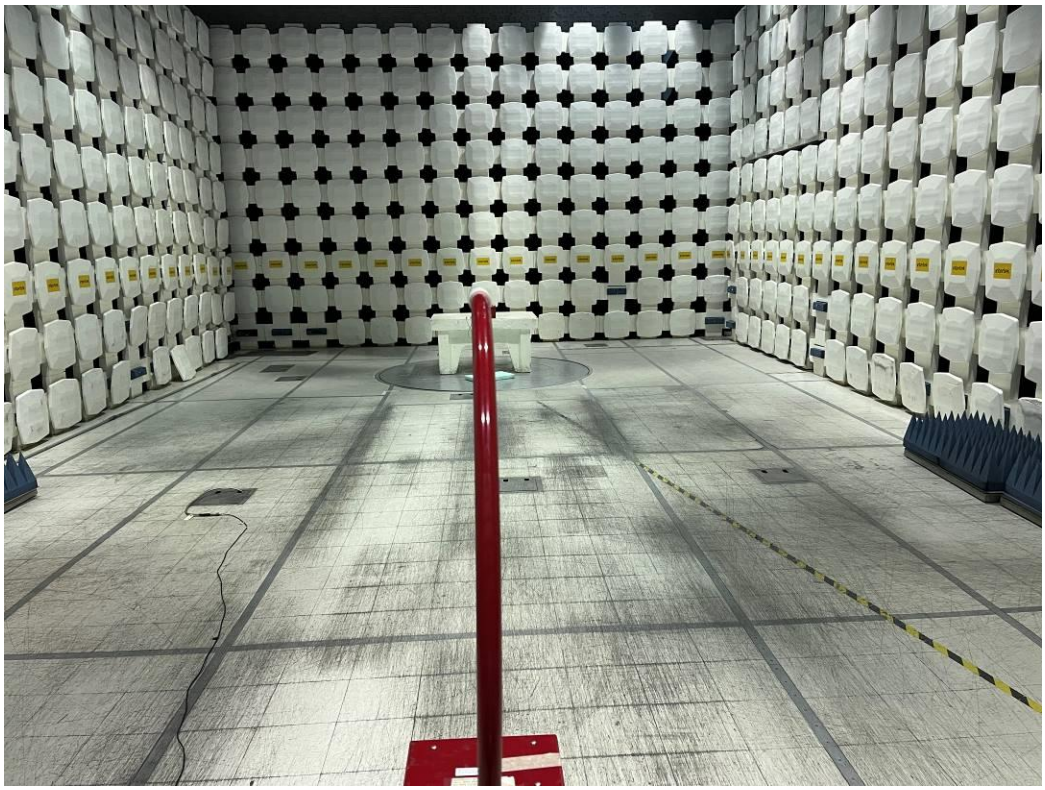
10.4 Setup Photographs:

