



## FCC PART 90

## TEST REPORT

For

### Auctus Technologies Co., Ltd.

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Nanshan Dist. Shenzhen, Guangdong, China

**FCC ID: 2ASCZ-AU269**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Digital Portable Radio
<b>Report Number:</b> SZ4210823-35861E-RF-00	
<b>Report Date:</b> 2021-09-08	
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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

Product	Digital Portable Radio
Tested Model	EP508
Multiple Model	EP500, APR280, APR220, APR280U, APR220U
Model Differences	Refer to the DoS letter
Frequency Range	430-470MHz
Rated Transmit Power	4Watts(High), 1Watt(Low)
Channel separation	12.5kHz
Modulation Technique	4FSK/FM
Antenna Specification	1.5dBi
Voltage Range	DC 7.4V from battery or DC 9V from adapter
Sample serial number	SZ4210823-35861E-RF-S1 (Assigned by BAACL, Shenzhen)
Received date	2021-08-23
Sample/EUT Status	Good condition
Adapter 1 information	Model: R121-0901000U Input: 100-240V~ 50/60Hz 0.4A Output: DC 9.0V, 1000mA
Adapter 2 information	Model: R122-0901000UC Input: 100-240V~ 50/60Hz 0.6A Output: DC 9.0V, 1.0A

### Objective

This test report is in accordance with Part 2, and Part 90 of the Federal Communication Commissions rules.

### Test Methodology

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

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

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters. Each test item follows test standards and with no deviation.

## Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.73dB
RF conducted test with spectrum		±1.6dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±1°C
Humidity		±6%
Supply voltages		±0.4%

*Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.*

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 5F(B-West), 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 342867, the FCC Designation No. : CN1221.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0023.

## SYSTEM TEST CONFIGURATION

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### Description of Test Configuration

The system was configured for testing in a test mode which has been done in the factory.

### EUT Exercise Software

No exercise software was used.

### Special Accessories

No special accessory was used.

### Equipment Modifications

No modification was made to the EUT tested.

### Support Equipment List and Details

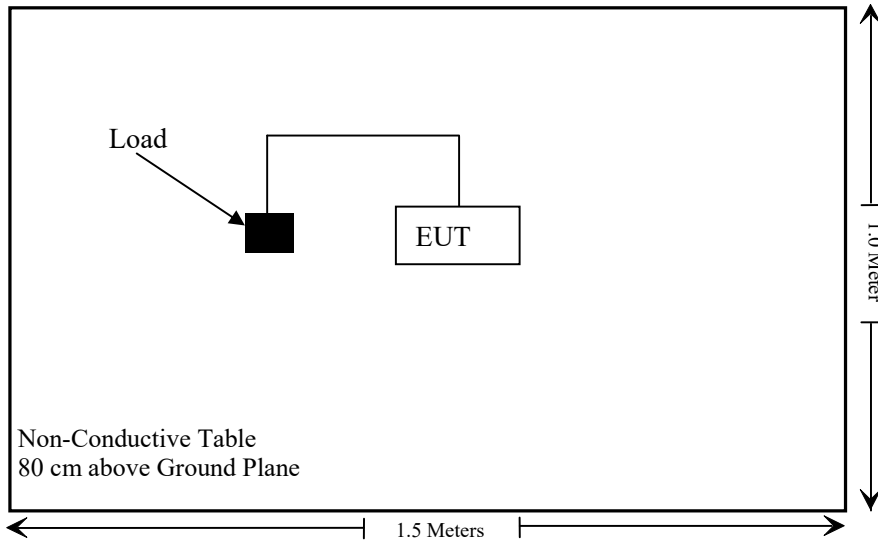
Manufacturer	Description	Model	Serial Number
Unknown	Load	Unknown	Unknown

### External I/O Cable

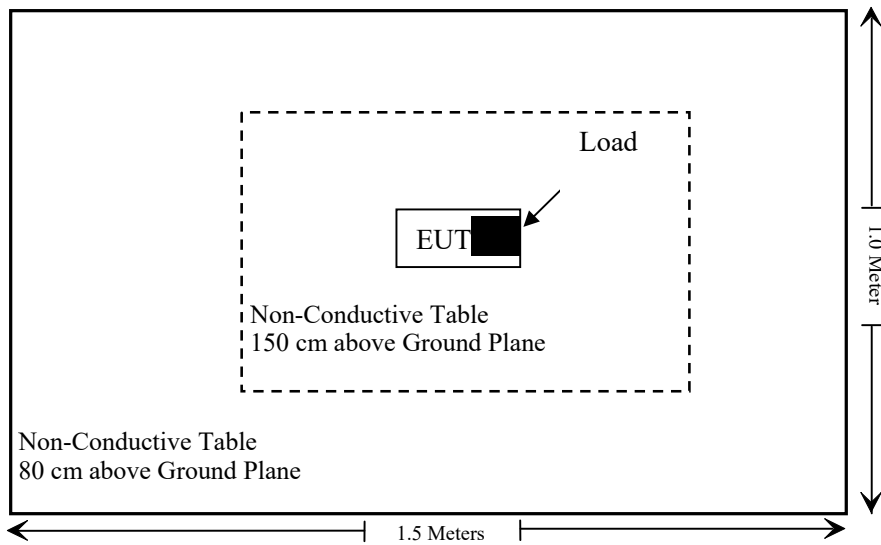
Cable Description	Length (m)	From Port	To
RF Cable	0.5	EUT	Load

### Block Diagram of Test Setup

RSE below 1GHz:



RSE above 1GHz:



**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Results</b>
§1.1307, §2.1093	RF Exposure (SAR)	Compliant
§2.1046; §90.205	RF Output Power	Compliant
§2.1047; §90.207	Modulation Characteristic	Compliant
§2.1049; §90.209; §90.210	Occupied Bandwidth & Emission Mask	Compliant
§2.1051; §90.210	Spurious Emission at Antenna Terminal	Compliant
§2.1053; §90.210	Spurious Radiated Emissions	Compliant
§2.1055; §90.213	Frequency Stability	Compliant
§90.214	Transient Frequency Behavior	Compliant



**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Radiated Emission Test</b>					
R&S	EMI Test Receiver	ESR3	102455	2021/07/06	2022/07/05
Sonoma instrument	Pre-amplifier	310 N	186238	2021/08/03	2022/08/02
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2020/12/22	2023/12/21
COM-POWER	Dipole Antenna	AD-100	721027	NCR	NCR
Unknown	Cable	Chamber Cable 1	F-03-EM236	2021/08/03	2022/08/02
Unknown	Cable	Chamber Cable 4	EC-007	2021/08/03	2022/08/02
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2021/07/06	2022/07/05
COM-POWER	Pre-amplifier	PA-122	181919	2020/11/29	2021/11/28
Sunol Sciences	Horn Antenna	3115	9107-3694	2021/01/15	2024/01/14
A.H.System	Horn Antenna	SAS-200/571	135	2021/07/14	2024/07/13
CHIGO	Temperature & Humidity Meter	HTC-1S	T-03-EM451	2021/04/07	2022/04/06
Insulated Wire Inc.	RF Cable	SPS-2503-3150	02222010	2020/11/29	2021/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2020/11/29	2021/11/28
Agilent	Signal Generator	N5183A	MY51040755	2020/12/29	2021/12/28
Unknown	Pass filter	NHP-600+	F-03-EM131	2020/11/29	2021/11/28
<b>RF Conducted Test</b>					
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2021/04/02	2022/04/01
HP Agilent	RF Communication test set	8920B	3325U00859	2021/07/06	2022/07/05
Unknown	30dB Attenuator	50FH-030-100 RF	1.7000672E11	2020/11/29	2021/11/28
Unknown	notch filter	SKU 5G3	ATR0205-04-13	2021/04/20	2022/04/20
Unknown	Pass filter	NHP-600+	F-03-EM131	2020/11/29	2021/11/28
instek	DC Power Supply	GPS-3030DD	EM832096	NCR	NCR
Fluke	Digital Multimeter	287	19000011	2021/02/22	2022/02/21
ESPEC	Temperature & Humidity Chamber	EL-10KA	9107726	2020/12/21	2021/12/21
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2021/4/24	2022/4/24
Weinschel	Power divider	1515	MY628	2020/11/29	2021/11/28

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

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## **FCC §1.1307(b) & §2.1093 - RF EXPOSURE INFORMATION**

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### **Applicable Standard**

FCC§1.1310 and §2.1093.

### **Test Result**

Compliance, please refer to the SAR report: SZ4210823-35861E-20.

## **FCC §2.1046 & §90.205 - RF OUTPUT POWER**

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### **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 spectrum analyzer through sufficient attenuation.

Spectrum Analyzer Setting:

R B/W	Video B/W
100 kHz	300 kHz

### **Test Data**

#### **Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	52 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Black Chen from 2021-08-25.*

*Test Mode: Transmitting*

***Test Result:*** Pass. Please refer to following table.

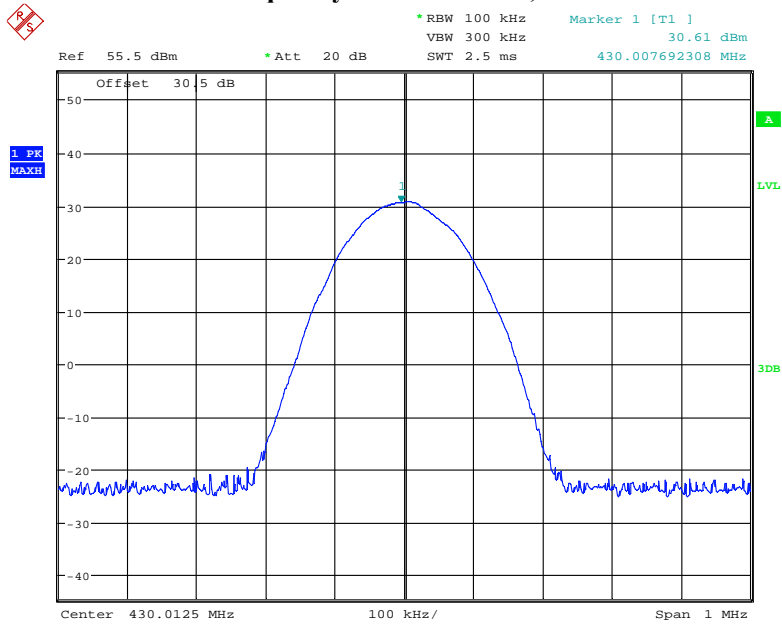
**Conducted Output Power**

Mode	Channel Spacing (kHz)	Frequency (MHz)	Power level	Output Power (dBm)	Output Power (Watt)
Digital	12.5	430.0125	L	30.61	1.151
			H	36.71	4.688
	12.5	453.2125	L	30.18	1.042
			H	36.74	4.721
	12.5	469.9875	L	29.34	0.859
			H	36.72	4.699
Analog	12.5	430.0125	L	29.95	0.989
			H	36.63	4.603
	12.5	453.2125	L	29.79	0.953
			H	36.39	4.355
	12.5	469.9875	L	30.30	1.072
			H	36.70	4.677

Note: High power: 4Watts (limit: 3.2~4.8W), Low power: 1Watt (Limit: 0.8~1.2W)

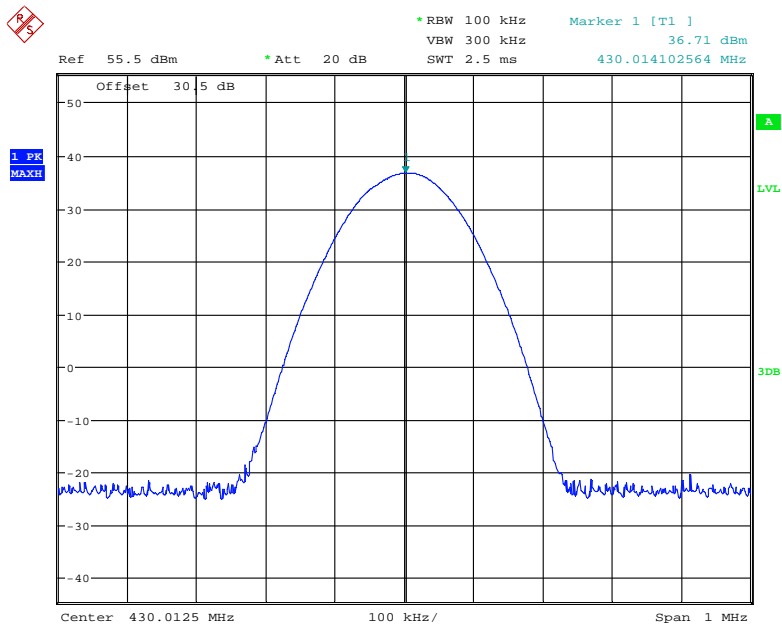
Digital:

