MOTOROLA SOLUTIONS

CERTIFICATE 2518.08

MS ISO/IEC 17025
TESTING
SAMM NO. 0825

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/ISED TEST REPORT
Report Revision : Rev.A

Date/s Tested	:	9-DEC-2020 - 15-DEC-2020
Report Issue Date	:	4-JAN-2021
Manufacturer	:	Motorola Solutions Malaysia SDN BHD
Manufacturer Address	:	Plot 2A, Medan Bayan Lepas, Mukim 12 SWD, 11900 Bayan Lepas, Penang, Malaysia
Requestor	:	Mohamad Shafiq Hanif Bin Ab Wahid
Product Type	:	Mobile
Product Version (PMN)	:	XPR 5550e
Model Number (HVIN)	:	AAM28QPN9RA1AN (PMUE3649C) (IC MODEL: PMUE3649CBMNAA)
Frequency Band	:	403-470MHz
Max RF Output Power	:	48 Watts
Applicant Name	:	Motorola Solutions Inc
Applicant Address	:	8000 West Sunrise Boulevard, Fort Lauderdale, Florida 33322
ISED Registrations	:	MY0001
FCC Registrations	:	461337
Firmware Version (FVIN)	:	R02.20.02.0002

The equipment was tested accordance to the requirement listed below:

(LMR)	
FCC 47 CFR Part 2 / 22 / 74 / 90	**PASS**
ISED RSS- Gen Issue 5 / 119 Issue 12	

Prepared By:

Putri Nur Sarah Sofia
Test Personnel

Approved Signatory:

Vincent Foong Chuen Kit
Responsible Engineer

Table of Contents

Report Revision History 3
1.0 General Information 4
2.0 Summary of Test Results 5
3.0 Measurement Uncertainty 6
4.0 Equipment List 7
5.0 Test Condition 10
5.1. Transmitter Test Conditions 10
6.0 Transmitter Test Parameters 11
6.1. RF Output Power 11
6.1.1. Test Setup 11
6.1.2. Test Result 11
6.2. Frequency Stability 12
6.2.1. Test Setup 12
6.2.2. Test Result 13
6.2.3. Test Limit 14
6.3. Audio Frequency Response 15
6.3.1. Test Setup 15
6.3.2. Test Result 16
6.3.3. Test Limit 18
6.4. Audio Low Pass Filter Response 19
6.4.1. Test Setup 19
6.4.2. Test Result 20
6.4.3. Test Limit 22
6.5. Modulation Limiting 23
6.5.1. Test Setup 23
6.5.2. Test Result 24
6.5.3. Test Limit 25
6.6. Occupied Bandwidth 26
6.6.1. Test Setup (Analog) 26
6.6.2. Test Result (Analog) 27
6.6.3. Test Setup (Digital) 32
6.6.4. Test Result (Digital) 33
6.6.5. Test Limit 39
6.7. Band Edge Conducted Spurious Emission (Part 22) 40
6.7.1. Test Setup (Analog) 40
6.7.2. Test Result (Analog) 41
6.7.3. Test Setup (Digital) 42
6.7.4. Test Result (Digital) 43
6.7.5. Test Limit 44
6.8. Transient Frequency Behavior 44
6.8.1. Test Setup 44
6.8.2. Test Result 45
6.8.3. Test Limit 47

6.9. Adjacent Channel Power 48
6.9.1. Test Setup (Analog) 48
6.9.2. Test Result 48
6.9.3. Test Setup (Digital) 49
6.9.4. Test Result 49
6.9.5. Test Limit 50
6.10. Conducted Spurious Emission 52
6.10.1. Test Setup 52
6.10.2. Test Result (Analog) 53
6.10.3. Test Result (Digital) 61
6.10.4. Test Limit 69
6.11. Radiated Spurious Emission 70
6.11.1. Test Setup 70
6.11.2. Test Result (Analog) 71
6.11.3. Test Result (Digital) 79
6.11.4. Test Limit 87
6.12. Effective Radiated Power (ERP) 88
6.12.1. Test Setup 88
6.12.2. Test Result 89
6.12.3. Test Limit 89
6.13. GNSS (EIRP for 1559 - 1610MHz) 90
6.13.1. Test Setup 90
6.13.1. Test Result 91
6.13.2. Test Limit 91

Report Revision History

Revision History	Description	Date	Originator
Rev. A	Initial Report	22-DEC-2020	Putri Nur Sarah Sofia

1.0 General Information

EUT Description:

Technologies	Land Mobile Radio (LMR)
Modulation Type	Analog, 4FSK

The EUT contains following accessory devices and data cable:

Item	Brand	Model or P/N
POWER CABLE TO BATTERY, 6M (20 FT.), 20 AMP (1- 45W)	MOTOROLA	HKN4192B
13 WATT EXTERNAL SPEAKER	MOTOROLA	RSN4002A
IMPRES 4-WAY NAVIGATION KEYPAD MICROPHONE WITH ENHANCED AUDIO	MOTOROLA	RMN5127C

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 C63.4-2014
ANSI C63.26-2015

No modifications were done to the UUT to facilitate the tests in this report.

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

GOB board
Test is performed with option board activated in EUT.

Selection of test modes
Some reports may contain a limited number of test points/modes, in which case all channels and modulations were evaluated and the worst case performance is presented in the report

2.0 Summary of Test Results

FCC General Rules Part (47CFR)	ISED General Rules Part	Test Item	Result	Remarks	Serial number tested
2.1046, 22.565, 74.461, 74.534	RSS-119	RF Power Output	Pass		511TWX2292
2.1055, 90.213, 22.355	RSS-119	Frequency Stability	Pass		511TWX2292
2.1047, 74.463	RSS-119	Audio Frequency Response	Pass		511TWX2292
2.1047, 74.463	RSS-119	Audio Low Pass Filter Response	Pass		511TWX2292
2.1047, 74.463	RSS-119	Modulation limiting	Pass		511TWX2292
74.462(c), 90.210, 22.359(b)	RSS-119	Occupied Bandwidth	Pass	16K0F3E- 14.9994KHz 11K0F3E- 9.8346KHz 7K60F1D/FXD- 7.5681KHz 7K60F1E/FXE- 7.1050KHz 7K60F1W- 7.3364KHz	511TWX2292
2.1051, 22.359 (a), (b)	RSS-119	Band Edge Conducted Spurious Emission	Pass		511TWX2292
90.214	RSS-119	Transient Frequency Behavior	Pass		511TWX2292
-	-	Adjacent Channel Power	NA		
2.1051, 22.359, 90.210 74.462(c)	RSS-119	Conducted Spurious Emissions	Pass	Highest spur - 29.71dBm	511TWX2292
2.1051, 22.359, 74.462(c)	RSS-119	Radiated Spurious Emission	Pass	Highest spur- 44.39dBm	511TWX2291
-	-	Effective Radiated Power (ERP)	NA		

3.0 Measurement Uncertainty

Measurement	Frequency	Expended Uncertainty (k=1.96) (±)
AC Power Line Conducted Spurious Emission	150KHz ~ 30MHz	3.43 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	4.25 dB
	200MHz ~ 1000MHz	4.25 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	4.94 dB
	18GHz ~ 25GHz	4.94 dB
Conducted Spurious Emissions	9kHz ~ 12.75GHz	2.82 dB
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
Band Edge Conducted Spurious Emission	9kHz ~ 12.75GHz	2.82 dB
Transient Frequency Behavior	9kHz ~ 12.75GHz	5.4 ms
Adjacent Channel Power	9kHz ~ 12.75GHz	2.82 dB

4.0 Equipment List

FCC Analog ATE#1: (SW version: 2.4.6 & FCC_Frequency Stability 1.0.3 rev.)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
CHAMBER	SH-641	92009188	06-Mar-20	06-Mar-21
DSA Dynamic Signal Analyzer	35670A	MY42507095	19-Jun-20	19-Jun-21
ANALYZER AUDIO	8903B	3514A15797	29-Oct-20	29-Oct-21
POWER METER	E4416A	MY45102699	26-Jun-20	26-Jun-21
POWER SENSOR	E9301B	MY41498918	12-Aug-20	12-Aug-21
POWER SUPPLY	6031A	3325A02771	13-Mar-20	13-Mar-21
SIGNAL GENERATOR	2042	119718/063	24-Jun-20	24-Jun-21
ANALYZER MODULATION	8901B	3122A03662	08-Jul-20	08-Jul-21
N to N RF Cable # 1	M17/128-RG400	NA	NA	NA
BNC to N RF Cable # 1	RG 58	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 BNC RF Cable # 7	RG 58	NA	NA	NA
N to SMA RF Cable # 1	RG 58	NA	NA	NA
N to SMA RF Cable # 2	RG 58	NA	NA	NA
N to SMA RF Cable # 3	RG 58	NA	NA	NA
Aeroflex Attenuator 30dB	49-30-34-LIM	NA	NA	NA

FCC Transient ATE #1: (SW version: FCC Transient ATE_R1.1.3)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
SWITCH CONTROL UNIT	3488A	2719A36210	CNR	CNR
ATTENUATOR / SWITCH DRIVER	11713A	2508A10141	CNR	CNR
POWER METER	E4416A	GB41293866	26-Feb-19	26-Feb-21
POWER SUPPLY	6032A	MY41002067	22-Feb-20	22-Feb-21
SIGNAL GENERATOR	8657A	3250A05137	19-Jun-20	19-Jun-21
STEP ATTENUATOR	8494G	MY42143006	12-Jun-20	12-Jun-21
STEP ATTENUATOR	8496G	MY42143012	13-Jun-20	13-Jun-21
OSCILLOSCOPE	MSO8104A	MY45002372	26-Jun-20	26-Jun-21
ANALYZER MODULATION	8901B	3438A05093	23-Jun-20	23-Jun-21
ANALYZER AUDIO	8903B	3011A12671	11-Mar-20	11-Mar-21
ANALYZER AUDIO	8903B	3011A08952	29-Jul-20	29-Jul-21
SPECTRUM ANAYLYZER	E4440A	MY46181974	2-Aug-20	2-Aug-21

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
N to N RF Cable # 9	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
SWITCH CONTROL UNIT	3488A	2719A36210	CNR	CNR

CONDUCTED SPUR EMISSION ATE # 1 (SW version: Conducted Spur ATE_rev 1.23.03)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
SWITCH CONTROL UNIT	3488A	2719A32735	CNR	CNR
ANALYZER SPECTRUM	E4440A	MY46185415	10-Jan-20	10-Jan-22
POWER SUPPLY	6031A	3543A03489	05-Jun-20	05-Jun-21
HIGH PASS FILTER SWITCH BOX	-	CS001	2-Jul-20	2-Jul-21
N to N RF Cable # 1	SF126/11N/11N	NA	NA	NA
N to N RF Cable # 2	SF126/11N/11N	NA	NA	NA
BNC to BNC RF Cable # 1	RG 58	NA	NA	NA
Aeroflex Attenuator 30dB	49-30-43-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	720	21-Mar-19	21-Mar-21
DRG HORN FREQ.	SAS-571	1143	14-Feb-19	14-Feb-21
POWER SUPPLY	6032A	2615A01178	21-May-20	21-May-21

