MOTOROLA SOLUTIONS

CERTIFICATE 2518.08

SAMM 825

MOTOROLA PENANG ADV. COMM. LABORATORY
Motorola Solutions Malaysia SDN BHD
Plot 2A, Medan Bayan Lepas,
Mukim 12 S.W.D., 11900 Bayan Lepas,
Penang, Malaysia.

FCC / IC TEST REPORT
Report Revision : Rev.A

Date/s Tested	:	11-December-2024 - 27-January-2025
Report Issue Date	:	07-February-2025
Manufacturer/Location	:	Motorola Solutions Malaysia SDN BHD Plot 2A, Medan Bayan Lepas, Mukim 12 S.W.D., 11900 Bayan Lepas, Penang, Malaysia
Requestor	:	WONG CHEW LOOI
Product Type	:	Portable
Product Marketing Name (PMN)	:	RMM2050
Hardware Version Identification Number (HVIN)	:	RMM2050BHLAA
Frequency Band	:	151.82-154.6 MHz
Max. Output Power	:	2W
Firmware Version Identification Number (FVIN)	:	R02.02
Applicant Name		Motorola Solutions Inc
Applicant Address	:	Plot 2A, Medan Bayan Lepas, Mukim 12 S.W.D., 11900 Bayan Lepas, Penang, Malaysia
FCC Registration	:	461337
IC Registrations	:	MY0001

The equipment was tested accordance to the requirement listed below:

(MURS) **FCC 47 CFR Part 2/95 J**	**PASS**

Prepared By:

Farah Nur Arina
Test Personnel

Approved Signatory :

Maheshvaran A/L Rajagopal
Responsible Engineer

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Revision History	Description	Date	Originator
Rev. A	Initial Report	**07-Feb-2025**	**Farah**

1.0. General Information

EUT Description:

Tx Frequency range	
151.8200MHz to 154.6000MHz	
Antenna type gain	FIXED HELIX, 3dBi
Technologies	LMR
Device voltage	4.0VDC

The EUT contains following accessory devices and data cable:

Item	**Model or P/N**
M/RVA/XT HC BATT LIION-3000 KIT	PMNN4453AR

MURS channel list:

In **§ 95.2763** MURS channels: Five VHF channels are allotted for shared use in the MURS. These channels, designated by their center frequencies in megahertz, are as follows: 151.820, 151.880, 151.940, 154.570, and 154.600 MHz. Each MURS transmitter type must be designed to transmit on one or more of these channels.

General Description of Applied Standards
The EUT is a RF Product. According to the specifications of the manufacturer, the EUT is to comply with the requirements of the following standards:

ANSI C63.26
FCC Part 2 & 95 J

Deviation from standard
Not applicable as no deviation from standard test method

Modifications to EUT
For RF conducted measurements a pigtail was soldered out of the board while for radiated measurements there were no modifications to the device

Antenna gain disclaimer
Antenna gain information is provided by customer. The validity of the results is dependent upon this information. The lab will not be held accountable in the event the supplied information affects compliance.

Test configuration of EUT
All relevant configurations involving radio models and accessories (including chargers, batteries, and antennas) were assessed. Only worst case configurations will be included in this report.

2.0. Summary of Test Results

FCC Clause	Test Item	Result	Remark	Tested by	Serial number	Environmental conditions
Part 95.2767	Maximum Output Power	Pass	NA	Farah	0245AX4528	25°C 50%RH
Part 2.1047(b)	Modulation Limiting	Pass	NA	Farah	0245AX4527	25°C 50%RH
Part 2.1047(a)	Audio Frequency Response	Pass	NA	Farah	0245AX4527	25°C 50%RH
Part 2.1047(a) Part 95.2775	Audio Low Pass Filter	Pass	NA	Farah	0245AX4527	25°C 50%RH
Part 2.1055 Part 95.2765(b)	Frequency Stability	Pass	NA	Farah	0245AX4527	25°C 50%RH
Part 95.2779	Emission Bandwidth	Pass	NA	Farah	0245AX4527	25°C 50%RH
Part 95.2773 Part 2.1049	Occupied Bandwidth	Pass	11K0F3E, 16K0F3E	Farah	0245AX4527	25°C 50%RH
Part 95.2779(b)	Unwanted Radiation	Pass	Worst Case: -43.03dBm (margin: 23.03dB)	Rezza & Fuad	0245AX4513	24.6°C 69.7%RH

3.0. Measurement Uncertainty

Measurement	**Frequency**	**Expended Uncertainty (k=1.96) (±dB)**
Maximum Output Power	462MHz ~ 468MHz	5.01
AC Power Line Conducted Spurious Emission	150KHz ~ 30MHz	3.48
Radiated Emissions up to 1 GHz	30MHz ~ 1000MHz	5.88
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.84
	18GHz ~ 40GHz	6.02
Frequency Stability	9kHz ~ 12.75GHz	0.0085 ppm
Audio Frequency Response / Low Pass Filter Response	300Hz – 20kHz	4.09 %
Modulation Limiting	300Hz – 3kHz	1.15 %
Occupied Bandwidth	9kHz ~ 12.75GHz	2.82 dB

3.0. Equipment List

FCC Analog ATE #1

Description	Model	Serial Number	Calibration Date	Calibration Due Date
CHAMBER	SH-641	92009188	04-Mar-24	04-Mar-25
POWER SUPPLY (0-20V / 0-120A, 1000W)	6031A	2729A00711	08-Jun-24	08-Jun-25
POWER SENSOR	E4412A	MY50000141	16-Aug-24	16-Aug-25
POWER METER	E4416A	MY45101448	23-Aug-24	23-Aug-25
CXA SIGNAL ANALYZER	N9000B	MY60250581	08-Jun-24	08-Jun-25
AUDIO ANALYZER	U8903B	MY61070007	17-Aug-24	17-Aug-25
N to N RF cable # 1	SUCOFLEX 104	NA	NA	NA
N to N RF cable # 2	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 3	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 4	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 5	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 6	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 7	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 8	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 9	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 10	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 11	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 12	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 13	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 14	84188418 H+S MY 0812	NA	NA	NA
N to N RF cable # 15	84188418 H+S MY 0812	NA	NA	NA
BNC to BNC RF cable # 1	NA	NA	NA	NA
BNC to BNC RF cable # 2	NA	NA	NA	NA
BNC to BNC RF cable # 3	NA	NA	NA	NA
BNC to BNC RF cable # 4	NA	NA	NA	NA
BNC to BNC RF cable # 5	NA	NA	NA	NA
BNC to BNC RF cable # 6	NA	NA	NA	NA
BNC to BNC RF cable # 7	NA	NA	NA	NA
BNC to BNC RF cable # 8	NA	NA	NA	NA
Test Software	FCC Analog ATE			
Version	2.5.0			

FCC Transient ATE #1: (SW version: FCC Transient ATE_R1.2.1)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
SWITCH CONTROL UNIT	3488A	2719A36210	Not Required	Not Required
ATTENUATOR / SWITCH DRIVER	11713A	3748A09090	Not Required	Not Required
POWER METER	E4416A	MY45101448	23-Aug-24	23-Aug-25
AUDIO ANALYZER	8903B	2836A05866	09-Feb-24	09-Feb-25
POWER SENSOR	E9301B	MY50180003	19-Jul-24	19-Jul-25
SPECTRUM ANALYZER	E4445A	MY46181513	04-Jul-24	04-Jul-25
ATTENUATOR/11DB	8494G	MY52300223	15-Aug-24	15-Aug-25
ATTENUATOR/110DB	8496G	MY52300088	15-Aug-24	15-Aug-25
MODULATION ANALYZER	8901B	3403A04772	18-Sep-24	18-Sep-25
POWER SUPPLY	6031A	3506A03271	26-Sep-24	26-Sep-25
SIGNAL GENERATOR	8657A	3250A05137	16-Aug-24	16-Aug-25
CXA SIGNAL ANALYZER	N9000B	MY60250716	03-Dec-24	03-Dec-25
AUDIO ANALYZER	8903B	3729A17612	14-Feb-24	14-Feb-25
N to N RF Cable # 1	SF126/11N/11N	NA	NA	NA
N to N RF Cable # 2	M17/128-RG400	NA	NA	NA
N to N RF Cable # 3	M17/128-RG400	NA	NA	NA
N to N RF Cable # 4	M17/128-RG400	NA	NA	NA
N to N RF Cable # 5	M17/128-RG400	NA	NA	NA
N to N RF Cable # 6	M17/128-RG400	NA	NA	NA
N to N RF Cable # 7	M17/128-RG400	NA	NA	NA
N to N RF Cable # 8	M17/128-RG400	NA	NA	NA
BNC to BNC RF Cable # 1	RG 58	NA	NA	NA
BNC to BNC RF Cable # 2	RG 58	NA	NA	NA
BNC to BNC RF Cable # 3	RG 58	NA	NA	NA
BNC to BNC RF Cable # 4	RG 58	NA	NA	NA
BNC to BNC RF Cable # 5	RG 58	NA	NA	NA
BNC to BNC RF Cable # 6	RG 58	NA	NA	NA
BNC to N RF Cable # 1	RG 58	NA	NA	NA
Aeroflex Attenuator 10dB	49-10-43-LIM	NA	NA	NA
Aeroflex Attenuator 10dB	33-10-34-LIM	NA	NA	NA

EMC CHAMBER 1

DESCRIPTION	MODEL	SERIAL NUMBER	CALIBRATION DATE	CALIBRATION DUE DATE
DRG HORN FREQ.	SAS-571	1143	08-Mar-23	08-Mar-25
DRG HORN FREQ.	SAS-571	720	18-Apr-23	18-Apr-25
DC Power Supply	6623A	3302A02585	30-Jul-24	30-Jul-25
SIGNAL GENERATOR	SMB 100A	182511	04-Jun-21	04-Feb-25
EMI TEST RECEIVER	ESW44	101750	08-Aug-24	07-Aug-25
5m SEMI-ANECHOIC CHAMBER	S800-HX	J2308	Not Required	Not Required
BILOG ANTENNA	CBL6112B	2964	08-Oct-24	08-Oct-25
BILOG ANTENNA	CBL6112D	30991	05-Feb-24	05-Feb-25
DATA LOGGER THERMOHYGROMETER	SDL500	A.016800	26-Jun-24	26-Jun-25
SYSTEM CONTROLLER	SC104V	050806-1	Not Required	Not Required
TURNTABLE FLUSH MOUNT 2M	FM2011	FM2011-001	Not Required	Not Required
ANTENNA POSITIONING TOWER	TLT2	NA	Not Required	Not Required
BROAD-BAND HORN ANTENNA	BBHA9170	BBHA9170255	13-Mar-2024	13-Mar-2025
PREAMPLIFIER 18-40GHz	Miteq Hi Gain Sucoflex	002	Not Required	Not Required
PREAMPLIFIER	PAM-0118P	270	11-Jun-24	11-Jun-25
LOOP ANTENNA	6502	00203479	06-Mac-24	06-Mac-25
TEST SOFTWARE	EMC_FCC_IC_BLUETOOTH_RE_TEST			
VERSION	EMC_FCC_RE_v1.6.5			

4.0. Test Mode Applicability and Test Channel Detail

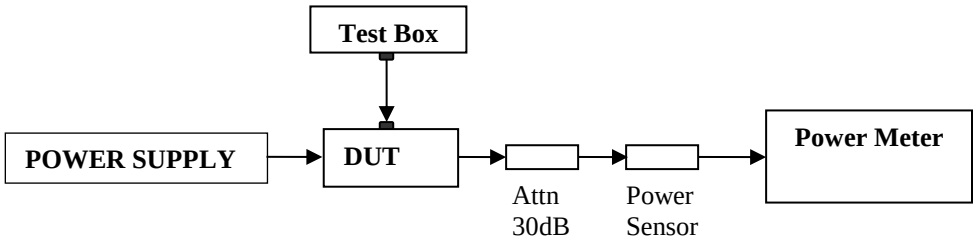
Test Frequency list:

Channel	Frequency	Channel Spacing
1	154.5700 MHz	25.0 kHz
2	154.6000 MHz	25.0 kHz
3	151.8200 MHz	12.5 kHz
4	151.8800 MHz	12.5 kHz
5	151.9400 MHz	12.5 kHz

5.0. Transmitter Test Parameters

5.1. Maximum Output Power

5.1.1. Test Setup



1) The DUT transmitter connected to Power Meter using the 30 dB attenuator and power sensor with above setup.
2) Path loss for the measurement included.
3) All the measurement was done at low, mid, high frequency for each band.
4) Record the power into the test report.