### Frequency 430.0125 MHz, Low Power



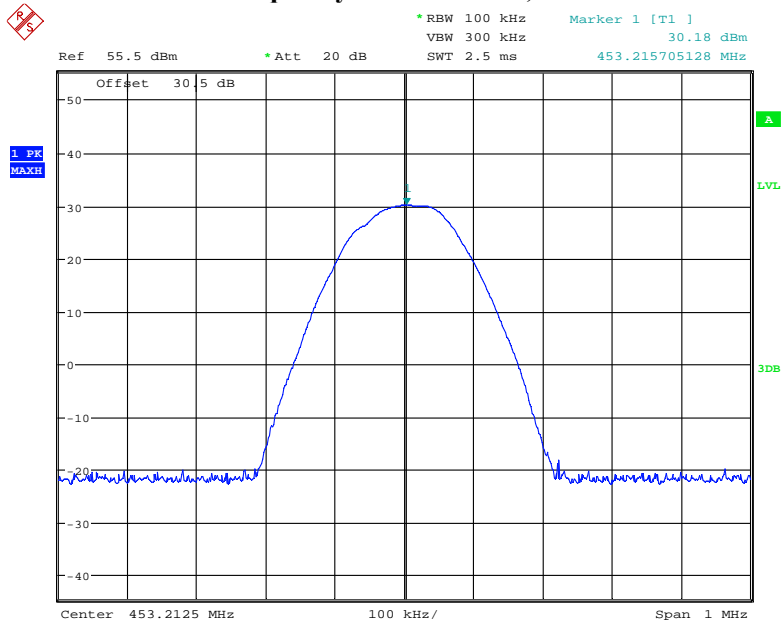
Date: 25.AUG.2021 10:47:59

### Frequency 430.0125 MHz, High Power



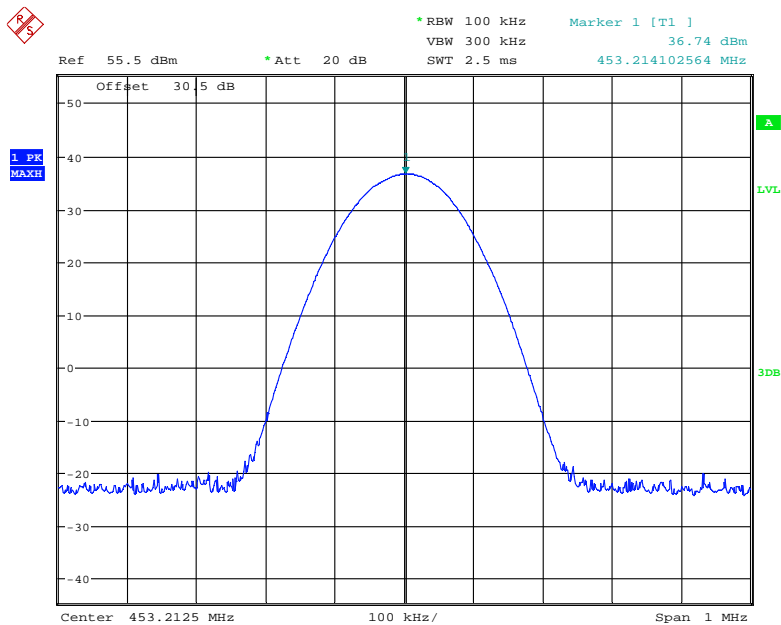
Date: 25.AUG.2021 10:49:00

### Frequency 453.2125MHz, Low Power



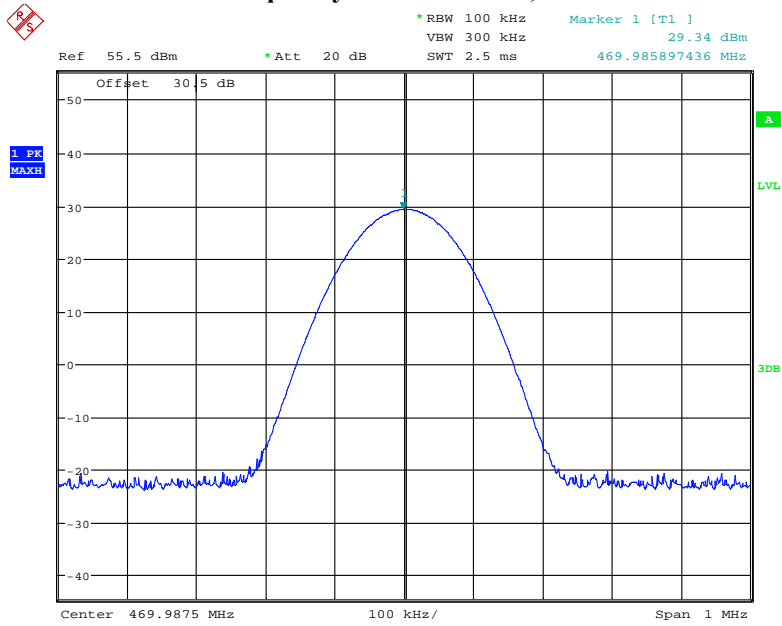
Date: 25.AUG.2021 10:45:27

### Frequency 453.2125MHz, High Power



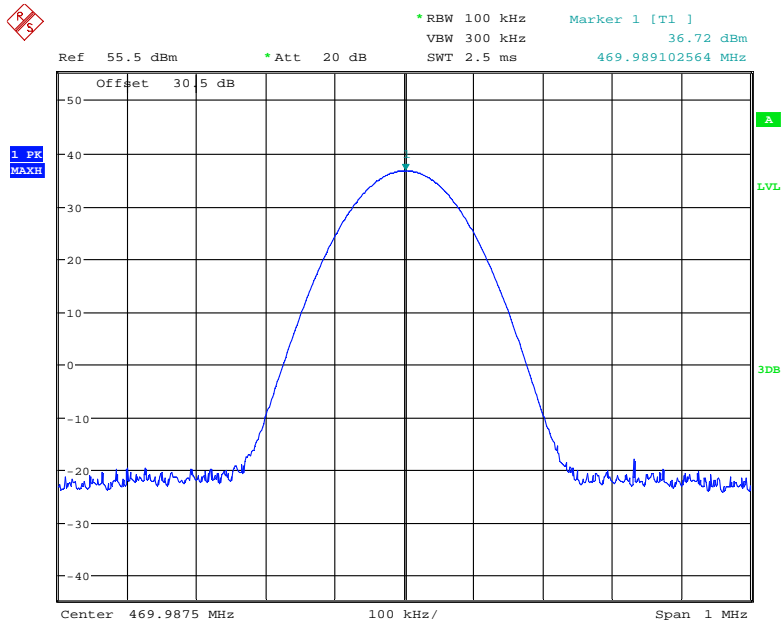
Date: 25.AUG.2021 10:53:57

### Frequency 469.9875 MHz, Low Power



Date: 25.AUG.2021 10:56:11

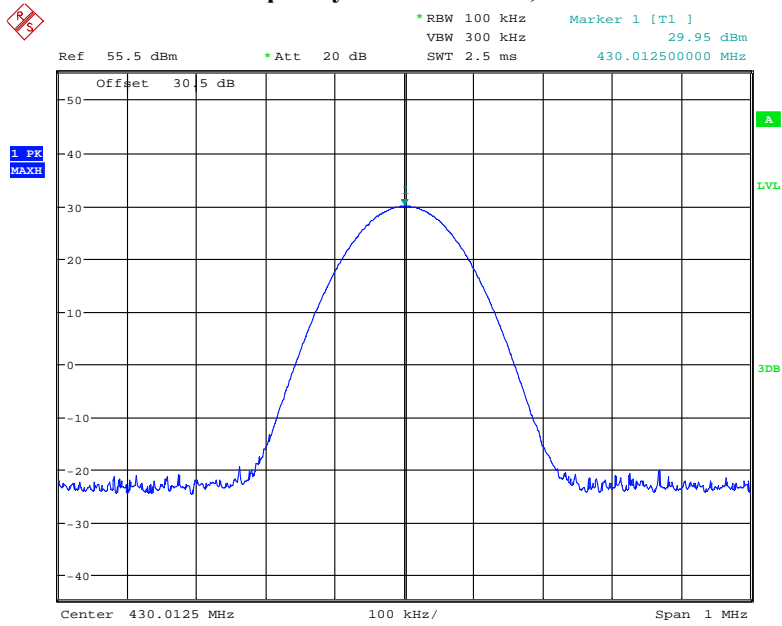
### Frequency 469.9875 MHz, High Power



Date: 25.AUG.2021 10:54:51

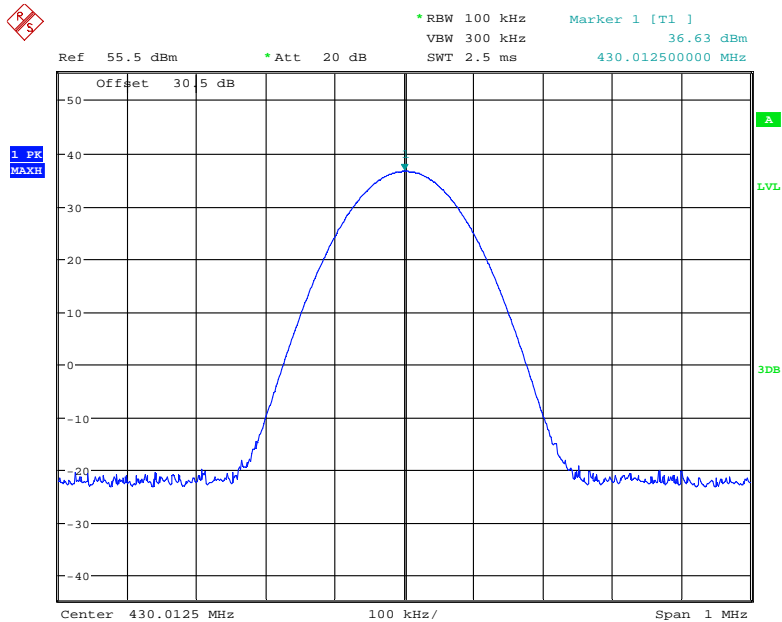
Analog

Frequency 430.0125 MHz, Low Power



Date: 25.AUG.2021 11:05:40

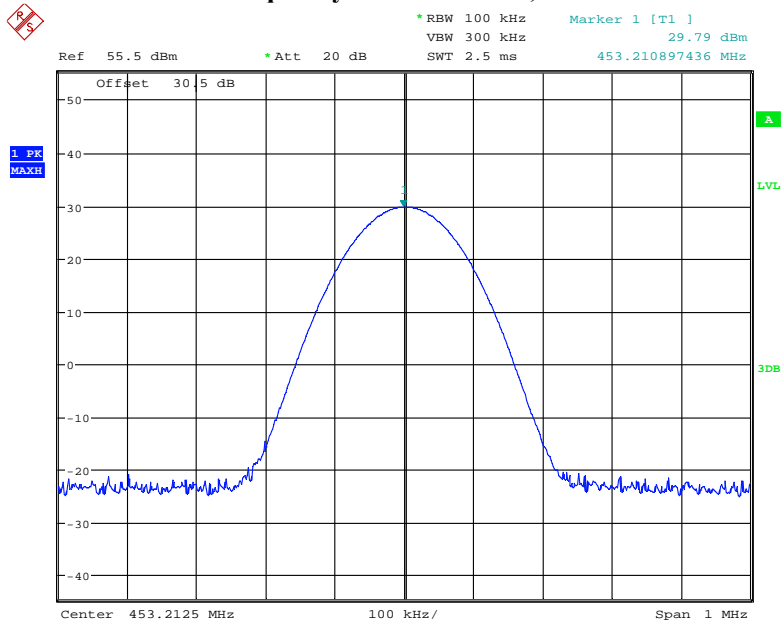
Frequency 430.0125 MHz, High Power



Date: 25.AUG.2021 11:06:53

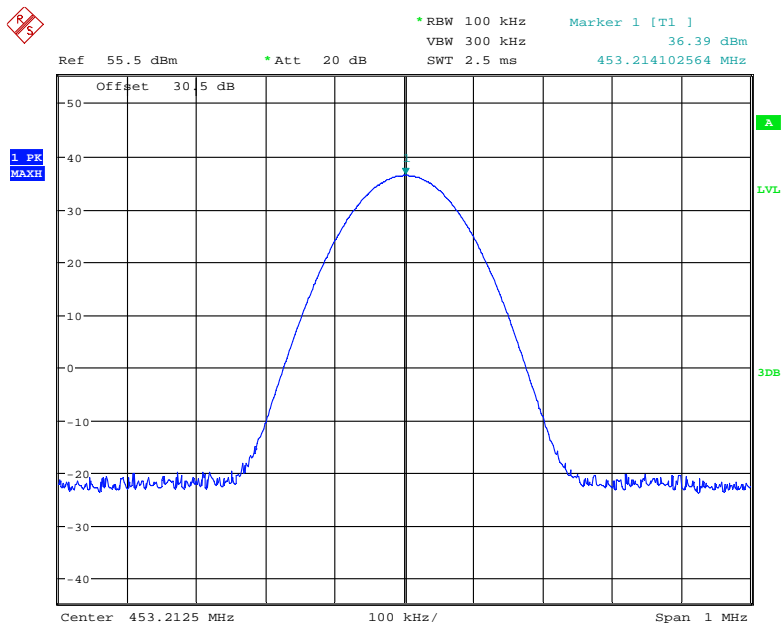


### Frequency 453.2125 MHz, Low Power



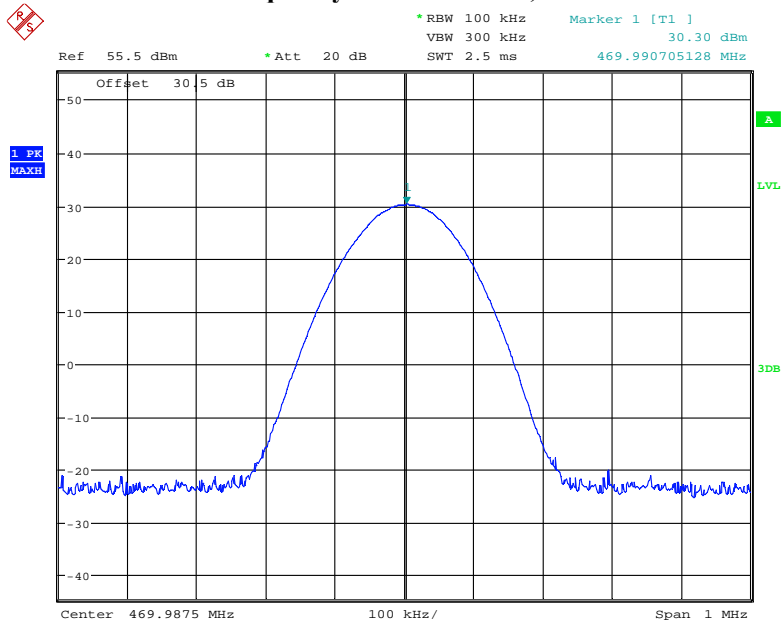
Date: 25.AUG.2021 11:07:32

### Frequency 453.2125 MHz, High Power



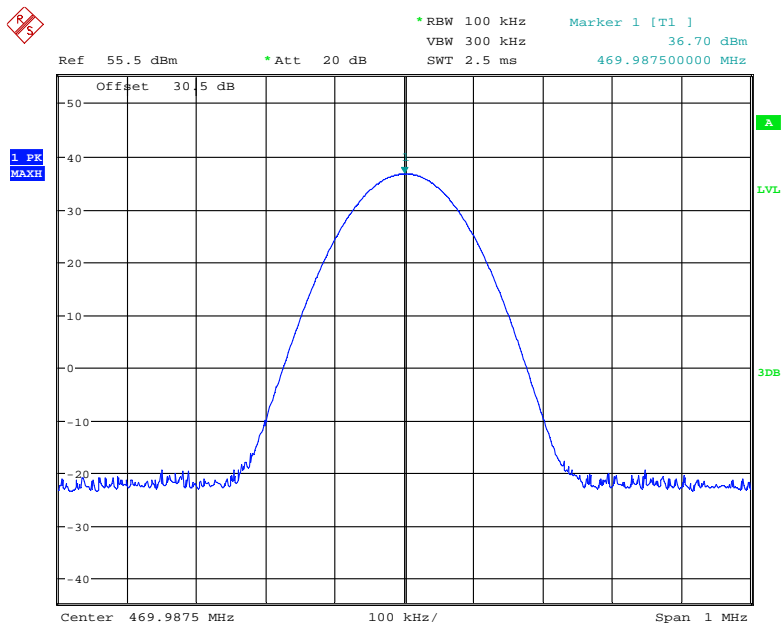
Date: 25.AUG.2021 11:08:00

### Frequency 469.9875 MHz, Low Power



Date: 25.AUG.2021 11:08:31

### Frequency 469.9875 MHz, High Power



Date: 25.AUG.2021 11:09:02

## **FCC §2.1047 & §90.207 - MODULATION CHARACTERISTIC**

### **Applicable Standard**

FCC§2.1047 and §90.207:

- (a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.
- (b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

### **Test Procedure**

Test Method: ANSI C63.26-2015

### **Test Data**

#### **Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	52 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Black Chen from 2021-09-02.*

