



TESTING LABORATORY
CERTIFICATE #4820.01



FCC PART 22, PART 74 AND PART 90

TEST REPORT

For

Tait International Limited

245 Wooldridge Road Harewood, P.O. Box 1645, Christchurch, 8051 New Zealand

FCC ID: CASTPEH7D

Report Type: Original Report	Product Type: Two way radio
Report Number: RDG190701004-00A	
Report Date: 2019-08-09	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		Two way radio
EUT Model:		T03-00302-HCAA
Multiple Model:		T03-00302-HAAA, T03-00302-HBAA
Operation Frequency:		450-520MHz
Output Power(Conducted):		High: 4W Low: 1W
Modulation Type:		FM/4FSK
Channel Spacing:		12.5/25kHz
Rated Input Voltage:		7.4V DC from battery or 12V DC from charger
Adapter Information	Model:	ICP30-120-2000
	Input:	AC 100-240V, 50/60Hz,0.8A
	Output:	DC 12V, 2000mA
External Dimension:		24.5cm(L)*6.6cm(W)*3.5cm(H)
Serial Number:		190701004-1(model: T03-00302-HCAA) 190701004-2(model: T03-00302-HAAA) 190701004-3(model: T03-00302-HBAA)
EUT Received Date:		2019-07-10

Note: The series products models T03-00302-HCAA, T03-00302-HAAA, T03-00302-HBAA are electrically identical, we selected T03-00302-HCAA for fully testing, and all model for radiation emission test, the details of the difference between them were explained in the attached declaration letter.

Objective

This test report is prepared on behalf of **Tait International Limited** in accordance with Part 2, part 22, part 74 and Part 90 of the Federal Communication Commission 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, Sub-part J as well as the following individual parts:

Part 22 – Public Mobile Service

Part 74 – Experimental Radio, Auxiliary, Special Broadcast and other Program Distributonal Service

Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA 603-D

All emissions measurement was performed and 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	$\pm 5\%$
RF output power, conducted	$\pm 0.61\text{dB}$
Unwanted Emissions, radiated	30MHz ~ 1GHz: 5.85 dB 1G~26.5GHz: 5.23 dB
Unwanted Emissions, conducted	$\pm 1.5\text{ dB}$
Temperature	$\pm 1^\circ\text{C}$
Humidity	$\pm 5\%$
DC and low frequency voltages	$\pm 0.4\%$
Duty Cycle	1%

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.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

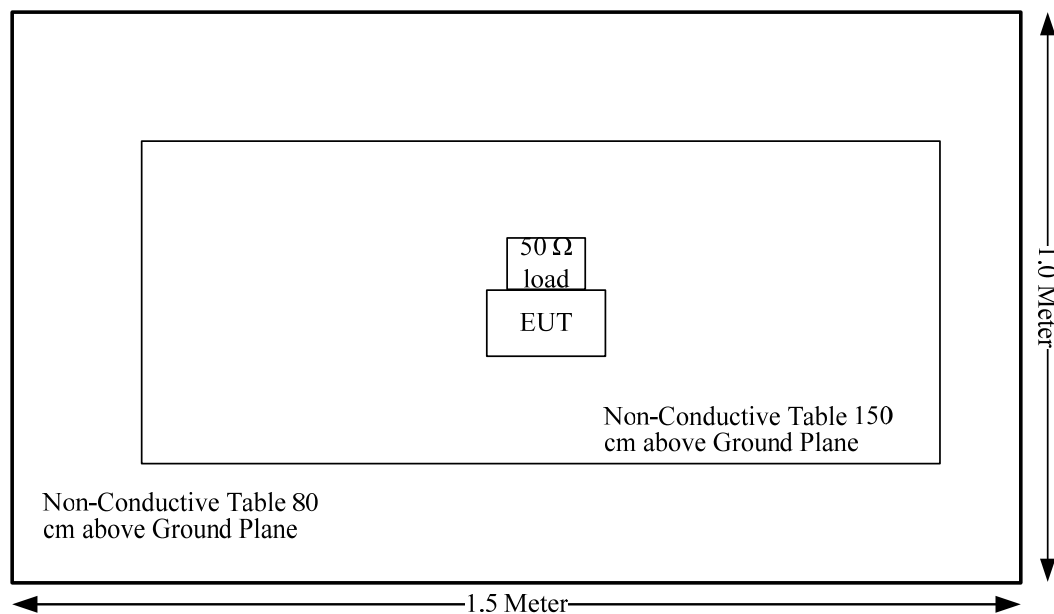
Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Unknown	50 Load Teminal	100W	100W-1

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1310 and §2.1093	RF Exposure	Compliance
§2.1046; § 22.727; §74.461; §90.205	RF Output Power	Compliance
§2.1047;§90.207	Modulation Characteristic	Compliance
§2.1049;§22.357;§ 22.731; §74.462; §90.209; §90.210	Occupied Bandwidth	Compliance
§2.1051; §22.861; §74.462; §90.210	Spurious Emission at Antenna Terminal	Compliance
§2.1053;§22.861; §74.462;§90.210	Spurious Radiated Emissions	Compliance
§2.1055; § 22.355; §74.464;§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 Emission Test					
R&S	EMI Test Receiver	ESCI	100035	2018-08-03	2019-08-03
Sunol Sciences	Antenna	JB3	A060611-2	2017-08-25	2020-08-25
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2018-09-24	2019-09-24
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2018-09-05	2019-09-05
HP	Amplifier	8447F	2443A01912	2018-09-05	2019-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-05-09	2020-05-09
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2018-09-05	2019-09-05
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2018-09-05	2019-09-05
Agilent	Signal Generator	E8247C	MY43321350	2018-12-10	2019-12-10
Conducted Emission Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	831929/005	2018-08-03	2019-08-03
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A
E-Microwave	Blocking Control	EMDCB-00036	0E01201047	Each time	N/A
Weinschel	Coaxial Attenuators	53-20-34	LN749	Each time	N/A
OuLi	Band Rejector Filter	400-470	003	Each time	N/A
HP	RF Communications Test Set	8920A	3438A05201	2019-01-04	2020-01-04
ESPEC	Constant temperature and humidity Tester	ESX-4CA	018 463	2019-03-26	2020-03-26
UNI-T	Multimeter	UT39A	M130199938	2019-07-24	2020-07-24
Pro instrument	DC Power Supply	pps3300	3300012	N/A	N/A
LEADER	Millivoltmeter	LMV-181A	601788	2018-08-11	2019-08-10

*** 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 & §2.1093 - RF EXPOSURE

Applicable Standard

FCC§1.1310 and §2.1093.

Test Result

Compliance, please refer to the SAR report: RDG190701004-20A.

FCC §2.1046 & § 22.727 & §74.461 & §90.205- RF OUTPUT POWER**Applicable Standard**

FCC §2.1046, § 22.727, §74.461 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:

RBW	VBW
100 kHz	300 kHz

Test Data**Environmental Conditions**

Temperature:	24.5°C
Relative Humidity:	67 %
ATM Pressure:	100.4 kPa
Tester:	Blake Yang
Test Date:	2019-07-26

Test Mode: Transmitting

Test Result: Compliance. Please refer to following table.

Modulation Mode	Channel Separation	f_c	Reading (W)		Note
		MHz	High Power Level	Low Power Level	
FM	12.5kHz	453.2125	4.315	1.169	FCC part 90
		481	4.150	1.096	
		519.9875	4.198	1.084	
4FSK	12.5kHz	453.2125	4.325	1.161	
		481	4.325	1.125	
		519.9875	4.426	1.167	
FM	12.5kHz	454.0125	4.159	1.122	FCC part 22
	25kHz	454.0125	4.305	1.109	
4FSK	12.5kHz	454.0125	4.266	1.146	
FM	12.5kHz	450.03125	4.159	1.167	FCC part 74
	25kHz	450.03125	4.256	1.135	
4FSK	12.5kHz	450.03125	4.315	1.169	

Note:

The high rated power level is 4W, and low rated power level is 1W.
(Limit: <4.8W for high power level, < 1.2W for low power level)

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/EIA-603 2.2.3

Test Data**Environmental Conditions**

Temperature:	24.5 °C
Relative Humidity:	67 %
ATM Pressure:	100.4 kPa
Tester:	Blake Yang
Test Date:	2019-07-26

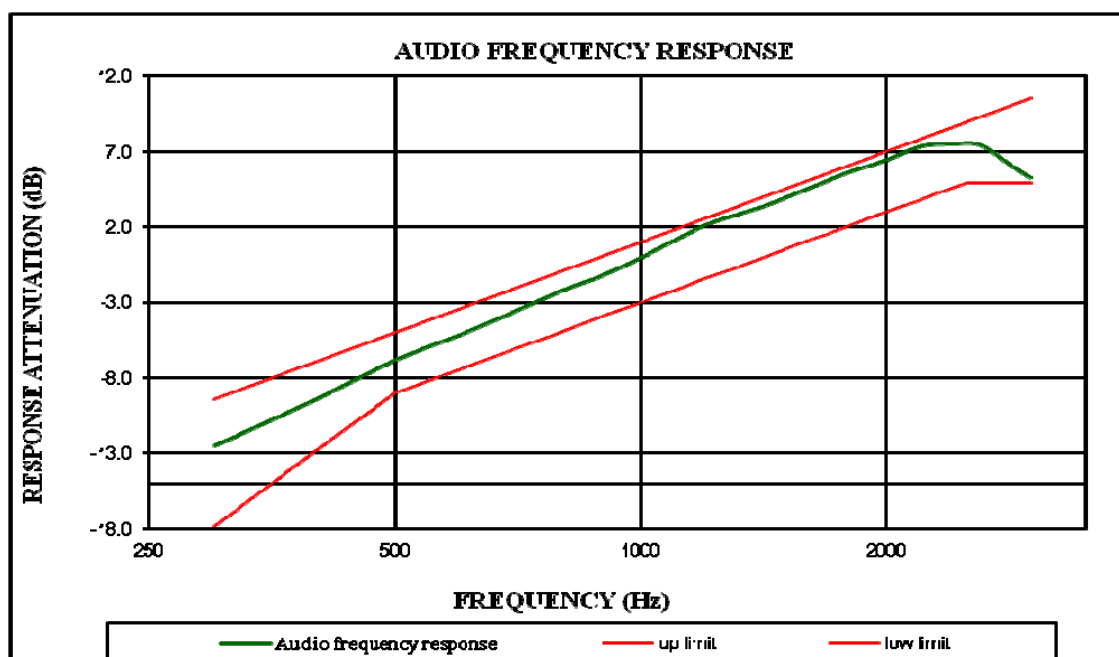
*Test Mode: Transmitting***Result:** Compliance.

12.5 kHz:

Audio Frequency Response – High Power

Carrier Frequency: 453.2125 MHz

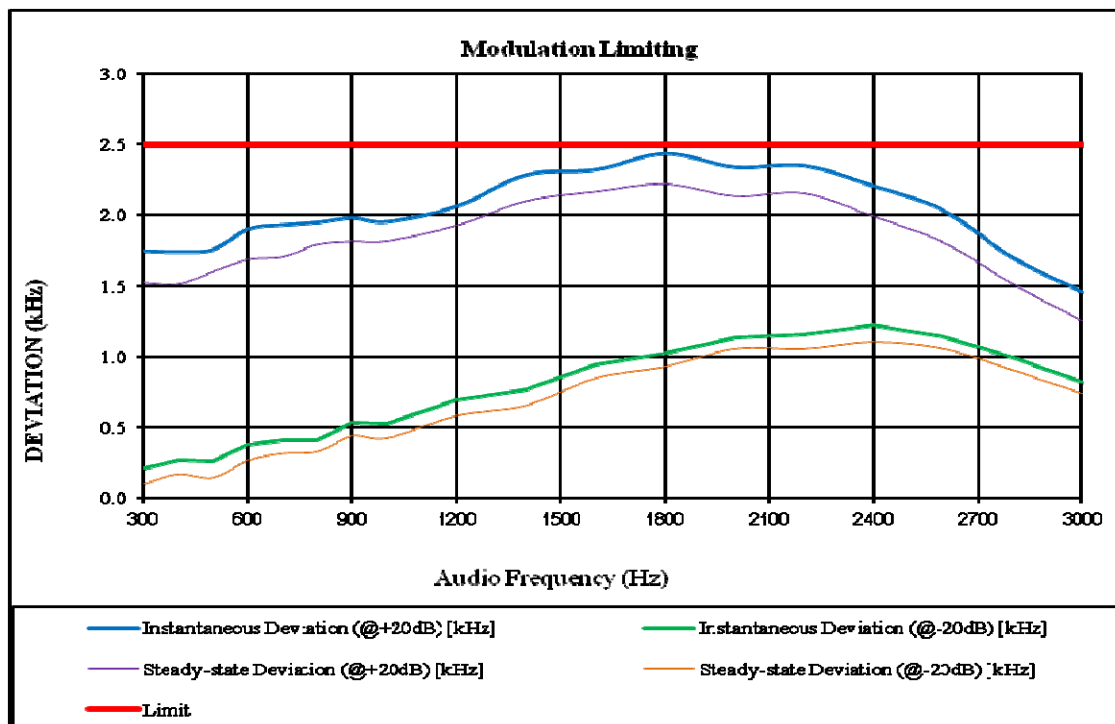
Modulation Frequency (Hz)	Response data (dB)
300	-12.48
400	-9.38
500	-6.79
600	-5.12
700	-3.57
800	-2.19
900	-1.14
1000	0.00
1200	2.16
1400	3.33
1600	4.57
1800	5.68
2000	6.47
2200	7.38
2400	7.54
2600	7.49
2800	6.34
3000	5.31



MODULATION LIMITING – High Power

Carrier Frequency: 453.2125 MHz

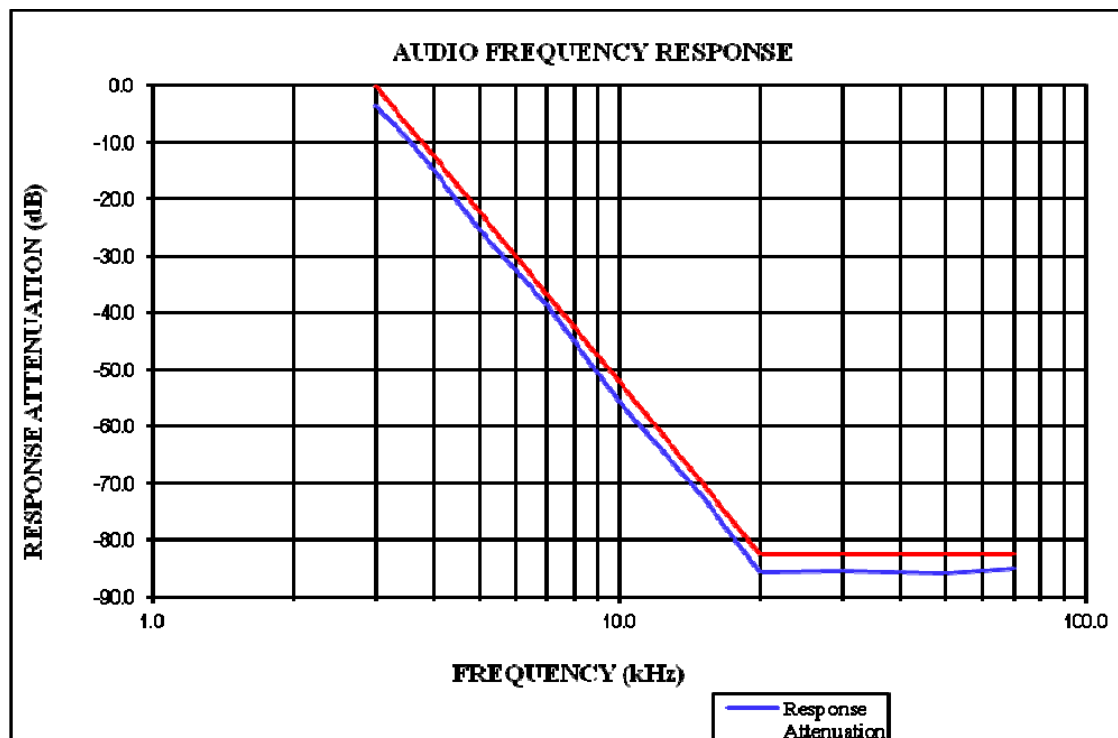
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [kHz]
	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	Deviation (@+20dB) [kHz]	Deviation (@-20dB) [kHz]	
300	1.744	0.209	1.524	0.099	2.5
400	1.737	0.267	1.517	0.167	2.5
500	1.755	0.262	1.605	0.142	2.5
600	1.900	0.376	1.690	0.266	2.5
700	1.929	0.405	1.709	0.315	2.5
800	1.946	0.409	1.796	0.329	2.5
900	1.978	0.529	1.818	0.439	2.5
1000	1.951	0.523	1.821	0.423	2.5
1200	2.060	0.690	1.930	0.580	2.5
1400	2.283	0.764	2.103	0.654	2.5
1600	2.319	0.945	2.169	0.845	2.5
1800	2.434	1.027	2.224	0.927	2.5
2000	2.337	1.132	2.137	1.052	2.5
2200	2.347	1.152	2.157	1.052	2.5
2400	2.203	1.221	1.993	1.101	2.5
2600	2.031	1.143	1.811	1.053	2.5
2800	1.696	0.992	1.516	0.902	2.5
3000	1.454	0.816	1.254	0.736	2.5



