



FCC PART 22, 74, 80 and 90

TEST REPORT

For

Hytera Communications Corporation Limited

Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen,
518057 China

FCC ID:YAMHR106XU2


Report Type: Original Report	Product Type: DIGITAL REPEATER
Report Number:	RDG200729005-00A
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	Digital Portable Radio
EUT Model:	HR1062 U(2)
Mutiple Models:	HR1060 U(2), HR1065 U(2), HR1066 U(2), HR1068 U(2)
Modulation Type:	FM/4FSK
Channel Spacing:	12.5 kHz/25kHz
Frequency Range:	450-527 MHz
Rated Output Power: (Conducted)	High Power Level: 50W Low Power Level: 5W
Rated Input Voltage:	AC 120V or DC 13.6V
Serial Number:	Configuration 1(double RJ45 port): RDG200729005-RF-S1 Configuration 2(single RJ45 port): RDG200729005-RF-S2
EUT Received Date:	2020.08.01
EUT Received Status:	Good

Note:

The series product, models HR1060 U(2), HR1065 U(2), HR1066 U(2), HR1068 U(2) and HR1062 U(2) are electrically identical, The difference between them please refer to the declaration letter for details. We selected HR1062 U(2) for fully test.

This model of device have two configurations, and the two configurations are identical. Configuration 1 was full tested.

Objective

This test report is prepared on behalf of *Hytera Communications Corporation Limited* in accordance with Part 2, and Part 22,74,80 and 90 of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

No related submittal(s)/grant(s).

Test Methodology

All tests and measurements indicated in this document were performed in accordance with:

the Code of federal Regulations Title 47, Part 2, Part 22, Part 74, Part 80 and Part 90

ANSI C63.26-2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

TIA-603-E-2016, Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Dongguan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Unwanted Emissions, radiated	30MHz ~ 1GHz: 5.85 dB 1G~26.5GHz: 5.23 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1 °C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%

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

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, 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. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “ Δ ”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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SYSTEM TEST CONFIGURATION

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.

Local Support Equipment List and Details

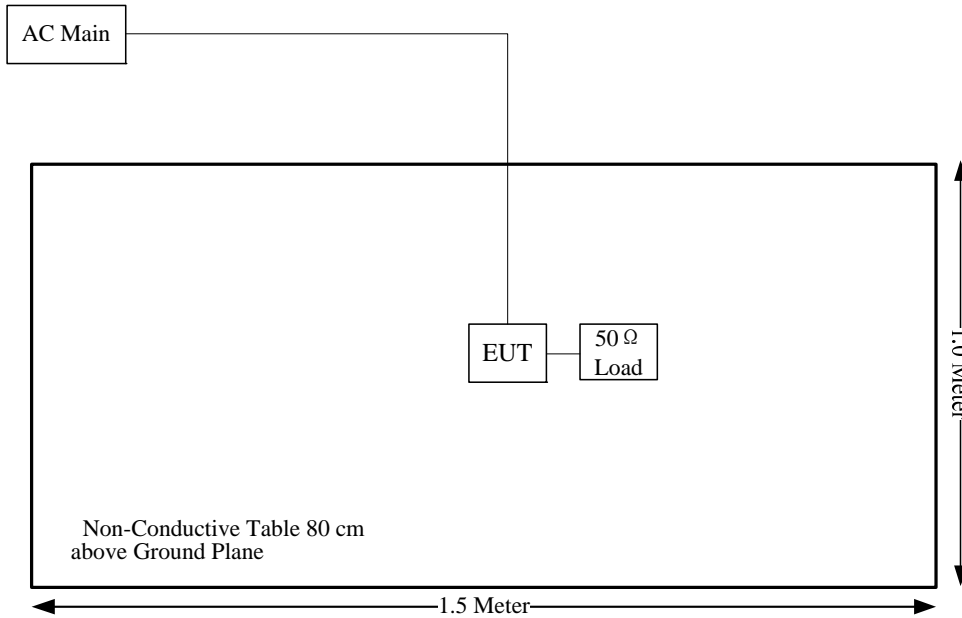
Manufacturer	Description	Model	Serial Number
WEINSCHTEL Corp	Coaxial Termination	50ohm	50ohm Load

Support Cable List and Details

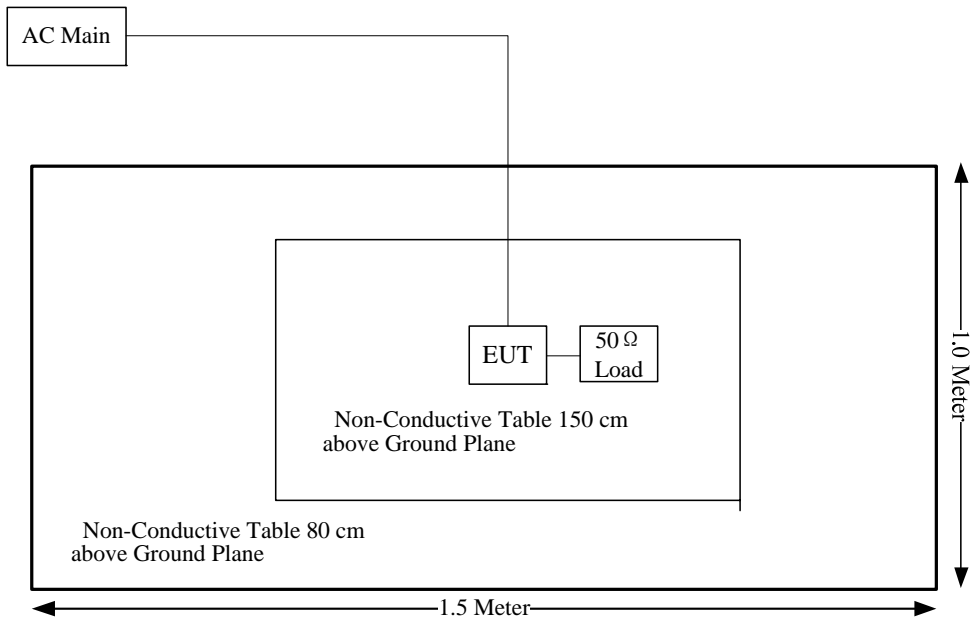
Cable Description	Shielding Type	Ferrite Core	Length (m)	From	To
Coaxial Cable	Yes	No	0.2	EUT	Coaxial Termination

Block Diagram of Test Setup

Radiation Below 1GHz:



Radiation Above 1GHz:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1310 and §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§2.1046; § 22.727; §80.215; §74.461; §90.205	RF Output Power	Compliance
§2.1047	Modulation Characteristic	Compliance
§2.1049;§22.357;§ 22.731; §74.462;§80.205; §80.207 §90.209; §90.210	Occupied Bandwidth & Emission Mask	Compliance
§2.1051; §22.861; §74.462; §80.211;§90.210	Spurious Emission at Antenna Terminal	Compliance
§2.1053;§22.861; §74.462;§80.211;§90.210	Spurious Radiated Emissions	Compliance
§2.1055; § 22.355; §74.464; §80.209; §90.213	Frequency Stability	Compliance
§90.214	Transient Frequency Behavior	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated emissions below 1GHz					
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
R&S	EMI Test Receiver	ESR3	102453	2019-09-12	2020-09-12
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2020-05-06	2021-05-06
HP	Amplifier	8447D	2727A05902	2019-09-05	2020-09-05
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2019-09-05	2020-09-05
Agilent	Signal Generator	E8247C	MY43321350	2019-12-10	2020-12-10
Ouli	Band Rejector Filter	400-470M	087	2020-01-23	2021-01-23
Radiated emissions above 1GHz					
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Agilent	Spectrum Analyzer	E4440A	SG43360054	2020-07-07	2021-07-07
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2019-09-05	2020-09-05
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2019-09-05	2020-09-05
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2019-09-05	2020-09-05
Agilent	Signal Generator	E8247C	MY43321350	2019-12-10	2020-12-10
Micro-tronics	High Pass Filter	HPM50111	S/N-G217	2020-06-16	2021-06-16
RF Conducted Test					
R&S	Spectrum Analyzer	FSU 26	200256	2020-07-07	2021-07-07
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2020-09-12	2021-09-12
Unknown	Coaxial Cable	C-SJ00-0010	C0010/02	Each time	N/A
E-Microwave	Coaxial Attenuators	EMCA40-200SN-6	OE01201046	2020-09-06	2021-09-06
HP	RF Communications Test Set	8920A	3438A05201	2020-07-07	2021-07-07
ESPEC	Constant temperature and humidity Tester	ESX-4CA	018 463	2020-03-26	2021-03-26
UNI-T	Multimeter	UT39A	M130199938	2019-07-23	2021-07-23
Ouli	Band Rejector Filter	400-470M	087	2020-01-23	2021-01-23

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

FCC §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to 1.1310, 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for Maximum Permissible Exposure (MPE)

Limits for Occupational/Controlled Exposure				
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E , H or S (minutes)
0.3- 3.0	614	1.63	(100)*	6
3.0 - 30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6

f = frequency in MHz;

* = Plane-wave equivalent power density;

MPE Calculation

Prediction of power density at the distance of the applicable MPE limit

$$S = PG/4\pi R^2$$

Where: S = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

MPE Results

Frequency (MHz)	Antenna Gain		Maximum Average output power including Tune-up Tolerance (mW)	Operation Duty Cycle (%)	Evaluation Distance (cm)	Power Density (mW/cm ²)	Power Density Limit (mW/cm ²)
	(dBi)	(numeric)					
450-527	10	10	60000	50	200.00	0.6	1.5

Note: the maximum power including Tune-up Tolerance is 60 W.

Result: The device meet FCC MPE at 200 cm distance

FCC §2.1046 & § 22.727 & §74.461 & §80.215& §90.205 - RF OUTPUT POWER

Applicable Standard

FCC §2.1046, § 22.727, §74.461, §80.215 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:	24.3~28.8°C
Relative Humidity:	64~73 %
ATM Pressure:	100.1~101 kPa
Tester:	James Chen
Test Date:	2020-09-05~2020-09-20

Test Mode: Transmitting

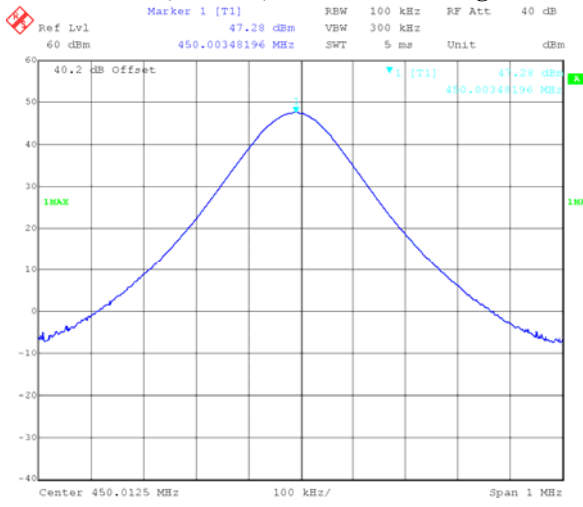
Test Result: Compliance. Please refer to following table.

Channel Separation	Test Modulation	Test Channel	Test Frequency (MHz)	Conducted Output Power (dBm)		Limit (dBm)		Note
				High Power Level	Low Power Level	High Power Level	Low Power Level	
12.5kHz	FM	Low	450.0125	47.28	37.34	47.78	37.78	FCC part 90
		Additional	453.2125	47.25	37.30	47.78	37.78	
		Middle	481.0000	47.09	37.20	47.78	37.78	
		High	526.9875	47.40	37.41	47.78	37.78	For federal
		Additional	455.0125	47.23	37.27	47.78	37.78	FCC part 74
	4FSK	Additional	454.0125	47.24	37.27	47.78	37.78	FCC part 22
		Low	450.0125	47.33	37.33	47.78	37.78	FCC part 90
		Additional	453.2125	47.32	37.32	47.78	37.78	
		Middle	481.0000	47.12	37.26	47.78	37.78	
		High	526.9875	47.49	37.45	47.78	37.78	For federal
Additional	455.0125	47.38	37.32	47.78	37.78	FCC part 74		
25kHz	FM	Additional	454.0125	47.33	37.33	47.78	37.78	FCC part 22
		Additional	459.9875	47.36	37.39	47.78	37.78	FCC part 80
		Additional	455.0125	47.23	37.27	47.78	37.78	FCC part 74
		Additional	454.0125	47.24	37.27	47.78	37.78	FCC part 22

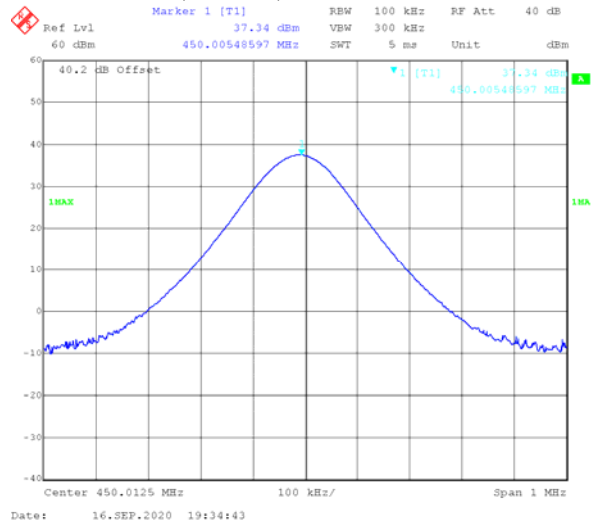
*Note: The high rated power level is 50W(47dBm), and low rated power level is 5W(37dBm).
The output power shall not exceed by more than 20 percent the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.*

FM, 12.5kHz:

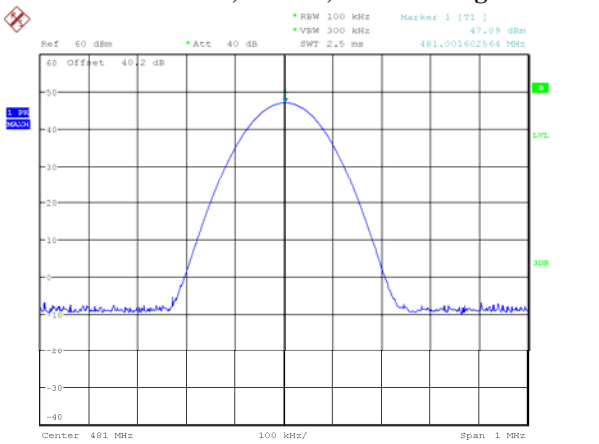
Low Channel, Part 90, 450.0125 MHz High Power



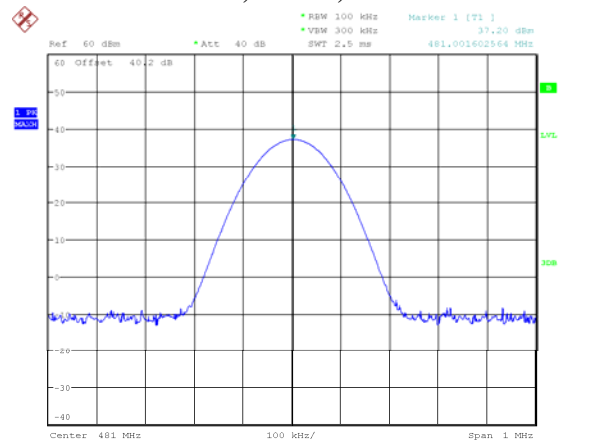
Low Channel, Part 90, 450.0125 MHz Low Power



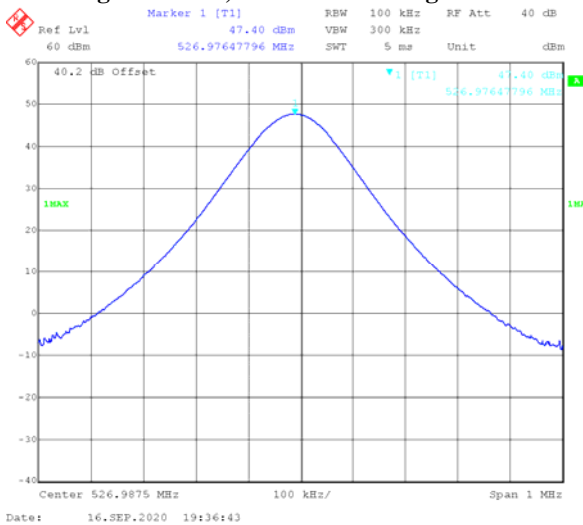
Middle Channel, Part 90, 481 MHz High Power



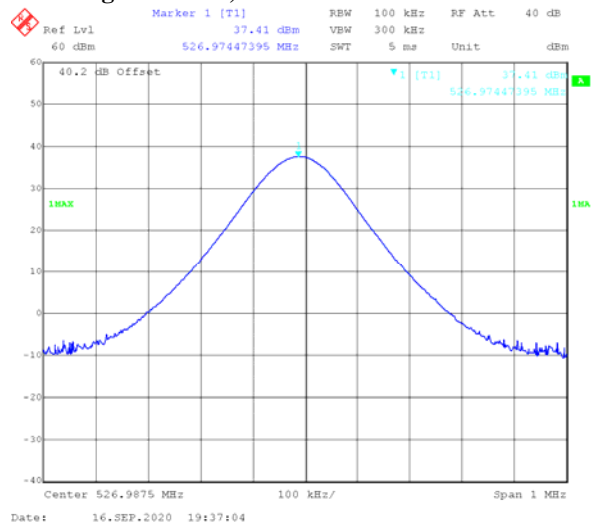
Middle Channel, Part 90, 481 MHz Low Power



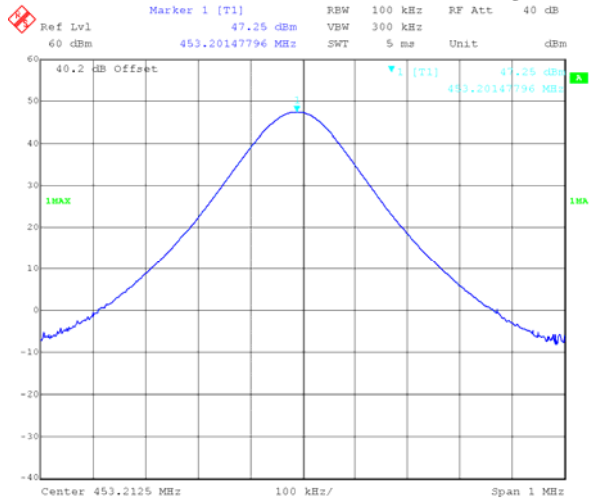
High Channel, 526.9875MHz High Power



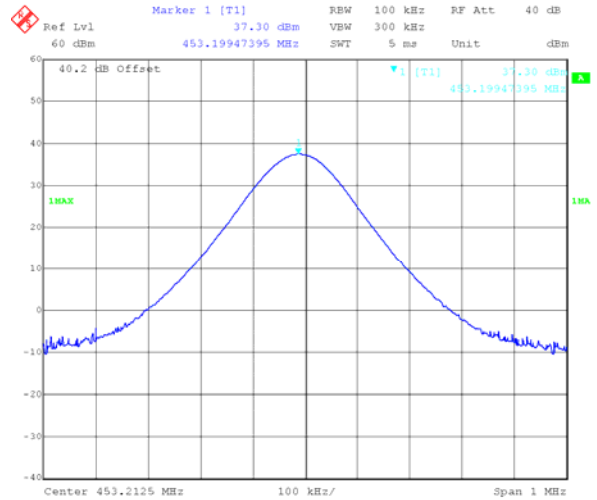
High Channel, 526.9875 MHz Low Power



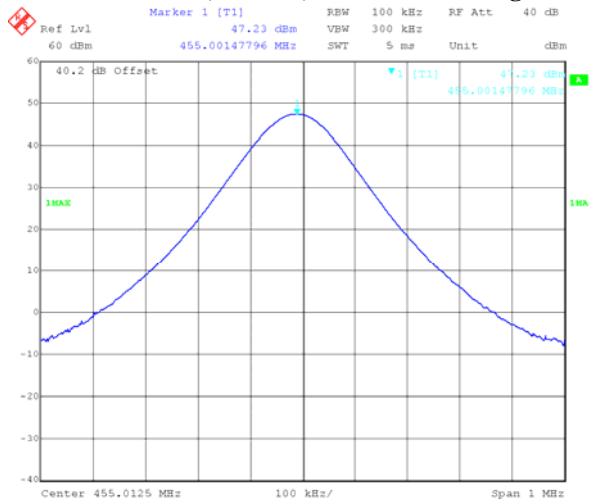
Additional Channel, Part 90, 453.2125 MHz High Power



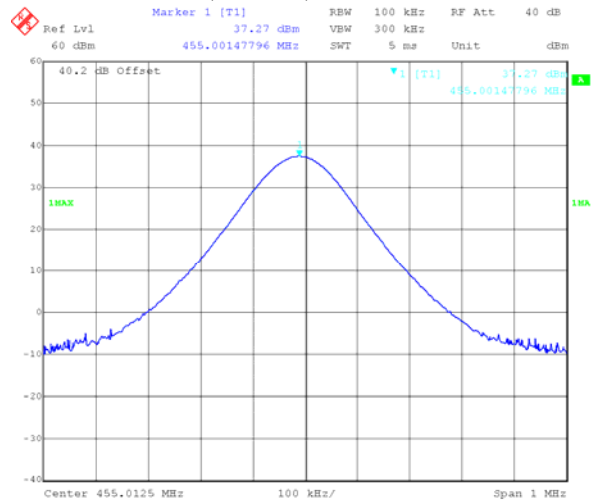
Additional Channel, Part 90, 453.2125 MHz Low Power



