FCC Part 90 (Subpart I)

RF Test Report

Report No.:	FCC_RF_SL20081801-ICOM-009_REV 4.0
FCC ID:	AFJ418001
Test Model:	IP740D
Received Date:	10/11/2020 Sample was received in good condition
Test Date:	10/11/2020 -11/23/2020 and 05/15/2021 to 05/18/2021
Original Report:	11/23/2020
Rev1 Issue date:	05/18/2021
Current rev4:	01/08/2023
Applicant:	Icom Inc.
Address:	1-1-32 Kamiminami Hirano-ku, Osaka Japan 547-0003, Japan
Manufacturer:	Icom Inc.
Address:	1-1-32 Kamiminami Hirano-ku, Osaka Japan 547-0003, Japan
Issued By:	Bureau Veritas Consumer Products Services, Inc.
Lab Address:	775 Montague Expressway, Milpitas, CA 95035
Test Location (1):	775 Montague Expressway, Milpitas, CA 95035

ACCREDITED
TESTING CERT # 2742-01

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Release Control Record

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
FCC_RF_SL20081801-ICOM-009	Orignal Release	11/23/ 2020
FCC_RF_SL20081801-ICOM-009_REV 1.0	Revise the incorrect test result	05/17/ 2021
FCC_RF_SL20081801-ICOM-009_REV 2.0	Revised to remove RSS references.	04/10/2022
FCC_RF_SL20081801-ICOM-009_REV 3.0	Revised to remove Part 22, 24 and to make part 90 Report Corrected Modulation Characteristic and Frequency stability errors in the report	12/30/2022
FCC_RF_SL20081801-ICOM-009_REV 4.0	Removed Modulation Limiting test and updated test equipment list	01/08/2023

1 Certificate of Conformity

Product: Two Way Radio

Brand: Icom

Test Model: IP740D

Sample Status: Engineering sample

Applicant: Icom Inc.

Test Date: 10/11/2020 -11/23/2020 and 05/15/2021 to 05/18/2021

Standards: FCC Part 90 (Subpart I)

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc., Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Gary Chou

Prepared by : _____ , **Date:** 05/18/2021

Gary Chou / Compliance Engineer

Deon

Approved by : _____ , **Date:** 05/18/2021

Deon Dai / Engineer Reviewer

Revision 2 Approved by: _____, **Date:** 04/10/2022

Suresh Kondapalli
Technical Director

Revision 4 Approved by: _____, **Date:** 01/08/2023

Suresh Kondapalli
Technical Director

2 Summary of Test Results

The EUT has been tested according to the following specifications:

FCC Parts 90 (Subpart I)		
CLAUSE	**TEST PARAMETER**	**RESULTS**
TRANSMITTING PHENOMENA		
§1.1310 and §2.1093	RF Exposure	Pass
§2.1046; § §90.205	RF Output Power	Pass
§2.1047;§ 90.242(b)(8)	Modulation Characteristic	Pass
§2.1049 §90.209; §90.210	Occupied Bandwidth	Pass
§2.1051; §90.210	Spurious Emission at Antenna Terminal	Pass
§2.1053;§ §90.210	Spurious Radiated Emissions	Pass
§2.1055; §90.213	Frequency Stability	Pass
§90.214	Transient Frequency Behavior	Pass

For spurious emissions test:

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
PXA Signal Analyzer KEYSIGHT	N9030B	MY55330108	07/07/2020	07/07/2021
Horn Antenna ETS-Lindgren	3117	218554	07/24/2020	07/24/2021
Horn Antenna A.H. SYSTEMS, INC	SAS-571	411	07/20/2018	07/20/2021
Biconilog Antenna Sunol	JB1	A030702	03/04/2021	03/04/2022
Pre-Amplifier RF-Lambda	RAMP00M50GA	17032300048	06/18/2020	06/18/2021
Tuned Dipole Antenna 30 - 1000 MHz (4pcs set)	AD-100	40133	01/20/2021	01/20/2022

For other test items:

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Spectrum Analyzer	N9020A (MXA)	MY5124010	07/21/2020	07/22/2022
Test Equity Environment Chamber	1007H	61201	12/16/2020	12/16/2022
MXG-B RF Vector Signal Generator	N5182B	MY56200550	11/01/2019	11/01/2022
Modulation Analyzer HP	8901B	3226A04414	10/05/2019	10/05/2022
Waveform Generator Tabor Electronic	WW1072	207593	7/17/2020	7/17/2022
ETS- Lindgren USB RF power sensor	7002-006	00159860	12/08/2022	18/08/2025
Oscilloscope Rohde & Schwarz	FSIQ26	831927/008	11/12/2020	11/12/2022
Radiated Emission Software Toyo Corporation	EP7/RE	V.8.0.130	-	-
30dB Attenuarator MCL-VAT	30W2	0851	%	%

% Verify before use

3 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.85 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	4.63 dB
Radiated Emissions above 1 GHz	Above 1GHz	4.58 dB

4 Modification Record

There were no modifications required for compliance.

5 General Information

5.1 General Description of EUT

Product	Two Way Radio	
Model No.	IP740D	
Power Supply Rating (Maximun)	7.5Vdc/ 1.8A	
Power Supply Rating (Receive)	Receive stand-by 300mA Receive max audio 520 mA (INT SP)	
Modulation Type	BT-BDR/EDR: GFSK, π/4-DQPSK, 8DPSK, BT LE: GFSK UMTS: QPSK, 16QAM LTE: QPSK/16QAM Land Mobile: Analog, 4FSK	
Operating Frequency	BT-BDR/EDR/LE : 2402MHz ~ 2480MHz Cellular : UMTS : BAND 2 1850 MHz-1910 MHz BAND 5 824 MHz-849 MHz LTE : BAND 2 1850 MHz- 1910 MHz BAND 4 1710 MHz- 1755 MHz BAND 12 699 MHz- 712 MHz Land Mobile : 400 MHz- 520 MHz	
Antenna Info	BT/ LE: PCB Antenna, -1.5dBi	
	Cellular (WCDMA/ LTE): Chip Antenna WCDMA Band 2/ 4: 2.6dBi, Band 5: 1 dBi LTE Band 12: 1.3 dBi	
	Land Mobile: Monopole Antenna	
	FA-SC01U 350–400 MHz 1/4 herical whip antenna -4.0 dBi FA-SC02U 330–380 MHz 1/4 herical whip antenna -4.0 dBi UHF Antenna (For FCC and Canada model) FA-SC03U 380–430 MHz 1/4 herical whip antenna -4.9 dBi FA-SC25U 400–430 MHz 1/4 herical whip antenna -2.6 dBi FA-SC57U 430–470 MHz 1/4 herical whip antenna -3.0 dBi FA-SC72U 470–520 MHz 1/4 herical whip antenna - 1.9 dBi UHF Stubby Antenna FA-SC26US 400–450 MHz 1/4 herical whip antenna -7.0dBi FA-SC73US 450–490 MHz 1/4 herical whip antenna -10.4 dBi UHF Cut Antenna FA-SC61UC 380–520 MHz 1/4 herical whip antenna	
Temperature Operating Range	-20 °C ~ 55 °C	
I/O Ports	Refer to user's manual	
Optional Accessories	**Description**	**Part Number**
Battery A	Li-Ion, 3350 mAh	BP-303
Battery B	Li-Ion, 2010 mAh	BP-302

Battery C	5 AA Battery Case	BP-305
Antenna A	350-400 MHz	FA-SC01U
Antenna B	330-380 MHz	FA-SC02U
Antenna C	380-430 MHz	FA-SC03U
Antenna D	400-430 MHz	FA-SC25U
Antenna E	400-450 MHz	FA-SC26US
Antenna F	430-470 MHz	FA-SC57U
Antenna G	380-520 MHz	FA-SC61UC
Antenna H	470-520 MHz	FA-SC72U
Antenna I	450-490 MHz	FA-SC73US
Audio Accessory A	Tie Clip Microphone	HM-163MC
Audio Accessory B	Speaker Microphone	HM-184
Audio Accessory C	Speaker Microphone	HM-222H
Audio Accessory D	Speaker Microphone	HM-236
Audio Accessory E	Tie Clip Microphone with Sub PTT Button	HM-238MC
Audio Accessory F	Speaker Microphone	HM-222
Audio Accessory G	Earphone Adapter	AD-135
Audio Accessory H	Earphone	SP-16BW
Audio Accessory I	Tube Earphone	SP-26
Audio Accessory J	Tube Earphone	SP-27
Audio Accessory K	Earhook Earphone	SP-28
Audio Accessory L	Earhook Earphone	SP-29
Audio Accessory M	Earphone	SP-40
Audio Accessory N	Earhook Type Headset	HS-94
Audio Accessory O	Neck Arm Type Headset	HS-95
Audio Accessory P	Headset with Throat Microphone	HS-97
Audio Accessory Q	Bluetooth Headset	VS-3
Audio Accessory R	PTT Switch Cable	VS-5MC
Audio Accessory S	PTT Switch Cable	VS-4MC
Audio Accessory T	External Speaker Microphone	HM-184H
Audio Accessory U	Earphone Adapter	AD-135
Audio Accessory V	External Speaker Microphone	HM-245T
Body Worn Accessory A	Belt Clip	MB-133
Body Worn Accessory B	Belt Clip	MB-136
Body Worn Accessory C	Belt Hanger	MB-96F
Body Worn Accessory D	Belt Hanger	MB-96FL
Body Worn Accessory E	Belt Hanger	MB-96N
Body Worn Accessory F	Shoulder Strap	MB-57L
Body Worn Accessory G	Carrying Case	LC-195
Emission Designation*:	Analog :11K0F3E/ Digital : 4K00F1D, 4K00F1E	

Note* :
1

For FM Mode (Channel Spacing: 12.5 kHz)
Emission Designator 11K0F3E
In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation. BW = 2(M+D) = 2*(3.0 kHz + 2.5 kHz) = 11 kHz = 11K0
F3E portion of the designator represents an FM voice transmission
Therefore, the entire designator for 12.5 kHz channel spacing FM mode is 11K0F3E.

Bandwidth: 11.0 kHz
Modulation Type: [F] Angle-modulated, straight FM

Modulation Nature: [3] Single analog channel
Information Type: [E] Telephony, voice, sound broadcastin

2.

For Digital mode (6.25KHz Channelization, Digital Voice/ Data)
Emission DESIGNATOR: 4K00F1D, 4K00F1E.

4K00F1D--
Bandwidth: 4.00 kHz
Modulation Type: [F] Angle-modulated, straight FM
Modulation Nature: [1] Digital, on-off or quantized, no modulation
Information Type: [D] Data, telemetry, telecommand
Emissions Designator Notes: 4K00F1D 6.25 kHz data NXDN (Narrow IDAS, NEXEDGE)
Radio Reference Identified Designator: 4K00F1D NXDN 6.25 kHz data (IDAS, NEXEDGE)

4K00F1E--
Bandwidth: 4.00 kHz
Modulation Type: [F] Angle-modulated, straight FM
Modulation Nature: [1] Digital, on-off or quantized, no modulation
Information Type: [E] Telephony, voice, sound broadcasting
Emissions Designator Notes: 4K00F1E 6.25 kHz voice NXDN (Narrow IDAS, NEXEDGE)
Radio Reference Identified Designator: 4K00F1E NXDN 6.25 kHz digital voice (IDAS, NEXEDGE)

Note:

1. The above EUT information was declared by manufacturer and for more detailed features and description, please refers to the manufacturer's specifications or User's Manual.