Audio Frequency Low Pass Filter Response – High Power

Carrier Frequency: 453.2125 MHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
3.0	-3.7	0.0
3.5	-9.1	-6.7
4.0	-15.0	-12.5
5.0	-25.3	-22.2
7.0	-38.8	-36.8
10.0	-55.8	-52.3
15.0	-72.4	-69.9
20.0	-85.7	-82.5
30.0	-85.6	-82.5
50.0	-85.9	-82.5
70.0	-85.1	-82.5

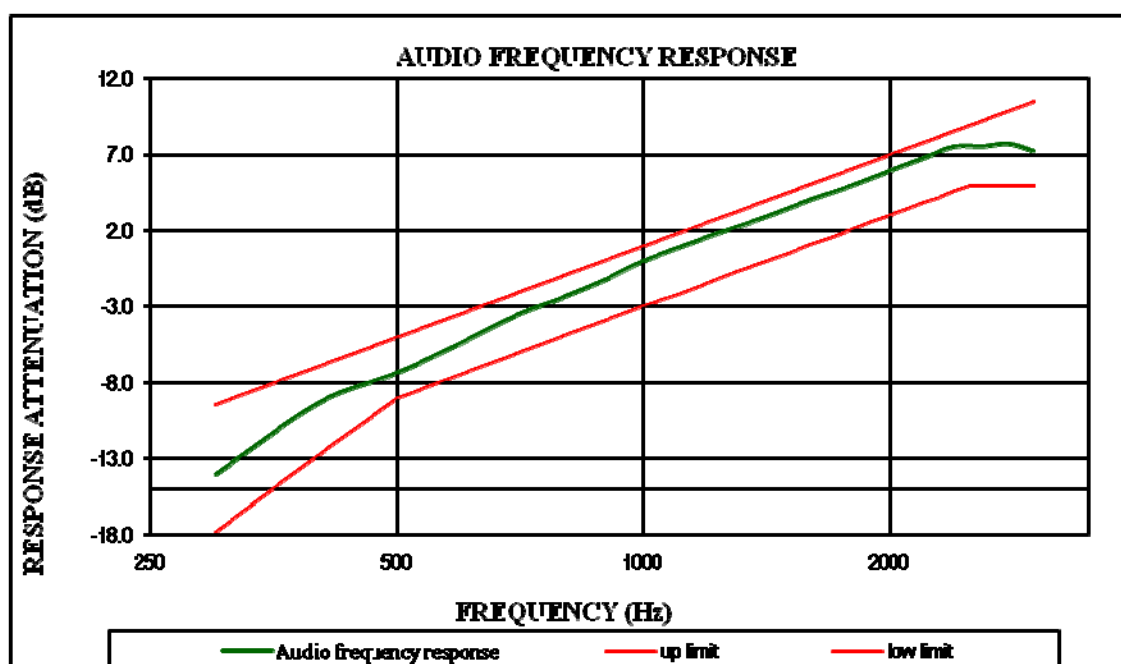


25 kHz:

Audio Frequency Response – High Power

Carrier Frequency: 454.0125 MHz, Channel Separation: 25 kHz

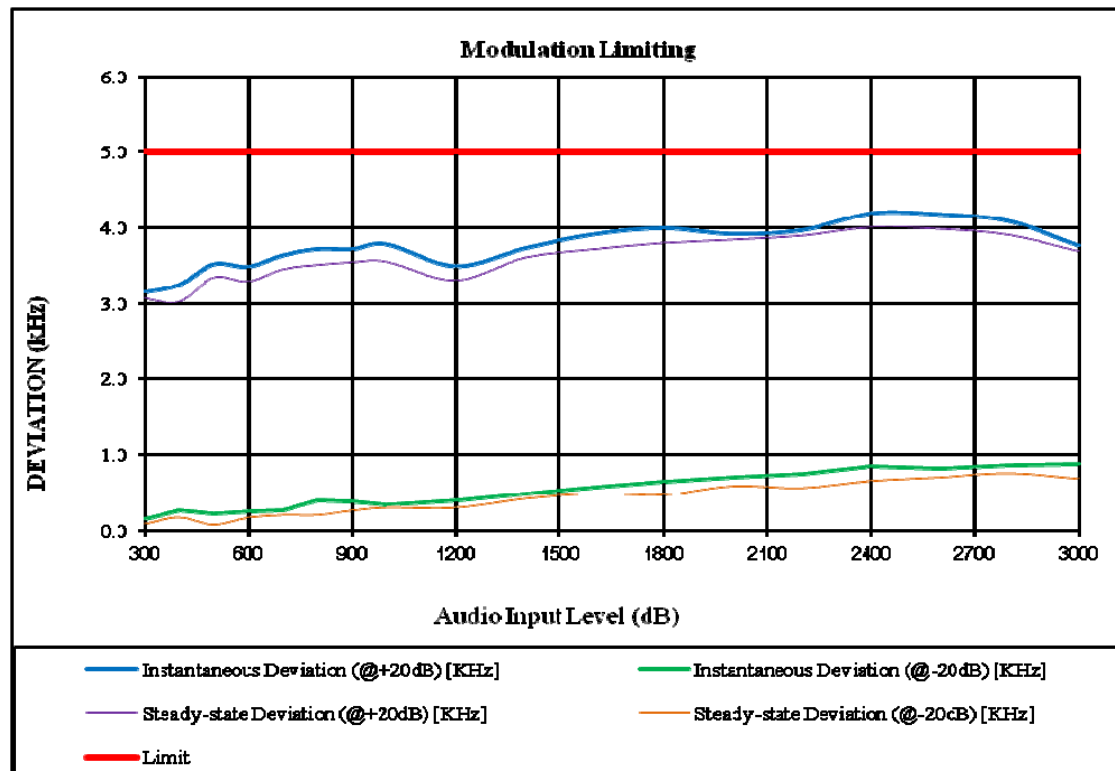
Modulation Frequency (kHz)	Response data (dB)
300	-14.02
400	-9.34
500	-7.35
600	-5.35
700	-3.55
800	-2.36
900	-1.19
1000	0.00
1200	1.60
1400	2.84
1600	4.03
1800	4.97
2000	5.93
2200	6.77
2400	7.53
2600	7.54
2800	7.71
3000	7.22



MODULATION LIMITING – High Power

Carrier Frequency: 454.0125 MHz, Channel Separation: 25 kHz

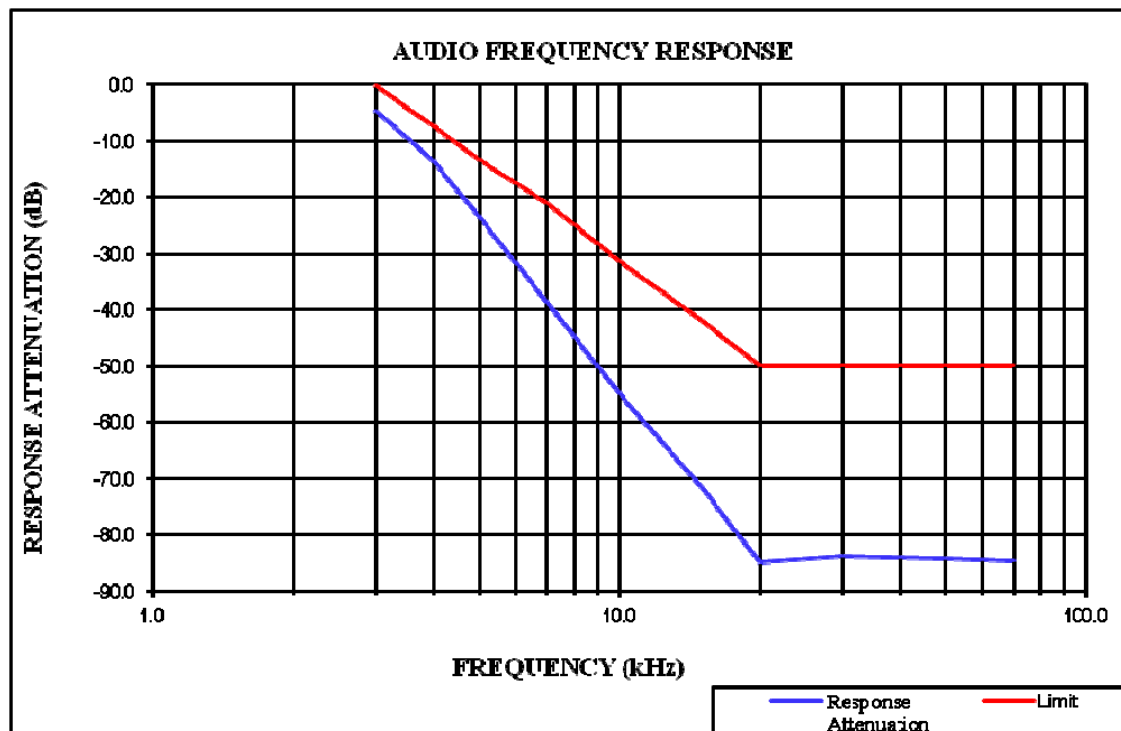
Audio Frequency (Hz)	Instantaneous		Steady-state		Limit [KHz]
	Deviation (@+20dB) [KHz]	Deviation (@-20dB) [KHz]	Deviation (@+20dB) [KHz]	Deviation (@-20dB) [KHz]	
300	3.169	0.163	3.039	0.063	5.0
400	3.298	0.255	3.198	0.175	5.0
500	3.388	0.276	3.208	0.186	5.0
600	3.565	0.214	3.375	0.124	5.0
700	3.543	0.314	3.353	0.224	5.0
800	3.682	0.348	3.462	0.238	5.0
900	3.767	0.32	3.547	0.24	5.0
1000	3.68	0.37	3.55	0.25	5.0
1200	3.563	0.419	3.353	0.319	5.0
1400	3.76	0.45	3.57	0.35	5.0
1600	3.946	0.506	3.846	0.396	5.0
1800	3.975	0.583	3.825	0.463	5.0
2000	3.901	0.716	3.791	0.606	5.0
2200	4.008	0.787	3.878	0.687	5.0
2400	4.143	0.742	3.983	0.662	5.0
2600	4.132	0.811	3.942	0.691	5.0
2800	4.031	0.925	3.921	0.805	5.0
3000	3.81	0.851	3.7	0.741	5.0



Audio Frequency Low Pass Filter Response – High Power

Carrier Frequency: 454.0125 MHz, Channel Spacing 25 kHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
3.0	-4.4	0.0
3.5	-9.7	-4.0
4.0	-13.4	-7.5
5.0	-23.3	-13.3
7.0	-37.9	-21.1
10.0	-54.3	-31.4
15.0	-71.0	-41.9
20.0	-84.3	-50.0
30.0	-83.9	-50.0
50.0	-83.7	-50.0
70.0	-84.6	-50.0



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

Applicable Standard

FCC §2.1049, §22.357, § 22.731, §74.462, §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 shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set $\geq 3 \times \text{RBW}$.

Test Data**Environmental Conditions**

Temperature:	24.5°C
Relative Humidity:	67 %
ATM Pressure:	100.4 kPa
Tester:	Blake Yang
Test Date:	2019-07-25

Modulation Mode	Channel Separation	f_c	99% Occupied Bandwidth	26 dB Bandwidth	Power Level	Note
		MHz	kHz	kHz		
FM	12.5kHz	453.2125	5.311	7.916	High	FCC part 90
			5.311	7.916	Low	
4FSK	12.5kHz		7.816	10.822	High	
			7.515	9.419	Low	
FM	12.5kHz	454.0125	5.311	7.916	High	FCC part 22
			5.311	7.916	Low	
	25kHz		14.429	16.032	High	
			14.429	16.032	Low	
4FSK	12.5kHz		7.415	9.920	High	
			7.214	8.818	Low	
FM	12.5kHz	450.03125	5.311	10.321	High	FCC part 74
			5.311	10.321	Low	
	25kHz		13.026	16.032	High	
			14.028	16.032	Low	
4FSK	12.5kHz		7.715	10.321	High	
			7.315	9.519	Low	

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

$$BW = 2M + 2D$$

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.

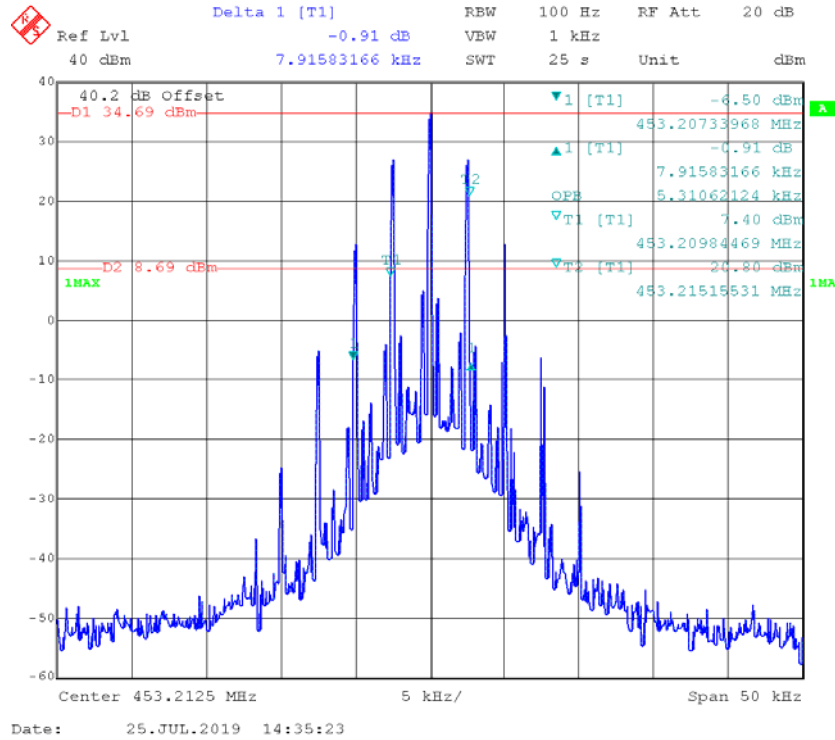
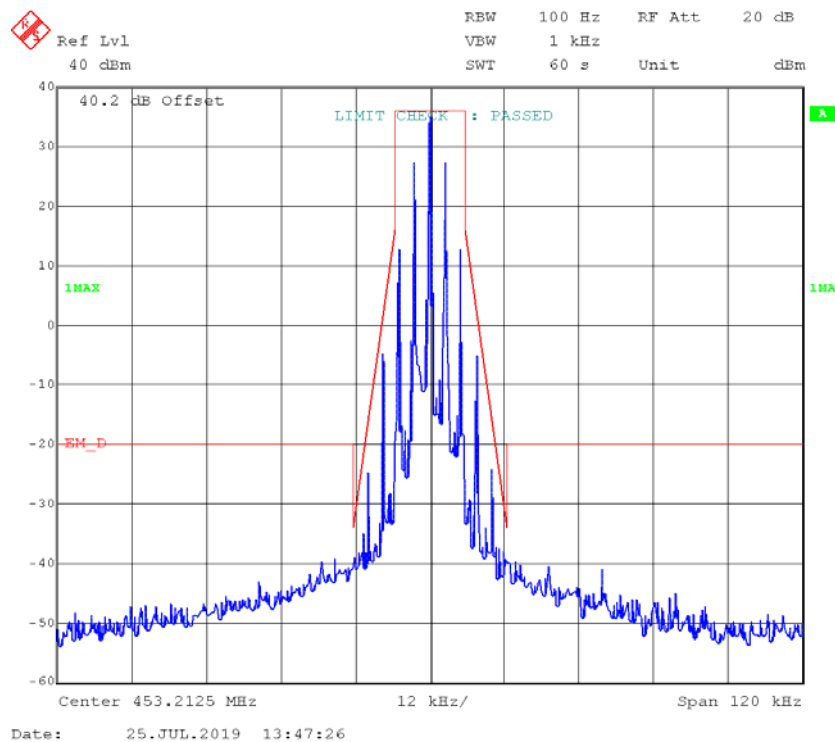
For Digital Mode (Channel Spacing: 12.5 kHz)

Emission Designator 7K60F1D and 7K60F1E

The 99% energy rule was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.60 kHz.