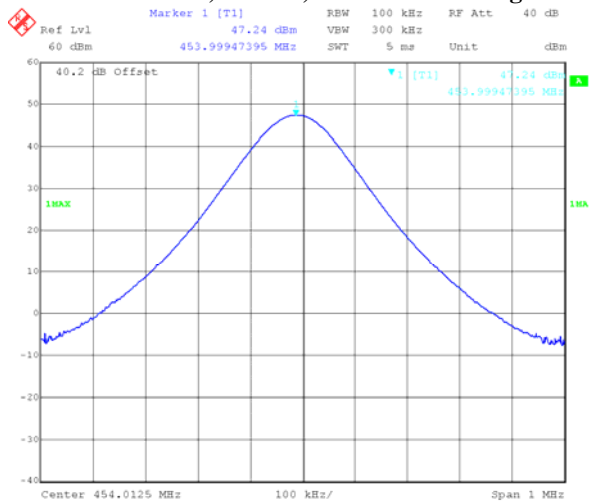
Additional Channel, Part 74, 455.0125 MHz High Power



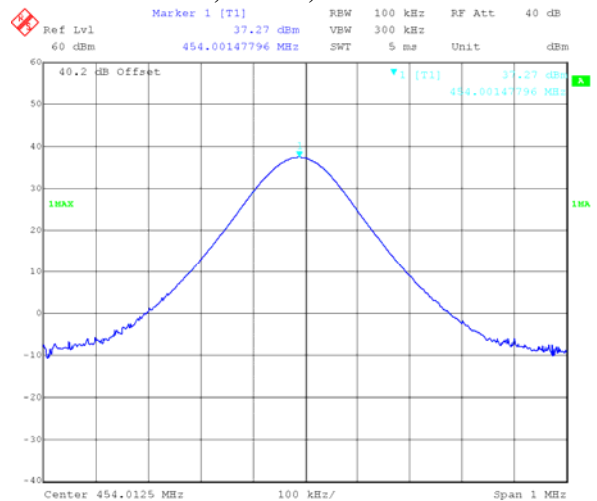
Additional Channel, Part 74, 455.0125 MHz Low Power



Additional Channel, Part 22, 454.0125 MHz High Power

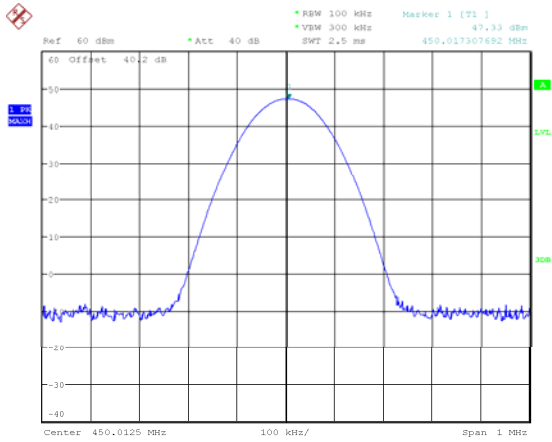


Additional Channel, Part 22, 454.0125 MHz Low Power



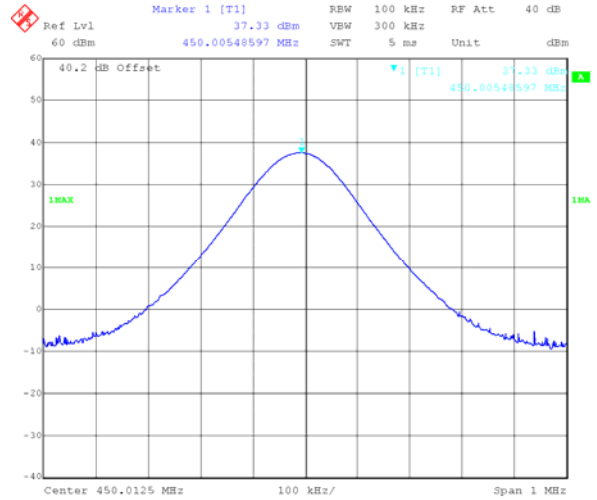
4FSK, 12.5kHz:

Low Channel, Part 90,450.0125 MHz High Power



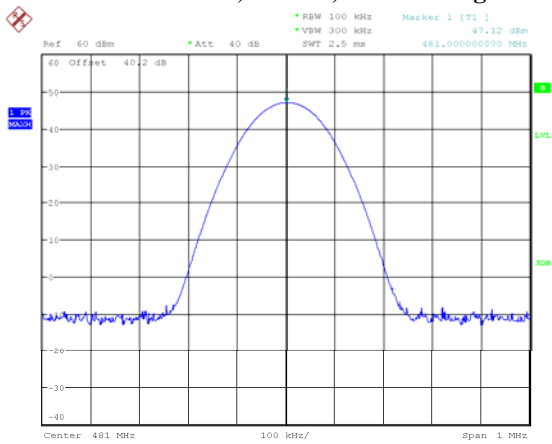
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Low Channel, Part 90, 450.0125 MHz Low Power



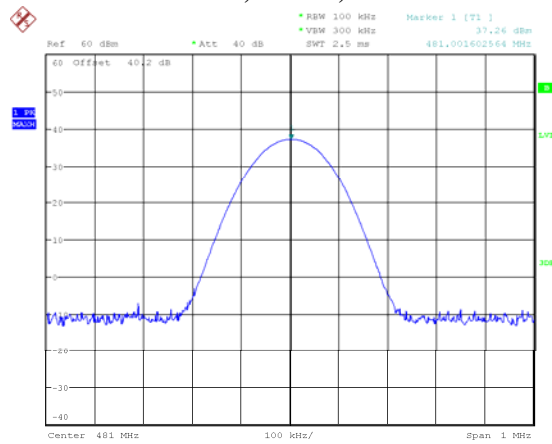
Date: 16.SEP.2020 19:26:05

Middle Channel, Part 90,481 MHz High Power



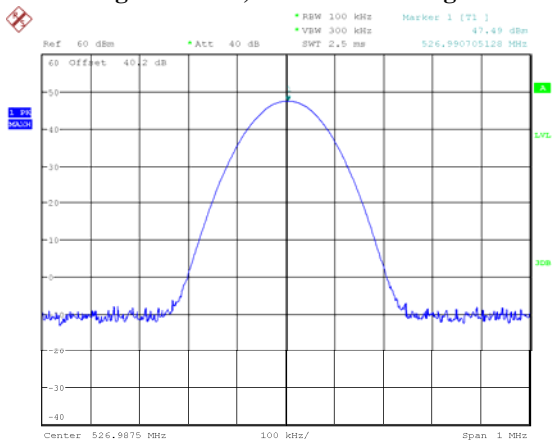
Date: 20.SEP.2020 13:15:56

Middle Channel, Part 90,481 MHz Low Power



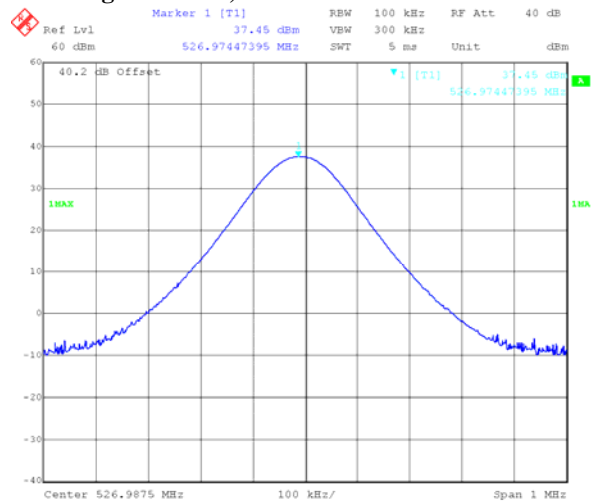
Date: 20.SEP.2020 13:18:00

High Channel, 526.9875MHz High Power



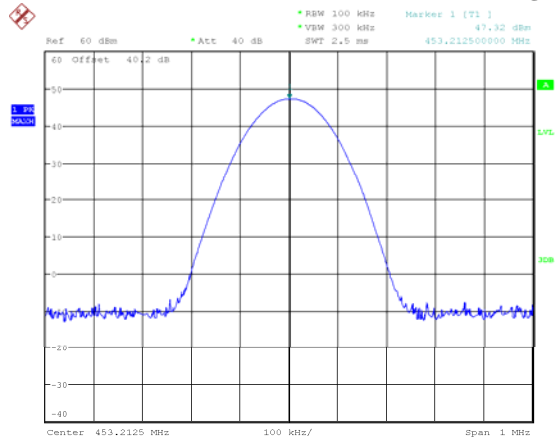
Date: 5.SEP.2020 21:04:29

High Channel, 526.9875 MHz Low Power



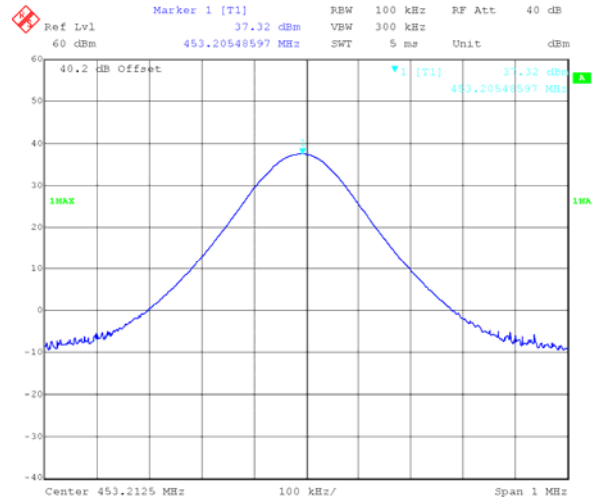
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Additional Channel, Part 90, 453.2125 MHz High Power



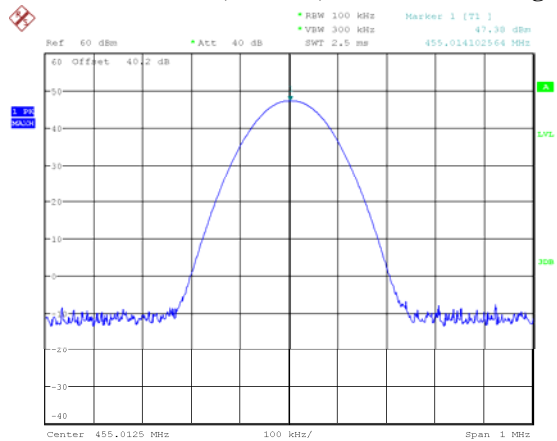
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Additional Channel, Part 90, 453.2125 MHz Low Power



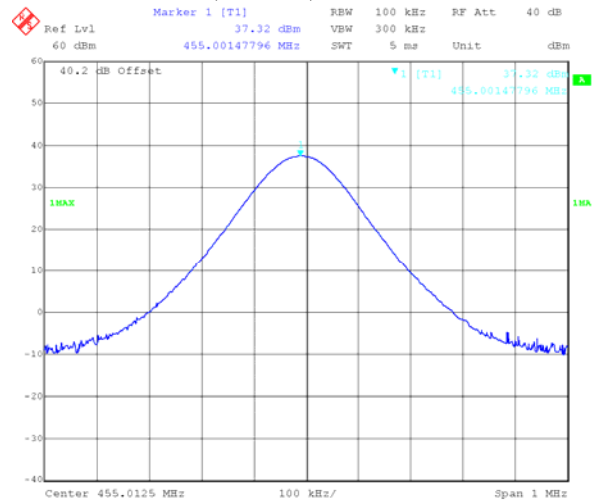
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Additional Channel, Part 74, 455.0125 MHz High Power



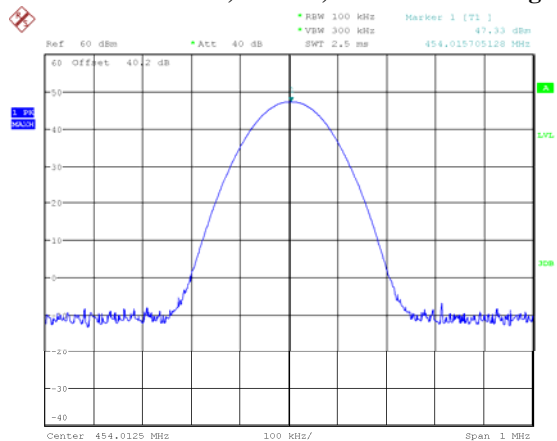
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Additional Channel, Part 74, 455.0125 MHz Low Power



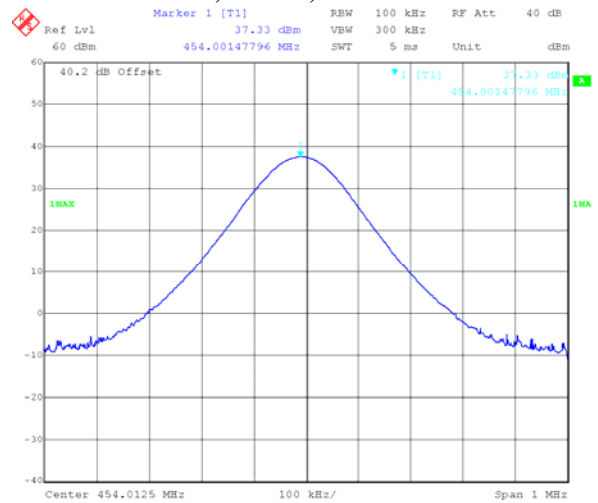
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Additional Channel, Part 22, 454.0125 MHz High Power



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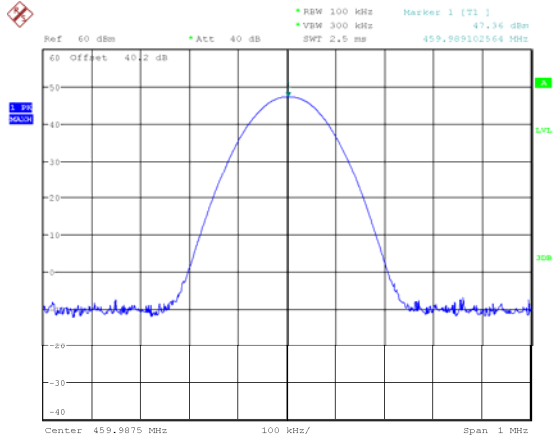
Additional Channel, Part 22, 454.0125 MHz Low Power



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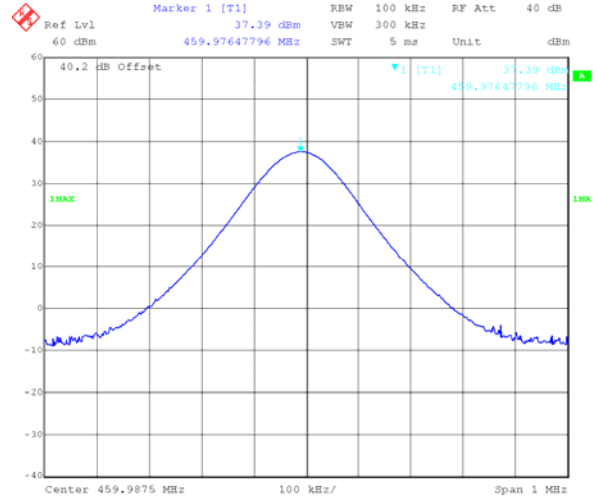
FM, 25kHz:

Additional Channel, Part 80, 459.9875 MHz High Power



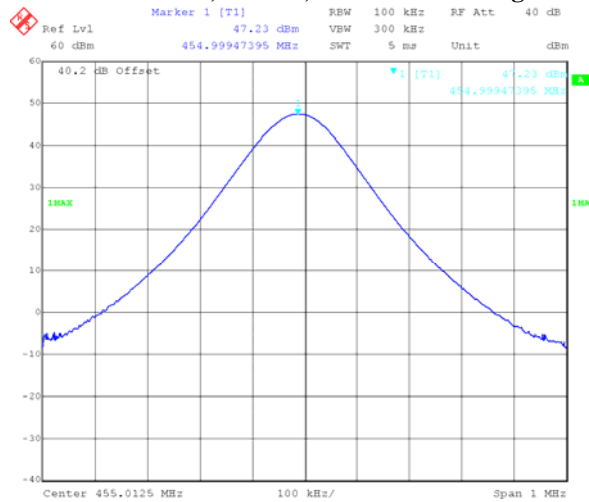
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Additional Channel, Part 90, 459.9875 MHz Low Power



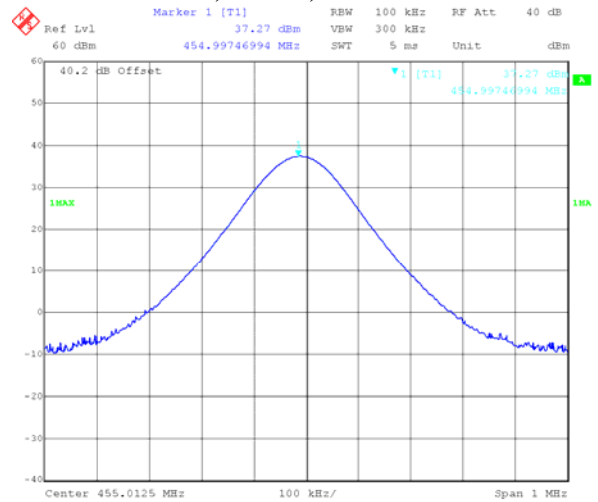
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Additional Channel, Part 74, 455.0125 MHz High Power



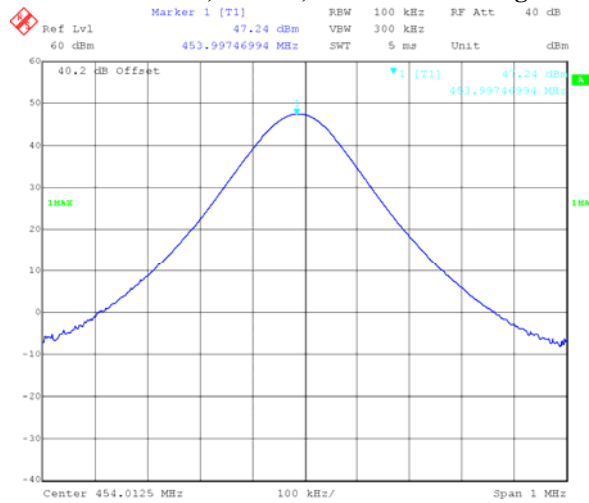
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Additional Channel, Part 74, 455.0125 MHz Low Power



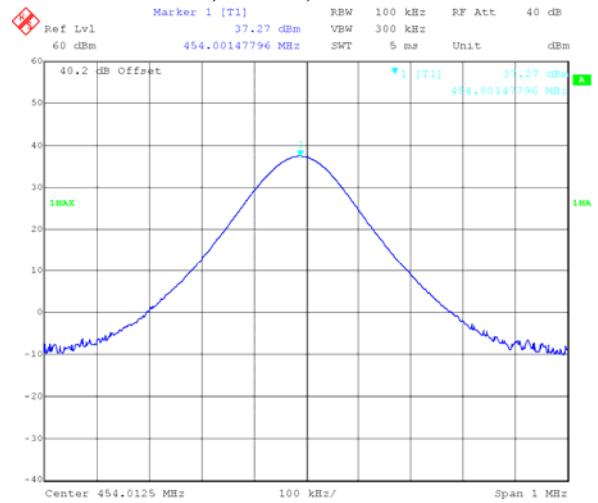
Date: 16.SEP.2020 19:40:27

Additional Channel, Part 22, 454.0125 MHz High Power



Date: 16.SEP.2020 19:41:36

Additional Channel, Part 22, 454.0125 MHz Low Power



Date: 16.SEP.2020 19:41:53

FCC §2.1047 - MODULATION CHARACTERISTIC

Applicable Standard

FCC §2.1047

- (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: TIA-603-E 2.2.3

Test Data

Environmental Conditions

Temperature:	27.8°C
Relative Humidity:	69 %
ATM Pressure:	100.8 kPa
Tester:	James Chen
Test Date:	2020-09-13