5.2 Power Setting

Freq. (MHz)	Power Setting	
400.025	High Power	Default
	Low Power	Default
460.025	High Power	Default
	Low Power	Default
519.975	High Power	Default
	Low Power	Default

5.3 General Description of Applied Standards

The EUT is a Land Mobile Service product, according to the specifications of the manufacturers; it must comply with the requirements of the following standards:

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 90 – Private Land Mobile Radio Service and sub part I

Applicable Standards: ANSI C63.26- 2015/ TIA 603-E

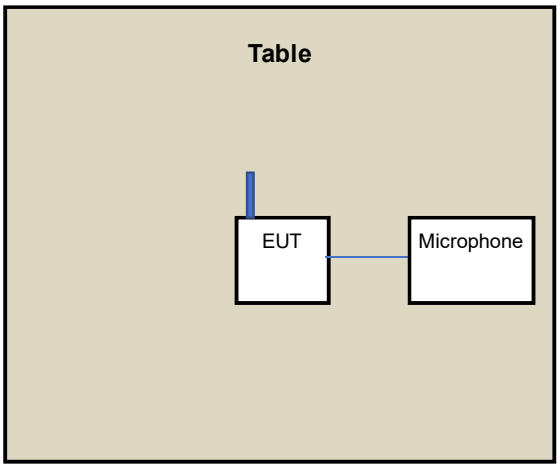
All test items were performed and recorded as per the above standards.

5.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID	Remark
-	DC Power Supply	RIGOL	DP712	DP7B182100068	DOC	-

5.5 Configuration of System under Test



5.6 FCC §1.1310 & §2.1093 - RF EXPOSURE

Applicable Standard

FCC§1.1310 and §2.1093.

Test Result

Compliance, please refer to the SAR report

5.7 RF OUTPUT POWER

OPERATING FREQUENCY RANGE	400.025-519.975 MHz

Applicable Standard

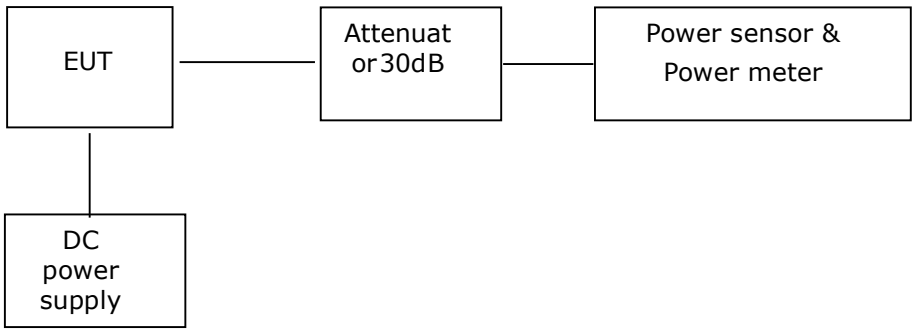
FCC §2.1046, and §90.205

Test Procedure

Conducted RF Output Power:

The RF output of the transmitter was connected to the input of the power meter through sufficient attenuation.

Configuration of System under Test



Test Data

Environmental Conditions

Date:	10/11/2020
Temperature:	24.5℃
Relative Humidity:	67 %
ATM Pressure:	100.4 kPa

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

Modulation Mode	Channel Separation	f_c MHz	Reading (W) High Power Level	INPUT Current(A)	Note
Digital	6.25kHz	400.025	4.47	2.06	FCC part 90
		460.025	3.79	1.91	
		519.975	4.60	2.36	
Analog	12.5kHz	400.025	4.59	2.06	
		460.025	3.83	1.9	
		519.975	4.64	2.38	

Voltage and Current through the final amplifier
High Power

Modulation Mode	Channel Separation	f_c MHz	Voltage(V)	Current(A)
Digital	6.25kHz	400.025	7.5	1.87
		460.025	7.5	1.69
		519.975	7.5	2.15
Analog	12.5kHz	400.025	7.5	1.85
		460.025	7.5	1.69
		519.975	7.5	2.17

Modulation Mode	Channel Separation	f_c	Reading (W)	INPUT Current(A)	Note
		MHz	Low Power Level		
Digital	6.25kHz	400.025	1.34	1.11	FCC part 90
		460.025	1.15	0.99	
		519.975	1.34	1.09	
Analog	12.5kHz	400.025	1.34	1.11	
		460.025	1.15	0.99	
		519.975	1.39	1.11	

Voltage and Current through the final amplifier
Low Power

Modulation Mode	Channel Separation	f_c	Voltage(V)	Current(A)
		MHz		
Digital	6.25kHz	400.025	7.5	0.92
		460.025	7.5	0.77
		519.975	7.5	0.88
Analog	12.5kHz	400.025	7.5	0.90
		460.025	7.5	0.78
		519.975	7.5	0.90

Note:
The high rated power level is 5W, and low rated power level is 1W. (Limit: <6W for high power level, < 1.2W for low power level)

5.8 MODULATION CHARACTERISTIC

Applicable Standard

§ 2.1047(a) & 90.242(b)(8)

Limit

§ **2.1047(a):** Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

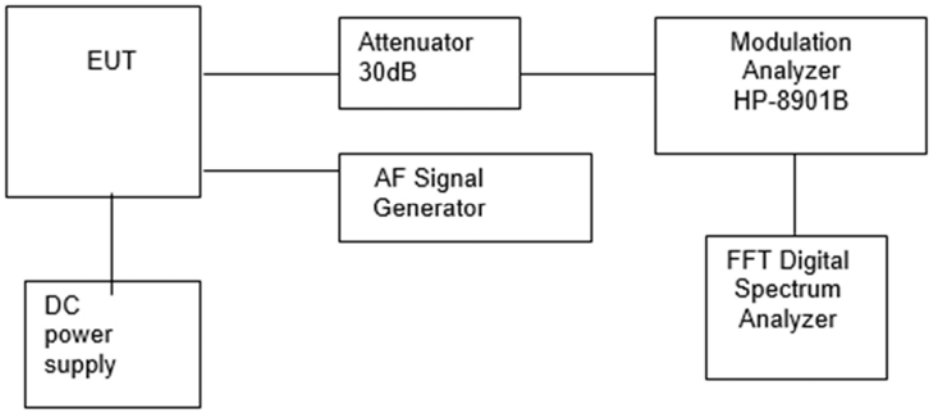
§ 90.242(b)(8): Recommended audio filter attenuation characteristics are given below:

Audio band	Minimum Attenuation Rel. to 1 kHz Attenuation
5 –20 KHz	83 $\log_{10}$(f/5) dB where f is in kHz
20 – 30 KHz	50dB

Test Procedure

The rated audio input signal was applied to the input of the audio low-pass filter (or of all modulation stages) using an audio oscillator, this input signal level and its corresponding output signal were then measured and recorded using the FFT Digital Spectrum Analyzer. Tests were repeated at different audio signal frequencies from 0 to 50 KHz.

Configuration of System under Test



Test Data

Environmental Conditions

Date :	10/12/2020
Temperature:	24.3 ℃
Relative Humidity:	68 %
ATM Pressure:	100.4 kPa

Mode: Transmitting

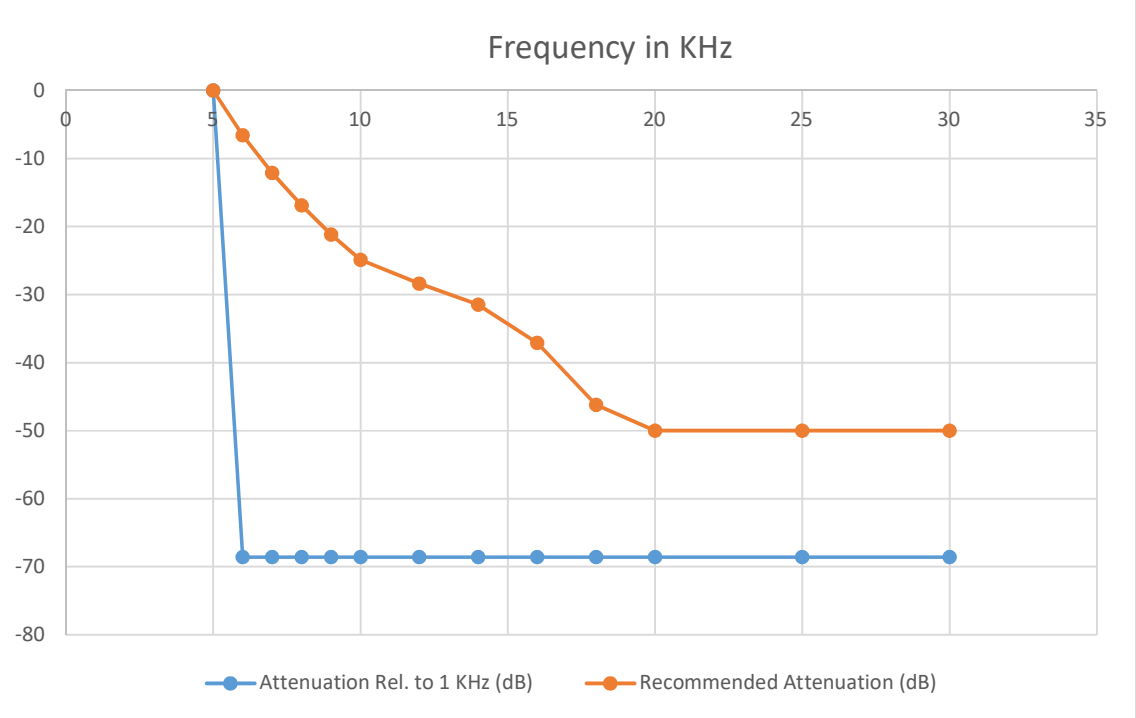
Result: Compliance.

Audio Frequency Response – 6.25kHz

Carrier Frequency: 460.025MHz

Remark: Due to the difficulty of measuring the Frequency Response of the internal low-pass filter, the Frequency Response of All Modulation States is performed to show the roll-off at 5 kHz in comparison with the recommended audio filter attenuation.

Frequency (KHz)	Audio In (dBV)	Audio Out (dBV)	Attenuation (Out - In) (dB)	Attenuation Rel. to 1 KHz(dB)	Recommended Attenuation (dB)
5	-37.72	-70	-32.3	-68.6	0
6	-37.72	-70	-32.3	-68.6	-6.57
7	-37.72	-70	-32.3	-68.6	-12.1
8	-37.72	-70	-32.3	-68.6	-16.9
9	-37.72	-70	-32.3	-68.6	-21.2
10	-37.72	-70	-32.3	-68.6	-24.9
12	-37.72	-70	-32.3	-68.6	-28.4
14	-37.72	-70	-32.3	-68.6	-31.5
16	-37.72	-70	-32.3	-68.6	-37.1
18	-37.72	-70	-32.3	-68.6	-46.2
20	-37.72	-70	-32.3	-68.6	-50.0
25	-37.72	-70	-32.3	-68.6	-50.0
30	-37.72	-70	-32.3	-68.6	-50.0

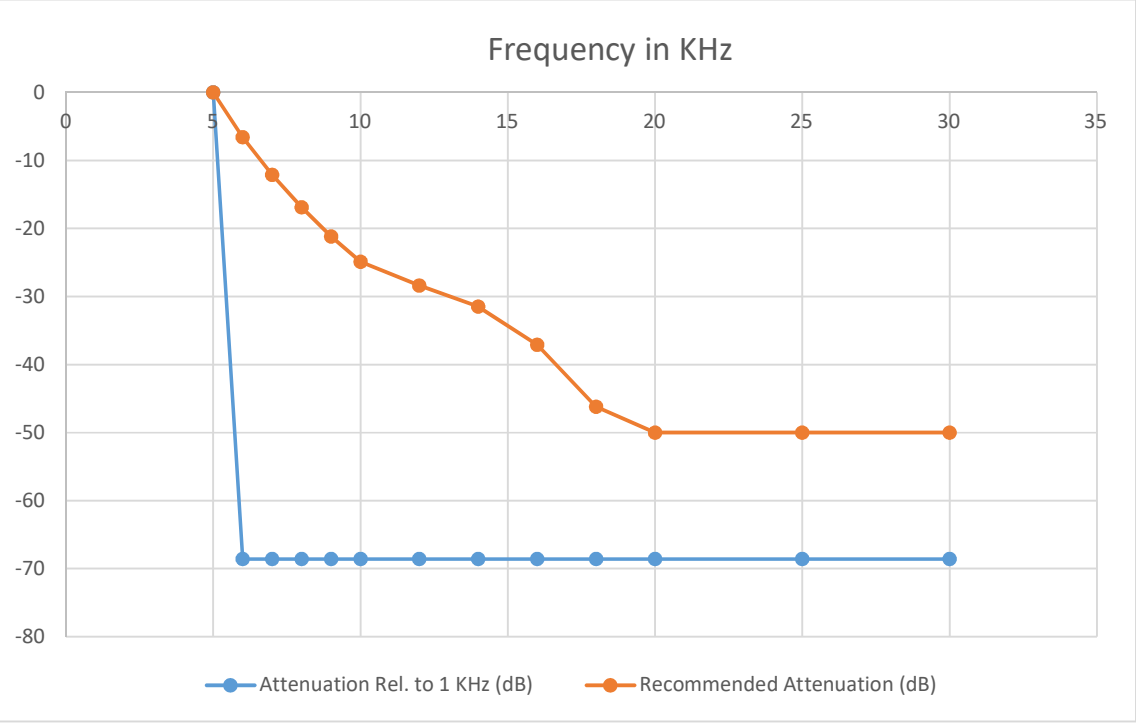


Audio Frequency Response – 12.5kHz

Carrier Frequency: 460.025 MHz

Remark: Due to the difficulty of measuring the Frequency Response of the internal low-pass filter, the Frequency Response of All Modulation States is performed to show the roll-off at 5 kHz in comparison with the recommended audio filter attenuation.