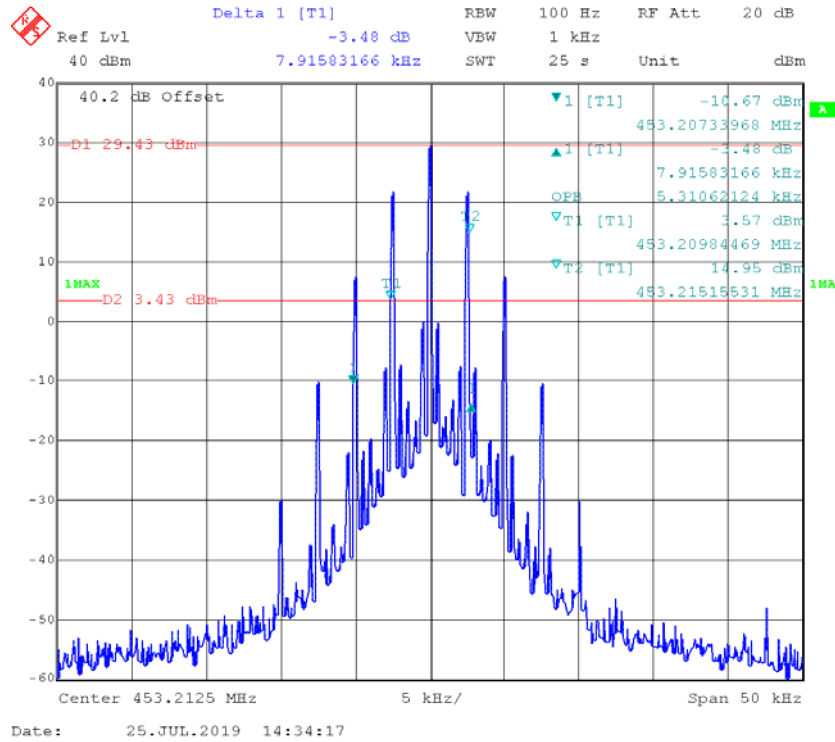
F1D and F1E portion of the designator indicates digital information.

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

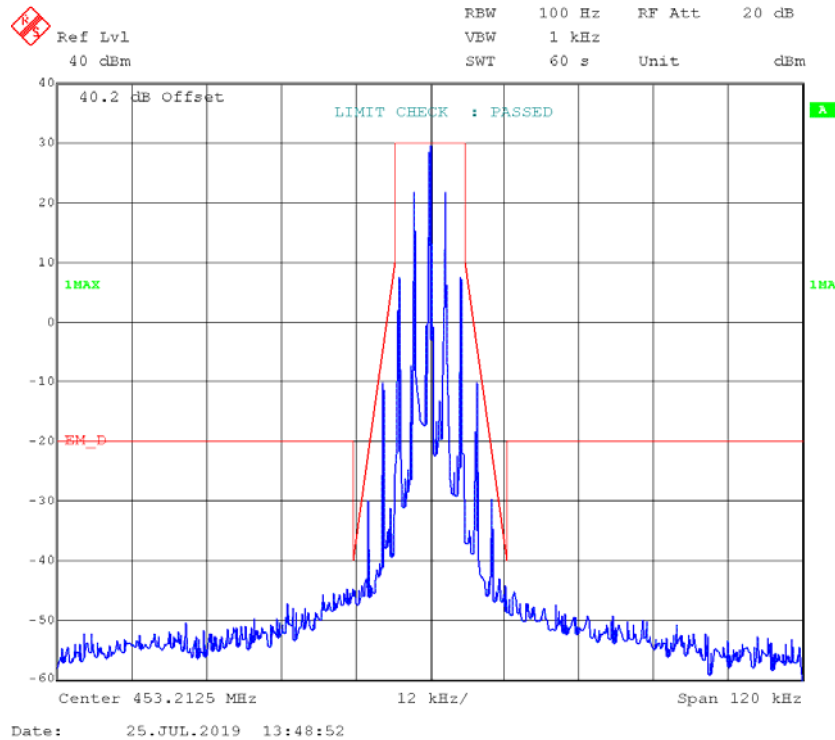
Part 90:**FM, 12.5 kHz, High Power - Frequency 453.2125 MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask D**

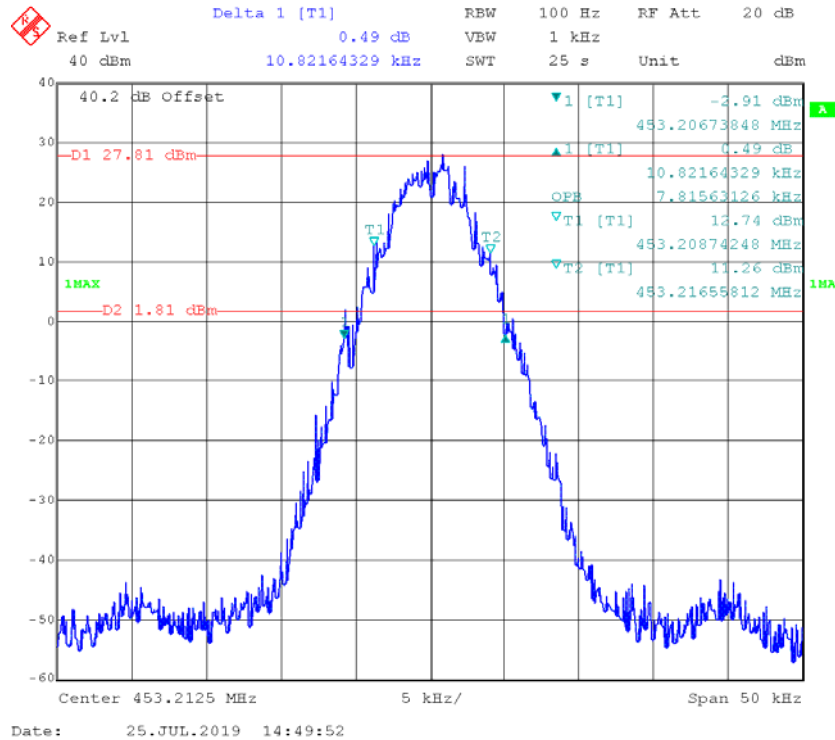
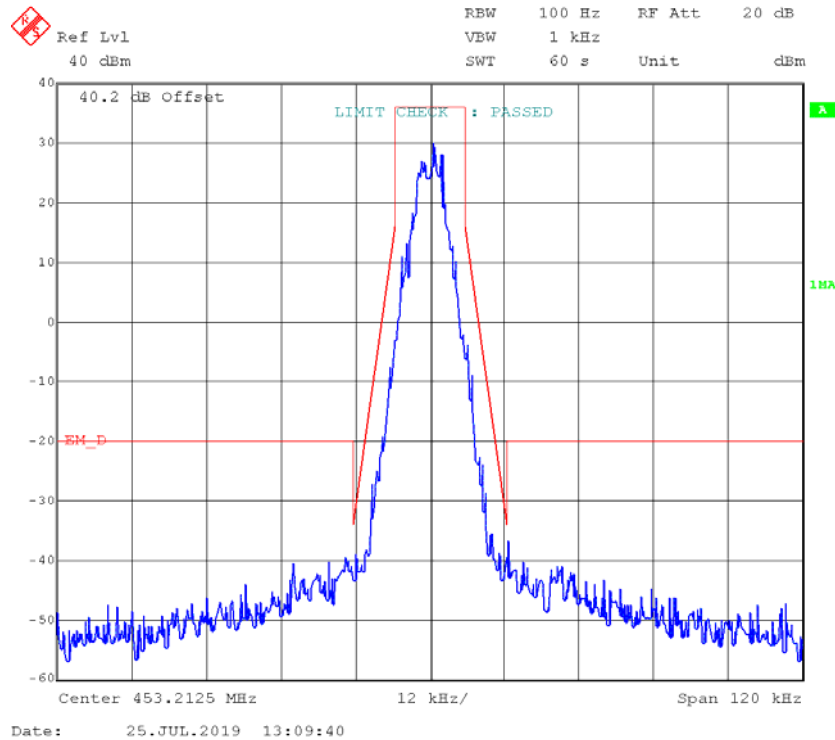
FM,12.5kHz, Low Power - Frequency 453.2125 MHz:

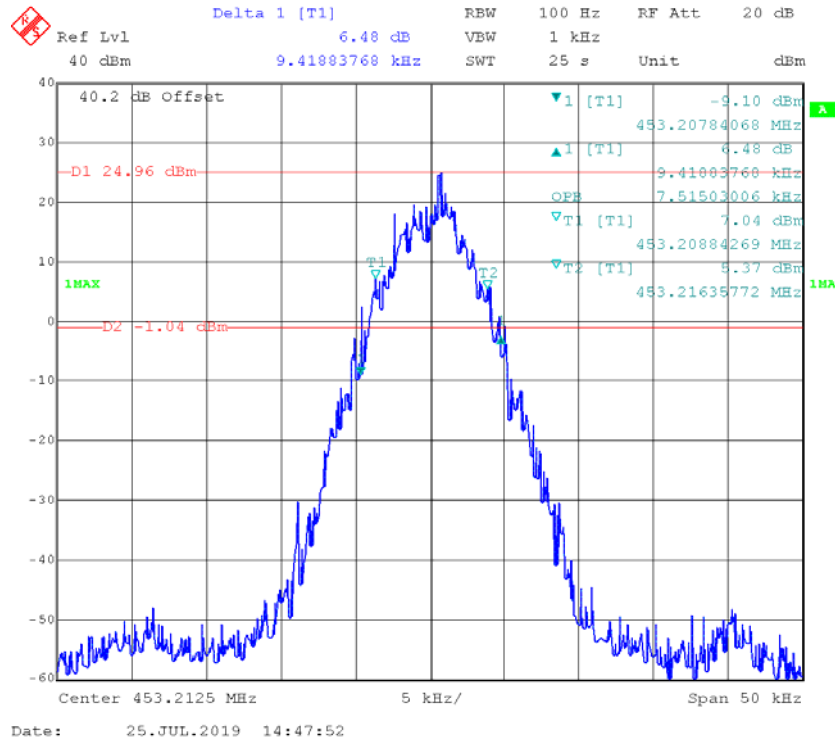
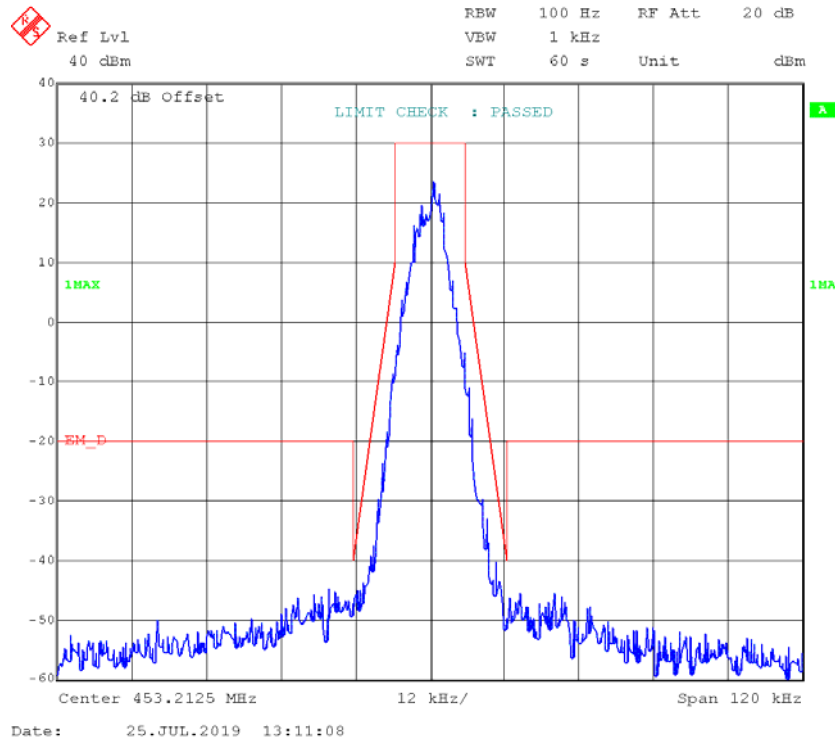
99% Occupied & 26 dB Bandwidth

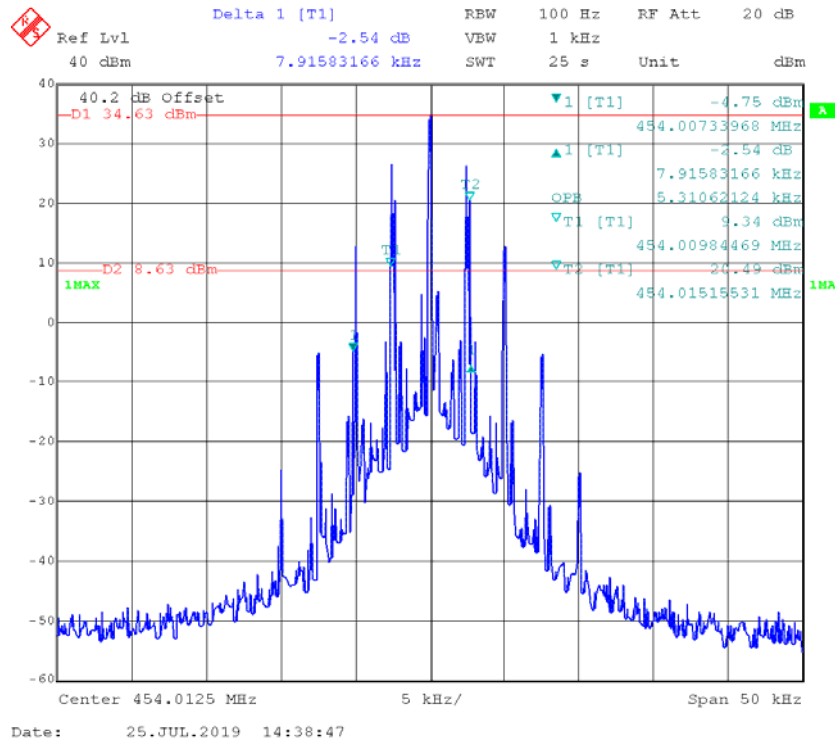
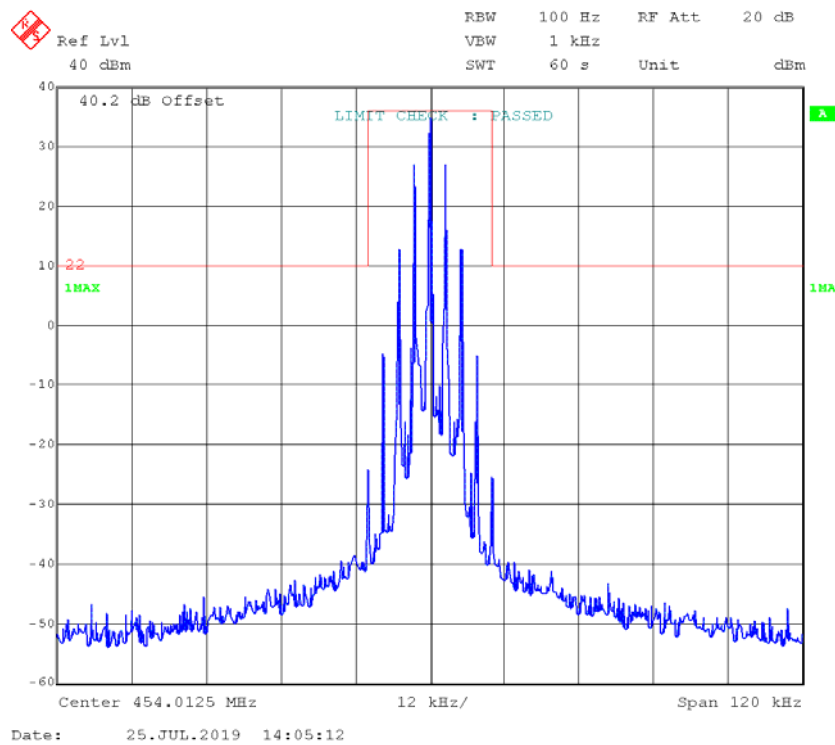