Test Mode: Transmitting

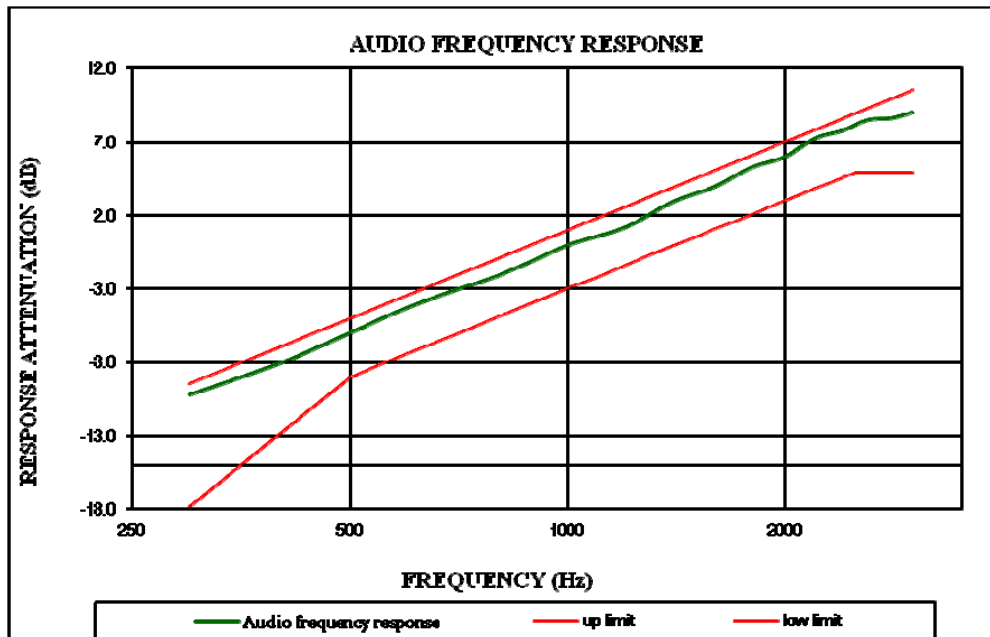
Test Result: Compliance. *please refer to the following tables.*

Audio Frequency Response – High Power

12.5kHz:

Carrier Frequency: 453.2125 MHz

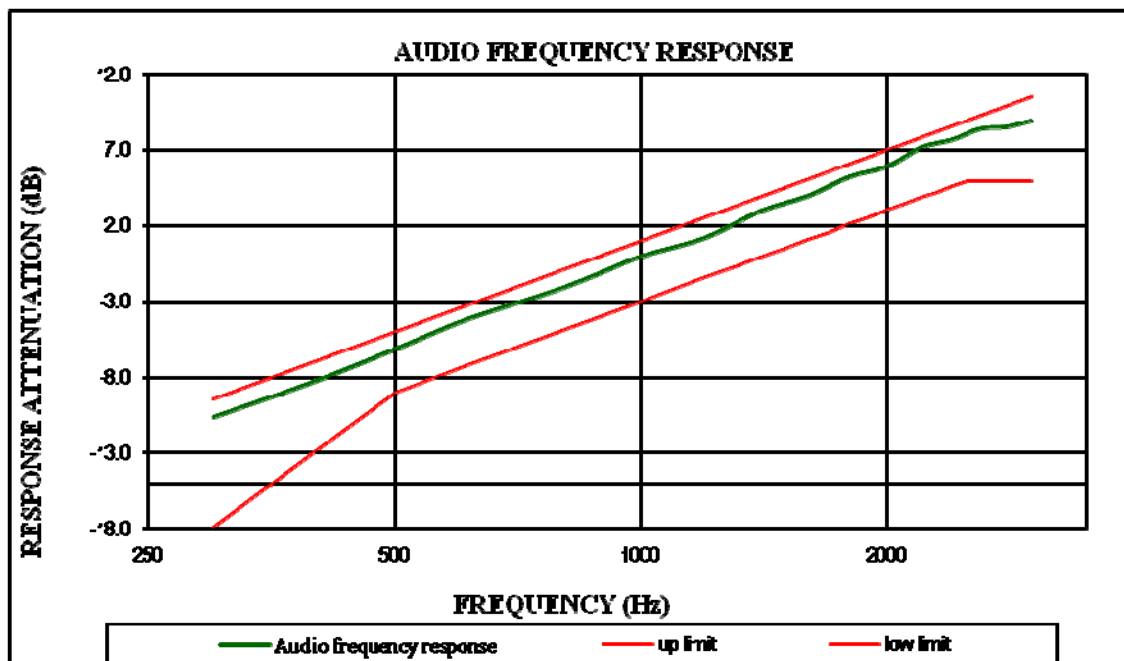
Modulation Frequency (Hz)	Response data (dB)
300	-10.17
400	-8.03
500	-5.96
600	-4.25
700	-3.06
800	-2.08
900	-1.01
1000	0.00
1200	1.21
1400	2.96
1600	3.99
1800	5.31
2000	6.01
2200	7.28
2400	7.80
2600	8.52
2800	8.64
3000	9.04



25 kHz:

Carrier Frequency: 459.9875 MHz

Modulation Frequency (Hz)	Response data (dB)
300	-10.59
400	-8.20
500	-6.11
600	-4.32
700	-3.12
800	-2.09
900	-1.00
1000	0.00
1200	1.24
1400	2.99
1600	3.98
1800	5.25
2000	5.92
2200	7.17
2400	7.68
2600	8.40
2800	8.52
3000	8.92

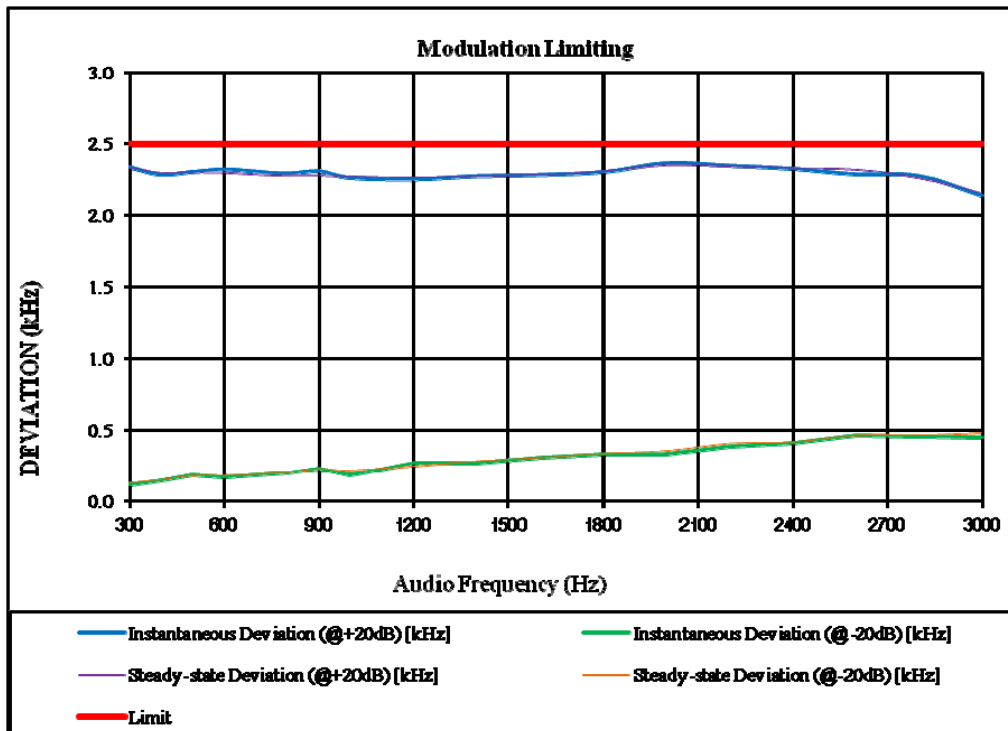


MODULATION LIMITING – High Power

12.5kHz

Carrier Frequency: 453.2125 MHz

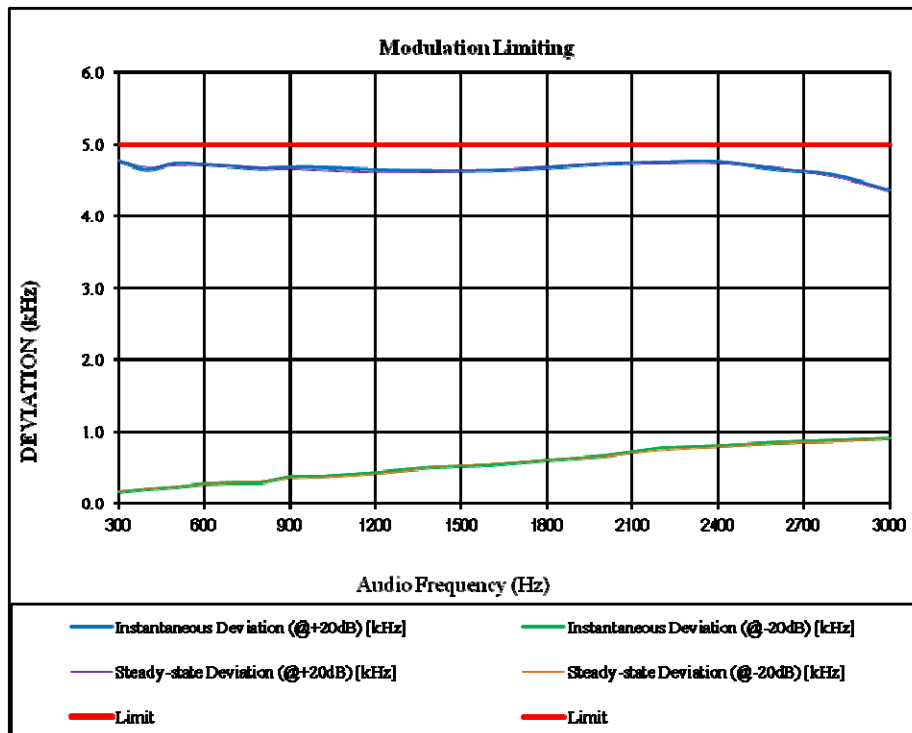
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [KHz]
	Deviation (@+20dB) [KHz]	Deviation (@-20dB) [KHz]	Deviation (@+20dB) [KHz]	Deviation (@-20dB) [KHz]	
300	2.337	0.114	2.337	0.134	2.5
400	2.286	0.148	2.301	0.151	2.5
500	2.304	0.182	2.305	0.182	2.5
600	2.322	0.168	2.302	0.184	2.5
700	2.307	0.182	2.289	0.191	2.5
800	2.293	0.203	2.281	0.203	2.5
900	2.309	0.234	2.281	0.230	2.5
1000	2.265	0.185	2.275	0.221	2.5
1200	2.254	0.271	2.266	0.251	2.5
1400	2.276	0.273	2.276	0.285	2.5
1600	2.284	0.308	2.284	0.308	2.5
1800	2.303	0.334	2.311	0.338	2.5
2000	2.364	0.333	2.356	0.357	2.5
2200	2.347	0.390	2.347	0.408	2.5
2400	2.326	0.411	2.334	0.417	2.5
2600	2.288	0.463	2.324	0.463	2.5
2800	2.277	0.458	2.265	0.466	2.5
3000	2.142	0.451	2.154	0.481	2.5



25kHz:

Carrier Frequency: 459.9875 MHz

Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [KHz]
	Deviation (@+20dB) [KHz]	Deviation (@-20dB) [KHz]	Deviation (@+20dB) [KHz]	Deviation (@-20dB) [KHz]	
300	4.769	0.158	4.776	0.178	5
400	4.646	0.202	4.681	0.208	5
500	4.731	0.234	4.707	0.234	5
600	4.714	0.273	4.711	0.273	5
700	4.691	0.282	4.691	0.291	5
800	4.662	0.286	4.667	0.314	5
900	4.676	0.376	4.664	0.351	5
1000	4.676	0.366	4.644	0.366	5
1200	4.645	0.431	4.613	0.415	5
1400	4.634	0.508	4.618	0.502	5
1600	4.636	0.536	4.644	0.556	5
1800	4.673	0.603	4.681	0.611	5
2000	4.723	0.664	4.731	0.656	5
2200	4.745	0.773	4.737	0.743	5
2400	4.756	0.803	4.738	0.788	5
2600	4.654	0.845	4.682	0.841	5
2800	4.579	0.877	4.555	0.857	5
3000	4.352	0.906	4.352	0.904	5

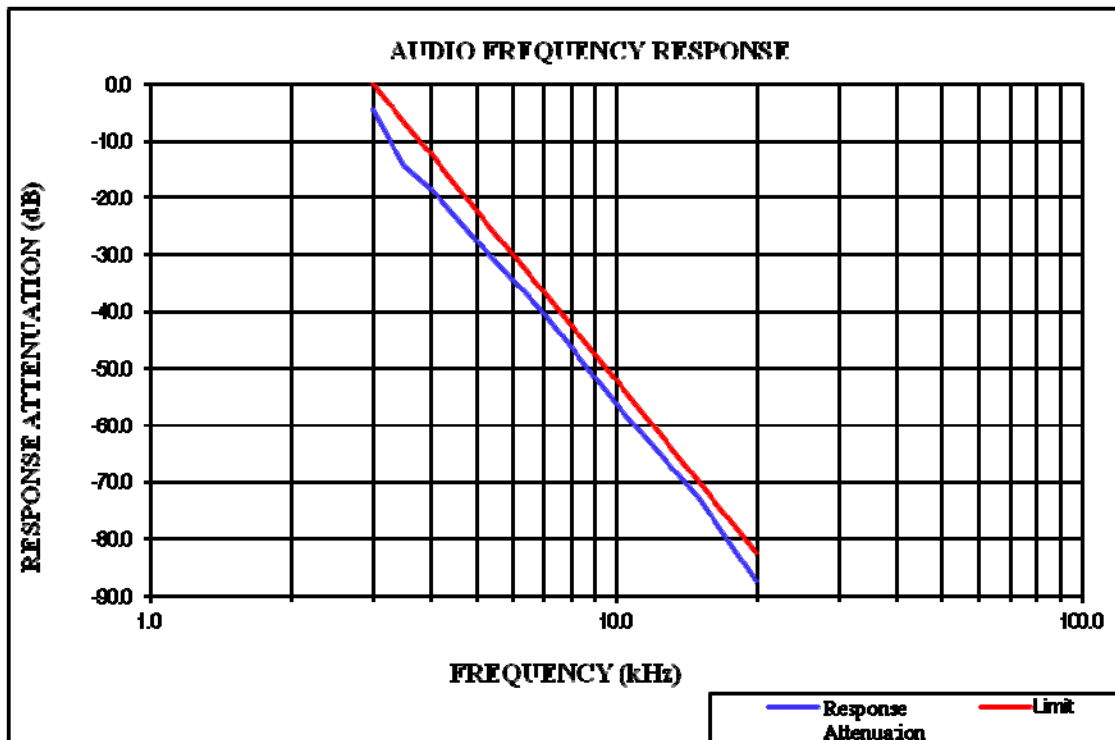


Audio Frequency Low Pass Filter Response – High Power

12.5kHz:

Carrier Frequency: 453.2125 MHz

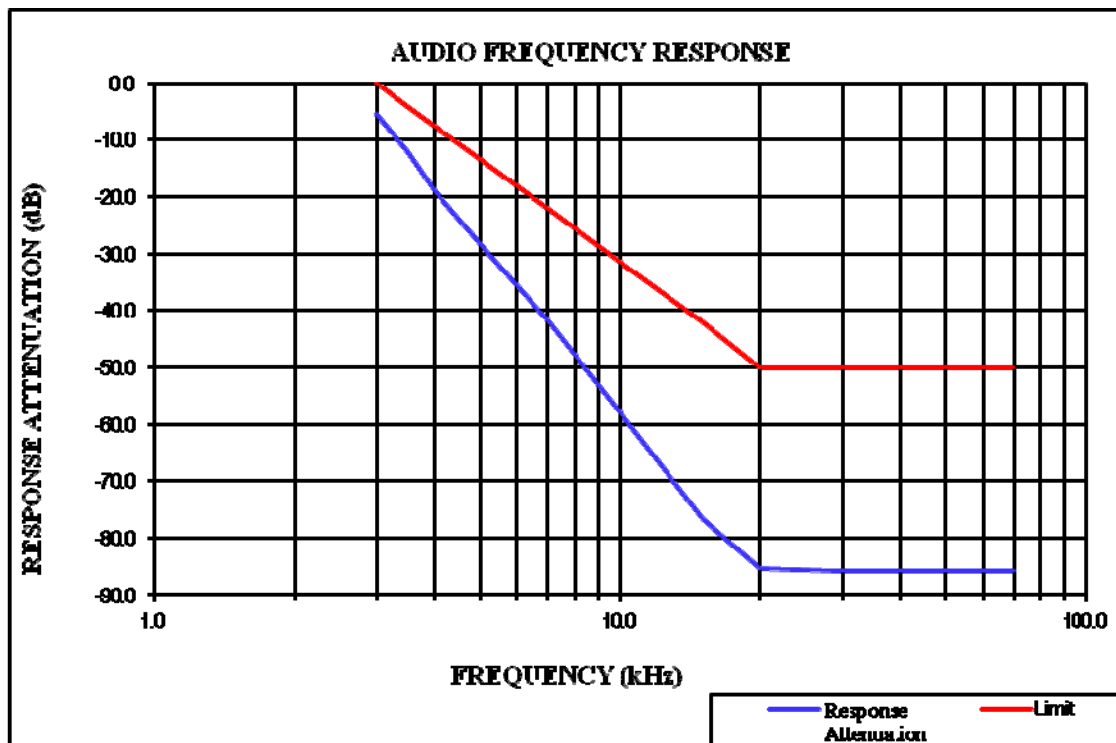
Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
3.0	-4.5	0.0
3.5	-14.4	-6.7
4.0	-18.6	-12.5
5.0	-27.5	-22.2
7.0	-40.3	-36.8
10.0	-56.5	-52.3
15.0	-72.9	-69.9
20.0	-87.6	-82.5



25kHz:

Carrier Frequency: 459.9875 MHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
3.0	-5.3	0.0
3.5	-12.0	-4.0
4.0	-19.0	-7.5
5.0	-28.1	-13.3
7.0	-41.8	-22.1
10.0	-57.9	-31.4
15.0	-76.5	-41.9
20.0	-85.4	-50.0
30.0	-85.7	-50.0
50.0	-85.8	-50.0
70.0	-85.7	-50.0



FCC §2.1049 & §22.357 & § 22.731 & §74.462 & 80.205& §80.207& §90.209 & §90.210 – OCCUPIED BANDWIDTH & EMISSION MASK

Applicable Standard

FCC §2.1049, §22.357, § 22.731, §74.462, §80.205, §80.207,§90.209 and §90.210

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 or 300 Hz and the spectrum was recorded in the frequency band ±50 kHz from the carrier frequency.

Test Data

Environmental Conditions

Temperature:	26.1°C
Relative Humidity:	73 %
ATM Pressure:	100.1~101 kPa
Tester:	James Chen
Test Date:	2020-09-16~2020-09-30

Test Mode: Transmitting

Test Result: Compliance. *Please refer to following table and plots.*

Test mode: transmitting

Test Mode	Test Channel	Test Frequency (MHz)	High Power Level		Low Power Level		Note
			99% Occupied Bandwidth (kHz)	26dB Emission Bandwidth (kHz)	99% Occupied Bandwidth (kHz)	26dB Emission Bandwidth (kHz)	
FM 12.5kHz	Low	450.0125	10.000	10.417	10.000	10337	FCC part 90
	Middle	481.0000	10.016	10.337	9.936	10.337	
	High	526.9875	9.936	10.337	10.016	10.337	For federal
	Additional	453.2125	10.000	10.337	10.100	10.317	FCC part 90
	Additional	455.0125	10.000	10.337	10.100	10.317	FCC part 74
	Additional	454.0125	10.000	10.337	10.100	10.317	FCC part 22
4FSK 12.5kHz	Low	450.0125	7.900	9.432	7.700	9.953	FCC part 90
	Middle	481.0000	7.933	9.615	7.853	10.737	
	High	526.9875	7.933	9.936	7.933	10.016	For federal
	Additional	453.2125	7.600	9.375	7.800	9.596	FCC part 90
	Additional	455.0125	7.600	9.295	7.700	9.375	FCC part 74
	Additional	454.0125	7.800	9.615	7.600	9.836	FCC part 22
FM 25kHz	Additional	450.0125	15.200	16.026	15.200	16.026	FCC part 80
	Additional	455.0125	15.200	18.429	15.200	18.429	FCC part 74
	Additional	454.0125	15.200	18.429	15.200	18.429	FCC part 22

Note: Emission bandwidth was based on calculation method instead of measurement.

Emission Designator

Per CFR 47 §2.201& §2.202, $BW = 2M + 2D$

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.

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

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 FM Mode (Channel Spacing: 25 kHz)

Emission Designator 16K0F3E

In this case, the maximum modulating frequency is 3.0 kHz with a 5.0 kHz deviation.

$$BW = 2(M+D) = 2*(3.0 \text{ kHz} + 5.0 \text{ kHz}) = 16 \text{ kHz} = 16K0$$

F3E portion of the designator represents an FM voice transmission

Therefore, the entire designator for 25 kHz channel spacing FM mode is 16K0F3E.