SIGNAL GENERATOR	SMB 100A	181117	8-Nov-18	8-Nov-21
EMI TEST RECEIVER	ESW44	101731	3-Dec-19	3-Feb-21
EMI TEST RECEIVER	ESIB26	100017	19-Jul-19	19-Jan-21
5m SEMI-ANECHOIC CHAMBER	S800-HX	J2308	No Cal. Req'd	No Cal. Req'd
BILOG ANTENNA	CBL6112B	2964	23-Apr-19	23-Apr-21
BILOG ANTENNA	CBL6112B	2950	8-Jul-19	8-Jul-21
DATA LOGGER	SDL500	A.016776	4-Jun-20	4-Jun-21
SYSTEM CONTROLLER	SC104V	050806-1	CNR	CNR
TURNTABLE FLUSH MOUNT 2M	FM2011	NA	CNR	CNR
ANTENNA POSITIONING TOWER	TLT2	NA	CNR	CNR
BROAD-BAND HORN ANTENNA	BBHA9170	BBHA9170255	27-Jan-20	27-Jan-21
18 - 40GHz PREAMPLIFIER	MITEQ Hi GAIN SUCOFLEX	001	CNR	CNR
PREAMPLIFIER	PAM-0118	269	24-May-19	24-May-22
LOOP ANTENNA	6502	00203479	21-Jan-20	21-Jan-21
TEST SOFTWARE	EMC_FCC_IC_BLUETOOTH_RE_TEST			
VERSION	EMC_FCC_RE_v1.6.2			

5.0 Test Condition

5.1. Transmitter Test Conditions

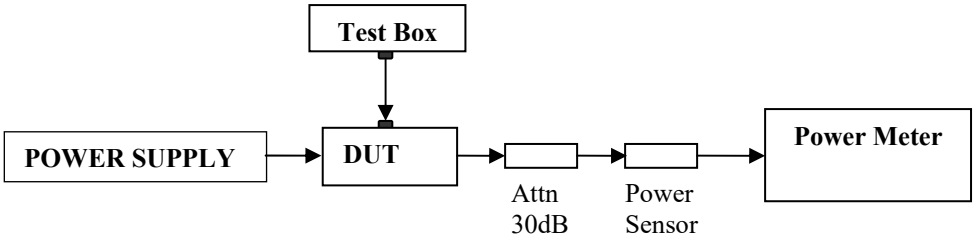
Test Item, (Channel Spacing)	Power (W)	Modulation	Test Frequency (MHz)	Tested By	Environmental conditions
RF Output Power	Low & Max	Analog	403.0125, 406.2, 450.025, 459.125, 467.775, 469.9875	Putri	23.4°C, 50%RH
Frequency Stability	Max	Analog	467.775	Putri	25.1°C, 54.3%RH, 60.3°C, 50%RH, -30.1°C, 51.2%RH
Audio Frequency Response (12.5kHz / 25kHz)	Max	Analog	467.775, 459.125	Putri	23.4°C, 50%RH
Audio Low Pass Filter Response (12.5kHz / 25kHz)	Max	Analog	467.775, 459.125	Putri	23.4°C, 50%RH
Modulation limiting (12.5kHz / 25kHz)	Max	Analog	467.775, 459.125	Putri	23.4°C, 50%RH
Occupied Bandwidth (12.5kHz / 20kHz / 25kHz)	Max	Analog, 4FSK	406.2, 450.025, 467.775, 469.9875, 459.125	Putri	23.4°C, 50%RH
Band Edge Conducted Spurious Emissions (Part 22) (12.5kHz / 20kHz / 25kHz)	Low / Max	Analog, 4FSK	459.025, 459.65, 473.0125, 479.2875	Putri	23.4°C, 50%RH
Transient Frequency Behavior *(UHF & VHF Band)* (12.5kHz / 25kHz)	Max	Analog	467.775	Putri	23.4°C, 50%RH
Adjacent Channel Power *(700MHz Band)* (12.5kHz / 25kHz)	Max	NA	NA		
Conducted Spurious Emissions- (12.5kHz / 25kHz)	Low / Max	Analog, 4FSK	403.0125, 406.2, 450.025, 459.125, 467.775, 469.9875	Putri	23.4°C, 50%RH
Radiated Spurious Emission (12.5kHz / 25kHz)	Low / Max	Analog, 4FSK	403.0125, 406.2, 450.025, 459.125, 467.775, 469.9875	Nazrin, Fendi, Qawiman	22.5 °C, 64%RH
GNSS (EIRP for 1559 - 1610MHz) (12.5kHz / 25kHz)	Max	NA	NA		
Effective Radiated Power (ERP) (12.5kHz / 25kHz)	Max	NA	NA		

NA → Not Applicable

6.0 Transmitter Test Parameters

6.1. RF Output Power

6.1.1. Test Setup



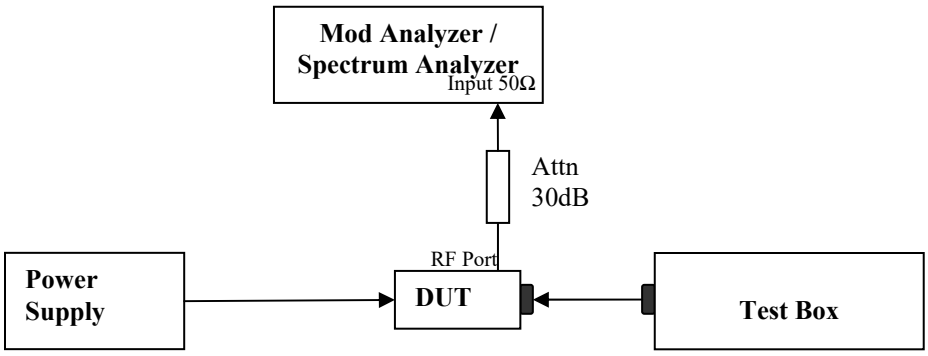
1) The DUT transmitter connected to Power Meter using the 30 dB attenuator and power sensor with above setup.
2) Path loss for the measurement included.
3) All the measurement was done at low, mid, high frequency for each band.
4) Record the power into the test report.

6.1.2. Test Result

Temperature	25˚C				
Voltage (V)	13.6V				
Frequency (MHz)	Low Power (W)	Current (A)	Max Power (W)	Current (A)	Remark
403.01250	24.80	5.82	47.70	8.04	Not for FCC review
406.20000	24.80	5.70	47.50	7.86	
450.02500	24.90	6.18	47.60	8.85	
459.12500	24.90	6.36	47.20	8.85	
467.77500	24.80	6.27	47.60	8.86	
469.98750	24.80	6.21	47.10	8.61	

6.2. Frequency Stability

6.2.1. Test Setup



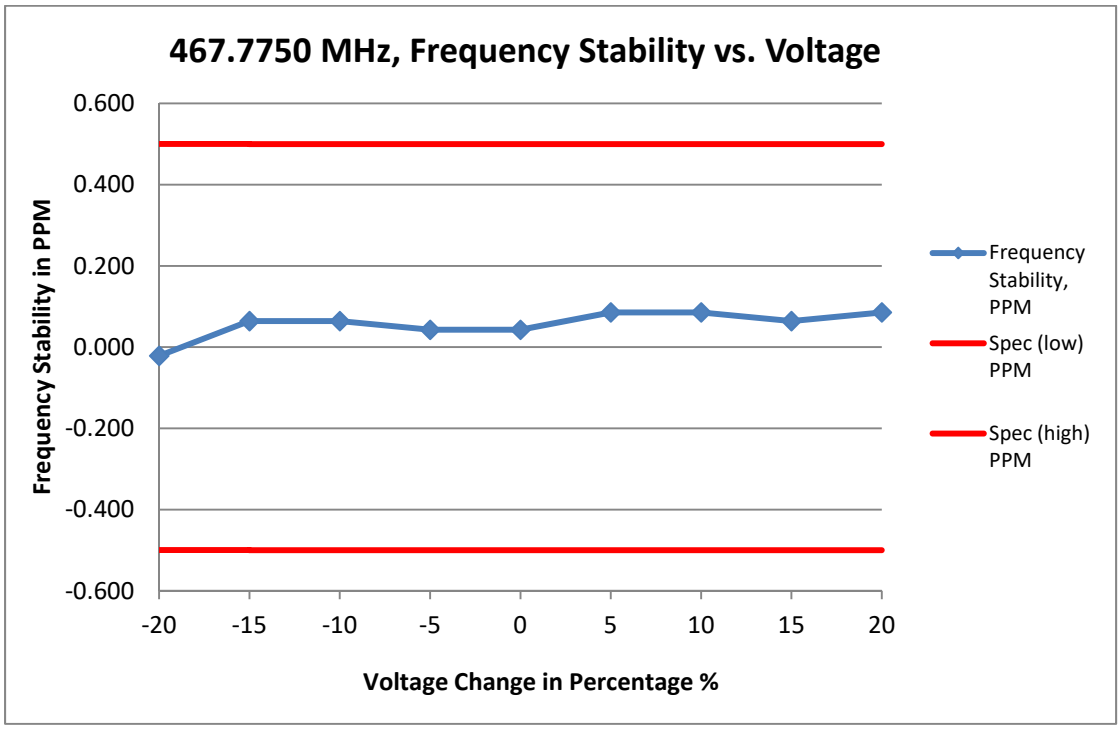
1) The DUT transmitter output port was connected to Modulation / Spectrum Analyzer.
2) Path loss for the measurement included.
3) Transmit the DUT and record the freq in MCF_{MHz}.
4) Test in 2 conditions:
   - Temperature: The frequency of the transmitter was measured from -30°C to 50°C.
   - Supply Voltage:
     -Mobile: The frequency of the transmitter was measured from 85% to 115% of the nominal operating input voltage.
     -Portable: The frequency of the transmitter was measured from nominal ± x % as specified by the manufacturer

5) Calculate the ppm frequency error by the following:

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

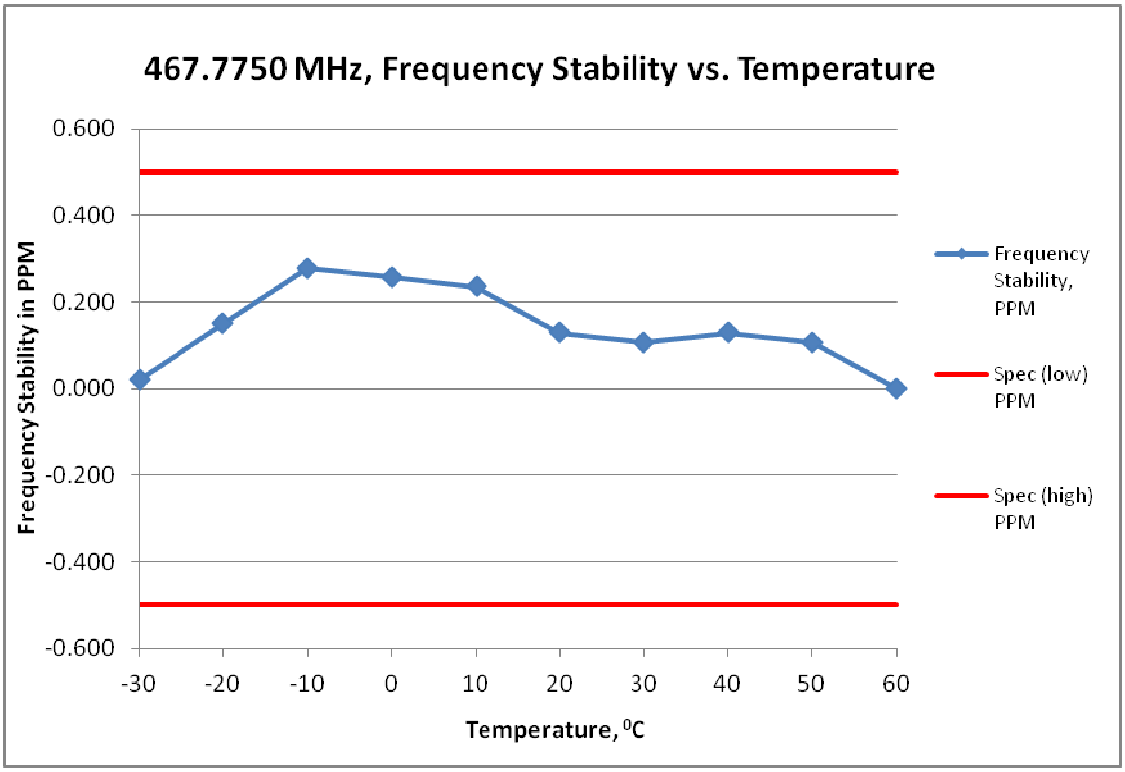
Where: MCF_{MHz} is the Measured Carrier Frequency in MHz
ACF_{MHz} is the Assigned Carrier Frequency in MHz