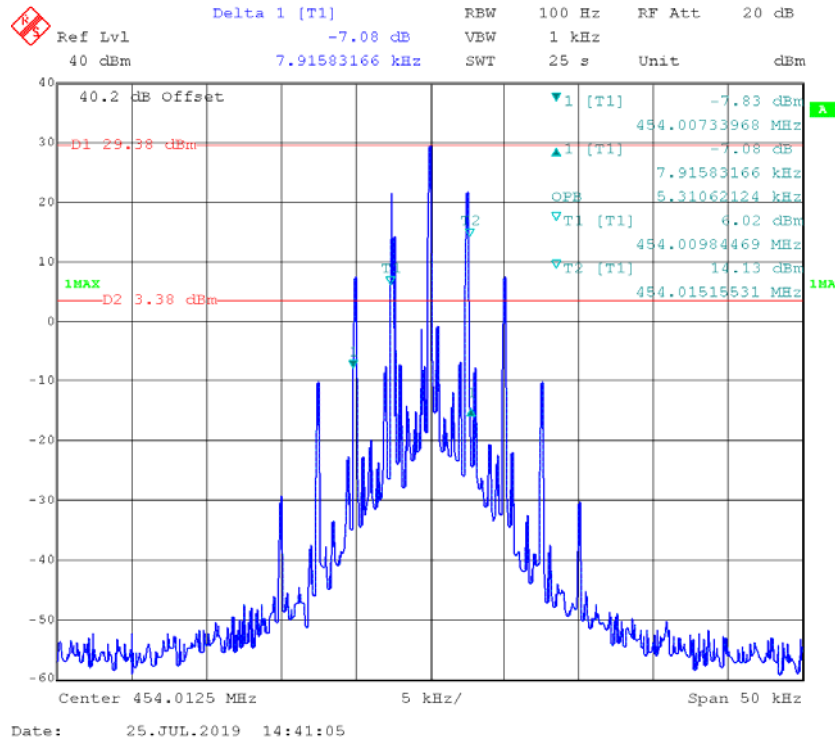
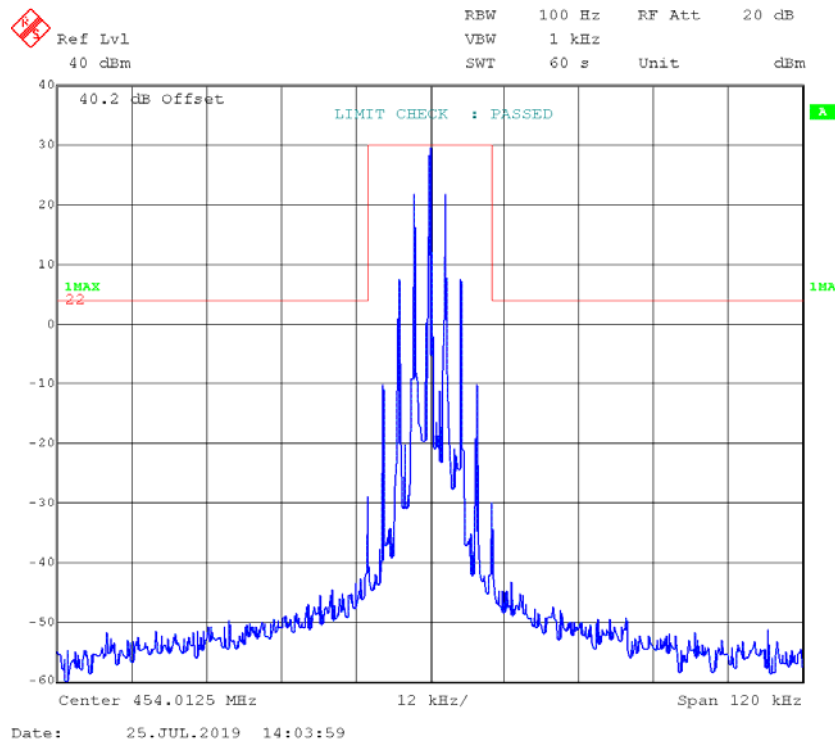
Emission Mask D

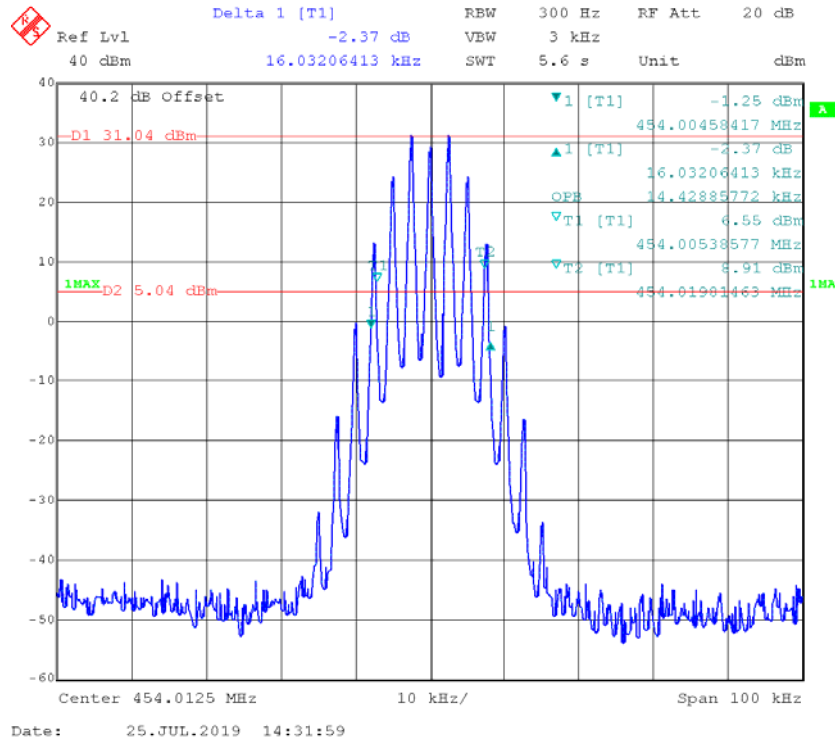
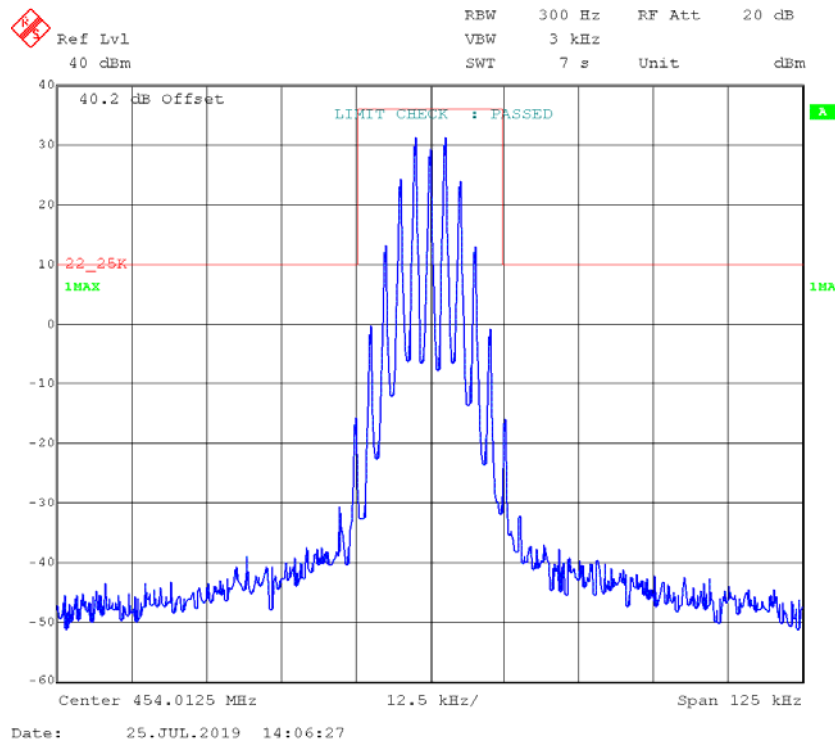


4FSK,12.5kHz, High Power - Frequency 453.2125 MHz:**99% Occupied & 26 dB Bandwidth****Emission Mask D**

4FSK,12.5kHz, Low Power - Frequency 453.2125 MHz:**99% Occupied & 26 dB Bandwidth****Emission Mask D**

Part 22**FM,12.5kHz, High Power - Frequency 454.0125 MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask-§22.359**

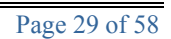
FM,12.5kHz, Low Power – Frequency 454.0125 MHz:**99% Occupied & 26 dB Bandwidth****Emission Mask-§22.359**

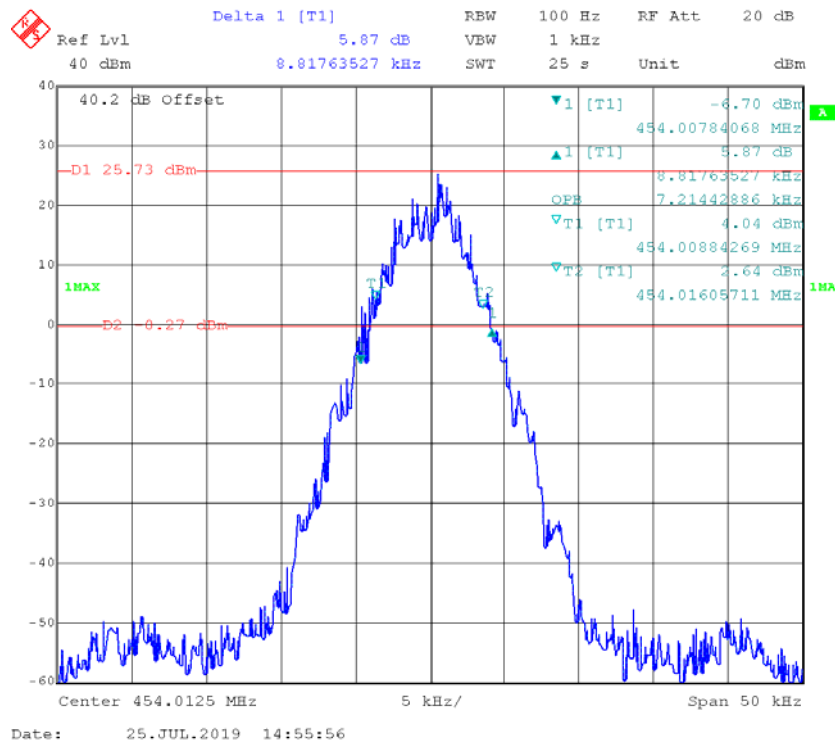
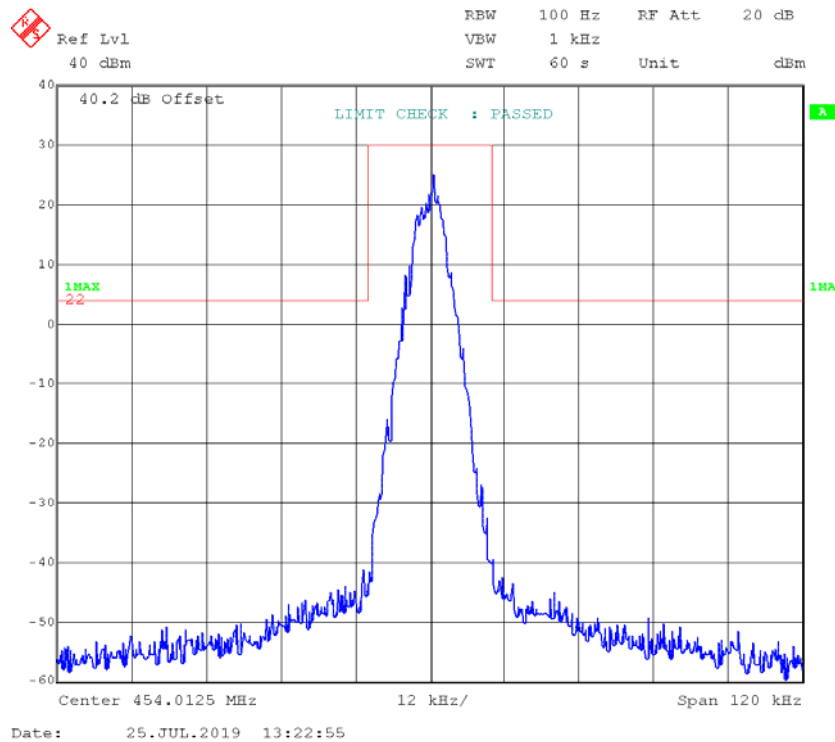
FM,25kHz, High Power - Frequency 454.0125 MHz:**99% Occupied & 26 dB Bandwidth****Emission Mask-§22.359**

99% Occupied & 26 dB Bandwidth



99% Occupied & 26 dB Bandwidth



4FSK,12.5 kHz, Low Power - Frequency 454.0125 MHz:**99% Occupied & 26 dB Bandwidth****Emission Mask-§22.359**

FM,12.5kHz, High Power - Frequency 450.03125 MHz:

Delta 1 [T1]

Ref Lvl 13.65 dB

40 dBm

10.32064128 kHz

RBW 100 Hz

RF Att 20 dB

VBW 1 kHz

SWT 25 s

Unit dBm

40.2 dB Offset

D1 34.71 dBm

D2 8.71 dBm

1MAX

1 [T1] -6.22 dBm

450.02608968 MHz

1 [T1] 11.65 dB

10.32064128 kHz

OPR 5.31062124 kHz

T1 [T1] 7.50 dBm

450.02859469 MHz

T2 [T1] 21.78 dBm

450.03390531 MHz

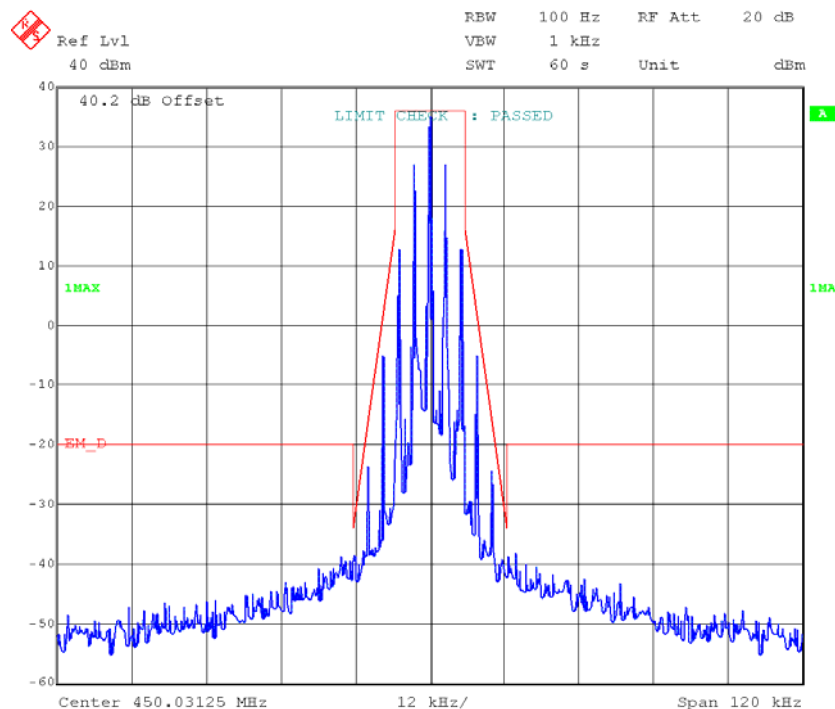
1MAX

Center 450.03125 MHz

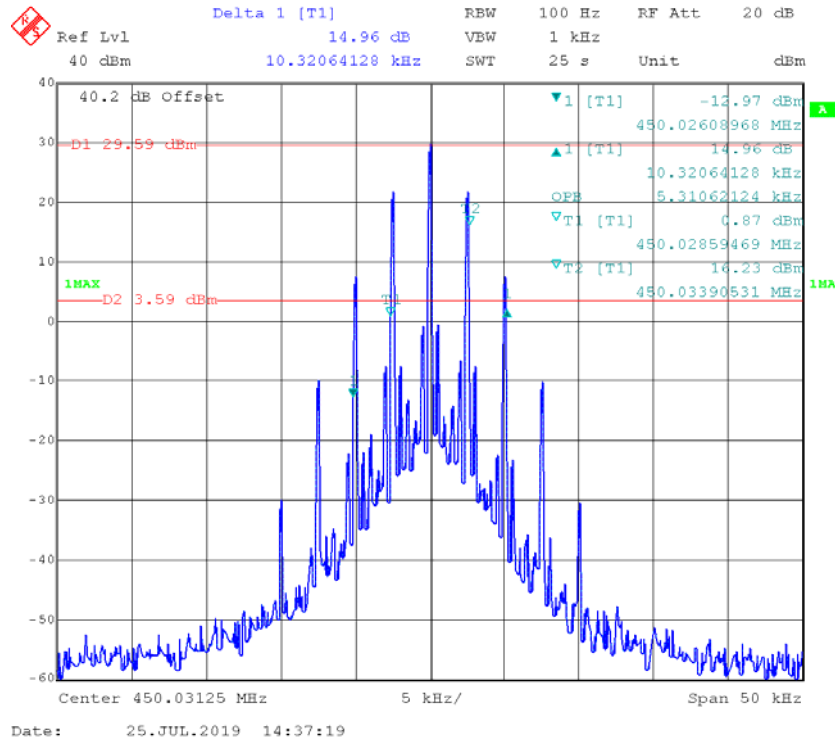
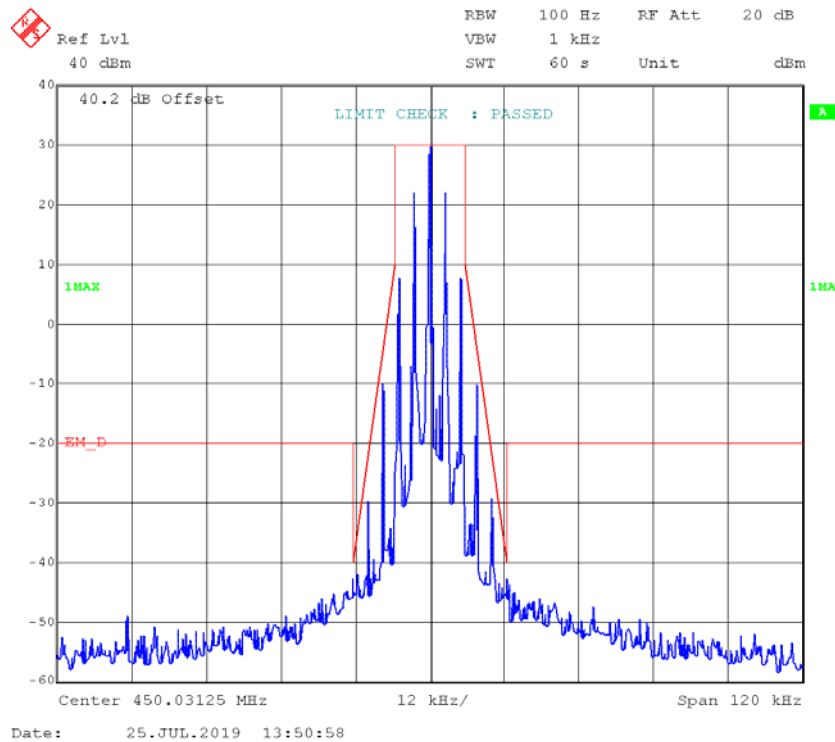
5 kHz/