For Digital Mode (Channel Spacing: 12.5 kHz)

Emission Designator 7K60F1D and 7K60F1E

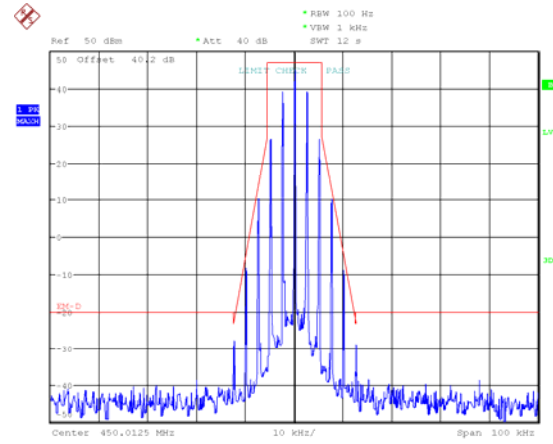
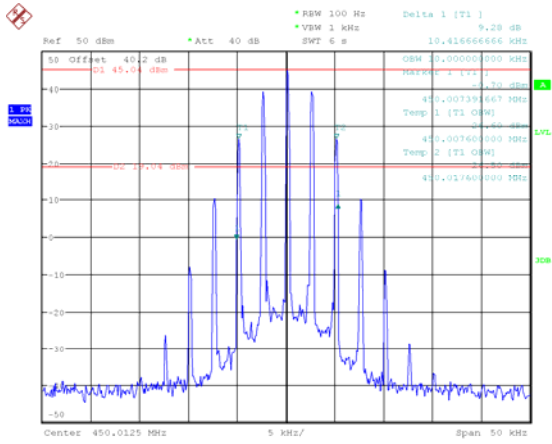
The 99% energy rule (title 47CFR 2.1049) was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.60 kHz. The emission mask was obtained from 47CFR 90.210(d).

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.

FM, 12.5kHz High Power:

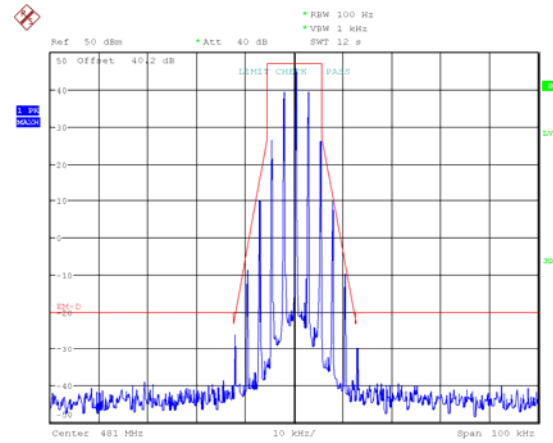
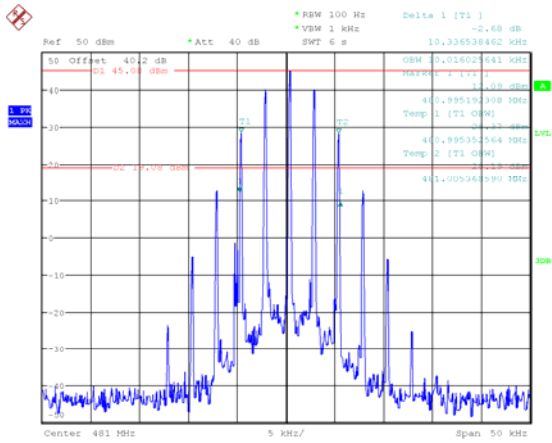
Low Channel



Date: 16.SEP.2020 21:05:28

Date: 16.SEP.2020 21:07:05

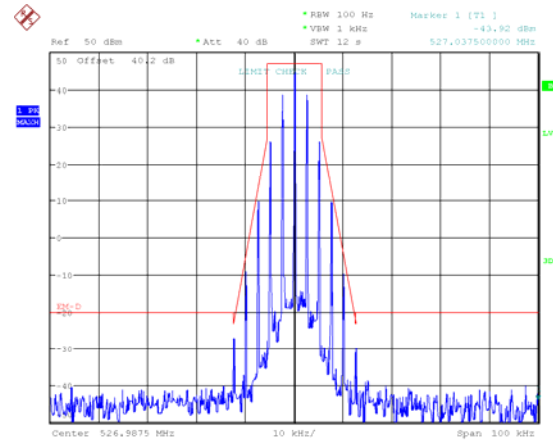
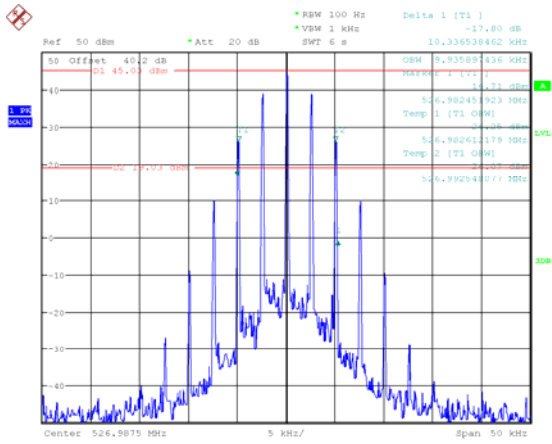
Middle Channel



Date: 20.SEP.2020 13:38:19

Date: 20.SEP.2020 13:42:25

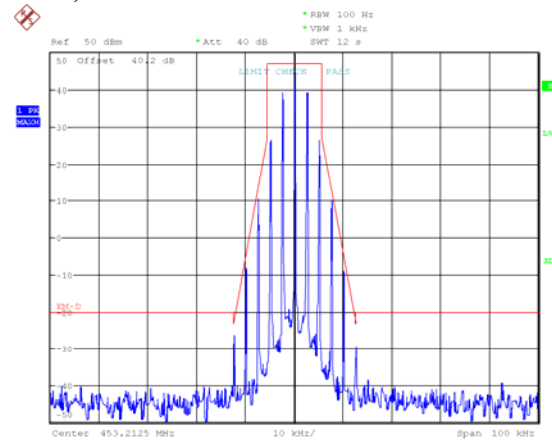
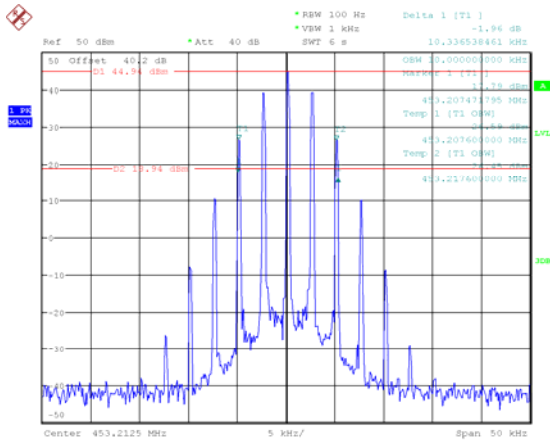
High Channel



Date: 30.SEP.2020 19:41:27

Date: 30.SEP.2020 19:44:57

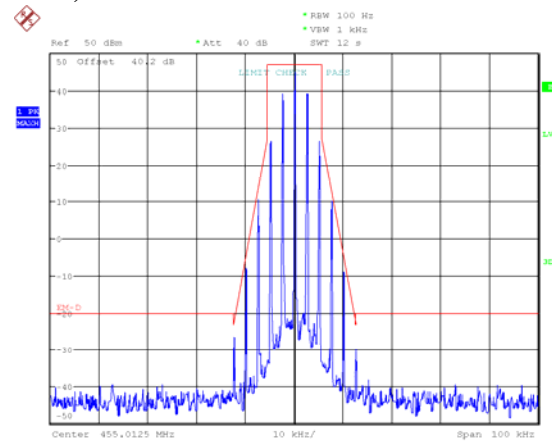
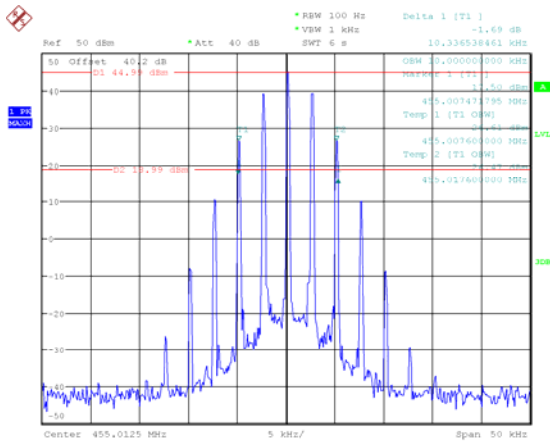
Additional Channel Part 90, 453.2125 MHz



Date: 16.SEP.2020 21:51:52

Date: 16.SEP.2020 21:52:52

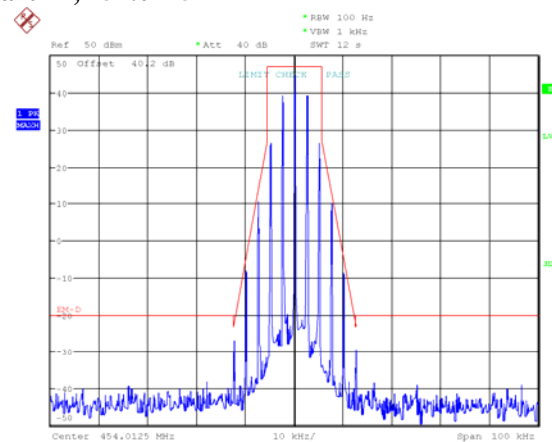
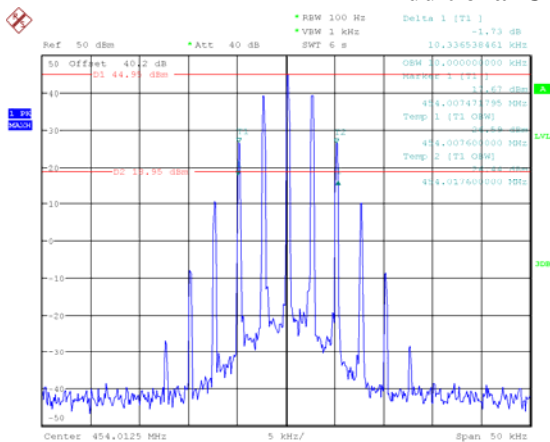
Additional Channel Part 74, 455.0125 MHz



Date: 16.SEP.2020 21:56:25

Date: 16.SEP.2020 21:57:35

Additional Channel Part 22, 454.0125 MHz

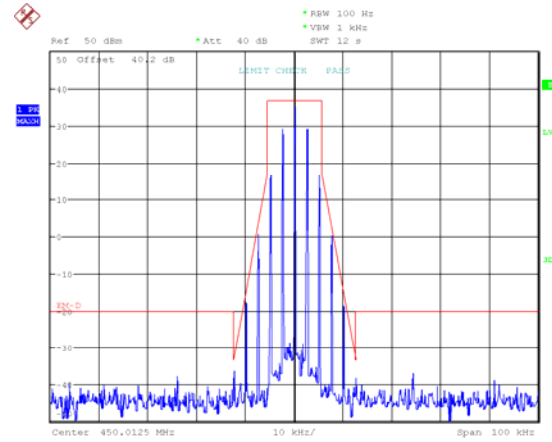
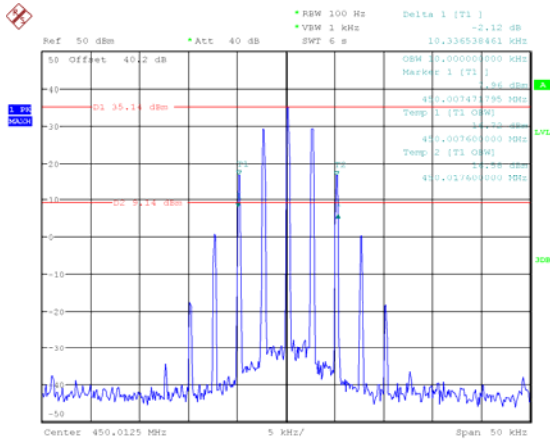


Date: 16.SEP.2020 22:00:52

Date: 16.SEP.2020 22:01:54

Low Power:

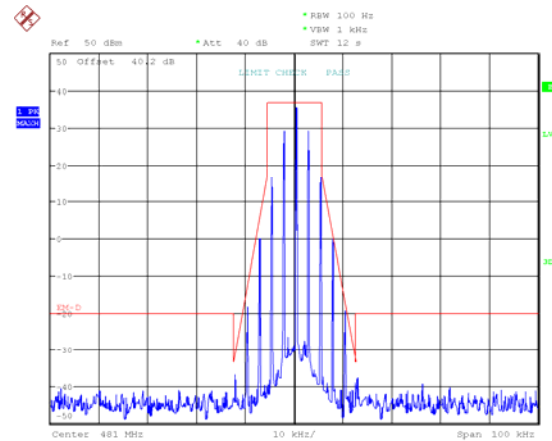
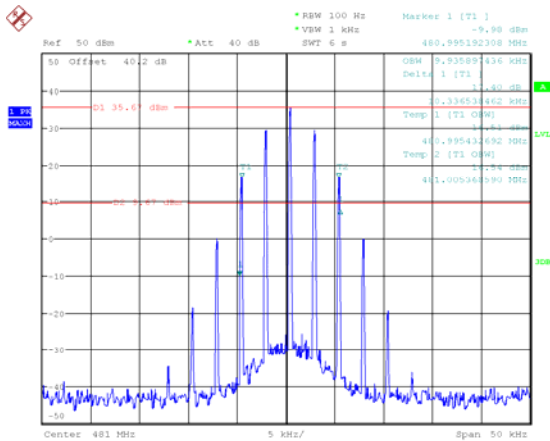
Low Channel



Date: 16.SEP.2020 21:09:22

Date: 16.SEP.2020 21:10:50

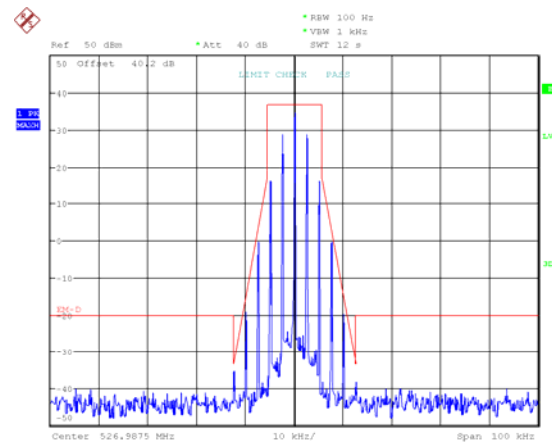
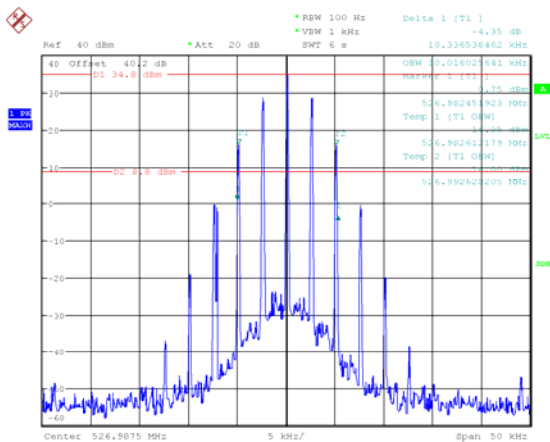
Middle Channel



Date: 20.SEP.2020 13:45:13

Date: 20.SEP.2020 13:46:05

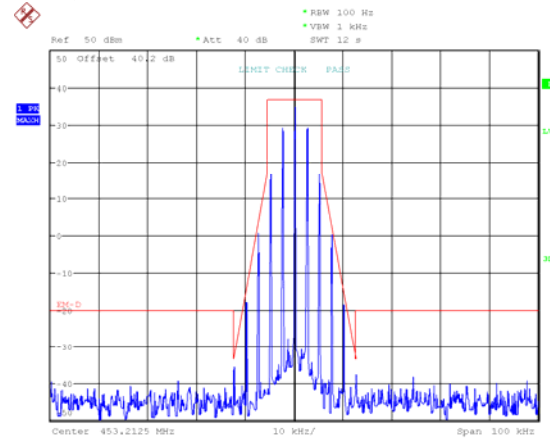
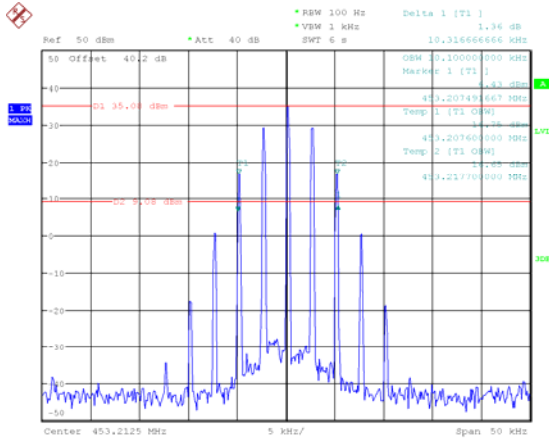
High Channel



Date: 30.SEP.2020 19:56:44

Date: 30.SEP.2020 19:57:42

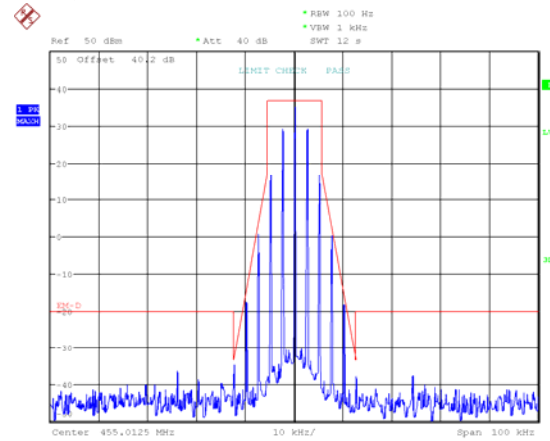
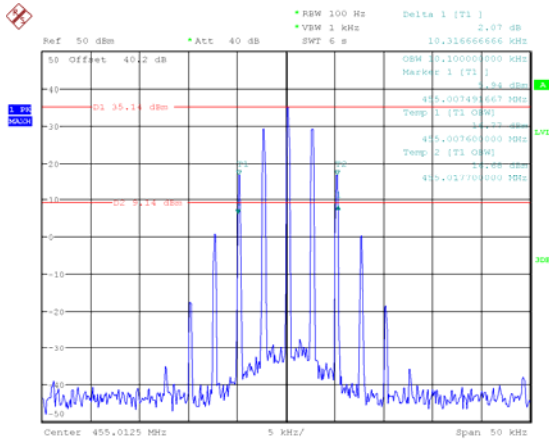
Additional Channel Part 90, 453.2125 MHz



Date: 16.SEP.2020 21:54:03

Date: 16.SEP.2020 21:54:40

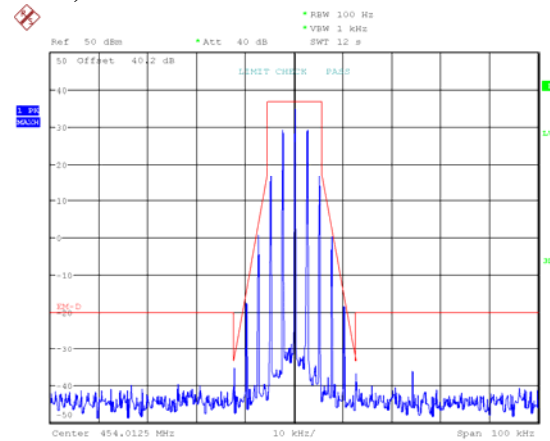
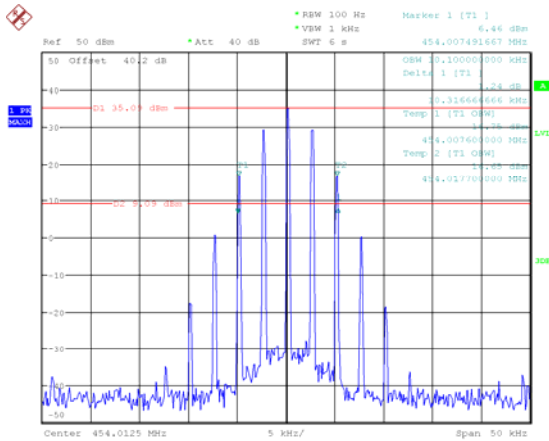
Additional Channel Part 74, 455.0125 MHz



Date: 16.SEP.2020 21:58:33

Date: 16.SEP.2020 21:59:17

Additional Channel Part 22, 454.0125 MHz

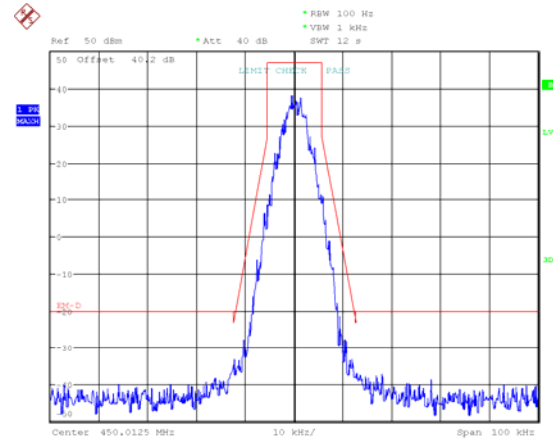
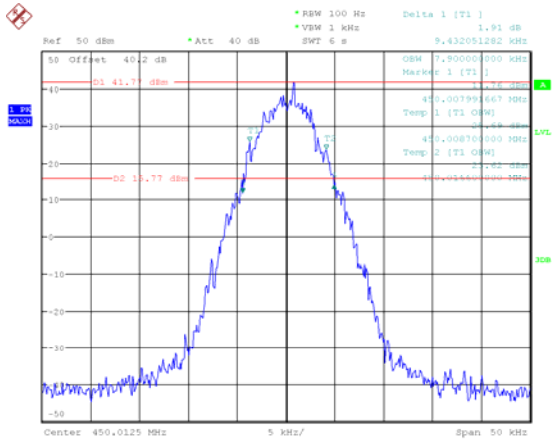


