TEST REPORT

Applicant Name :	CALTTA TECHNOLOGIES CO., LTD.
Address :	Floor12,Building G2,international E-City, Nanshan District, Shenzhen, China
Report Number :	SZNS220519-21600E-RF-00C
FCC ID:	2AQV7PH6X0UHF

Test Standard (s)

FCC PART 90

Sample Description

Product Type:	Digital Portable Radio
Model No.:	PH690 UHF
Multiple Model(s) No.:	PH660 UHF, PH600 UHF, PH690 U(1), PH660 U(1), PH600 U(1) (Please refer to DOS for Model difference)
Trade Mark:	Caltta
Date Received:	2022/05/19
Report Date:	2022/06/29

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Nick Fang

EMC Engineer

Approved By:

Robert Li

EMC Engineer

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Frequency Range	400-470MHz
Rated Transmit Power	4.0Watts(High) 1.0Watt(Low)
Channel separation	12.5kHz
Modulation Technique	4FSK/FM
Voltage Range	DC 7.4V from battery or DC 12.0V from adapter
Sample serial number	Model: PH690 UHF SZNS220519-21600E-RF-S3 Model: PH600 U(1) SZNS220519-21600E-RF-S3 Model: PH660 U(1) SZNS220519-21600E-RF-S1 (Assigned by ATC)
Sample/EUT Status	Good condition
Adapter information	Model: ES085H-X120100XYF Input: AC 100-240V, 50/60Hz, 0.5A Output: DC 12.0V, 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 Shenzhen Accurate Technology Co., Ltd. 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, conducted		±0.73dB
Unwanted Emission, conducted		±1.6dB
RF Frequency		$\pm 0.082*10^{-7}$
Emissions, Radiated	30MHz - 1GHz	±4.28dB
	1GHz - 18GHz	±4.98dB
	18GHz - 26.5GHz	±5.06dB
Temperature		±1℃
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 Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Justification

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

Equipment Modifications

No modification was made to the EUT.

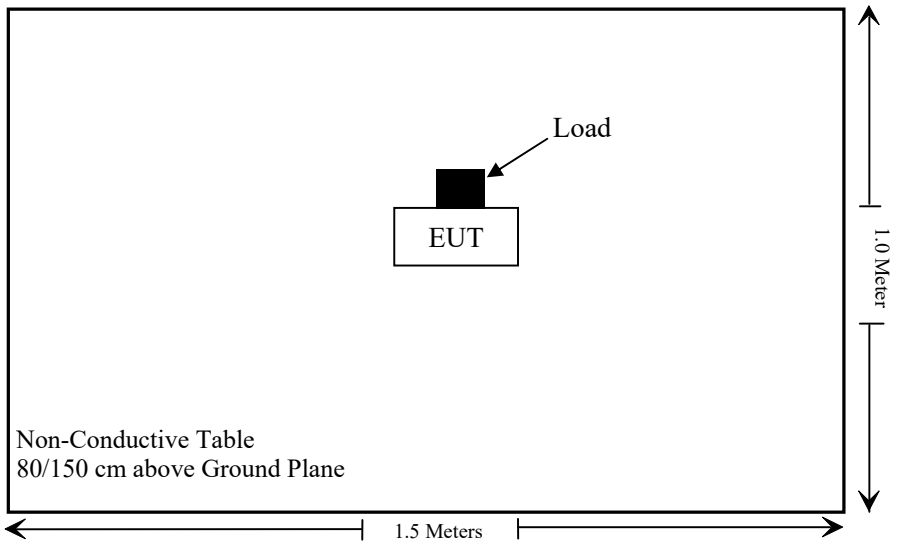
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Unknown	Load	Unknown	Unknown

External I/O Cable

Cable Description	Length (m)	From Port	To
/	/	/	

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§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

Note 1: The multiple models are electrically identical with the Model:PH690 UHF. Please refer to the declaration letter for more details, which was provided by the applicant. Fully test was performed with Model:PH690 UHF except radiation emission below 1GHz test with Model: PH690 UHF, PH600 U(1), PH660 U(1).

Note 2: The EUT has two battery which the model is AB610 and AB660, pre-scan with the two battery, the worst case is the model AB660 which was recorded in the report.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2021/12/13	2022/12/12
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2021/12/13	2022/12/12
SONOMA INSTRUMENT	Amplifier	310 N	186131	2021/11/09	2022/11/08
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2021/11/09	2022/11/08
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Bilog Antenna	VULB9163	9163-194	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-655	2020/01/05	2023/01/04
Unknown	Pass filter	NHP-600+	F-03-EM131	2021/11/29	2022/11/28
Anritsu	Signal Generator	68369B	004114	2021/07/31	2022/07/30
Unknown	RF Coaxial Cable	No.11	N1000	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	2022/12/13
RF Conducted Test					
SPECTRUM ANALYZER	Rohde & Schwarz	FSU26	200982	2021/07/06	2022/07/05
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2022/04/24	2023/04/24
E-Microwave	Notch Filter	OBF-ZP-400-470-NF	OE01201051	2021/10/15	2022/10/14
HP Agilent	RF Communication test set	8920B	3325U00859	2021/12/14	2022/12/13
Aeroflex/Weinschel	30dB Attenuator (Input 250W/Output 50W)	58-30-33	PS467	2021/12/14	2022/12/13
Mini-Circuits	Power Splitter	DC-18000MHz	SF10944151S	2021/12/14	2022/12/13
Gongwen	Temp. & Humid. Chamber	HSD-500	109	2021/10/14	2022/10/13
Fluke	Multi Meter	45	7664009	2021/12/14	2022/12/13
Manson	DC Power Source	KPS-6604	ATCS-205	NCR	NCR
Unknown	RF Cable	Unknown	Unknown	Each time	

* Statement of Traceability: Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

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

Applicable Standard

FCC§1.1310 and §2.1093.

Test Result

Compliance, please refer to the SAR report: CR22050033-SA.

FCC §2.1046 & §90.205 - RF OUTPUT POWER

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

Temperature:	26.9 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-17.

Test Mode: Transmitting

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

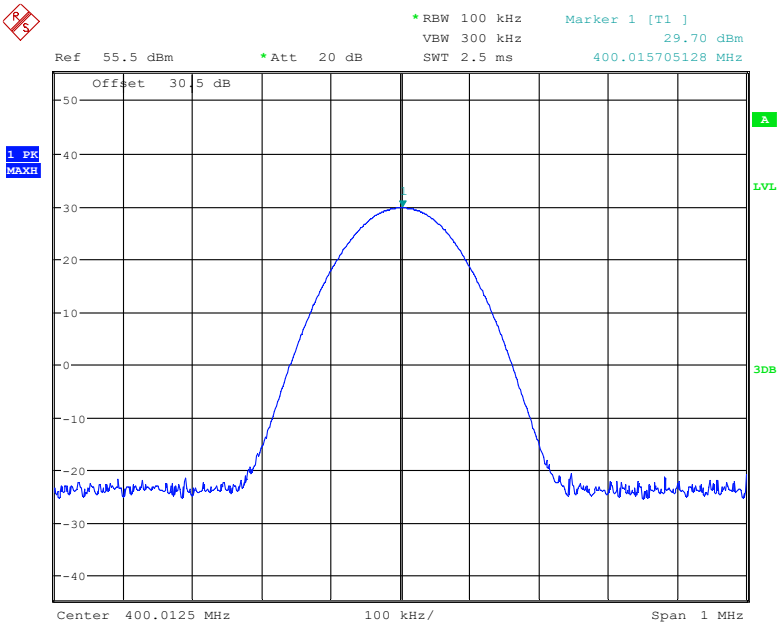
Conducted Output Power

Mode	Frequency Spacing (kHz)	Frequency (MHz)	Power level	Output Power (dBm)	Output Power (W)
Digital	12.5	400.0125	Low	29.70	0.933
			High	35.99	3.972
	12.5	435.0125	Low	30.62	1.153
			High	36.01	3.990
	12.5	469.9875	Low	29.39	0.869
			High	35.94	3.926
Analog	12.5	400.0125	Low	29.70	0.933
			High	35.99	3.972
	12.5	435.0125	Low	30.60	1.148
			High	36.01	3.990
	12.5	469.9875	Low	29.37	0.865
			High	35.94	3.926

Note: Rated high power: 4W, so the limit is 3.2W~4.8W.
Rated low power: 1W, so the limit is 0.8W~1.2W.

Digital**:**

Frequency 400.0125 MHz, low



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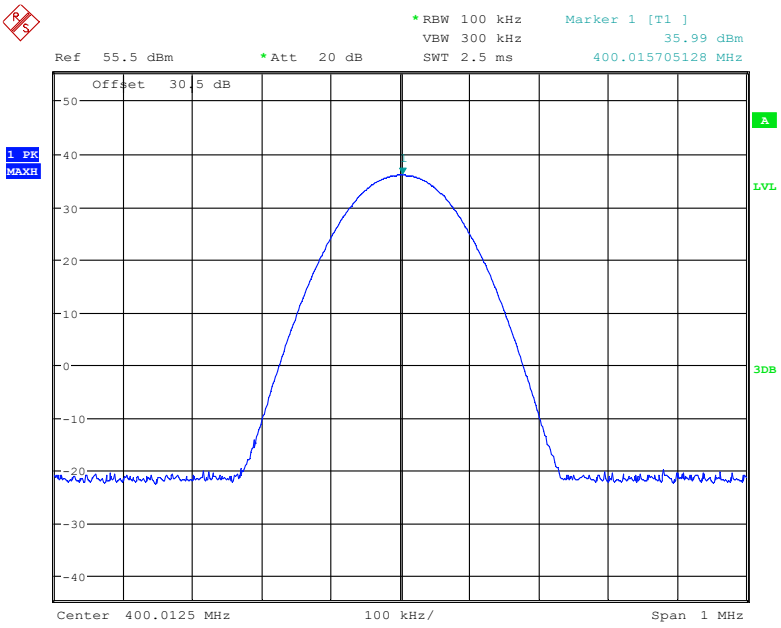
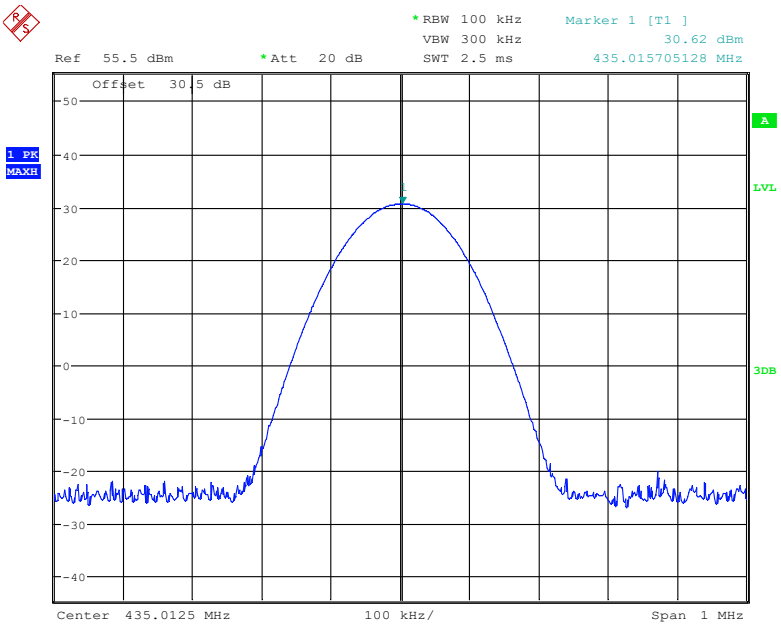
Frequency 400.0125 MHz, high



Date: 17.JUN.2022 14:10:44

Frequency 435.0125MHz, low



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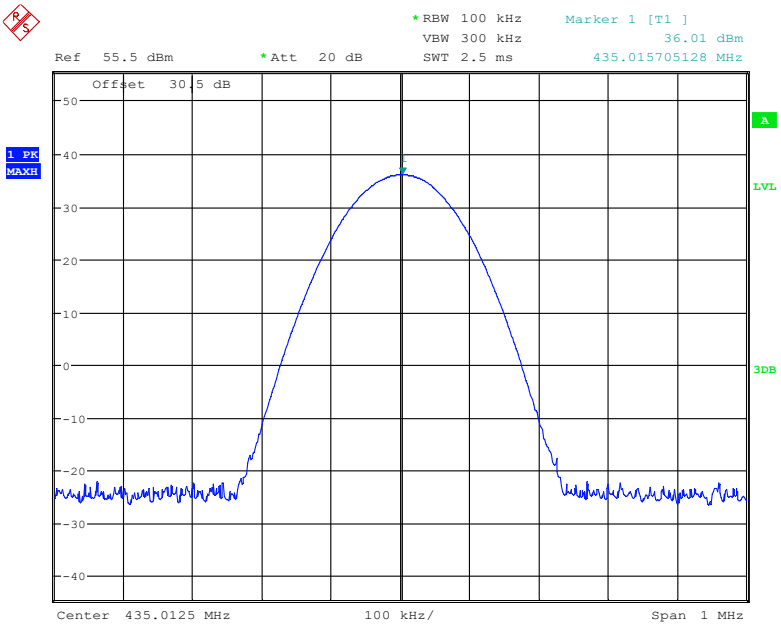
Frequency 435.0125MHz, high



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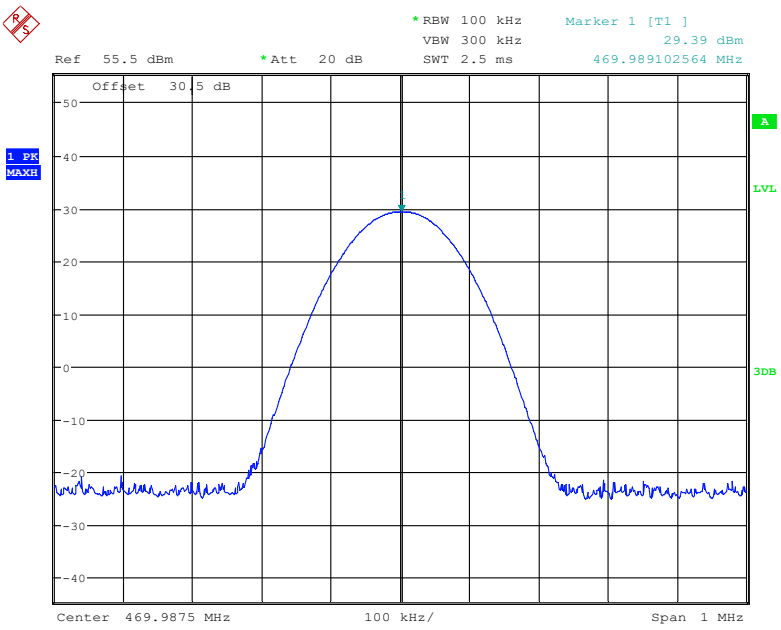
Frequency 469.9875 MHz, low