*Test Mode: Transmitting*

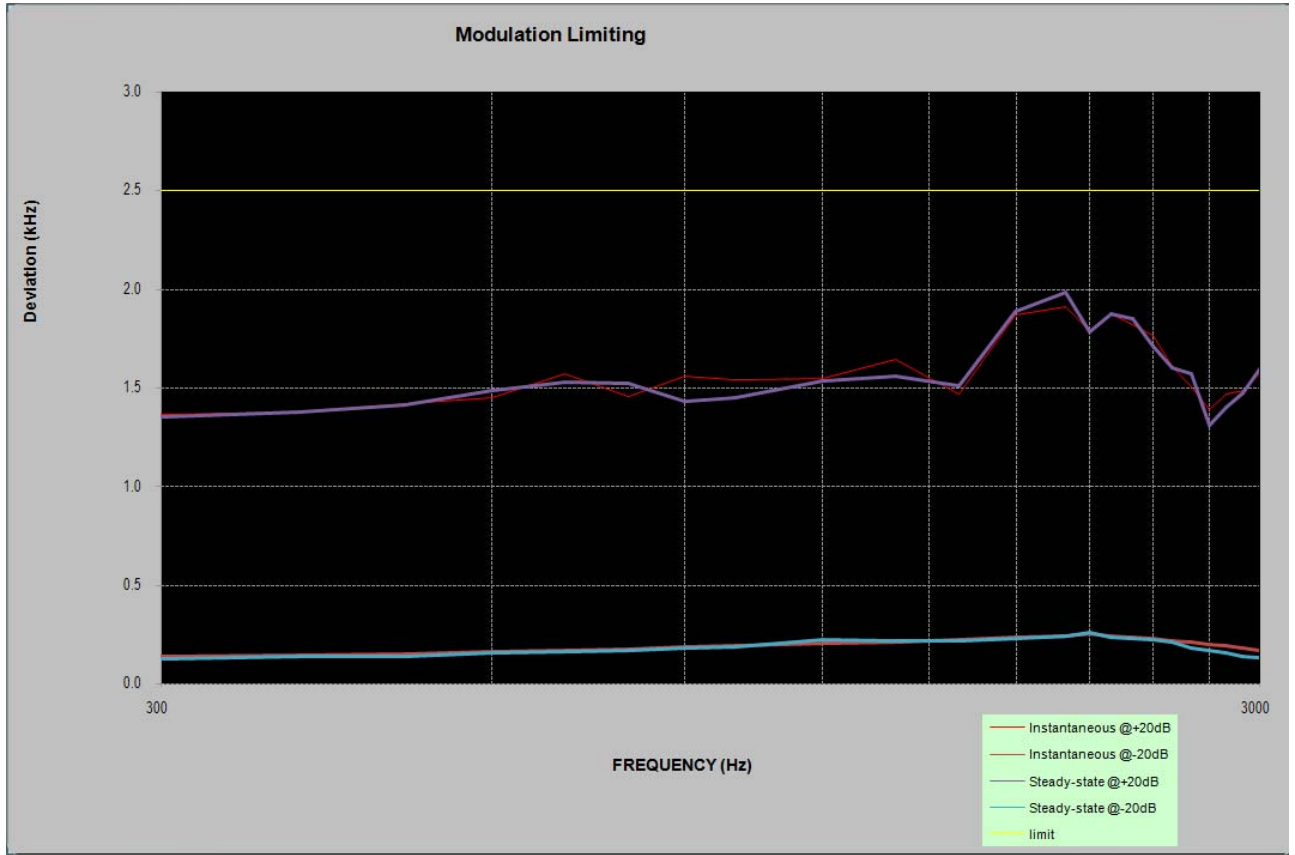
**Test Result:** *Pass. Please refer to the following tables and plots.*

**Analog Modulation:**

**MODULATION LIMITING**

Carrier Frequency: 453.2125MHz, Channel Separation=12.5 kHz

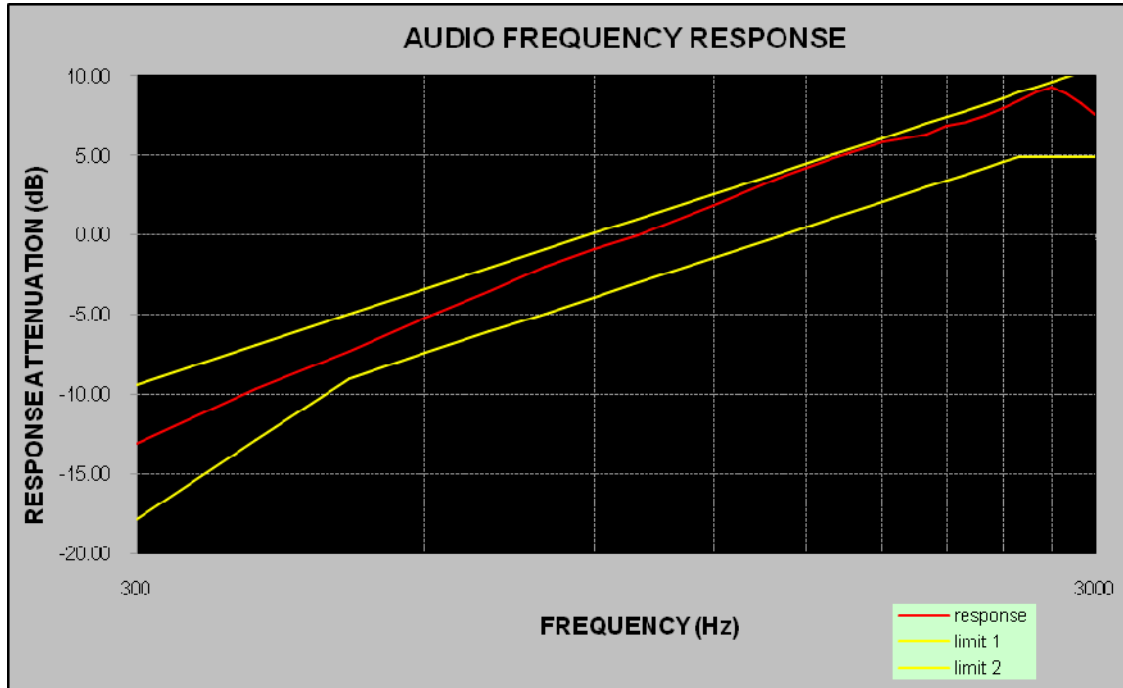
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	1.369	0.138	1.356	0.129	2.500
400	1.381	0.145	1.376	0.138	2.500
500	1.423	0.154	1.413	0.142	2.500
600	1.449	0.164	1.489	0.158	2.500
700	1.575	0.171	1.531	0.164	2.500
800	1.457	0.180	1.525	0.172	2.500
900	1.559	0.189	1.433	0.185	2.500
1000	1.540	0.193	1.454	0.191	2.500
1200	1.550	0.210	1.537	0.223	2.500
1400	1.648	0.213	1.561	0.221	2.500
1600	1.473	0.224	1.511	0.218	2.500
1800	1.868	0.236	1.887	0.234	2.500
2000	1.912	0.243	1.988	0.246	2.500
2100	1.792	0.259	1.784	0.261	2.500
2200	1.879	0.241	1.874	0.235	2.500
2300	1.820	0.239	1.851	0.231	2.500
2400	1.766	0.234	1.713	0.228	2.500
2500	1.609	0.221	1.604	0.213	2.500
2600	1.506	0.215	1.572	0.184	2.500
2700	1.391	0.204	1.314	0.173	2.500
2800	1.470	0.195	1.402	0.158	2.500
2900	1.489	0.184	1.474	0.143	2.500
3000	1.571	0.171	1.599	0.135	2.500



**Audio Frequency Response**

Carrier Frequency: 453.2125MHz, Channel Separation=12.5 kHz

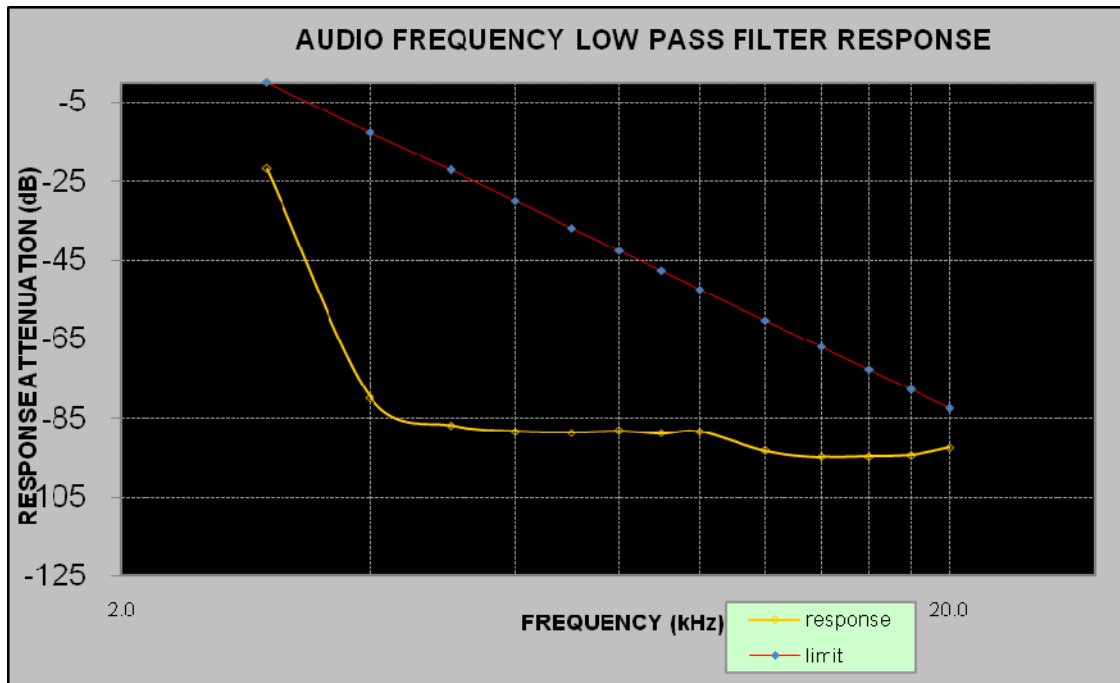
<b>Audio Frequency (Hz)</b>	<b>Response Attenuation (dB)</b>
300	-13.07
400	-9.68
500	-7.33
600	-5.19
700	-3.58
800	-2.00
900	-0.93
1000	0.00
1200	1.88
1400	3.60
1600	4.82
1800	5.86
2000	6.33
2100	6.85
2200	7.09
2300	7.47
2400	7.99
2500	8.39
2600	9.00
2700	9.30
2800	8.86
2900	8.27
3000	7.54



**Audio frequency lows pass filter response**

Carrier Frequency: 453.2125MHz, Channel Separation=12.5 kHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-21.8	0.0
4.0	-79.8	-12.5
5.0	-86.8	-22.2
6.0	-88.3	-30.1
7.0	-88.6	-36.8
8.0	-88.2	-42.6
9.0	-88.8	-47.7
10.0	-88.4	-52.3
12.0	-93.2	-60.2
14.0	-94.8	-66.9
16.0	-94.7	-72.7
18.0	-94.3	-77.8
20.0	-92.5	-82.5





## FCC §2.1049 & §90.209 & §90.210 – OCCUPIED BANDWIDTH & EMISSION MASK

### Applicable Standard

FCC §2.1049 and §90.210

Emission Mask D - 12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- 1) For any frequency removed from the center of the authorized bandwidth  $f_0$  to 5.625 kHz removed from  $f_0$ , 0dB.
- 2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5.625 kHz but no more than 12.5 kHz, at least  $7.27 (f_d - 2.88 \text{ kHz})$  dB.
- 3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 12.5 kHz at least: At least  $50 + 10 \log (P)$  dB or 70 dB, whichever is the lesser attenuation.

### 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 was set at 100 Hz and the spectrum was recorded in the frequency band  $\pm 50$  kHz from the carrier frequency.

### Test Data

#### Environmental Conditions

Temperature:	23~26 °C
Relative Humidity:	52~56 %
ATM Pressure:	101.0 kPa

*The testing was performed by Black Chen from 2021-08-25.*

*Test mode: transmitting*

**Test Result:** *Pass. Please refer to the following tables and plots.*

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)
Analog	12.5	430.0125	L	5.192	5.288
	12.5		H	5.192	5.192
	12.5	453.2125	L	5.192	5.385
	12.5		H	5.192	5.288
	12.5	469.9875	L	5.192	5.385
	12.5		H	5.192	5.385
Digital	12.5	430.0125	L	6.731	8.942
	12.5		H	7.115	9.423
	12.5	453.2125	L	6.635	8.558
	12.5		H	6.923	8.846
	12.5	469.9875	L	6.731	8.846
	12.5		H	6.923	8.846

Note: Emission designator is base on calculation instead of measurement.

Emission Designator Per CFR 47 §2.201 & §2.202,  $B_n = 2M + 2D$

**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.  $BW = 2(M+D) = 2*(3.0 \text{ kHz} + 2.5 \text{ kHz}) = 11 \text{ kHz} \rightarrow 11K0$

F3E portion of the designator represents an FM voice transmission Therefore, the entire designator for 12.5 kHz channel spacing FM mode is 11K0F3E.

**For Digital Mode (Channel Spacing: 12.5 kHz)**

Emission Designator 7K60F1D and 7K60F1E

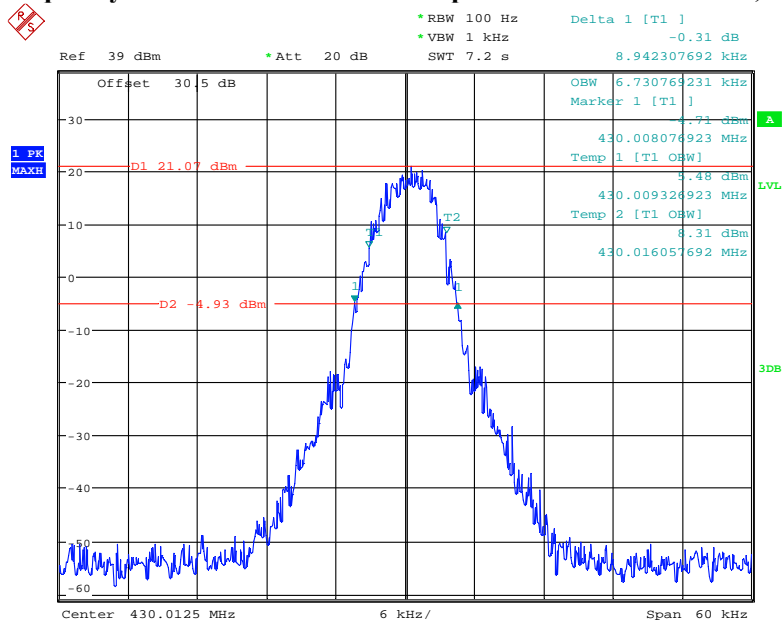
The 99% energy rule (title 47CFR 2.1049) was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.60 kHz. The emission mask was obtained from 47CFR 90.210(d).

F1D and F1E portion of the designator indicates digital information.

Therefore, the entire designator for 12.5 kHz channel spacing digital mode is 7K60F1D and 7K60F1E.