Date: 16.SEP.2020 22:02:57

Date: 16.SEP.2020 22:03:45

4FSK, 12.5kHz High Power:

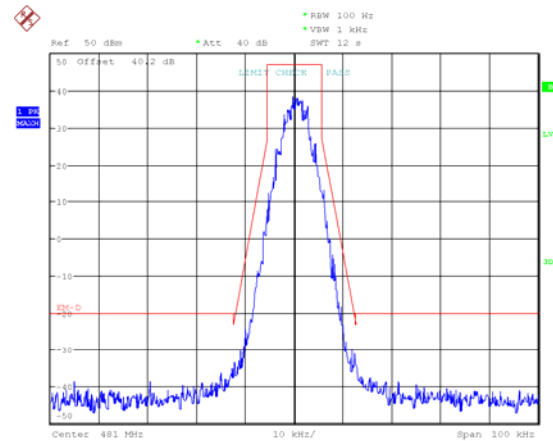
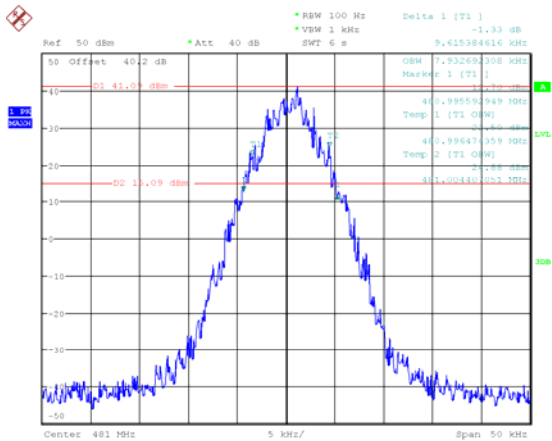
Low Channel



Date: 16.SEP.2020 21:17:44

Date: 16.SEP.2020 21:18:42

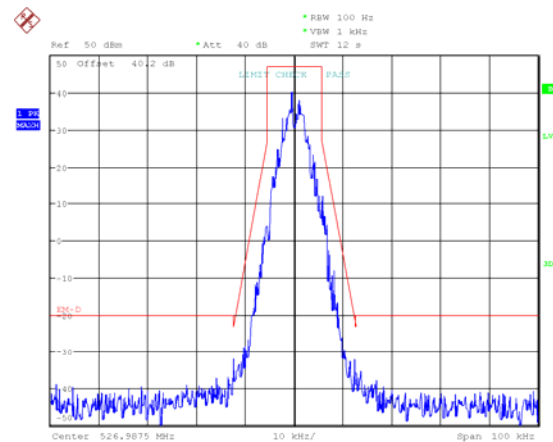
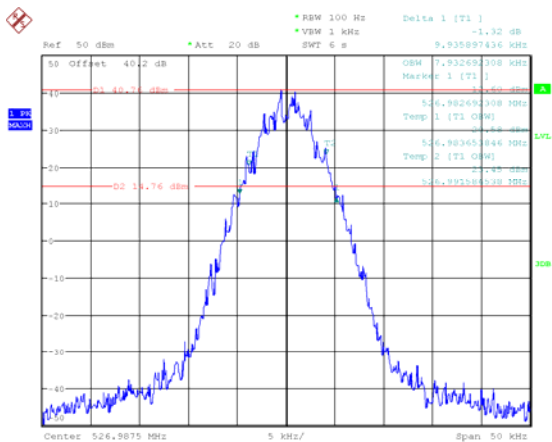
Middle Channel



Date: 20.SEP.2020 13:48:02

Date: 20.SEP.2020 13:49:05

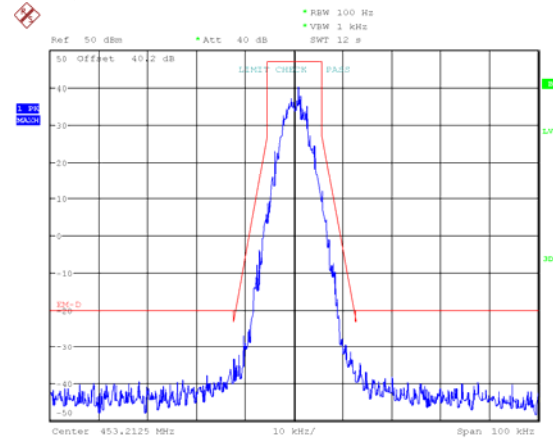
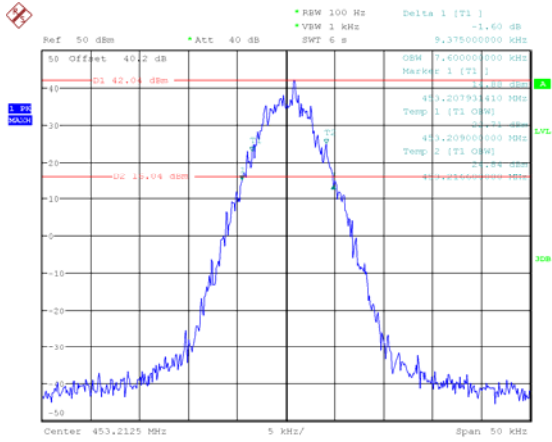
High Channel



Date: 30.SEP.2020 20:00:06

Date: 30.SEP.2020 20:01:07

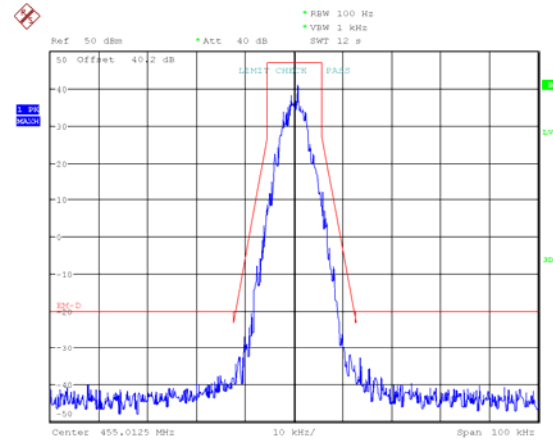
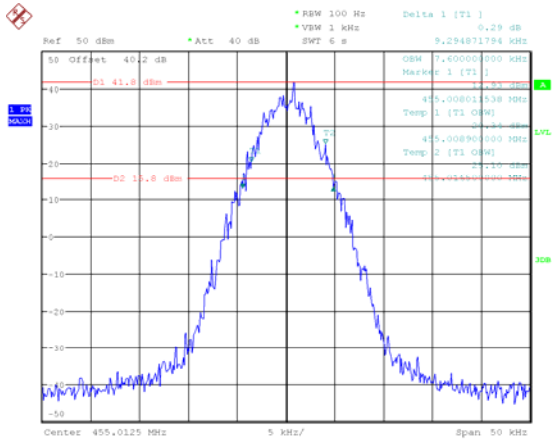
Additional Channel Part 90, 453.2125 MHz



Date: 16.SEP.2020 21:23:47

Date: 16.SEP.2020 21:24:57

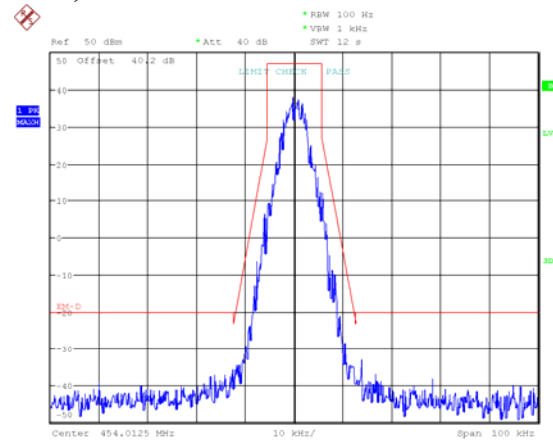
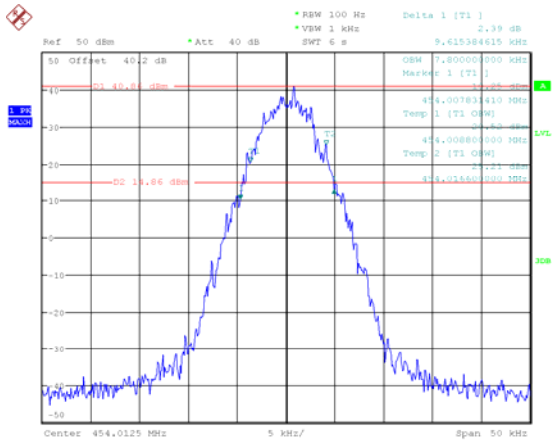
Additional Channel Part 74, 455.0125 MHz



Date: 16.SEP.2020 21:29:48

Date: 16.SEP.2020 21:30:39

Additional Channel Part 22, 454.0125 MHz

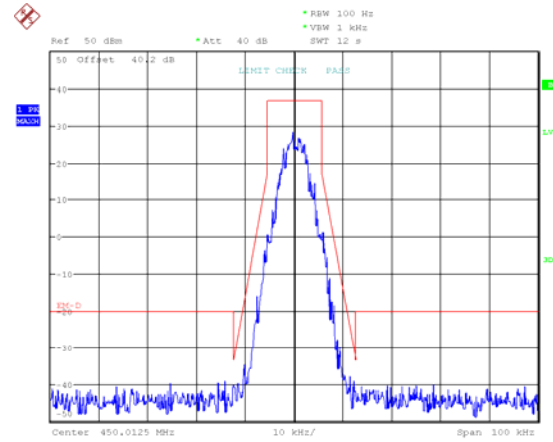
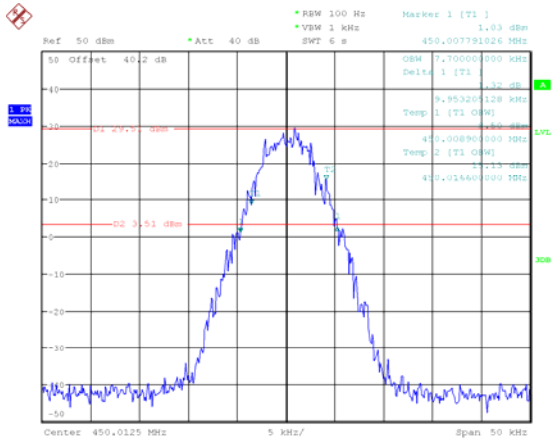


Date: 16.SEP.2020 21:34:34

Date: 16.SEP.2020 21:35:39

Low Power:

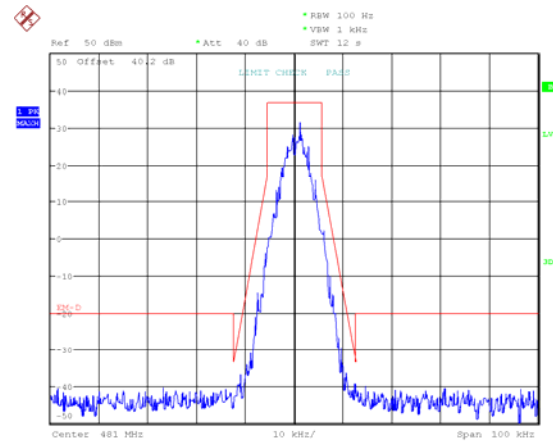
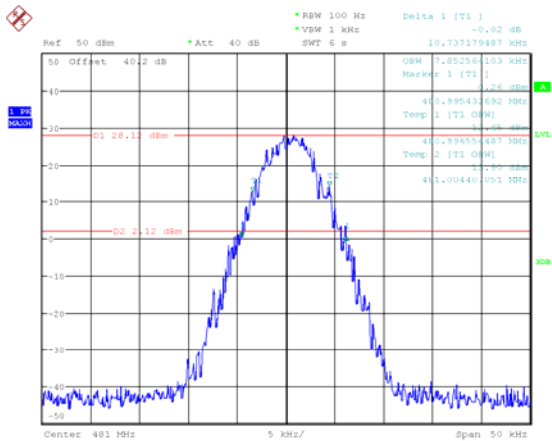
Low Channel



Date: 16.SEP.2020 21:21:32

Date: 16.SEP.2020 21:20:17

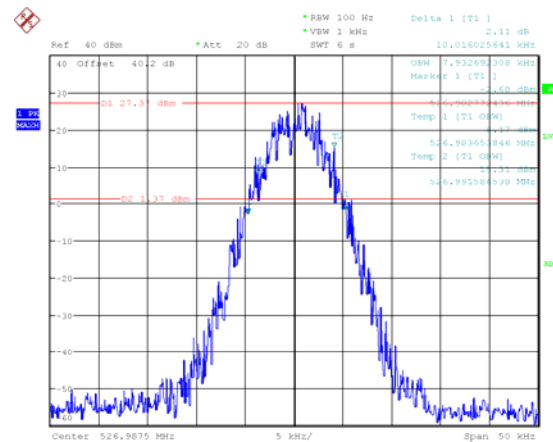
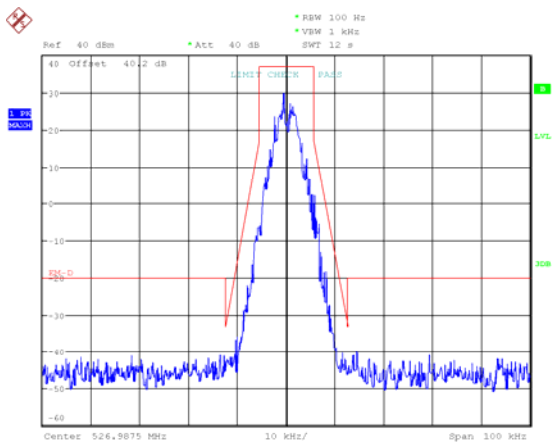
Middle Channel



Date: 20.SEP.2020 13:50:32

Date: 20.SEP.2020 13:51:39

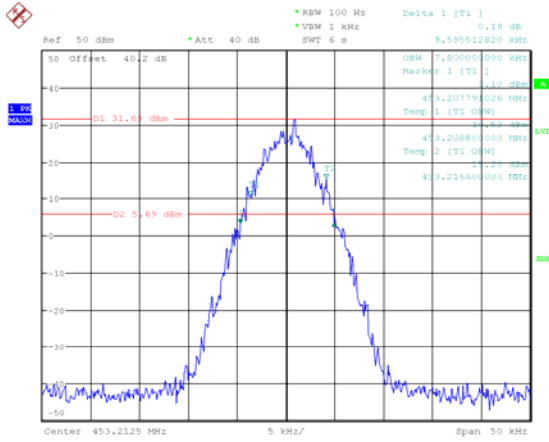
High Channel



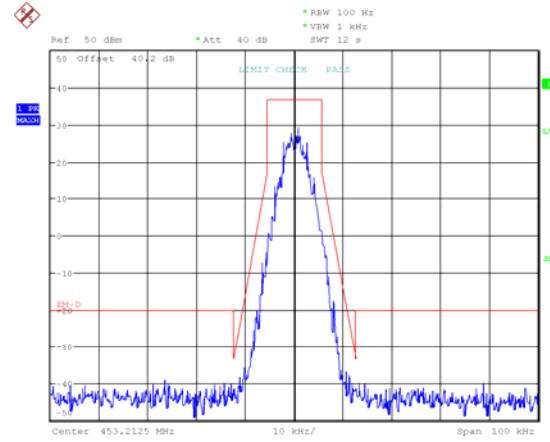
Date: 30.SEP.2020 20:02:24

Date: 30.SEP.2020 20:03:28

Additional Channel Part 90, 453.2125 MHz

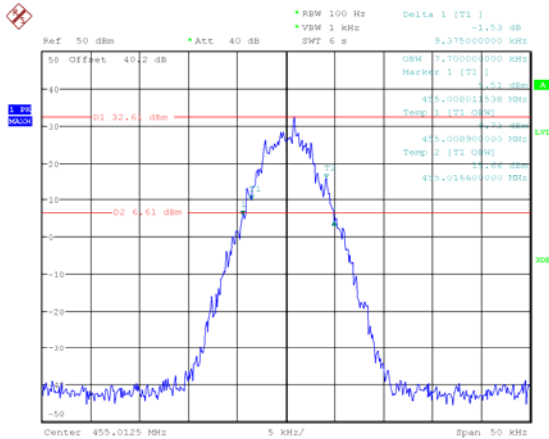


Date: 16.SEP.2020 21:27:14

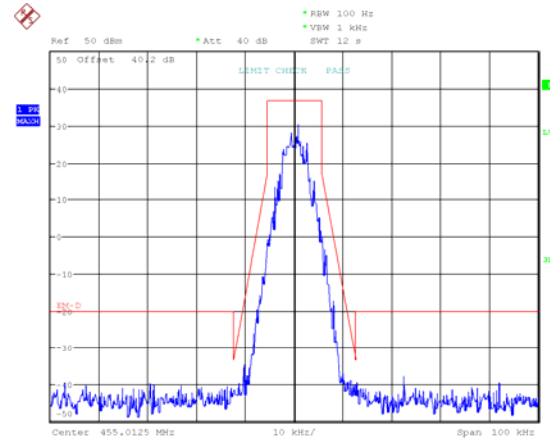


Date: 16.SEP.2020 21:26:13

Additional Channel Part 74, 455.0125 MHz

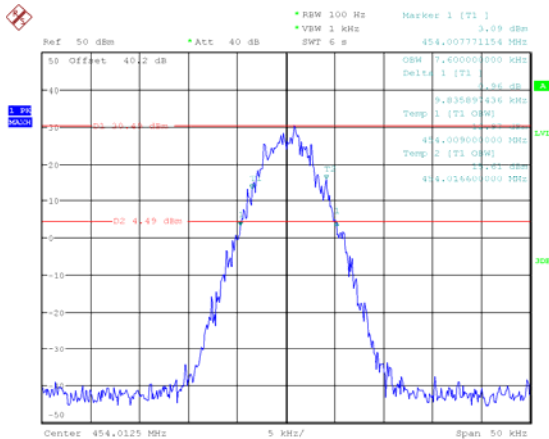


Date: 16.SEP.2020 21:33:07

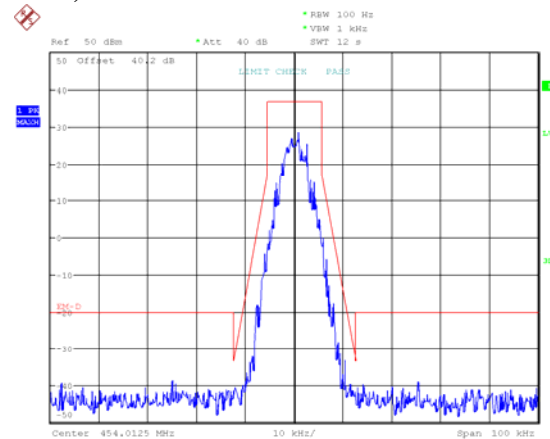


Date: 16.SEP.2020 21:31:45

Additional Channel Part 22, 454.0125 MHz



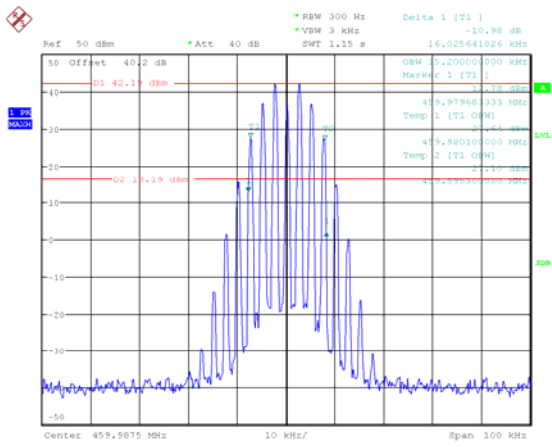
Date: 16.SEP.2020 21:37:44



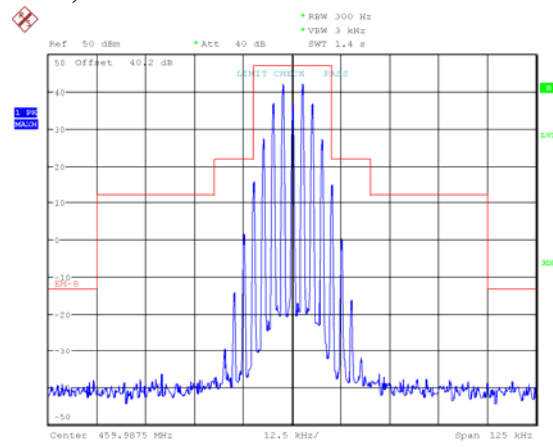
Date: 16.SEP.2020 21:38:34

FM, 25 kHz, High Power:

Additional Channel Part 80, 459.9875 MHz

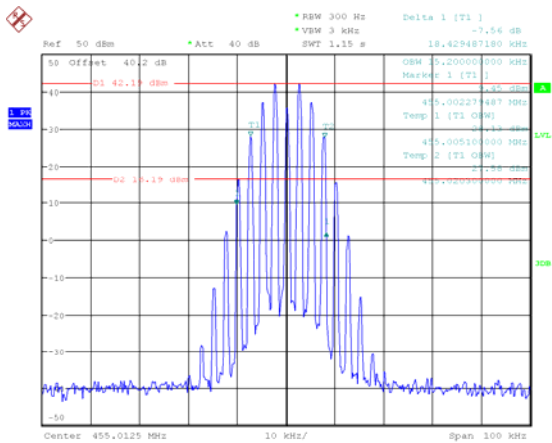


Date: 16.SEP.2020 22:13:46

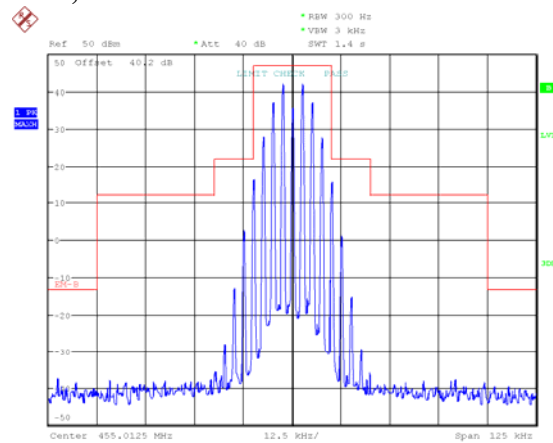


Date: 16.SEP.2020 22:14:34

Additional Channel Part 74, 455.0125 MHz

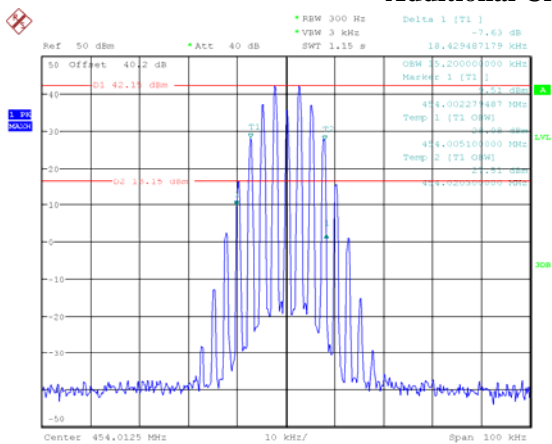


Date: 16.SEP.2020 22:18:01

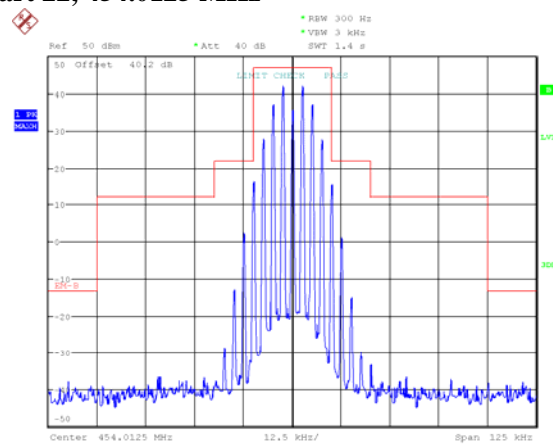


Date: 16.SEP.2020 22:18:36

Additional Channel Part 22, 454.0125 MHz



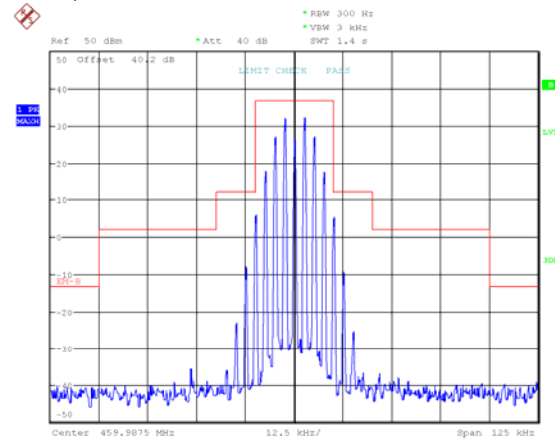
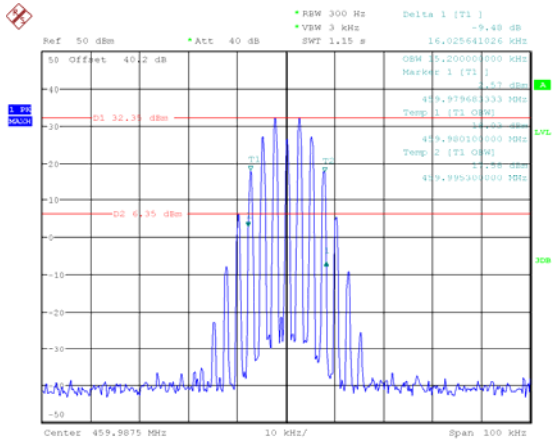
Date: 16.SEP.2020 22:21:22



Date: 16.SEP.2020 22:21:56

Low Power:

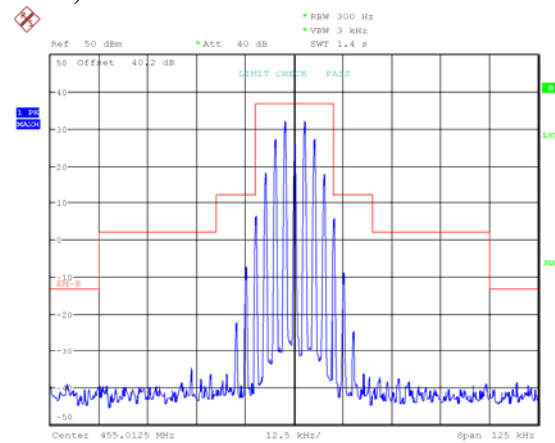
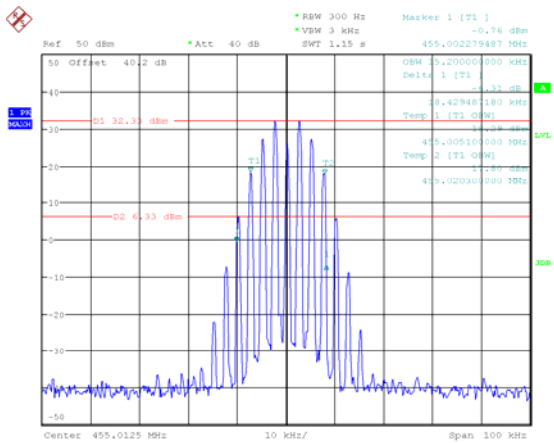
Additional Channel Part 80, 459.9875 MHz



Date: 16.SEP.2020 22:16:04

Date: 16.SEP.2020 22:16:35

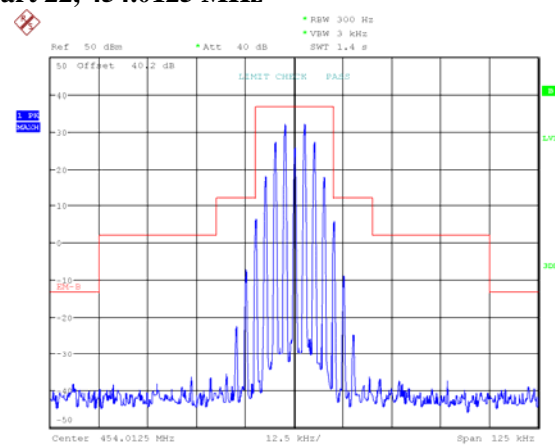
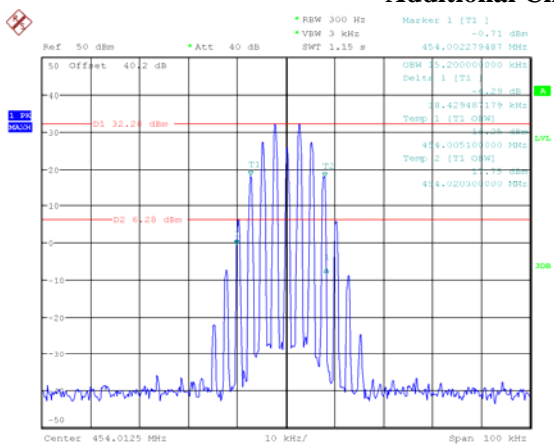
Additional Channel Part 74, 455.0125 MHz



Date: 16.SEP.2020 22:19:30

Date: 16.SEP.2020 22:20:03

Additional Channel Part 22, 454.0125 MHz



Date: 16.SEP.2020 22:23:05

Date: 16.SEP.2020 22:23:39

FCC §2.1051 & §22.861 & §74.462 & § 80.211 & §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

FCC §2.1051, §22.861, §74.462, §80.211, and §90.210

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

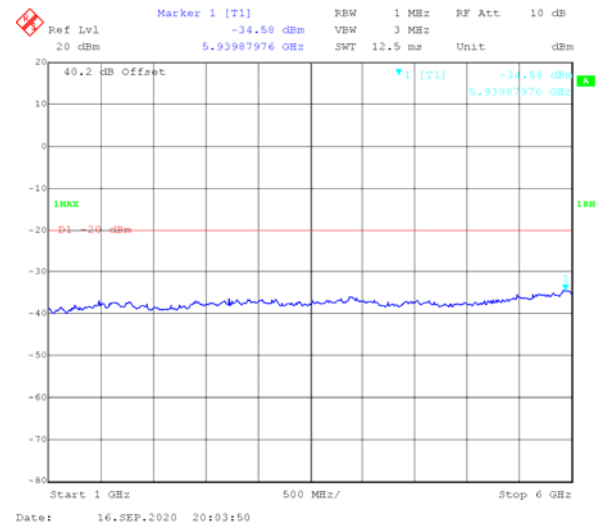
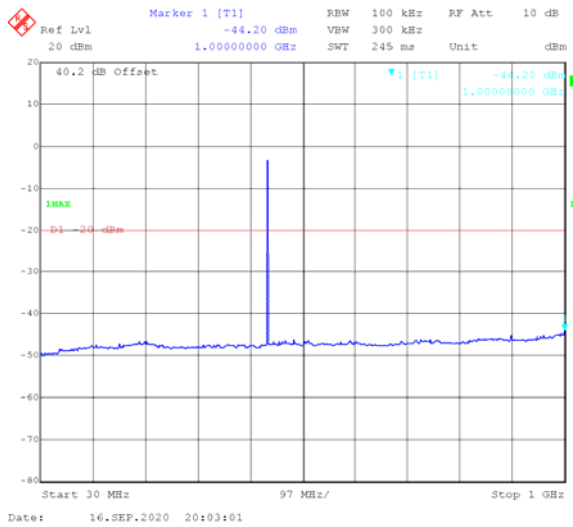
Temperature:	24.3~27.3°C
Relative Humidity:	64~73 %
ATM Pressure:	100.1~101 kPa
Tester:	James Chen
Test Date:	2020-09-07~2020-09-20

Test Mode: Transmitting

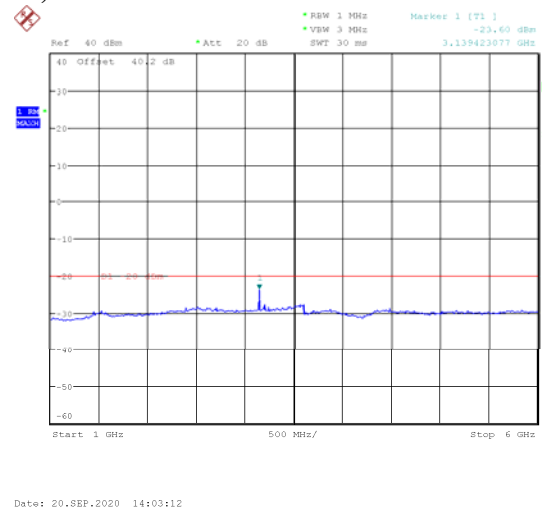
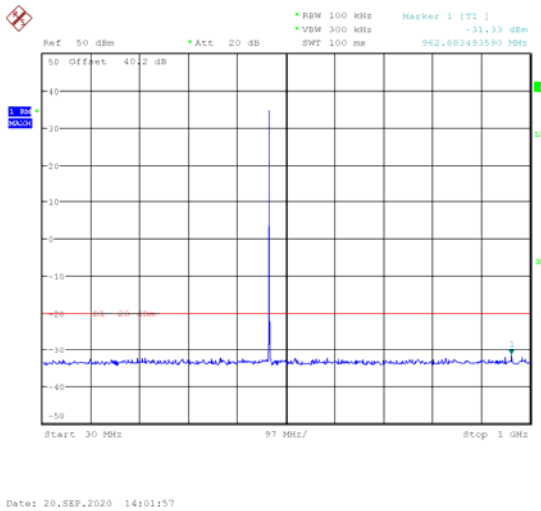
Test Result: Compliance. *Test performed at high power level with Band reject filter, please refer to the following plots.*

FCC part 90, FM, 12.5kHz:

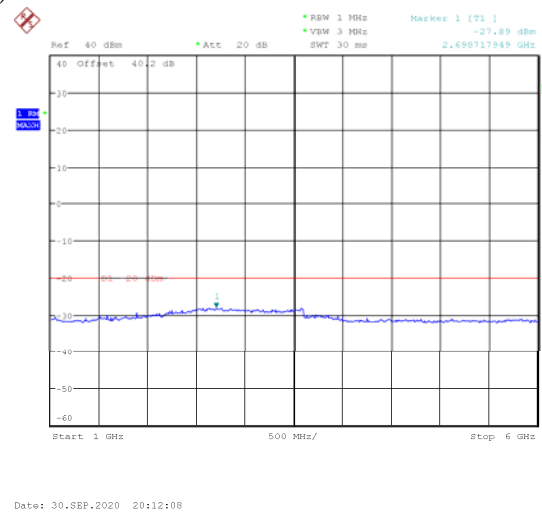
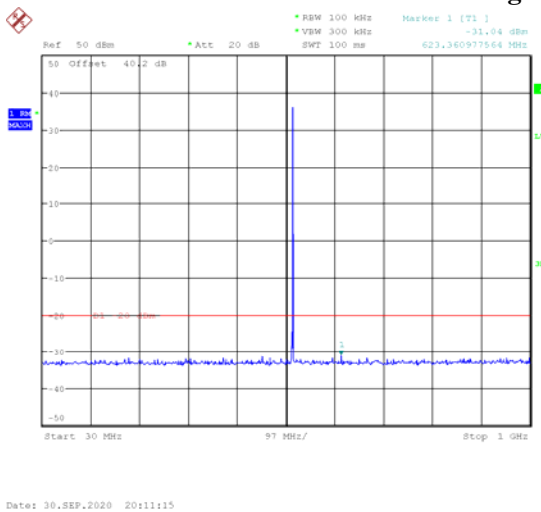
Low Channel, 450.0125 MHz



Middle Channel, 481 MHz

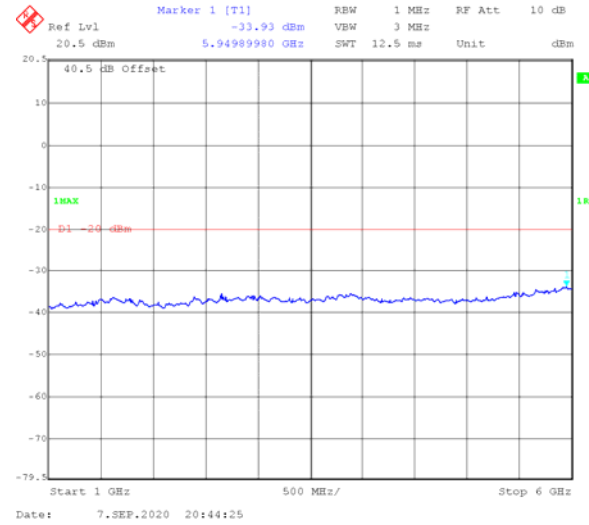
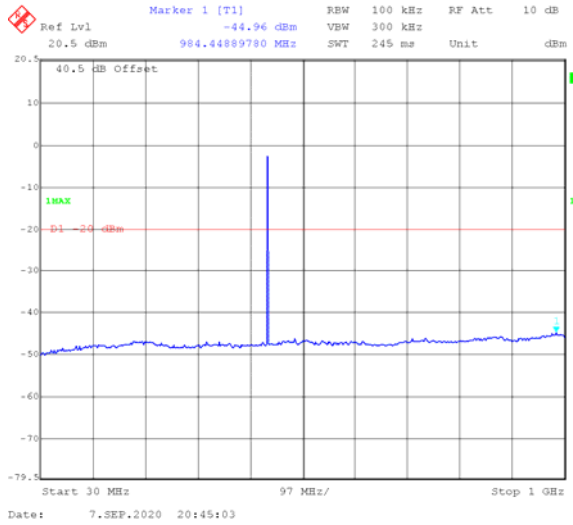


High Channel, 526.9875 MHz

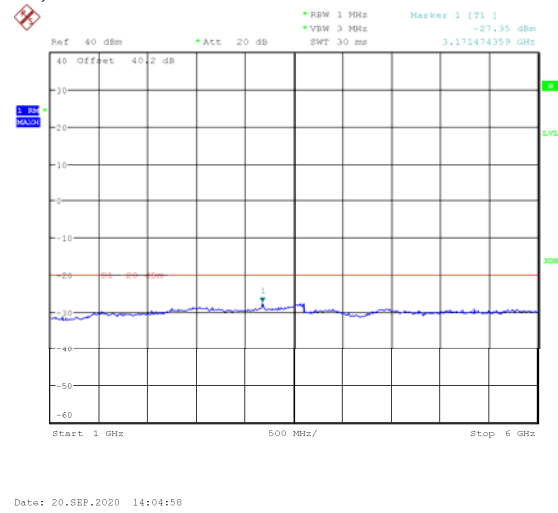
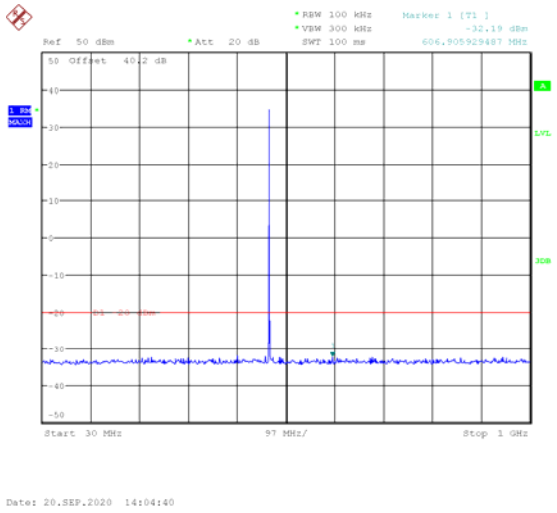


4FSK, 12.5kHz:

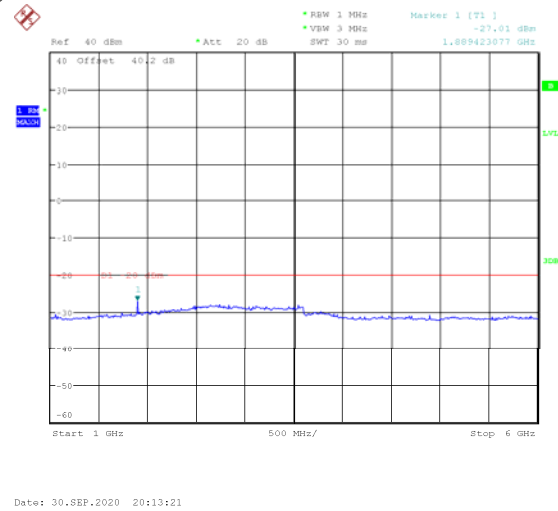
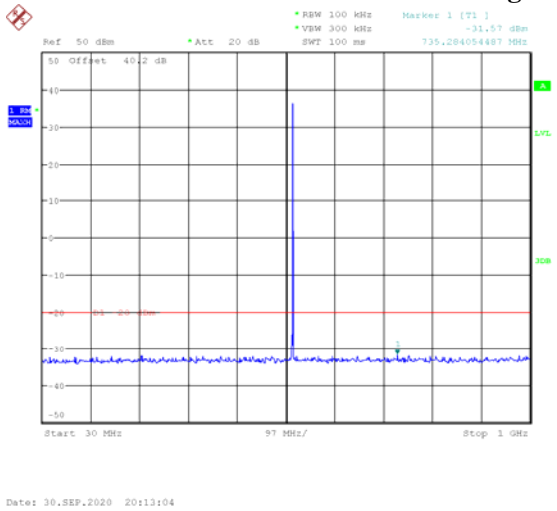
Low Channel, 450.0125 MHz