5.1.2. Test Limits

§95.2767 MURS transmitting power limit.

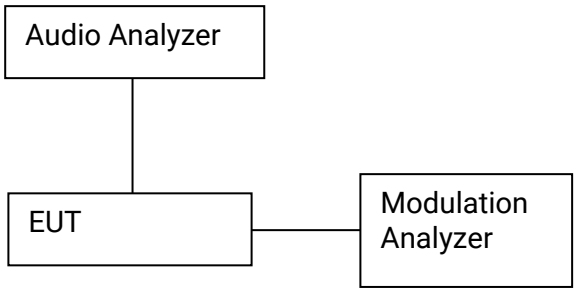
Each MURS transmitter type must be designed such that the transmitter power output does not exceed 2 Watts under normal operating conditions.

5.1.3. Test Data

Temperature	25˚C			
Voltage (V)	7.5V			
Frequency (MHz)	Low Power (W)	Current (A)	Max Power (W)	Current (A)
151.82000	0.95	1.08	1.92	1.56
151.88000	0.96	1.08	1.92	1.56
151.94000	0.95	1.08	1.92	1.56
154.57000	1.03	1.08	1.95	1.53
154.60000	1.04	1.08	1.96	1.53

5.2. Modulation Limiting

5.2.1. Test Setup



1) The DUT transmitter output port was connected to Modulation Analyzer.
2) Path loss for the measurement included.
3) Set the audio bandwidth filter to 15 kHz.
4) Transmit the radio and set the audio analyzer to 1 kHz audio frequency and 60% of the maximum deviation.
5) Record the frequency deviation as 0dB input level at 1kHz audio frequency.
6) Repeat the step and record the frequency deviation from -20dB to 20dB by 5dB increments and different audio freq 300Hz, 2.5 KHz and 3 KHz.

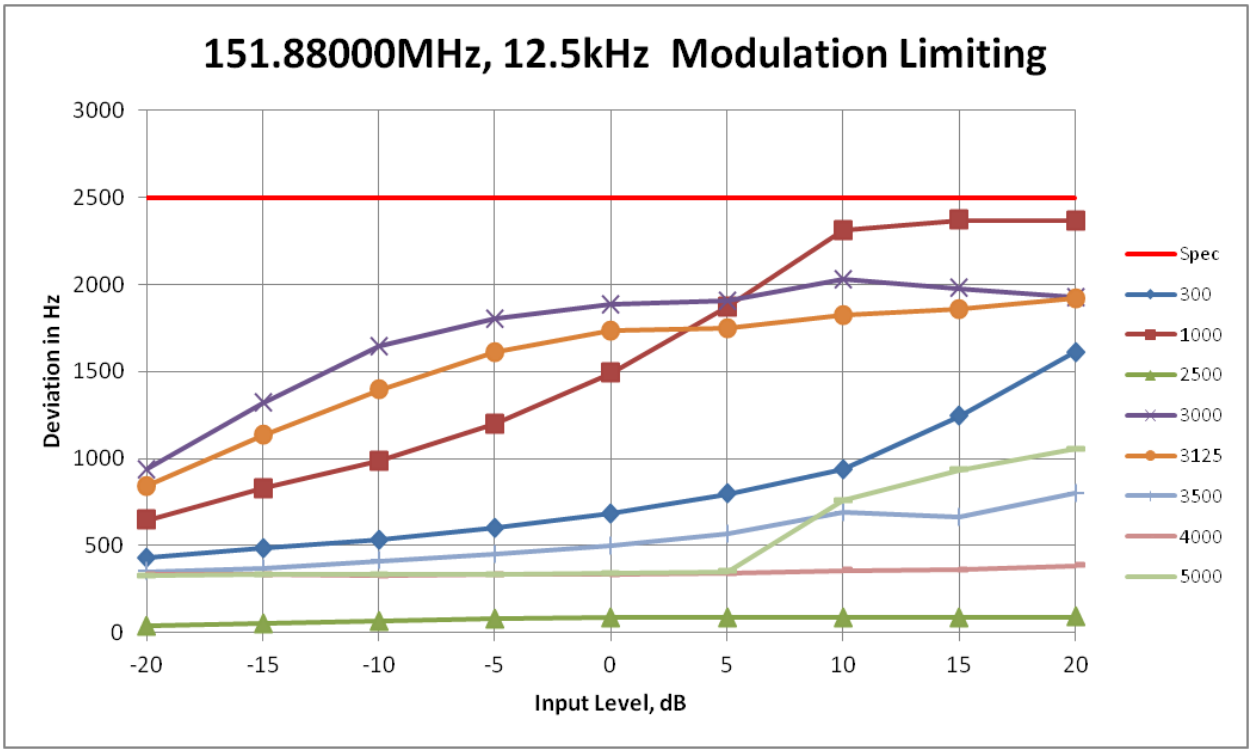
5.2.2. Test Limits

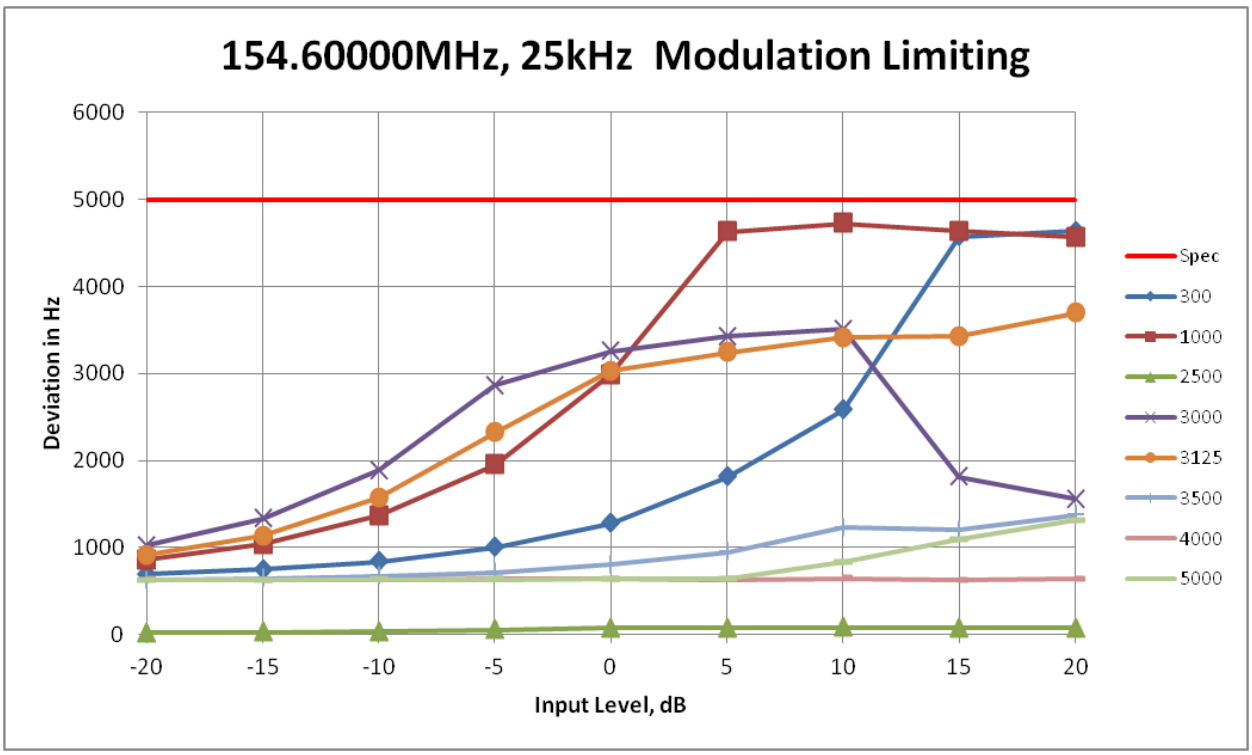
§ 2.1047 Measurements required: Modulation characteristics.

(b) Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

Note: Testing was done to the performance requirements of TIA-603-E. Compliance with this limit is not required by FCC Part 95 J.

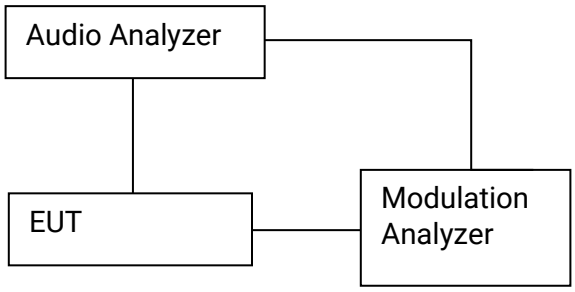
5.2.3. Test Result





5.3. Audio Frequency Response

5.3.1. Test Setup



1) The DUT transmitter output port was connected to Modulation Analyzer.
2) Path loss for the measurement included.
3) Set the audio bandwidth filter to 15 kHz and 50kHz.
4) Transmit the radio and set the audio analyzer to 1 kHz audio frequency and 20% of the maximum deviation.
5) On audio analyzer, set the rated level as reference to zero.
6) Vary the audio frequency from 300Hz to 3 kHz. Record the change in dB on the audio analyzer.

5.3.2. Test Limits:

§ 2.1047 Measurements required: Modulation characteristics.

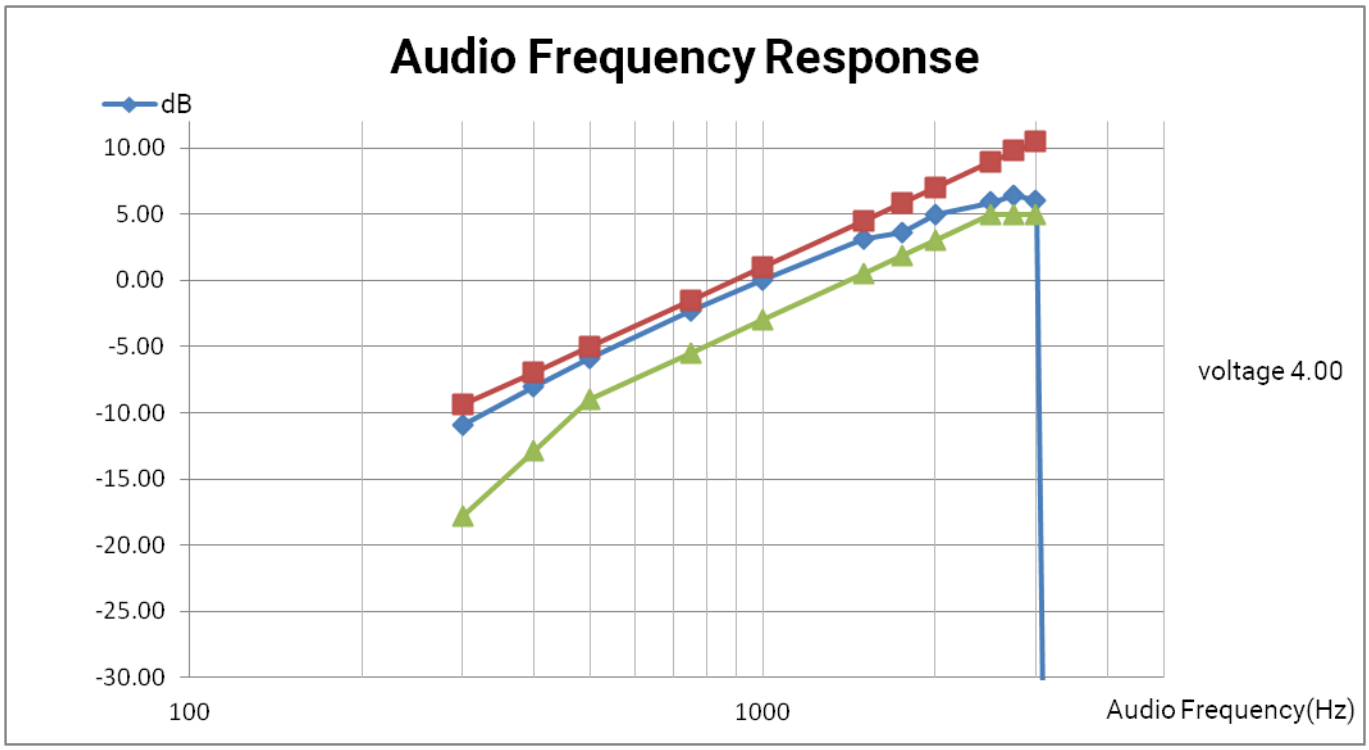
(a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of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

Note: Testing was done to the performance requirements of TIA-603-E. Compliance with this limit is not required by FCC Part 95 J.