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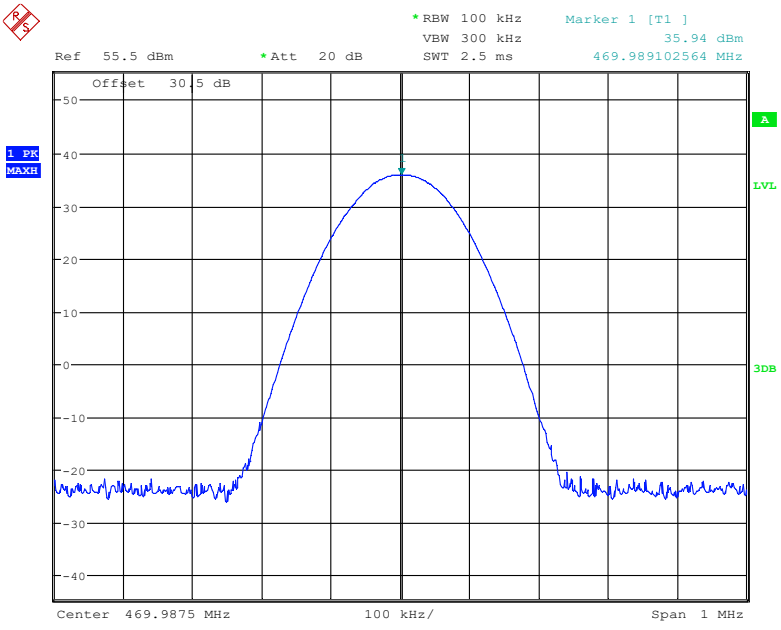
Frequency 469.9875 MHz, high



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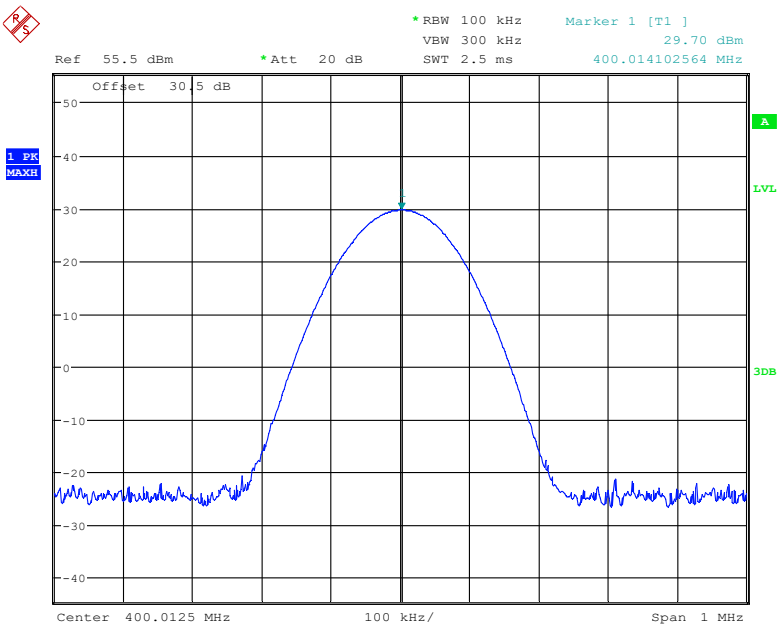
Analog

Frequency 400.0125 MHz, low



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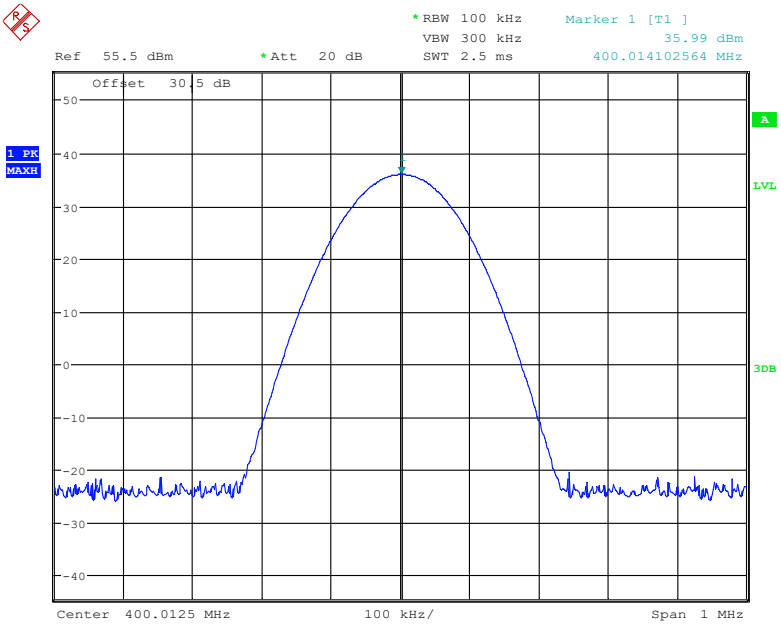
Frequency 400.0125 MHz, high



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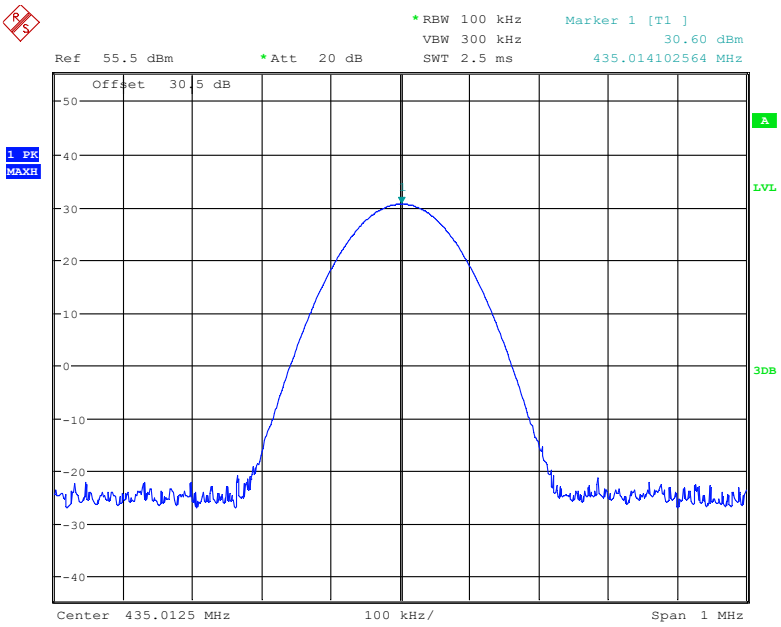
Frequency 435.0125MHz, low



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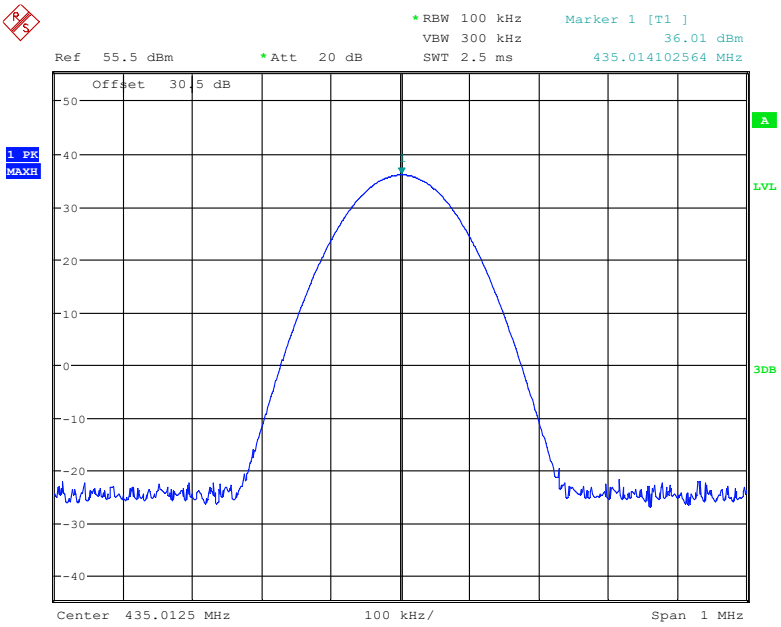
Frequency 435.0125MHz, high



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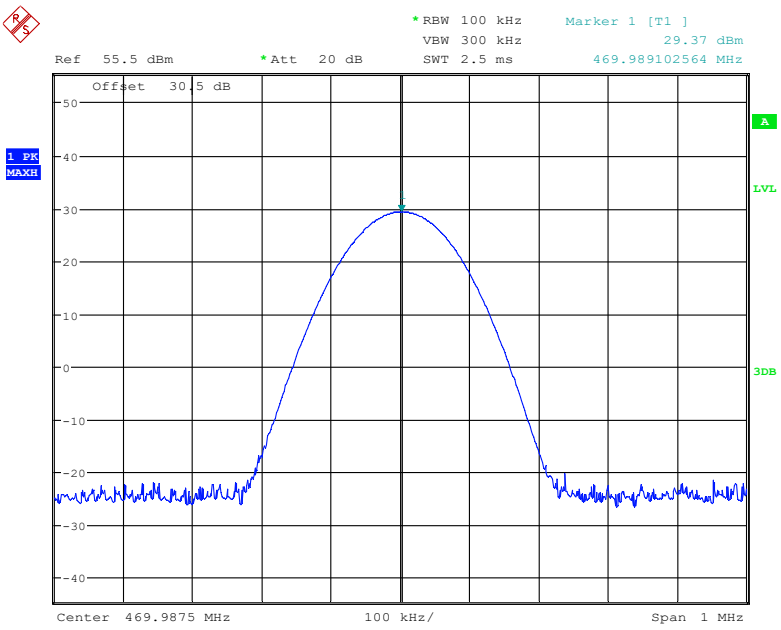
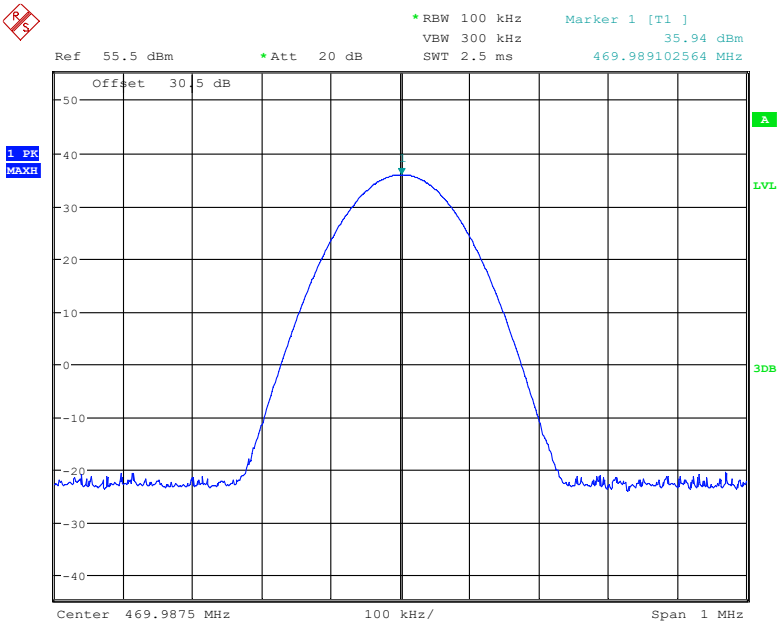
Frequency 469.9875 MHz, low



Date: 17.JUN.2022 14:16:28

Frequency 469.9875 MHz, high



Date: 17.JUN.2022 14:16:04

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

Temperature:	26.9 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-17.