6.2.2. Test Result



(i) Frequency Stability VS Voltage

Frequency / Channel Spacing	467.7750 MHz / 12.5 kHz				
Temperature, ^{0}C	25				
Voltage %	Voltage, V	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-20	9.000	467.774990	-0.021	-0.500	0.500
-15	11.560	467.775030	0.064	-0.500	0.500
-10	12.240	467.775030	0.064	-0.500	0.500
-5	12.920	467.775020	0.043	-0.500	0.500
0	13.600	467.775020	0.043	-0.500	0.500
5	14.280	467.775040	0.086	-0.500	0.500
10	14.960	467.775040	0.086	-0.500	0.500
15	15.640	467.775030	0.064	-0.500	0.500
20	16.320	467.775040	0.086	-0.500	0.500



(ii) Frequency Stability VS temperature

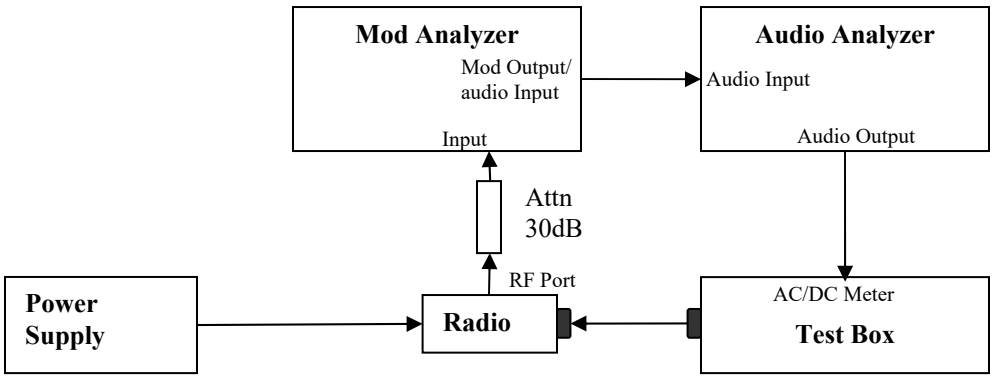
Frequency / Channel Spacing	467.7750 MHz / 12.5 kHz			
Voltage, V	13.6			
Temperature, °C	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-30	467.775010	0.021	-0.500	0.500
-20	467.775070	0.150	-0.500	0.500
-10	467.775130	0.278	-0.500	0.500
0	467.775120	0.257	-0.500	0.500
10	467.775110	0.235	-0.500	0.500
20	467.775060	0.128	-0.500	0.500
30	467.775050	0.107	-0.500	0.500
40	467.775060	0.128	-0.500	0.500
50	467.775050	0.107	-0.500	0.500
60	467.775000	0.000	-0.500	0.500

6.2.3. Test Limit

As per manufacturer declared spec +/- 0.5ppm

6.3. Audio Frequency Response

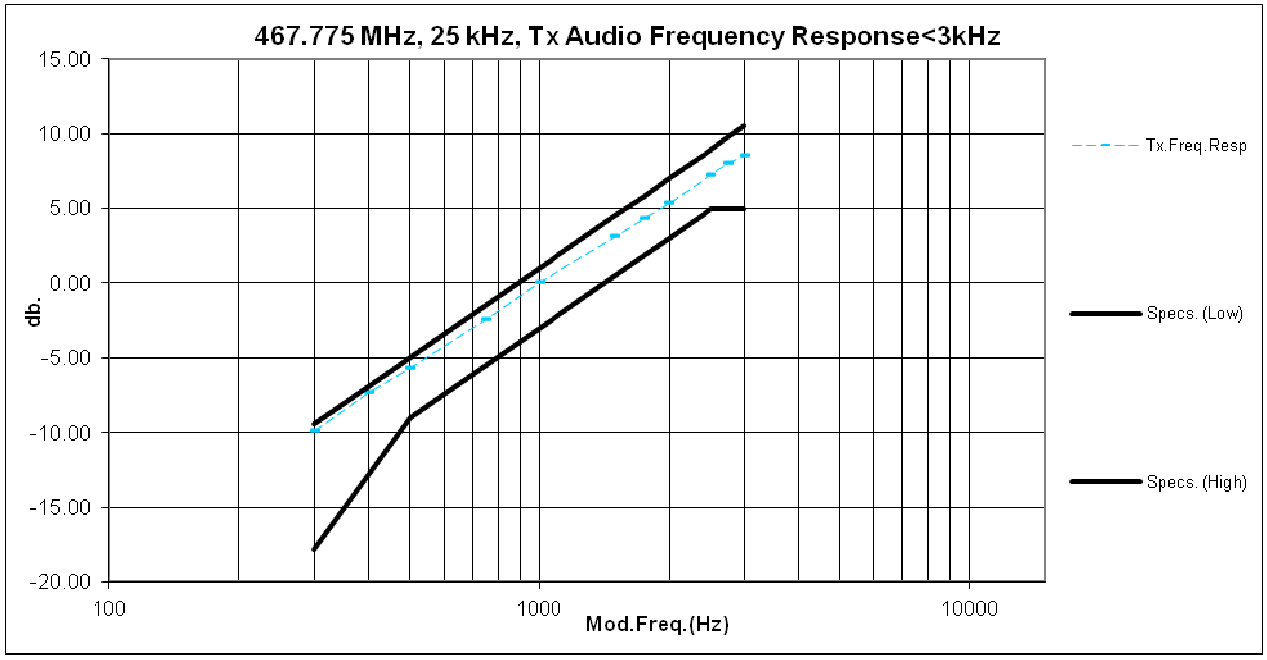
6.3.1. Test Setup

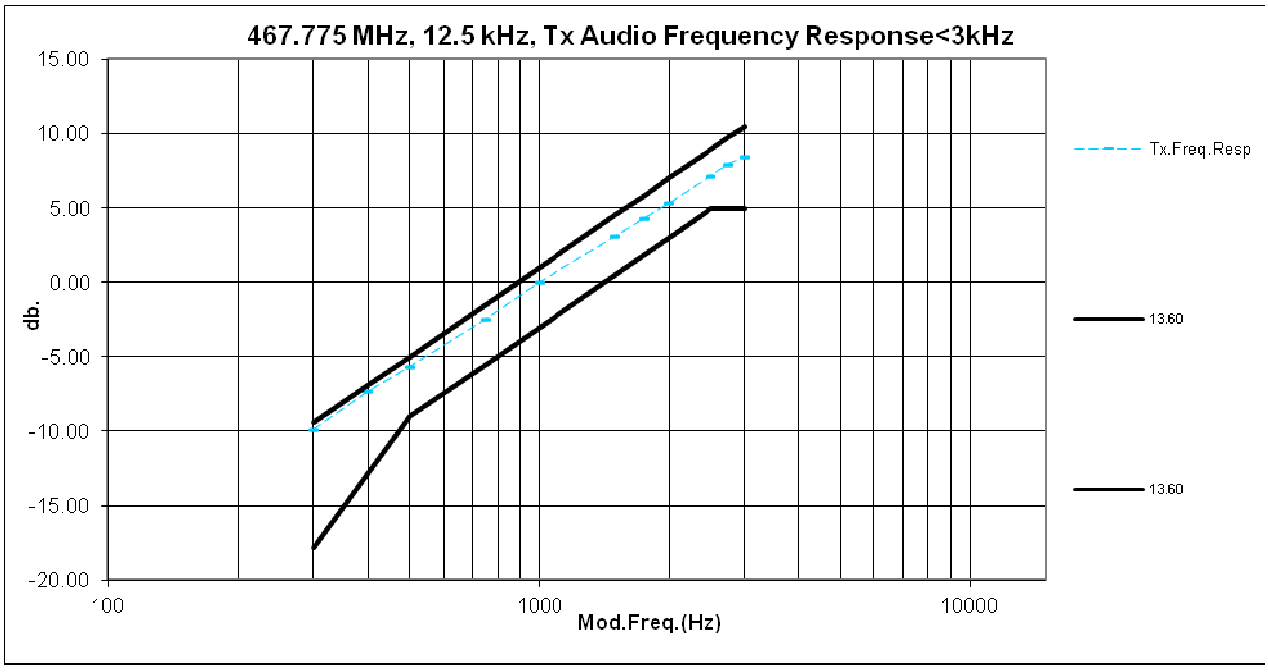


1) The DUT transmitter output port was connected to Modulation Analyzer.
2) Path loss for the measurement included.
3) Set the audio bandwidth filter to 15 kHz and 50 kHz.
4) Transmit the radio and set the audio analyzer to 1 kHz audio frequency and 20% of the Full rated system deviation.
5) On audio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