5.3.3. Test Result

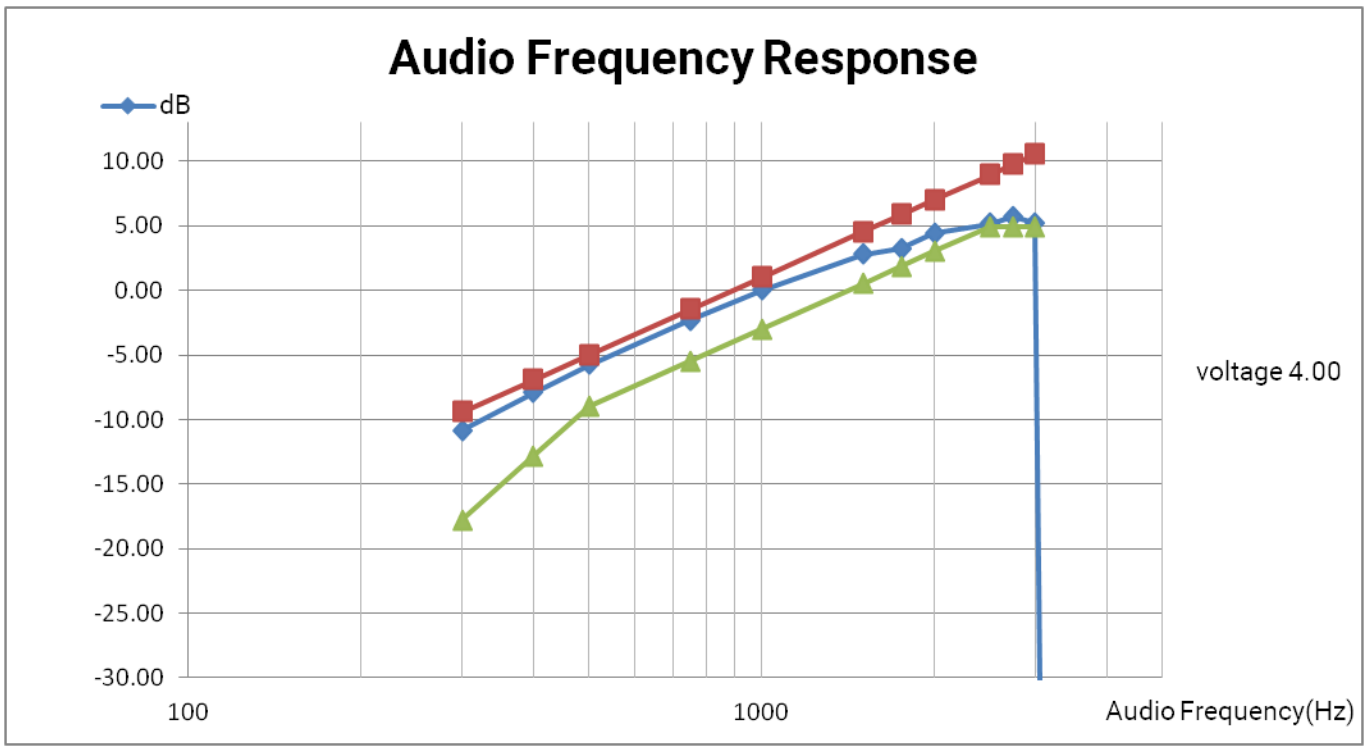
Frequency : 151.88 MHz 2.0W

voltage	4.00		
Temp. (°C)	25		
Audio Frequency(Hz)	dB	HighSide Specs	LowSide Specs
100			
200			
300	-10.95	-9.4218	-17.8436
400	-8.03	-6.9316	-12.8631
500	-5.89	-5.0000	-9.0000
750	-2.31	-1.4902	-5.4902
1000	0.04	1.0000	-3.0000
1500	3.09	4.5098	0.5098
1750	3.62	5.8441	1.8441
2000	4.93	7.0000	3.0000
2500	5.89	8.9316	4.9316
2750	6.42	9.7566	4.9316
3000	5.99	10.5098	4.9316
3125	-56.26		
3250			
3500			
4000			
5000			



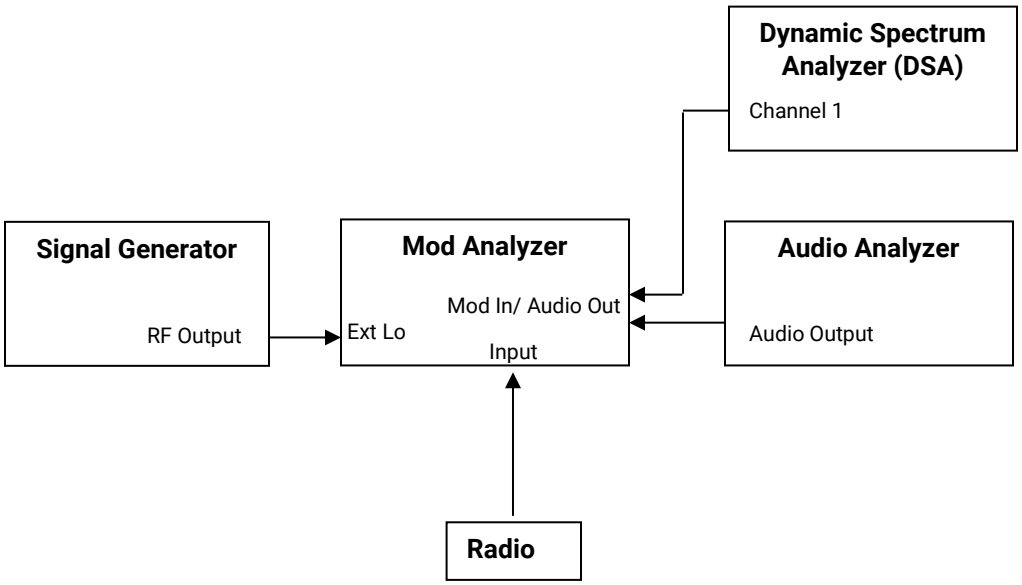
Frequency : 154.6 MHz 2.0W

voltage	4.00		
Temp. (°C)	25		
Audio Frequency(Hz)	dB	HighSide Specs	LowSide Specs
100			
200			
300	-10.86	-9.4218	-17.8436
400	-7.94	-6.9316	-12.8631
500	-5.77	-5.0000	-9.0000
750	-2.34	-1.4902	-5.4902
1000	-0.02	1.0000	-3.0000
1500	2.79	4.5098	0.5098
1750	3.24	5.8441	1.8441
2000	4.41	7.0000	3.0000
2500	5.15	8.9316	4.9316
2750	5.73	9.7566	4.9316
3000	5.21	10.5098	4.9316
3125	-66.67		
3250			
3500			
4000			
5000			



5.4. Audio Low Pass Filter

5.4.1. Test Setup



1) The DUT transmitter output port was connected to Modulation Analyzer.
2) Path loss for the measurement included.
3) Press 23.1SPCL on modulation analyzer to enable the external LO from SIgen.
4) Set the Sigen frequency to Fc + 1.5MHz, RF output level to 0dBm without modulation.
5) Transmit the radio and set the audio analyzer to 1 kHz audio frequency and 60% of the maximum deviation.
6) Up the amplitude by 20dB.
7) On DSA, get the reference point to 0dB.
8) Vary the frequency on audio analyzer from 3 kHz to 30 kHz, record the audio tone from DSA.

5.4.2. Test Limits:

§95.2775 MURS audio filter

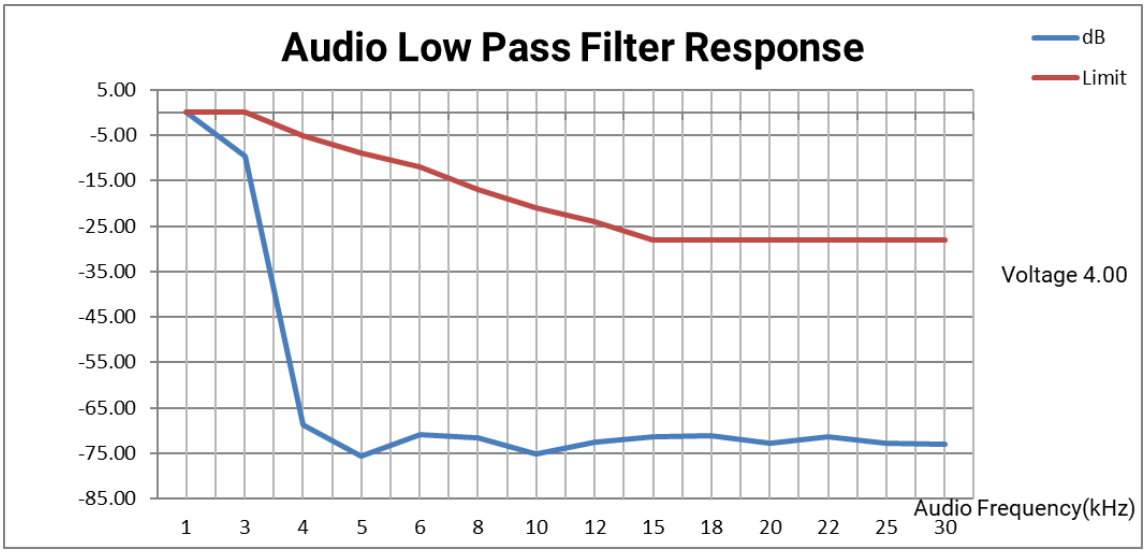
The audio filter referenced in § 95.2779 must satisfy the requirements in this section.

(a) The audio filter must be between the modulation limiter and the modulated stage of the transmitter.
(b) At any frequency (f in kHz) between 3 and 15 kHz, the filter must have an attenuation of at least 40 log (f/3) dB more than the attenuation at 1 kHz. Above 15 kHz, it must have an attenuation of at least 28 dB more than the attenuation at 1 kHz.