Test Mode: Transmitting

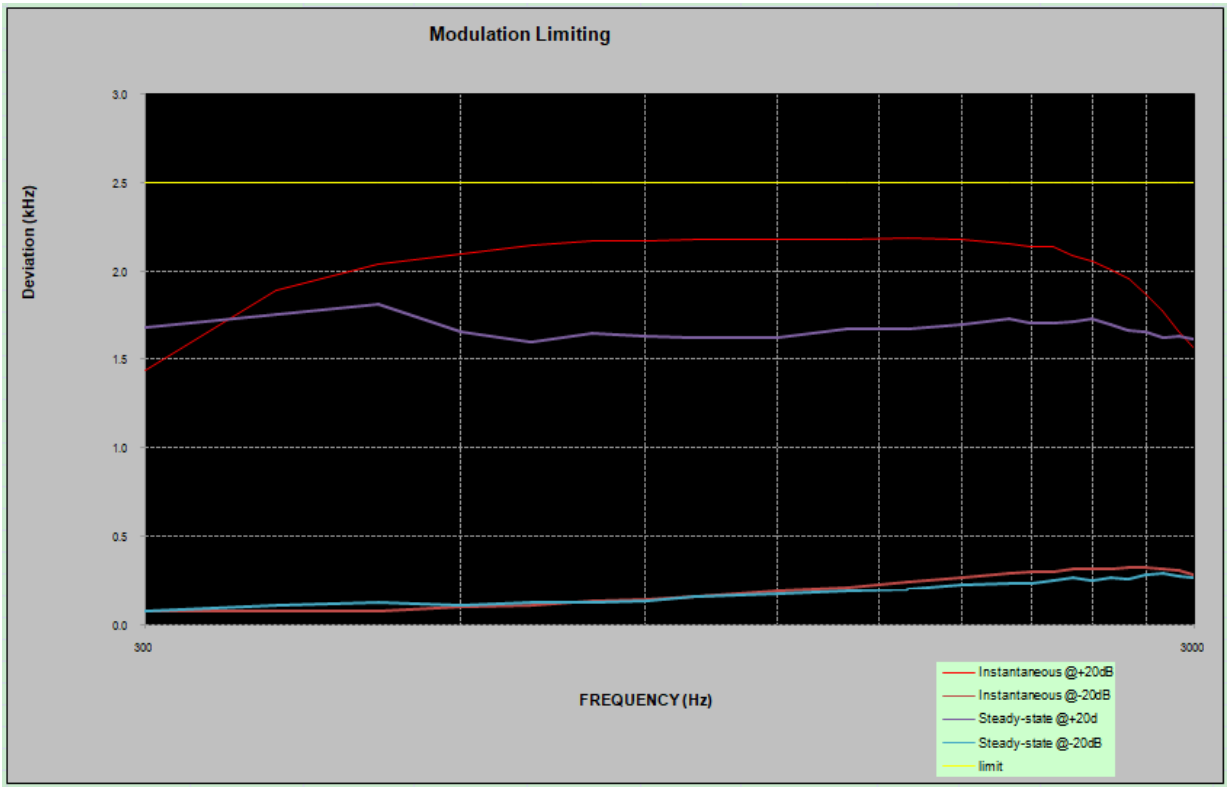
Test Result: *Pass. Please refer to the following tables and plots.*

Analog Modulation:

MODULATION LIMITING

Carrier Frequency: 435.0125 MHz, Channel Separation=12.5 kHz

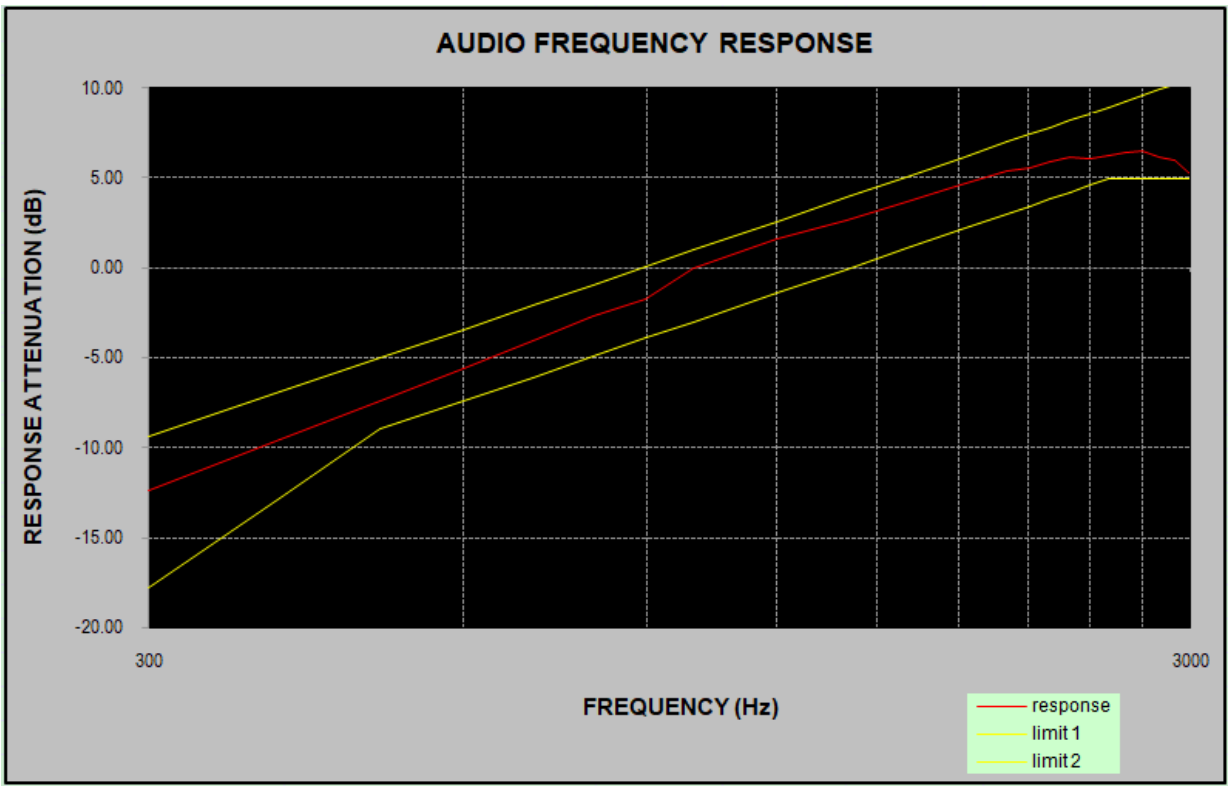
Audio Frequency (Hz)	Instantaneous		Steady-state		FCC Limit [kHz]
	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	DEVIATION (@+20dB) [kHz]	DEVIATION (@-20dB) [kHz]	
300	1.443	0.075	1.686	0.078	2.500
400	1.891	0.080	1.758	0.111	2.500
500	2.041	0.081	1.815	0.124	2.500
600	2.101	0.106	1.656	0.114	2.500
700	2.144	0.109	1.602	0.125	2.500
800	2.175	0.133	1.648	0.125	2.500
900	2.174	0.144	1.636	0.134	2.500
1000	2.180	0.157	1.625	0.157	2.500
1200	2.179	0.190	1.628	0.175	2.500
1400	2.180	0.210	1.677	0.197	2.500
1600	2.190	0.241	1.675	0.203	2.500
1800	2.177	0.267	1.702	0.225	2.500
2000	2.156	0.292	1.729	0.238	2.500
2100	2.141	0.301	1.705	0.231	2.500
2200	2.137	0.302	1.708	0.249	2.500
2300	2.093	0.314	1.715	0.269	2.500
2400	2.057	0.313	1.732	0.252	2.500
2500	2.003	0.314	1.698	0.268	2.500
2600	1.954	0.325	1.668	0.257	2.500
2700	1.867	0.322	1.659	0.284	2.500
2800	1.779	0.315	1.628	0.295	2.500
2900	1.662	0.312	1.632	0.277	2.500
3000	1.559	0.285	1.618	0.269	2.500


Modulation Limiting
Deviation (kHz)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
300
3000
FREQUENCY (Hz)
Instantaneous @+20dB
Instantaneous @-20dB
Steady-state @+20d
Steady-state @-20dB
limit

Audio Frequency Response

Carrier Frequency: 435.0125MHz, Channel Separation=12.5 kHz

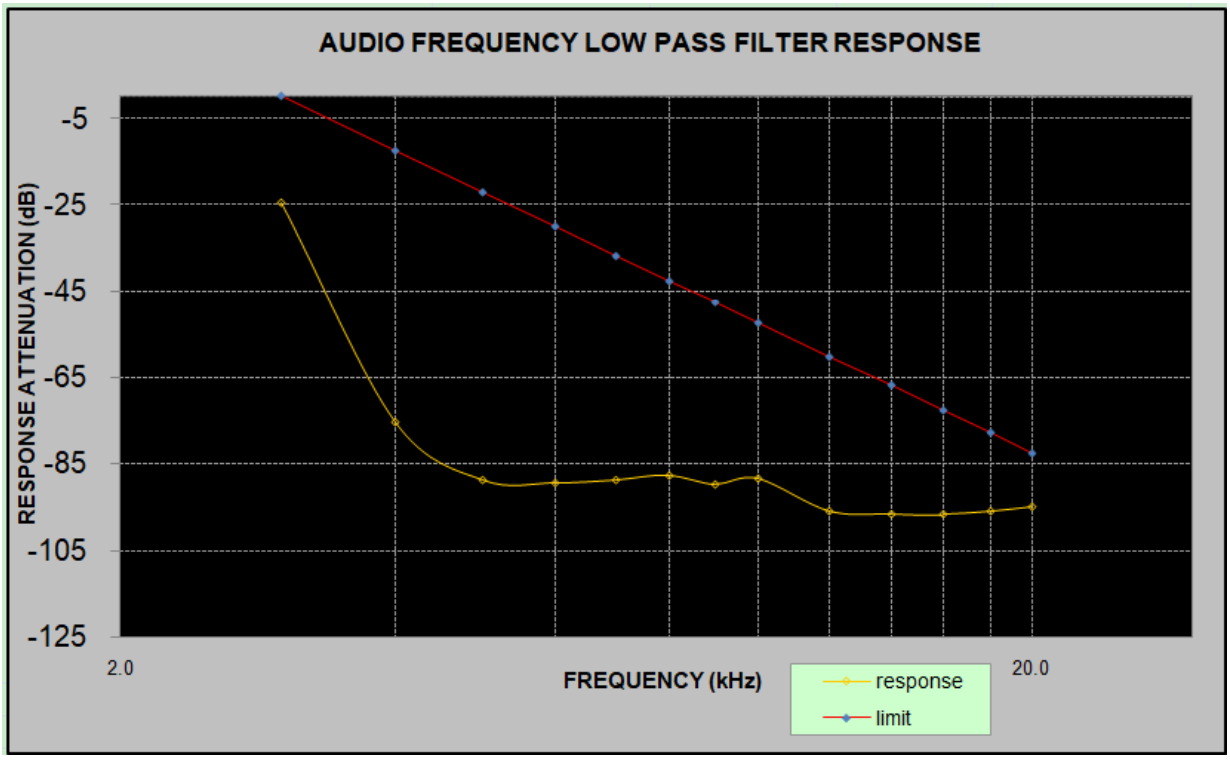
Audio Frequency (Hz)	Response Attenuation (dB)
300	-12.40
400	-9.53
500	-7.41
600	-5.65
700	-4.04
800	-2.69
900	-1.70
1000	0.00
1200	1.58
1400	2.65
1600	3.66
1800	4.62
2000	5.36
2100	5.58
2200	5.92
2300	6.16
2400	6.06
2500	6.21
2600	6.43
2700	6.48
2800	6.19
2900	5.97
3000	5.20


AUDIO FREQUENCY RESPONSE
RESPONSE ATTENUATION (dB)
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
300
3000
FREQUENCY (Hz)
response
limit 1
limit 2

Audio frequency lows pass filter response

Carrier Frequency: 435.0125MHz, Channel Separation=12.5 kHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-24.5	0.0
4.0	-75.4	-12.5
5.0	-88.9	-22.2
6.0	-89.5	-30.1
7.0	-88.6	-36.8
8.0	-87.7	-42.6
9.0	-89.8	-47.7
10.0	-88.5	-52.3
12.0	-95.9	-60.2
14.0	-96.5	-66.9
16.0	-96.8	-72.7
18.0	-95.9	-77.8
20.0	-94.8	-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 5.626 kHz but no more than 12.5 kHz, at least 7.27 (f_d –2.88 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 ±50 kHz from the carrier frequency.

Test Data

Environmental Conditions

Temperature:	26.9 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-17.

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	400.0125	Low	10.000	10.385
	12.5		High	9.904	10.385
Digital	12.5	400.0125	Low	7.788	9.327
	12.5		High	7.308	9.712

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)
Analog	12.5	435.0125	Low	9.904	10.288
	12.5		High	9.904	10.288
Digital	12.5	435.0125	Low	7.692	10.000
	12.5		High	7.500	9.423

Modulation	Channel Separation (kHz)	Frequency (MHz)	Power Level	99% Occupied Bandwidth (kHz)	26 dB Emissions Bandwidth (kHz)
Analog	12.5	469.9875	Low	10.000	10.385
	12.5		High	10.000	10.385
Digital	12.5	469.9875	Low	7.404	9.615
	12.5		High	6.923	8.750

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

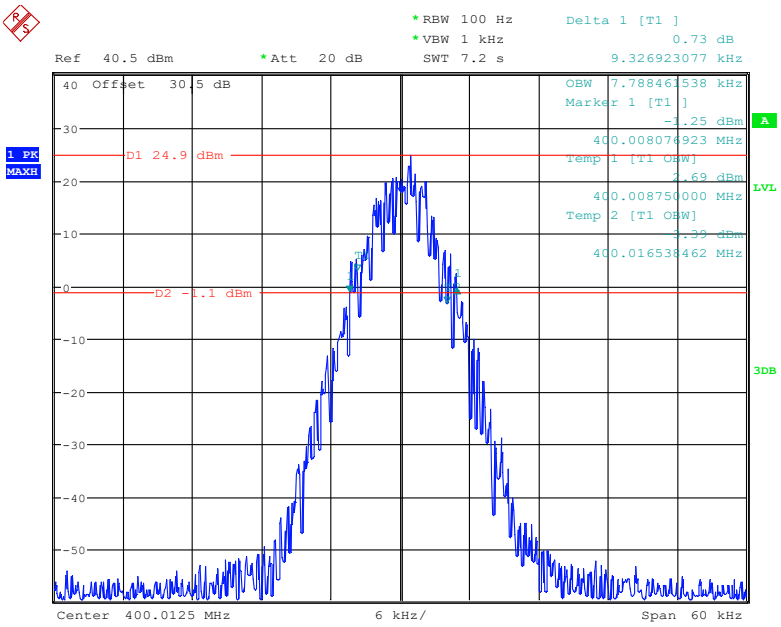
Emission Designator Per CFR 47 §2.201& §2.202&, Bn = 2M + 2D

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 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.