Frequency (KHz)	Audio In (dBV)	Audio Out (dBV)	Attenuation (Out - In) (dB)	Attenuation Rel. to 1 KHz(dB)	Recommended Attenuation (dB)
5	-37.72	-70	-32.28	-68.6	0
6	-37.72	-70	-32.28	-68.6	-6.57
7	-37.72	-70	-32.28	-68.6	-12.1
8	-37.72	-70	-32.28	-68.6	-16.9
9	-37.72	-70	-32.28	-68.6	-21.2
10	-37.72	-70	-32.28	-68.6	-24.9
12	-37.72	-70	-32.28	-68.6	-28.4
14	-37.72	-70	-32.28	-68.6	-31.5
16	-37.72	-70	-32.28	-68.6	-37.1
18	-37.72	-70	-32.28	-68.6	-46.2
20	-37.72	-70	-32.28	-68.6	-50.0
25	-37.72	-70	-32.28	-68.6	-50.0
30	-37.72	-70	-32.28	-68.6	-50.0



5.9 OCCUPIED BANDWIDTH & EMISSION MASK

Applicable Standard

FCC §2.1049, §90.209 and §90.210

Limit

Emissions shall be attenuated below the mean output power of the transmitter as follows:

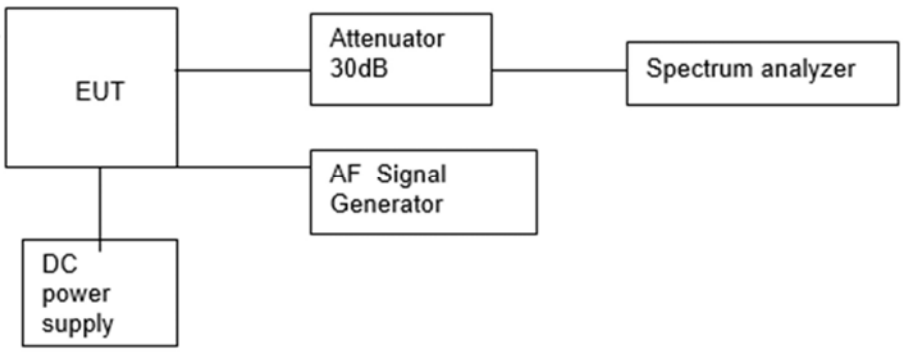
Frequency Range (MHz)	Channel Spacing (KHz)	FCC Applicable ask
400-520	12.5	Mask D – Voice & Data
400-520	6.25	Mask E – Voice & Data

Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

Configuration of System under Test



Test Data

Environmental Conditions

Date:	05/15/2021, 05/17/2021 05/18/2021
Temperature:	24.2℃ ; 24. 5℃ ; 24. 4℃
Relative Humidity:	68 % 67% 65%
ATM Pressure:	100.5 kPa 100.4 kPa 100.3kPa

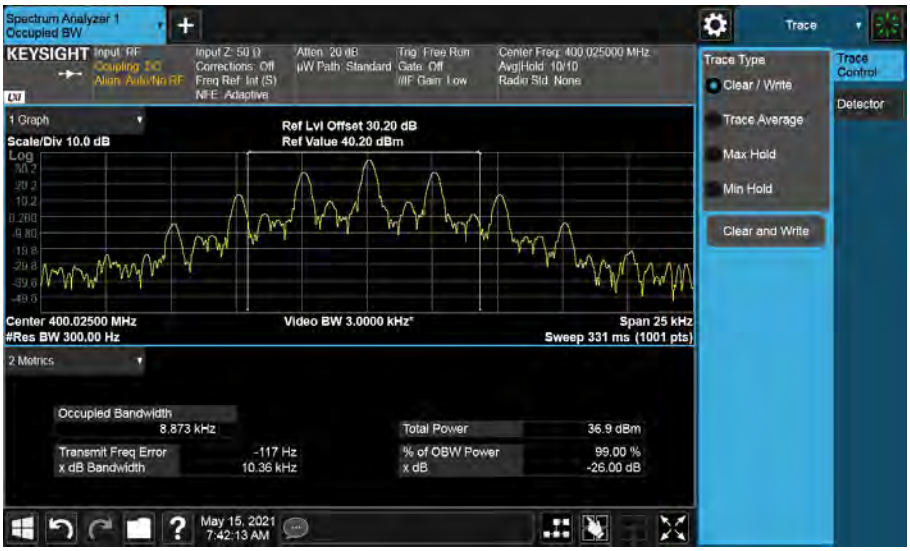
Mode: Transmitting

Result: Compliance.

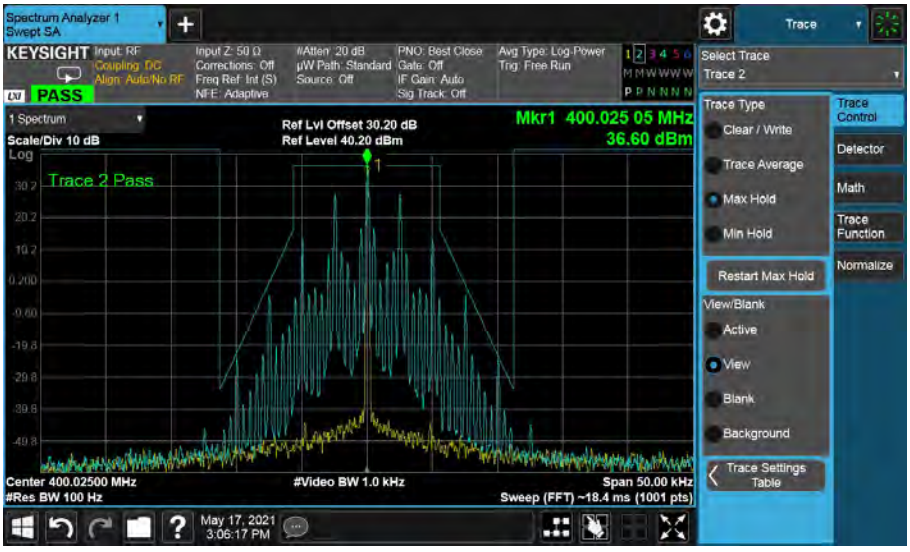
	Modulation Mode	Channel Separation	f_c	99% Occupied Bandwidth	26 dB Bandwidth	Note
			MHz	kHz	kHz	
High Power	Digital 4K00F1D/ 4K00F1E	6.25kHz	400.025	3.49	4.73	FCC part 90 FCC part 22 FCC part 74
			460.025	3.41	4.61	
			519.975	3.37	4.56	
	FM with 2.5 KHz sine wave signal	12.5KHz	400.025	8.87	10.36	
			460.025	8.59	10.36	
			519.975	7.11	10.36	

	Modulation Mode	Channel Separation	f_c	99% Occupied Bandwidth	26 dB Bandwidth	Note
			MHz	kHz	kHz	
Low Power	Digital 4K00F1D/ 4K00F1E	6.25kHz	400.025	3.28	4.64	FCC part 90 FCC part 22 FCC part 74
			460.025	3.32	4.49	
			519.975	3.36	4.43	
	FM with 2.5 KHz sine wave signal	12.5KHz	400.025	6.07	10.49	
			460.025	6.05	10.62	
			519.975	6.06	10.55	

12.5kHz (FM with 2.5 KHz sine wave signal), Frequency 400.025 MHz: 99% Occupied & 26 dB Bandwidth, High power

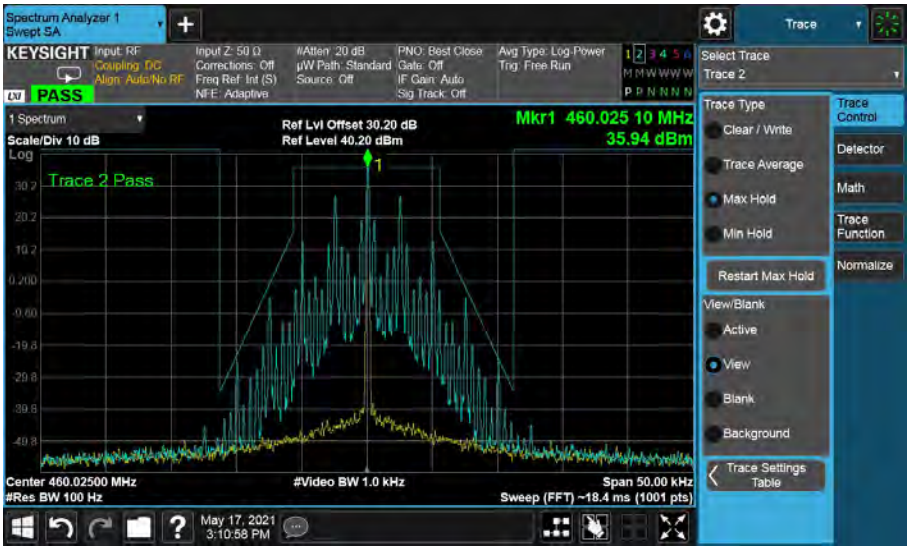


Emission Mask D



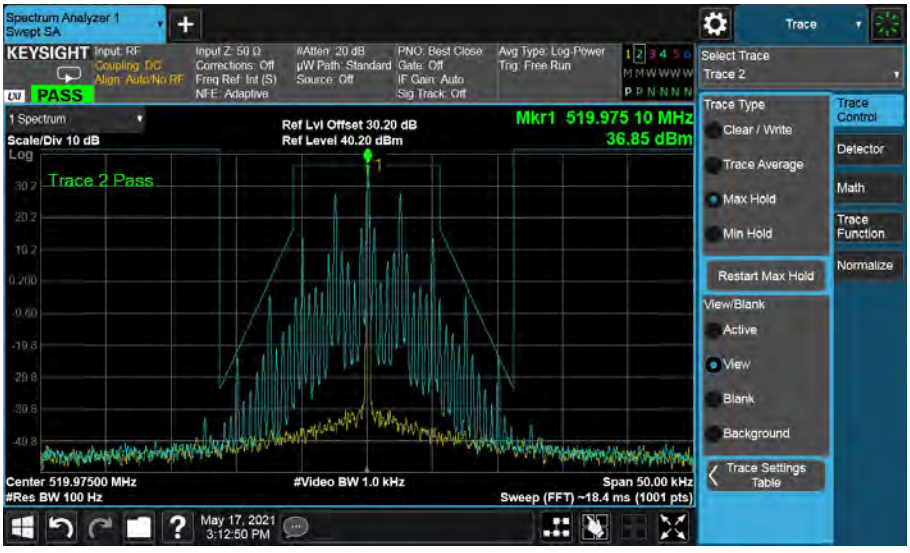
12.5kHz (FM with 2.5 KHz sine wave signal), Frequency 460.025 MHz: 99% Occupied & 26 dB Bandwidth, High power