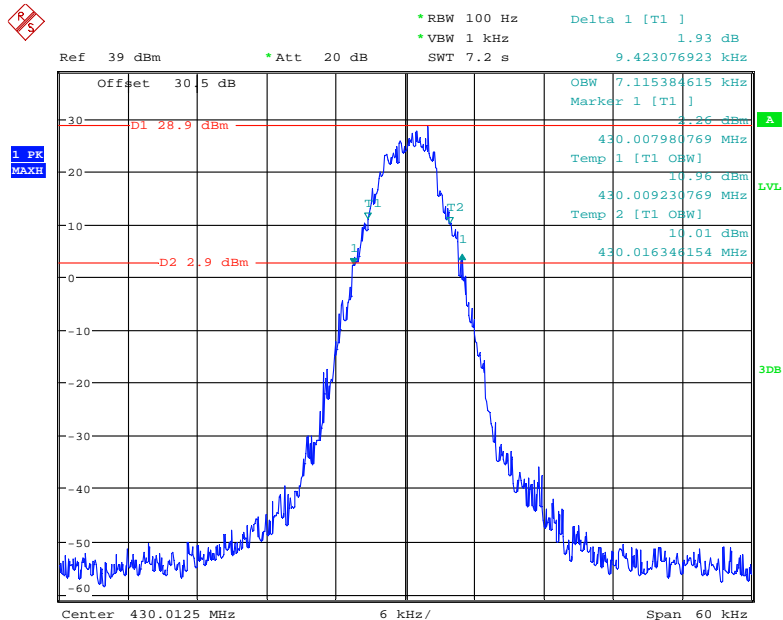
Digital:

**Frequency 430.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power**



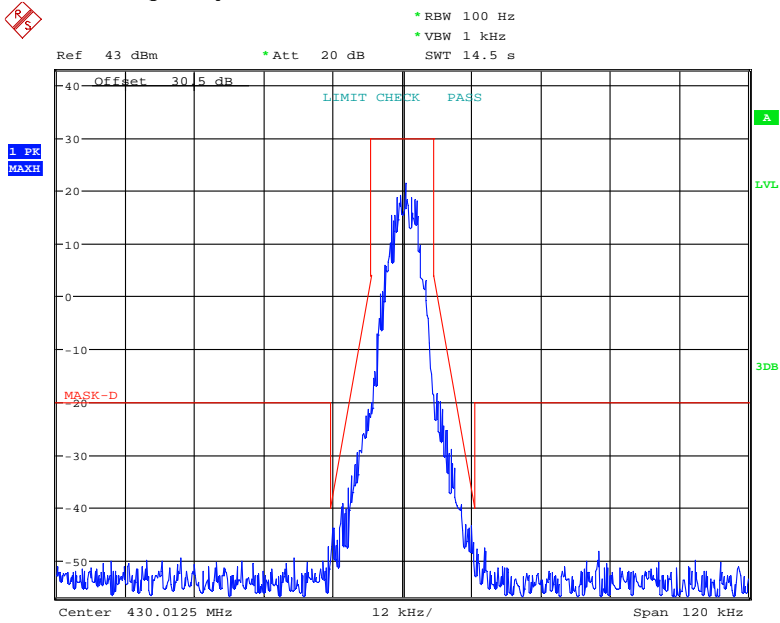
Date: 25.AUG.2021 13:25:25

**Frequency 430.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power**



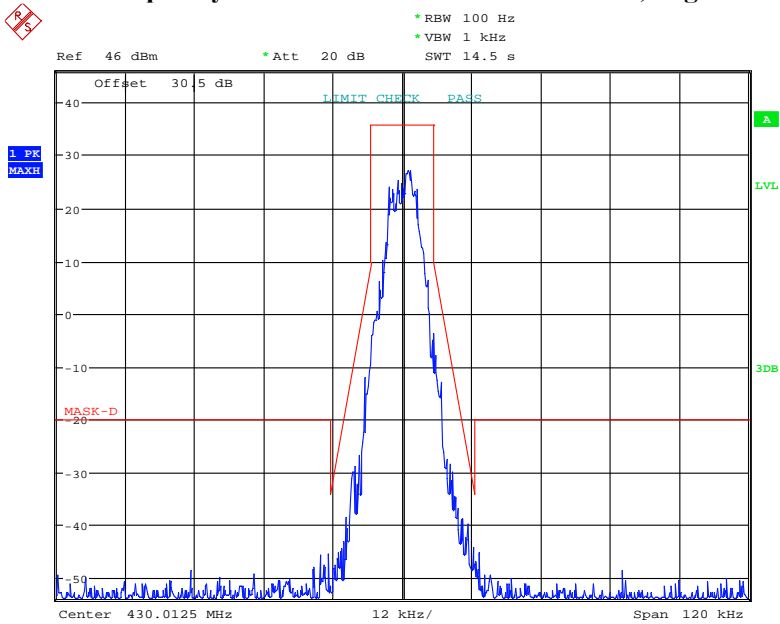
Date: 25.AUG.2021 12:00:40

### Frequency 430.0125 MHz: Emission Mask D, Low Power



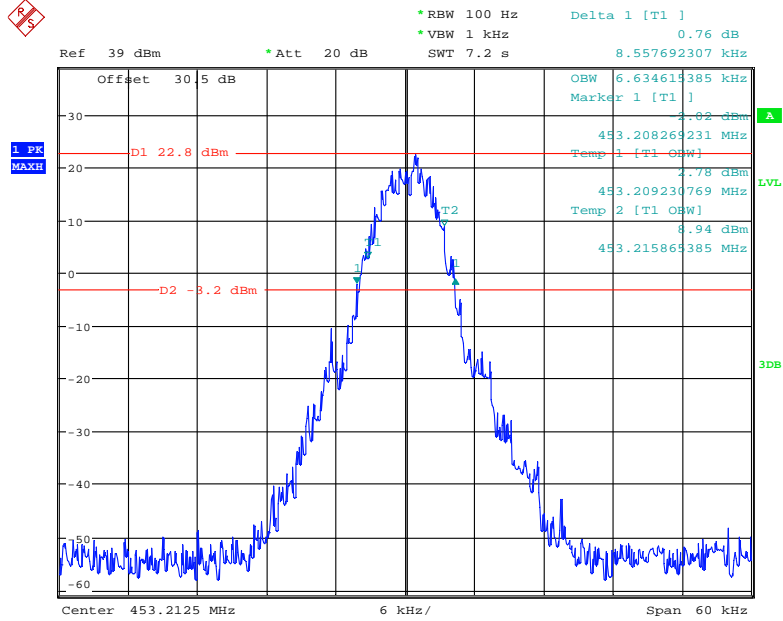
Date: 25.AUG.2021 17:03:06

### Frequency 430.0125 MHz: Emission Mask D, High Power



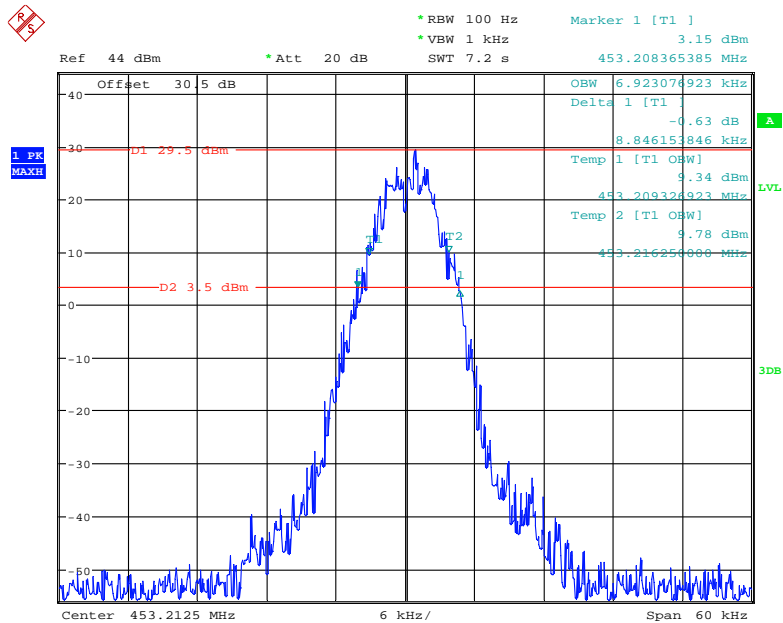
Date: 25.AUG.2021 16:56:41

**Frequency 453.2125MHz: 99% Occupied & 26 dB Bandwidth, Low Power**



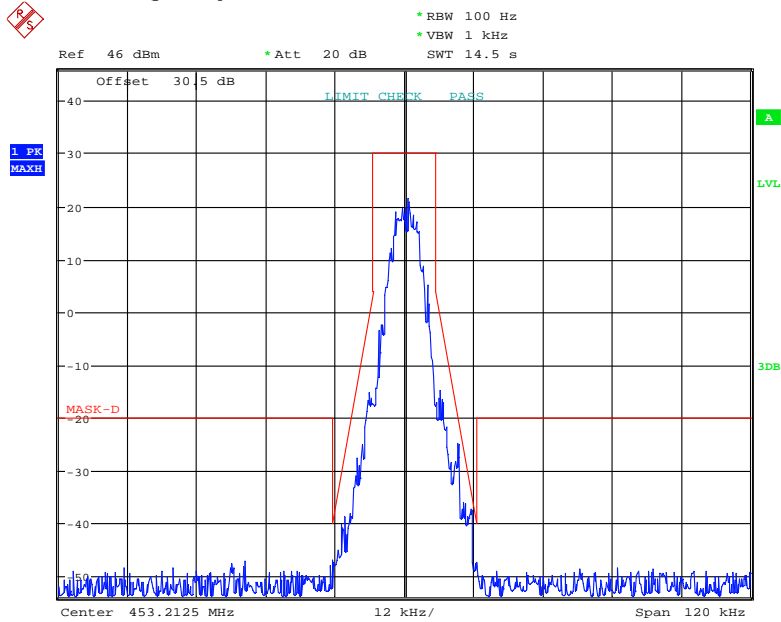
Date: 25.AUG.2021 13:35:32

**Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth, High Power**



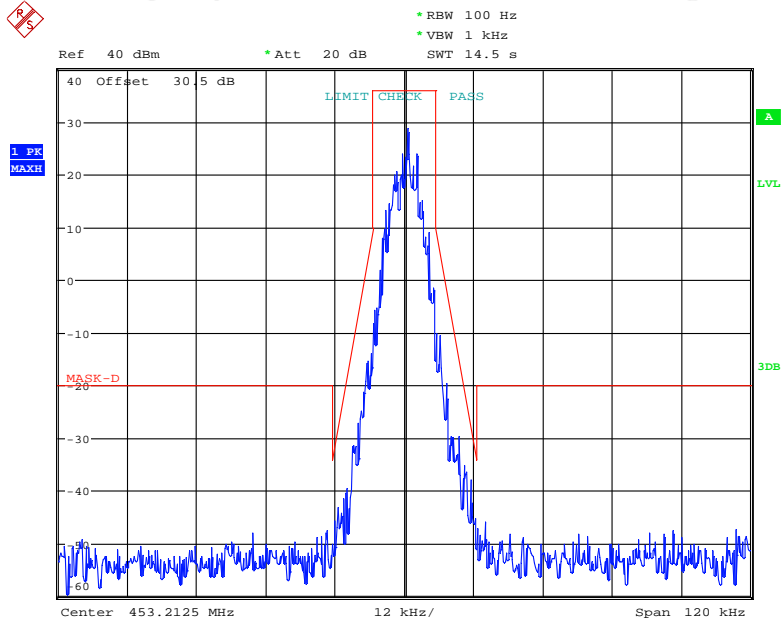
Date: 25.AUG.2021 13:29:40

### Frequency 453.2125 MHz: Emission Mask D, Low Power



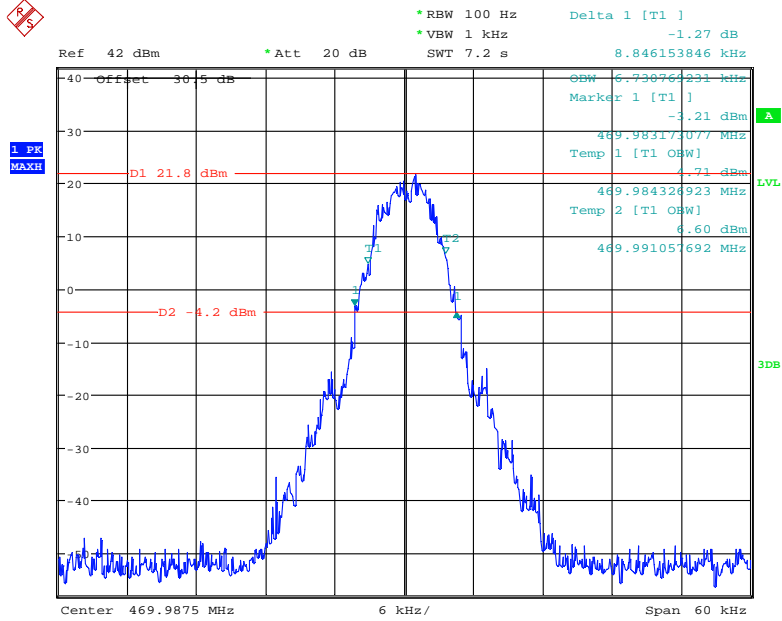
Date: 25.AUG.2021 17:00:20

### Frequency 453.2125 MHz: Emission Mask D, High Power



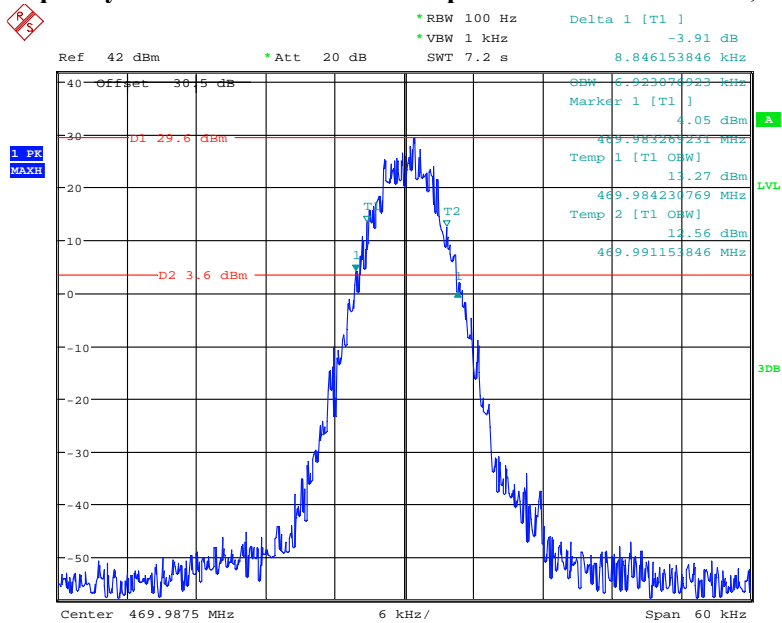
Date: 25.AUG.2021 16:46:08

**Frequency 469.9875 MHz: 99% Occupied & 26 dB Bandwidth, Low Power**



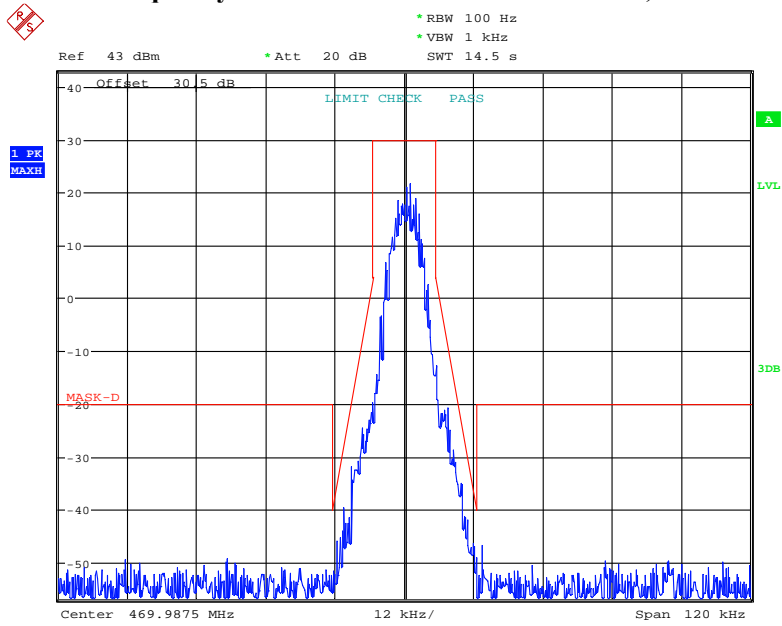
Date: 25.AUG.2021 13:43:13

**Frequency 469.9875 MHz: 99% Occupied & 26 dB Bandwidth, High Power**



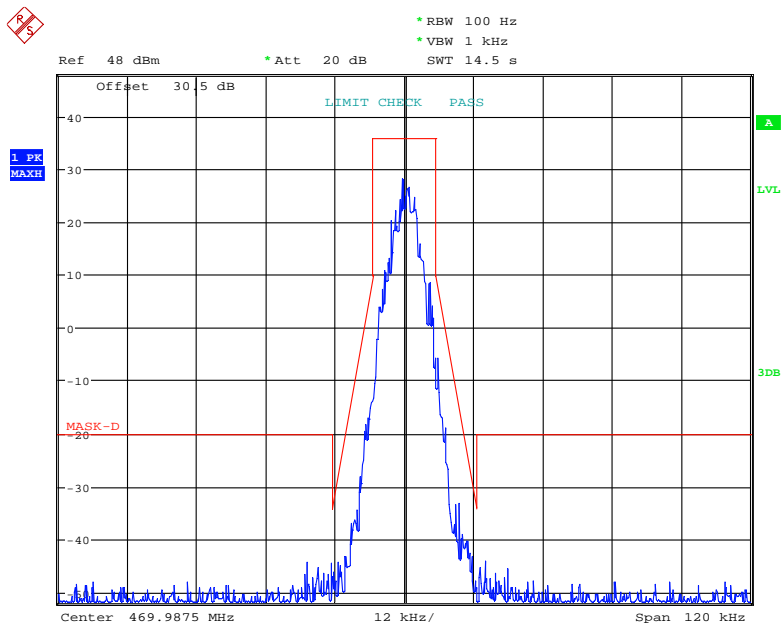
Date: 25.AUG.2021 13:38:02

### Frequency 469.9875 MHz: Emission Mask D, Low Power



Date: 25.AUG.2021 16:34:28

### Frequency 469.9875 MHz: Emission Mask D, High Power

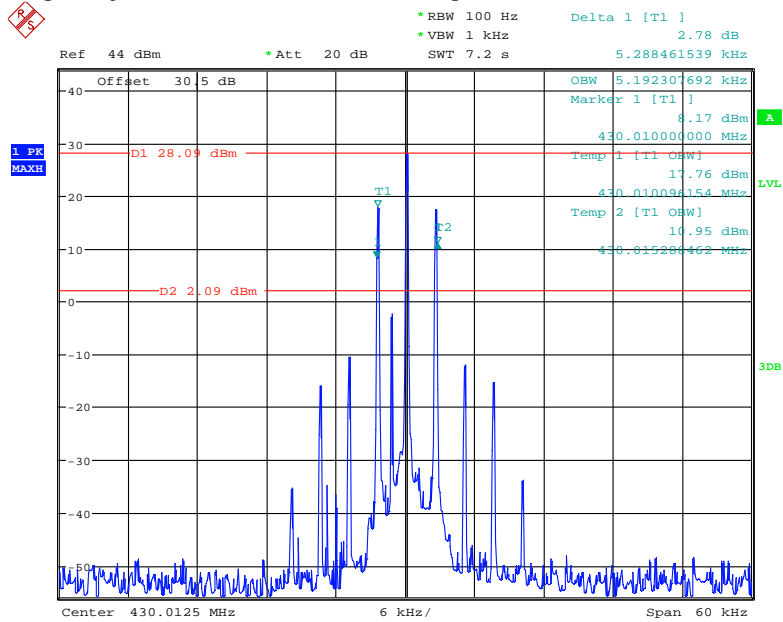


Date: 25.AUG.2021 17:17:30



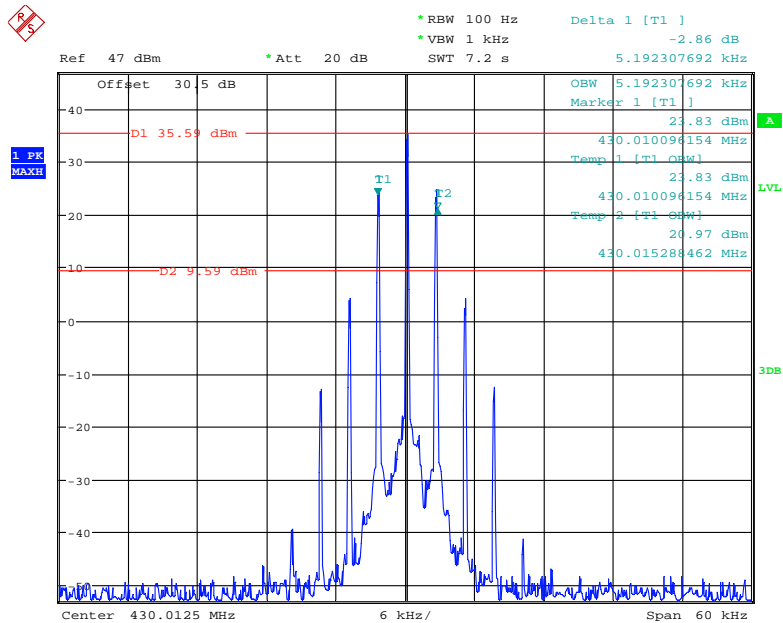
Analog

### Frequency 430.0125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



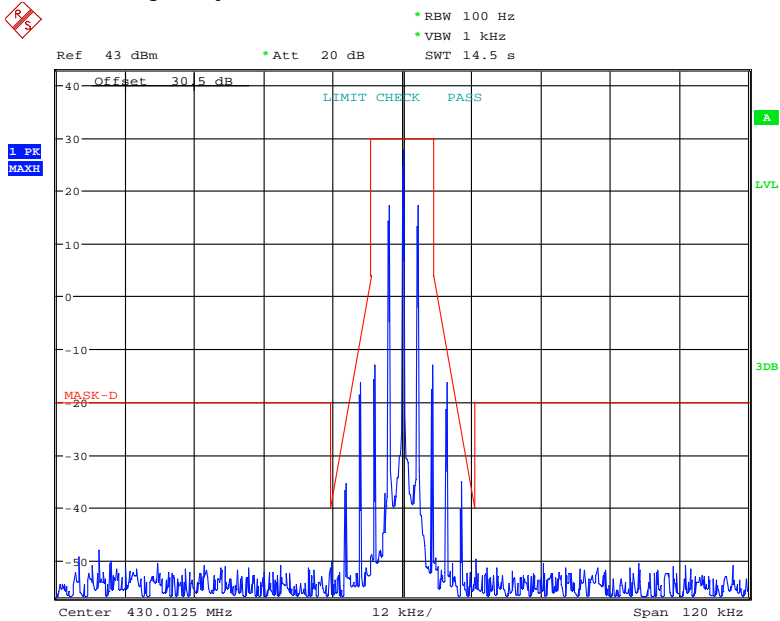
Date: 25.AUG.2021 15:42:16

### Frequency 430.0125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



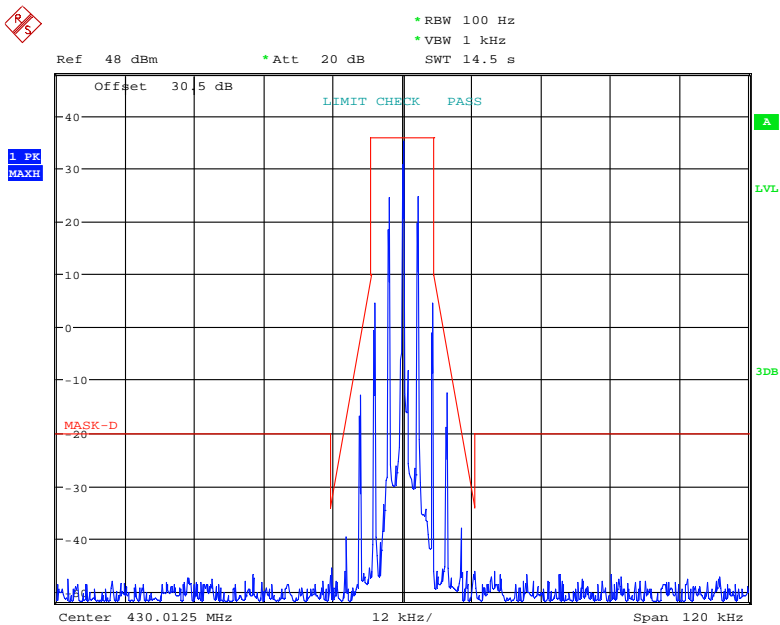
Date: 25.AUG.2021 15:44:02

### Frequency 430.0125 MHz: Emission Mask D, Low Power



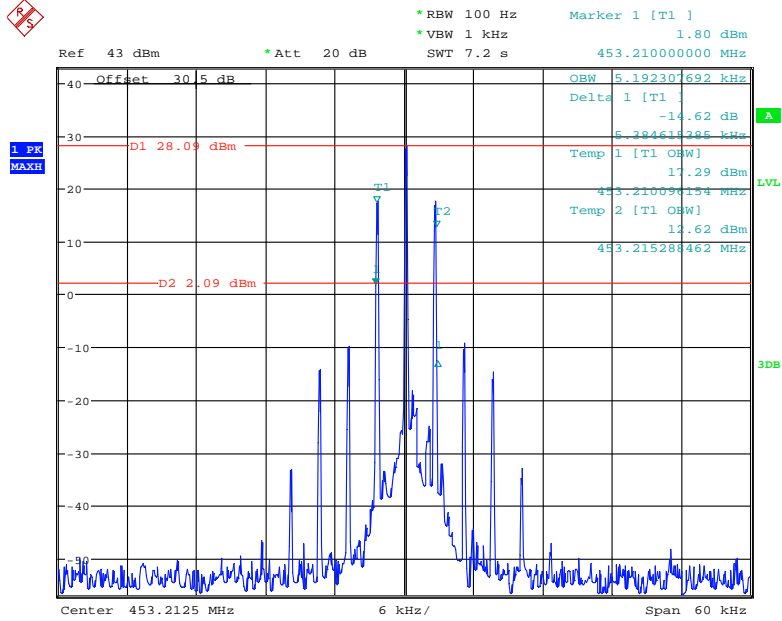