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 400.0125 MHz, low: 99% Occupied & 26 dB Bandwidth



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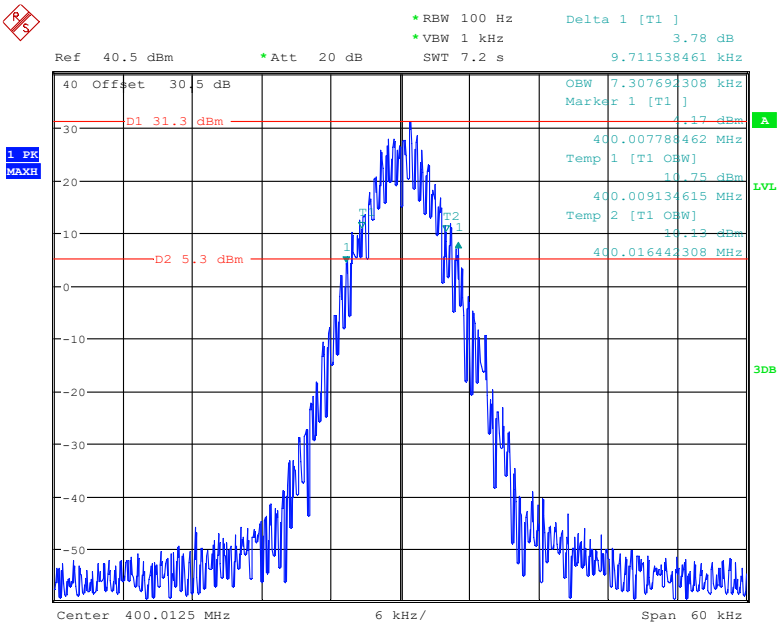
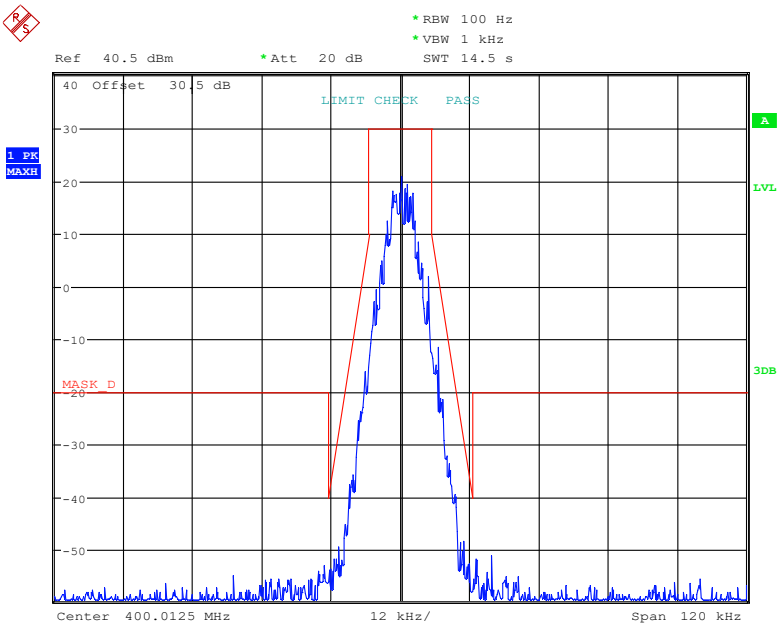
Frequency 400.0125 MHz, high: 99% Occupied & 26 dB Bandwidth