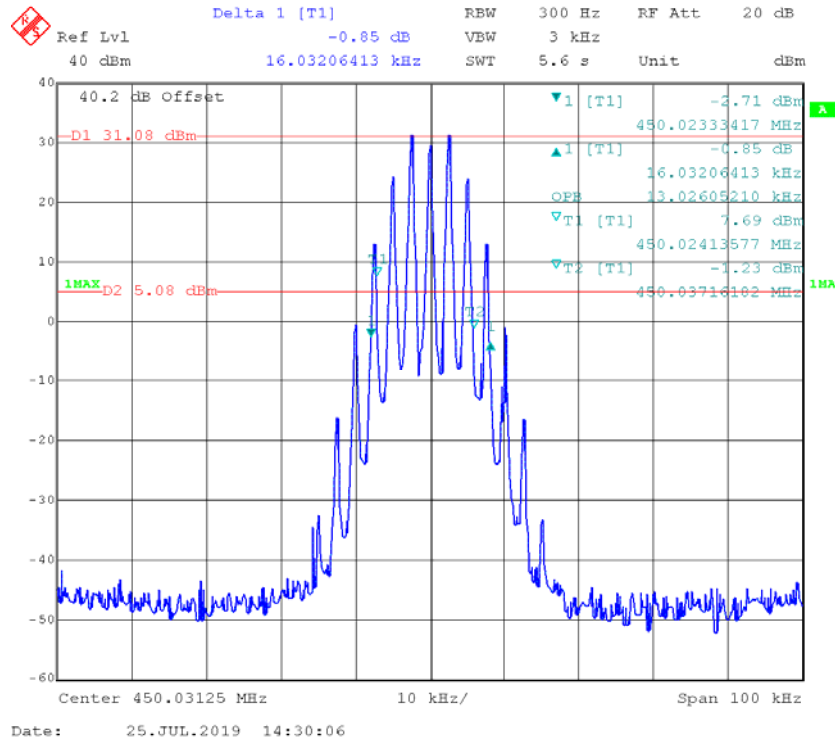
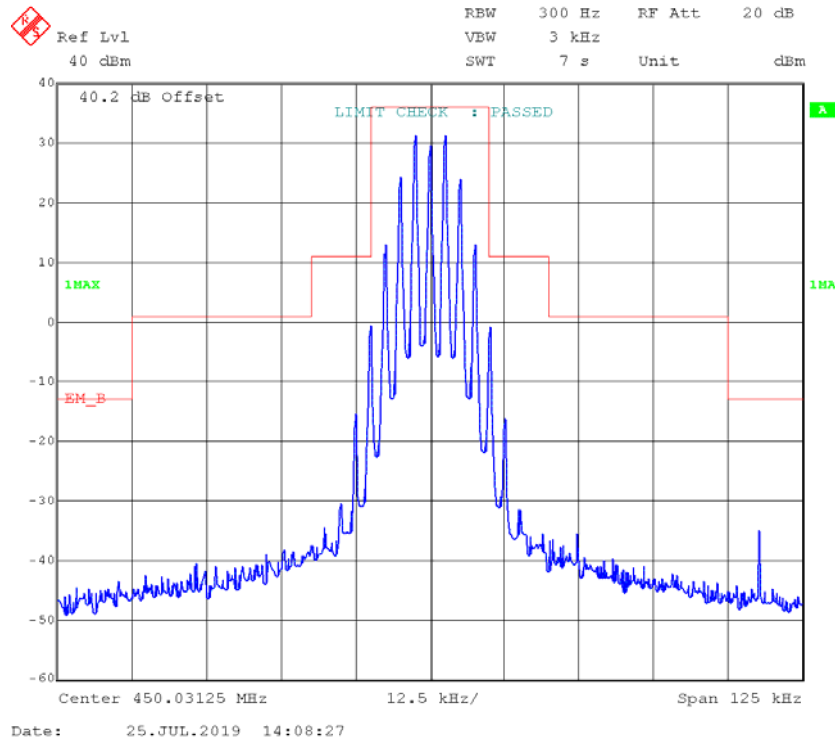
Span 50 kHz

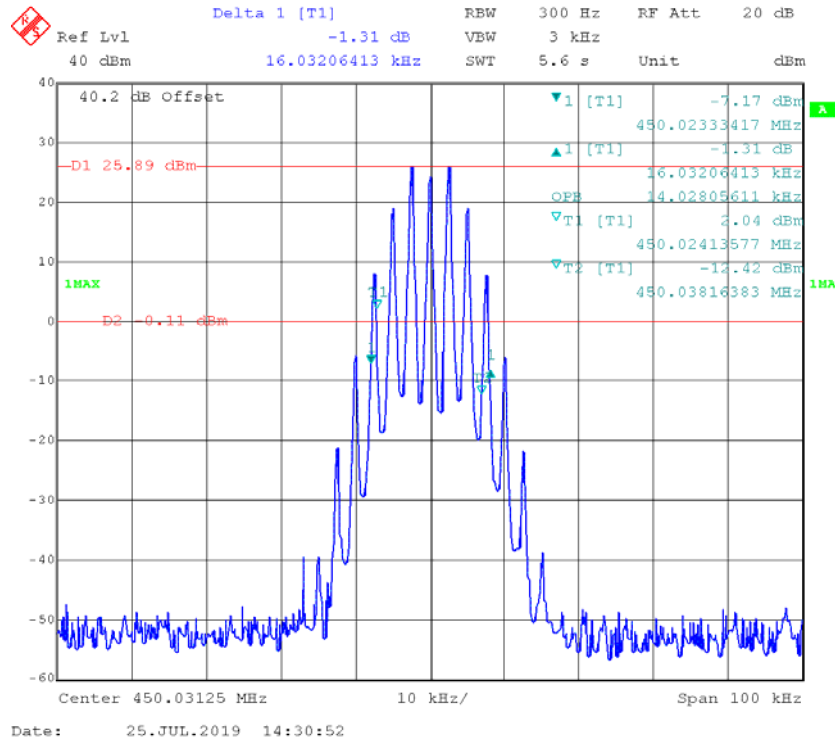
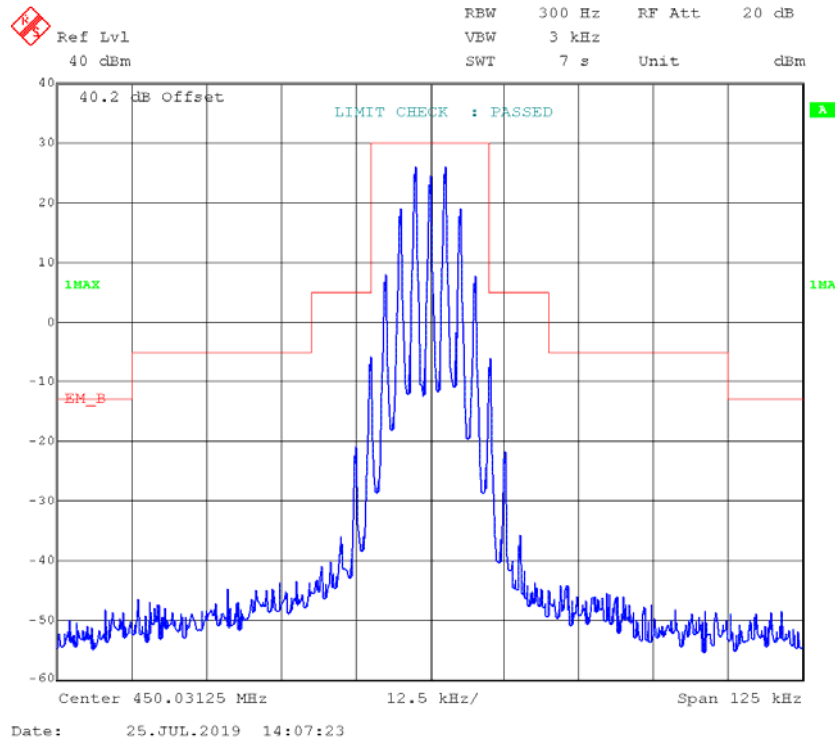
Emission Mask D

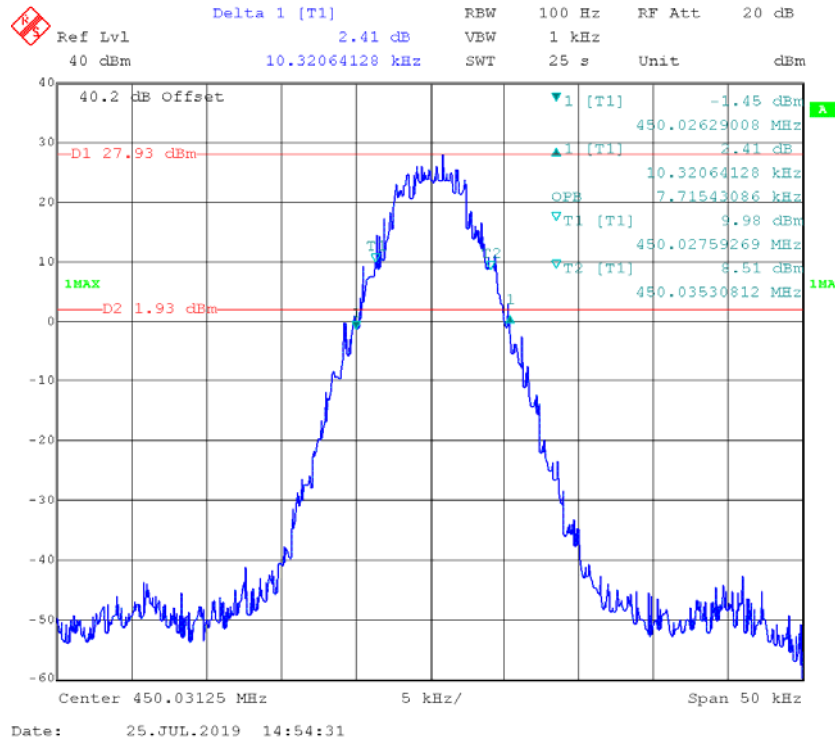
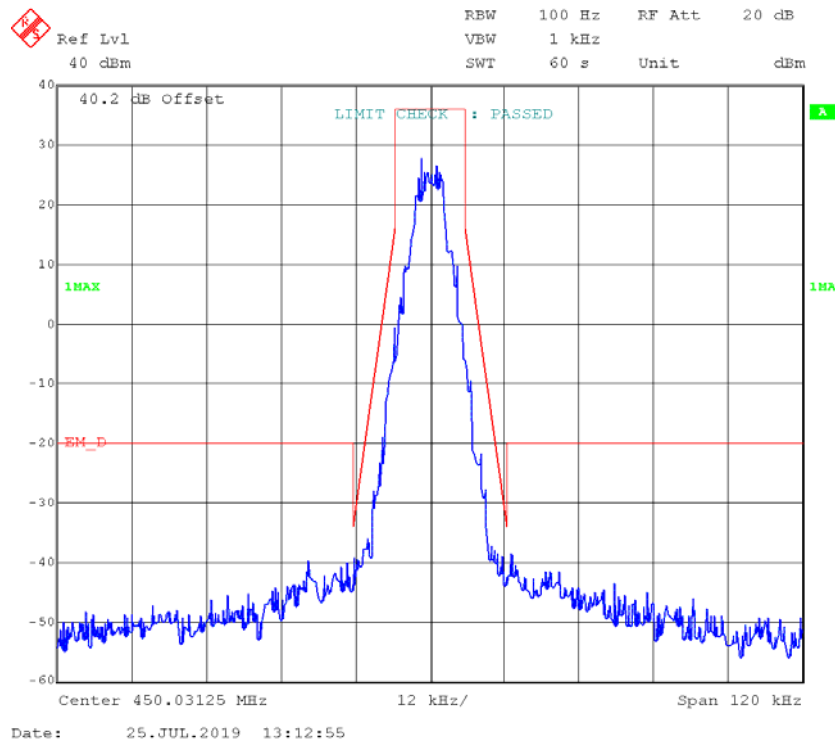


Date: 25.JUL.2019 13:52:47

FM,12.5kHz, Low Power – Frequency 450.03125 MHz:**99% Occupied & 26 dB Bandwidth****Emission Mask D**

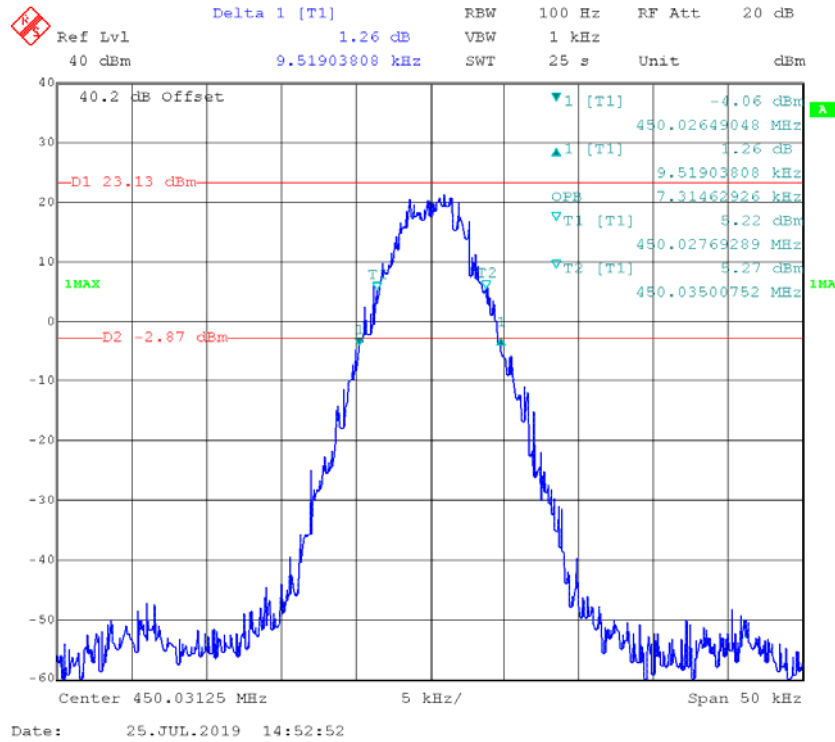
FM,25kHz, High Power - Frequency 450.03125 MHz:**99% Occupied & 26 dB Bandwidth****Emission Mask B**

FM, 25 kHz, Low Power – Frequency 450.03125 MHz:**99% Occupied & 26 dB Bandwidth****Emission Mask B**

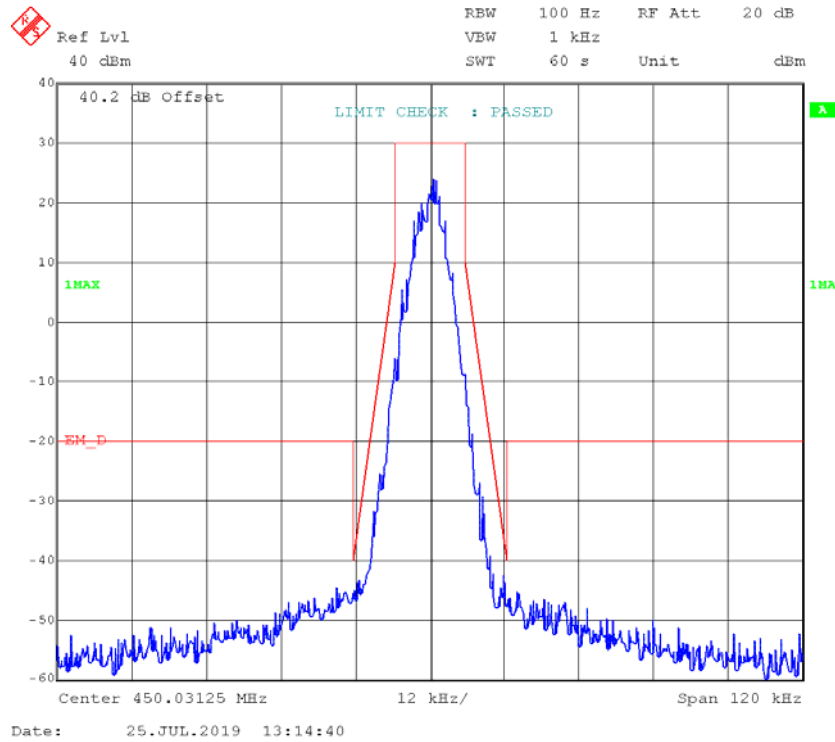
4FSK,12.5 kHz, High Power - Frequency 450.03125 MHz:**99% Occupied & 26 dB Bandwidth****Emission Mask D**