5.4.3. Test Result

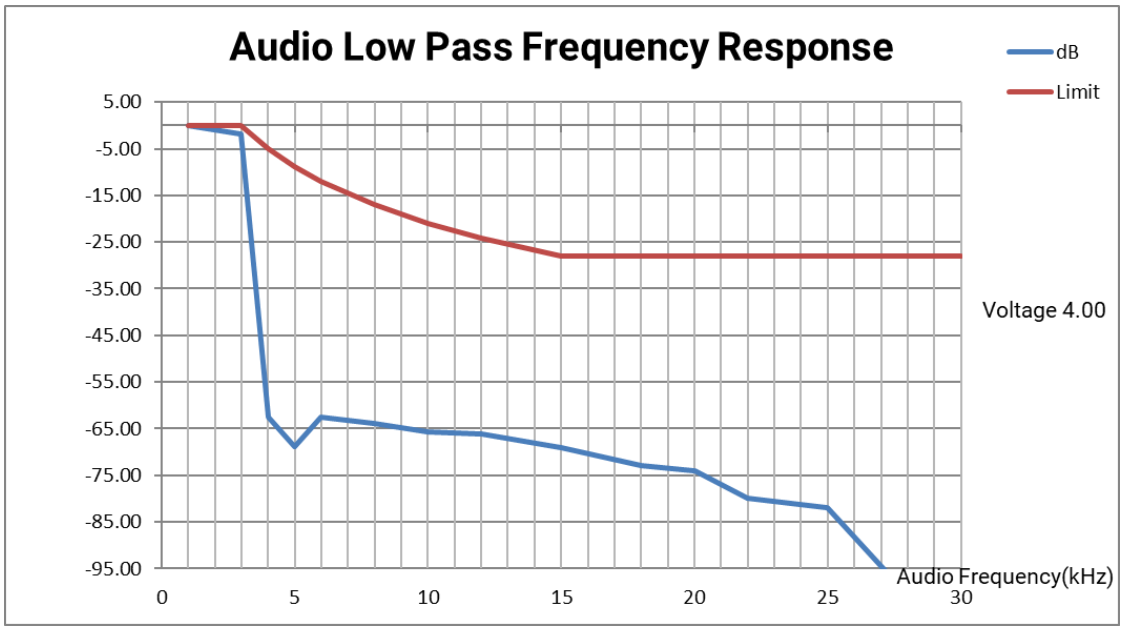
Frequency: 154.600MHz, 2W
Channel Spacing: 25.0kHz

Voltage	4.00	
Temp. (°C)	25	
Audio Frequency(kHz)	dB	Limit
1	0.02	0.00
3	-9.70	0.00
4	-68.80	-5.00
5	-75.61	-8.87
6	-71.00	-12.04
8	-71.68	-17.04
10	-75.19	-20.92
12	-72.46	-24.08
15	-71.33	-27.96
18	-71.11	-28.00
20	-72.80	-28.00
22	-71.28	-28.00
25	-72.87	-28.00
30	-73.00	-28.00



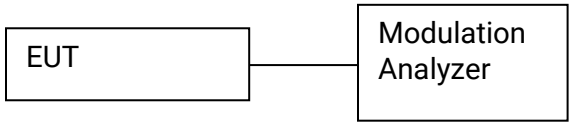
Frequency: 151.8800MHz, 2W
Channel Spacing: 12.5kHz

Voltage	4.00	
Temp. (°C)	25	
Audio Frequency(kHz)	dB	Limit
1	0.00	0.00
3	-1.90	0.00
4	-62.63	-5.00
5	-68.86	-8.87
6	-62.59	-12.04
8	-63.91	-17.04
10	-65.77	-20.92
12	-66.17	-24.08
15	-69.11	-27.96
18	-72.85	-28.00
20	-74.00	-28.00
22	-80.00	-28.00
25	-82.00	-28.00
30	-113.00	-28.00



5.5. Frequency Stability

5.5.1. Test Setup



1) The DUT transmitter output port was connected to Modulation Analyzer.
2) Transmit the DUT and record the freq in MCF_{MHz}.
3) Test in 2 conditions: Different Temperature & Supply Voltage input.
   - Temperature: Vary from -30°C to +50°C with Nominal supply voltage.
   - Supply Voltage: Vary +/-15 % in room temperature
4) Calculate the ppm frequency error by the following:

$$ppm\ error = \left(\frac{MCF_{MHz}}{ACF_{MHz}} - 1 \right) * 10^6$$

Where: *MCF*MHz is the Measured Carrier Frequency in MHz
*ACF*MHz is the Assigned Carrier Frequency in MHz

5.5.2. Test Limits:

§ 95.2765 MURS frequency accuracy

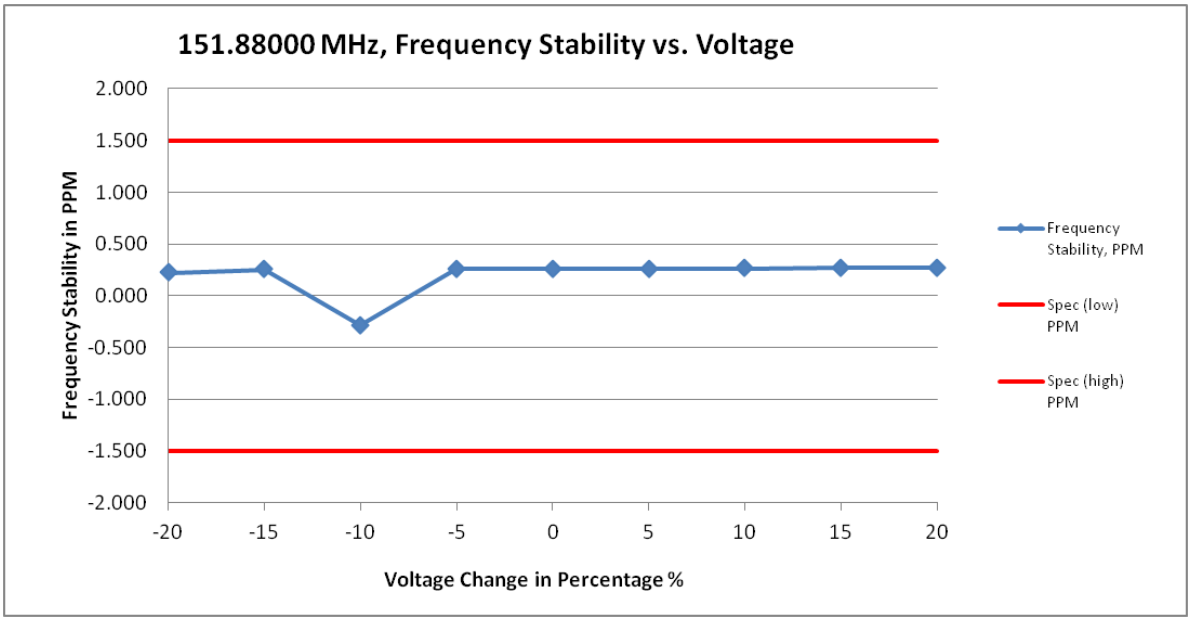
Each MURS transmitter type must be designed to meet the applicable frequency tolerance and stability requirements of this section.

(a) MURS transmitters that operate with an emission bandwidth of 6.25 kHz or less must be designed such that the carrier frequencies remain within ±2.0 parts-per-million (ppm) of the channel center frequencies specified in § 95.2763 during normal operating conditions.

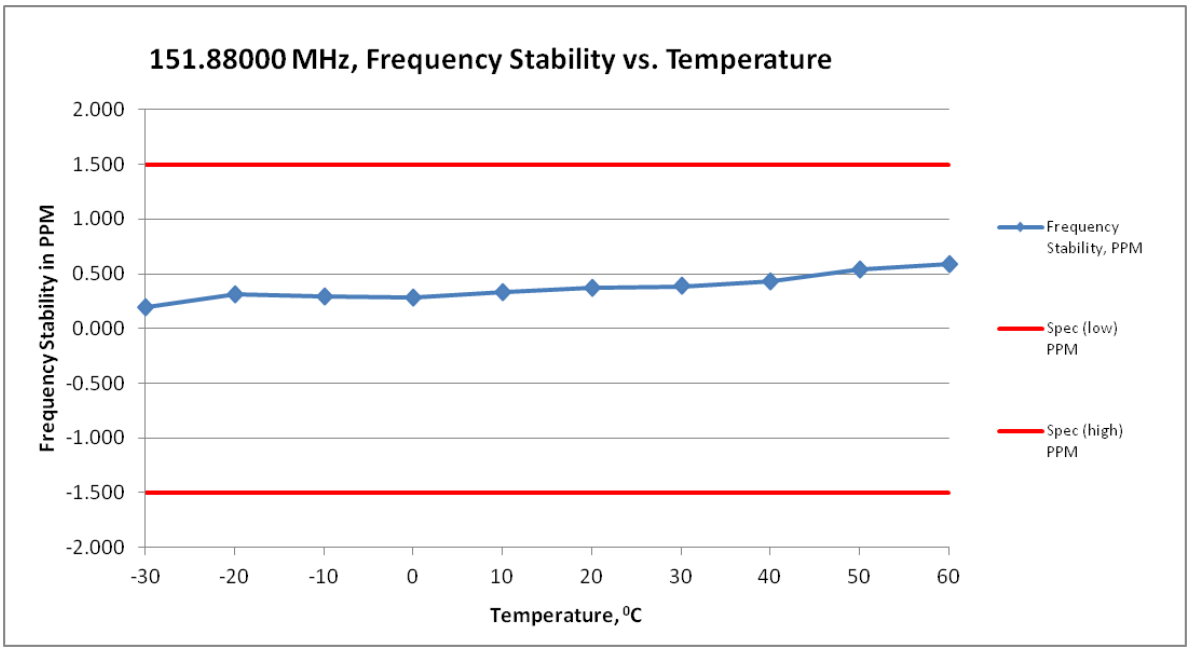
(b) MURS transmitters that operate with an emission bandwidth greater than 6.25 kHz must be designed such that the carrier frequencies remain within ±5.0 ppm of the channel center frequencies specified in § 95.2763 during normal operating conditions.

Note: The frequency stability limit is established as the most stringent value derived from the applicable regulatory requirements or the product-declared specifications.