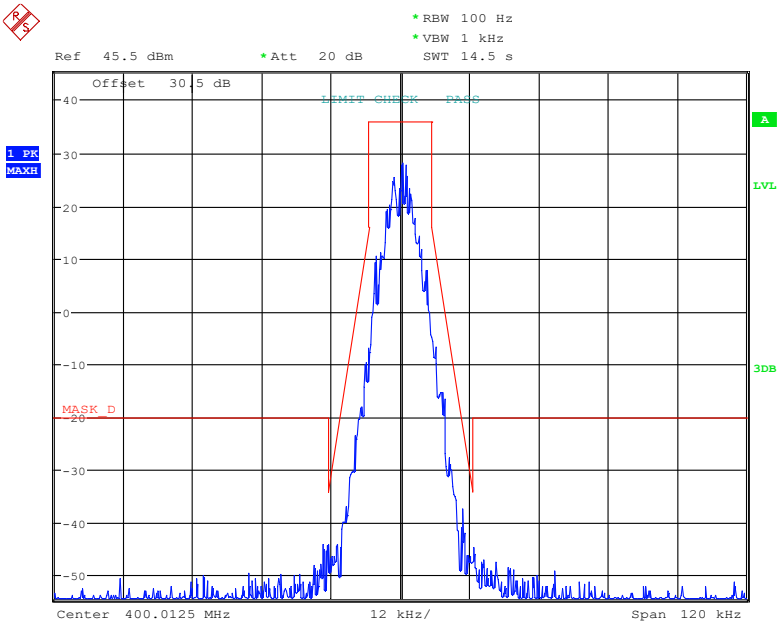
Date: 17.JUN.2022 15:22:35

Frequency 400.0125MHz, low: Emission Mask D



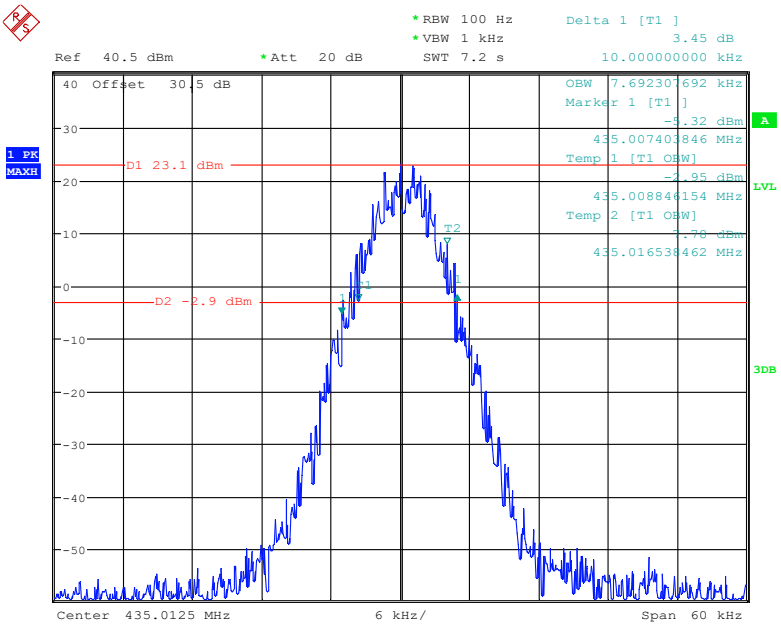
Date: 17.JUN.2022 16:00:41

Frequency 400.0125MHz, high: Emission Mask D



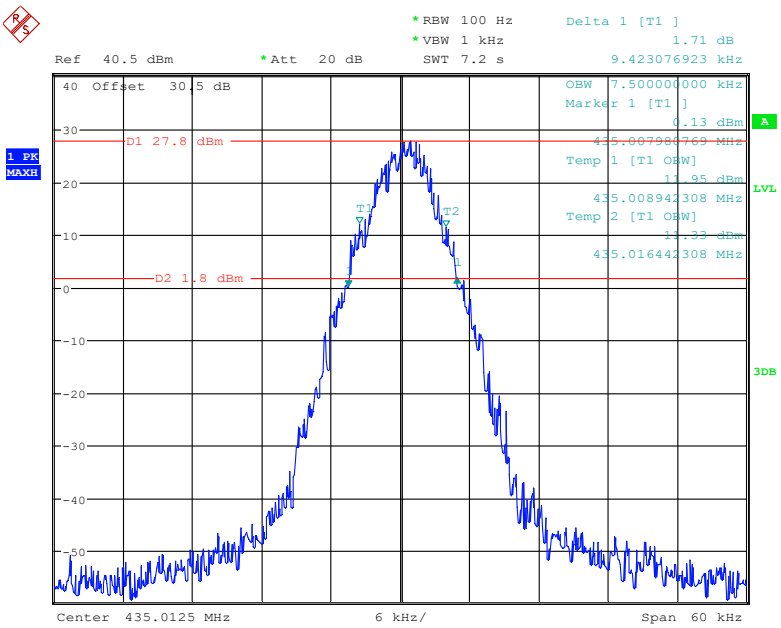
Date: 17.JUN.2022 16:01:49

Frequency 435.0125 MHz, low: 99% Occupied & 26 dB Bandwidth



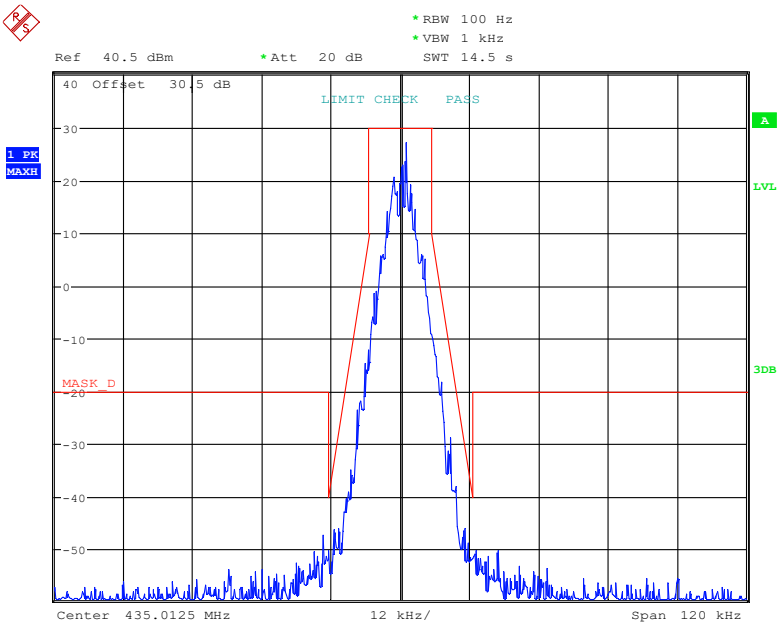
Date: 17.JUN.2022 15:25:53

Frequency 435.0125 MHz, high: 99% Occupied & 26 dB Bandwidth



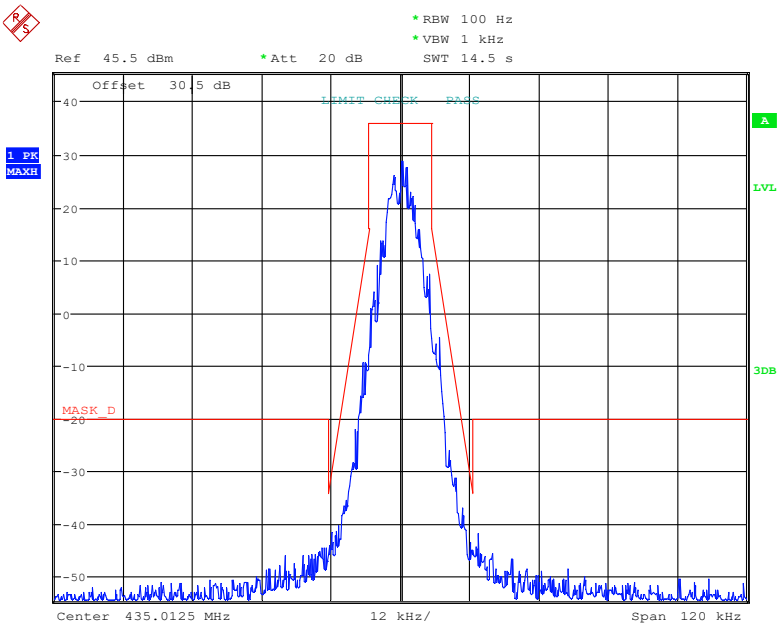
Date: 17.JUN.2022 15:27:22

Frequency 435.0125MHz, low: Emission Mask D



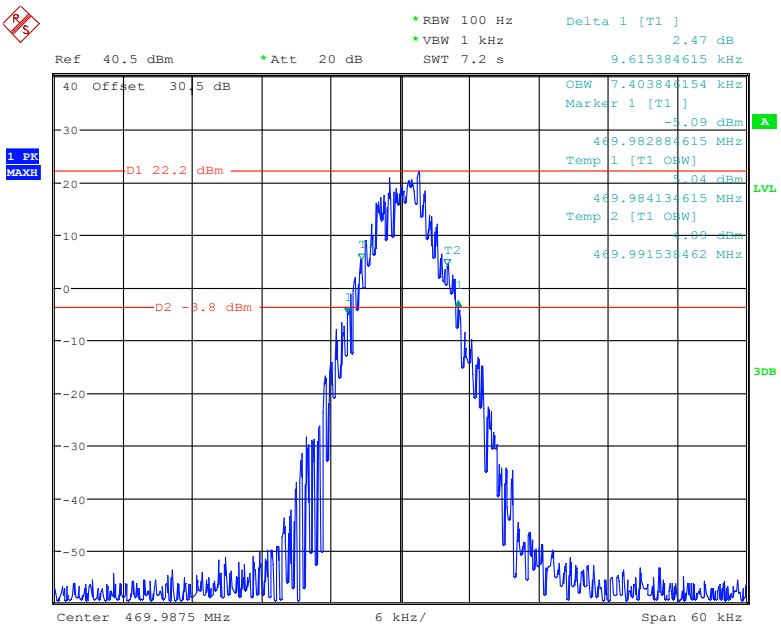
Date: 17.JUN.2022 15:59:31

Frequency 435.0125MHz, high: Emission Mask D



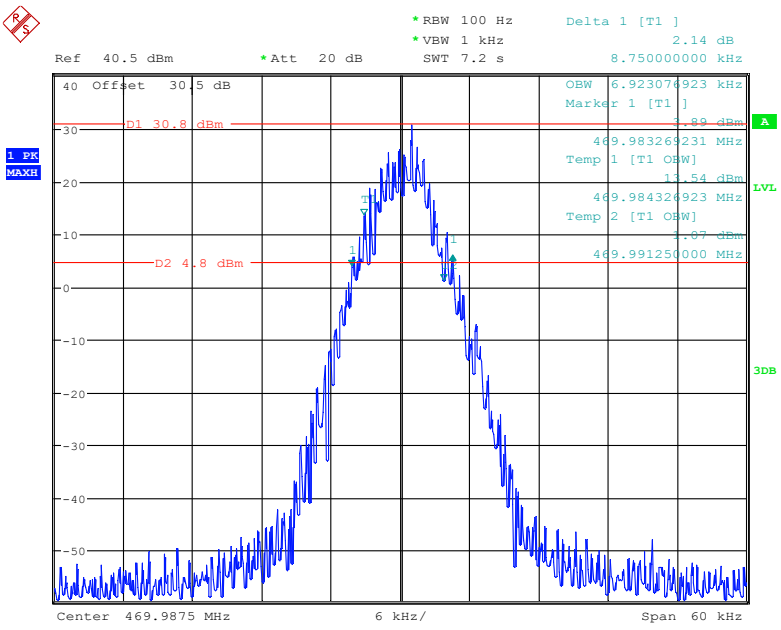
Date: 17.JUN.2022 15:57:59

Frequency 469.9875 MHz, low: 99% Occupied & 26 dB Bandwidth



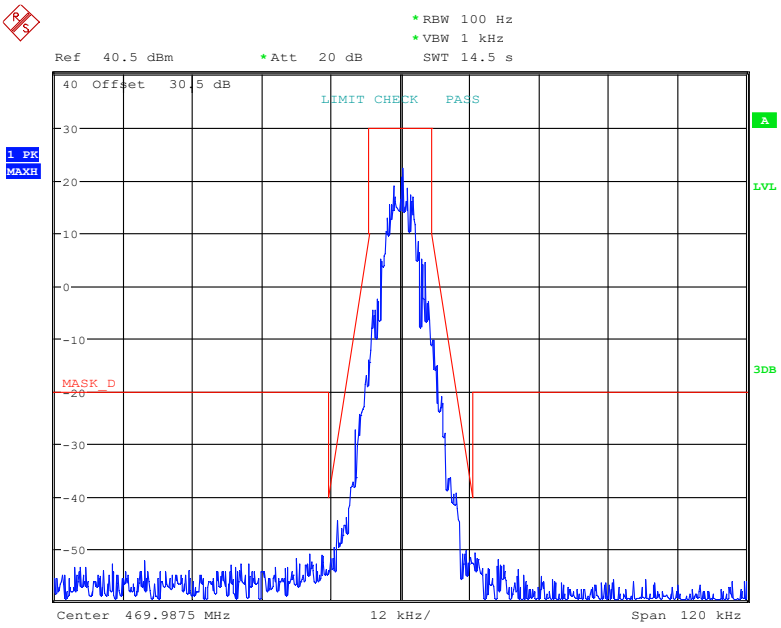
Date: 17.JUN.2022 15:29:38

Frequency 469.9875 MHz, high: 99% Occupied & 26 dB Bandwidth



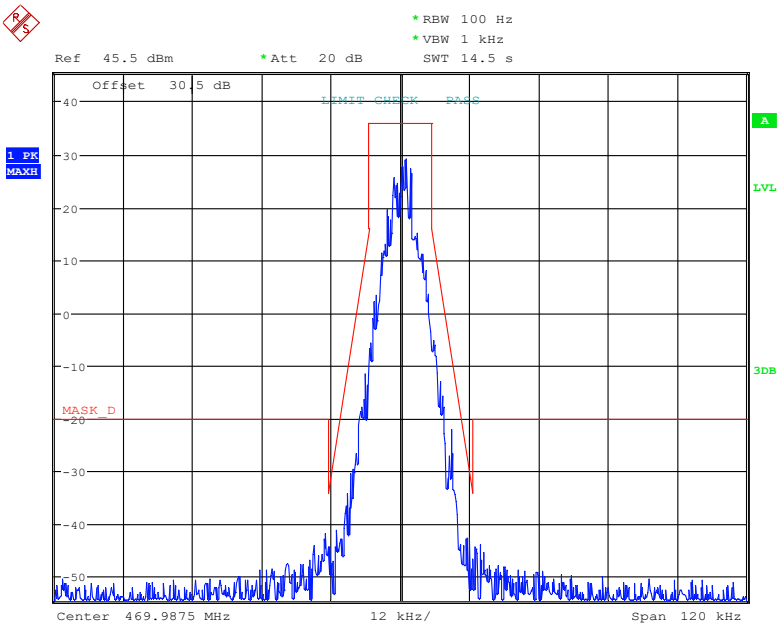
Date: 17.JUN.2022 15:30:35

Frequency 469.9875MHz, low: Emission Mask D



Date: 17.JUN.2022 15:53:02

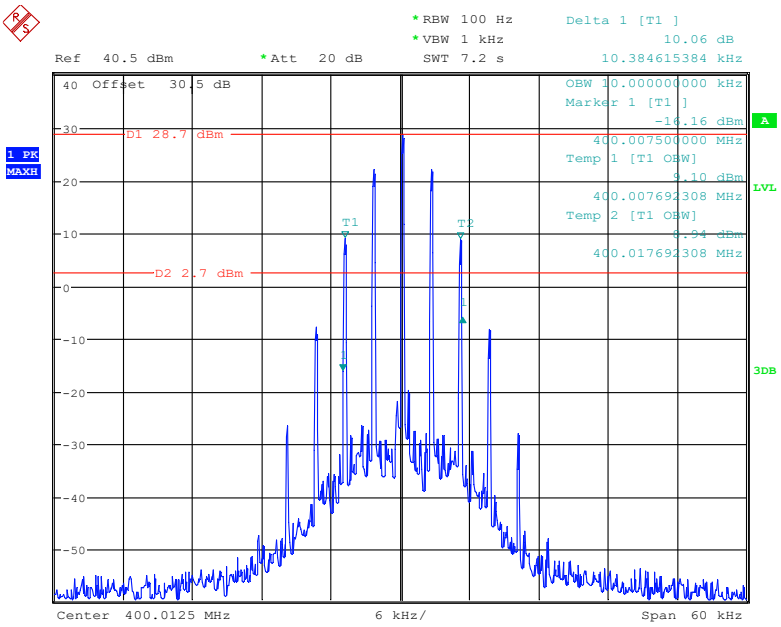
Frequency 469.9875MHz, high: Emission Mask D