Antenna Port Conducted Emissions

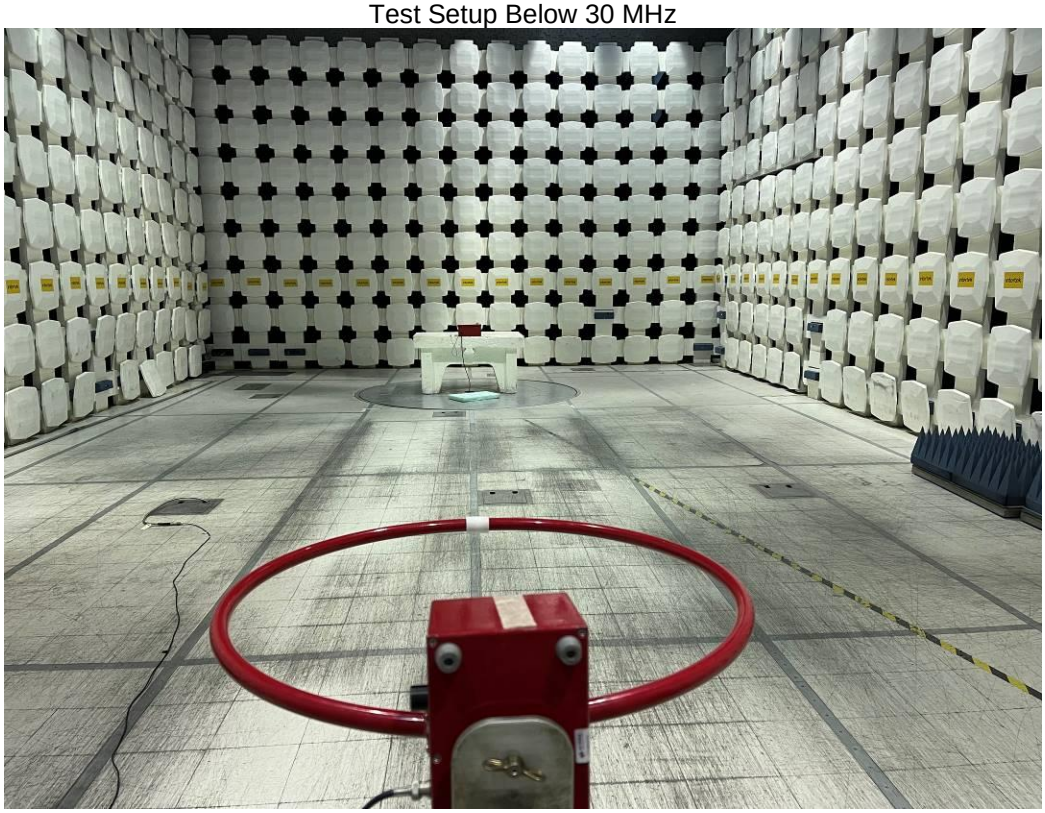
Test Setup Below 30 MHz



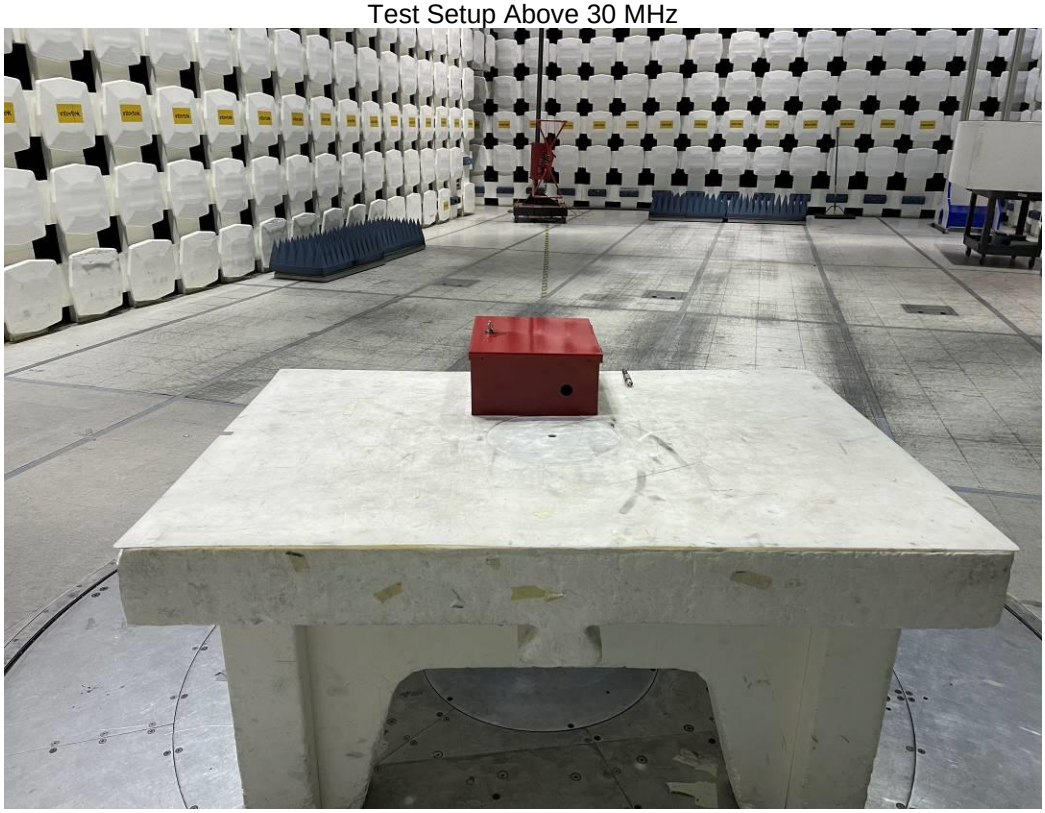
Test Setup Below 30 MHz



Test Setup Below 30 MHz

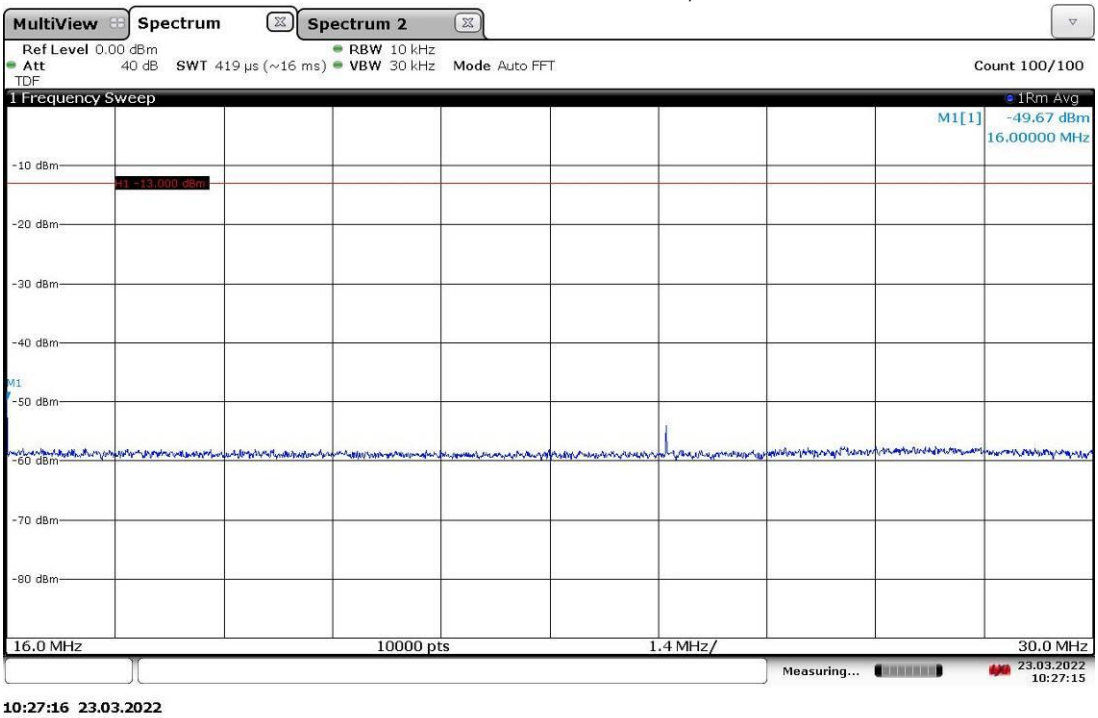