4FSK,12.5 kHz, Low Power - Frequency 450.03125 MHz:

99% Occupied & 26 dB Bandwidth



Emission Mask D



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

Applicable Standard

FCC §2.1051, §22.861, §74.462 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 100 kHz for below 1GHz, and 1MHz for above 1GHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

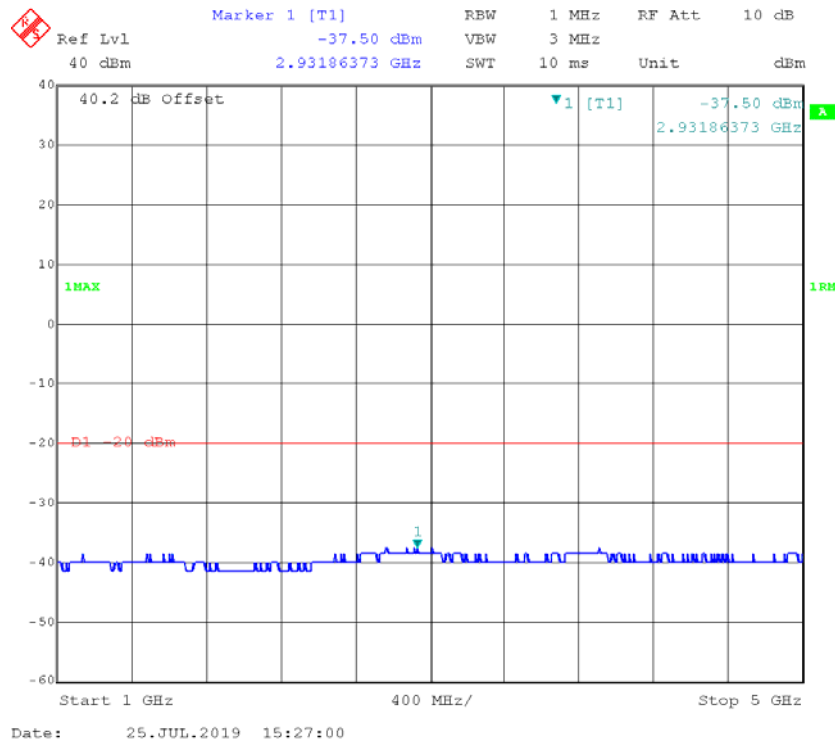
Test Data**Environmental Conditions**

Temperature:	24.5°C
Relative Humidity:	67 %
ATM Pressure:	100.4 kPa
Tester:	Blake Yang
Test Date:	2019-07-25

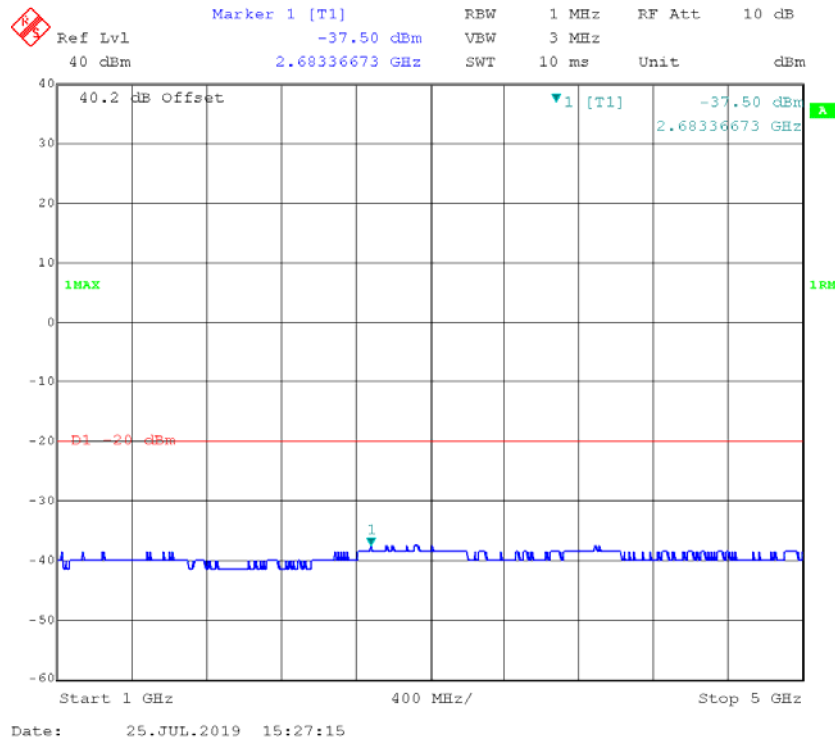
Test Mode: Transmitting

Part 90

453.2125 MHz, 12.5 kHz, FM, High power

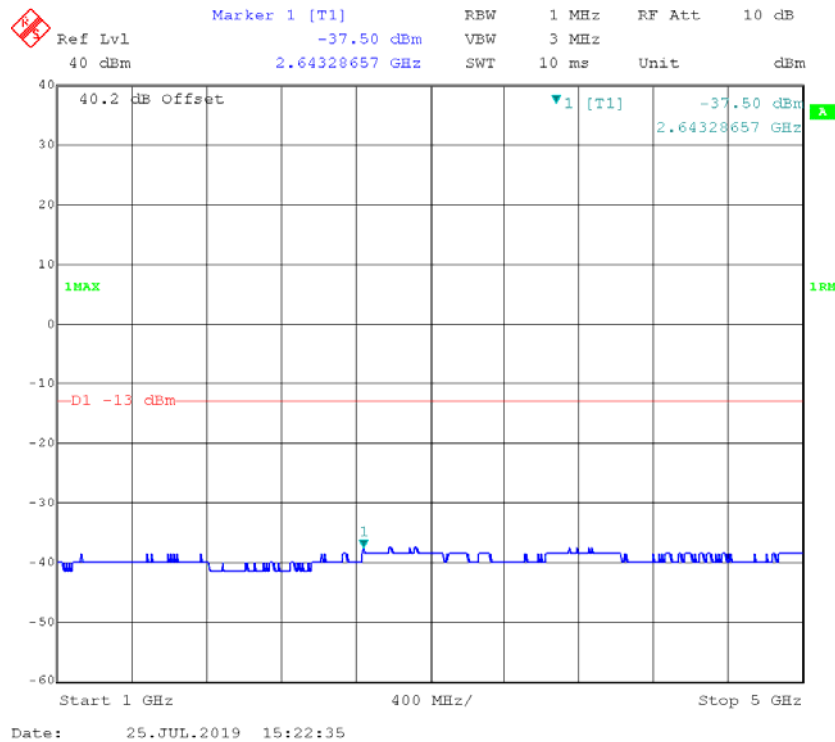


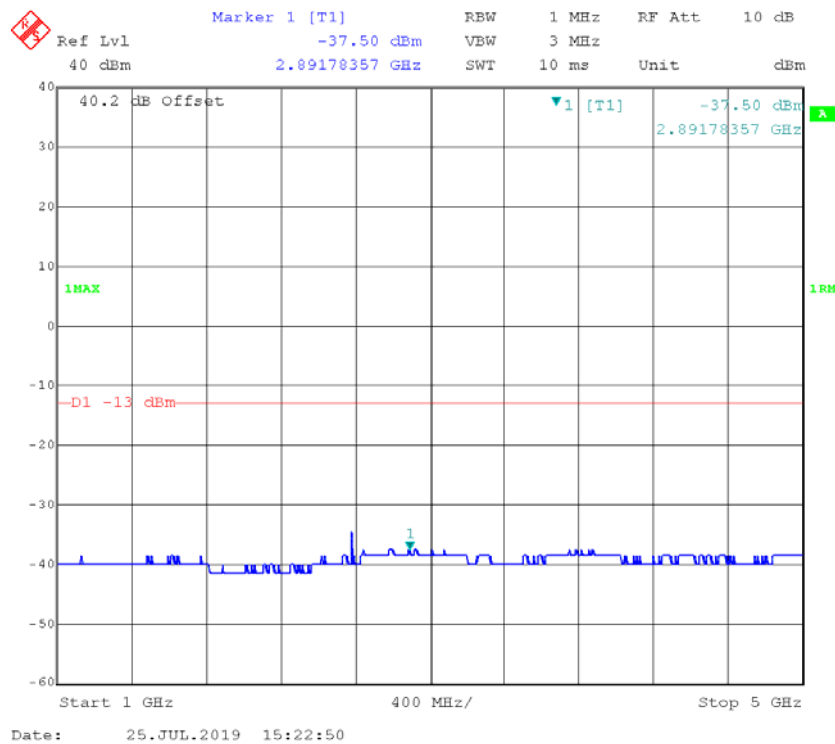
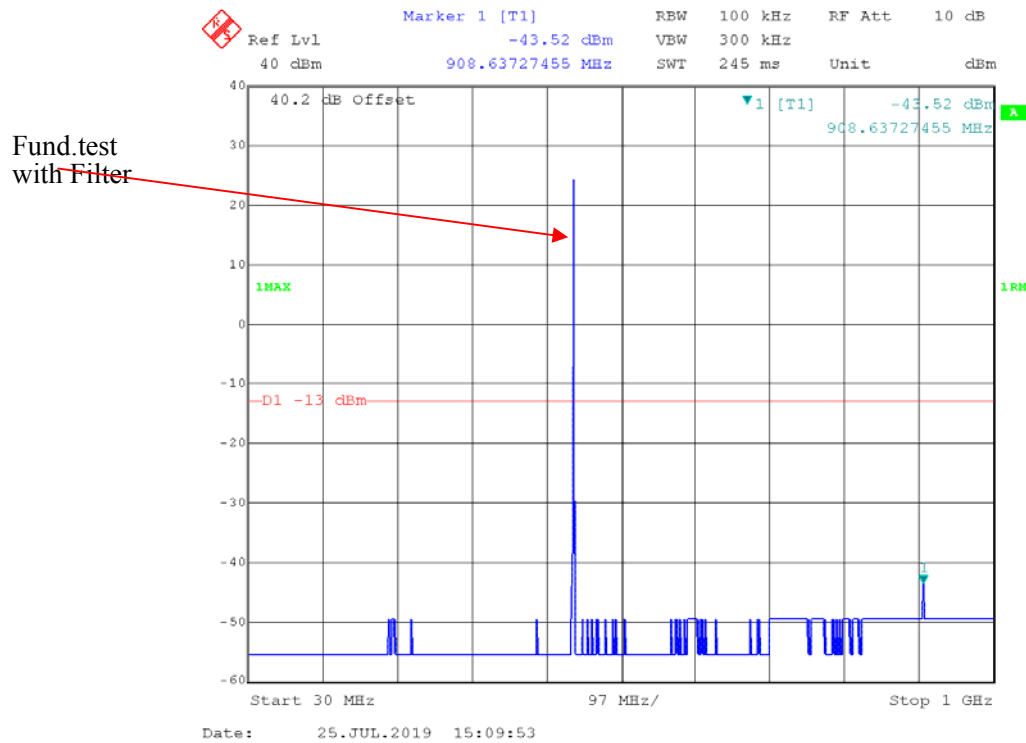
453.2125 MHz, 12.5kHz, 4FSK, High power



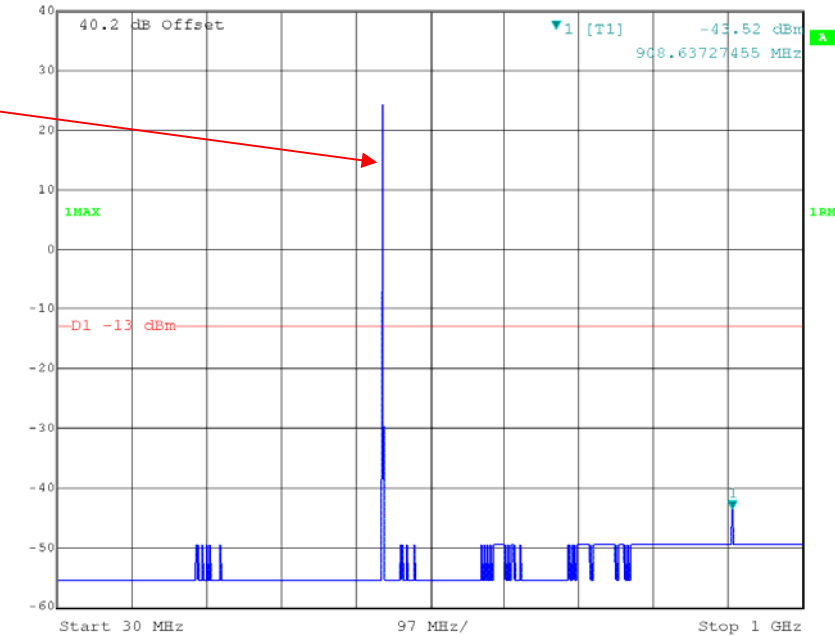
Part 22:

454.0125 MHz, 12.5 kHz, FM, High power

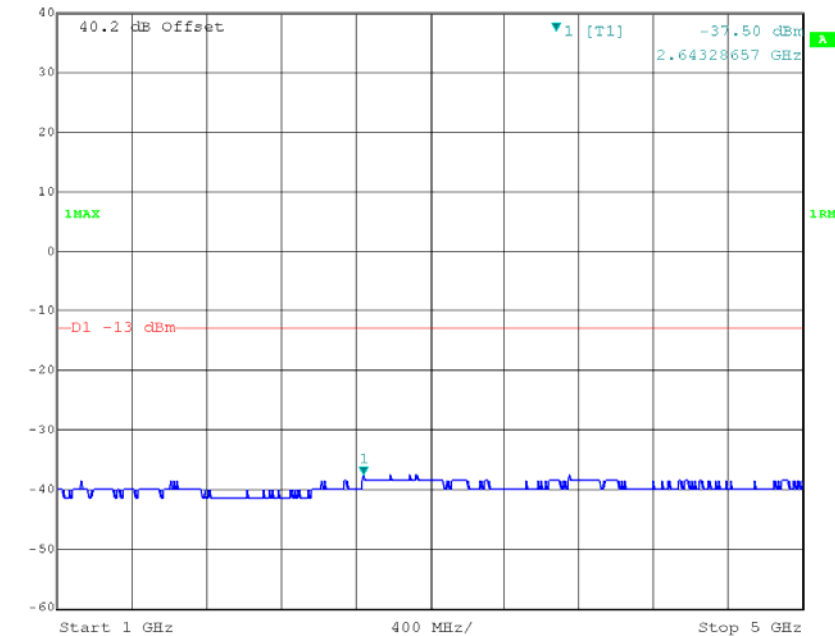


454.0125 MHz, 25 kHz, FM, High power

	Marker 1 [T1]		RBW	100 kHz	RF Att	10 dB
	Ref Lvl	-43.52 dBm	VBW	300 kHz		
	40 dBm	908.63727455 MHz	SWT	245 ms	Unit	dBm



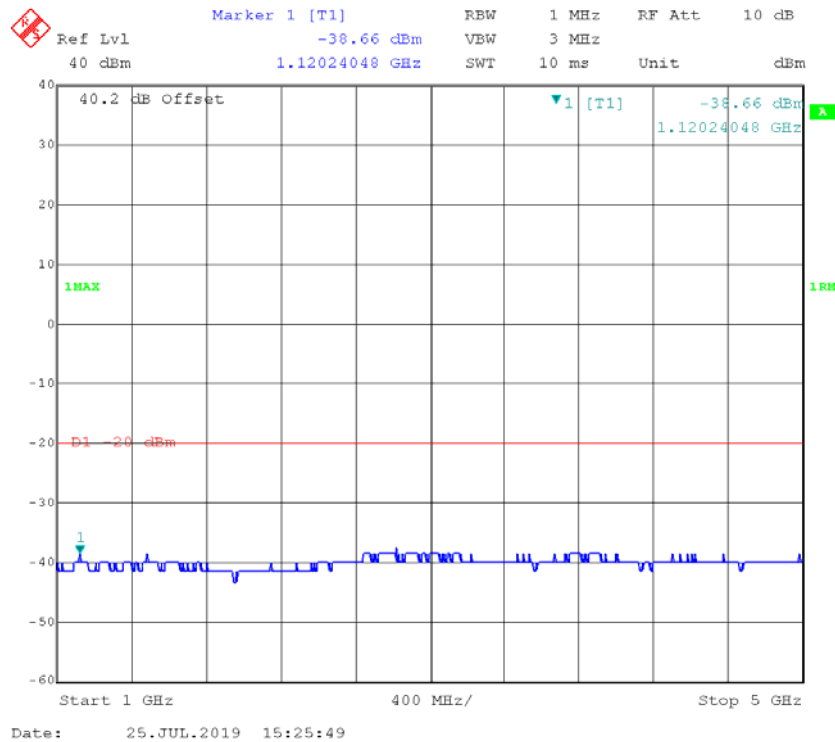
	Marker 1 [T1]	RBW	1 MHz	RF Att	10 dB
	Ref Lvl	-37.50 dBm	VBW	3 MHz	
	40 dBm	2.64328657 GHz	SWT	10 ms	Unit