Date: 17.JUN.2022 15:51:28

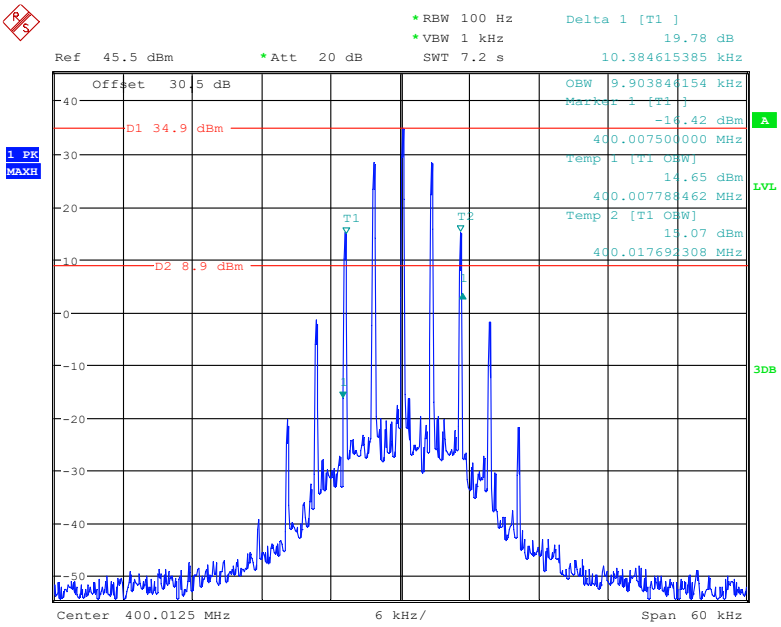
Analog

Frequency 400.0125 MHz, low: 99% Occupied & 26 dB Bandwidth



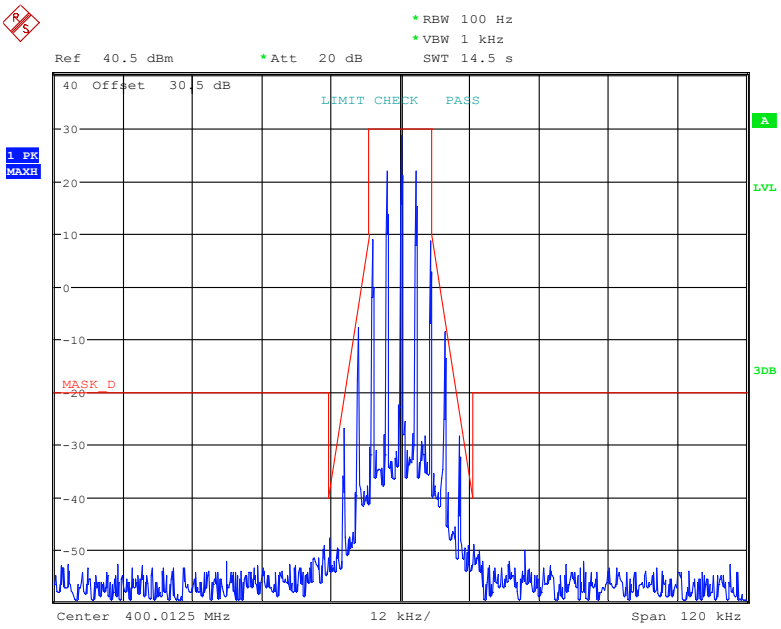
Date: 17.JUN.2022 15:39:52

Frequency 400.0125 MHz, high: 99% Occupied & 26 dB Bandwidth



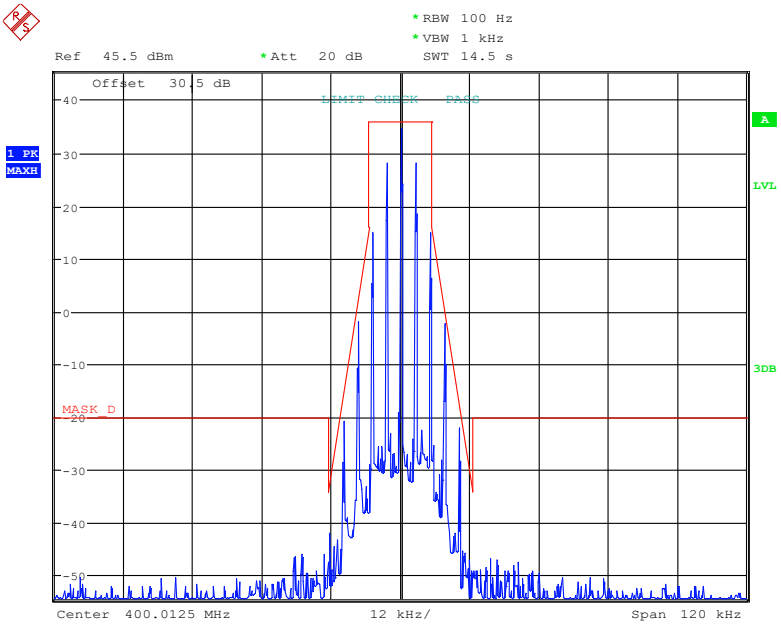
Date: 17.JUN.2022 15:41:16

Frequency 400.0125MHz, low: Emission Mask D



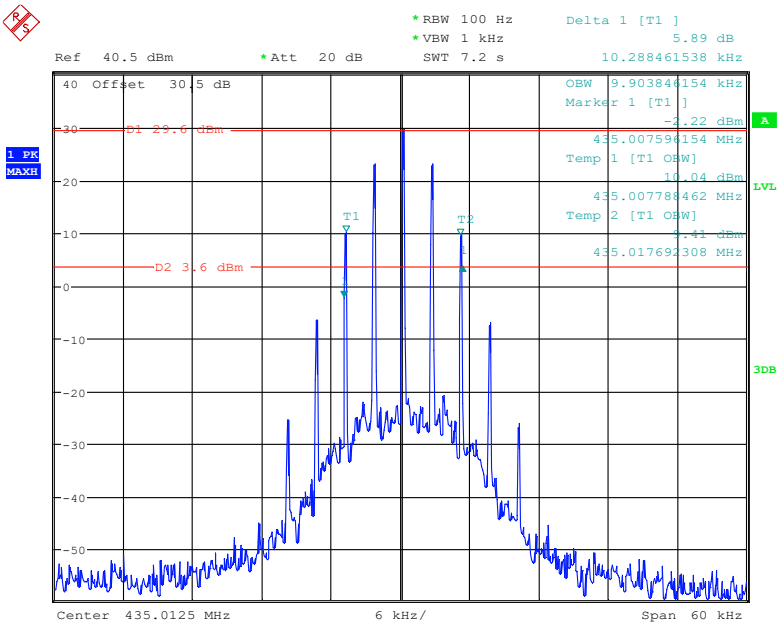
Date: 17.JUN.2022 16:03:30

Frequency 400.0125MHz, high: Emission Mask D



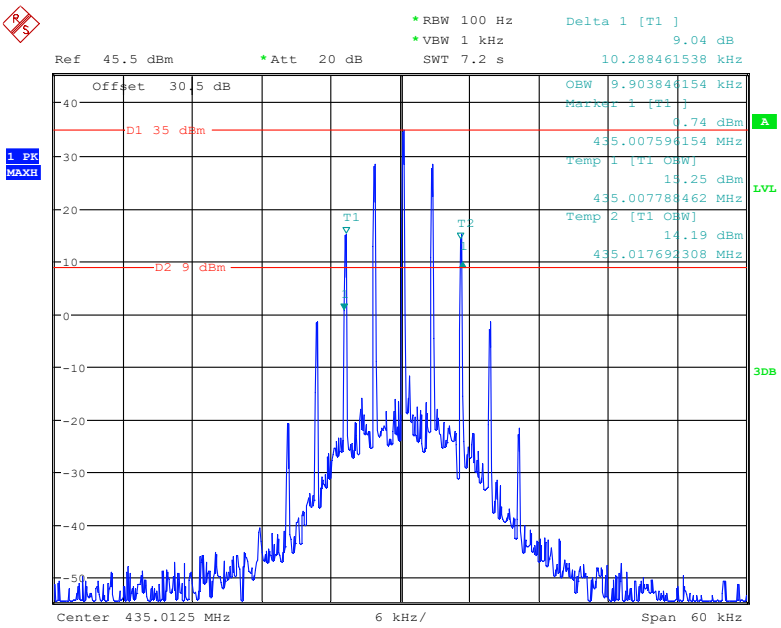
Date: 17.JUN.2022 16:02:19

Frequency 435.0125 MHz, low: 99% Occupied & 26 dB Bandwidth



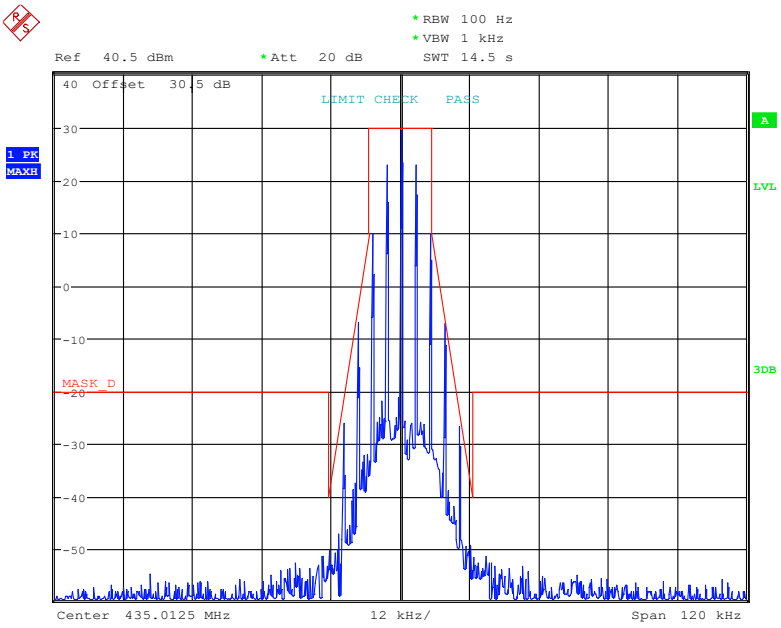
Date: 17.JUN.2022 15:42:10

Frequency 435.0125 MHz, high: 99% Occupied & 26 dB Bandwidth



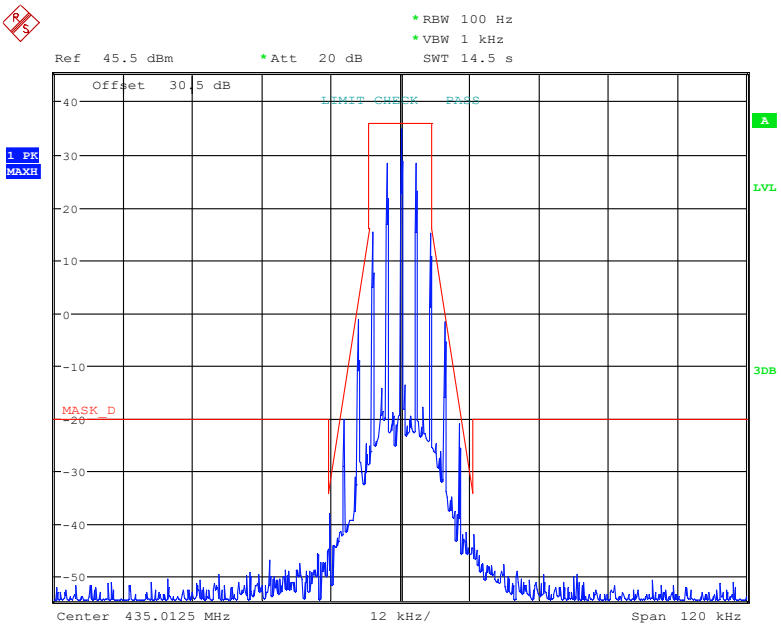
Date: 17.JUN.2022 15:44:24

Frequency 435.0125MHz, low: Emission Mask D



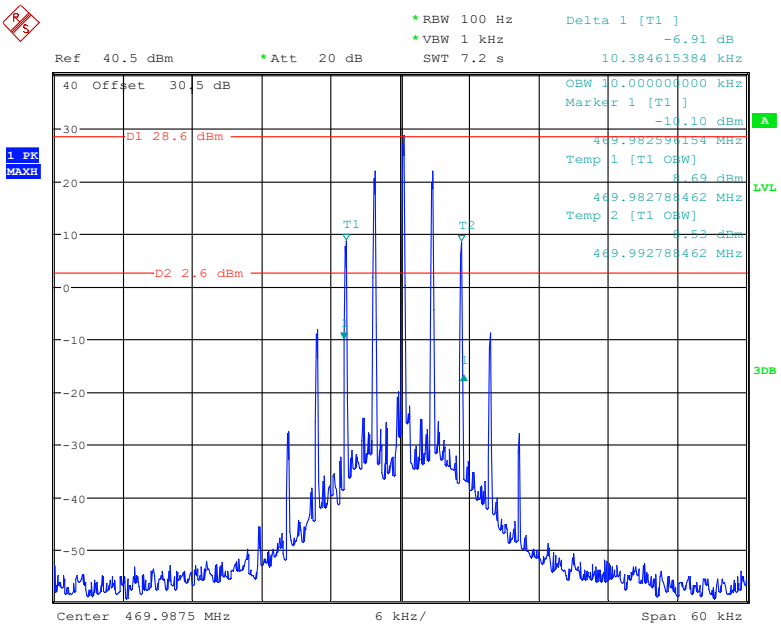
Date: 17.JUN.2022 15:55:08

Frequency 435.0125MHz, high: Emission Mask D



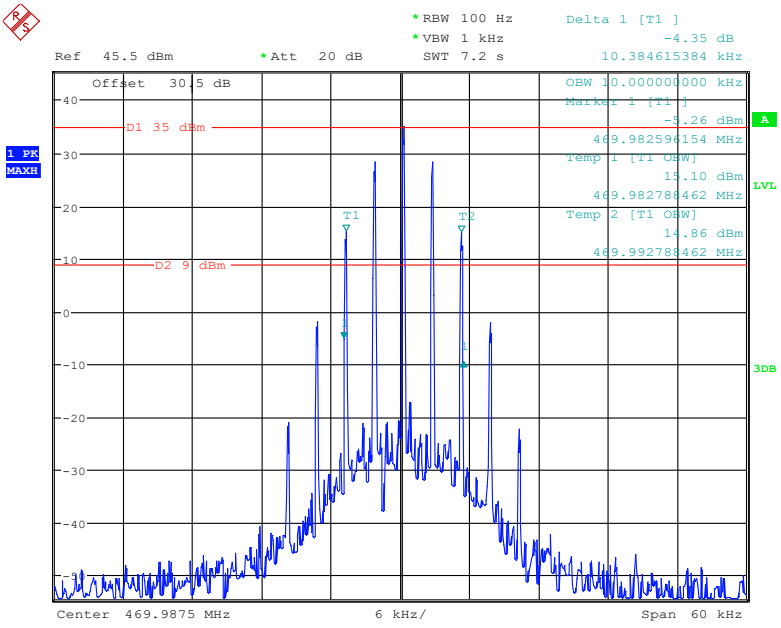
Date: 17.JUN.2022 15:56:19

Frequency 469.9875 MHz, low: 99% Occupied & 26 dB Bandwidth



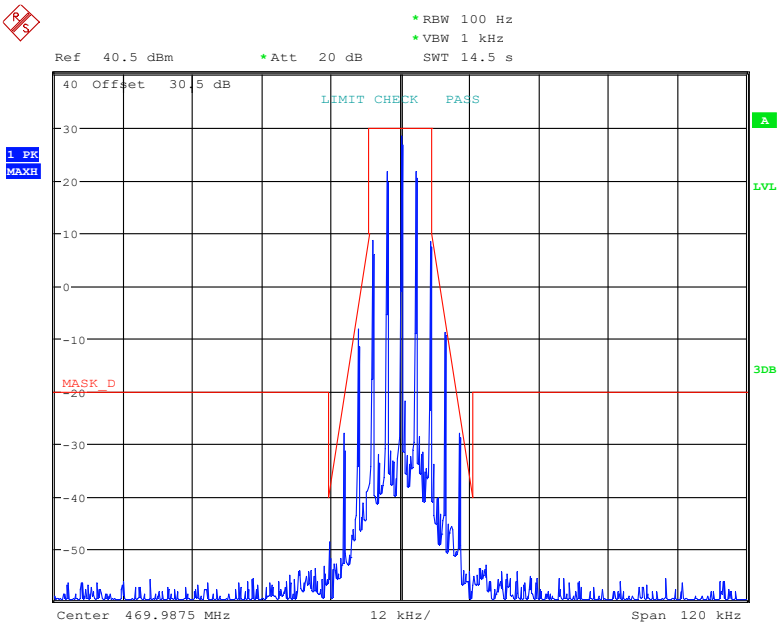
Date: 17.JUN.2022 15:46:16

Frequency 469.9875 MHz, high: 99% Occupied & 26 dB Bandwidth



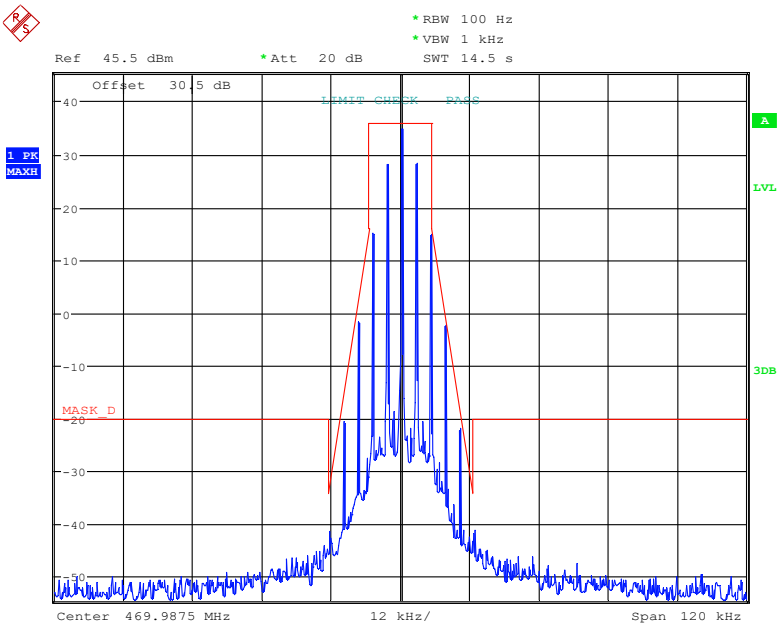
Date: 17.JUN.2022 15:47:47

Frequency 469.9875MHz, low: Emission Mask D



Date: 17.JUN.2022 15:53:54

Frequency 469.9875MHz, high: Emission Mask D



Date: 17.JUN.2022 15:49:49

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 5.626 kHz but no more than 12.5 kHz, at least 7.27 (f_d –2.88 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 10th harmonic.

Test Data

Environmental Conditions

Temperature:	26.9 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-17.

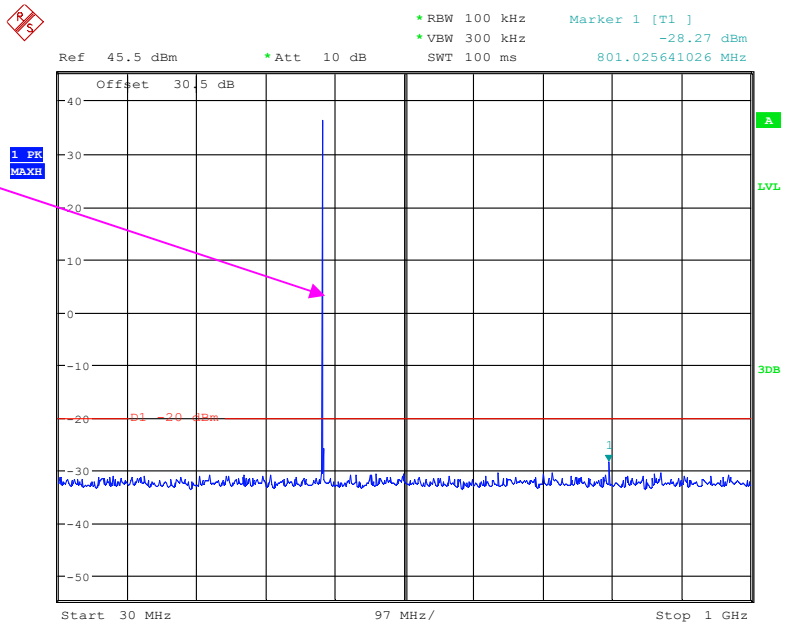
Test Mode: Transmitting (Worst case is high power level)