Date: 25.AUG.2021 16:23:31

### Frequency 430.0125 MHz: Emission Mask D, High Power



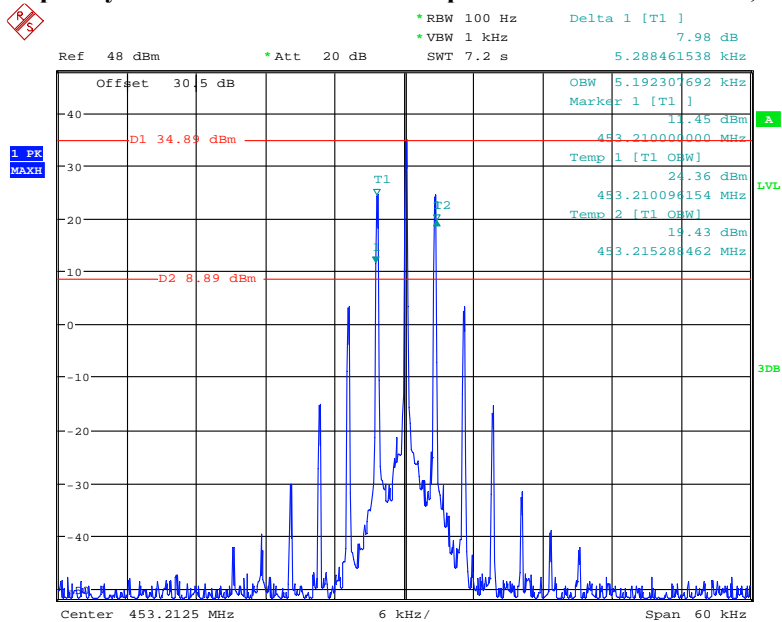
Date: 25.AUG.2021 17:06:56

### Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth, Low Power



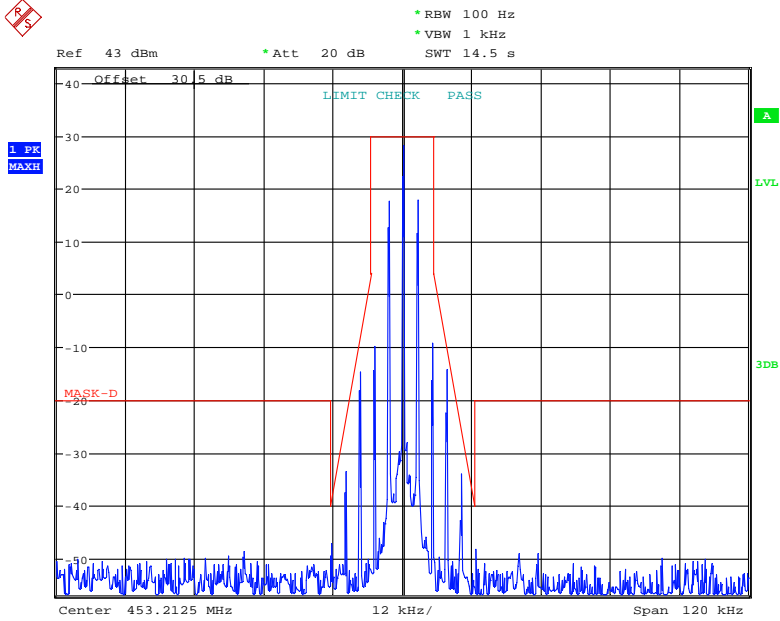
Date: 25.AUG.2021 15:37:58

### Frequency 453.2125 MHz: 99% Occupied & 26 dB Bandwidth, High Power



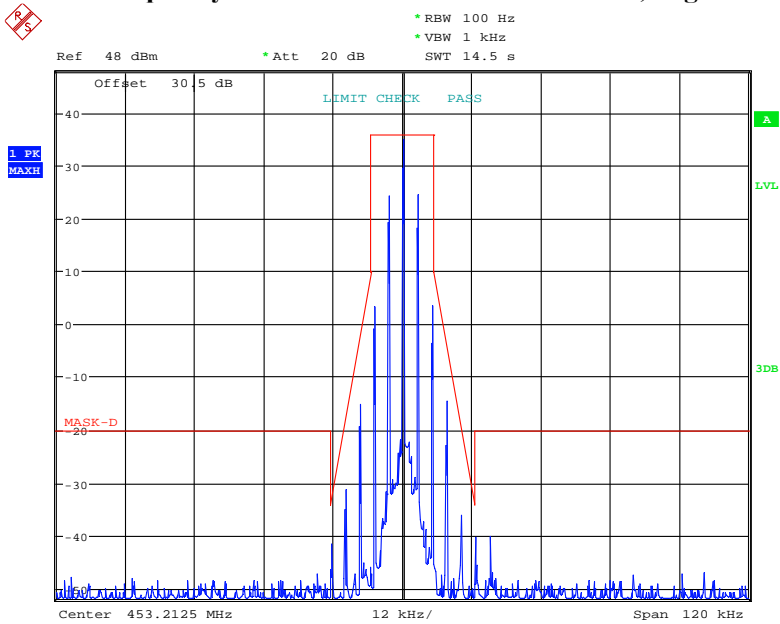
Date: 25.AUG.2021 15:39:18

### Frequency 453.2125 MHz: Emission Mask D, Low Power



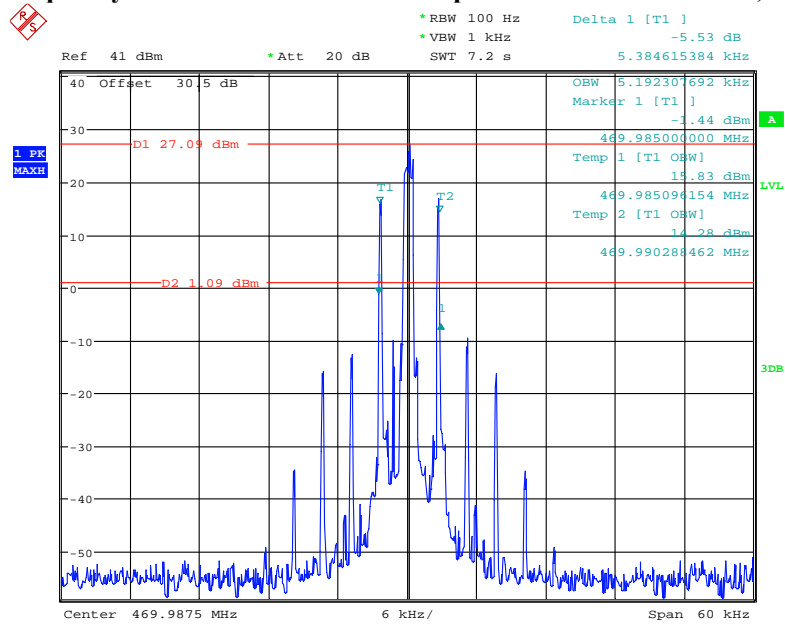
Date: 25.AUG.2021 16:26:39

### Frequency 453.2125 MHz: Emission Mask D, High Power



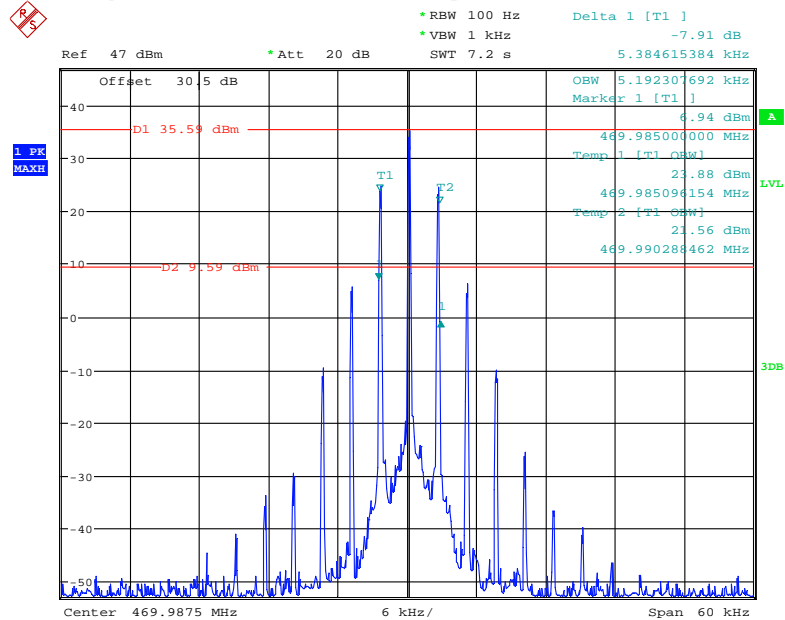
Date: 25.AUG.2021 16:42:38

**Frequency 469.9875 MHz: 99% Occupied & 26 dB Bandwidth, Low Power**



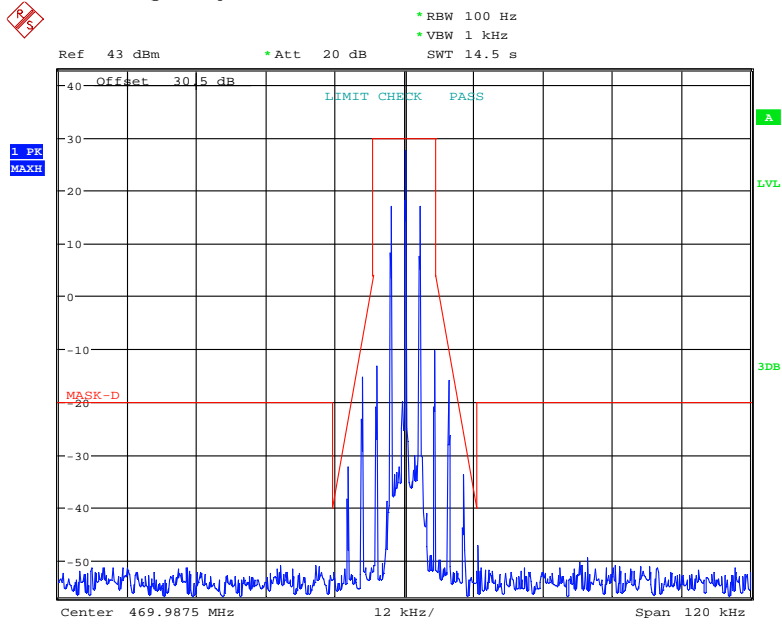
Date: 25.AUG.2021 15:47:21

**Frequency 469.9875 MHz: 99% Occupied & 26 dB Bandwidth, High Power**



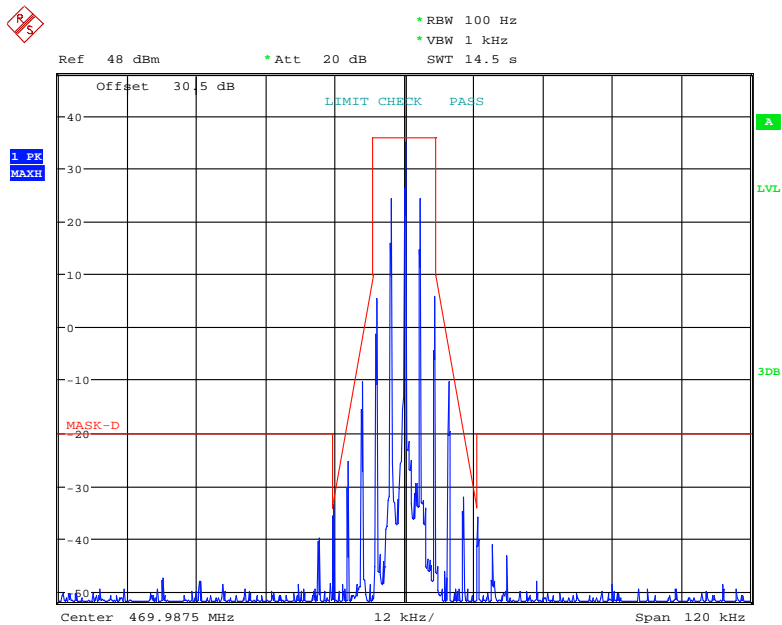
Date: 25.AUG.2021 15:45:49

### Frequency 469.9875 MHz: Emission Mask D, Low Power



Date: 25.AUG.2021 16:30:58

### Frequency 469.9875 MHz: Emission Mask D, High Power



Date: 25.AUG.2021 17:14:02

## FCC §2.1051 & §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

### Applicable Standard

Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- 1) For any frequency removed from the center of the authorized bandwidth  $f_0$  to 5.625 kHz removed from  $f_0$ , 0 dB.
- 2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5.625 kHz but no more than 12.5 kHz, at least  $7.27 (f_d - 2.88 \text{ kHz})$  dB.
- 3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 12.5 kHz: At least  $50 + 10 \log (P)$  dB or 70 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 10<sup>th</sup> harmonic.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	52 %
<b>ATM Pressure:</b>	101.0 kPa

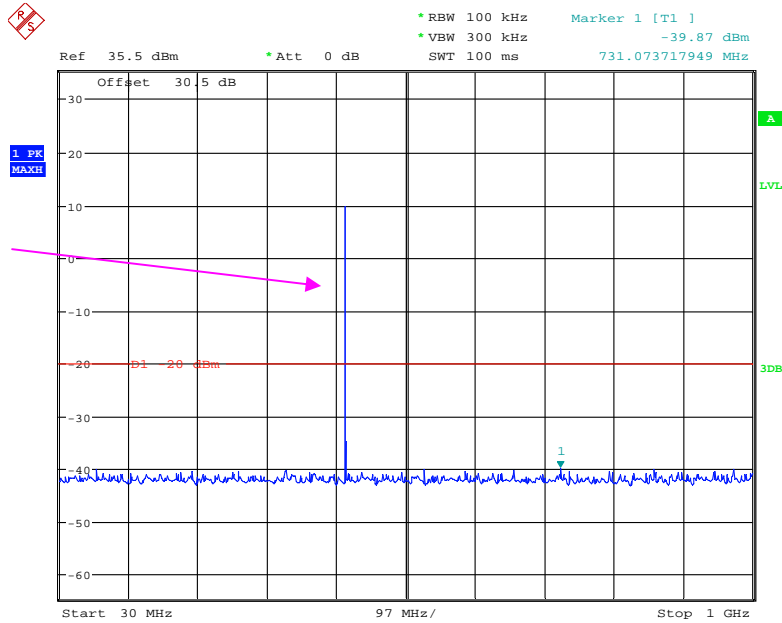
*The testing was performed by Black Chen on 2021-09-08.*