Test Setup Above 30 MHz



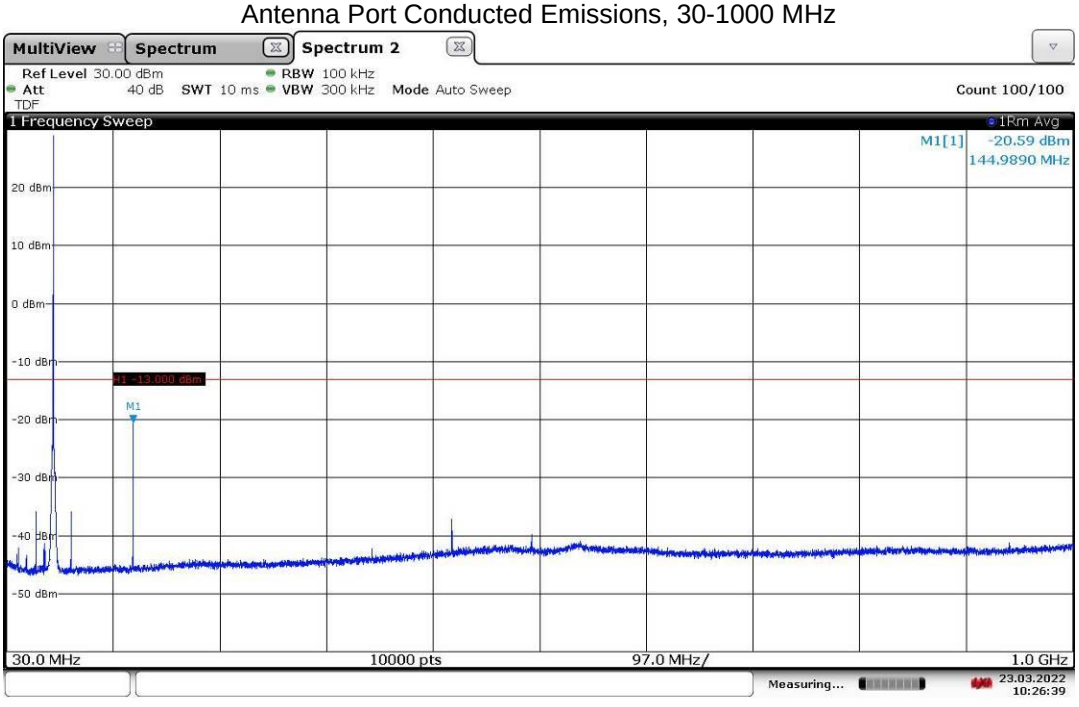
10.5 Plots/Data:

Transmit at 72.5 MHz, GFSK BT= 0.3, Symbol Rate = 1.2 KS/s, Dev= 3KHz,
Antenna Port Conducted Emissions, 16-30 MHz