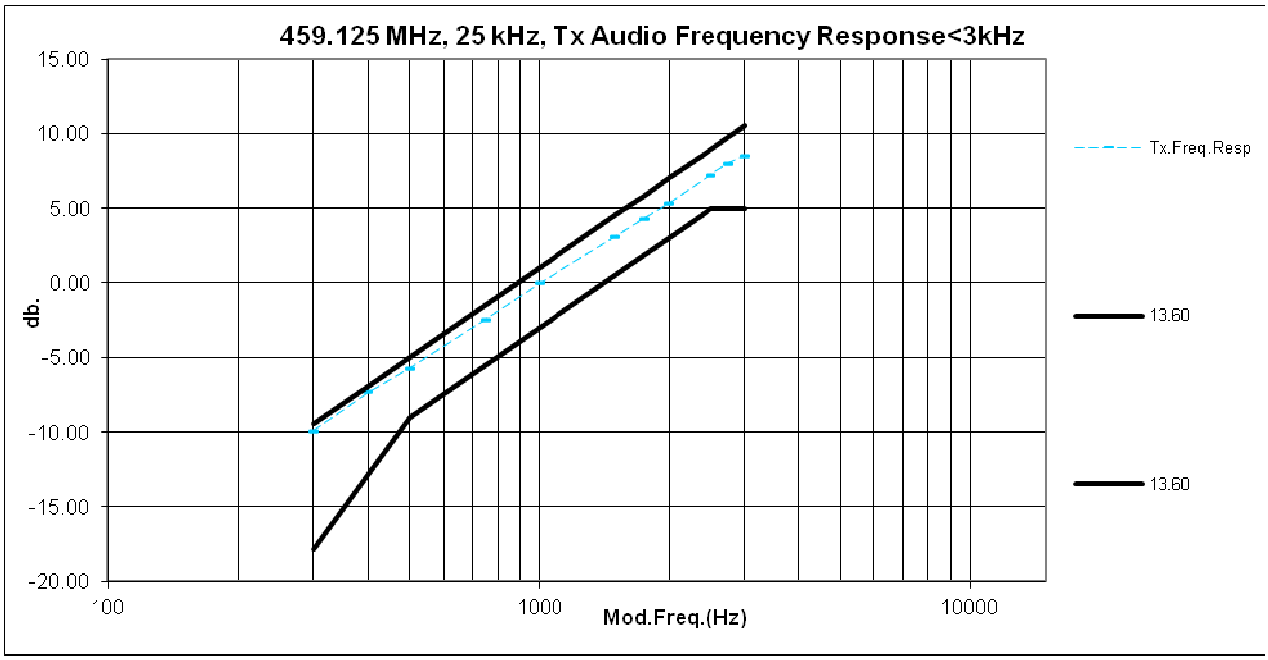
6.3.2. Test Result

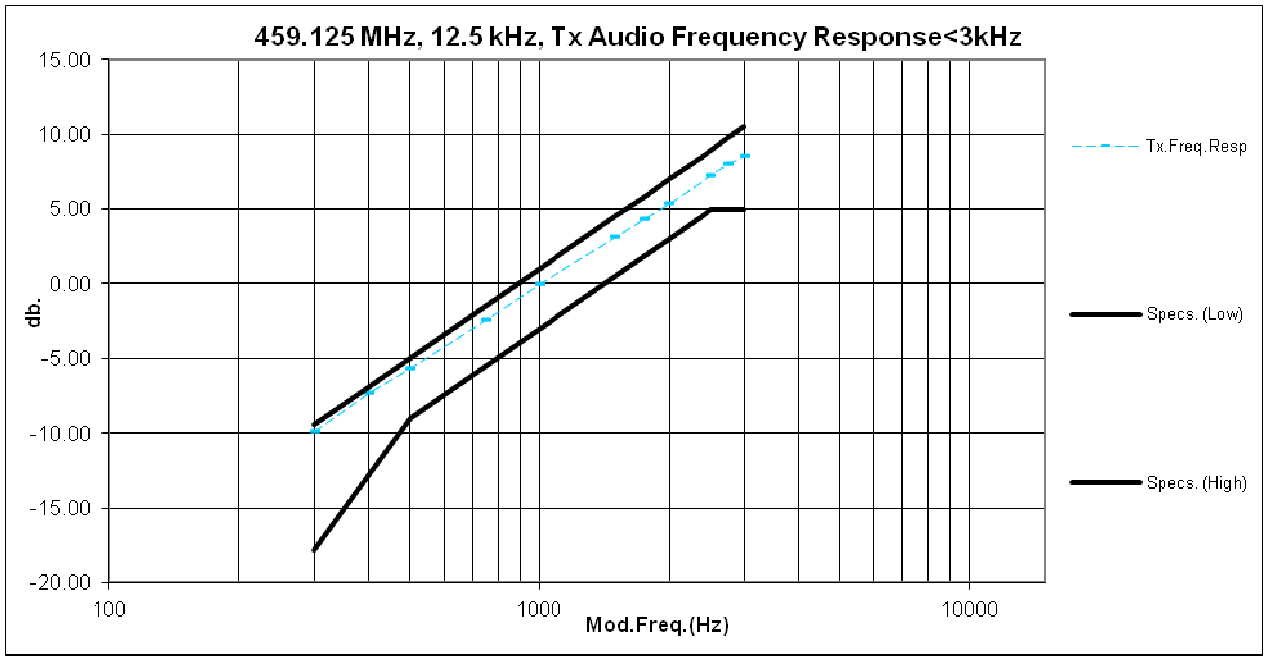
Not for FCC review



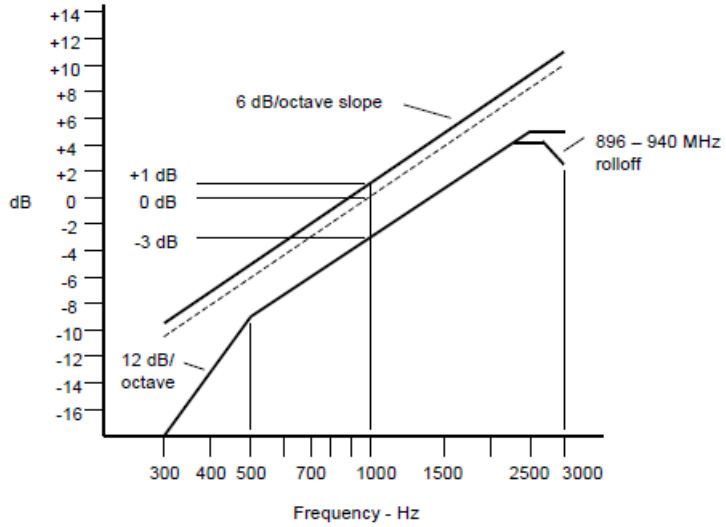


Not for FCC review





6.3.3. Test Limit

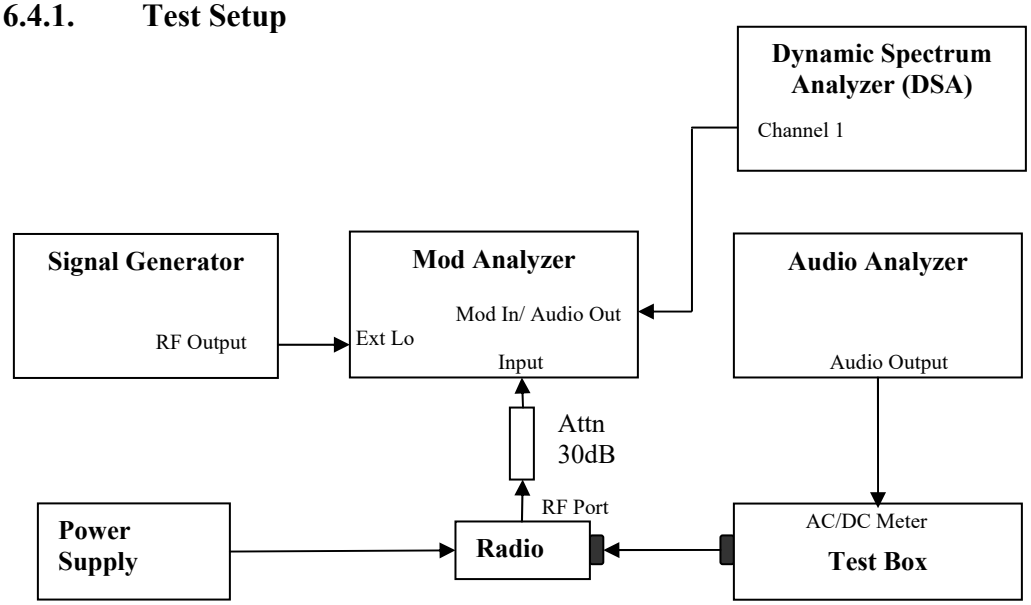


Note:

- *There are additional 6 dB per octave attenuation is allowed from 2.5KHz to 3KHz in equipment 25MHz to 869MHz radio.*
- *Additional 6 dB per octave attenuation is allowed from 2.3KHz to 2.7KHz & additional 12 dB per octave attenuation is allowed from 2.7KHz to 3KHz in equipment 896MHz to 940MHz radio.*