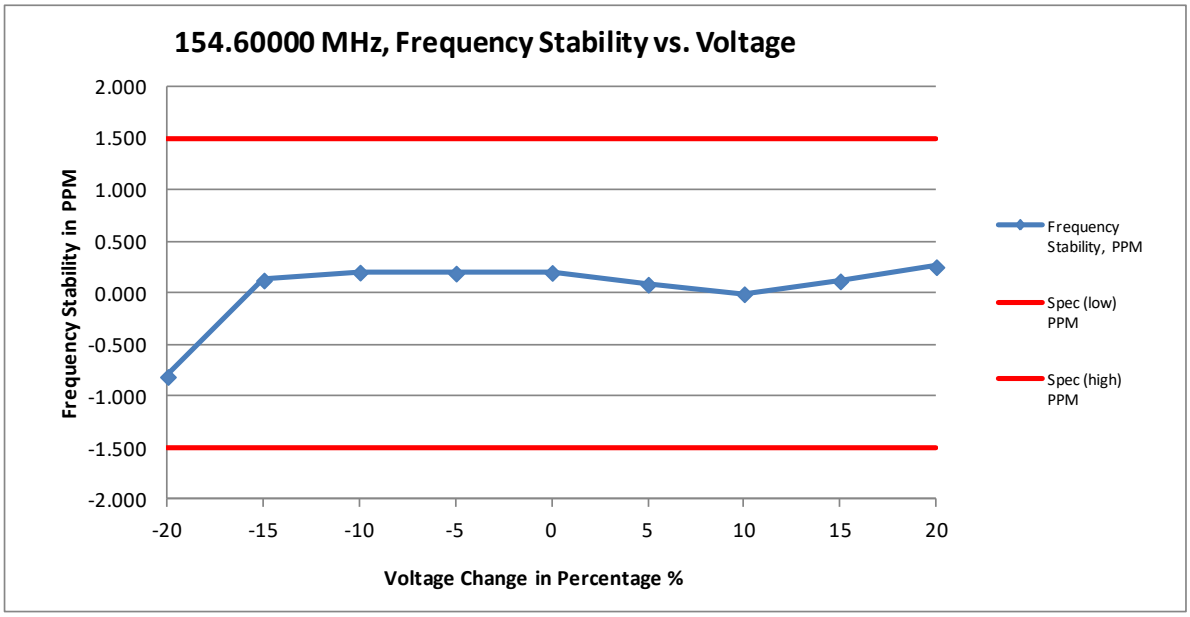
5.5.3. Test Result



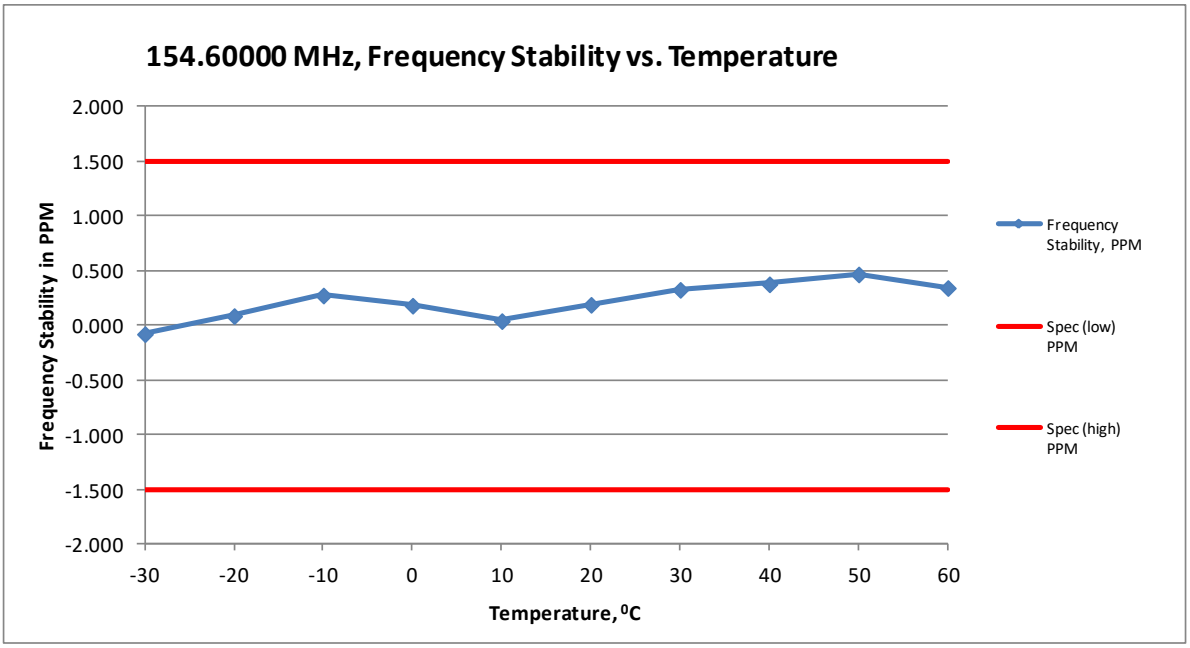
Frequency / Channel Spacing	151.88000 MHz / 12.50 kHz				
Temperature, ^{0}C	25				
Voltage %	Voltage, V	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-20	3.200	151.880034	0.221	-1.500	1.500
-15	3.400	151.880039	0.254	-1.500	1.500
-10	3.600	151.879957	-0.285	-1.500	1.500
-5	3.800	151.880039	0.257	-1.500	1.500
0	4.000	151.880039	0.255	-1.500	1.500
5	4.200	151.880039	0.259	-1.500	1.500
10	4.400	151.880040	0.263	-1.500	1.500
15	4.600	151.880041	0.267	-1.500	1.500
20	4.800	151.880041	0.270	-1.500	1.500



Frequency / Channel Spacing	151.88000 MHz / 12.50 kHz			
Voltage, V	4.0V			
Temperature, °C	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-30	151.880029	0.194	-1.500	1.500
-20	151.880048	0.316	-1.500	1.500
-10	151.880044	0.290	-1.500	1.500
0	151.880043	0.281	-1.500	1.500
10	151.880050	0.332	-1.500	1.500
20	151.880057	0.376	-1.500	1.500
30	151.880059	0.387	-1.500	1.500
40	151.880066	0.432	-1.500	1.500
50	151.880081	0.535	-1.500	1.500
60	151.880090	0.593	-1.500	1.500



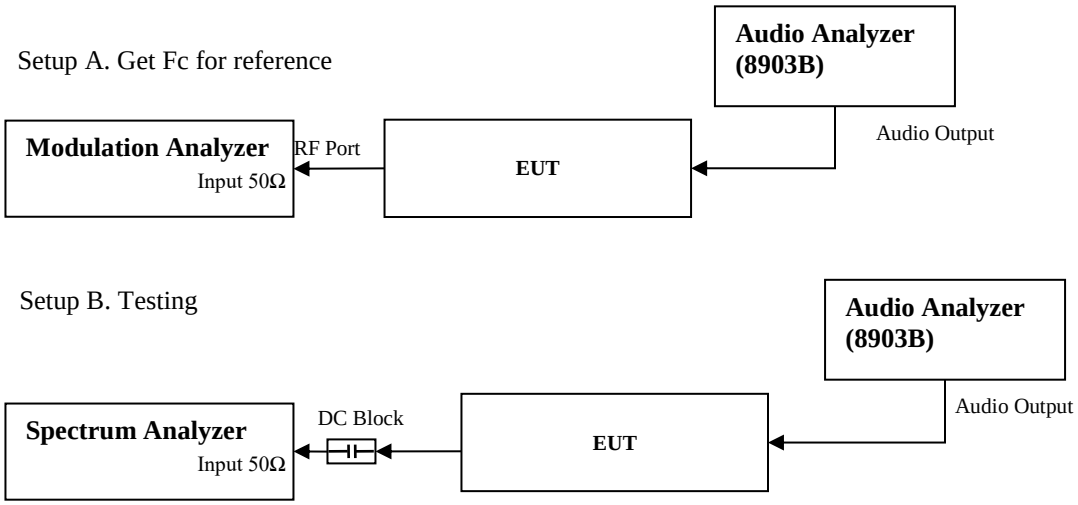
Frequency / Channel Spacing	154.60000 MHz / 25.00 kHz				
Temperature, ^{0}C	25				
Voltage %	Voltage, V	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-20	3.200	154.599875	-0.807	-1.500	1.500
-15	3.400	154.600020	0.128	-1.500	1.500
-10	3.600	154.600032	0.205	-1.500	1.500
-5	3.800	154.600030	0.196	-1.500	1.500
0	4.000	154.600031	0.202	-1.500	1.500
5	4.200	154.600014	0.088	-1.500	1.500
10	4.400	154.599999	-0.005	-1.500	1.500
15	4.600	154.600019	0.120	-1.500	1.500
20	4.800	154.600040	0.258	-1.500	1.500



Frequency / Channel Spacing	154.60000 MHz / 25.00 kHz			
Voltage, V	4.0V			
Temperature, ⁰C	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-30	154.599989	-0.072	-1.500	1.500
-20	154.600014	0.093	-1.500	1.500
-10	154.600043	0.281	-1.500	1.500
0	154.600029	0.188	-1.500	1.500
10	154.600007	0.047	-1.500	1.500
20	154.600030	0.196	-1.500	1.500
30	154.600051	0.333	-1.500	1.500
40	154.600059	0.383	-1.500	1.500
50	154.600073	0.473	-1.500	1.500
60	154.600054	0.349	-1.500	1.500

5.6. Occupied Bandwidth

5.6.1. Test Setup



1) The DUT transmitter output port was connected to Modulation Analyzer.
2) Path loss for the measurement included.
3) Key in the Fc to assigned center frequency with the span 100 kHz.
4) Set the spectrum analyzer with RBW= 300Hz and VBW= 900Hz.
5) Transmit the UUT and record the result.
6) Set modulation analyzer audio bandwidth filter to 15 kHz low pass filter and 50 kHz high pass filter.
7) Transmit the radio and set the audio analyzer to 2.5 kHz audio frequency and 60% of the maximum deviation.
8) Up the amplitude by 16dB and remove the audio tone from audio analyzer.
9) Capture the screen shot with and without modulation.

5.6.2. Test Limits:

§ 95.2773 MURS authorized bandwidths.

Each MURS transmitter type must be designed to meet the emission bandwidth limitations in this section.

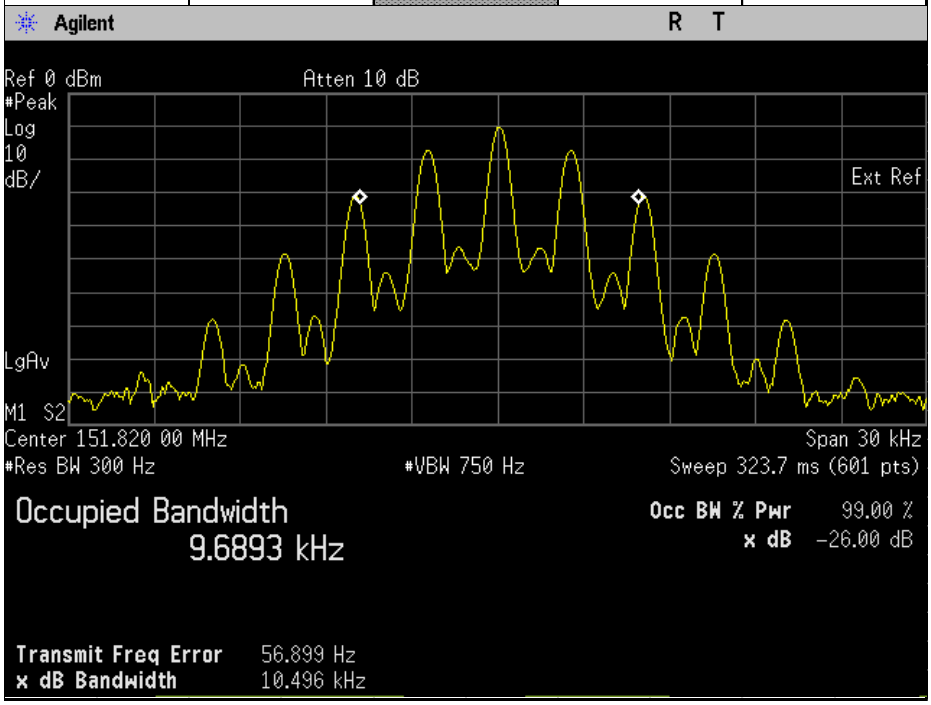
(a) The occupied bandwidth of emissions transmitted on the center frequencies 151.820 MHz, 151.880 MHz, and 151.940 MHz must not exceed 11.25 kHz.
(b) The occupied bandwidth of emissions transmitted on the center frequencies 154.570 MHz and 154.600 MHz must not exceed 20.0 kHz.
(c) The occupied bandwidth of type A3E emissions must not exceed 8.0 kHz.

§ 2.1049 Measurements required: Occupied bandwidth

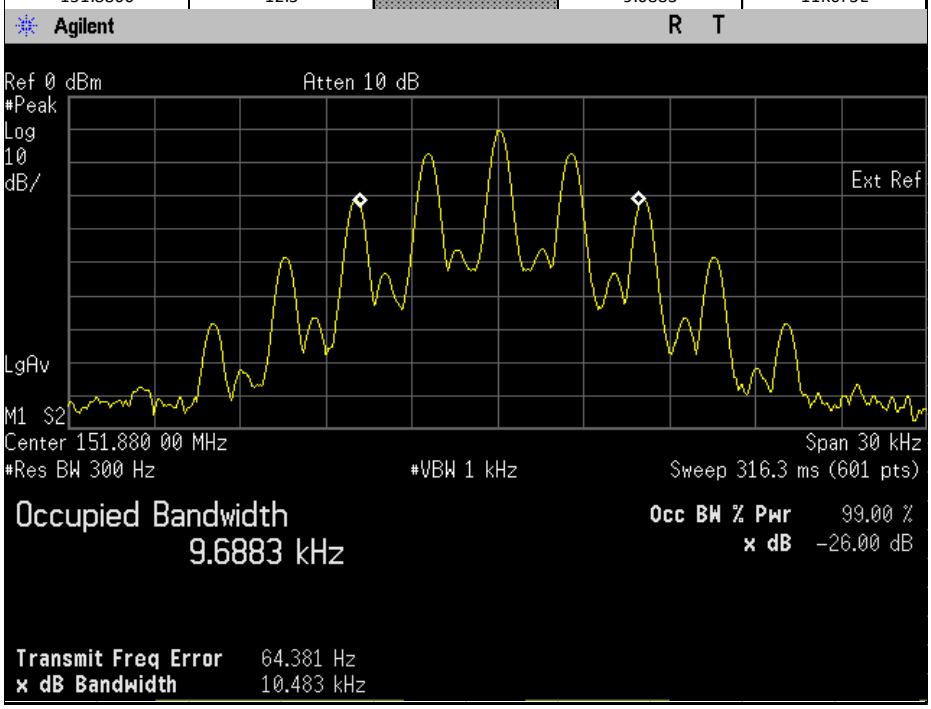
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