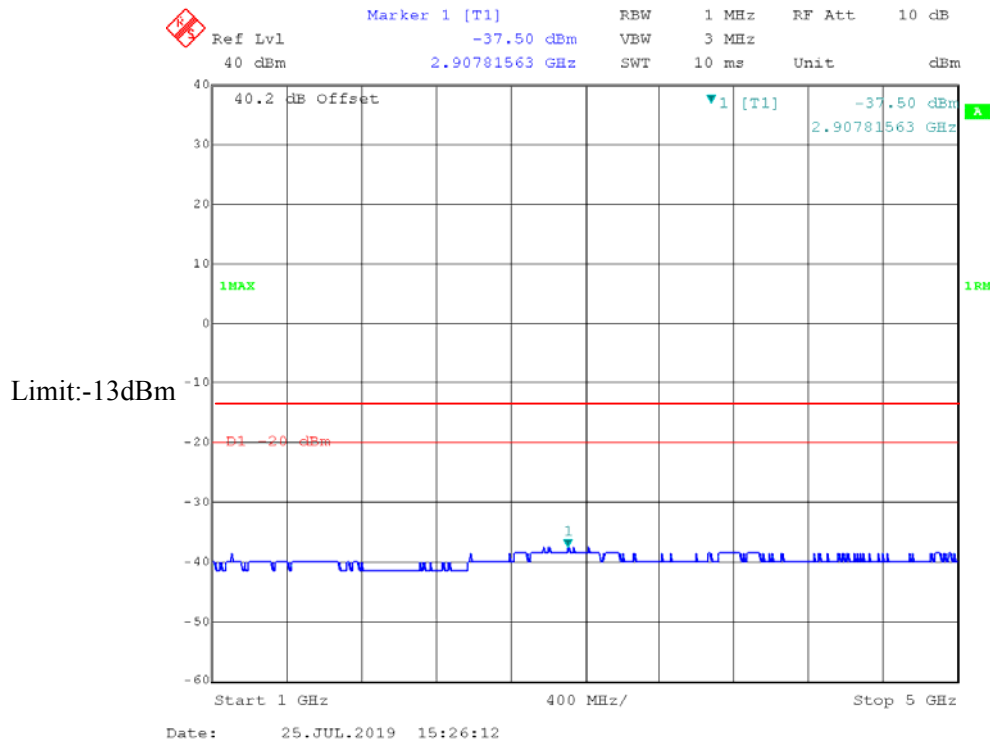
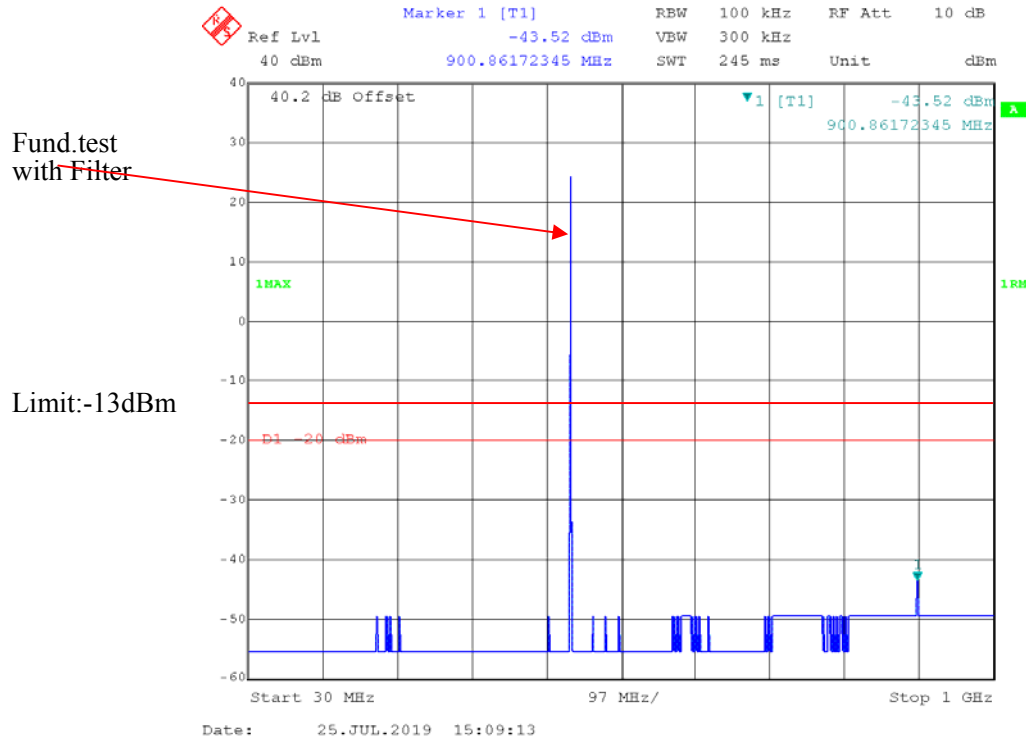
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Part 74:

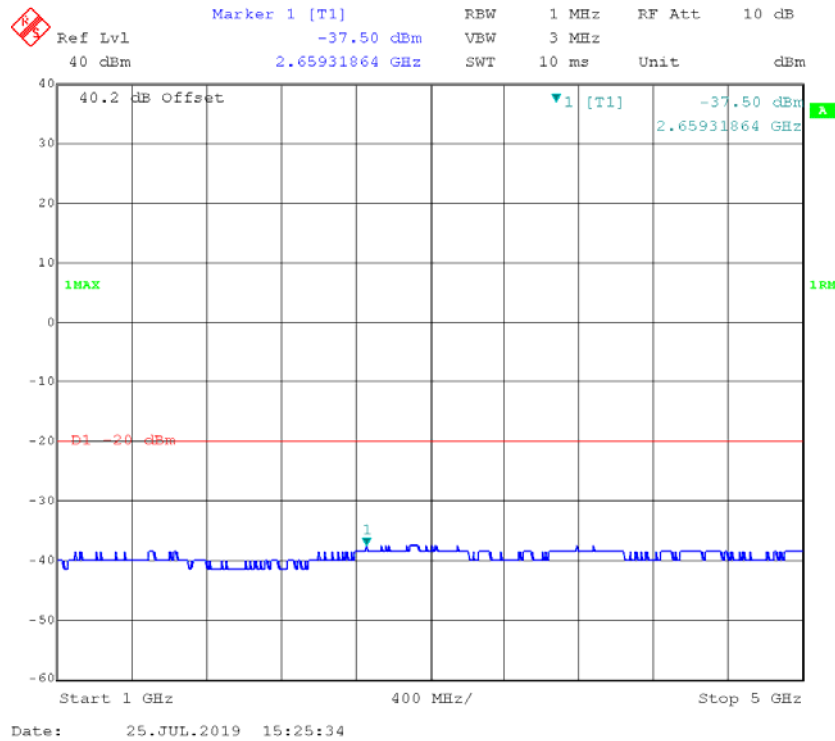
450.03125 MHz, 12.5 kHz, FM, High power



450.03125 MHz, 25 kHz, FM, High power



450.03125 MHz, 12.5 kHz, 4FSK, High power



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

Applicable Standard

FCC §2.1053, §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.

Test Data

Environmental Conditions

Test Item:	Radiated Spurious Emissions Below 1GHz	Radiated Spurious Emissions Above 1GHz
Temperature:	23.8 °C	22.1 °C
Relative Humidity:	58 %	52 %
ATM Pressure:	100.5 kPa	100.5 kPa
Tester:	Sunny Cen	Neil Liao
Test Date:	2019-07-25	2019-07-28

Test Mode: Transmitting(T03-00302-HCAA was the worst and reported)

30MHz - 5GHz:

Part 90

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, High Power								
906.4250	H	34.63	-60.74	0.00	0.51	-61.25	-20.00	41.25
906.4250	V	36.75	-55.29	0.00	0.51	-55.80	-20.00	35.80
1359.6375	H	50.34	-63.02	8.72	1.20	-55.50	-20.00	35.50
1359.6375	V	59.47	-54.61	8.72	1.20	-47.09	-20.00	27.09
1812.8500	H	51.36	-62.82	11.19	0.72	-52.35	-20.00	32.35
1812.8500	V	59.12	-55.62	11.19	0.72	-45.15	-20.00	25.15
2266.0625	H	58.74	-53.53	11.06	1.20	-43.67	-20.00	23.67
2266.0625	V	53.36	-58.81	11.06	1.20	-48.95	-20.00	28.95
2719.2750	H	54.12	-58.16	13.10	1.27	-46.33	-20.00	26.33
2719.2750	V	53.22	-59.18	13.10	1.27	-47.35	-20.00	27.35
3172.4875	H	52.38	-57.71	13.49	1.64	-45.86	-20.00	25.86
3172.4875	V	56.97	-53.17	13.49	1.64	-41.32	-20.00	21.32
3625.7000	H	51.66	-58.26	14.07	1.58	-45.77	-20.00	25.77
3625.7000	V	50.21	-59.70	14.07	1.58	-47.21	-20.00	27.21
4078.9125	H	47.98	-61.01	13.76	1.36	-48.61	-20.00	28.61
4078.9125	V	48.39	-60.72	13.76	1.36	-48.32	-20.00	28.32
4532.1250	H	52.22	-56.43	14.13	1.64	-43.94	-20.00	23.94
4532.1250	V	50.47	-58.11	14.13	1.64	-45.62	-20.00	25.62
4FSK,Frequency: 453.2125MHz-12.5 kHz, High Power								
906.4250	H	47.89	-47.48	0.00	0.51	-47.99	-20.00	27.99
906.4250	V	54.64	-37.40	0.00	0.51	-37.91	-20.00	17.91
1359.6375	H	51.75	-61.61	8.72	1.20	-54.09	-20.00	34.09
1359.6375	V	60.83	-53.25	8.72	1.20	-45.73	-20.00	25.73
1812.8500	H	52.90	-61.28	11.19	0.72	-50.81	-20.00	30.81
1812.8500	V	59.25	-55.49	11.19	0.72	-45.02	-20.00	25.02
2266.0625	H	59.40	-52.87	11.06	1.20	-43.01	-20.00	23.01
2266.0625	V	54.81	-57.36	11.06	1.20	-47.50	-20.00	27.50
2719.2750	H	55.48	-56.80	13.10	1.27	-44.97	-20.00	24.97
2719.2750	V	54.80	-57.60	13.10	1.27	-45.77	-20.00	25.77
3172.4875	H	54.32	-55.77	13.49	1.64	-43.92	-20.00	23.92
3172.4875	V	57.53	-52.61	13.49	1.64	-40.76	-20.00	20.76
3625.7000	H	52.80	-57.12	14.07	1.58	-44.63	-20.00	24.63
3625.7000	V	50.83	-59.08	14.07	1.58	-46.59	-20.00	26.59
4078.9125	H	48.19	-60.80	13.76	1.36	-48.40	-20.00	28.40
4078.9125	V	49.83	-59.28	13.76	1.36	-46.88	-20.00	26.88
4532.1250	H	51.25	-57.40	14.13	1.64	-44.91	-20.00	24.91
4532.1250	V	49.18	-59.40	14.13	1.64	-46.91	-20.00	26.91

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, High Power								
908.0250	H	34.53	-60.79	0.00	0.51	-61.30	-13.00	48.30
908.0250	V	37.89	-54.10	0.00	0.51	-54.61	-13.00	41.61
1362.0375	H	51.66	-61.69	8.73	1.20	-54.16	-13.00	41.16
1362.0375	V	59.86	-54.21	8.73	1.20	-46.68	-13.00	33.68
1816.0500	H	51.36	-62.77	11.21	0.73	-52.29	-13.00	39.29
1816.0500	V	57.46	-57.22	11.21	0.73	-46.74	-13.00	33.74
2270.0625	H	57.36	-54.90	11.08	1.20	-45.02	-13.00	32.02
2270.0625	V	53.76	-58.40	11.08	1.20	-48.52	-13.00	35.52
2724.0750	H	53.14	-59.14	13.10	1.28	-47.32	-13.00	34.32
2724.0750	V	52.69	-59.71	13.10	1.28	-47.89	-13.00	34.89
3178.0875	H	53.11	-56.91	13.51	1.63	-45.03	-13.00	32.03
3178.0875	V	58.67	-51.40	13.51	1.63	-39.52	-13.00	26.52
3632.1000	H	53.77	-56.08	14.07	1.61	-43.62	-13.00	30.62
3632.1000	V	51.98	-57.86	14.07	1.61	-45.40	-13.00	32.40
4086.1125	H	49.36	-59.67	13.74	1.36	-47.29	-13.00	34.29
4086.1125	V	50.78	-58.38	13.74	1.36	-46.00	-13.00	33.00
4540.1250	H	52.74	-55.88	14.14	1.66	-43.40	-13.00	30.40
4540.1250	V	52.33	-56.24	14.14	1.66	-43.76	-13.00	30.76
4FSK, Frequency: 454.0125MHz-12.5 kHz, High Power								
908.0250	H	35.53	-59.79	0.00	0.51	-60.30	-13.00	47.30
908.0250	V	37.84	-54.15	0.00	0.51	-54.66	-13.00	41.66
1362.0375	H	50.69	-62.66	8.73	1.20	-55.13	-13.00	42.13
1362.0375	V	59.87	-54.20	8.73	1.20	-46.67	-13.00	33.67
1816.0500	H	52.44	-61.69	11.21	0.73	-51.21	-13.00	38.21
1816.0500	V	60.12	-54.56	11.21	0.73	-44.08	-13.00	31.08
2270.0625	H	57.35	-54.91	11.08	1.20	-45.03	-13.00	32.03
2270.0625	V	53.46	-58.70	11.08	1.20	-48.82	-13.00	35.82
2724.0750	H	56.97	-55.31	13.10	1.28	-43.49	-13.00	30.49
2724.0750	V	55.54	-56.86	13.10	1.28	-45.04	-13.00	32.04
3178.0875	H	55.14	-54.88	13.51	1.63	-43.00	-13.00	30.00
3178.0875	V	58.90	-51.17	13.51	1.63	-39.29	-13.00	26.29
3632.1000	H	53.23	-56.62	14.07	1.61	-44.16	-13.00	31.16
3632.1000	V	51.47	-58.37	14.07	1.61	-45.91	-13.00	32.91
4086.1125	H	59.67	-49.36	13.74	1.36	-36.98	-13.00	23.98
4086.1125	V	50.14	-59.02	13.74	1.36	-46.64	-13.00	33.64
4540.1250	H	50.69	-57.93	14.14	1.66	-45.45	-13.00	32.45
4540.1250	V	52.74	-55.83	14.14	1.66	-43.35	-13.00	30.35

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-25 kHz, High Power								
908.0250	H	46.95	-48.37	0.00	0.51	-48.88	-13.00	35.88
908.0250	V	53.57	-38.42	0.00	0.51	-38.93	-13.00	25.93
1362.0375	H	51.21	-62.14	8.73	1.20	-54.61	-13.00	41.61
1362.0375	V	61.35	-52.72	8.73	1.20	-45.19	-13.00	32.19
1816.0500	H	53.22	-60.91	11.21	0.73	-50.43	-13.00	37.43
1816.0500	V	60.14	-54.54	11.21	0.73	-44.06	-13.00	31.06
2270.0625	H	60.11	-52.15	11.08	1.20	-42.27	-13.00	29.27
2270.0625	V	54.32	-57.84	11.08	1.20	-47.96	-13.00	34.96
2724.0750	H	56.22	-56.06	13.10	1.28	-44.24	-13.00	31.24
2724.0750	V	55.74	-56.66	13.10	1.28	-44.84	-13.00	31.84
3178.0875	H	56.77	-53.25	13.51	1.63	-41.37	-13.00	28.37
3178.0875	V	56.14	-53.93	13.51	1.63	-42.05	-13.00	29.05
3632.1000	H	53.14	-56.71	14.07	1.61	-44.25	-13.00	31.25
3632.1000	V	51.47	-58.37	14.07	1.61	-45.91	-13.00	32.91
4086.1125	H	49.78	-59.25	13.74	1.36	-46.87	-13.00	33.87
4086.1125	V	50.47	-58.69	13.74	1.36	-46.31	-13.00	33.31
4540.1250	H	52.44	-56.18	14.14	1.66	-43.70	-13.00	30.70
4540.1250	V	51.39	-57.18	14.14	1.66	-44.70	-13.00	31.70