Emission Mask D



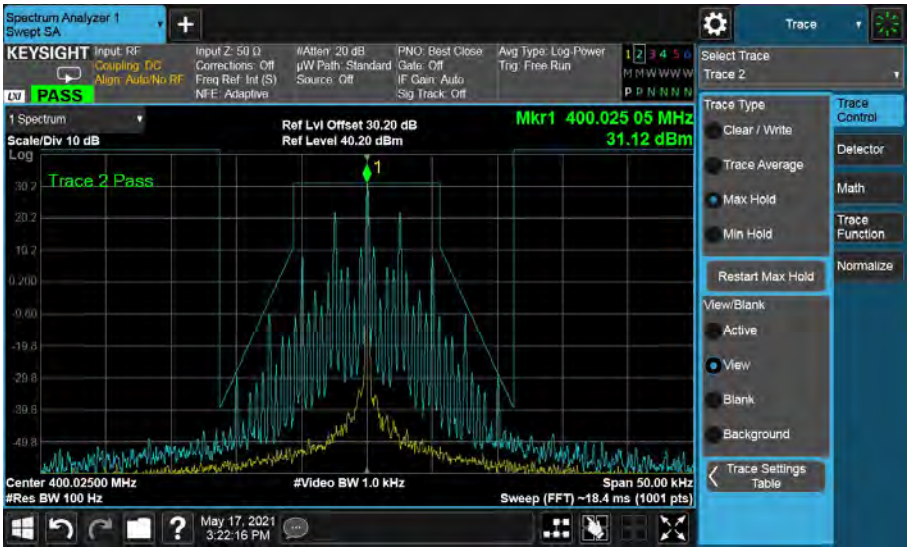
12.5kHz (FM with 2.5 KHz sine wave signal), Frequency 519.975 MHz: 99% Occupied & 26 dB Bandwidth, High power

Emission Mask D



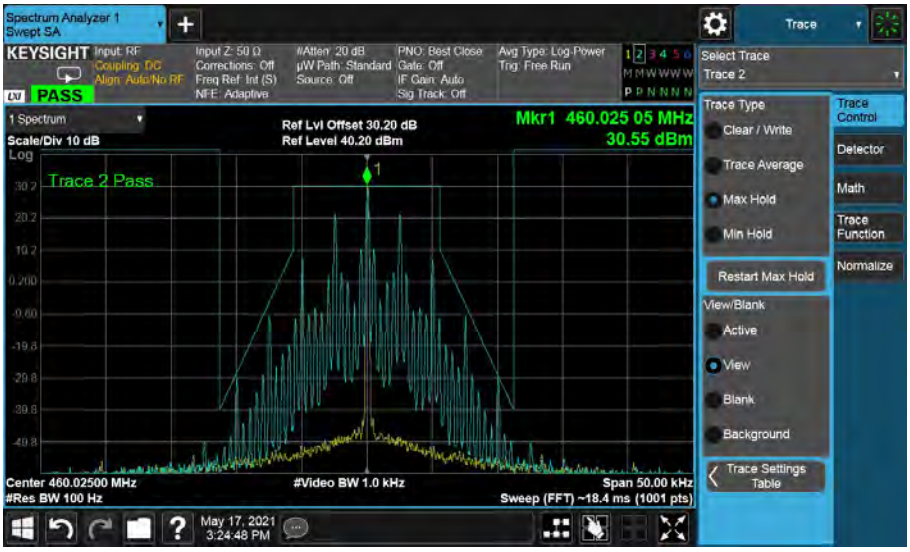
12.5kHz (FM with 2.5 KHz sine wave signal), Frequency 400.025 MHz: 99% Occupied & 26 dB Bandwidth, Low power

Emission Mask D

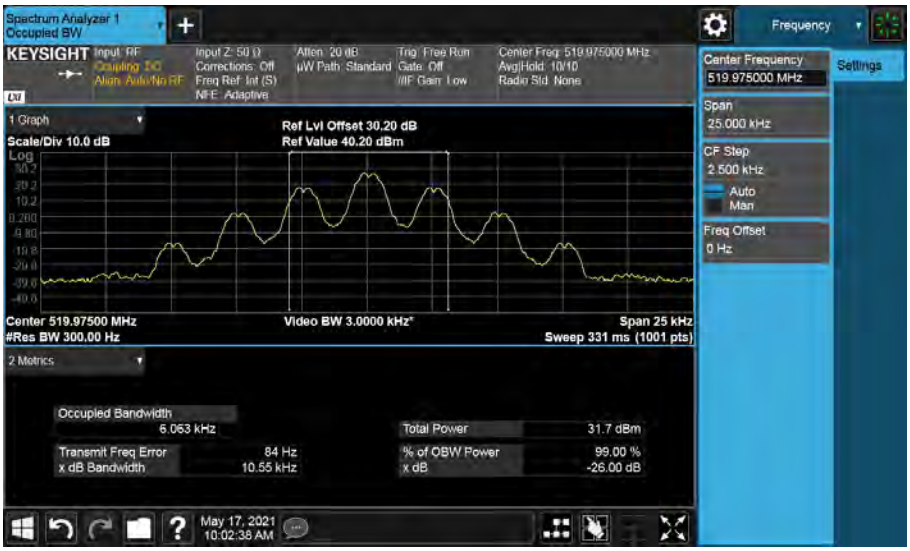


12.5kHz (FM with 2.5 KHz sine wave signal), Frequency 460.025 MHz: 99% Occupied & 26 dB Bandwidth, Low power

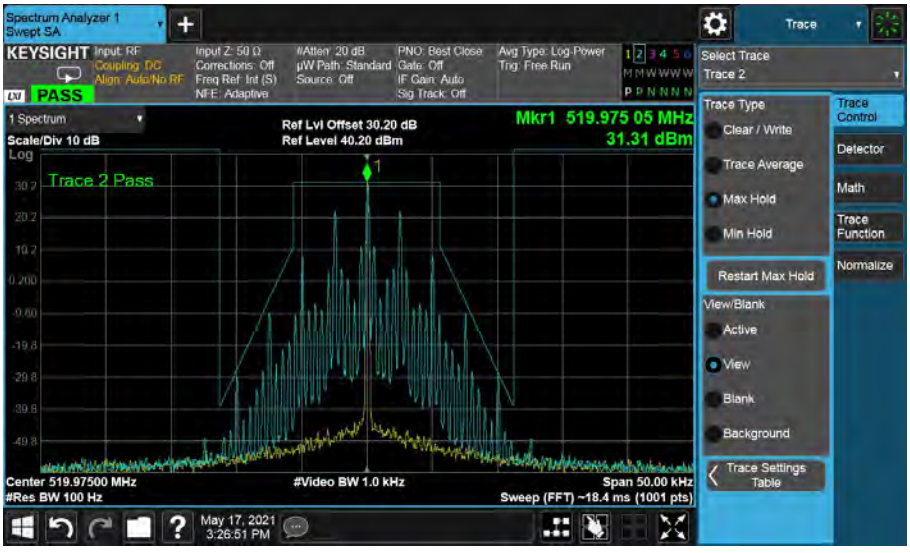
Emission Mask D



12.5kHz (FM with 2.5 KHz sine wave signal), Frequency 519.975 MHz: 99% Occupied & 26 dB Bandwidth, Low power

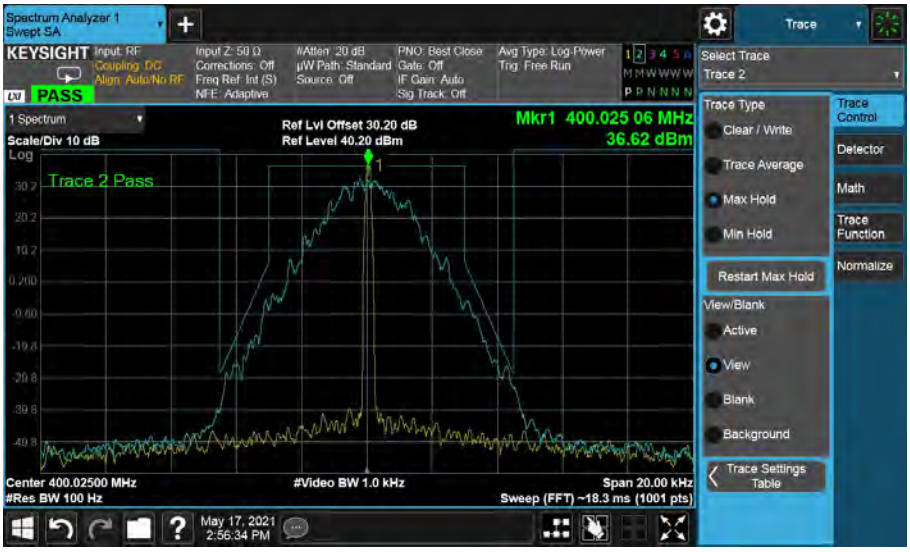


Emission Mask D



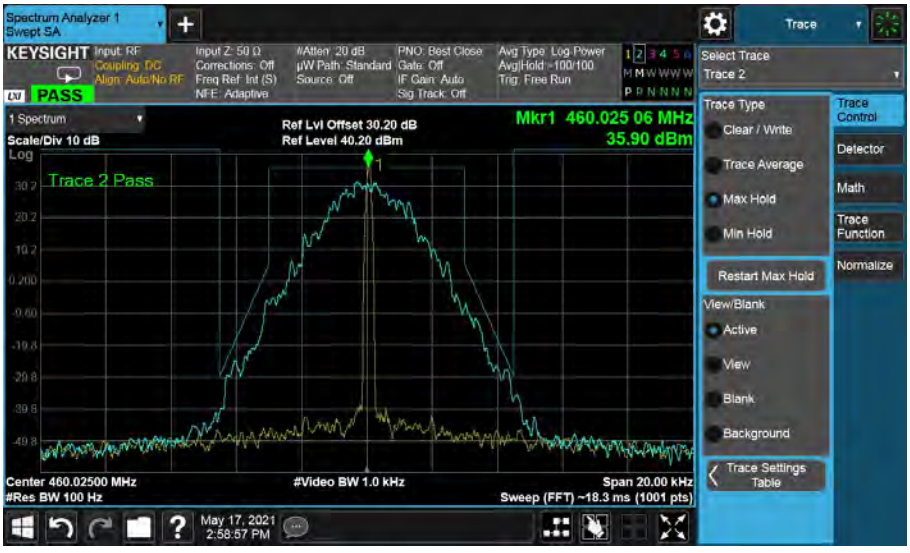
6.25kHz Digital (F1D, F1E)), Frequency 400.025 MHz:
99% Occupied & 26 dB Bandwidth, High power

Emission Mask E



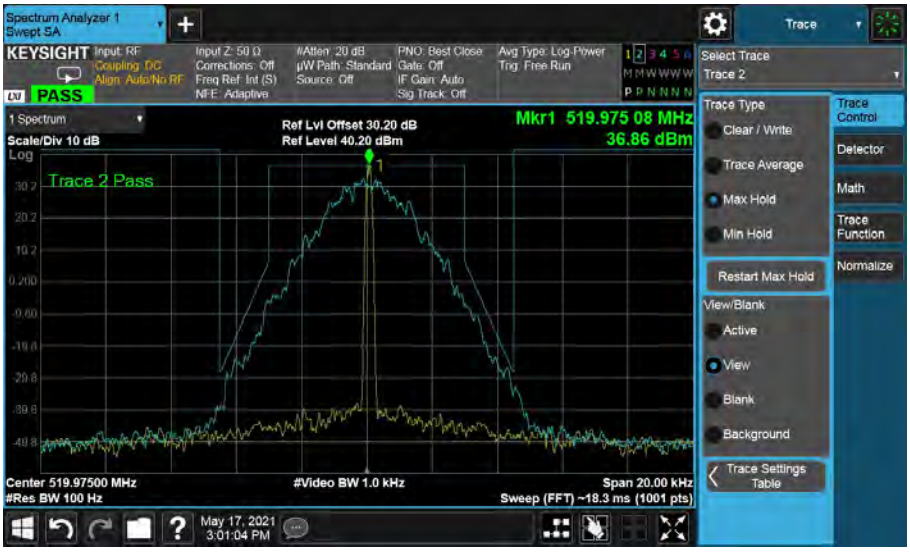
6.25kHz Digital (F1D, F1E), Frequency 460.025 MHz:
99% Occupied & 26 dB Bandwidth, High power