5.6.3. Test Data

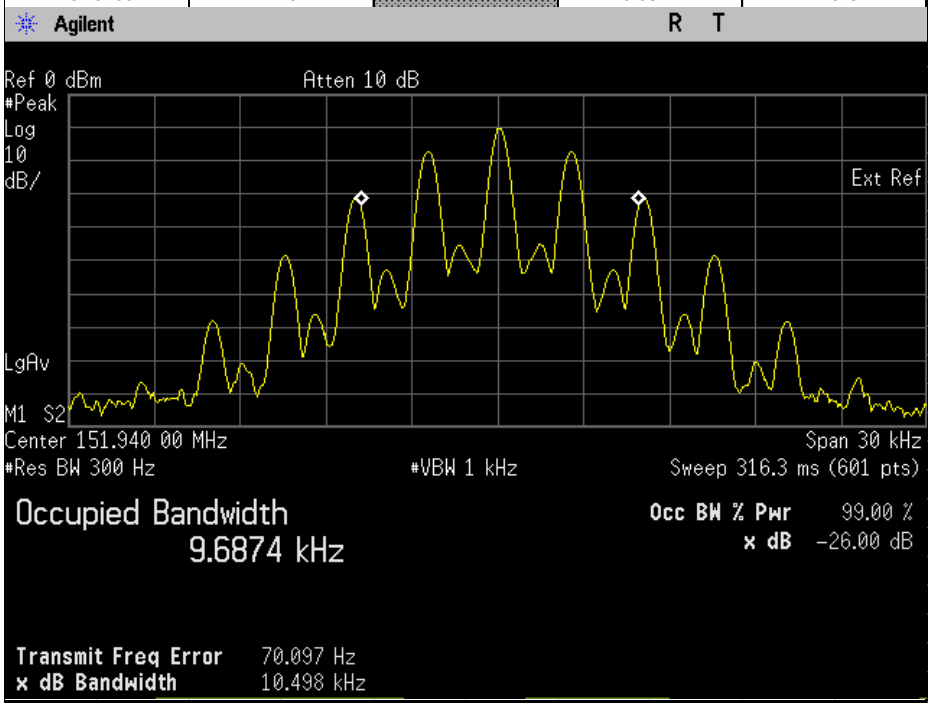
Modulation			Rules Part	
Analog			95.2773 (a)	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
151.8200	12.5		9.6893	11K0F3E



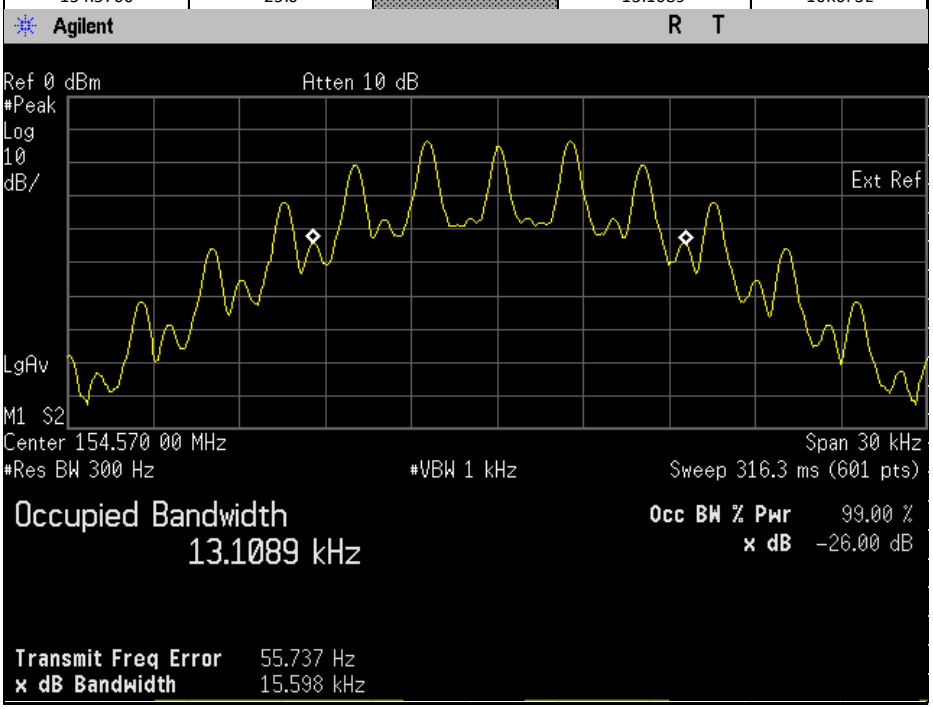
Modulation			Rules Part	
Analog			95.2773 (a)	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
151.8800	12.5		9.6883	11K0F3E



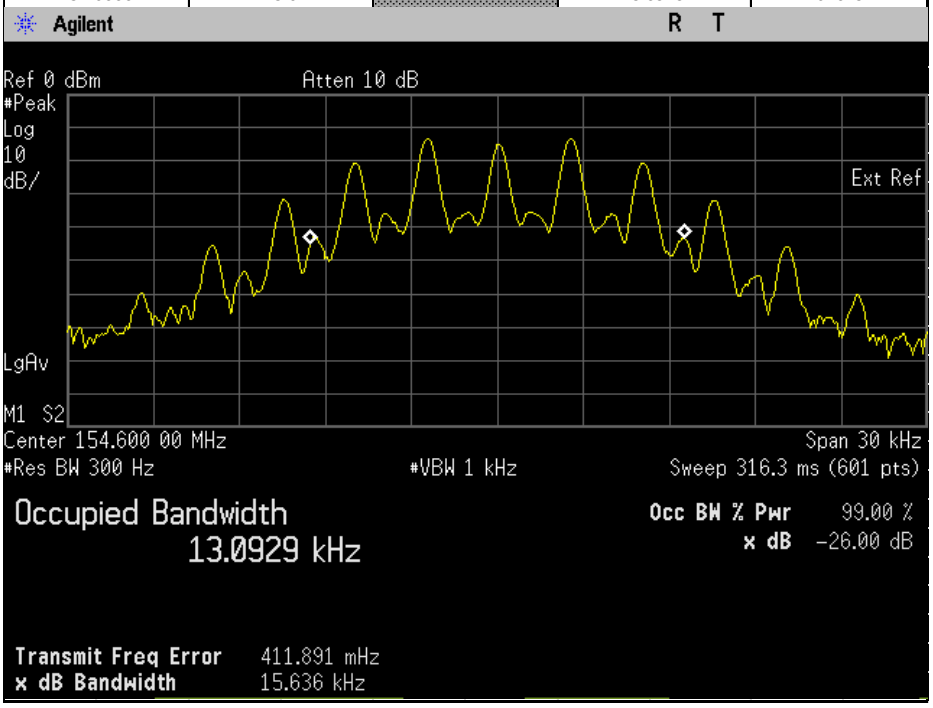
Modulation			Rules Part	
Analog			95.2773 (a)	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
151.9400	12.5		9.6874	11K0F3E



Modulation			Rules Part	
Analog			95.2773 (b)	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
154.5700	25.0		13.1089	16K0F3E



Modulation			Rules Part	
Analog			95.2773 (b)	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
154.6000	25.0		13.0929	16K0F3E



BANDWIDTH CALCULATIONS:

Carson's Rule for FM modulation is utilized to compute the bandwidth shown in the FCC emission designator. Carson's Rule is: BW = 2 * (M + D)

where: BW = Bandwidth
M = Maximum modulating frequency
D = Deviation

Standard Audio Modulation (12.5 kHz Channelization, Analog Voice):

Emission Designator 11K0F3E
In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation.
BW = 2(M+D) = 2*(3.0 kHz + 2.5 kHz) = 11 kHz ➔ 11K0
F3E portion of the designator indicates voice.
Therefore, the entire designator for 12.5 kHz channelization analog voice is 11K0F3E.

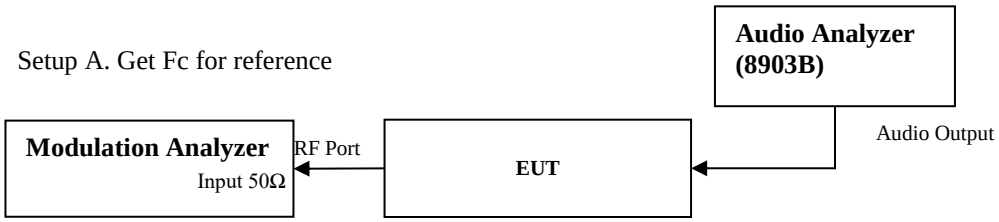
Standard Audio Modulation (25.0 kHz Channelization, Analog Voice):

Emission Designator 16K0F3E
In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation.
BW = 2(M+D) = 2*(3.0 kHz + 5.0 kHz) = 16 kHz ➔ 16K0
F3E portion of the designator indicates voice.
Therefore, the entire designator for 25.0 kHz channelization analog voice is 16K0F3E.

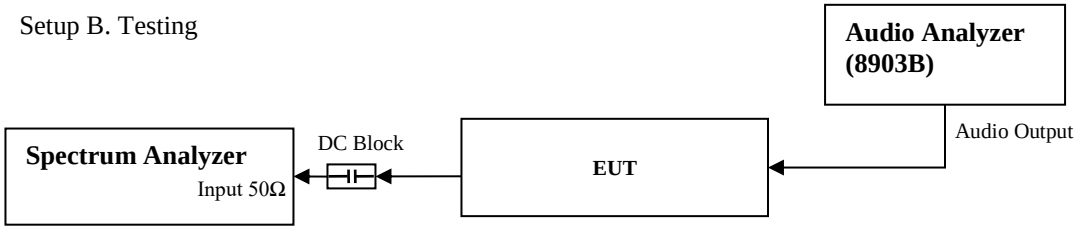
5.7. Emission Mask

5.7.1. Test Setup

Setup A. Get Fc for reference



Setup B. Testing



10) The DUT transmitter output port was connected to Modulation Analyzer.
11) Path loss for the measurement included.
12) Key in the Fc to assigned center frequency with the span 100 kHz.
13) Set the spectrum analyzer with RBW= 300Hz and VBW= 900Hz.
14) Transmit the UUT and record the result.
15) Set modulation analyzer audio bandwidth filter to 15 kHz low pass filter and 50 kHz high pass filter.
16) Transmit the radio and set the audio analyzer to 2.5 kHz audio frequency and 60% of the maximum deviation.
17) Up the amplitude by 16dB and remove the audio tone from audio analyzer.
18) Capture the screen shot with and without modulation.

5.7.2. Test Limits:

§ 95.2779 MURS unwanted emissions limits.

The requirements in this section apply to each MURS transmitter type both with and without the connection of attachments, such as an external microphone, power cord and/or antenna.

(a) Emission masks. Emission masks applicable to transmitting equipment in the MURS are defined by the requirements in the following table. The numbers in the paragraphs column refer to attenuation requirement rule paragraph numbers under paragraph (b) of this section. The words “audio filter” refer to the audio filter described in § 95.2775.

Channel center frequencies (MHz)	Paragraphs
151.820, 151.880 and 151.940	(1), (2).
154.570 & 154.600, with audio filter	(3), (4), (7).
154.570 & 154.600, without audio filter	(5), (6), (7).

(1) Each MURS transmitter type that transmits F3E or G3E emissions on 154.570 MHz or 154.600 MHz and incorporates an audio filter satisfying the requirements of § 95.2775 in its design may comply with the less stringent unwanted emissions attenuation requirements set forth in paragraphs (b)(3), (4), and (7) of this section.

(2) Each MURS transmitter type that transmits on 154.570 MHz or 154.600 MHz, but does not incorporate an audio filter satisfying the requirements of § 95.2775 in its design, must comply with the unwanted emissions attenuation requirements set forth in paragraphs (b)(5) through (7) of this section.

(b) Attenuation requirements. The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) by at least:

(1) 7.27(fd−2.88 kHz) dB on any frequency removed from the channel center frequency by a displacement frequency (fd in kHz) that is more than 5.625 kHz, but not more than 12.5 kHz.

(2) 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation, on any frequency removed from the channel center frequency by more than 12.5 kHz.

(3) 25 dB on any frequency removed from the channel center frequency by more than 10 kHz, but not more than 20 kHz.

(4) 35 dB on any frequency removed from the channel center frequency by more than 20 kHz, but not more than 50 kHz.

(5) 83 log (fd ÷ 5) dB on any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) that is more than 5 kHz, but not more than 10 kHz.

(6) 29 log (fd2 ÷ 11) dB or 50 dB, whichever is the lesser attenuation on any frequency removed from the channel center frequency by a displacement frequency (fd in kHz) that is more than 10 kHz, but not more than 50 kHz.