10:27:16 23.03.2022

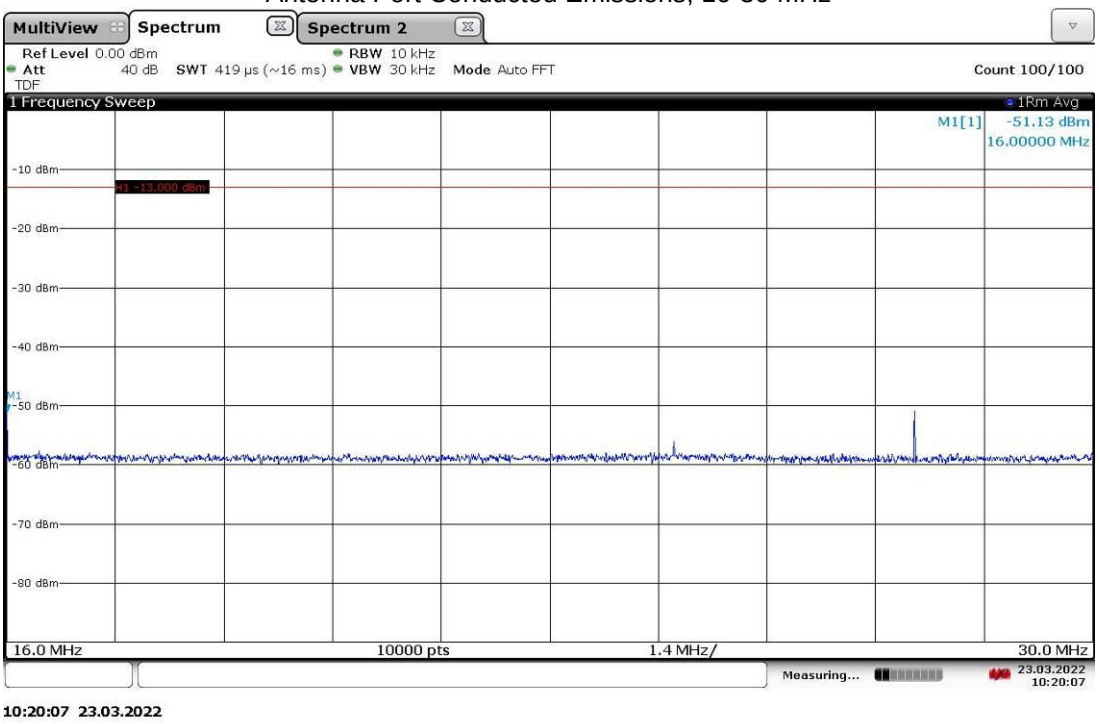
Transmit at 72.5 MHz, GFSK BT= 0.3, Symbol Rate = 1.2 KS/s, Dev= 3KHz,
Antenna Port Conducted Emissions, 30-1000 MHz



10:26:40 23.03.2022

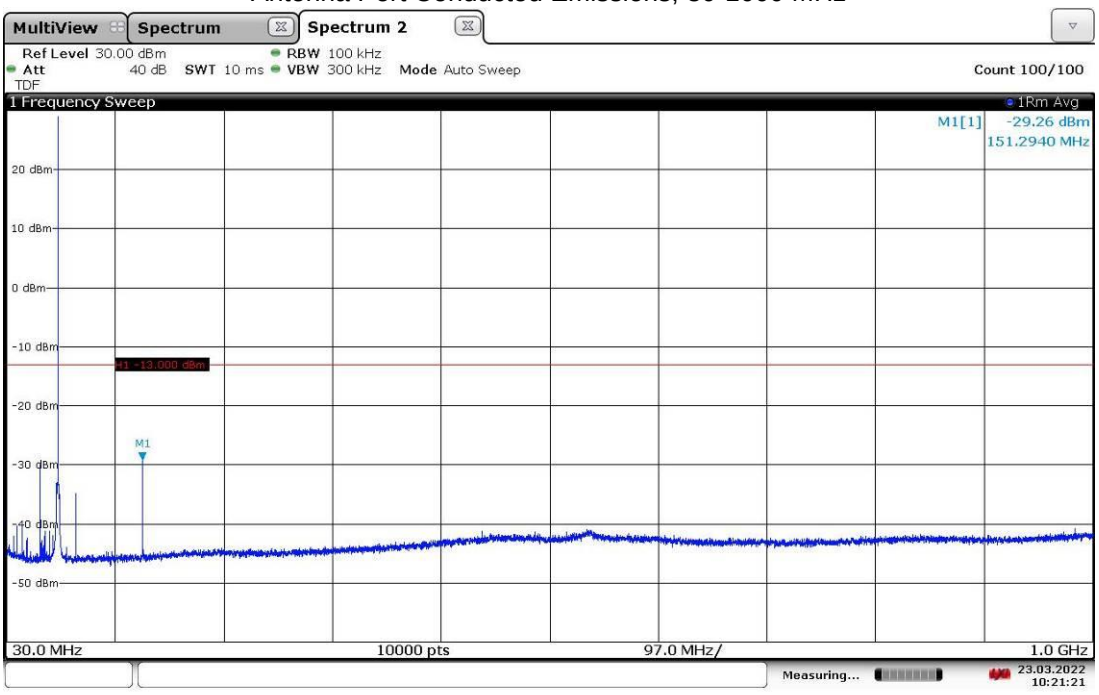
Notes: The lowest frequency used in the EUT is 16 MHz.

Transmit at 75.7 MHz, GFSK BT= 0.3, Symbol Rate = 1.2 KS/s, Dev= 3KHz,
Antenna Port Conducted Emissions, 16-30 MHz



10:20:07 23.03.2022

Transmit at 75.7 MHz, GFSK BT= 0.3, Symbol Rate = 1.2 KS/s, Dev= 3KHz,
Antenna Port Conducted Emissions, 30-1000 MHz