6.4. Audio Low Pass Filter Response

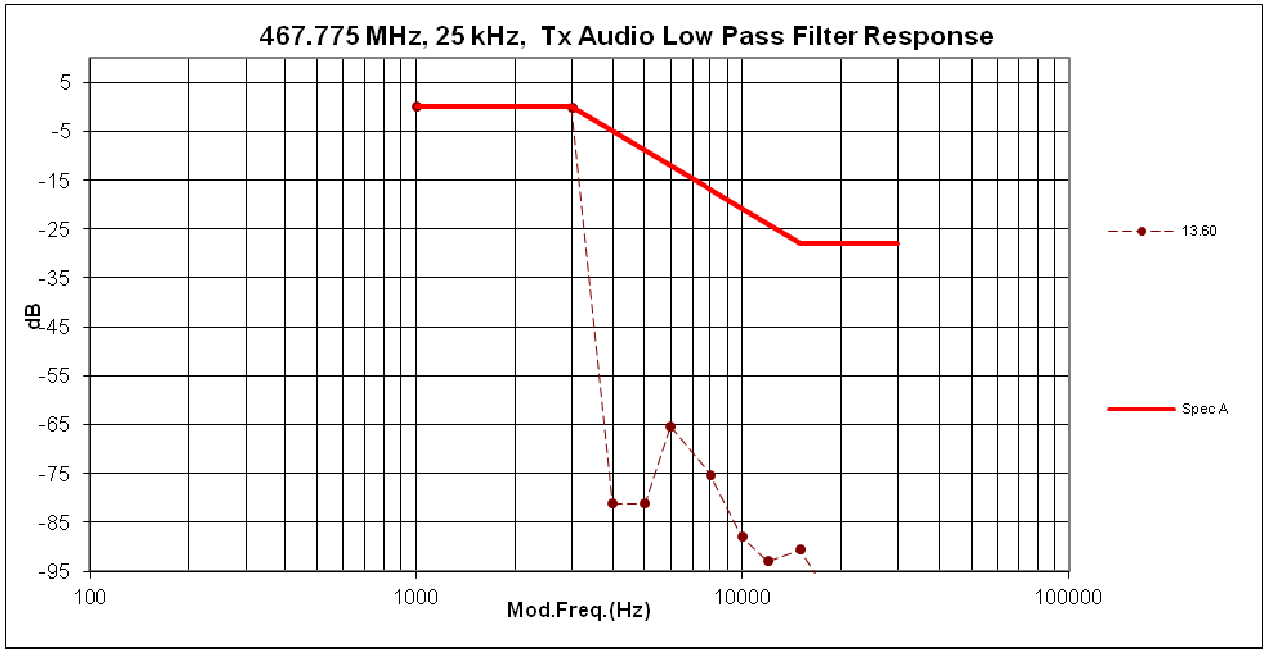
6.4.1. Test Setup

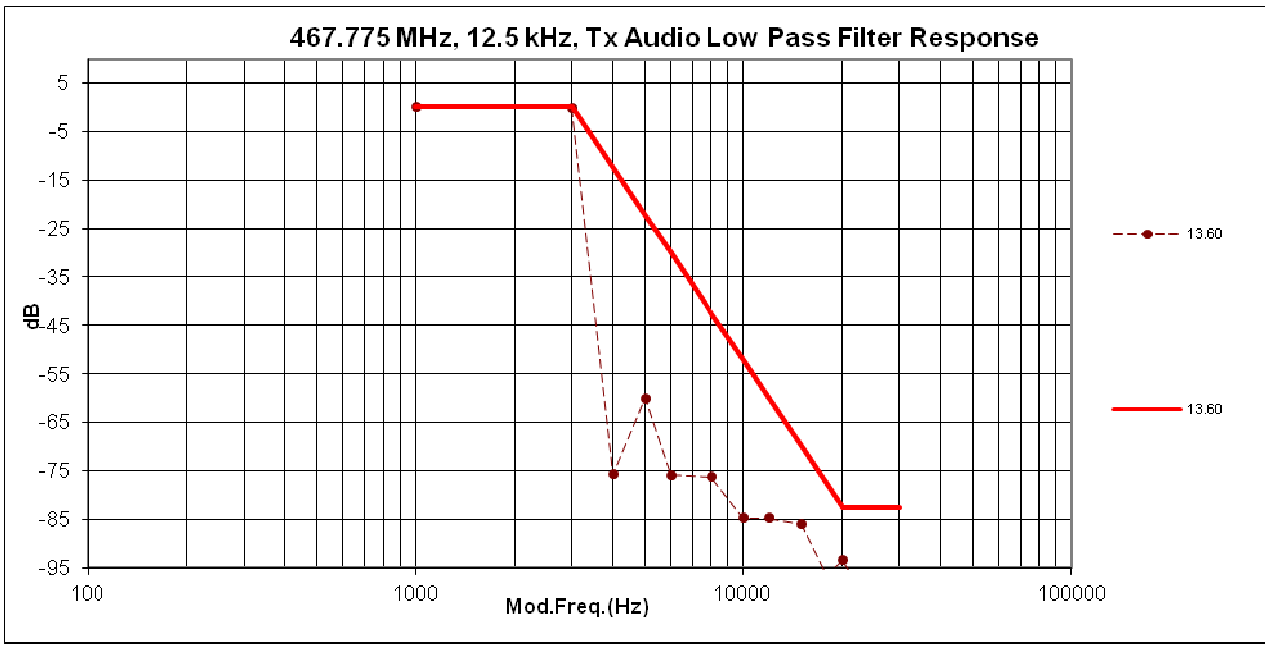


1) The DUT transmitter output port was connected to Modulation Analyzer.
2) Path loss for the measurement included.
3) Press 23.1SPCL on modulation analyzer to enable the external LO from Sigen.
4) Set the Sigen frequency to Fc + 1.5 MHz, RF output level to 0dBm without modulation.
5) Transmit the radio and set the audio analyzer to 1 kHz audio frequency and 60% of the Full rated system 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 20 kHz, record the audio tone from DSA.

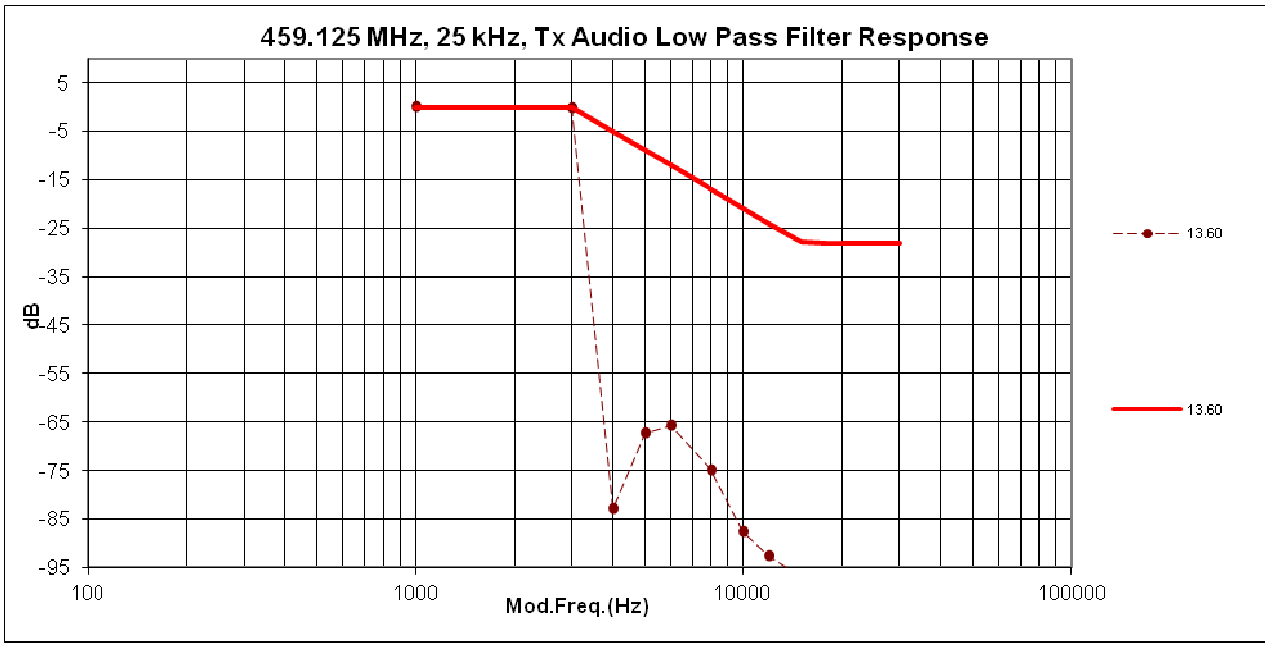
6.4.2. Test Result

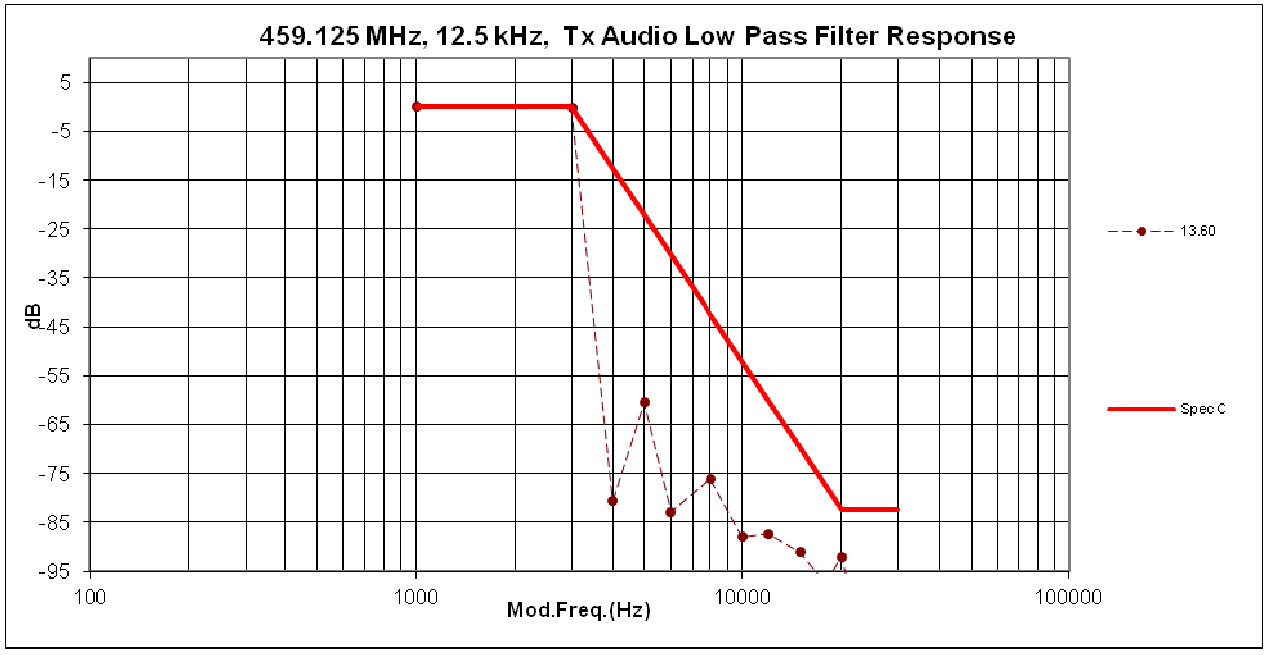
Not for FCC review



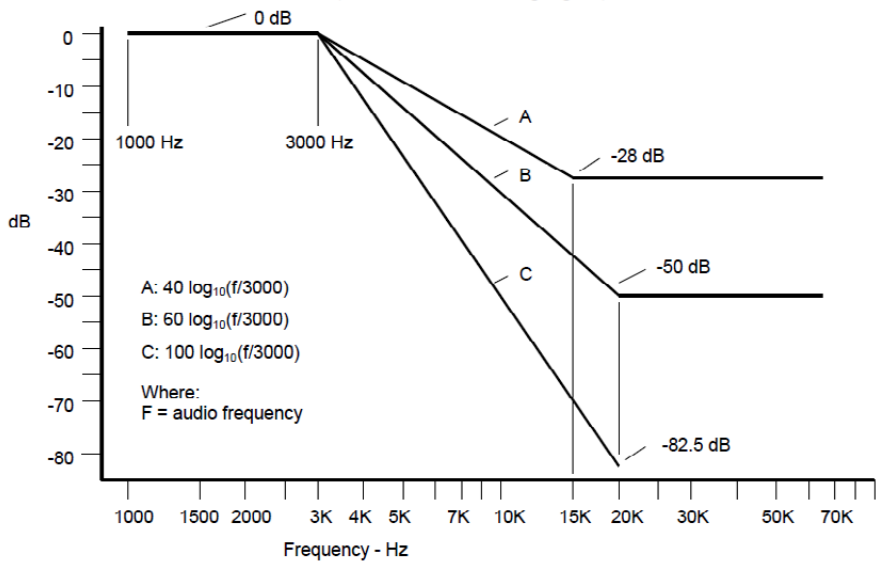


Not for FCC review





6.4.3. Test Limit



For audio frequencies above 3000 Hz, the audio response of the post limiter low-pass filter shall meet or exceed the following requirements:

a) For equipment operating on 20, 25 or 30 kHz channel bandwidth in the 25 MHz to 174 MHz range:

At frequencies from 3000 Hz through 15,000 Hz the attenuation shall be greater than the attenuation at 1000 Hz by at least: $40 \log_{10}(f / 3000)$ dB

where: f is the audio frequency in Hz.

At frequencies above 15,000 Hz, the attenuation shall be greater than the attenuation at 1000 Hz, by at least: 28 dB.

b) For equipment operating with 25 kHz bandwidth channels between 406 and 512 MHz through 896 MHz, and between 929 MHz through 930 MHz:

At frequencies from 3000 Hz through 20,000 Hz, the attenuation shall be greater than the attenuation at 1000 Hz by at least: $60 \log_{10}(f / 3000)$ dB

where: f is the audio frequency in Hz.

At frequencies above 20,000 Hz the attenuation shall be greater than the attenuation at 1000 Hz by at least: 50 dB.

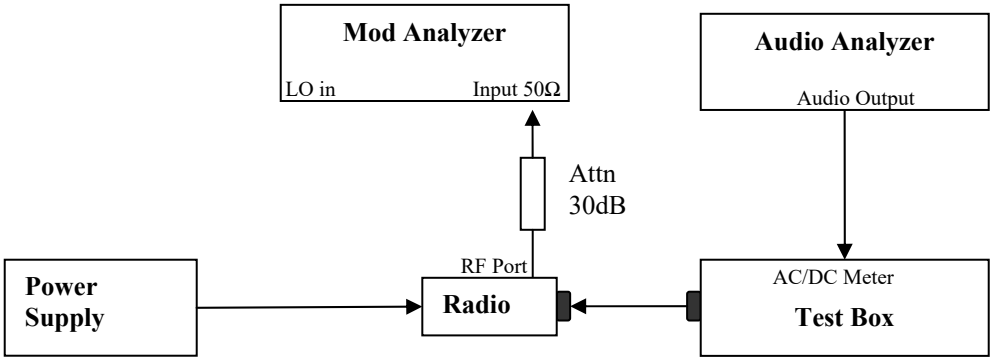
c) For equipment operating on channels between 896 MHz through 901 MHz, between 935 MHz through 940 MHz, and 12.5 or 15 kHz spaced channels in the frequency range 138-174 MHz and 406-512 MHz.