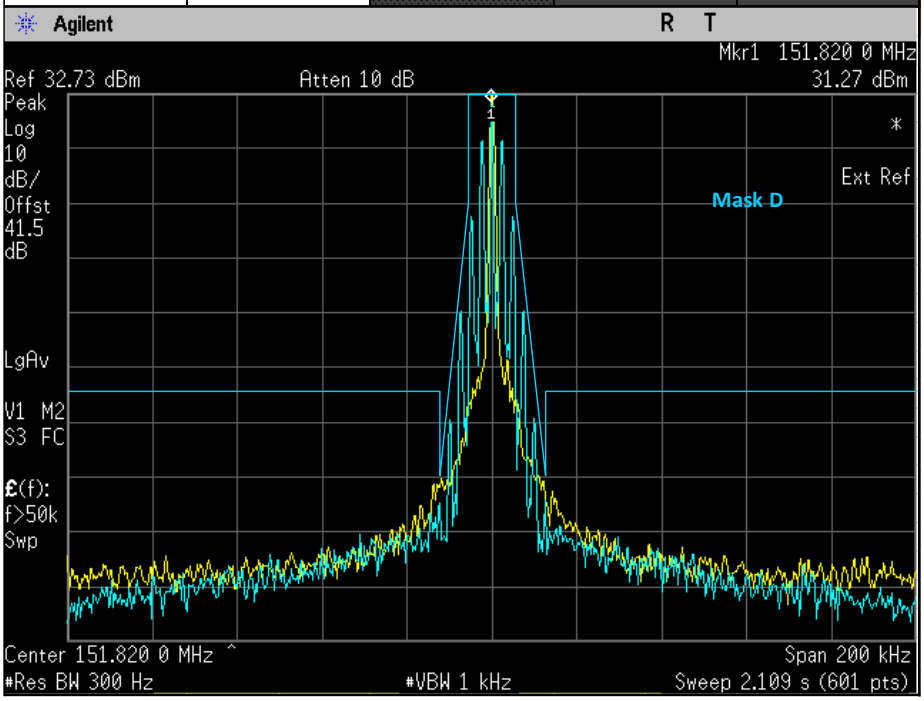
(7) 43 + 10 log(P) dB on any frequency removed from the channel center frequency by more than 50 kHz.

(c) Measurement bandwidths. The power of unwanted emissions in the frequency bands specified in paragraphs (b)(1) and (3) through (6) of this section is measured with a reference bandwidth of 300 Hz. The power of unwanted emissions in the frequency ranges specified in paragraphs (b)(2) and (7) of this section is measured with a reference bandwidth of at least 30 kHz.

5.7.3. Test Data

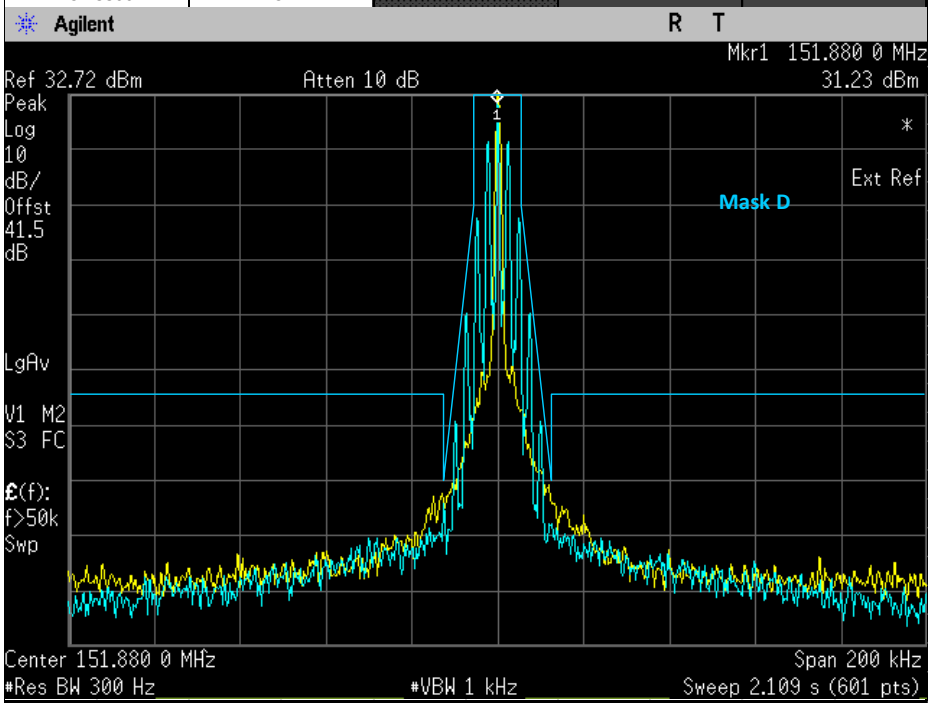
Modulation	Rules Part
Analog	95.2779 (b)(1)(2)

Channel Frequency (MHz)	Channel Spacing (kHz)
151.8200	12.5kHz



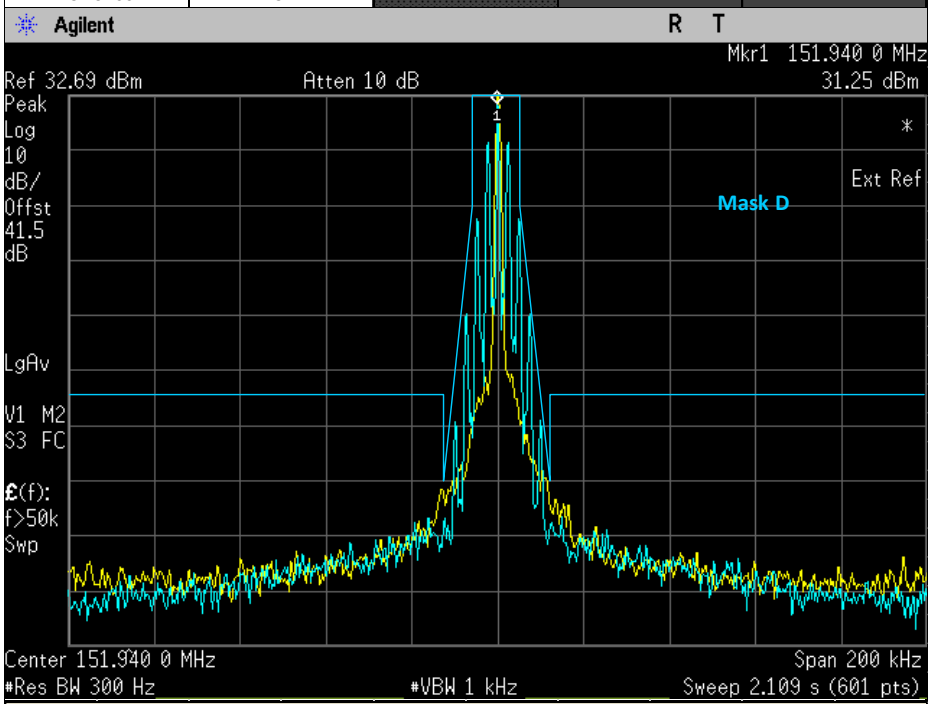
Modulation	Rules Part
Analog	95.2779 (b)(1)(2)

Channel Frequency (MHz)	Channel Spacing (kHz)
151.8800	12.5kHz



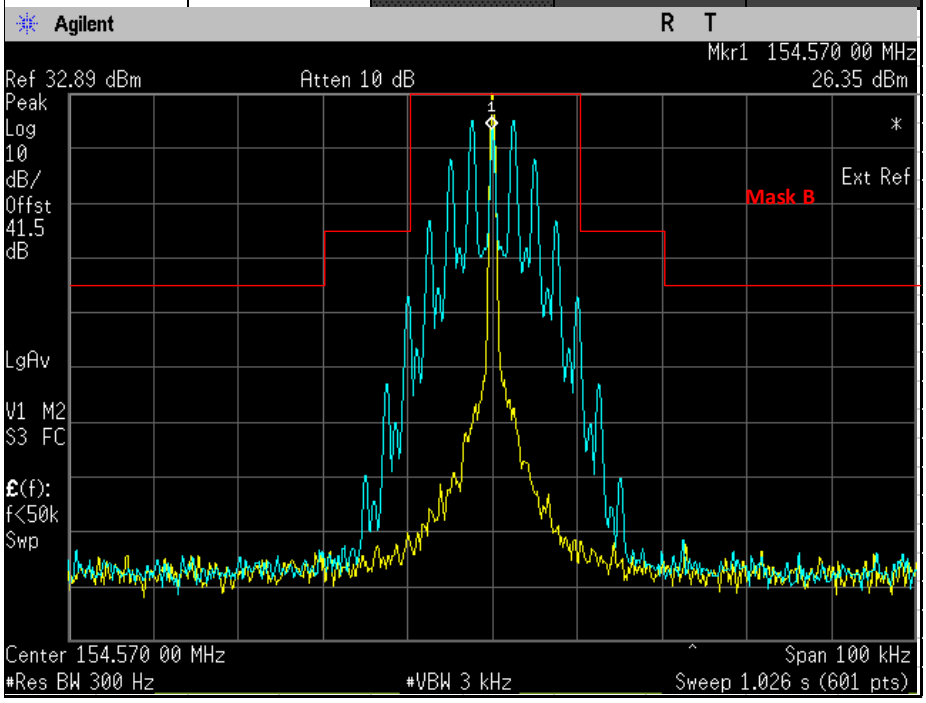
Modulation	Rules Part
Analog	95.2779 (b)(1)(2)

Channel Frequency (MHz)	Channel Spacing (kHz)
151.9400	12.5kHz



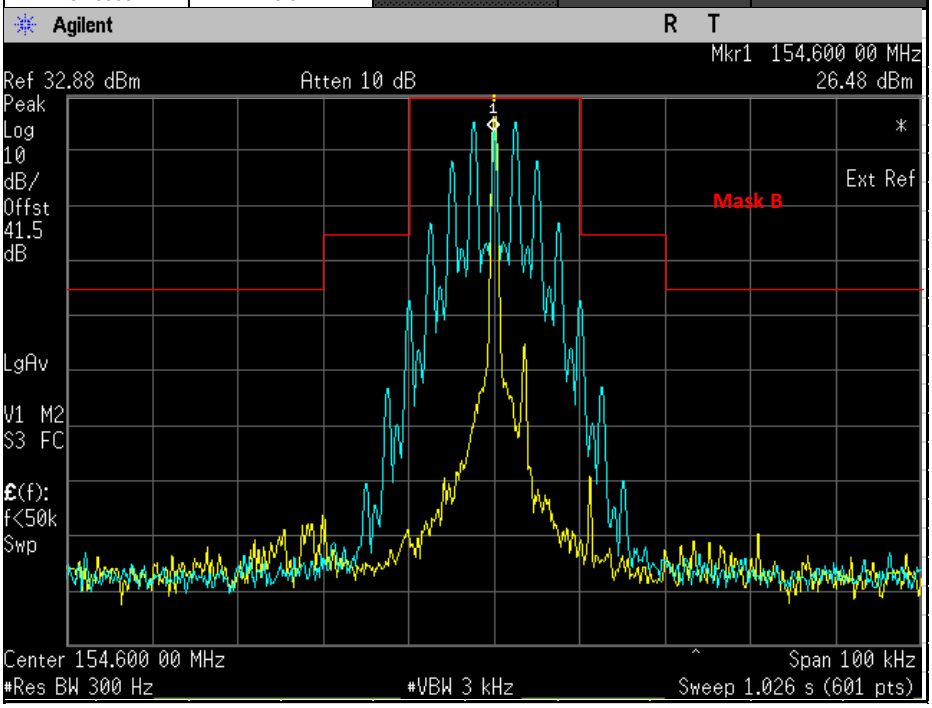
Modulation	Rules Part
Analog	95.2779 (b)(3)(4)(7)