10:21:21 23.03.2022

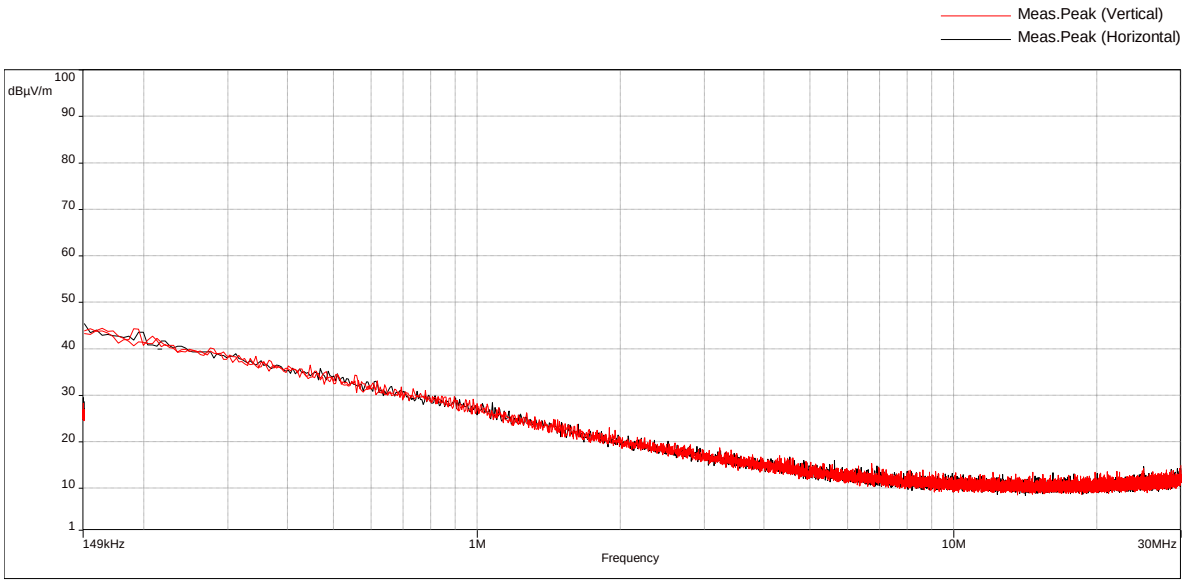
Notes: The lowest frequency used in the EUT is 16 MHz.

Transmit at 72.5 MHz, GFSK BT= 0.3, Symbol Rate = 1.2 KS/s, Dev= 3KHz,
Radiated Emissions, 16-30 MHz

Test Information:

Date and Time	4/1/2022 12:33:02 PM
Client and Project Number	Signal Communication
Engineer	Kouma Sinn
Temperature	24 C
Humidity	41 %
Atmospheric Pressure	987 mbar
Comments	Scan 2: Tx 72.5 MHz., RE 10-30MHz Loop antenna, Electric Field, 10M Location

Graph:



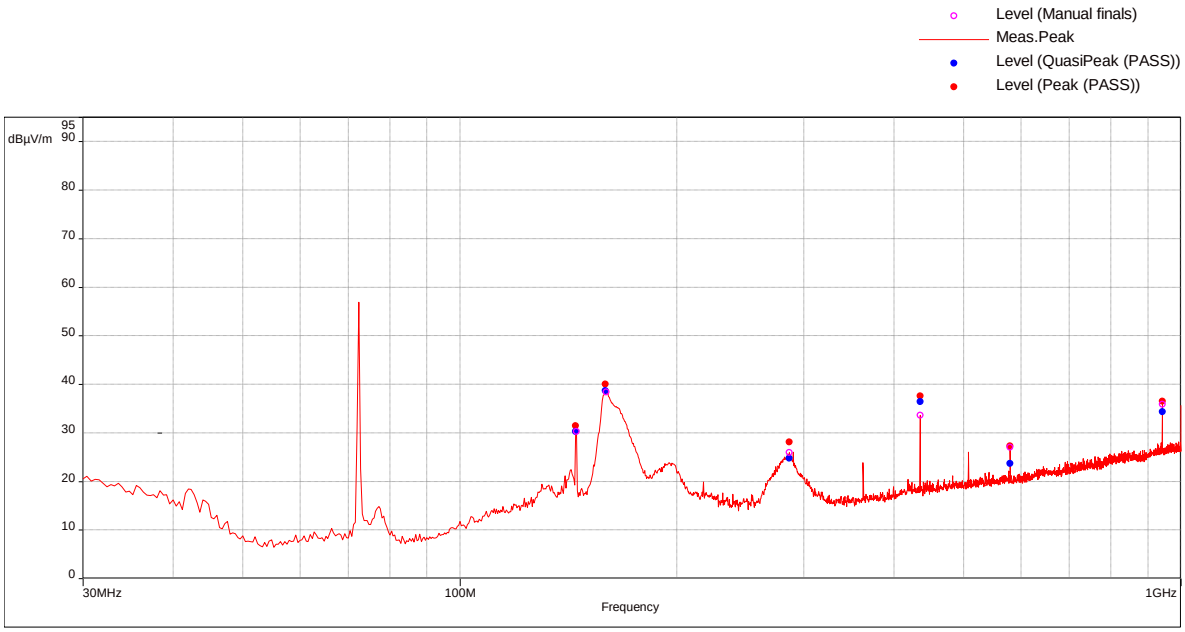
Notes: No emission was detected. Scan was performed from 149 kHz instead of 16 MHz.