Middle Channel, 481 MHz

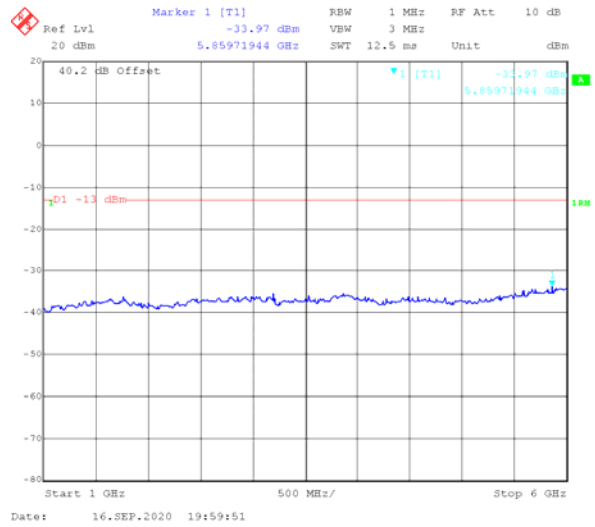
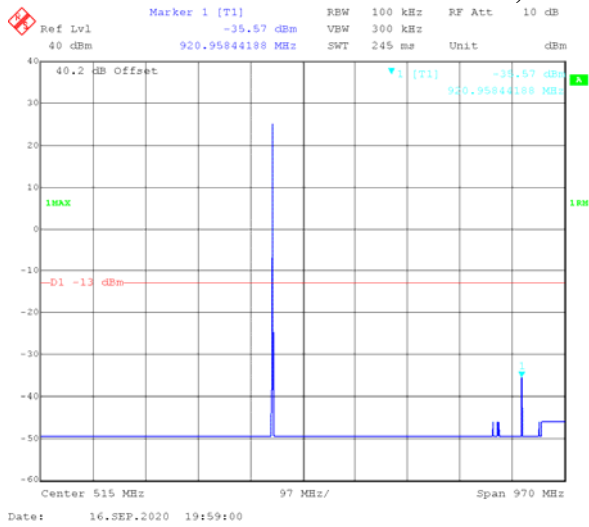


High Channel, 526.9875 MHz



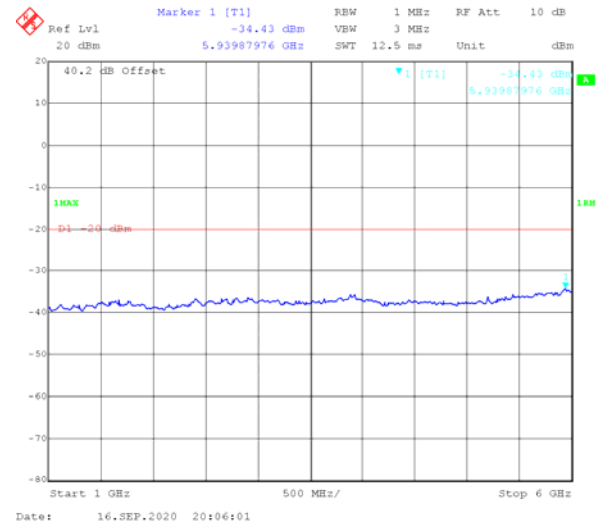
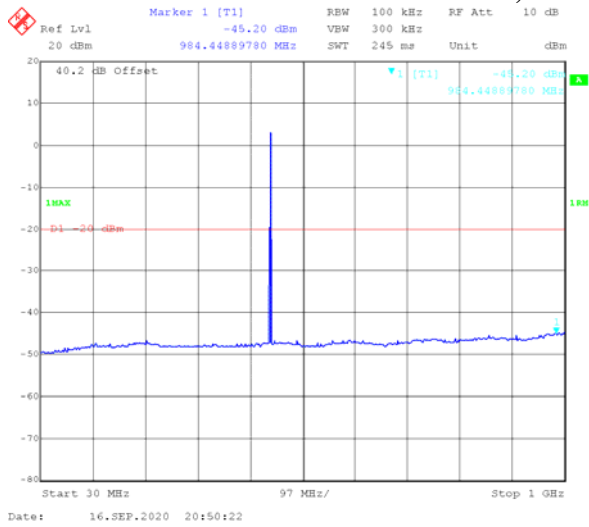
Part 80:

FM, 12.5kHz, 459.8875 MHz

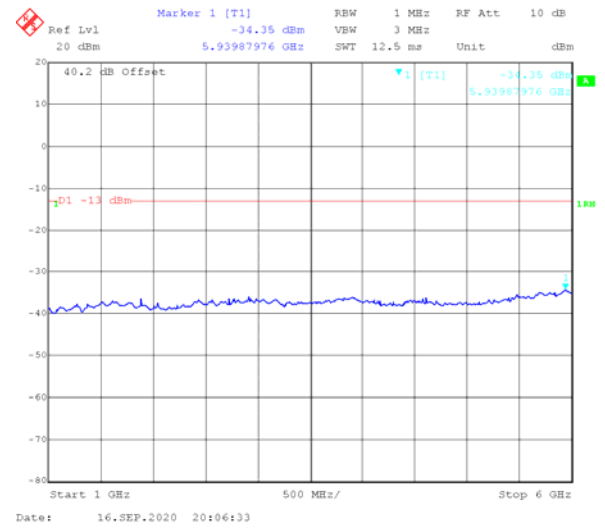
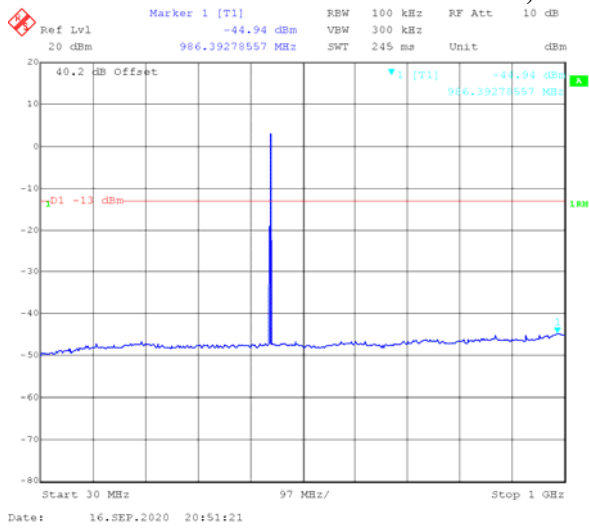


Part 74:

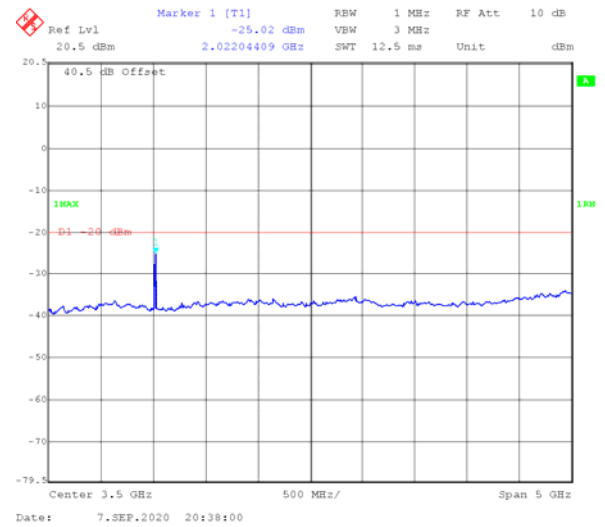
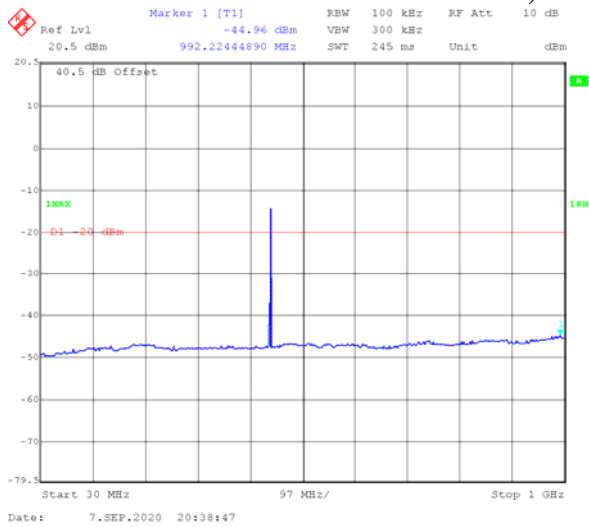
FM,12.5kHz, 455.0125 MHz



FM,25kHz, 455.0125 MHz

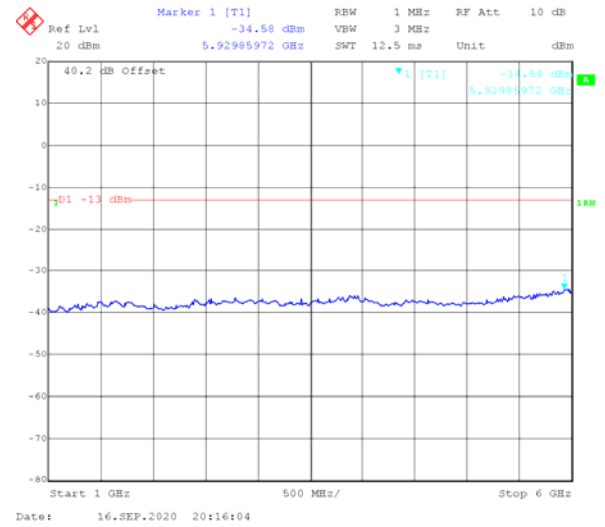
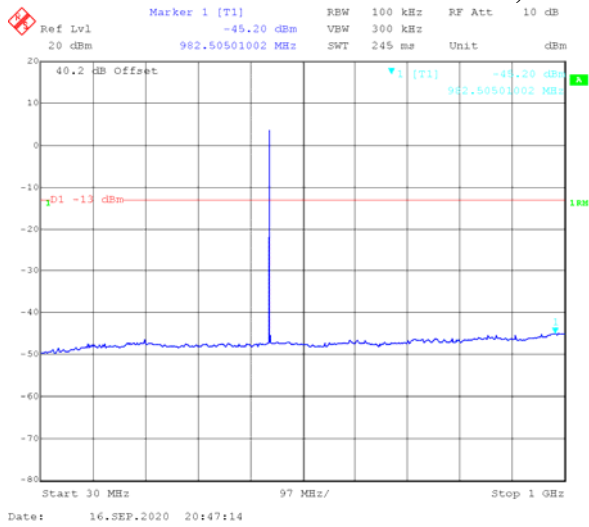


4FSK,12.5kHz, 455.0125 MHz

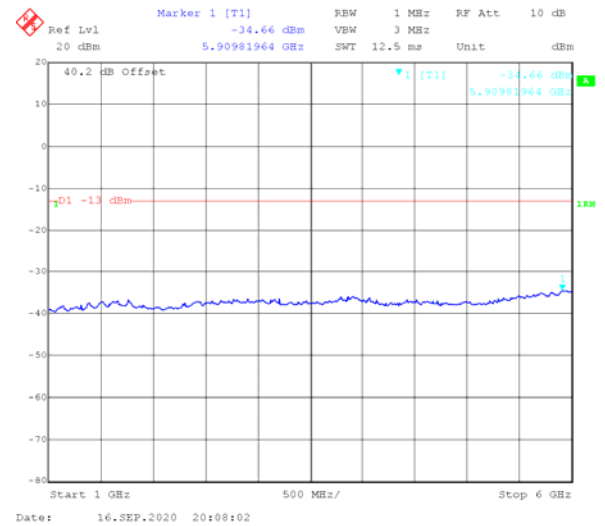
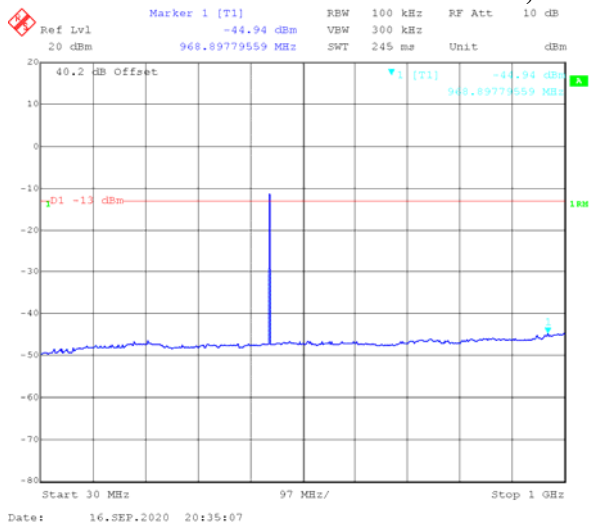


Part 22:

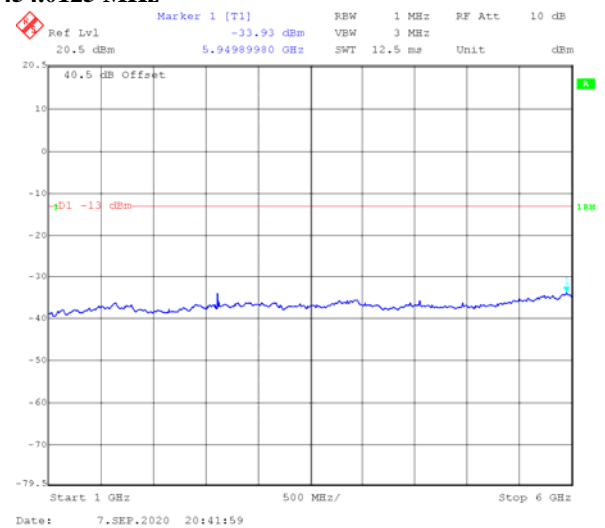
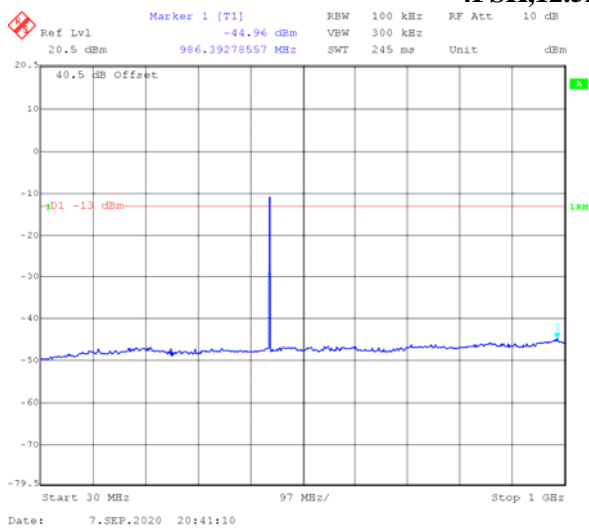
FM,12.5kHz, 454.0125 MHz



FM,25kHz, 454.0125 MHz



4FSK,12.5kHz, 454.0125 MHz



FCC §2.1053 & §22.861 & §74.462 & §80.211 & §90.210 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

FCC §2.1053, §22.861, §74.462, §80.211 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

Test Data

Environmental Conditions

Temperature:	28 ~29.4 °C
Relative Humidity:	38.2 ~55 %
ATM Pressure:	100 kPa
Tester:	Jalon Liu, Bond Qin
Test Date:	2020-09-01

Test Mode: Transmitting

Test Result: Compliance. *Test performed at high power level with Band Rejector Filter, configuration 1 was the worst, please refer to the following table.*

30MHz - 6GHz:**Part 90**

Frequency (MHz)	Polar (H/V)	Receiver Reading (dB μ V)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM, Frequency: 450.0125MHz-12.5 kHz								
900.025	H	35.73	-61.41	0.00	1.05	-62.46	-20.0	42.46
900.025	V	35.60	-63.55	0.00	1.05	-64.60	-20.0	44.60
1350.038	H	38.12	-65.47	8.65	1.20	-58.02	-20.0	38.02
1350.038	V	38.56	-65.78	8.65	1.20	-58.33	-20.0	38.33
1800.050	H	37.12	-67.17	11.10	0.68	-56.75	-20.0	36.75
1800.050	V	37.26	-67.63	11.10	0.68	-57.21	-20.0	37.21
2250.063	H	37.15	-64.85	11.00	1.19	-55.04	-20.0	35.04
2250.063	V	37.26	-64.64	11.00	1.19	-54.83	-20.0	34.83
2700.075	H	37.23	-64.72	13.10	1.25	-52.87	-20.0	32.87
2700.075	V	37.89	-64.16	13.10	1.25	-52.31	-20.0	32.31
3150.09	H	37.45	-61.85	13.40	1.70	-50.15	-20.0	30.15
3150.09	V	37.99	-61.34	13.40	1.70	-49.64	-20.0	29.64
4FSK, Frequency: 450.0125MHz-12.5 kHz								
900.025	H	36.62	-60.52	0.00	1.05	-61.57	-20.0	41.57
900.025	V	36.28	-62.87	0.00	1.05	-63.92	-20.0	43.92
1350.038	H	37.56	-66.03	8.65	1.20	-58.58	-20.0	38.58
1350.038	V	37.89	-66.45	8.65	1.20	-59.00	-20.0	39.00
1800.050	H	38.55	-65.74	11.10	0.68	-55.32	-20.0	35.32
1800.050	V	38.24	-66.65	11.10	0.68	-56.23	-20.0	36.23
2250.063	H	37.26	-64.74	11.00	1.19	-54.93	-20.0	34.93
2250.063	V	37.56	-64.34	11.00	1.19	-54.53	-20.0	34.53
2700.075	H	37.59	-64.36	13.10	1.25	-52.51	-20.0	32.51
2700.075	V	37.16	-64.89	13.10	1.25	-53.04	-20.0	33.04
3150.09	H	36.13	-63.17	13.40	1.70	-51.47	-20.0	31.47
3150.09	V	36.56	-62.77	13.40	1.70	-51.07	-20.0	31.07

Frequency (MHz)	Polar (H/V)	Receiver Reading (dB μ V)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM, Frequency: 481.0000MHz-12.5 kHz								
962.000	H	38.95	-55.61	0.00	0.86	-56.47	-20.0	36.47
962.000	V	36.18	-59.95	0.00	0.86	-60.81	-20.0	40.81
1443.000	H	37.47	-66.55	9.22	1.26	-58.59	-20.0	38.59
1443.000	V	38.35	-66.05	9.22	1.26	-58.09	-20.0	38.09
1924.000	H	37.99	-64.83	11.85	1.05	-54.03	-20.0	34.03
1924.000	V	37.88	-65.27	11.85	1.05	-54.47	-20.0	34.47
2405.000	H	37.20	-65.28	12.34	1.29	-54.23	-20.0	34.23
2266.063	V	37.51	-64.44	11.06	1.20	-54.58	-20.0	34.58
2886.000	H	38.01	-62.85	13.79	1.35	-50.41	-20.0	30.41
2886.000	V	37.09	-64.06	13.79	1.35	-51.62	-20.0	31.62
3367.00	H	36.42	-63.19	13.94	1.62	-50.87	-20.0	30.87
3367.00	V	36.35	-63.33	13.94	1.62	-51.01	-20.0	31.01
4FSK, Frequency: 481.0000MHz -12.5 kHz								
906.425	H	38.76	-58.11	0.00	1.03	-59.14	-20.0	39.14
906.425	V	36.11	-62.73	0.00	1.03	-63.76	-20.0	43.76
1359.638	H	37.61	-65.95	8.72	1.20	-58.43	-20.0	38.43
1359.638	V	37.27	-67.01	8.72	1.20	-59.49	-20.0	39.49
1812.850	H	38.00	-66.10	11.19	0.72	-55.63	-20.0	35.63
1812.850	V	38.05	-66.61	11.19	0.72	-56.14	-20.0	36.14
2266.063	H	37.21	-64.84	11.06	1.20	-54.98	-20.0	34.98
2266.063	V	37.48	-64.47	11.06	1.20	-54.61	-20.0	34.61
2719.275	H	37.57	-64.34	13.10	1.27	-52.51	-20.0	32.51
2719.275	V	37.23	-64.79	13.10	1.27	-52.96	-20.0	32.96
3172.49	H	36.43	-62.59	13.49	1.64	-50.74	-20.0	30.74
3172.49	V	36.00	-63.06	13.49	1.64	-51.21	-20.0	31.21

Frequency (MHz)	Polar (H/V)	Receiver Reading (dB μ V)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM, Frequency: 526.9875MHz-12.5 kHz								
1053.975	H	39.58	-64.25	7.63	0.89	-57.51	-20.0	37.51
1053.975	V	40.12	-64.20	7.63	0.89	-57.46	-20.0	37.46
1580.963	H	38.12	-66.56	9.99	0.81	-57.38	-20.0	37.38
1580.963	V	39.87	-65.31	9.99	0.81	-56.13	-20.0	36.13
2107.950	H	37.58	-64.46	11.35	1.10	-54.21	-20.0	34.21
2107.950	V	37.24	-64.80	11.35	1.10	-54.55	-20.0	34.55
2634.938	H	36.78	-65.86	13.17	1.29	-53.98	-20.0	33.98
2634.938	V	36.55	-66.32	13.17	1.29	-54.44	-20.0	34.44
3161.925	H	36.89	-62.26	13.45	1.67	-50.48	-20.0	30.48
3161.925	V	36.25	-62.94	13.45	1.67	-51.16	-20.0	31.16
3688.91	H	36.59	-61.52	14.01	1.79	-49.30	-20.0	29.30
3688.91	V	36.12	-61.97	14.01	1.79	-49.75	-20.0	29.75
4FSK, Frequency: 526.9875MHz-12.5 kHz								
1053.975	H	39.87	-63.96	7.63	0.89	-57.22	-20.0	37.22
1053.975	V	39.56	-64.76	7.63	0.89	-58.02	-20.0	38.02
1580.963	H	37.33	-67.35	9.99	0.81	-58.17	-20.0	38.17
1580.963	V	37.79	-67.39	9.99	0.81	-58.21	-20.0	38.21
2107.950	H	37.56	-64.48	11.35	1.10	-54.23	-20.0	34.23
2107.950	V	37.68	-64.36	11.35	1.10	-54.11	-20.0	34.11
2634.938	H	37.58	-65.06	13.17	1.29	-53.18	-20.0	33.18
2634.938	V	36.86	-66.01	13.17	1.29	-54.13	-20.0	34.13
3161.925	H	37.56	-61.59	13.45	1.67	-49.81	-20.0	29.81
3161.925	V	37.27	-61.92	13.45	1.67	-50.14	-20.0	30.14
3688.91	H	36.21	-61.90	14.01	1.79	-49.68	-20.0	29.68
3688.91	V	37.25	-60.84	14.01	1.79	-48.62	-20.0	28.62