At frequencies from 3000 Hz through 20,000 Hz the attenuation shall be greater than the attenuation at 1000 Hz by at least: $100 \log_{10}(f / 3000)$ dB

where: f is the audio frequency in Hz.

6.5. Modulation Limiting

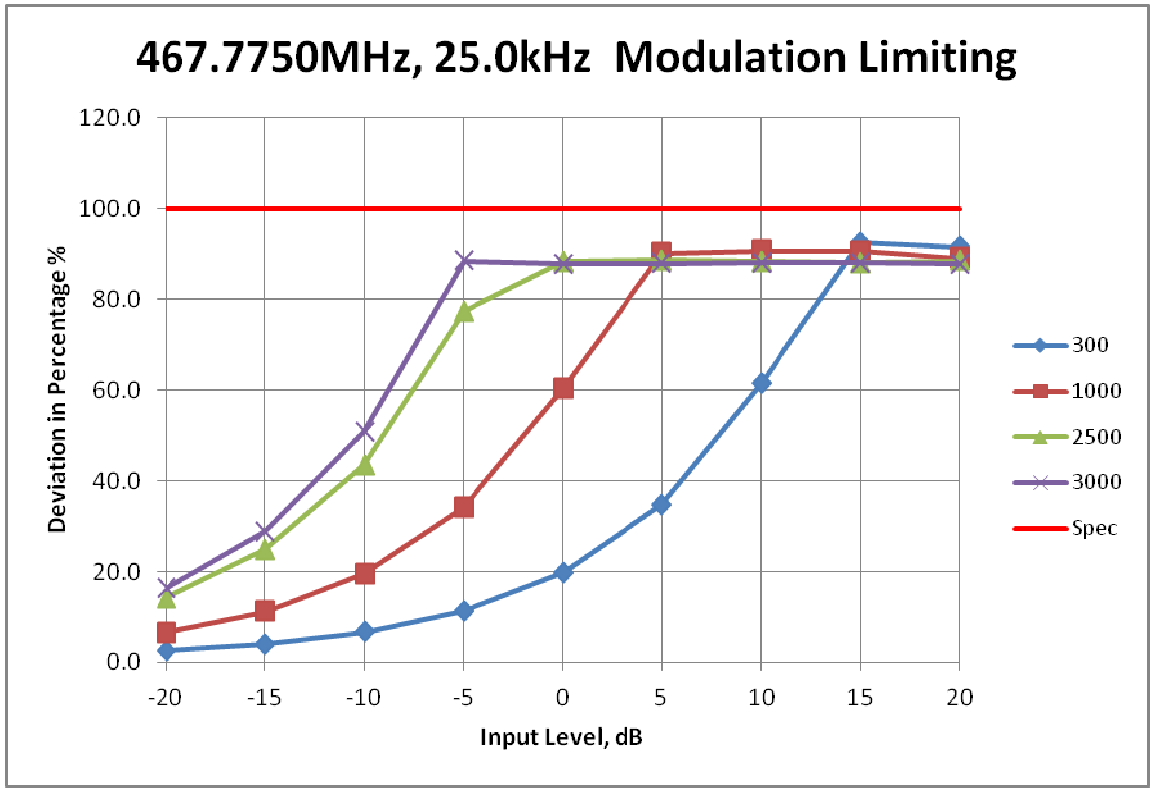
6.5.1. Test Setup

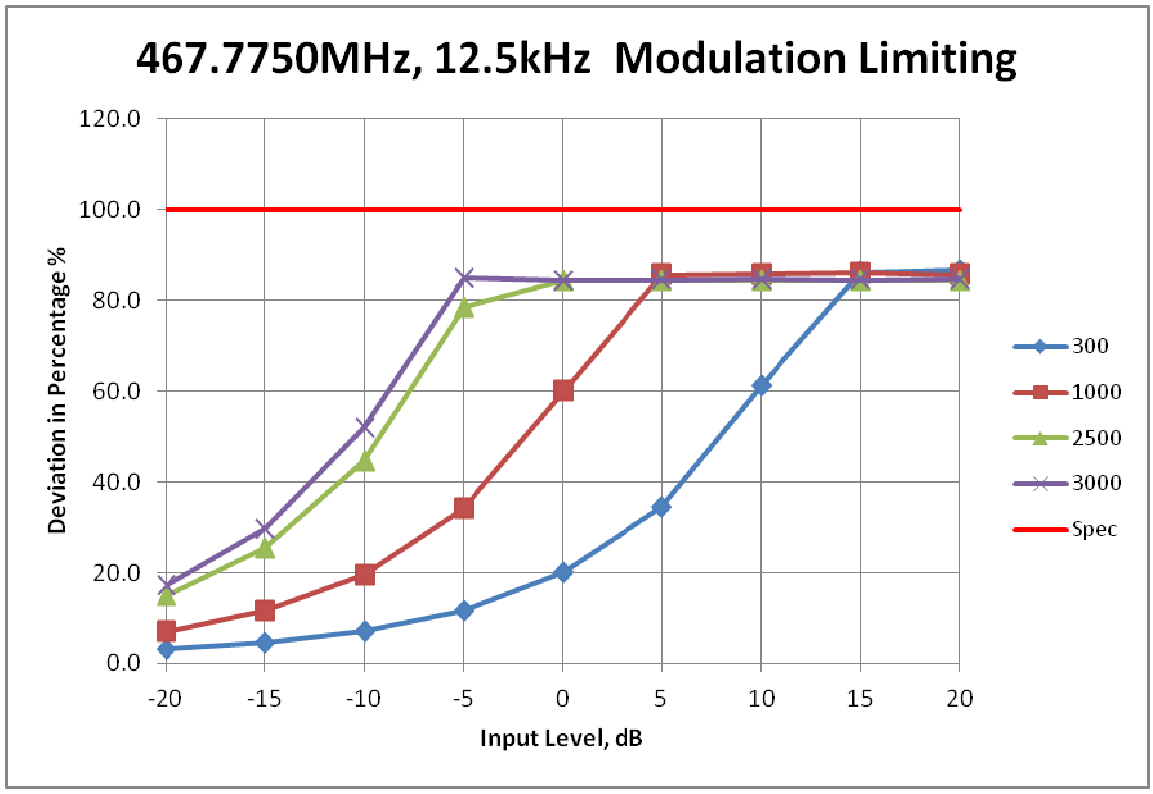


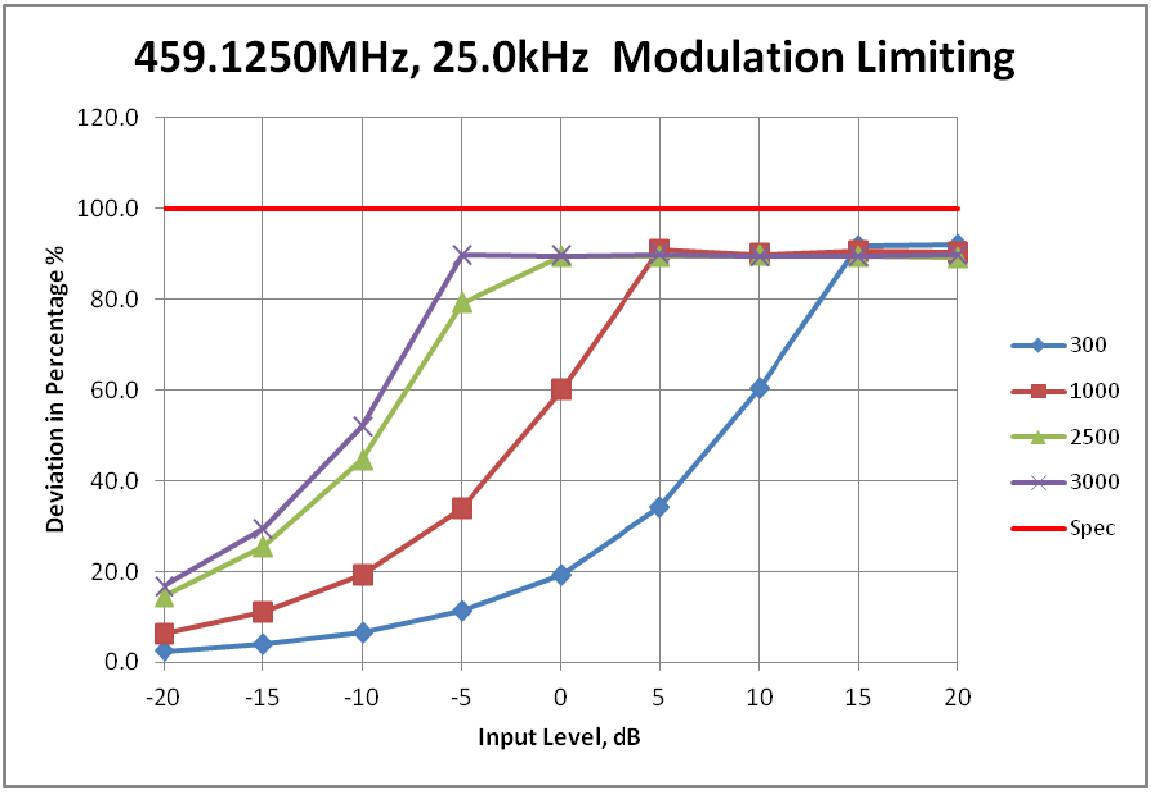
1) The DUT transmitter output port was connected to Modulation Analyzer.
2) Path loss for the measurement included.
3) Set the audio bandwidth filter to 15 kHz.
4) Transmit the radio and set the audio analyzer to 1 kHz audio frequency and 60% of the Full rated system deviation.
5) Record the frequency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