Emission Mask E



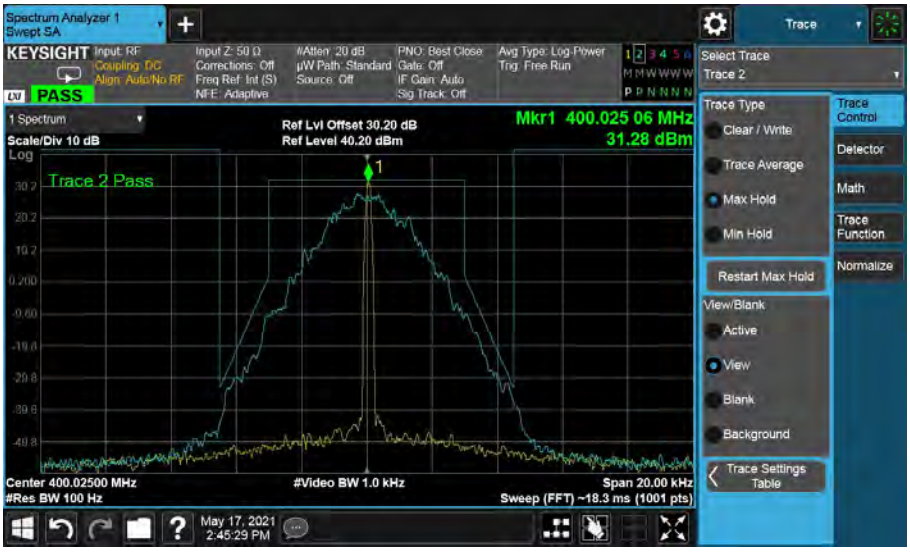
6.25kHz Digital (F1D, F1E), Frequency 519.975 MHz:
99% Occupied & 26 dB Bandwidth, High power

Emission Mask E



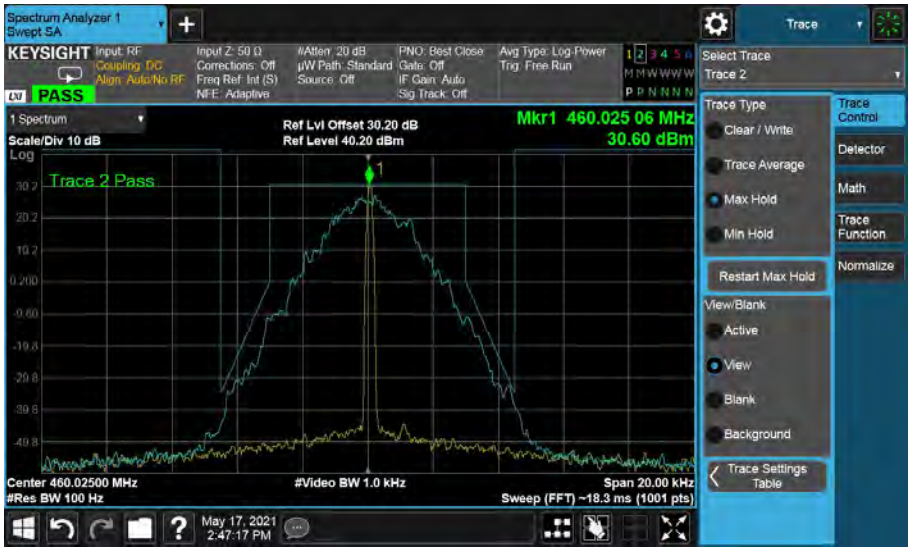
6.25kHz Digital (F1D, F1E), Frequency 400.025 MHz:
99% Occupied & 26 dB Bandwidth, Low power

Emission Mask E



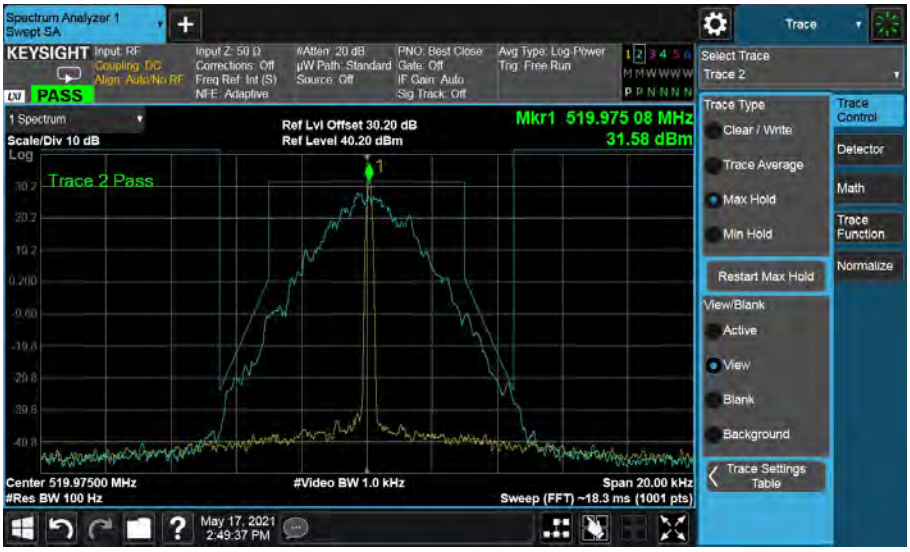
6.25kHz Digital (F1D, F1E), Frequency 460.025 MHz:
99% Occupied & 26 dB Bandwidth, Low power

Emission Mask E



6.25kHz Digital (F1D, F1E), Frequency 519.975 MHz:
99% Occupied & 26 dB Bandwidth, Low power

Emission Mask E



5.10 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

FCC §2.1051 and §90.210

Limit

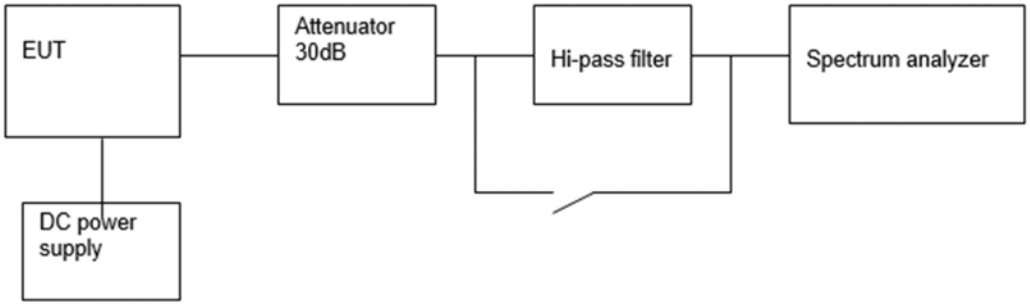
Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Attenuation Limit (dBc)
§ 90.210(d)	At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.
§ 90.210(e)	At least 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100kHz for below 1GHz, and 1MHz for above 1GHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

Configuration of System under Test



Test Data

Environmental Conditions

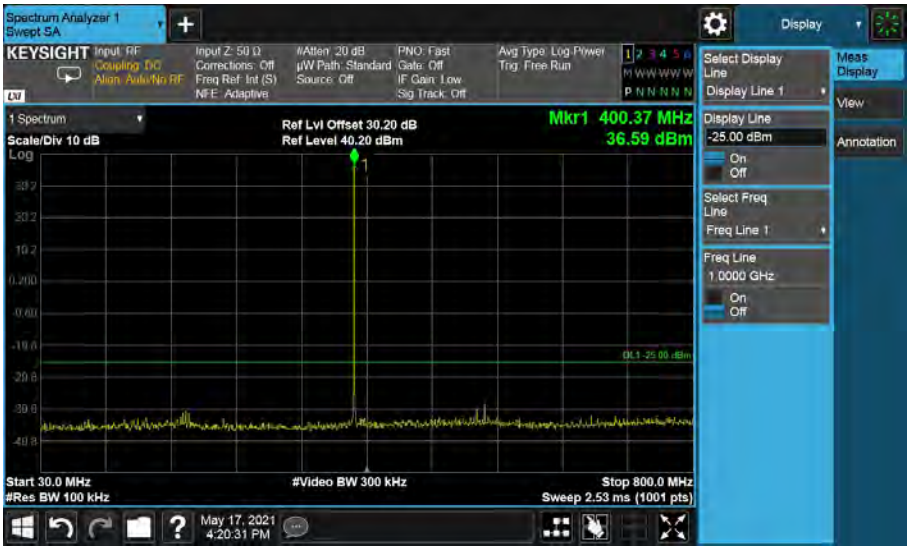
Date:	05/17/2021
Temperature:	24.5℃
Relative Humidity:	67 %
ATM Pressure:	100.4 kPa

Note: There was no difference in spurious/harmonic emissions on the pre-scans for different channel spacing and modulation types. Therefore, the rf spurious/harmonic emissions in this section would be performed for Digital modulation with 6.25 kHz channel spacing and the more stringent limit of 55 + 10*log(P), High power would be applied for worst case.

Test Mode: Transmitting

Result: Compliance.

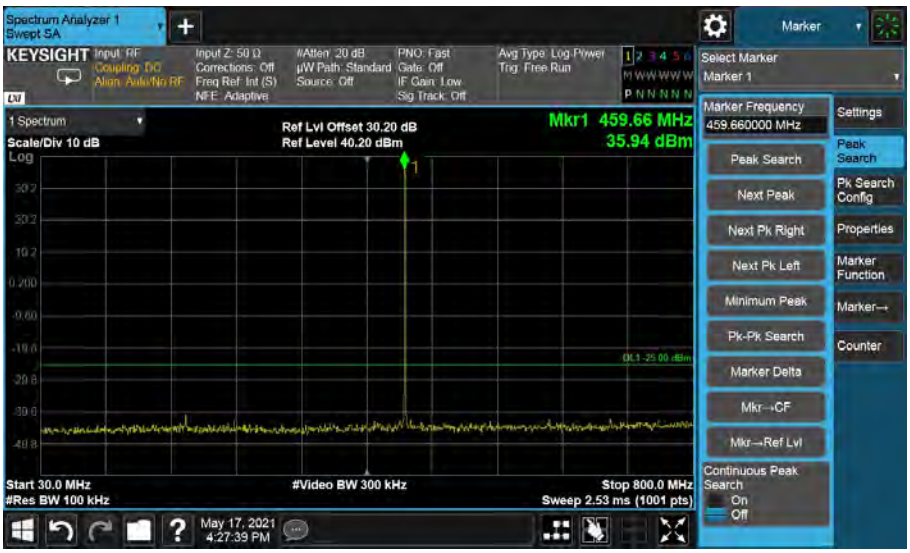
6.25kHz Digital (F1D, F1E), Frequency 400.025 MHz, High power 30MHz-800MHz