*Test Mode: Transmitting(Worst case is high power level)*

**Test Result:** *Pass. Please refer to the following tables and plots.*

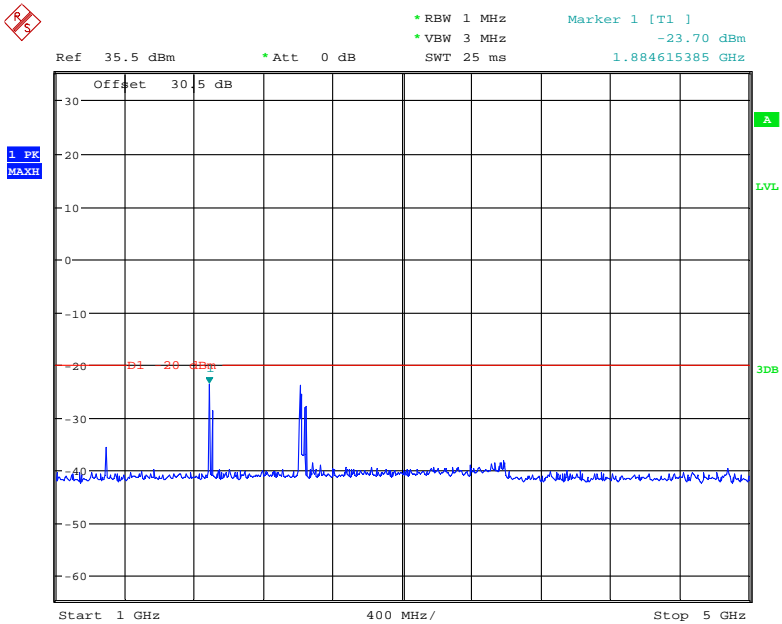
Digital

30MHz – 1 GHz, - Low Channel



Date: 8.SEP.2021 17:14:13

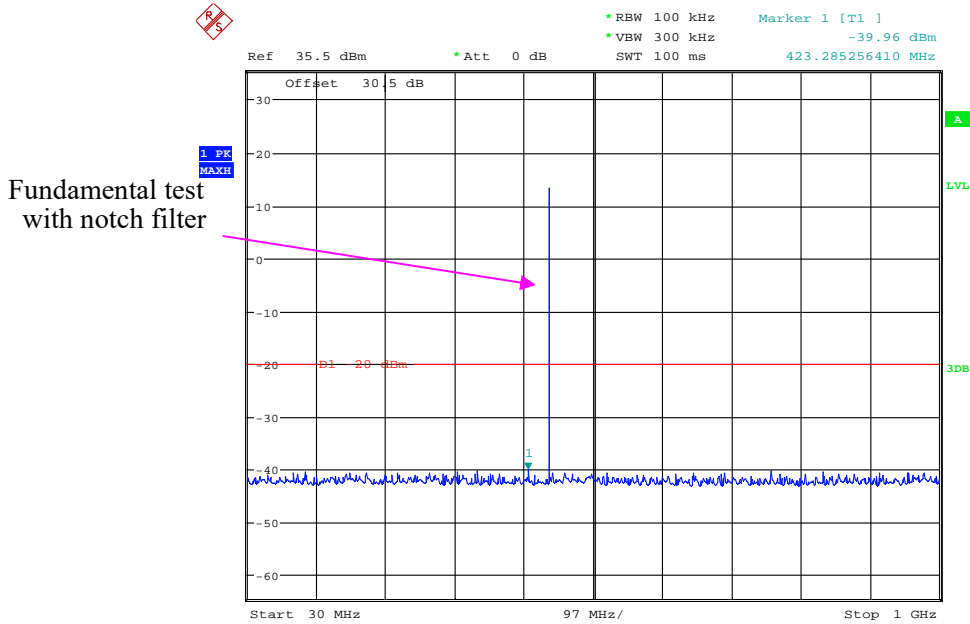
1 GHz – 5 GHz, - Low Channel



Date: 8.SEP.2021 17:21:57

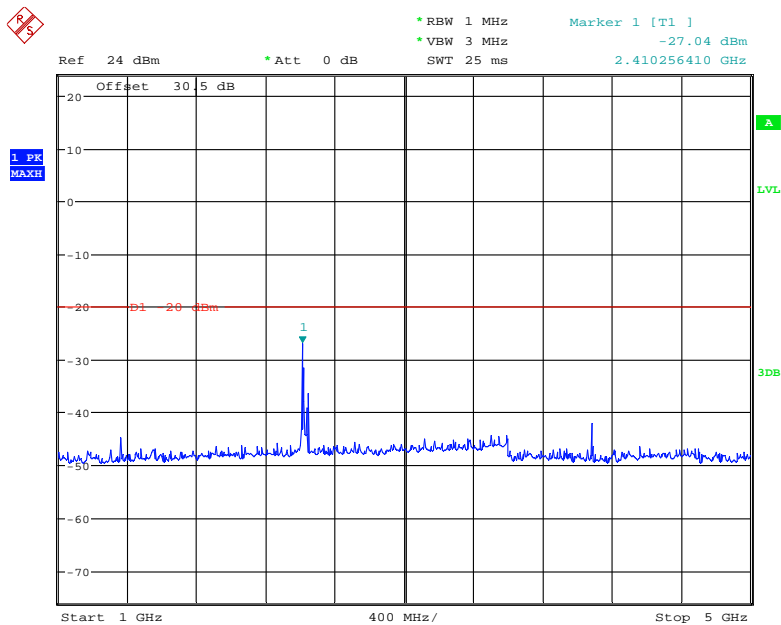


### 30MHz – 1 GHz, - Middle Channel



Date: 8.SEP.2021 17:20:23

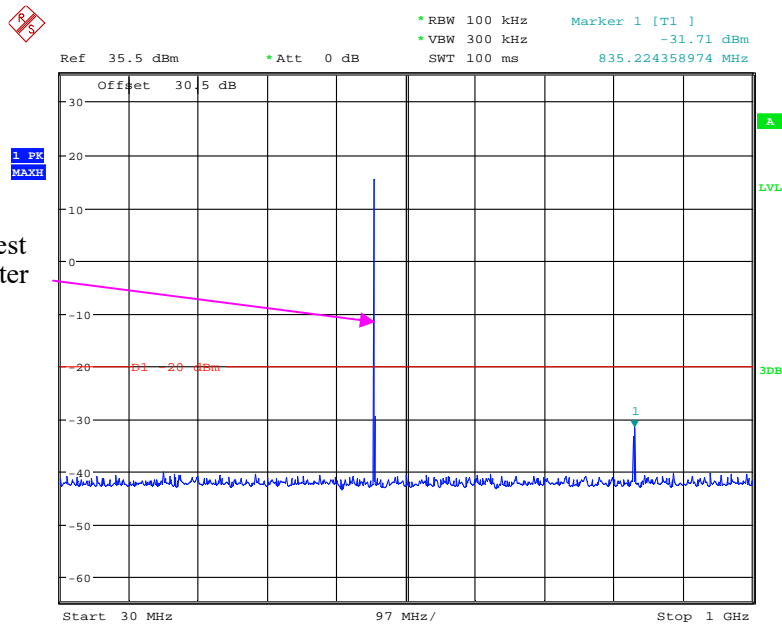
### 1 GHz – 5 GHz, Middle Channel



Date: 8.SEP.2021 17:22:17

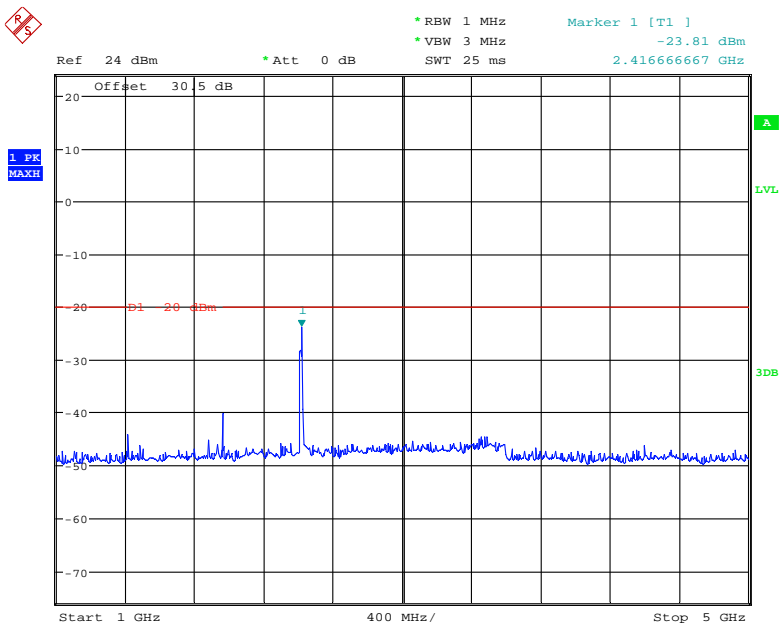
### 30MHz – 1 GHz, - High Channel

Fundamental test with notch filter



Date: 8.SEP.2021 17:17:16

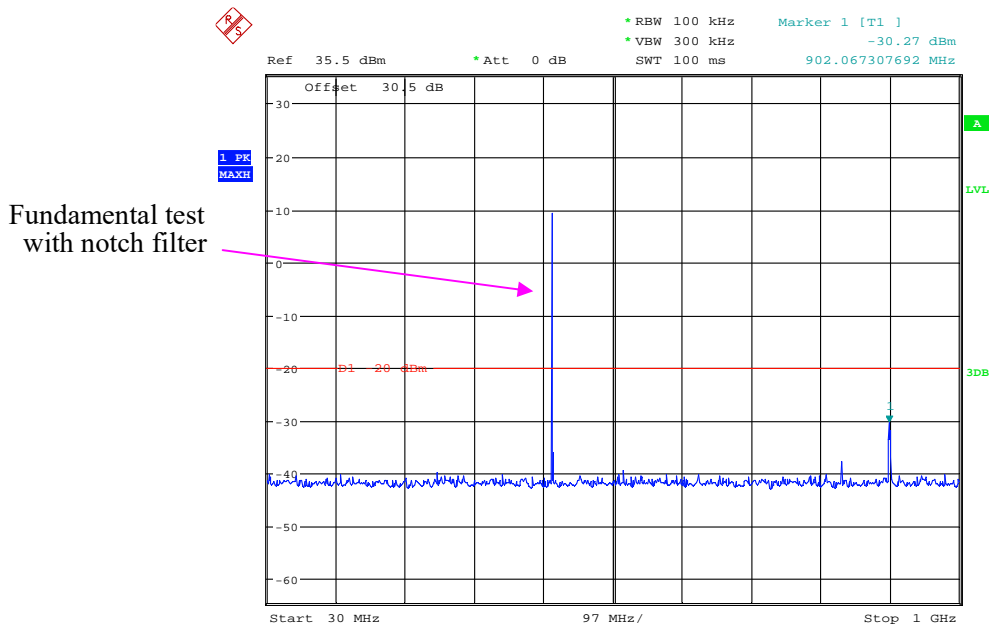
### 1 GHz – 5 GHz, High Channel



Date: 8.SEP.2021 17:22:34

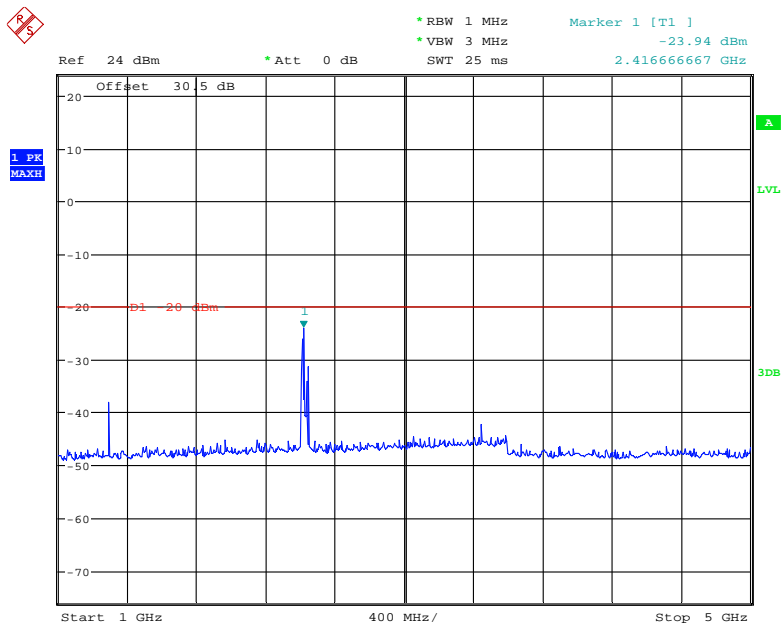
Analog

30MHz – 1 GHz, - Low Channel



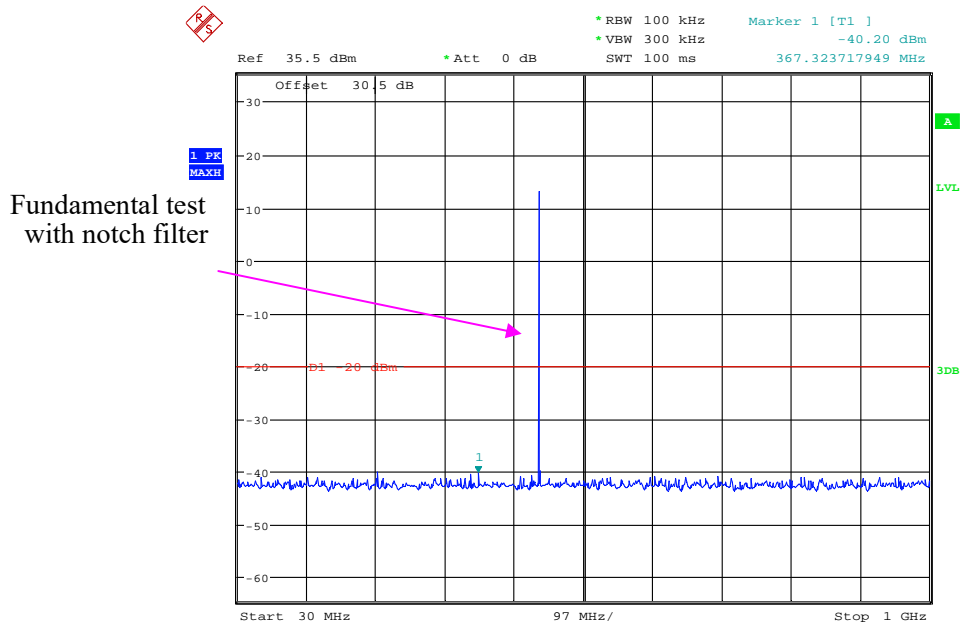
Date: 8.SEP.2021 17:18:22

1 GHz – 5 GHz, - Low Channel



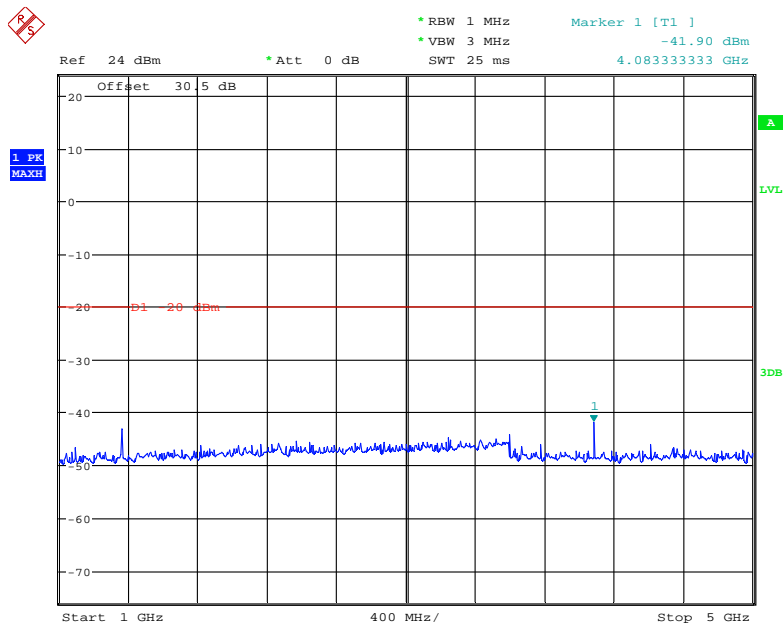
Date: 8.SEP.2021 17:23:20

### 30MHz – 1 GHz, - Middle Channel



Date: 8.SEP.2021 17:18:49

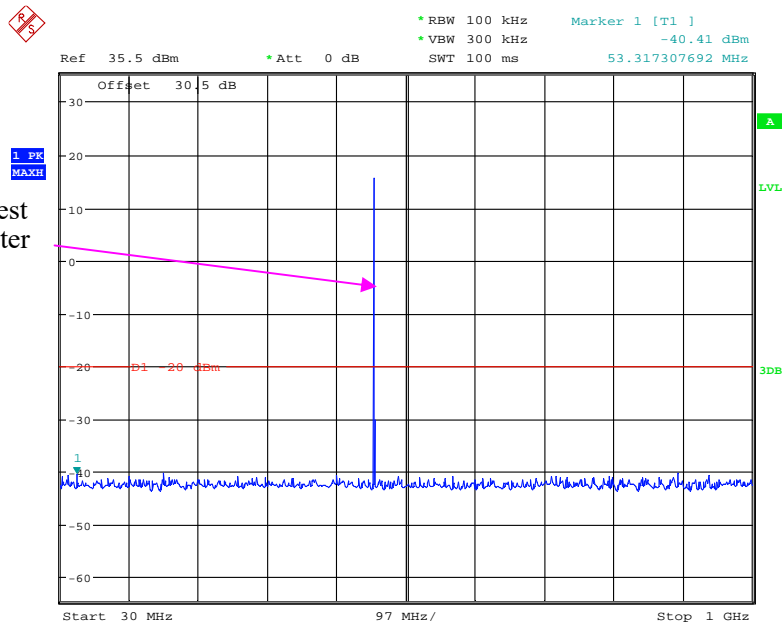
### 1 GHz – 5 GHz, Middle Channel



Date: 8.SEP.2021 17:23:34

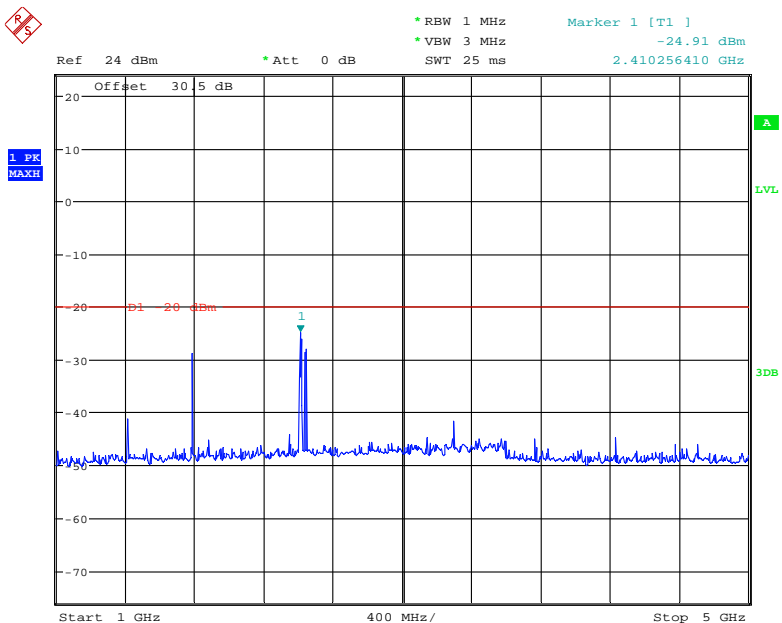
### 30MHz – 1 GHz, - High Channel

Fundamental test with notch filter



Date: 8.SEP.2021 17:19:17

### 1 GHz – 5 GHz, High Channel



Date: 8.SEP.2021 17:23:50

## FCC §2.1053 & §90.210 - RADIATED SPURIOUS EMISSIONS

### Applicable Standard

FCC §2.1053 and §90.210

### 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.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB = 50 + 10 Log<sub>10</sub> (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	26 ~28.2 °C
<b>Relative Humidity:</b>	50~ 56 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Cloud Qiu on 2021-08-28 for below 1GHz and Dio Ding on 2021-08-31 for above 1GHz.*

*Test Mode: Transmitting(Worst case is high power level)*

*Test Result: Pass. Please refer to the following tables and plots.*

Frequency (MHz)	Receiver Reading (dBμV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
Analogue 430.0125MHz										
860.025	33.69	244	2.0	H	-62.8	1.32	0.0	-64.12	-20	44.12
860.025	41.05	57	1.4	V	-54.1	1.32	0.0	-55.42	-20	35.42
1290.04	54.13	155	2.4	H	-54.7	1.60	7.30	-49.00	-20	29.00
1290.04	65.31	132	2.4	V	-43.4	1.60	7.30	-37.70	-20	17.70
1720.05	49.97	145	1.1	H	-56.8	1.30	8.90	-49.20	-20	29.20
1720.05	46.44	25	1.2	V	-59.7	1.30	8.90	-52.10	-20	32.10
2150.06	49.63	172	1.7	H	-53.9	1.30	9.80	-45.40	-20	25.40
2150.06	45.83	346	1.8	V	-58.4	1.30	9.80	-49.90	-20	29.90
2580.08	46.38	87	1.6	H	-57.6	2.20	10.20	-49.60	-20	29.60
2580.08	44.83	86	1.0	V	-58.8	2.20	10.20	-50.80	-20	30.80
3010.09	48.79	60	1.5	H	-55.0	1.60	10.80	-45.80	-20	25.80
3010.09	46.37	9	2.1	V	-57.1	1.60	10.80	-47.90	-20	27.90
3440.10	57.46	224	1.9	H	-44.0	1.40	11.80	-33.60	-20	13.60
3440.10	55.31	158	1.5	V	-46.0	1.40	11.80	-35.60	-20	15.60
3870.11	47.98	51	1.7	H	-54.4	1.60	11.90	-44.10	-20	24.10
3870.11	46.39	260	2.4	V	-55.9	1.60	11.90	-45.60	-20	25.60
4300.13	44.86	58	1.3	H	-56.7	1.50	11.70	-46.50	-20	26.50
4300.13	45.99	73	2.4	V	-54.9	1.50	11.70	-44.70	-20	24.70
Analogue 453.2125MHz										
906.425	36.25	189	1.9	H	-60.1	1.33	0.0	-61.43	-20	41.43
906.425	42.57	248	2.3	V	-53.5	1.33	0.0	-54.83	-20	34.83
1359.64	51.15	302	2.3	H	-57.1	1.60	7.90	-50.80	-20	30.80
1359.64	62.84	266	2.0	V	-45.7	1.60	7.90	-39.40	-20	19.40
1812.85	45.90	189	2.1	H	-59.5	1.30	9.30	-51.50	-20	31.50
1812.85	48.55	199	2.1	V	-56.4	1.30	9.30	-48.40	-20	28.40
2266.06	54.35	255	1.1	H	-51.6	1.30	10.00	-42.90	-20	22.90
2266.06	46.67	177	1.6	V	-59.2	1.30	10.00	-50.50	-20	30.50
2719.28	48.10	300	2.3	H	-55.6	2.00	10.40	-47.20	-20	27.20
2719.28	46.49	305	1.3	V	-56.8	2.00	10.40	-48.40	-20	28.40
3172.49	48.69	207	2.3	H	-52.2	1.60	11.50	-42.30	-20	22.30
3172.49	49.37	46	2.3	V	-51.8	1.60	11.50	-41.90	-20	21.90
3625.70	48.08	55	2.1	H	-54.3	1.50	12.10	-43.70	-20	23.70
3625.70	47.49	344	1.5	V	-54.4	1.50	12.10	-43.80	-20	23.80
4078.91	47.41	316	2.2	H	-55.0	1.40	12.20	-44.20	-20	24.20
4078.91	49.35	92	1.7	V	-52.0	1.40	12.20	-41.20	-20	21.20
4532.13	50.20	175	1.3	H	-51.7	1.50	12.10	-41.10	-20	21.10
4532.13	48.05	41	2.0	V	-53.2	1.50	12.10	-42.60	-20	22.60