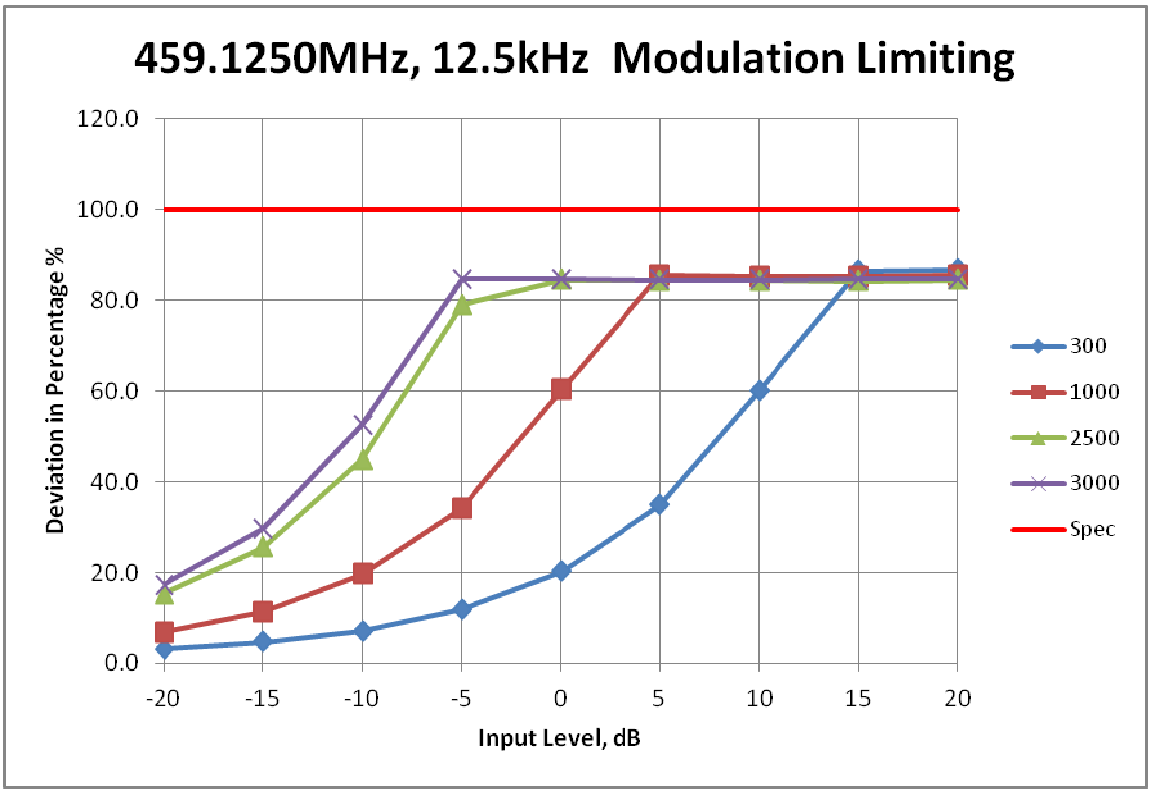
6.5.2. Test Result

Not for FCC review









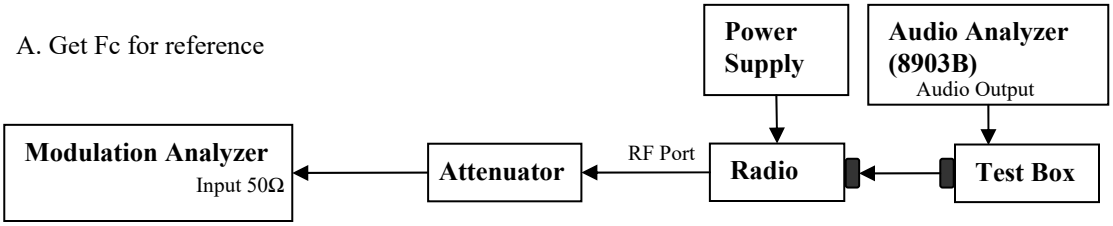
6.5.3. Test Limit

Modulation Limiting shall not exceed 100 percent.

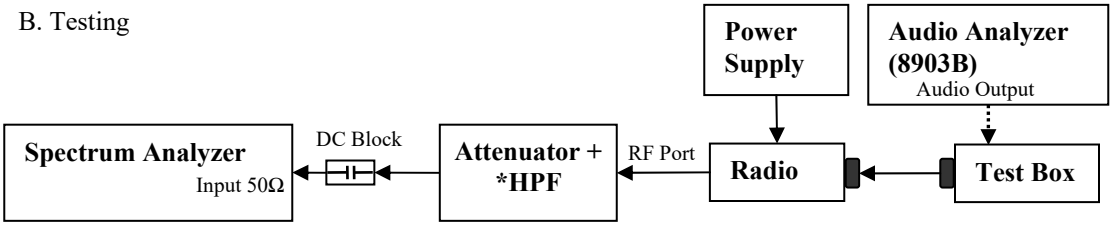
6.6. Occupied Bandwidth

6.6.1. Test Setup (Analog)

A. Get Fc for reference



B. Testing



1) The DUT transmitter output port was connected to Modulation Analyzer.
2) Set the audio bandwidth filter to 15 kHz low pass filter and 50 kHz high pass filter.
3) Transmit the radio and set the audio analyzer to 2.5 kHz audio frequency and 50% of the rated deviation. Up the amplitude by 16 dB. Dekey the DUT.
4) Path loss for the measurement included.
5) Select the Occupied Bandwidth measurement for 99% Emissions Bandwidth Measurement.
6) Key in the Fc and Resolution Bandwidth (1 ~ 5 % of emission designator).
7) Transmit the DUT and record the occupied Bandwidth frequency.
8) Preset the spectrum analyzer for sideband spectrum measurement.
9) Set the span and Resolution Bandwidth (according to FCC/ ISED standard).
10) Save the screen shot as modulated signal
11) Remove the audio tone from audio analyzer to capture unmodulated signal.

* Only HPF added for Mask 80.211 measurement with attenuator.

6.6.2. Test Result (Analog)

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 (25 kHz Channelization, Analog Voice):
Emission Designator 16K0F3E

In this case, the maximum modulating frequency is 3 kHz with a 5 kHz deviation.

BW = 2(M+D) = 2*(3 kHz + 5 kHz) = 16 kHz =➔ 16K0
F3E portion of the designator indicates voice.

Therefore, the entire designator for 25 kHz channelization analog voice is 16K0F3E

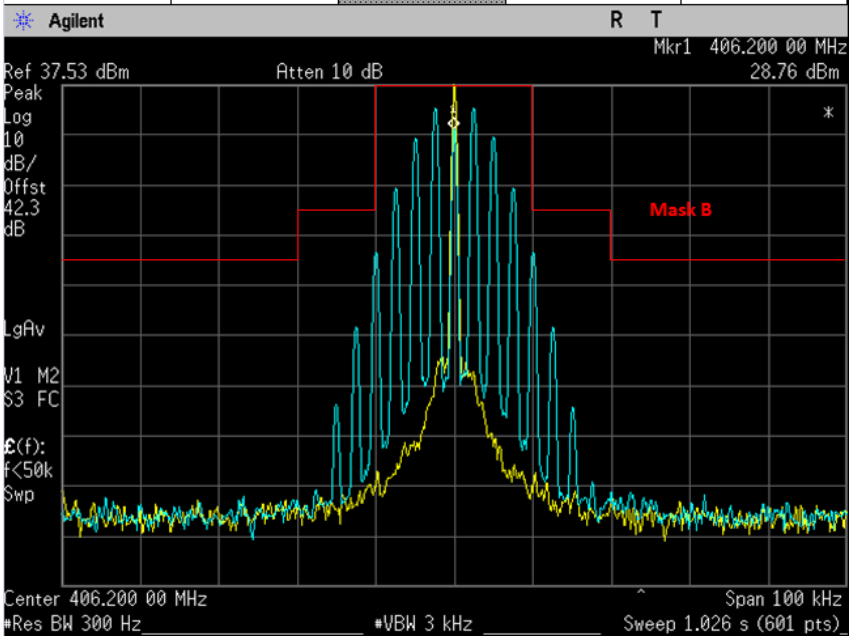
Standard Audio Modulation (12.5 kHz Channelization, Analog Voice):
Emission Designator 11K0F3E

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.

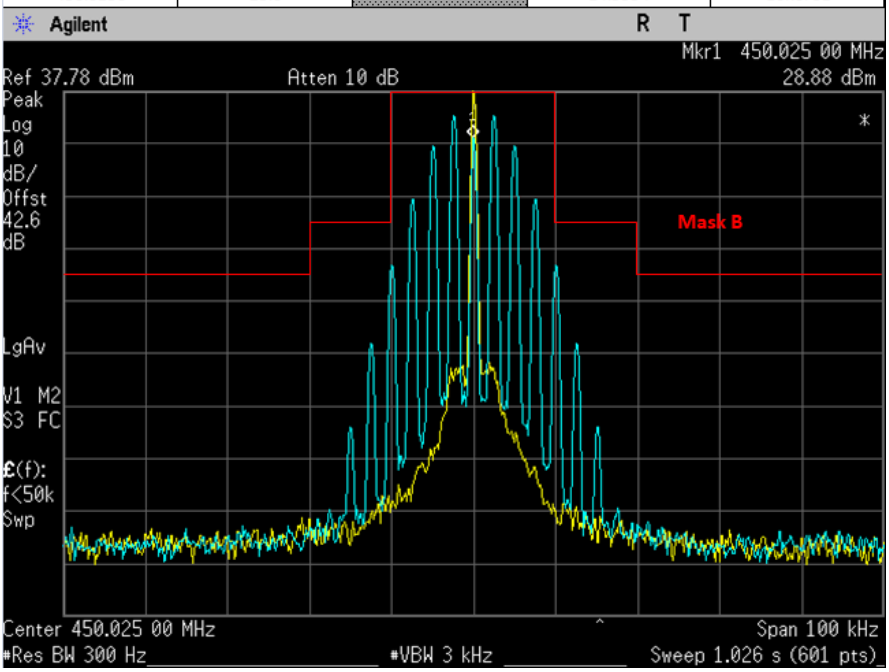
Therefore, the entire designator for 12.5 kHz channelization analog voice is 11K0F3E.

Modulation			Rules Part	
Analog Voice			RSS 119	
Channel Frequency (MHz)	Channel Spacing (kHz)		99% OCB (kHz)	Emission Designator
406.2000	25.0		14.9885	16K0F3E



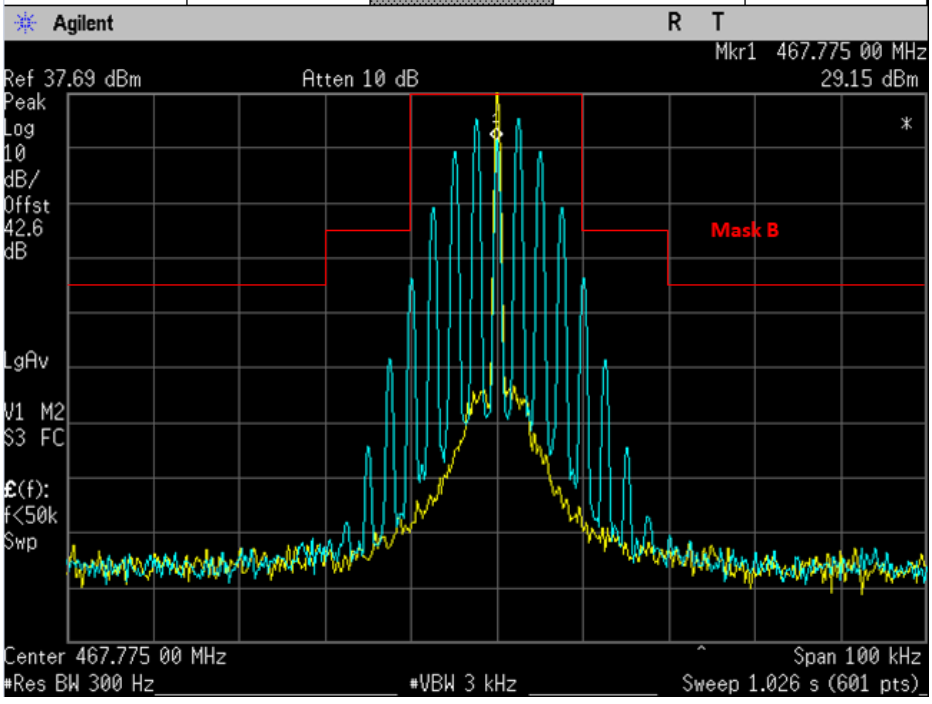
Not for FCC review

Modulation			Rules Part	
Analog Voice			74.462(c) / RSS 119	
Channel Frequency (MHz)	Channel Spacing (kHz)		99% OCB (kHz)	Emission Designator
450.0250	25.0		14.9994	16K0F3E