6.25kHz Digital (F1D, F1E), Frequency 400.025 MHz, High power 800MHz-1000MHz

6.25kHz Digital (F1D, F1E), Frequency 400.025 MHz, High power
1Ghz - 6GHz

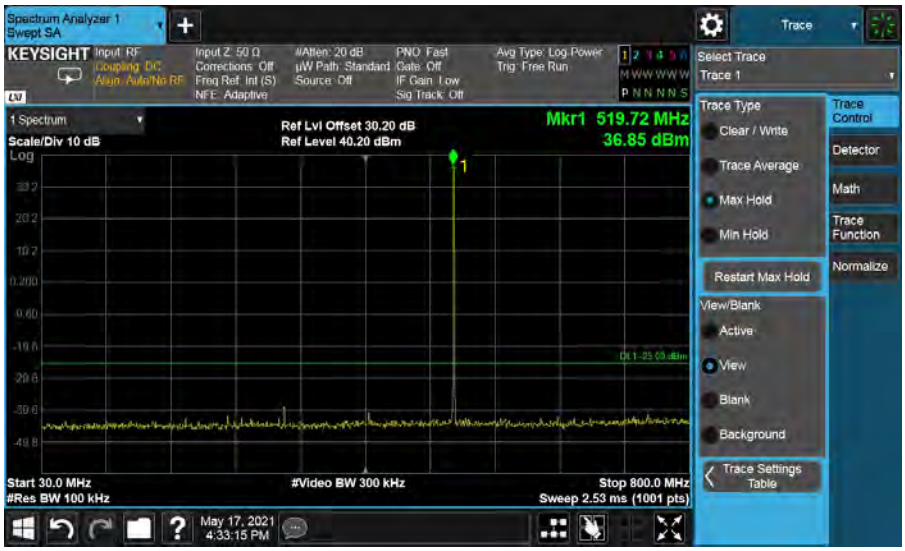
6.25kHz Digital (F1D, F1E), Frequency 460.025 MHz, High power 30MHz-800MHz



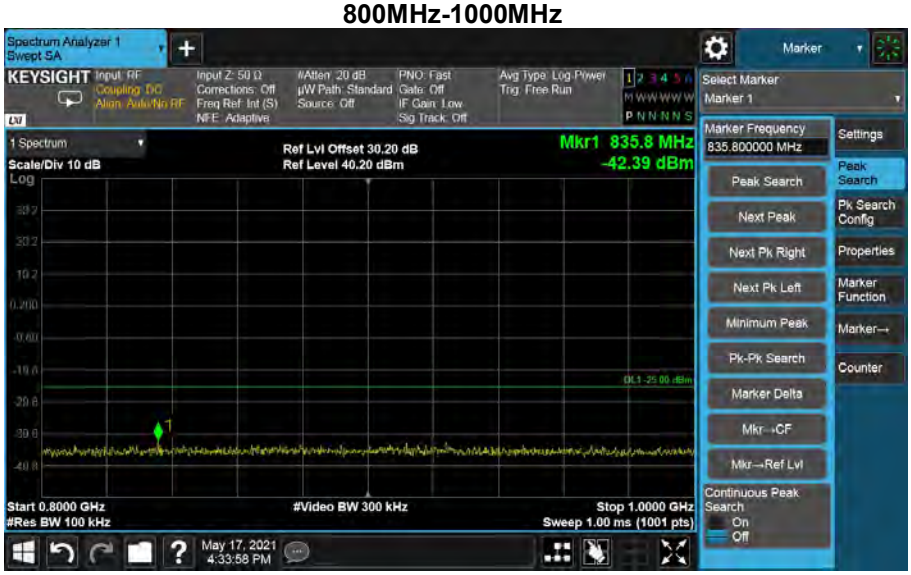
6.25kHz Digital (F1D, F1E), Frequency 460.025 MHz, High power 800MHz-1000MHz

6.25kHz Digital (F1D, F1E), Frequency 460.025 MHz, High power
1GHz - 6GHz

6.25kHz Digital (F1D, F1E), Frequency 519.975 MHz, High power 30MHz-800MHz



6.25kHz Digital (F1D, F1E), Frequency 519.975 MHz, High power 800MHz-1000MHz



6.25kHz Digital (F1D, F1E), Frequency 519.975 MHz, High power

1GHz - 6GHz

5.11 FCC §2.1053; & §90.210 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053, §90.210

Limit

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Attenuation Limit (dBc)
§ 90.210(d)	At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.
§ 90.210(e)	At least 55 + 10 log (P) or 65 dB, whichever is the lesser attenuation.

Test Procedure

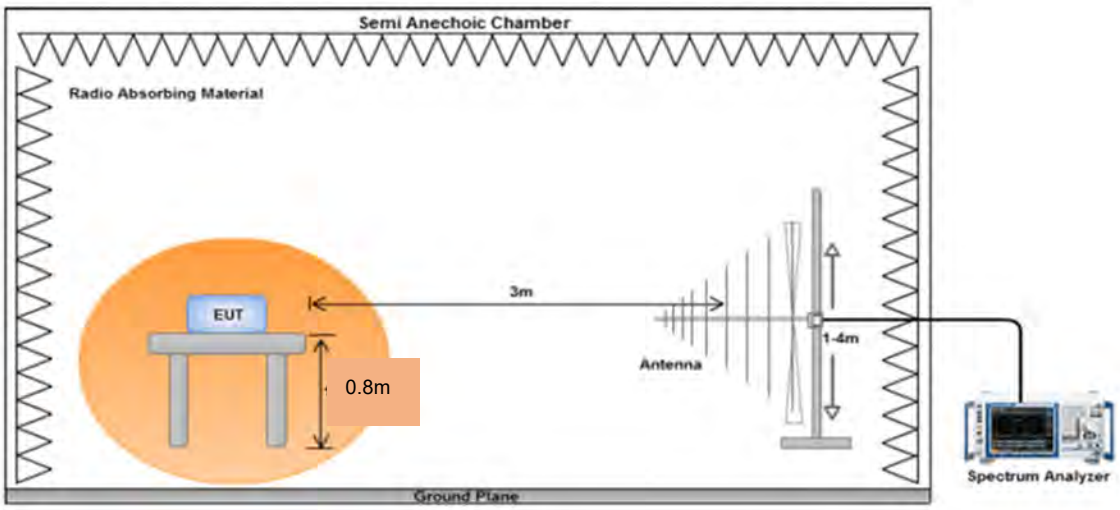
The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT .The test was performed by placing the EUT on 3-orthogonal axis.

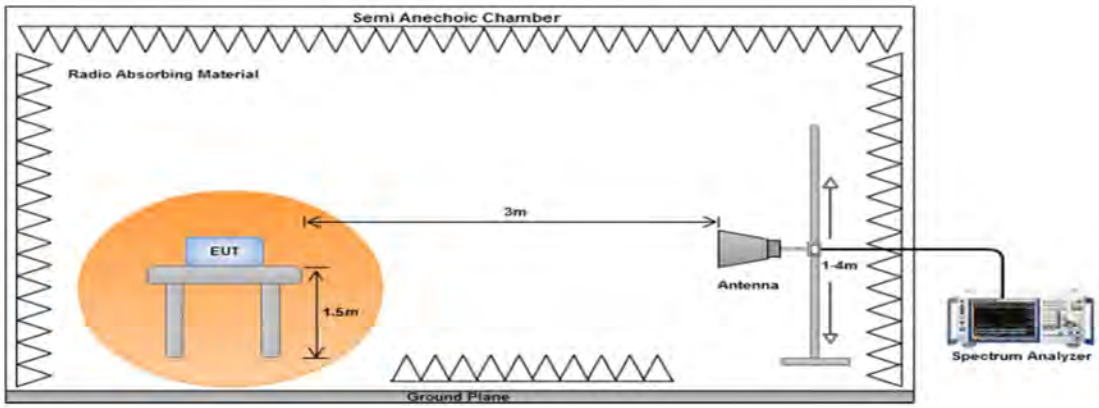
The frequency range up to teeth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Test Setup



Test Setup below 1GHz



Test Setup above 1GHz

Test Data

Remarks:

•The RF spurious/harmonic emission characteristics for different channel spacing are indistinguishable.

•There was no difference in spurious/harmonic emissions on the pre-scans for different channel spacing and modulation types. Therefore, the rf spurious/harmonic emissions in this section would be performed for Digital modulation with 6.25 kHz channel spacing and the more stringent limit of 55 + 10*log(P), for worst case.

Environmental Conditions

Date:	05/17/2021
Temperature:	24.5℃
Relative Humidity:	67 %
ATM Pressure:	100.4 kPa

Mode: Transmitting

Result: Compliance.

Below 1GHz Worst-case Data

OPERATING STATE	Transmitting 400.025MHz	SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz

Indicated			Test Antenna		Substituted						
Frequency (MHz)	Raw (dBm)	Degree	Hgt (cm)	Pol (V/H)	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
800.05	-72.18	148	139	V	800.05	-67.36	0	0.74	-68.10	-25	-43.10
800.05	-75.25	246	141	H	800.05	-68.42	0	0.74	-69.16	-25	-44.16

OPERATING STATE	Transmitting 460.025MHz	SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz

Indicated			Test Antenna		Substituted						
Frequency (MHz)	Raw (dBm)	Degree	Hgt (cm)	Pol (V/H)	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
920.05	-70.24	126	143	V	920.05	-65.39	0	0.72	-66.11	-25	-41.11
920.05	-73.19	127	145	H	920.05	-67.53	0	0.72	-68.25	-25	-43.25

Above 1GHz

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	400.025 MHz

Indicated			Test Antenna		Substituted						
Frequency (MHz)	Raw (dBm)	Degree	Hgt (cm)	Pol (V/H)	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
1200.075	-48.48	266	200	V	1200.075	-77.17	8.36	1.14	-69.95	-25	-44.95
1200.075	-47.27	271	189	H	1200.075	-78.45	8.36	1.14	-71.23	-25	-46.23
1600.1	-50.45	217	126	V	1600.1	-77.23	9.42	1.32	-69.13	-25	-44.13
1600.1	-50.89	265	255	H	1600.1	-78.18	9.42	1.32	-70.08	-25	-45.08
2000.125	-50.32	247	159	V	2000.125	-77.49	8.79	1.43	-70.13	-25	-45.13
2000.125	-50.63	216	167	H	2000.125	-78.52	8.79	1.43	-71.16	-25	-46.16

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	460.025 MHz

Indicated			Test Antenna		Substituted						
Frequency (MHz)	Raw (dBm)	Degree	Hgt (cm)	Pol (V/H)	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
1380.075	-48.54	217	200	V	1380.075	-77.36	8.87	1.14	-69.63	-25	-44.63
1380.075	-47.67	239	189	H	1380.075	-78.27	8.87	1.14	-70.54	-25	-45.54
1840.1	-50.38	253	126	V	1840.1	-77.49	9.18	1.32	-69.63	-25	-44.63
1840.1	-50.25	218	255	H	1840.1	-78.56	9.18	1.32	-70.7	-25	-45.7
2300.125	-50.46	245	159	V	2300.125	-77.39	9.27	1.43	-69.55	-25	-44.55
2300.125	-50.53	229	167	H	2300.125	-78.43	9.27	1.43	-70.59	-25	-45.59

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	519.975 MHz

Indicated			Test Antenna		Substituted						
Frequency (MHz)	Raw (dBm)	Degree	Hgt (cm)	Pol (V/H)	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
1039.89	-48.26	217	200	V	1039.89	-77.43	7.5	1.14	-71.07	-25	-46.07
1039.89	-47.14	239	189	H	1039.89	-78.58	7.5	1.14	-72.22	-25	-47.22
1559.805	-50.43	253	126	V	1559.805	-77.29	9.42	1.32	-69.19	-25	-44.19
1559.805	-50.53	218	255	H	1559.805	-78.36	9.42	1.32	-70.26	-25	-45.26
2079.72	-50.29	245	159	V	2079.72	-77.61	9.3	1.43	-69.74	-25	-44.74
2079.72	-50.51	229	167	H	2079.72	-78.17	9.3	1.43	-70.3	-25	-45.3

5.12 FREQUENCY STABILITY

Applicable Standard

FCC §2.1055, §90.213

Limit

§ 90.213 Transmitters used must have minimum frequency stability

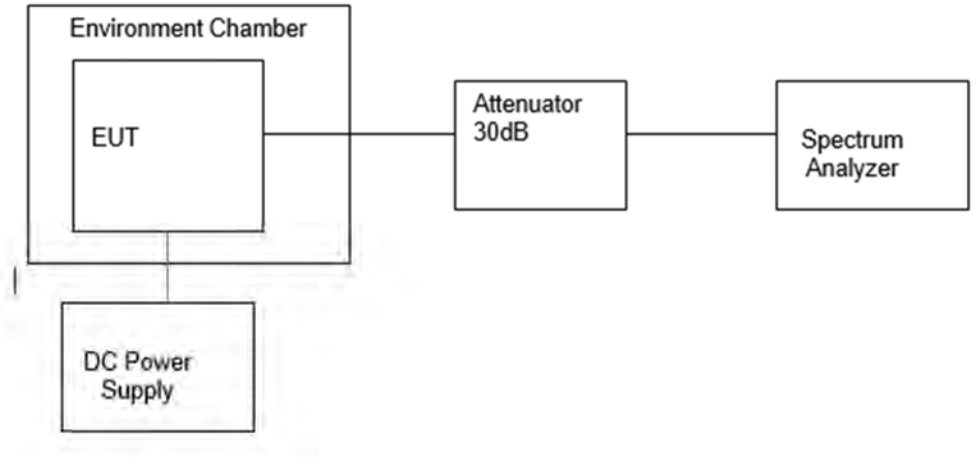
as specified in the following table.