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

Digital

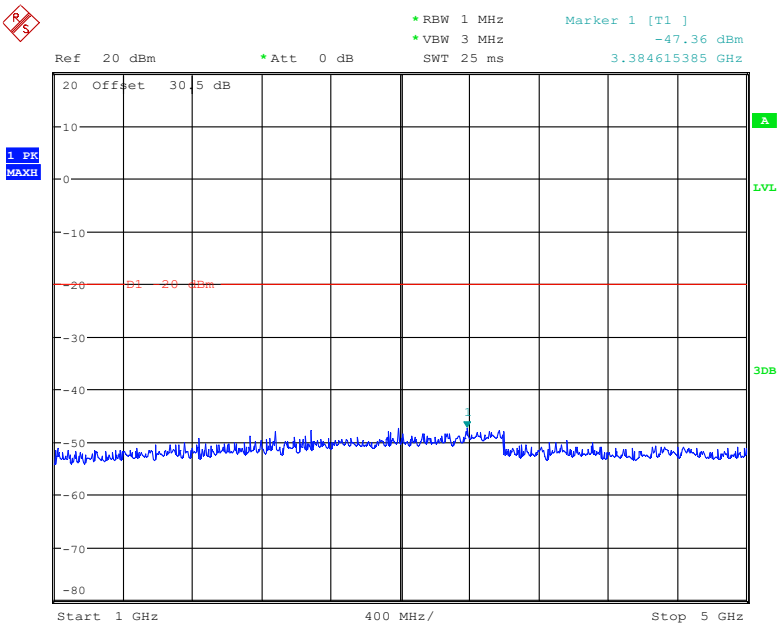
30MHz – 1 GHz, - Low Channel

Fundamental



Date: 17.JUN.2022 16:06:05

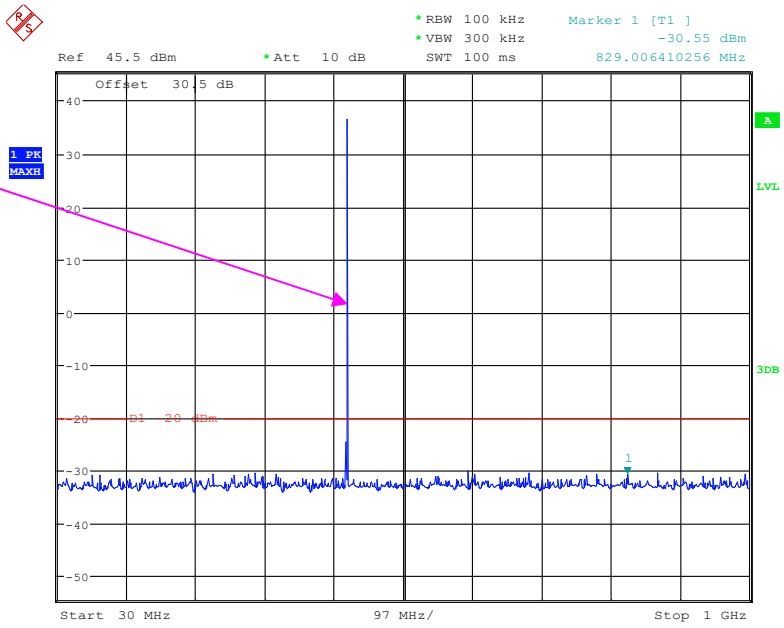
1 GHz – 5 GHz, - Low Channel



Date: 17.JUN.2022 16:14:08

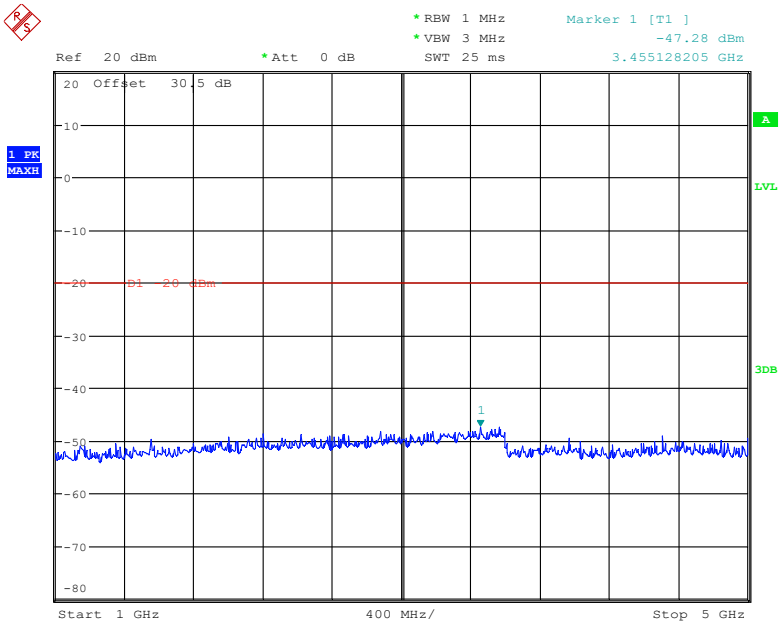
30MHz – 1 GHz, - Middle Channel

Fundamental



Date: 17.JUN.2022 16:08:32

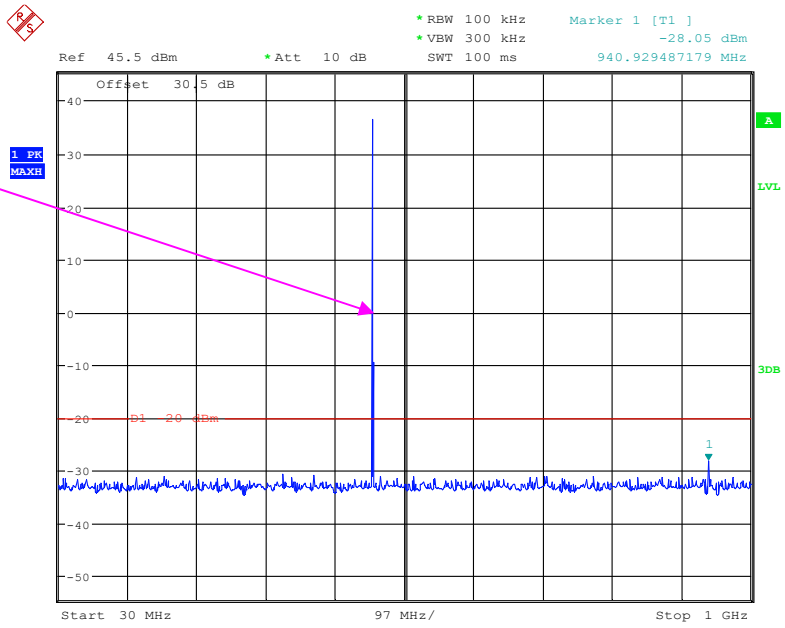
1 GHz – 5 GHz, Middle Channel



Date: 17.JUN.2022 16:14:18

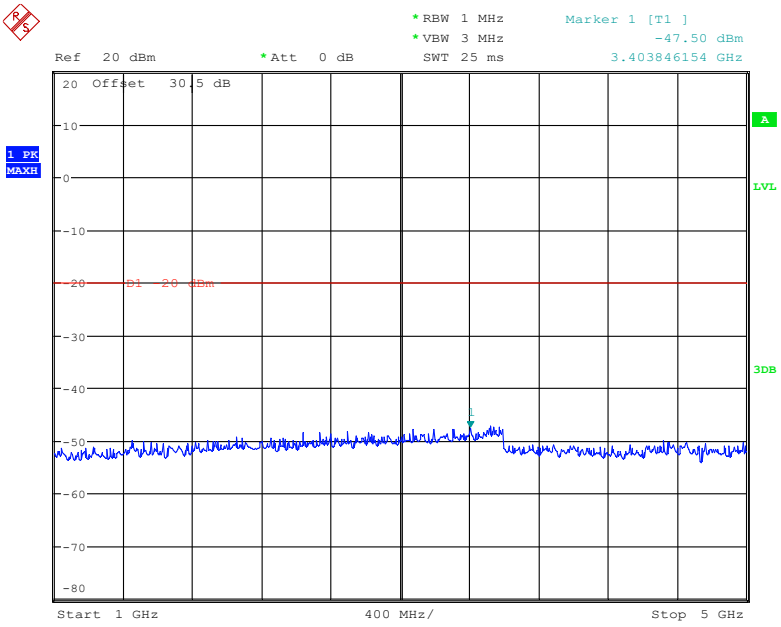
30MHz – 1 GHz, - High Channel

Fundamental



Date: 17.JUN.2022 16:08:55

1 GHz – 5 GHz, High Channel

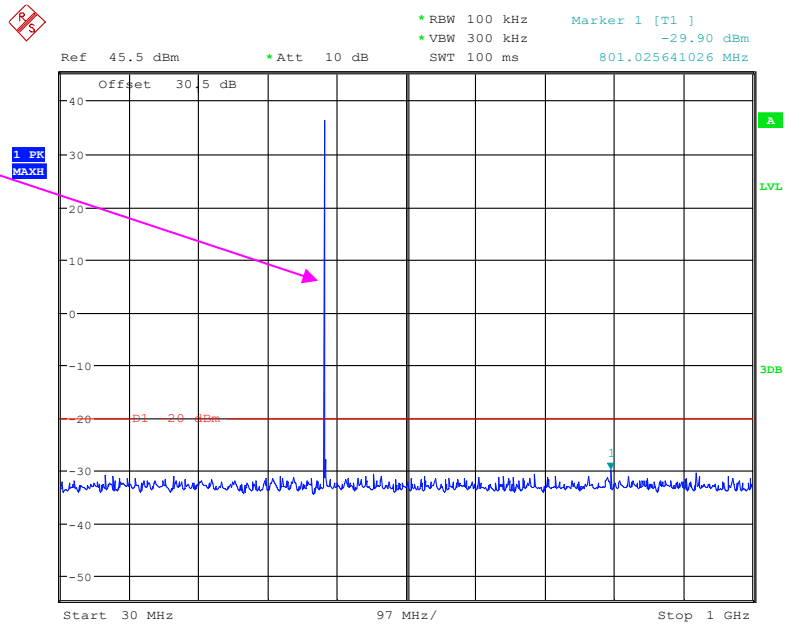


Date: 17.JUN.2022 16:14:53

Analog

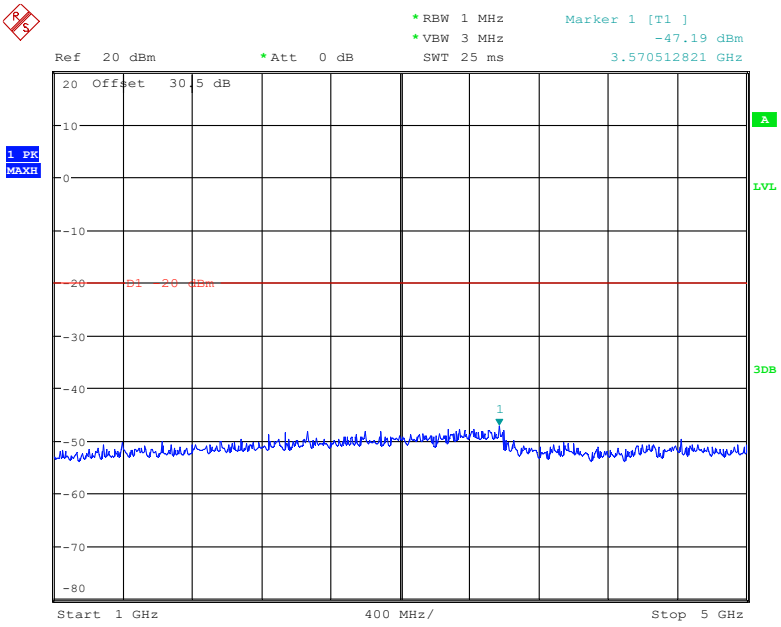
30MHz – 1 GHz, - Low Channel

Fundamental



Date: 17.JUN.2022 16:09:21

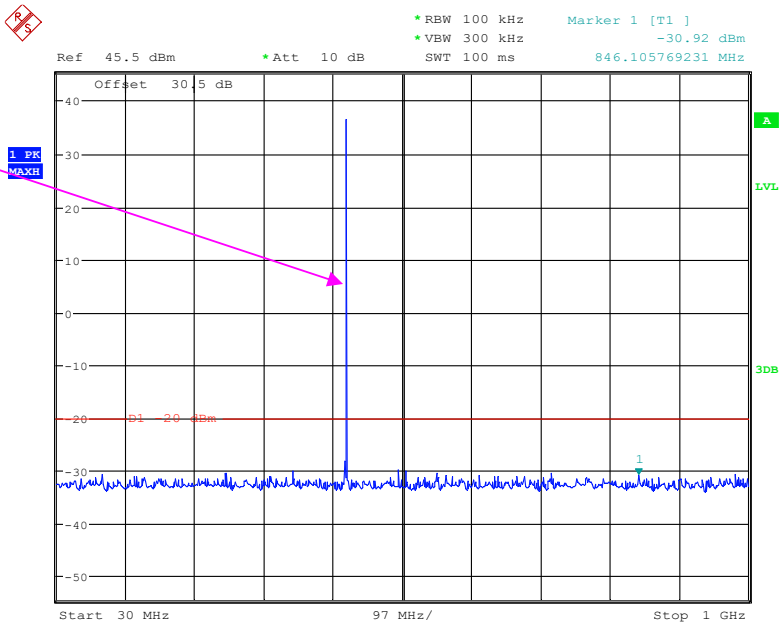
1 GHz – 5 GHz, - Low Channel



Date: 17.JUN.2022 16:13:59

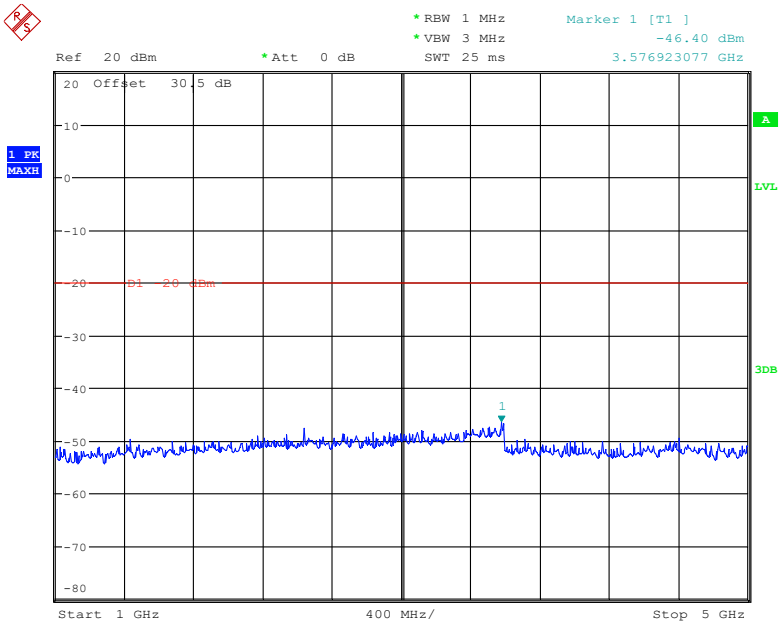
30MHz – 1 GHz, - Middle Channel

Fundamental



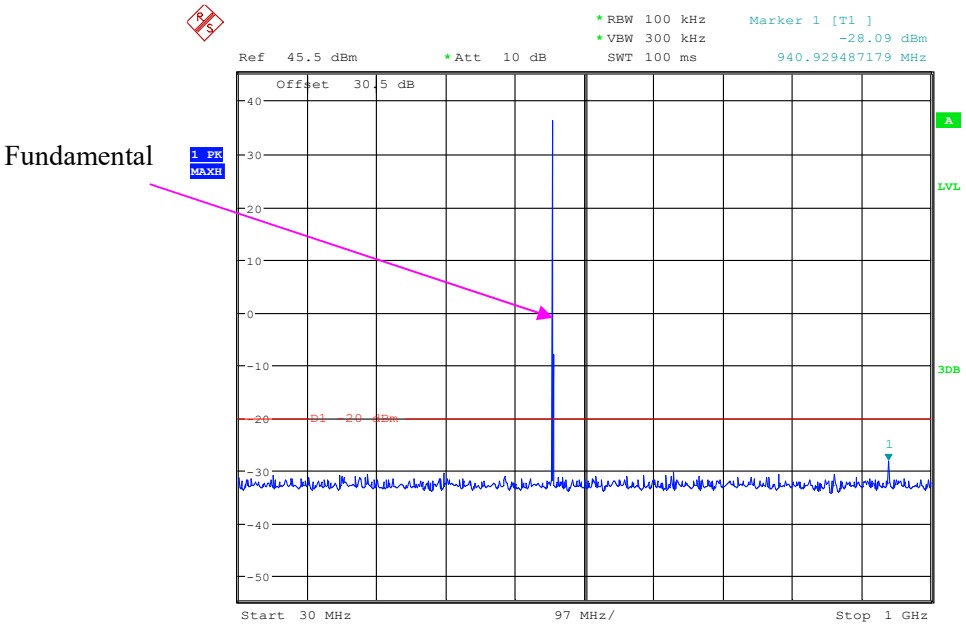
Date: 17.JUN.2022 16:09:46

1 GHz – 5 GHz, Middle Channel



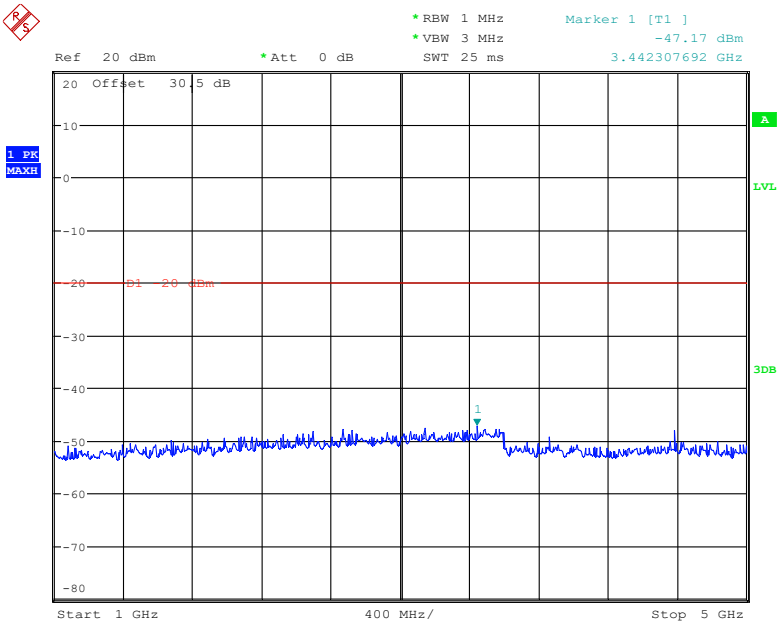
Date: 17.JUN.2022 16:13:43

30MHz – 1 GHz, - High Channel



Date: 17.JUN.2022 16:10:10

1 GHz – 5 GHz, High Channel



Date: 17.JUN.2022 16:13:35

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 1g (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB =50+10 Log_{10} (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

Test Data

Environmental Conditions

Temperature:	25~25.7 ℃
Relative Humidity:	46~50 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-14 for below 1GHz, on 2022-06-17 for above 1GHz.

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

Pre-scan in the X,Y and Z axes of orientation, the worst case of orientation was Y which was recorded.

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

Below 1GHz
Model: PH690 UHF

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
Digital								
400.0125MHz								
800.025	-77.16	177	1.2	H	10.8	-66.36	-20	46.36
800.025	-75.36	337	1.3	V	9.7	-65.66	-20	45.66
435.0125 MHz								
870.025	-77.5	231	1.1	H	11	-66.5	-20	46.5
870.025	-78.92	251	1.6	V	12.6	-66.32	-20	46.32
469.9875 MHz								
939.975	-75.42	272	1	H	9.2	-66.22	-20	46.22
939.975	-76.9	53	1.6	V	11.7	-65.2	-20	45.2
Analogue								
400.0125MHz								
800.025	-76.87	290	1.2	H	10.8	-66.07	-20	46.07
800.025	-75.59	163	1.3	V	9.7	-65.89	-20	45.89
435.0125 MHz								
870.025	-76.15	128	1.6	H	11	-65.15	-20	45.15
870.025	-79.14	211	2.1	V	12.6	-66.54	-20	46.54
469.9875 MHz								
939.975	-75.55	322	1.5	H	9.2	-66.35	-20	46.35
939.975	-77.41	312	1.5	V	11.7	-65.71	-20	45.71

Model: PH600 U(1)

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
Digital								
400.0125MHz								
800.025	-77.44	303	2	H	10.8	-66.64	-20	46.64
800.025	-74.81	145	1.9	V	9.7	-65.11	-20	45.11
435.0125 MHz								
870.025	-76.31	308	2	H	11	-65.31	-20	45.31
870.025	-78.07	38	1.9	V	12.6	-65.47	-20	45.47
469.9875 MHz								
939.975	-75.99	6	1.3	H	9.2	-66.79	-20	46.79
939.975	-77.14	299	1.9	V	11.7	-65.44	-20	45.44
Analogue								
400.0125MHz								
800.025	-76.49	319	1.4	H	10.8	-65.69	-20	45.69
800.025	-75.23	227	1.9	V	9.7	-65.53	-20	45.53
435.0125 MHz								
870.025	-76.83	85	1.6	H	11	-65.83	-20	45.83
870.025	-79.19	264	1.2	V	12.6	-66.59	-20	46.59
469.9875 MHz								
939.975	-74.97	131	1.1	H	9.2	-65.77	-20	45.77
939.975	-78.6	292	1.5	V	11.7	-66.9	-20	46.9

Model: PH660 U(1)

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
Digital								
400.0125MHz								
800.025	-77.36	145	1.8	H	10.8	-66.56	-20	46.56
800.025	-75.77	49	1.7	V	9.7	-66.07	-20	46.07