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: 450.03125MHz-12.5 kHz, High Power								
900.0625	H	34.52	-61.08	0.00	0.51	-61.59	-20.00	41.59
900.0625	V	36.89	-55.33	0.00	0.51	-55.84	-20.00	35.84
1359.6375	H	52.31	-61.05	8.72	1.20	-53.53	-20.00	33.53
1359.6375	V	61.22	-52.86	8.72	1.20	-45.34	-20.00	25.34
1812.8500	H	53.45	-60.73	11.19	0.72	-50.26	-20.00	30.26
1812.8500	V	61.32	-53.42	11.19	0.72	-42.95	-20.00	22.95
2266.0625	H	60.41	-51.86	11.06	1.20	-42.00	-20.00	22.00
2266.0625	V	55.78	-56.39	11.06	1.20	-46.53	-20.00	26.53
2719.2750	H	56.98	-55.30	13.10	1.27	-43.47	-20.00	23.47
2719.2750	V	55.74	-56.66	13.10	1.27	-44.83	-20.00	24.83
3172.4875	H	55.39	-54.70	13.49	1.64	-42.85	-20.00	22.85
3172.4875	V	58.96	-51.18	13.49	1.64	-39.33	-20.00	19.33
3625.7000	H	53.77	-56.15	14.07	1.58	-43.66	-20.00	23.66
3625.7000	V	52.33	-57.58	14.07	1.58	-45.09	-20.00	25.09
4078.9125	H	50.36	-58.63	13.76	1.36	-46.23	-20.00	26.23
4078.9125	V	52.45	-56.66	13.76	1.36	-44.26	-20.00	24.26
4532.1250	H	53.45	-55.20	14.13	1.64	-42.71	-20.00	22.71
4532.1250	V	53.66	-54.92	14.13	1.64	-42.43	-20.00	22.43
4FSK, Frequency: 450.03125MHz-12.5 kHz, High Power								
900.0625	H	34.52	-61.08	0.00	0.51	-61.59	-20.00	41.59
900.0625	V	37.56	-54.66	0.00	0.51	-55.17	-20.00	35.17
1359.6375	H	50.12	-63.24	8.72	1.20	-55.72	-20.00	35.72
1359.6375	V	59.35	-54.73	8.72	1.20	-47.21	-20.00	27.21
1812.8500	H	51.47	-62.71	11.19	0.72	-52.24	-20.00	32.24
1812.8500	V	58.66	-56.08	11.19	0.72	-45.61	-20.00	25.61
2266.0625	H	58.36	-53.91	11.06	1.20	-44.05	-20.00	24.05
2266.0625	V	55.47	-56.70	11.06	1.20	-46.84	-20.00	26.84
2719.2750	H	54.98	-57.30	13.10	1.27	-45.47	-20.00	25.47
2719.2750	V	53.41	-58.99	13.10	1.27	-47.16	-20.00	27.16
3172.4875	H	55.98	-54.11	13.49	1.64	-42.26	-20.00	22.26
3172.4875	V	56.21	-53.93	13.49	1.64	-42.08	-20.00	22.08
3625.7000	H	52.47	-57.45	14.07	1.58	-44.96	-20.00	24.96
3625.7000	V	50.11	-59.80	14.07	1.58	-47.31	-20.00	27.31
4078.9125	H	57.36	-51.63	13.76	1.36	-39.23	-20.00	19.23
4078.9125	V	48.45	-60.66	13.76	1.36	-48.26	-20.00	28.26
4532.1250	H	50.33	-58.32	14.13	1.64	-45.83	-20.00	25.83
4532.1250	V	48.15	-60.43	14.13	1.64	-47.94	-20.00	27.94

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: 450.03125MHz-25 kHz, High Power								
900.0625	H	47.85	-47.75	0.00	0.51	-48.26	-13.00	35.26
900.0625	V	54.63	-37.59	0.00	0.51	-38.10	-13.00	25.1
1362.0375	H	52.14	-61.21	8.73	1.20	-53.68	-13.00	40.68
1362.0375	V	61.36	-52.71	8.73	1.20	-45.18	-13.00	32.18
1816.0500	H	53.41	-60.72	11.21	0.73	-50.24	-13.00	37.24
1816.0500	V	60.22	-54.46	11.21	0.73	-43.98	-13.00	30.98
2270.0625	H	60.34	-51.92	11.08	1.20	-42.04	-13.00	29.04
2270.0625	V	55.98	-56.18	11.08	1.20	-46.30	-13.00	33.3
2724.0750	H	56.12	-56.16	13.10	1.28	-44.34	-13.00	31.34
2724.0750	V	53.12	-59.28	13.10	1.28	-47.46	-13.00	34.46
3178.0875	H	55.32	-54.70	13.51	1.63	-42.82	-13.00	29.82
3178.0875	V	56.41	-53.66	13.51	1.63	-41.78	-13.00	28.78
3632.1000	H	53.12	-56.73	14.07	1.61	-44.27	-13.00	31.27
3632.1000	V	49.12	-60.72	14.07	1.61	-48.26	-13.00	35.26
4086.1125	H	47.12	-61.91	13.74	1.36	-49.53	-13.00	36.53
4086.1125	V	48.32	-60.84	13.74	1.36	-48.46	-13.00	35.46
4540.1250	H	48.33	-60.29	14.14	1.66	-47.81	-13.00	34.81
4540.1250	V	47.32	-61.25	14.14	1.66	-48.77	-13.00	35.77

Note:

Absolute Level = SG Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

FCC §2.1055 & § 22.355 & §74.464 & §90.213- FREQUENCY STABILITY**Applicable Standard**

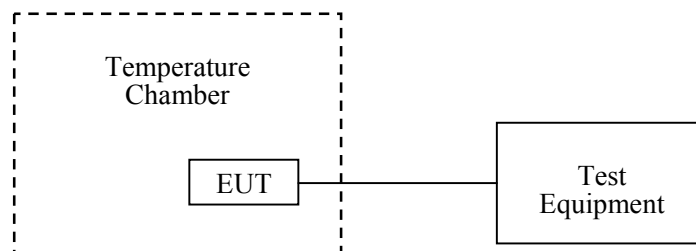
FCC §2.1055, § 22.355, §74.464, §90.213

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 communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The 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 communication test set.

Frequency Stability vs. Voltage: An external variable DC power supply was connected to the battery terminals of the equipment under test. The voltage was set from 85% to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the battery end point. The output frequency was recorded for each battery voltage.

**Test Data****Environmental Conditions**

Temperature:	24.5°C
Relative Humidity:	67 %
ATM Pressure:	100.4 kPa
Tester:	Blake Yang
Test Date:	2019-07-25

Test Mode: Transmitting(the worst is high power level)

FCC Part 90:

FM, 12.5kHz, Reference Frequency: 453.2125 MHz, Limit: ± 2.5 ppm			
Temperature (°C)	Voltage Supplied (V _{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	7.4	453.212477	-0.05
-20	7.4	453.212457	-0.09
-10	7.4	453.212620	0.26
0	7.4	453.212999	1.10
10	7.4	453.212399	-0.22
20	7.4	453.212306	-0.43
30	7.4	453.212899	0.88
40	7.4	453.213222	1.59
50	7.4	453.213195	1.53
20	6.3	453.212103	-0.88
20	8.4	453.212951	1.00

4FSK, 12.5kHz, Reference Frequency: 453.21255 MHz, Limit: ± 2.5 ppm			
Temperature (°C)	Voltage Supplied (V _{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	7.4	453.212273	-0.50
-20	7.4	453.212581	0.18
-10	7.4	453.212538	0.08
0	7.4	453.212368	-0.29
10	7.4	453.212981	1.06
20	7.4	453.212281	-0.48
30	7.4	453.213116	1.36
40	7.4	453.213119	1.37
50	7.4	453.212353	-0.32
20	6.3	453.213223	1.60
20	8.4	453.212768	0.59

FCC Part 22:

FM, 12.5kHz, Reference Frequency: 454.0125 MHz, Limit: ± 5 ppm			
Temperature (°C)	Voltage Supplied (V _{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	7.4	454.012055	-0.980
-20	7.4	454.012062	-0.960
-10	7.4	454.012604	0.230
0	7.4	454.012964	1.020
10	7.4	454.012302	-0.440
20	7.4	454.012784	0.630
30	7.4	454.012988	1.070
40	7.4	454.012962	1.020
50	7.4	454.012541	0.090
20	6.3	454.012668	0.370
20	8.4	454.012336	-0.360

4FSK, 12.5kHz, Reference Frequency: 454.0125 MHz, Limit: ± 5 ppm			
Temperature (°C)	Voltage Supplied (V _{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	7.4	454.011894	-1.33
-20	7.4	454.011934	-1.25
-10	7.4	454.012633	0.29
0	7.4	454.012469	-0.07
10	7.4	454.012195	-0.67
20	7.4	454.012779	0.61
30	7.4	454.012870	0.81
40	7.4	454.012533	0.07
50	7.4	454.012475	-0.06
20	6.3	454.012452	-0.11
20	8.4	454.011958	-1.19

FM, 25kHz, Reference Frequency: 454.0125 MHz, Limit: ± 5 ppm			
Temperature (°C)	Voltage Supplied (V _{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	7.4	454.012117	-0.84
-20	7.4	454.012717	0.48
-10	7.4	454.012731	0.51
0	7.4	454.012609	0.24
10	7.4	454.012102	-0.88
20	7.4	454.012857	0.79
30	7.4	454.012455	-0.10
40	7.4	454.012903	0.89
50	7.4	454.012298	-0.44
20	6.3	454.012411	-0.20
20	8.4	454.012451	-0.11

FCC Part 74:

FM, 12.5kHz, Reference Frequency: 450.03125 MHz, Limit: ± 5 ppm			
Temperature (°C)	Voltage Supplied (V _{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	7.4	450.031388	0.31
-20	7.4	450.031346	0.21
-10	7.4	450.031906	1.46
0	7.4	450.030856	-0.88
10	7.4	450.031088	-0.36
20	7.4	450.031478	0.51
30	7.4	450.031450	0.44
40	7.4	450.031965	1.59
50	7.4	450.031458	0.46
20	6.3	450.031166	-0.19
20	8.4	450.031502	0.56

4FSK, 12.5kHz, Reference Frequency: 450.0312 MHz, Limit: ± 5 ppm			
Temperature (°C)	Voltage Supplied (V _{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	7.4	450.031666	0.92
-20	7.4	450.031591	0.76
-10	7.4	450.030603	-1.44
0	7.4	450.031650	0.89
10	7.4	450.031030	-0.49
20	7.4	450.031540	0.64
30	7.4	450.031593	0.76
40	7.4	450.031749	1.11
50	7.4	450.031851	1.34
20	6.3	450.031119	-0.29
20	8.4	450.031593	0.76

FM, 25kHz, Reference Frequency: 450.0312 MHz, Limit: ± 5 ppm			
Temperature (°C)	Voltage Supplied (V _{DC})	Measured Frequency (MHz)	Frequency Error (ppm)
-30	7.4	450.031184	-0.15
-20	7.4	450.030656	-1.32
-10	7.4	450.031423	0.38
0	7.4	450.030994	-0.57
10	7.4	450.030689	-1.25
20	7.4	450.031290	0.09
30	7.4	450.031208	-0.09
40	7.4	450.031178	-0.16
50	7.4	450.031183	-0.15
20	6.3	450.031480	0.51
20	8.4	450.031285	0.08

FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

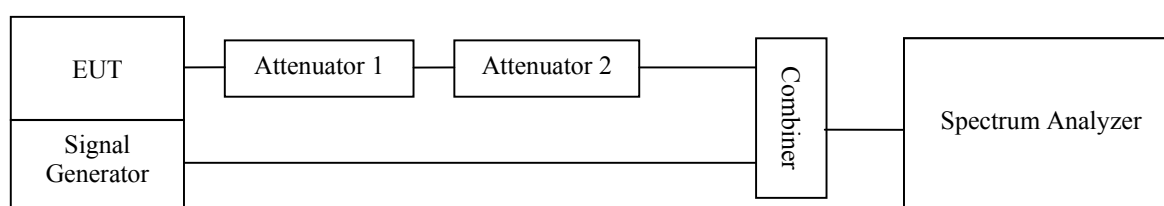
Applicable Standard

Regulations: FCC §90.214

Test method: ANSI/TIA-603-D 2010, section 2.2.19.3

Test Procedure

- Connect the EUT and test equipment as shown on the following block diagram.
- Set the Spectrum Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.
- 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.
- Turn on the transmitter.
- 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 .
- Turn off the transmitter.
- 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.
- Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.
- 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.
- 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 .
- 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**

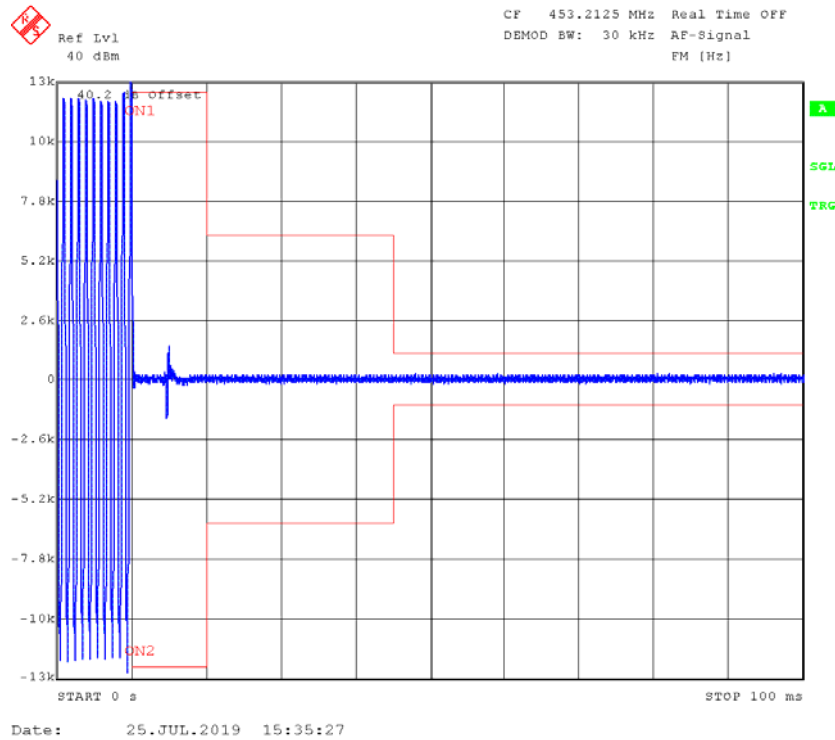
Temperature:	24.5°C
Relative Humidity:	67 %
ATM Pressure:	100.4 kPa
Tester:	Blake Yang
Test Date:	2019-07-25

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	

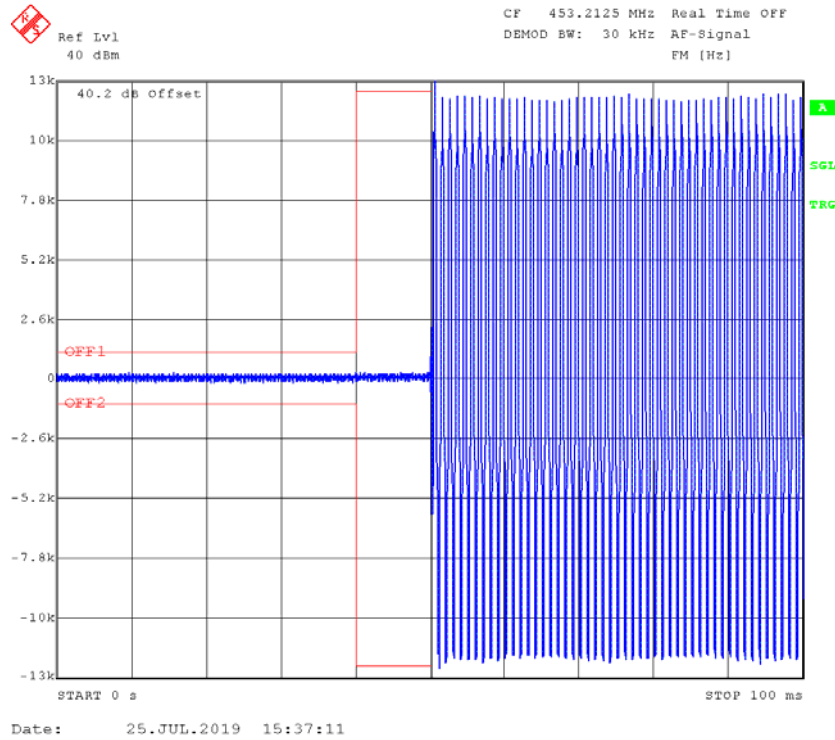
Please refer to the following plots.

High Power Channel: 453.2125 MHz

Turn on



Turn off



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