Frequency Range (MHz)	Channel Bandwidth (KHz)	Frequency Tolerance (ppm)		
		Fixed and Base Stations	Mobile Stations	
			> 2 W	≤ 2 W
150-174 MHz	6.25	1.0	2.0	2.0
	12.5	2.5	5.0	5.0
	25	5.0	5.0	50.0*
421-512 MHz	6.25	0.5	1.0	1.0
	12.5	1.5	2.5	2.5
	25	2.5	5.0	5.0

In the 421-512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth or designed to operate on a frequency specifically designated for itinerant use or designed for low-power operation of two watts or less, must have a frequency stability of 5.0 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 2.0 ppm.

Test Procedure

Refer to Section 8.6 of this test report and ANSI C63.26-2015, Section 2 /TIA/EIA-603-E.
Configuration of System under Test



Test Data

Environmental Conditions

Date:	05/17/2021
Temperature:	24.5 ℃
Relative Humidity:	67 %
ATM Pressure:	100.4 kPa

Test Mode: Transmitting

Result: Compliance.

Test Result:

6.25kHz, Reference Frequency: 460.025 MHz, Limit: ±1 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	7.5	460.02527	0.586925
-20	7.5	460.02526	0.565187
-10	7.5	460.02525	0.543449
0	7.5	460.02524	0.521711
10	7.5	460.02523	0.499973
20	7.5	460.02521	0.456497
30	7.5	460.02520	0.434759
40	7.5	460.02519	0.413021
50	7.5	460.02518	0.391283

6.25kHz, Reference Frequency: 460.025 MHz, Limit: ±1 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
20	7.5	460.02521	0.456497
20	6.38(-15%)	460.02521	0.456497
20	8.63(+15%)	460.02520	0.434759

12.5kHz, Reference Frequency: 460.025 MHz, Limit: ±1 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	7.5	460.02527	0.586925
-20	7.5	460.02526	0.565187
-10	7.5	460.02525	0.543449
0	7.5	460.02524	0.521711
10	7.5	460.02523	0.499973
20	7.5	460.02521	0.456497
30	7.5	460.02520	0.434759
40	7.5	460.02519	0.413021
50	7.5	460.02518	0.391283

12.5kHz, Reference Frequency: 460.025 MHz, Limit: ±1 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
20	7.5	460.02521	0.456497
20	6.38(-15%)	460.02521	0.456497
20	8.63(+15%)	460.02520	0.434759

5.13 FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

Applicable Standard

Regulations: FCC §90.214
Test method: ANSI/TIA-603-E 2010, section 2.2.19.3

LIMIT

Time intervals [1, 2]	Maximum frequency difference [3]	All equipment	
		150 to 174 MHz	421 to 512MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 KHz Channels			
t_1 [4] ……..	± 25.0 KHz	5.0 ms	10.0 ms
t_2 ……	± 12.5 KHz	20.0 ms	25.0 ms
t_3 [4] ……..	± 25.0 KHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 KHz Channels			
t_1 [4] ……..	± 12.5 KHz	5.0 ms	10.0 ms
t_2 ……	± 6.25 KHz	20.0 ms	25.0 ms
t_3 [4] ……..	± 12.5 KHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 KHz Channels			
t_1 [4] ……..	±6.25 KHz	5.0 ms	10.0 ms
t_2 ……	±3.125 KHz	20.0 ms	25.0 ms
t_3 [4] ……..	±6.25 KHz	5.0 ms	10.0 ms

Test Procedure

a) Connect the EUT and test equipment as shown on the following block diagram.

b) Set the Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.

c) Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at
±12.5 kHz deviation and set its output level to -100dBm.

d) Turn on the transmitter.

e) Supply sufficient attenuation via the RF attenuator to provide an input level to the Spectrum Analyzer that is 40 dB below the maximum allowed input power when the transmitter is operating at its rated power level. Note this power level on the Spectrum Analyzer as P_0.

f) Turn off the transmitter.

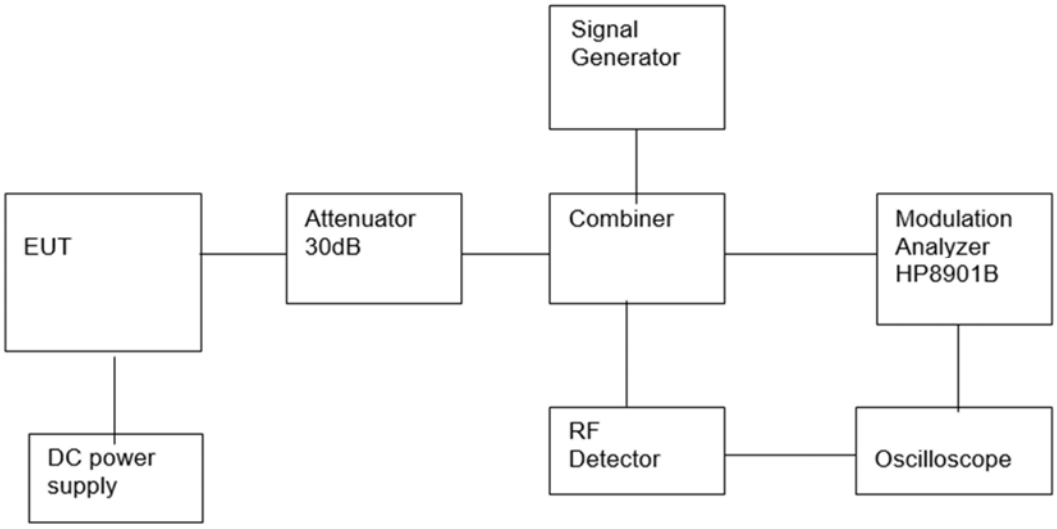
g) Adjust the RF level of the signal generator to provide RF power equal to P_0. This signal generator RF level shall be maintained throughout the rest of the measurement.

h) Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.

i) Adjust the vertical amplitude control of the spectrum analyzer to display the 1000 Hz at ±4 divisions vertically centered on the display. Set trigger mode of the Spectrum Analyzer to "Video", and tune the "trigger level" on suitable level. Then set the "tiger offset" to -10ms for turn on and -15ms for turn off.

j) Turn on the transmitter and the transient wave will be captured on the screen of Spectrum Analyzer. Observe the stored display. The instant when the 1 kHz test signal is completely suppressed is considered to be t_{on}. The trace should be maintained within the allowed divisions during the period t_1 and t_2.

k) Then turn off the transmitter, and another transient wave will be captured on the screen of Spectrum Analyzer. The trace should be maintained within the allowed divisions during the period t_3.



Test Data

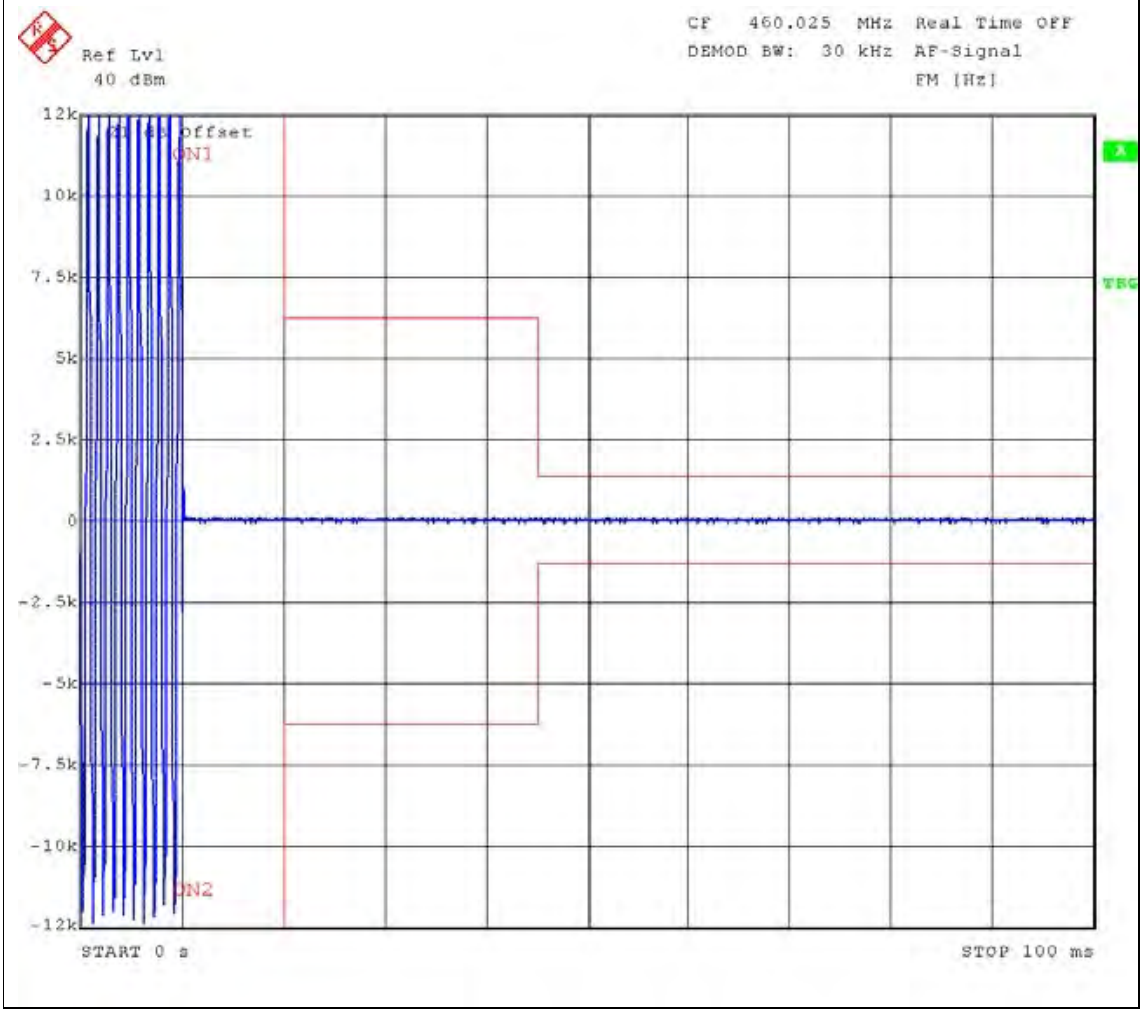
Environmental Conditions

Date:	05/17/2021
Temperature:	24.5℃
Relative Humidity:	67 %
ATM Pressure:	100.4kPa