Channel Frequency (MHz)	Channel Spacing (kHz)
154.5700	25.0



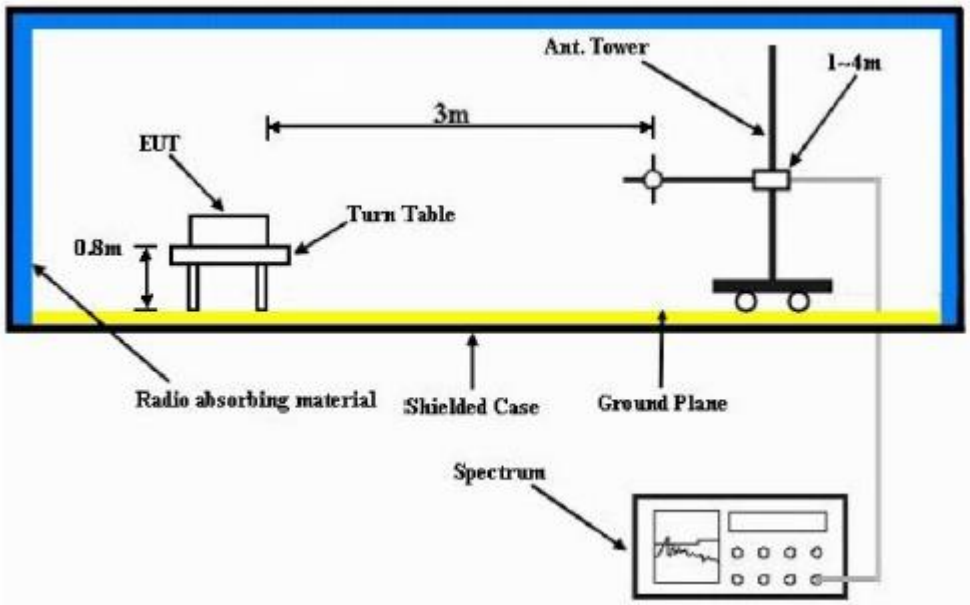
Modulation	Rules Part
Analog	95.2779 (b)(3)(4)(7)

Channel Frequency (MHz)	Channel Spacing (kHz)
154.6000	25.0



5.8. Radiated Spurious Emission

5.8.1. Test Setup



1) The spectrum setting for scanning Radiated Emission below 1 GHz is RBW = 100 kHz, VBW = 300 kHz and above 1 GHz is RBW = 1 MHz, VBW = 3 MHz. Detector mode is positive peak.
2) In the semi-anechoic chamber, setup as illustrated above the EUT placed on the 0.8m height (for frequencies < 1GHz) or 1.5m (for frequencies > 1GHz) of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
3) The substitution antenna is substituted for EUT at the same position and signals generator (S.G) export the CW signal to the substitution antenna via a TX cable. The receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum radiation power. Record the power level of maximum radiation power from spectrum. So, the measured substitution value = Ref level of S.G + TX cables loss – Substituted Antenna Gain.
4) Final Radiated Spurious Emission = “Read Value” + Measured substitution value.

5.8.2. Test limit

§ 95.2779 MURS unwanted emissions limits.

The requirements in this section apply to each MURS transmitter type both with and without the connection of attachments, such as an external microphone, power cord and/or antenna.

(a) Emission masks. Emission masks applicable to transmitting equipment in the MURS are defined by the requirements in the following table. The numbers in the paragraphs column refer to attenuation requirement rule paragraph numbers under paragraph (b) of this section. The words “audio filter” refer to the audio filter described in § 95.2775.

Channel center frequencies (MHz)	Paragraphs
151.820, 151.880 and 151.940	(1), (2).
154.570 & 154.600, with audio filter	(3), (4), (7).
154.570 & 154.600, without audio filter	(5), (6), (7).

(1) Each MURS transmitter type that transmits F3E or G3E emissions on 154.570 MHz or 154.600 MHz and incorporates an audio filter satisfying the requirements of § 95.2775 in its design may comply with the less stringent unwanted emissions attenuation requirements set forth in paragraphs (b)(3), (4), and (7) of this section.

(2) Each MURS transmitter type that transmits on 154.570 MHz or 154.600 MHz, but does not incorporate an audio filter satisfying the requirements of § 95.2775 in its design, must comply with the unwanted emissions attenuation requirements set forth in paragraphs (b)(5) through (7) of this section.

(b) Attenuation requirements. The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) by at least:

(1) 7.27(fd−2.88 kHz) dB on any frequency removed from the channel center frequency by a displacement frequency (fd in kHz) that is more than 5.625 kHz, but not more than 12.5 kHz.

(2) 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation, on any frequency removed from the channel center frequency by more than 12.5 kHz.

(3) 25 dB on any frequency removed from the channel center frequency by more than 10 kHz, but not more than 20 kHz.

(4) 35 dB on any frequency removed from the channel center frequency by more than 20 kHz, but not more than 50 kHz.

(5) 83 log (fd ÷ 5) dB on any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) that is more than 5 kHz, but not more than 10 kHz.

(6) 29 log (fd2 ÷ 11) dB or 50 dB, whichever is the lesser attenuation on any frequency removed from the channel center frequency by a displacement frequency (fd in kHz) that is more than 10 kHz, but not more than 50 kHz.

(7) 43 + 10 log(P) dB on any frequency removed from the channel center frequency by more than 50 kHz.

(c) Measurement bandwidths. The power of unwanted emissions in the frequency bands specified in paragraphs (b)(1) and (3) through (6) of this section is measured with a reference bandwidth of 300 Hz. The power of unwanted emissions in the frequency ranges specified in paragraphs (b)(2) and (7) of this section is measured with a reference bandwidth of at least 30 kHz.

5.8.3. Test Data

SAC Transmitter Radiated Emission:

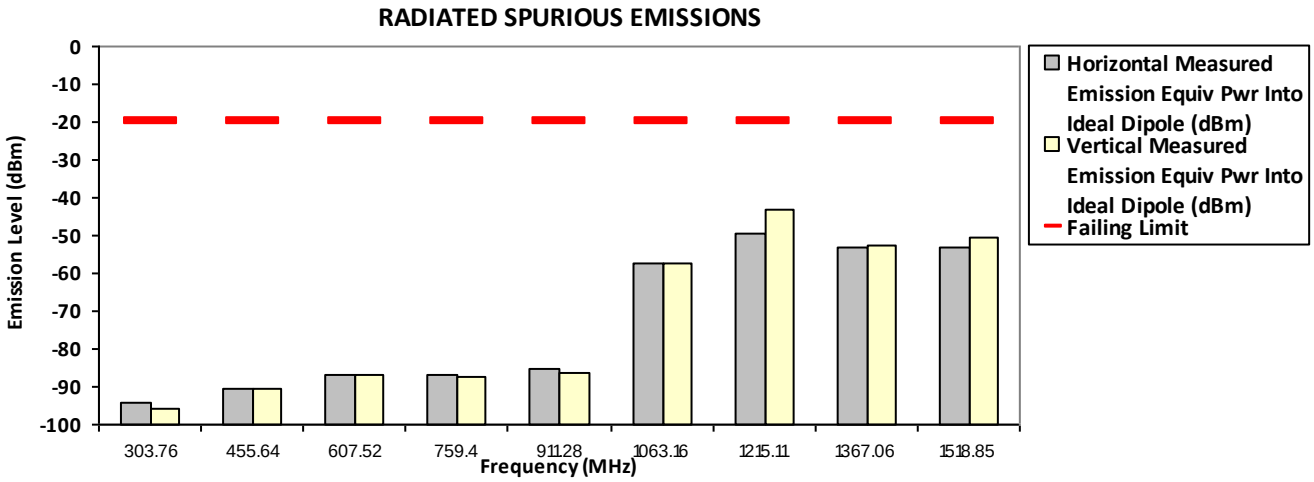
Model Number: RMM2050BHLAA **S/N: 0245AX4513** **SR: 1088P00-EMC-00001**

Battery Part No: PMNN4453AR **Accy Part No: NA**

Test Mode: TX Analog

151.880000 MHz **12.5 kHz** **2.000 Watt(s) /Max Power**

Frequency (MHz)	Limit	Horizontal Measured Emission Equiv Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into ideal Dipole (dBm)
303.7600	-20.0000	-94.3099 **	-95.7336 **
455.6400	-20.0000	-90.4412 **	-90.5646 **
607.5200	-20.0000	-87.0895 **	-86.6814 **
759.4000	-20.0000	-86.9087 **	-87.2397 **
911.2800	-20.0000	-85.5229 **	-86.1730 **
1063.1600	-20.0000	-57.3424 **	-57.5832 **
1215.1140	-20.0000	-49.5400 *	-43.0300 *
1367.0570	-20.0000	-53.1700 *	-52.8500 *
1518.8490	-20.0000	-53.0400 *	-50.5000 *



The data presented here was taken using the substitution method as found in the ANSI C63.26-2015 document.

Motorola Penang EMC Lab - Test Performed by: Rezza & Fuad **Wed, 11 Dec, 2024**

Remarks: ** Indicates the spurious emission could not be detected due to noise limitations or ambient.
***Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported**
Temp(Deg): 23.5 Hum(%RH): 68.1

System MU: 4.03 dB

Remarks:	Passed Results	**Marginal Results**	**Failed Results**

SAC Transmitter Radiated Emission:

Model Number: RMM2050BHLAA **S/N: 0245AX4513** **SR: 1088P00-EMC-00001**

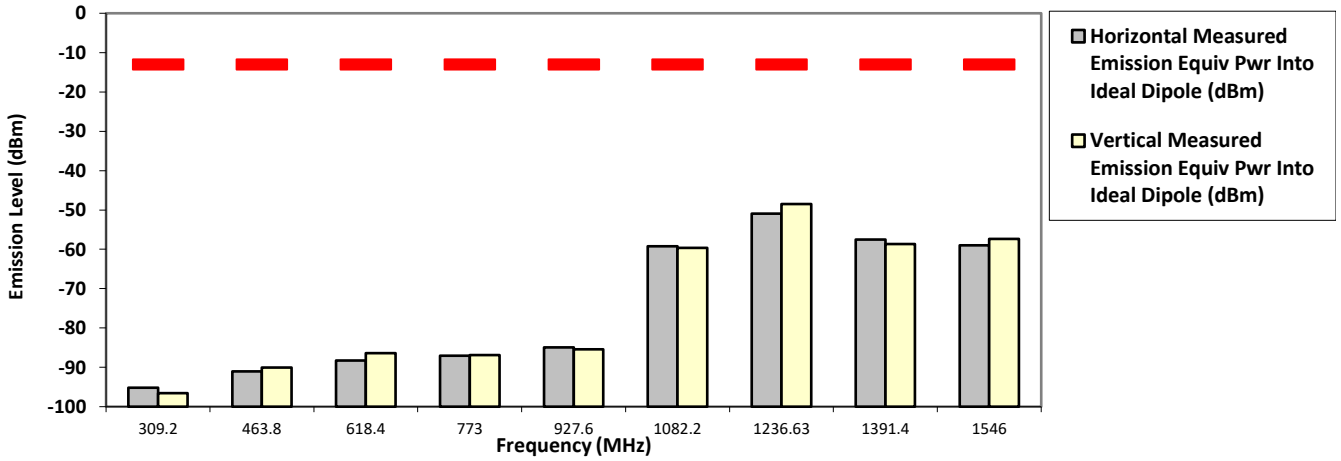
Battery Part No: PMNN4453AR **Accy Part No: NA**

Test Mode: TX Analog

154.600000 MHz **25 kHz** **2.000 Watt(s) /Max Power**

Frequency (MHz)	Limit	Horizontal Measured Emission Equiv Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into ideal Dipole (dBm)
309.2000	-13.0000	-95.1832 **	-96.5593 **
463.8000	-13.0000	-91.0012 **	-90.0173 **
618.4000	-13.0000	-88.2882 **	-86.4111 **
773.0000	-13.0000	-87.0670 **	-86.9180 **
927.6000	-13.0000	-84.9053 **	-85.4471 **
1082.2000	-13.0000	-59.1958 **	-59.6001 **
1236.6300	-13.0000	-50.9600 *	-48.4900 *
1391.4000	-13.0000	-57.5049 **	-58.6298 **
1546.0000	-13.0000	-59.0045 **	-57.3835 **

RADIATED SPURIOUS EMISSIONS



The data presented here was taken using the substitution method as found in the ANSI C63.26-2015 document.

Motorola Penang EMC Lab - Test Performed by: Rezza & Fuad **Wed, 11 Dec, 2024**

Remarks: ** Indicates the spurious emission could not be detected due to noise limitations or ambient.
***Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported**
Temp(Deg): 23.5 Hum(%RH): 68.1

System MU: 4.03 dB

Remarks:	Passed Results	**Marginal Results**	**Failed Results**

End of Test Report -