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM, Frequency: 453.2125MHz-12.5 kHz								
906.425	H	37.10	-59.77	0.00	1.03	-60.80	-20.0	40.80
906.425	V	36.54	-62.30	0.00	1.03	-63.33	-20.0	43.33
1359.638	H	37.56	-66.00	8.72	1.20	-58.48	-20.0	38.48
1359.638	V	38.26	-66.02	8.72	1.20	-58.50	-20.0	38.50
1812.850	H	38.99	-65.11	11.19	0.72	-54.64	-20.0	34.64
1812.850	V	37.89	-66.77	11.19	0.72	-56.30	-20.0	36.30
2266.063	H	37.21	-64.84	11.06	1.20	-54.98	-20.0	34.98
2266.063	V	38.25	-63.70	11.06	1.20	-53.84	-20.0	33.84
2719.275	H	39.01	-62.90	13.10	1.27	-51.07	-20.0	31.07
2719.275	V	37.29	-64.73	13.10	1.27	-52.90	-20.0	32.90
3172.49	H	36.45	-62.57	13.49	1.64	-50.72	-20.0	30.72
3172.49	V	36.25	-62.81	13.49	1.64	-50.96	-20.0	30.96
4FSK, Frequency: 453.2125MHz-12.5 kHz								
906.425	H	37.05	-59.82	0.00	1.03	-60.85	-20.0	40.85
906.425	V	36.29	-62.55	0.00	1.03	-63.58	-20.0	43.58
1359.638	H	37.65	-65.91	8.72	1.20	-58.39	-20.0	38.39
1359.638	V	37.21	-67.07	8.72	1.20	-59.55	-20.0	39.55
1812.850	H	38.02	-66.08	11.19	0.72	-55.61	-20.0	35.61
1812.850	V	38.56	-66.10	11.19	0.72	-55.63	-20.0	35.63
2266.063	H	37.24	-64.81	11.06	1.20	-54.95	-20.0	34.95
2266.063	V	37.58	-64.37	11.06	1.20	-54.51	-20.0	34.51
2719.275	H	37.59	-64.32	13.10	1.27	-52.49	-20.0	32.49
2719.275	V	37.24	-64.78	13.10	1.27	-52.95	-20.0	32.95
3172.49	H	37.12	-61.90	13.49	1.64	-50.05	-20.0	30.05
3172.49	V	36.21	-62.85	13.49	1.64	-51.00	-20.0	31.00

Part 80

Frequency (MHz)	Polar (H/V)	Receiver Reading (dB μ V)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM, Frequency: 459.9875MHz-25 kHz								
919.98	H	37.44	-58.87	0.00	0.99	-59.86	-13.0	46.86
919.98	V	36.61	-61.57	0.00	0.99	-62.56	-13.0	49.56
1379.96	H	37.60	-65.87	8.86	1.20	-58.21	-13.0	45.21
1379.96	V	37.64	-66.49	8.86	1.20	-58.83	-13.0	45.83
1839.95	H	37.52	-66.18	11.38	0.82	-55.62	-13.0	42.62
1839.95	V	37.30	-66.88	11.38	0.82	-56.32	-13.0	43.32
2299.94	H	37.21	-64.94	11.20	1.23	-54.97	-13.0	41.97
2299.94	V	37.19	-64.86	11.20	1.23	-54.89	-13.0	41.89
2759.93	H	36.71	-65.10	13.10	1.32	-53.32	-13.0	40.32
2759.93	V	37.24	-64.73	13.10	1.32	-52.95	-13.0	39.95
3219.91	H	36.59	-62.31	13.60	1.57	-50.28	-13.0	37.28
3219.91	V	37.56	-61.39	13.60	1.57	-49.36	-13.0	36.36

Part 74

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM, Frequency: 455.0125MHz-12.5 kHz								
910.03	H	38.01	-58.71	0.00	1.02	-59.73	-20.0	39.73
910.03	V	36.88	-61.78	0.00	1.02	-62.80	-20.0	42.80
1365.04	H	36.84	-66.69	8.76	1.20	-59.13	-20.0	39.13
1365.04	V	37.12	-67.12	8.76	1.20	-59.56	-20.0	39.56
1820.05	H	37.56	-66.44	11.24	0.75	-55.95	-20.0	35.95
1820.05	V	38.26	-66.28	11.24	0.75	-55.79	-20.0	35.79
2275.06	H	37.23	-64.85	11.10	1.21	-54.96	-20.0	34.96
2275.06	V	37.48	-64.50	11.10	1.21	-54.61	-20.0	34.61
2730.08	H	37.89	-63.99	13.10	1.28	-52.17	-20.0	32.17
2730.08	V	37.48	-64.53	13.10	1.28	-52.71	-20.0	32.71
3185.09	H	37.59	-61.27	13.54	1.61	-49.34	-20.0	29.34
3185.09	V	37.26	-61.65	13.54	1.61	-49.72	-20.0	29.72
FM, Frequency: 455.0125MHz-25 kHz								
910.03	H	37.76	-58.96	0.00	1.02	-59.98	-13.0	46.98
910.03	V	37.03	-61.63	0.00	1.02	-62.65	-13.0	49.65
1365.04	H	37.88	-65.65	8.76	1.20	-58.09	-13.0	45.09
1365.04	V	37.01	-67.23	8.76	1.20	-59.67	-13.0	46.67
1820.05	H	37.26	-66.74	11.24	0.75	-56.25	-13.0	43.25
1820.05	V	37.58	-66.96	11.24	0.75	-56.47	-13.0	43.47
2275.06	H	37.27	-64.81	11.10	1.21	-54.92	-13.0	41.92
2275.06	V	37.68	-64.30	11.10	1.21	-54.41	-13.0	41.41
2730.08	H	37.21	-64.67	13.10	1.28	-52.85	-13.0	39.85
2730.08	V	37.24	-64.77	13.10	1.28	-52.95	-13.0	39.95
3185.09	H	36.89	-61.97	13.54	1.61	-50.04	-13.0	37.04
3185.09	V	37.56	-61.35	13.54	1.61	-49.42	-13.0	36.42

Frequency (MHz)	Polar (H/V)	Receiver Reading (dB μ V)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
4FSK, Frequency: 455.0125MHz-12.5 kHz								
910.03	H	37.17	-59.55	0.00	1.02	-60.57	-20.0	40.57
910.03	V	36.95	-61.71	0.00	1.02	-62.73	-20.0	42.73
1365.04	H	37.45	-66.08	8.76	1.20	-58.52	-20.0	38.52
1365.04	V	37.25	-66.99	8.76	1.20	-59.43	-20.0	39.43
1820.05	H	37.64	-66.36	11.24	0.75	-55.87	-20.0	35.87
1820.05	V	37.59	-66.95	11.24	0.75	-56.46	-20.0	36.46
2275.06	H	37.29	-64.79	11.10	1.21	-54.90	-20.0	34.90
2275.06	V	37.68	-64.30	11.10	1.21	-54.41	-20.0	34.41
2730.08	H	37.26	-64.62	13.10	1.28	-52.80	-20.0	32.80
2730.08	V	37.89	-64.12	13.10	1.28	-52.30	-20.0	32.30
3185.09	H	36.59	-62.27	13.54	1.61	-50.34	-20.0	30.34
3185.09	V	37.16	-61.75	13.54	1.61	-49.82	-20.0	29.82

Part 22

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
FM, Frequency: 454.0125MHz-12.5 kHz								
908.03	H	37.50	-59.31	0.00	1.03	-60.34	-13.0	47.34
908.03	V	37.11	-61.65	0.00	1.03	-62.68	-13.0	49.68
1362.04	H	37.59	-65.96	8.73	1.20	-58.43	-13.0	45.43
1362.04	V	37.25	-67.01	8.73	1.20	-59.48	-13.0	46.48
1816.05	H	37.56	-66.49	11.21	0.73	-56.01	-13.0	43.01
1816.05	V	38.25	-66.36	11.21	0.73	-55.88	-13.0	42.88
2270.06	H	37.25	-64.81	11.08	1.20	-54.93	-13.0	41.93
2270.06	V	37.68	-64.28	11.08	1.20	-54.40	-13.0	41.40
2724.08	H	37.14	-64.75	13.10	1.28	-52.93	-13.0	39.93
2724.08	V	37.26	-64.76	13.10	1.28	-52.94	-13.0	39.94
3178.09	H	37.12	-61.83	13.51	1.63	-49.95	-13.0	36.95
3178.09	V	37.48	-61.51	13.51	1.63	-49.63	-13.0	36.63
FM, Frequency: 454.0125MHz-25 kHz								
908.03	H	37.64	-59.17	0.00	1.03	-60.20	-13.0	47.20
908.03	V	36.92	-61.84	0.00	1.03	-62.87	-13.0	49.87
1362.04	H	37.14	-66.41	8.73	1.20	-58.88	-13.0	45.88
1362.04	V	38.26	-66.00	8.73	1.20	-58.47	-13.0	45.47
1816.05	H	37.78	-66.27	11.21	0.73	-55.79	-13.0	42.79
1816.05	V	37.59	-67.02	11.21	0.73	-56.54	-13.0	43.54
2270.06	H	37.89	-64.17	11.08	1.20	-54.29	-13.0	41.29
2270.06	V	37.26	-64.70	11.08	1.20	-54.82	-13.0	41.82
2724.08	H	37.14	-64.75	13.10	1.28	-52.93	-13.0	39.93
2724.08	V	37.46	-64.56	13.10	1.28	-52.74	-13.0	39.74
3178.09	H	37.10	-61.85	13.51	1.63	-49.97	-13.0	36.97
3178.09	V	37.25	-61.74	13.51	1.63	-49.86	-13.0	36.86

Frequency (MHz)	Polar (H/V)	Receiver Reading (dB μ V)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
4FSK, Frequency: 454.0125MHz-12.5 kHz								
908.03	H	37.73	-59.08	0.00	1.03	-60.11	-13.0	47.11
908.03	V	36.89	-61.87	0.00	1.03	-62.90	-13.0	49.90
1362.04	H	37.79	-65.76	8.73	1.20	-58.23	-13.0	45.23
1362.04	V	37.58	-66.68	8.73	1.20	-59.15	-13.0	46.15
1816.05	H	37.24	-66.81	11.21	0.73	-56.33	-13.0	43.33
1816.05	V	37.56	-67.05	11.21	0.73	-56.57	-13.0	43.57
2270.06	H	37.01	-65.05	11.08	1.20	-55.17	-13.0	42.17
2270.06	V	37.25	-64.71	11.08	1.20	-54.83	-13.0	41.83
2724.08	H	37.54	-64.35	13.10	1.28	-52.53	-13.0	39.53
2724.08	V	37.87	-64.15	13.10	1.28	-52.33	-13.0	39.33
3178.09	H	37.26	-61.69	13.51	1.63	-49.81	-13.0	36.81
3178.09	V	37.23	-61.76	13.51	1.63	-49.88	-13.0	36.88

Note 1: The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

Note 2:

Absolute Level = Substituted Level - Cable loss + Antenna Gain

Margin = Limit - Absolute Level

FCC §2.1055 & § 22.355 & §74.464& §80.209 & §90.213 - FREQUENCY STABILITY

Applicable Standard

FCC §2.1055, § 22.355, §74.464, §80.209 and §90.213

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads 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:	27.8°C
Relative Humidity:	69 %
ATM Pressure:	100.8 kPa
Tester:	James Chen
Test Date:	2020-09-13

Test Mode: Transmitting

Test Result: Compliance. The AC power board supplied DC 13.6V to the RF board,same with DC power input, so only the DC power supply was tested. Please refer to the following Tables.

FCC Part 90:

FM,12.5kHz, Reference Frequency: 453.2125 MHz, Limit: ±1.5 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	13.6	453.2123604	-0.31
-20		453.2121604	-0.75
-10		453.2124104	-0.20
0		453.2128704	0.82
10		453.2124404	-0.13
20		453.2126804	0.40
30		453.2129604	1.02
40		453.2125404	0.09
50		453.2127104	0.46
20		11	453.2125404
20	15.6	453.2131104	1.35

4FSK, 12.5kHz, Reference Frequency: 453.2125MHz, Limit: ±1.5 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	13.6	453.2129604	1.02
-20		453.2125404	0.09
-10		453.2130008	1.11
0		453.2130208	1.15
10		453.2128704	0.82
20		453.2129008	0.88
30		453.2128408	0.75
40		453.2128704	0.82
50		453.2124404	-0.13
20		11	453.2127104
20	15.6	453.2128408	0.75

FCC Part 80:

FM,25kHz, Reference Frequency: 459.9875MHz, Limit: ±5.0 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	13.6	459.987694	0.42
-20		459.987664	0.36
-10		459.987689	0.41
0		459.987692	0.42
10		459.987670	0.37
20		459.987680	0.39
30		459.987724	0.49
40		459.987646	0.32
50		459.987668	0.37
20		11	459.987634
20	15.6	459.987708	0.45

FCC Part 74:

FM, 12.5kHz, Reference Frequency: 455.0125 MHz, Limit: ±2.5 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	13.6	455.0126924	0.42
-20		455.0126764	0.39
-10		455.0126804	0.40
0		455.0127204	0.48
10		455.0126744	0.38
20		455.0126804	0.40
30		455.0126804	0.40
40		455.0126784	0.39
50		455.0127024	0.44
20		11	455.0126774
20	15.6	455.0126654	0.36

4FSK, 12.5kHz, Reference Frequency: 455.0125 MHz, Limit: ±2.5 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	13.6	455.0127295	0.50
-20		455.0126785	0.39
-10		455.0127545	0.56
0		455.0127505	0.55
10		455.0127145	0.47
20		455.0127505	0.55
30		455.0127365	0.52
40		455.0126945	0.43
50		455.0127655	0.58
20		11	455.0126985
20	15.6	455.0127445	0.54

FM, 25kHz, Reference Frequency: 455.0125 MHz, Limit: ±2.5 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	13.6	455.0127304	0.51
-20		455.0126894	0.42
-10		455.0126734	0.38
0		455.0127124	0.47
10		455.0127254	0.50
20		455.0126804	0.40
30		455.0127124	0.47
40		455.0127434	0.53
50		455.0127214	0.49
20		11	455.0127254
20	15.6	455.0126804	0.40

FCC Part 22:

FM, 12.5kHz, Reference Frequency: 454.0125MHz, Limit: ±2.5 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	13.6	454.0127114	0.47
-20		454.0127144	0.47
-10		454.0126854	0.41
0		454.0126774	0.39
10		454.0126964	0.43
20		454.0126804	0.40
30		454.0126754	0.39
40		454.0126714	0.38
50		454.0126844	0.41
20		11	454.0126984
20	15.6	454.0126754	0.39

4FSK, 12.5kHz, Reference Frequency: 454.0125MHz, Limit: ±2.5 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	13.6	454.0128738	0.82
-20		454.0129408	0.97
-10		454.0128858	0.85
0		454.0128858	0.85
10		454.0129408	0.97
20		454.0129008	0.88
30		454.0129068	0.90
40		454.0129248	0.94
50		454.0129138	0.91
20		11	454.0129328
20	15.6	454.0128708	0.82

FM, 25kHz, Reference Frequency: 454.0125MHz, Limit: ±2.5 ppm			
Temperature (°C)	Voltage Supplied (V_{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	13.6	454.0126814	0.40
-20		454.0126444	0.32
-10		454.0126644	0.36
0		454.0126904	0.42
10		454.0126594	0.35
20		454.0126804	0.40
30		454.0126804	0.40
40		454.0126654	0.36
50		454.0126904	0.42
20		11	454.0126564
20	15.6	454.0127204	0.49

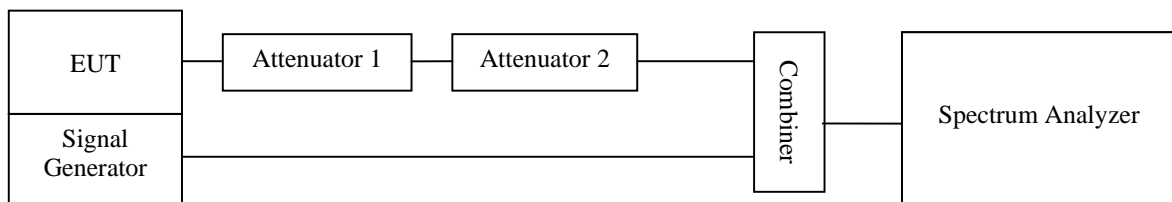
FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

Applicable Standard

Regulations: FCC §90.214

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 "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**

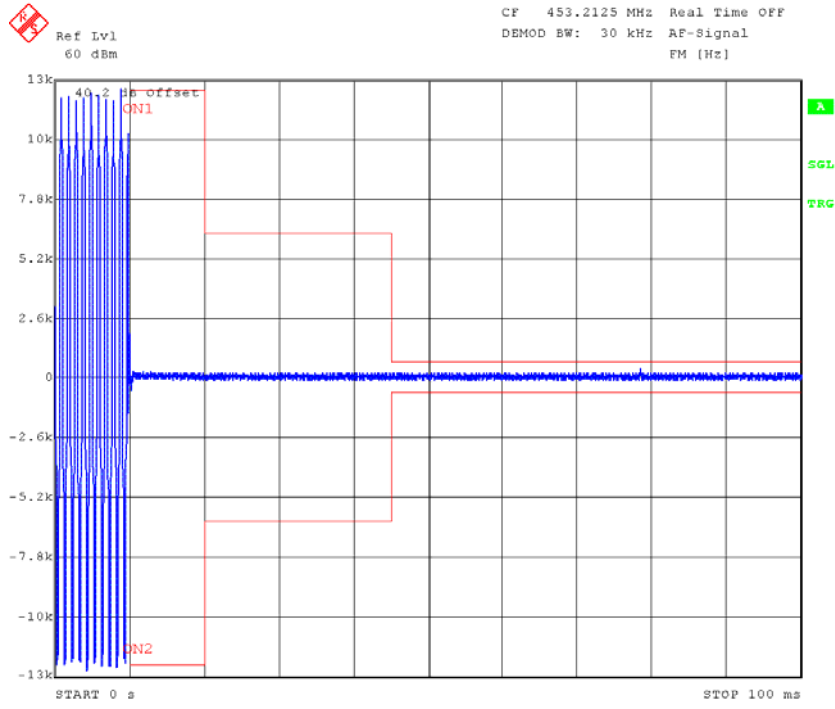
Temperature:	26.1 °C
Relative Humidity:	73 %
ATM Pressure:	100.9 kPa
Tester:	James Chen
Test Date:	2020-09-16

Test Mode: Transmitting**Test Result: Compliance.** *Please refer to the following table and plots.*

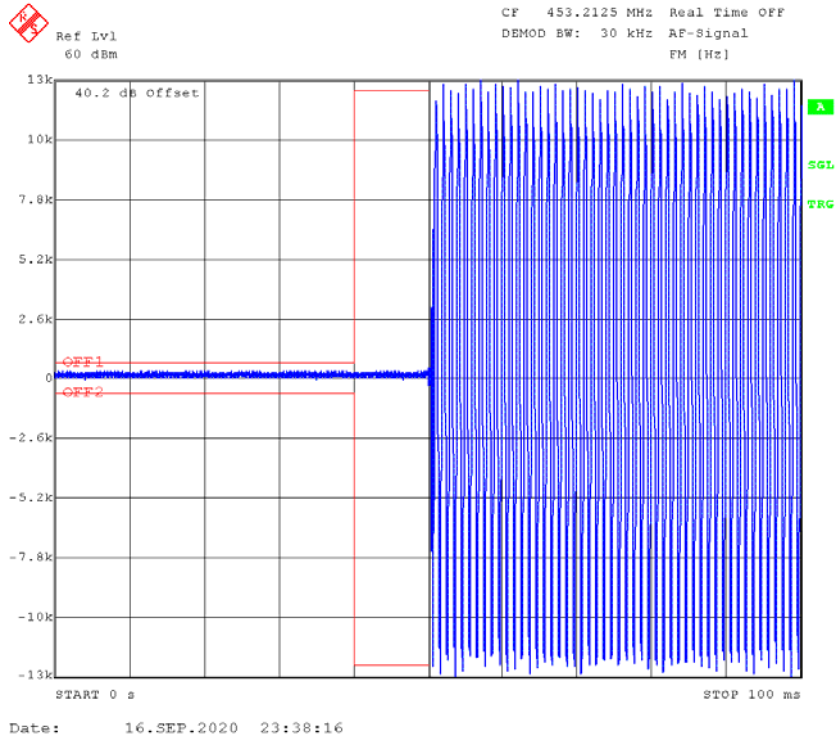
Channel Spacing (kHz)	Transient Period (ms)	Transient Frequency	Result
12.5	<10(t ₁)	±12.5 kHz	Pass
	<25(t ₂)	±6.25 kHz	
	<10(t ₃)	±12.5 kHz	

High Power Channel: 453.2125 MHz

Turn on



Turn off



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