Frequency (MHz)	Receiver Reading (dBµV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
Analogue 469.9875MHz										
939.975	33.39	27	2.1	H	-63.0	1.33	0.0	-64.33	-20	44.33
939.975	41.71	249	1.7	V	-54.4	1.33	0.0	-55.73	-20	35.73
1409.96	45.71	218	1.2	H	-62.6	1.60	7.90	-56.30	-20	36.30
1409.96	55.78	145	1.8	V	-52.8	1.60	7.90	-46.50	-20	26.50
1879.95	47.06	16	2.4	H	-56.2	1.30	9.40	-48.10	-20	28.10
1879.95	45.26	164	1.8	V	-58.2	1.30	9.40	-50.10	-20	30.10
2349.94	50.49	71	1.0	H	-55.5	1.30	10.00	-46.80	-20	26.80
2349.94	45.55	111	1.5	V	-60.3	1.30	10.00	-51.60	-20	31.60
2819.93	48.89	116	2.4	H	-55.7	1.80	10.50	-47.00	-20	27.00
2819.93	51.30	54	1.4	V	-52.9	1.80	10.50	-44.20	-20	24.20
3289.91	54.43	11	1.5	H	-46.5	1.50	11.70	-36.30	-20	16.30
3289.91	53.81	294	1.1	V	-47.2	1.50	11.70	-37.00	-20	17.00
3759.90	51.96	182	1.2	H	-51.2	1.50	11.80	-40.90	-20	20.90
3759.90	51.23	214	2.2	V	-51.4	1.50	11.80	-41.10	-20	21.10
4229.89	48.99	355	2.3	H	-53.2	1.50	11.80	-42.90	-20	22.90
4229.89	51.32	322	1.7	V	-50.1	1.50	11.80	-39.80	-20	19.80
4699.88	49.50	32	2.2	H	-53.1	1.70	12.00	-42.80	-20	22.80
4699.88	51.66	196	1.0	V	-49.3	1.70	12.00	-39.00	-20	19.00



Frequency (MHz)	Receiver Reading (dBµV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
Digital 430.0125MHz										
860.025	44.06	103	2.4	H	-52.4	1.32	0.0	-53.72	-20	33.72
860.025	53.98	238	2.0	V	-41.1	1.32	0.0	-42.42	-20	22.42
1290.04	52.63	146	2.3	H	-56.2	1.60	7.30	-50.50	-20	30.50
1290.04	63.92	122	1.8	V	-44.8	1.60	7.30	-39.10	-20	19.10
1720.05	55.46	94	2.4	H	-51.3	1.30	8.90	-43.70	-20	23.70
1720.05	47.57	70	1.2	V	-58.6	1.30	8.90	-51.00	-20	31.00
2150.06	56.83	132	1.4	H	-46.7	1.30	9.80	-38.20	-20	18.20
2150.06	49.05	106	1.0	V	-55.1	1.30	9.80	-46.60	-20	26.60
2580.08	50.01	123	1.3	H	-54.0	2.20	10.20	-46.00	-20	26.00
2580.08	47.60	210	1.0	V	-56.0	2.20	10.20	-48.00	-20	28.00
3010.09	48.95	27	1.4	H	-54.8	1.60	10.80	-45.60	-20	25.60
3010.09	46.25	311	1.1	V	-57.2	1.60	10.80	-48.00	-20	28.00
3440.10	59.09	359	2.4	H	-42.4	1.40	11.80	-32.00	-20	12.00
3440.10	56.16	116	1.6	V	-45.1	1.40	11.80	-34.70	-20	14.70
3870.11	57.49	282	1.4	H	-44.9	1.60	11.90	-34.60	-20	14.60
3870.11	58.48	241	1.6	V	-43.8	1.60	11.90	-33.50	-20	13.50
4300.13	54.76	223	1.0	H	-46.8	1.50	11.70	-36.60	-20	16.60
4300.13	54.65	25	2.2	V	-46.2	1.50	11.70	-36.00	-20	16.00
Digital 453.2125MHz										
906.425	46.41	69	1.7	H	-49.9	1.33	0.0	-51.23	-20	31.23
906.425	54.22	337	2.4	V	-41.9	1.33	0.0	-43.23	-20	23.23
1359.64	52.06	211	1.7	H	-56.2	1.60	7.90	-49.90	-20	29.90
1359.64	64.47	131	1.2	V	-44.1	1.60	7.90	-37.80	-20	17.80
1812.85	49.23	285	1.4	H	-56.1	1.30	9.30	-48.10	-20	28.10
1812.85	51.56	89	2.1	V	-53.4	1.30	9.30	-45.40	-20	25.40
2266.06	56.80	346	2.4	H	-49.2	1.30	10.00	-40.50	-20	20.50
2266.06	49.27	46	1.5	V	-56.6	1.30	10.00	-47.90	-20	27.90
2719.28	52.38	198	1.5	H	-51.3	2.00	10.40	-42.90	-20	22.90
2719.28	45.86	16	2.1	V	-57.5	2.00	10.40	-49.10	-20	29.10
3172.49	52.69	262	2.2	H	-48.2	1.60	11.50	-38.30	-20	18.30
3172.49	51.14	313	1.8	V	-50.0	1.60	11.50	-40.10	-20	20.10
3625.70	47.46	333	1.1	H	-55.0	1.50	12.10	-44.40	-20	24.40
3625.70	49.62	356	2.5	V	-52.3	1.50	12.10	-41.70	-20	21.70
4078.91	53.48	350	1.5	H	-48.9	1.40	12.20	-38.10	-20	18.10
4078.91	52.82	21	2.4	V	-48.5	1.40	12.20	-37.70	-20	17.70
4532.13	54.87	239	2.1	H	-47.0	1.50	12.10	-36.40	-20	16.40
4532.13	56.71	357	1.7	V	-44.5	1.50	12.10	-33.90	-20	13.90

Frequency (MHz)	Receiver Reading (dBµV)	Turn Table Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
Digital 469.9875MHz										
939.975	44.63	257	1.3	H	-51.7	1.33	0.0	-53.03	-20	33.03
939.975	53.53	314	1.6	V	-42.5	1.33	0.0	-43.83	-20	23.83
1409.96	46.55	199	1.6	H	-61.7	1.60	7.90	-55.40	-20	35.40
1409.96	55.26	336	2.4	V	-53.3	1.60	7.90	-47.00	-20	27.00
1879.95	45.29	358	1.5	H	-58.0	1.30	9.40	-49.90	-20	29.90
1879.95	44.01	50	2.2	V	-59.5	1.30	9.40	-51.40	-20	31.40
2349.94	51.06	304	1.6	H	-54.9	1.30	10.00	-46.20	-20	26.20
2349.94	46.28	130	2.5	V	-59.6	1.30	10.00	-50.90	-20	30.90
2819.93	45.18	179	1.4	H	-59.4	1.80	10.50	-50.70	-20	30.70
2819.93	44.60	86	2.0	V	-59.6	1.80	10.50	-50.90	-20	30.90
3289.91	51.97	102	2.3	H	-49.0	1.50	11.70	-38.80	-20	18.80
3289.91	51.47	16	1.6	V	-49.5	1.50	11.70	-39.30	-20	19.30
3759.90	52.22	155	2.3	H	-50.9	1.50	11.80	-40.60	-20	20.60
3759.90	54.19	26	1.5	V	-48.5	1.50	11.80	-38.20	-20	18.20
4229.89	53.97	130	2.4	H	-48.2	1.50	11.80	-37.90	-20	17.90
4229.89	51.85	69	1.7	V	-49.5	1.50	11.80	-39.20	-20	19.20
4699.88	52.53	204	1.0	H	-50.1	1.70	12.00	-39.80	-20	19.80
4699.88	52.15	213	1.7	V	-48.8	1.70	12.00	-38.50	-20	18.50

**Note:**  
 Absolute Level = Substituted Level - Cable loss + Antenna Gain  
 Margin = Limit- Absolute Level

## **FCC §2.1055 & §90.213 - FREQUENCY STABILITY**

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### **Applicable Standard**

FCC §2.1055 and §90.213

### **Test Procedure**

Frequency Stability vs. Temperature: The equipment under test was connected to an external AC/DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The power cable and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

### **Test Data**

#### **Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	52 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Black Chen on 2021-08-30.*

*Test Mode: Transmitting(Worst case is high power level)*

***Test Result: Pass. Please refer to the following tables and plots.***

For Analog Modulation

Reference Frequency: 453.2125MHz, Limit:±2.5 ppm, channel spacing: 12.5kHz			
Environment Temperature (°C)	Power Supplied (V <sub>DC</sub> )	Frequency Measure with Time Elapsed	
		MCF (MHz)	ppm Error
50	7.4	453.212356	-0.318
40	7.4	453.212348	-0.335
30	7.4	453.212370	-0.287
20	7.4	453.212370	-0.287
10	7.4	453.212373	-0.280
0	7.4	453.212373	-0.280
-10	7.4	453.212359	-0.311
-20	7.4	453.212329	-0.377
-30	7.4	453.212349	-0.333
Frequency Stability Versus Input Voltage			
20	6.8	453.212348	-0.335
20	8.4	453.212359	-0.311

For DIGITAL

Reference Frequency: 453.2125 MHz, Limit: ±2.5 ppm, channel spacing: 12.5kHz			
Environment Temperature (°C)	Power Supplied (V <sub>DC</sub> )	Frequency Measure with Time Elapsed	
		MCF (MHz)	ppm Error
50	7.4	453.212348	-0.335
40	7.4	453.212384	-0.256
30	7.4	453.212387	-0.249
20	7.4	453.212378	-0.269
10	7.4	453.212385	-0.254
0	7.4	453.212385	-0.254
-10	7.4	453.212385	-0.254
-20	7.4	453.212389	-0.245
-30	7.4	453.212385	-0.254
Frequency Stability Versus Input Voltage			
20	6.8	453.212368	-0.291
20	8.4	453.212378	-0.269

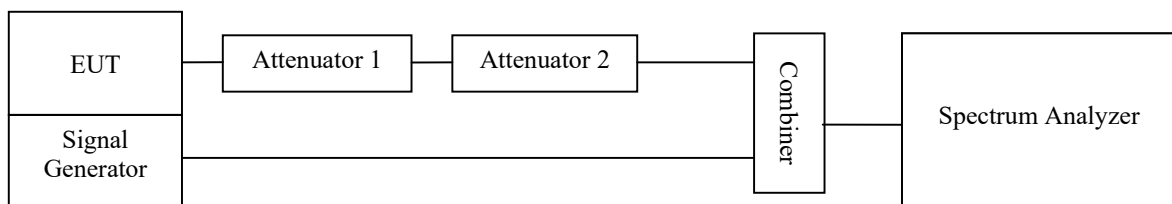
## FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

### Applicable Standard

Regulations: FCC §90.214  
Test method: ANSI C63.26-2015

### Test Procedure

- a) Connect the EUT and test equipment as shown on the following block diagram.
- b) Set the Spectrum 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  $\pm 12.5$  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  $\pm 4$  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 "trigger 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**

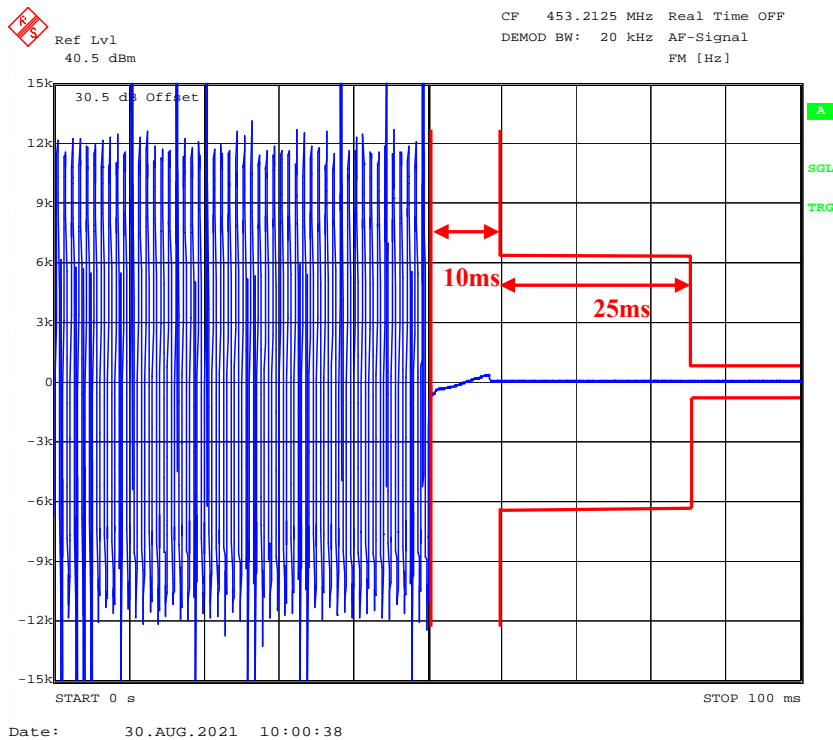
<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	52 %
<b>ATM Pressure:</b>	101.0 kPa

The testing was performed by Black Chen on 2021-08-30.

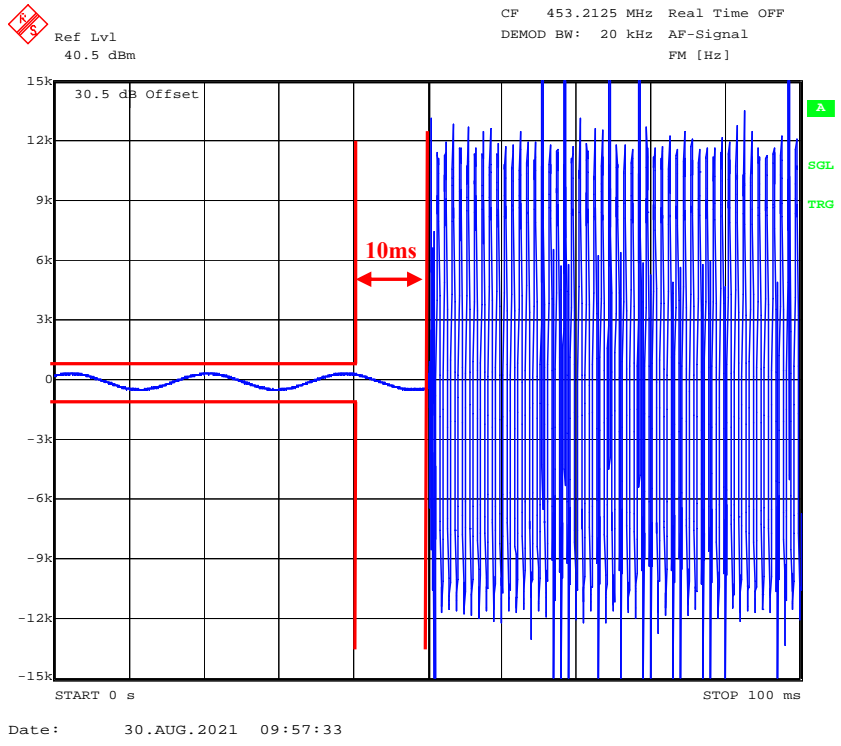
**Test Result:** Pass. Please refer to the following tables and plots.

Channel Separation (kHz)	Transient Period (ms)	Transient Frequency	Result
12.5	10 (t1)	<+/-12.5 kHz	Pass
	25(t2)	<+/-6.25 kHz	
	10 (t3)	<+/-12.5 kHz	

**Turn on**



### Turn off



\*\*\*\*\* END OF REPORT \*\*\*\*\*