435.0125 MHz								
870.025	-77.58	340	1.3	H	11	-66.58	-20	46.58
870.025	-78.33	65	2	V	12.6	-65.73	-20	45.73
469.9875 MHz								
939.975	-74.89	50	1.1	H	9.2	-65.69	-20	45.69
939.975	-78.36	172	2.1	V	11.7	-66.66	-20	46.66
Analogue								
400.0125MHz								
800.025	-76.81	8	1.7	H	10.8	-66.01	-20	46.01
800.025	-76.54	129	1.2	V	9.7	-66.84	-20	46.84
435.0125 MHz								
870.025	-76.1	112	1.2	H	11	-65.1	-20	45.1
870.025	-77.96	178	2.1	V	12.6	-65.36	-20	45.36
469.9875 MHz								
939.975	-76.13	112	1.7	H	9.2	-66.93	-20	46.93
939.975	-77.16	173	1.8	V	11.7	-65.46	-20	45.46

Above 1GHz (Worst case is model: PH690 UHF)

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
Digital								
400.0125MHz								
1200.04	-53.6	183	1.5	H	4.5	-49.1	-20	29.1
1200.04	-52.44	58	1.1	V	3.6	-48.84	-20	28.84
435.0125 MHz								
1305.04	-54.11	288	1.6	H	6.4	-47.71	-20	27.71
1305.04	-53.18	58	2.1	V	5.1	-48.08	-20	28.08
469.9875 MHz								
1409.96	-53.68	271	1.1	H	5.9	-47.78	-20	27.78
1409.96	-54.77	10	1.9	V	5.9	-48.87	-20	28.87
Analogue 12.5K								
400.0125MHz								
1200.04	-52.86	193	1.9	H	4.5	-48.36	-20	28.36
1200.04	-52.54	174	1.1	V	3.6	-48.94	-20	28.94
435.0125 MHz								
1305.04	-55.65	159	2	H	6.4	-49.25	-20	29.25
1305.04	-54.16	131	1.7	V	5.1	-49.06	-20	29.06
469.9875 MHz								
1409.96	-53.76	211	1.5	H	5.9	-47.86	-20	27.86
1409.96	-54.97	324	1.4	V	5.9	-49.07	-20	29.07

Note:
Absolute Level = Reading Level + Substituted Factor
Substituted Factor contains: SG Level - Cable loss+ Antenna Gain
Margin = Limit - Absolute Level

FCC §2.1055 & §90.213 - FREQUENCY STABILITY

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

Temperature:	26.9 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-17.

Test Mode: Transmitting (Worst case is hight power level)

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

For Analog Modulation:

Reference Frequency:435.0125MHz, Limit:2.5 ppm			
Environment Temperature (°C)	**Power Supplied (V_{DC})**	**Frequency Measure with Time Elapsed**	
		MCF (MHz)	**PPM Error**
50	7.4	435.012542	0.097
40	7.4	435.012512	0.028
30	7.4	435.012523	0.053
20	7.4	435.012550	0.115
10	7.4	435.012521	0.048
0	7.4	435.012596	0.221
-10	7.4	435.012587	0.200
-20	7.4	435.012522	0.051
-30	7.4	435.012529	0.067
Frequency Stability Versus Input Voltage			
20	6.8	435.012589	0.205
20	8.4	435.012581	0.186

For Digital Modulation:

Reference Frequency:435.0125MHz, Limit:2.5 ppm			
Environment Temperature (°C)	**Power Supplied (V_{DC})**	**Frequency Measure with Time Elapsed**	
		MCF (MHz)	**PPM Error**
50	7.4	435.012595	0.218
40	7.4	435.012586	0.198
30	7.4	435.012547	0.108
20	7.4	435.012586	0.198
10	7.4	435.012512	0.028
0	7.4	435.012587	0.200
-10	7.4	435.012503	0.007
-20	7.4	435.012592	0.211
-30	7.4	435.012581	0.186
Frequency Stability Versus Input Voltage			
20	6.8	435.012583	0.191
20	8.4	435.012599	0.228

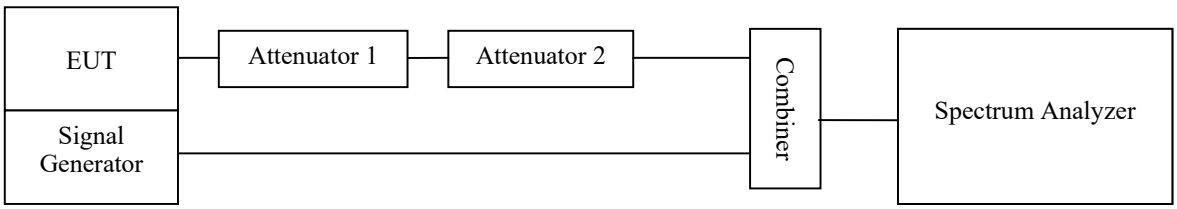
FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

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 ±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

Temperature:	26.9 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2022-06-27.

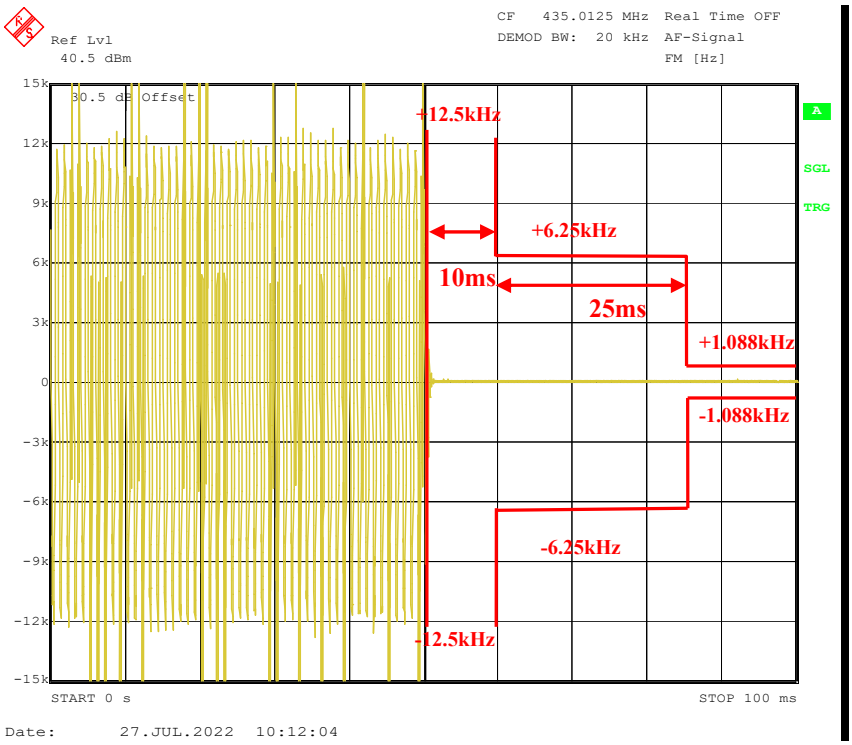
Test Result: *Pass. Please refer to the following tables and plots.*

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	

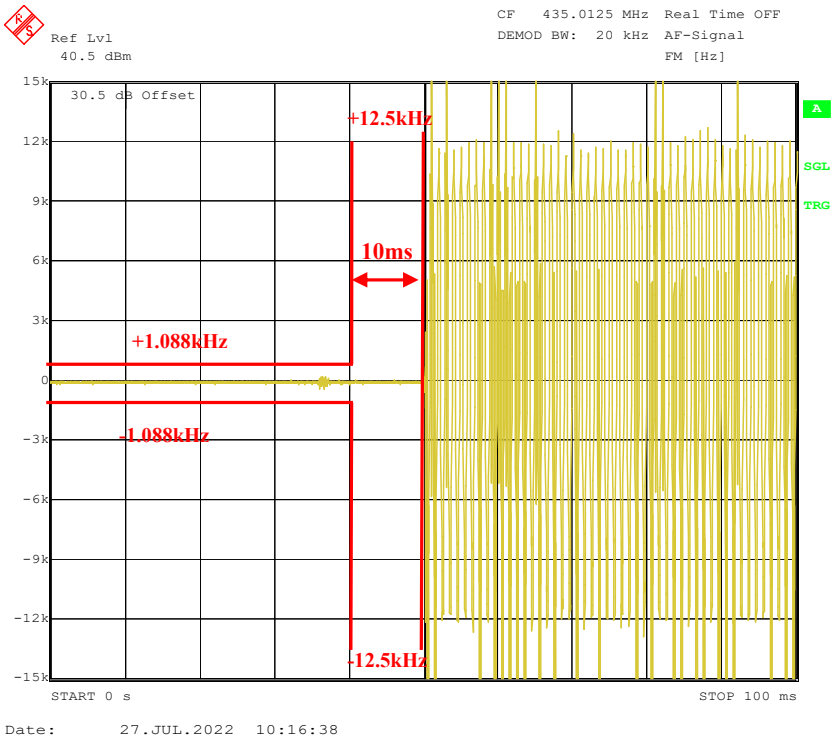
Note: During the time from the end of t_2 to the beginning of t_3, the frequency difference not exceed the limits specified in section 3.2.19 of TIA-603-E.

For 435.0125 MHz 12.5 kHz mode, the limit is 435.0125 MHz*2.5ppm=1.088 kHz

Turn on



Turn off



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