Transmit at 72.5 MHz, GFSK BT= 0.3, Symbol Rate = 1.2 KS/s, Dev= 3KHz,
Radiated Emissions, 30-1000 MHz

Test Information:

Date and Time	4/1/2022 10:43:56 AM
Client and Project Number	Signal Communication
Engineer	Kouma Sinn
Temperature	24 C
Humidity	41 %
Atmospheric Pressure	987 mbar
Comments	Scan 1: Tx 72.5 MHz RE 30-1000MHz SA mode

Graph:



Results:

EIRP Peak (PASS) (6)

Frequency (MHz)	Peak Level (dBµV/m)	EIRP Level (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
144.9789474	31.48	-44.83	-13	-31.83	245.00	1.46	Vertical	120000.00	-19.55
159.1263158	39.97	-56.72	-13	-43.72	155.00	1.96	Vertical	120000.00	-20.23
286.4315789	28.08	-47.27	-13	-34.27	227.00	1.00	Vertical	120000.00	-18.26
434.9578947	37.53	-57.5	-13	-44.5	284.00	2.07	Horizontal	120000.00	-14.58
579.9684211	27.30	-48.35	-13	-35.35	161.00	3.91	Vertical	120000.00	-11.85
942.4947368	36.45	-44.83	-13	-31.83	242.00	1.00	Horizontal	120000.00	-5.90

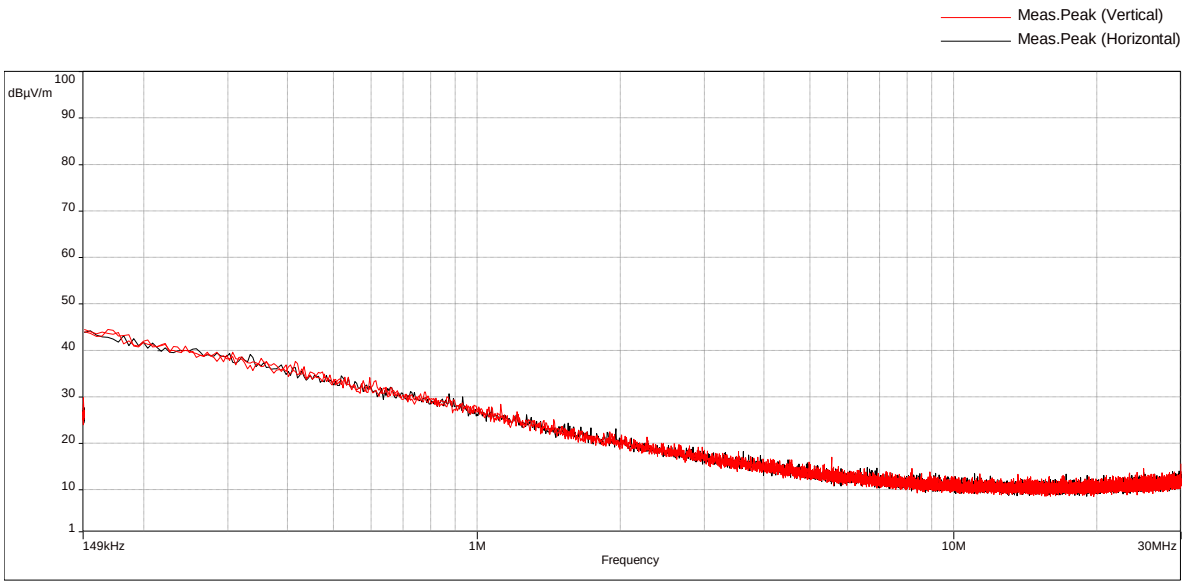
Notes:
The level in EIRP (dBm) is calculated from the peak readings as, EIRP (dBm) = E Peak (dBµV/m) + 20*Log(d) – 104.8, where d is the measurement distance (in the far field region) in meter.

Transmit at 75.7 MHz, GFSK BT= 0.3, Symbol Rate = 1.2 KS/s, Dev= 3KHz,
Radiated Emissions, 16-30 MHz

Test Information:

Date and Time	4/1/2022 12:41:14 PM
Client and Project Number	Signal Communication
Engineer	Kouma Sinn
Temperature	24 C
Humidity	41 %
Atmospheric Pressure	987 mbar
Comments	Scan 3: Tx 75.7 MHz., RE 10-30MHz Loop antenna, Electric Field, 10M Location

Graph:



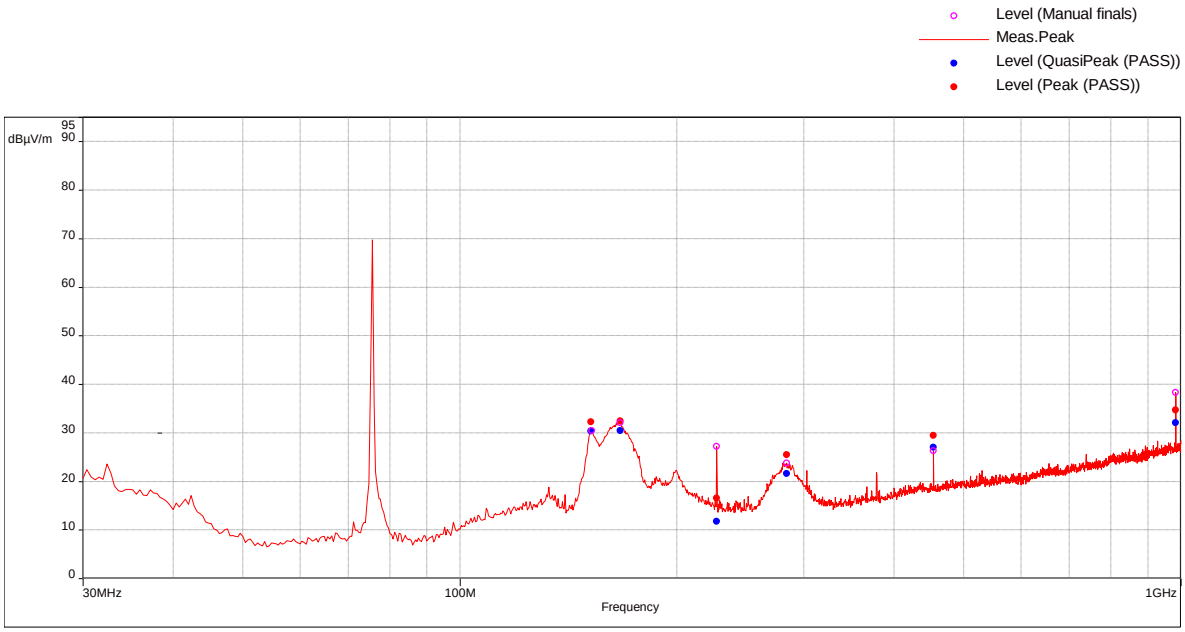
Notes: No emission was detected. Scan was performed from 149 kHz instead of 16 MHz.

Transmit at 75.7 MHz, GFSK BT= 0.3, Symbol Rate = 1.2 KS/s, Dev= 3KHz,
Radiated Emissions, 30-1000 MHz

Test Information:

Date and Time	4/1/2022 1:33:30 PM
Client and Project Number	Signal Communication
Engineer	Kouma Sinn
Temperature	24 C
Humidity	41 %
Atmospheric Pressure	987 mbar
Comments	Scan 4: Tx 75.7 MHz RE 30-1000MHz SA mode

Graph:



Results:

EIRP Peak (PASS) (6)

Frequency (MHz)	Peak Level (dBµV/m)	EIRP Level (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
152.1789474	32.23	-52.57	-13	-39.57	142.00	1.63	Vertical	120000.00	-19.98
166.7368421	32.41	-52.39	-13	-39.39	228.00	2.63	Vertical	120000.00	-20.47
227.0736842	16.54	-68.26	-13	-55.26	0.00	1.81	Vertical	120000.00	-21.03
283.9052632	25.43	-59.37	-13	-46.37	243.00	1.00	Vertical	120000.00	-18.28
454.1894737	29.49	-55.31	-13	-42.31	288.00	2.30	Horizontal	120000.00	-14.22
984.0631579	34.72	-50.08	-13	-37.08	236.00	3.97	Horizontal	120000.00	-5.26

Notes:
The level in EIRP (dBm) is calculated from the peak readings as, EIRP (dBm) = E Peak (dBµV/m) + 20*Log(d) – 104.8, where d is the measurement distance (in the far field region) in meter.

Test Personnel:	Kouma Sinn KPS	Test Date:	04/01/2022
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 90	Limit Applied:	-13 dBm
Input Voltage:	120VAC 60Hz		
		Ambient Temperature:	24 ºC
Pretest Verification w/ BB Source:	**Yes**	Relative Humidity:	41 %
		Atmospheric Pressure:	987 mbars

Deviations, Additions, or Exclusions: None

11 AC Mains Conducted Emissions

11.1 Method

Tests are performed in accordance with ANSI C3.2014.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
AC Line Conducted Emissions	150 kHz - 30 MHz	1.2 dB	3.4dB
Telco Port Emissions	150 kHz - 30 MHz	2.8 dB	5.0dB
AC Line Conducted Emissions	9 kHz - 150 MHz	2.2 dB	3.4 dB

As shown in the table above our conducted emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculations

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN or ISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(49.1\ dB\mu V / 20)}$ = 285.1 μV/m

When BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes LISN Factor, Attenuator, and Cable Loss. These are already accounted for in the “Level” column.

11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DS40'	Temp, humidity, pressure gauge	Digi Sense	68000-49	181717625	11/00/2021	11/09/2022
ROS002'	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	06/24/2021	06/24/2022
LISN32'	LISN - CISPR16 Compliant 9kHz-30MHz	Com-Power	LI-215A	191955	05/11/2021	05/11/2022
WEI26'	Attenuator 20dB 2 Watts	Weinschel	WA18-20	1001015N0010004	05/18/2021	05/18/2022
CBL043'	3ft BNC to BNC	Hosiwell	Coax RG-58	CBL043	09/23/2021	09/23/2022
FLU13'	Digital Multimeter	Fluke	87-5	23500632	11/16/2021	11/16/2022
FLU17'	True RMS Clamp Meter	Fluke	374	27980421WS	04/26/2021	04/26/2022

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	3.18.0.16

11.3 Results:

The sample tested was found to Comply.