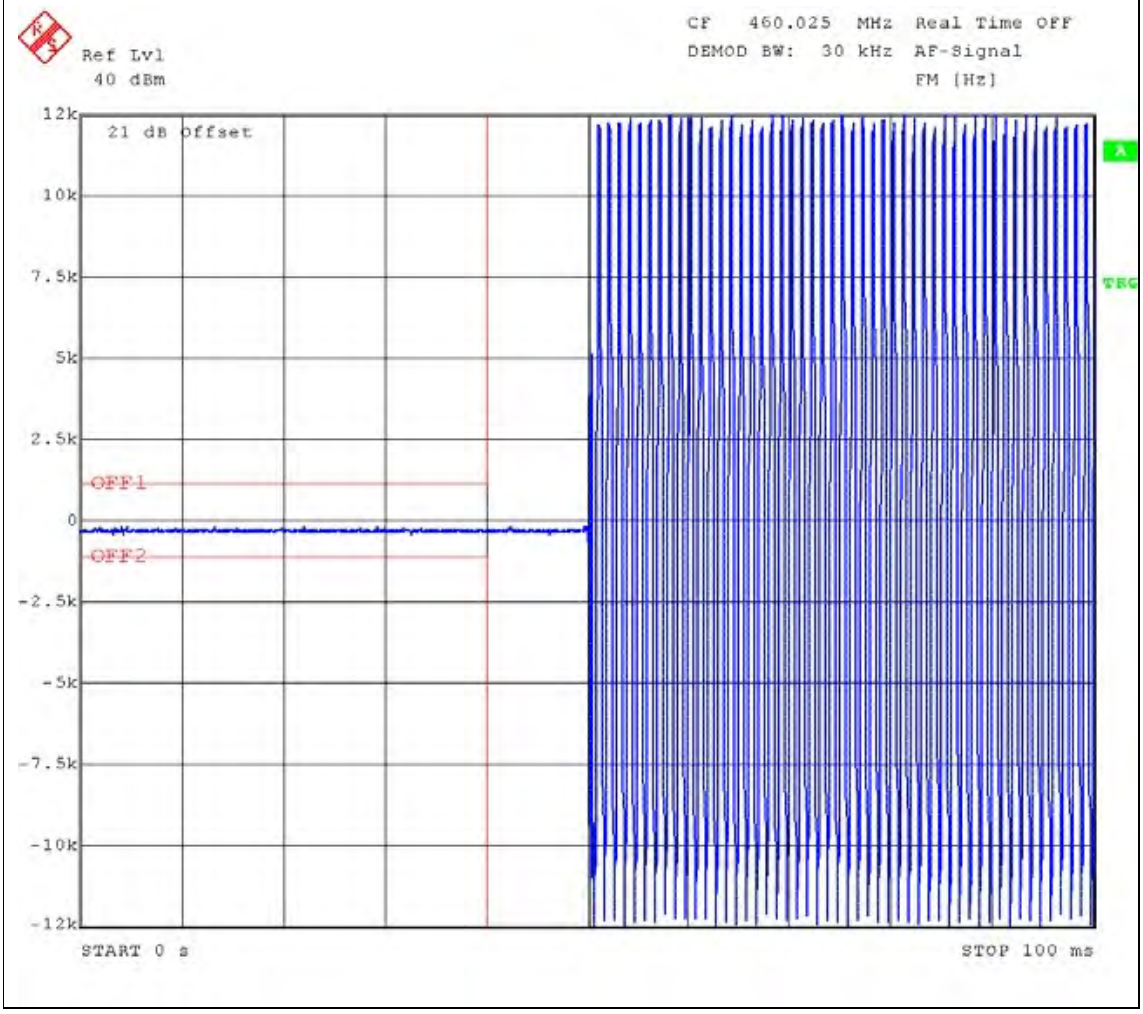
Test Result:

Channel Spacing (kHz)	Transient Period (ms)	Transient Frequency	Result
6.25	<5(t_1)	±12.5 kHz	Pass
	<20(t_2)	±6.25 kHz	
12.5	<5(t_3)	±12.5 kHz	

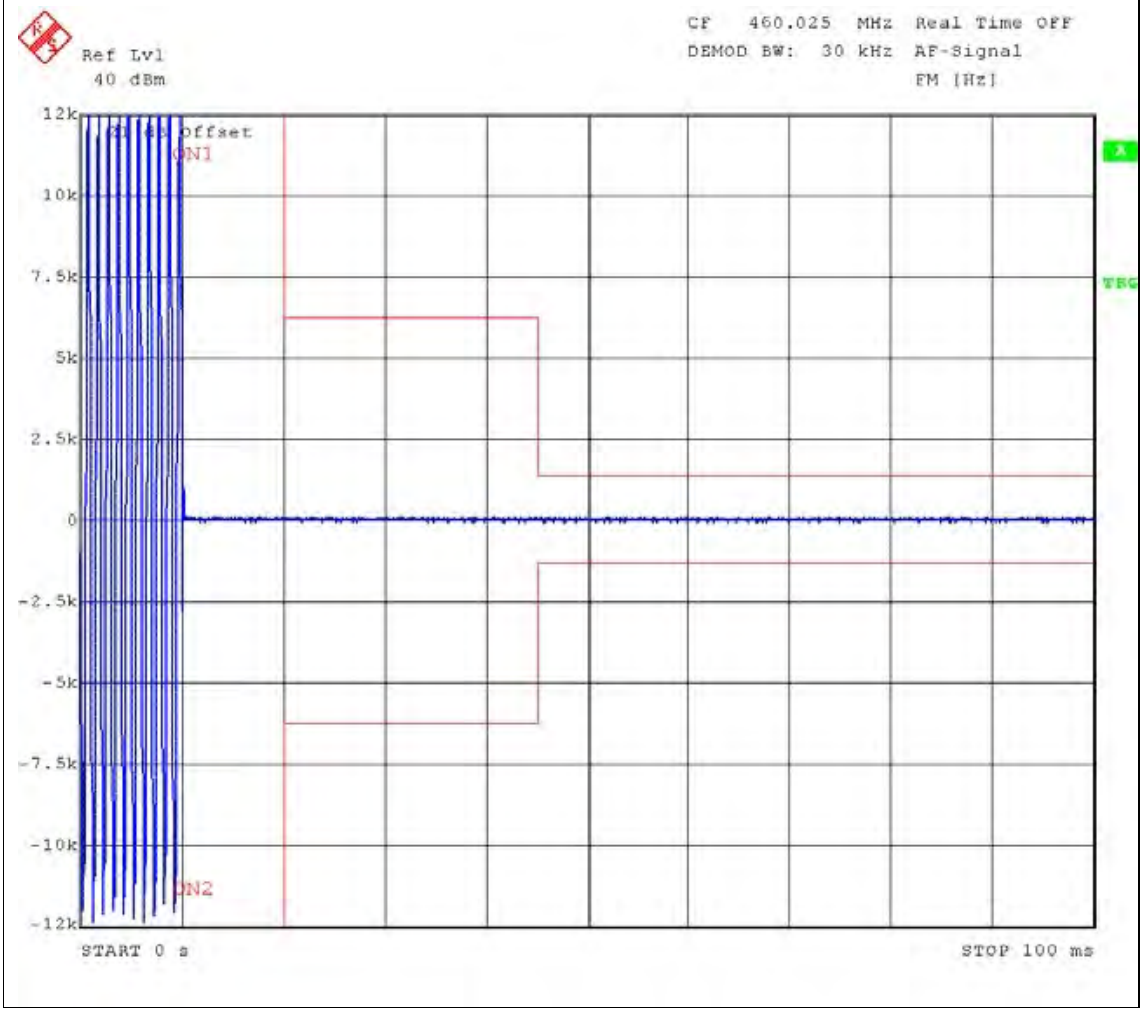
Test Frequency:	460.025 MHz
Channel Spacing:	6.25 kHz
Power:	5 W
Test Conditions:	Switch on condition t_{on}, t_1, and t_2



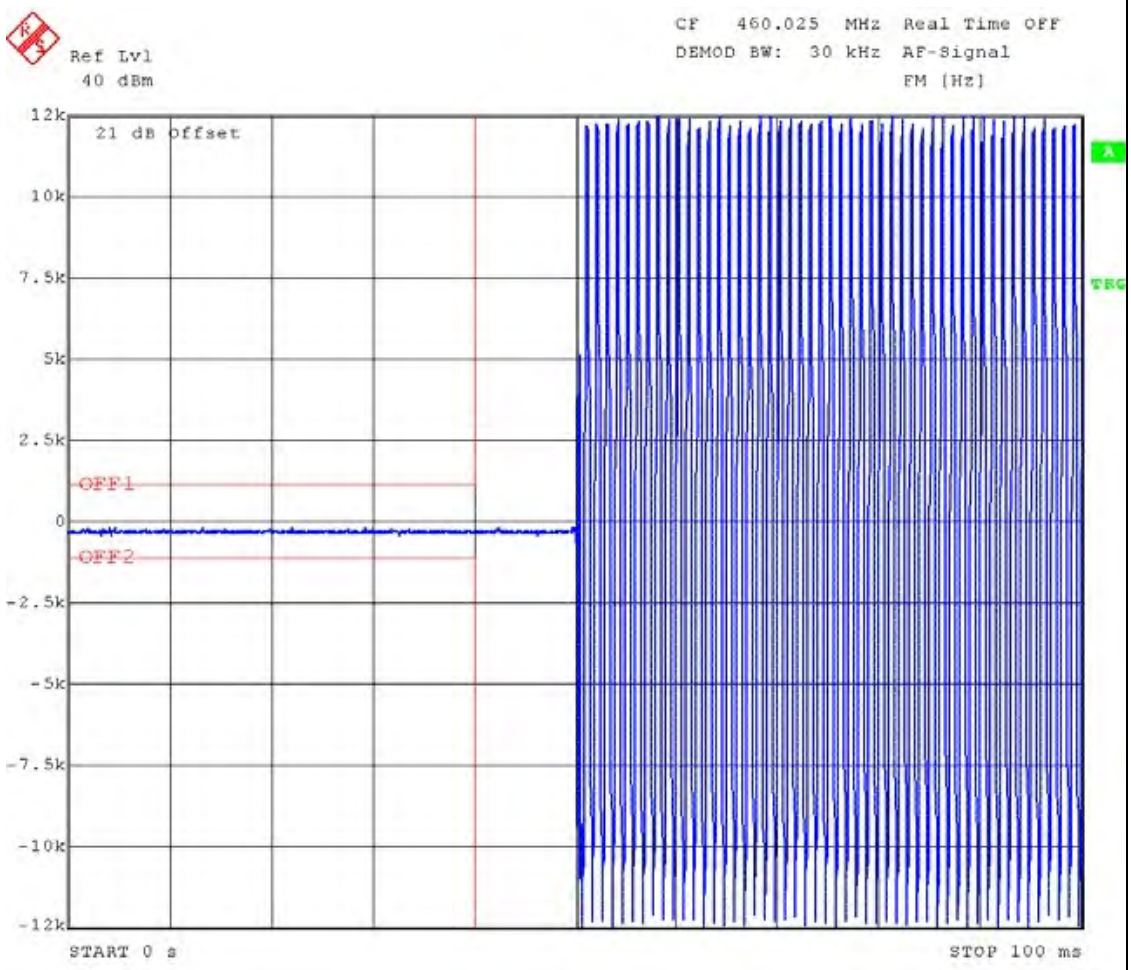
Test Frequency:	460.025 MHz
Channel Spacing:	6.25 kHz
Power:	5 W
Test Conditions:	Switch off condition t_3, t_{off}



Test Frequency:	460.025 MHz
Channel Spacing:	12.5 kHz
Power:	5 W
Test Conditions:	Switch on condition t_{on}, t_1, and t_2



Test Frequency:	460.025 MHz
Channel Spacing:	12.5 kHz
Power:	5 W
Test Conditions:	Switch off condition t_3, t_{off}



6. Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

Milpitas EMC/RF/Safety/Telecom Lab
775 Montague Expressway, Milpitas, CA 95035
Tel: +1 408 526 1188

Sunnyvale OTA/Bluetooth Lab
1293 Anvilwood Avenue, Sunnyvale, CA 94089
Tel: +1 669 600 5293

Littleton EMC/RF/Safety/Environmental Lab
1 Distribution Center Cir #1, Littleton, MA 01460
Tel: +1 978 486 8880

Email: sales.eaw@us.bureauveritas.com
Web Site: www.cpsusa-bureauveritas.com

The address and road map of all our labs can also be found on our web site.

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