Limits – FCC Part 15.207

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

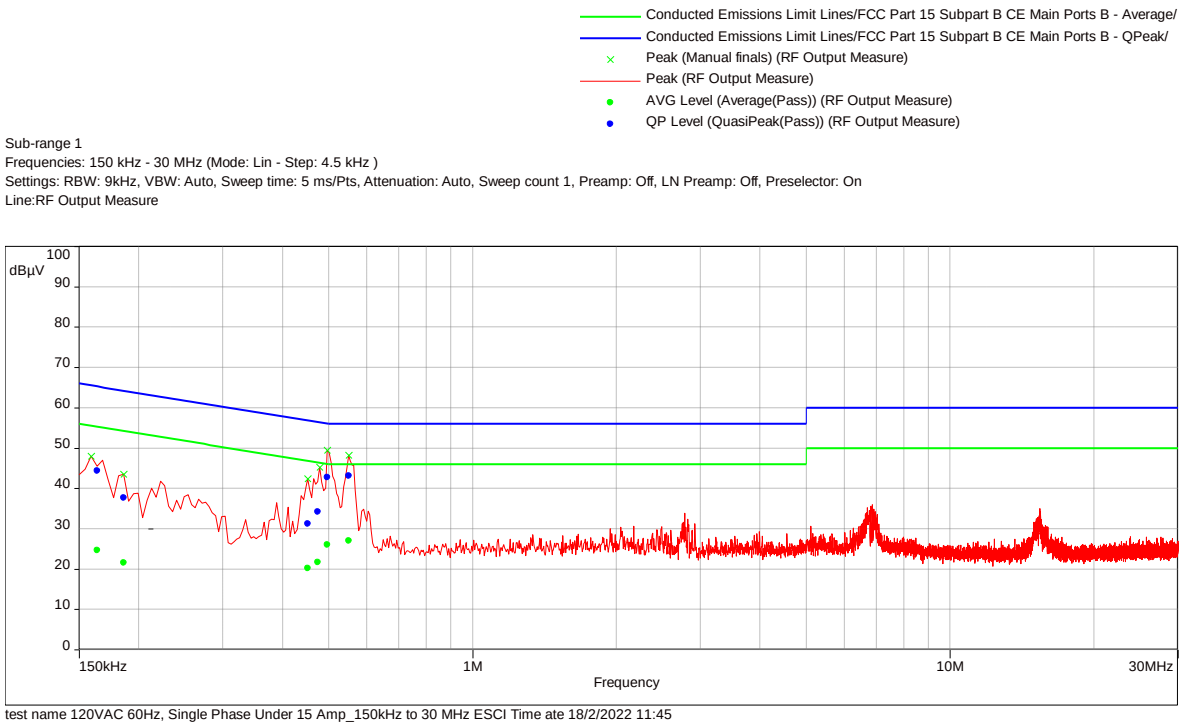
11.4 Setup Photographs:

11.5 Plots/Data:

Test Information:

Date and Time	2/18/2022 11:37:25 AM
Client and Project Number	Signal Communication
Engineer	Kouma Sinn
Temperature	23 deg C
Humidity	32 %
Atmospheric Pressure	992 mbars
Comments	120VAC 60Hz, Single Phase Under 15 Amp_150kHz to 30 MHz ESCI

Graph:



Results:

QuasiPeak(Pass) (6)

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBuV)	QP Margin (dB)	Line	RBW	Meas.Time	Correction (dB)
0.162	44.36	65.28	-20.92	Neutral	9k	0.01	19.91
0.1845	37.64	64.21	-26.58	Neutral	9k	0.01	19.90
0.4495	31.29	56.85	-25.56	Neutral	9k	0.01	19.91
0.476	34.21	56.44	-22.24	Neutral	9k	0.01	19.91
0.4985	42.80	56.06	-13.25	Neutral	9k	0.01	19.91
0.5515	43.11	56.00	-12.89	Neutral	9k	0.01	19.92

Average(Pass) (6)

Frequency (MHz)	AVG Level (dBµV)	AVG Limit (dBuV)	AVG Margin (dB)	Line	RBW	Meas.Time	Correction (dB)
0.162	24.67	55.28	-30.62	Neutral	9k	0.01	19.91
0.1845	21.51	54.21	-32.70	Neutral	9k	0.01	19.90
0.4495	20.24	46.85	-26.61	Neutral	9k	0.01	19.91
0.476	21.75	46.44	-24.69	Neutral	9k	0.01	19.91
0.4985	26.03	46.06	-20.02	Neutral	9k	0.01	19.91
0.5515	27.01	46.00	-18.99	Neutral	9k	0.01	19.92

Test Personnel:	Kouma Sinn KPS	Test Date:	02/17/2022
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 90	Limit Applied:	See Report Section 11.3
Input Voltage:	120VAC 60Hz	Ambient Temperature:	23 ºC
Pretest Verification w/ Signal Generator:	**Yes**	Relative Humidity:	32 %
		Atmospheric Pressure:	992 mbars

Deviations, Additions, or Exclusions: None

12 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	04/06/2022	104936117BOX-001c	KPS	VFV	Original Issue
1	04/11/2022	104936117BOX-001c	KPS	VFV	Removed all FM related data and typo correction
2	07/11/2022	104936117BOX-001c	KPS	VFV	Added emission mask C limit on plots