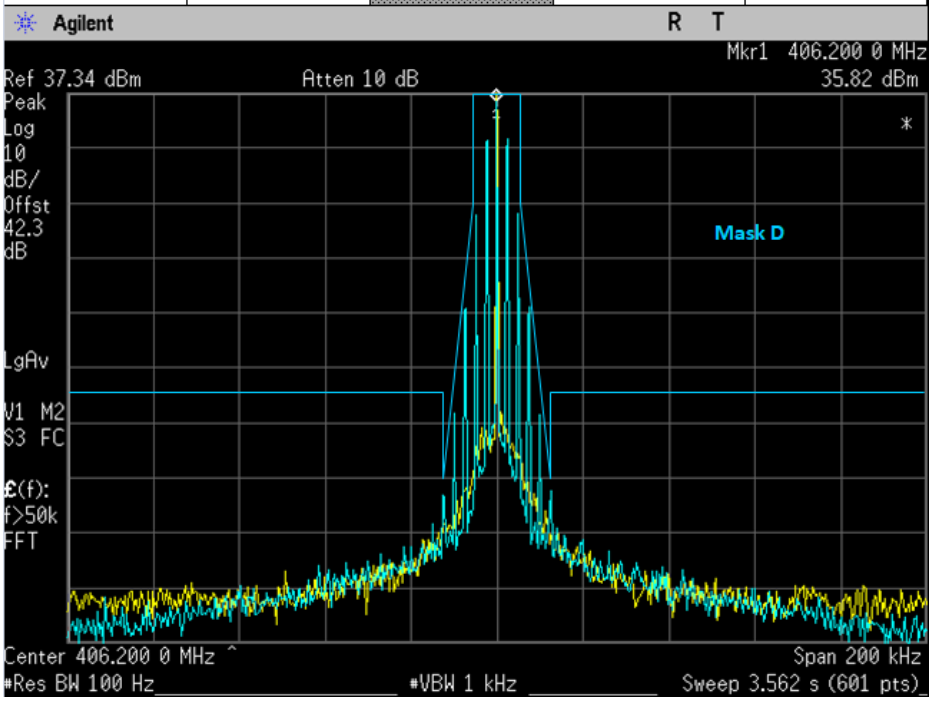
For Part 74

Modulation			Rules Part	
Analog Voice			80.211(f) / RSS 119	
Channel Frequency (MHz)	Channel Spacing (kHz)		99% OCB (kHz)	Emission Designator
467.7750	25.0		14.9701	16K0F3E

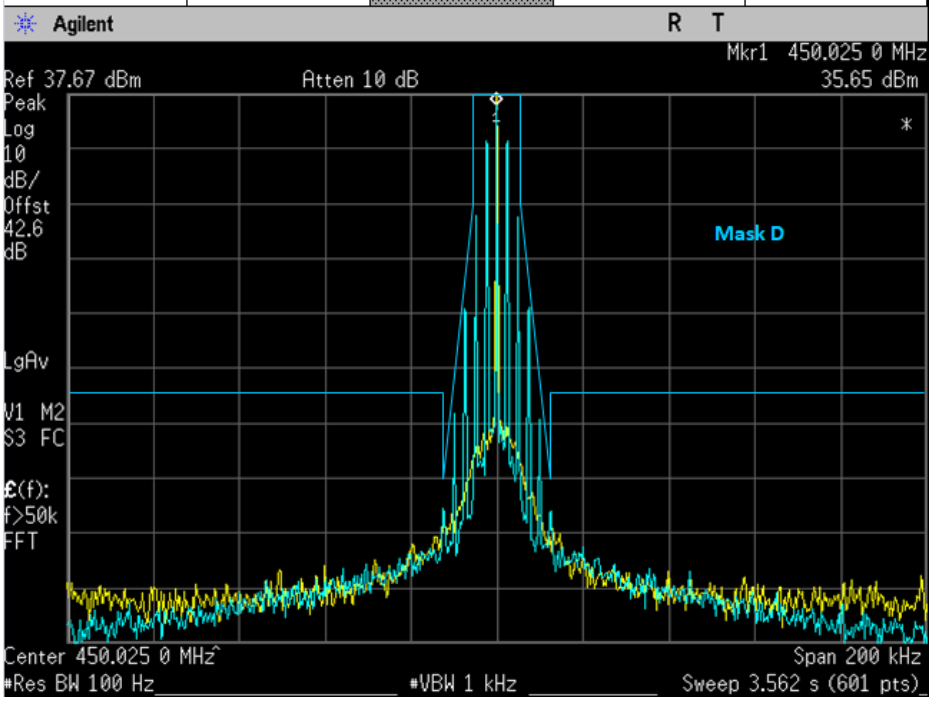


For Part 80 (NOT FOR FCC REVIEW)

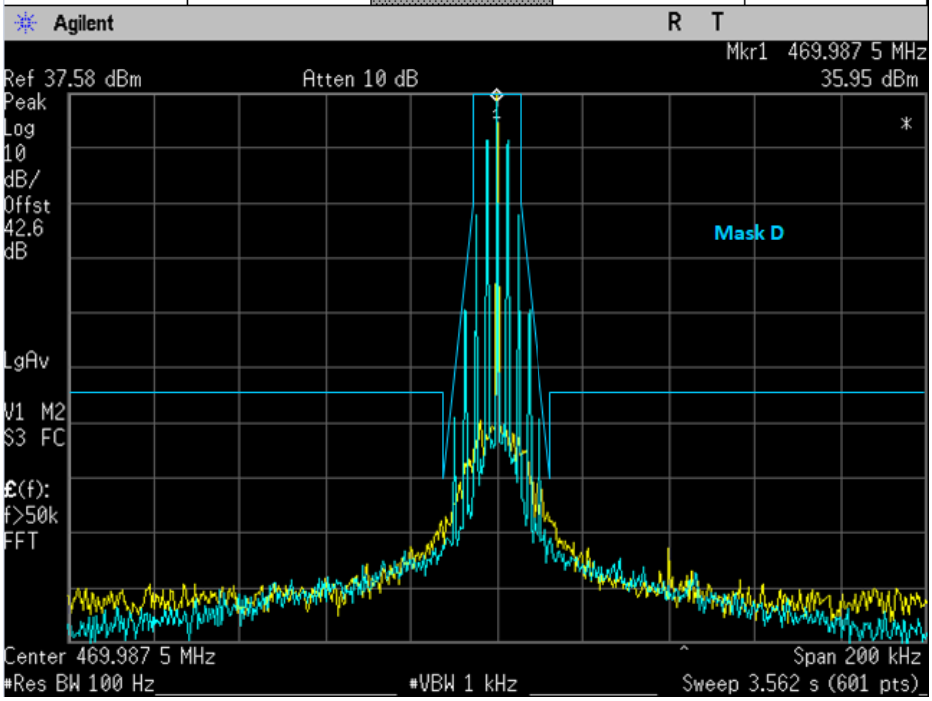
Modulation			Rules Part	
Analog Voice			90.210 / RSS 119	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
406.2000	12.5		9.8061	11K0F3E



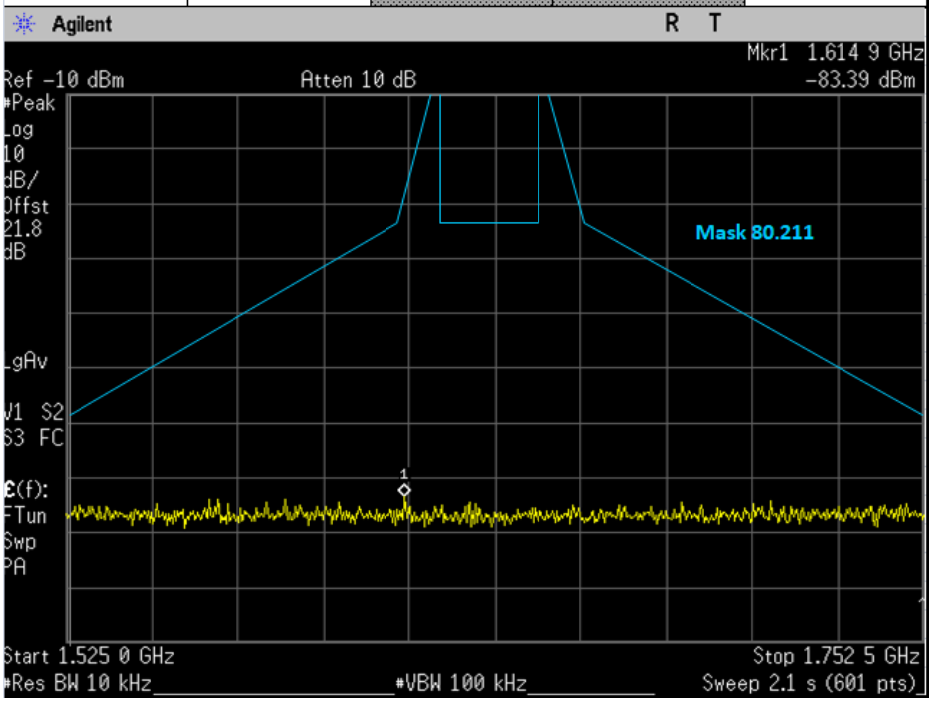
Modulation			Rules Part	
Analog Voice			90.210 / 74.462(c)	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
450.0250	12.5		9.8346	11K0F3E



Modulation	Rules Part			
Analog Voice	90.210			
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
469.9875	12.5		9.8097	11K0F3E

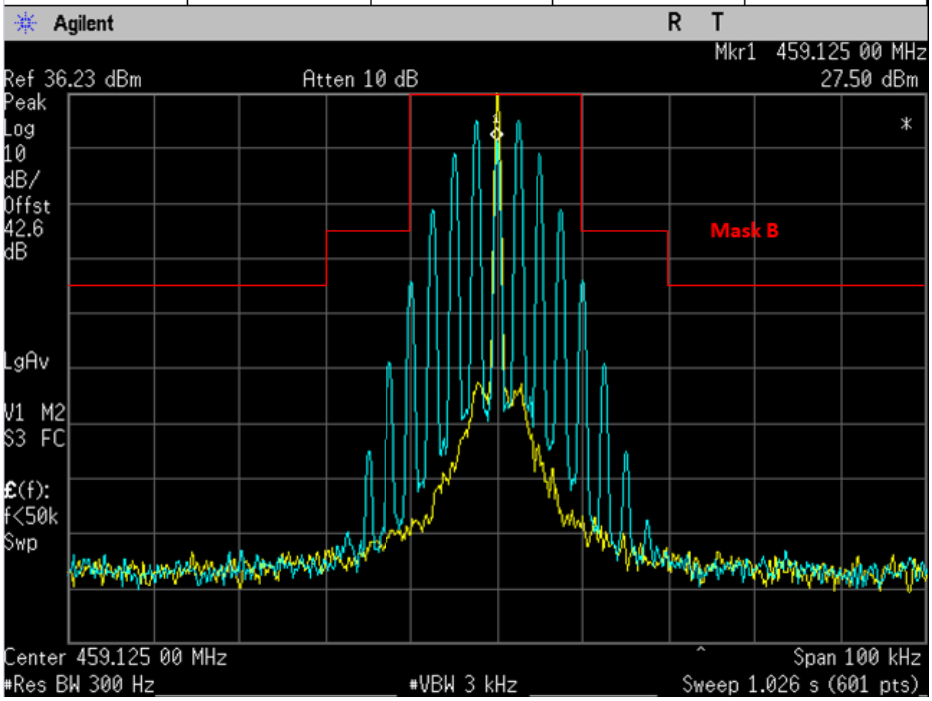


Modulation	Rules Part			
Analog Voice	80.211(c)			
Channel Frequency (MHz)	**Channel Spacing (kHz)**			**Emission Designator**
467.7750	25.0			16K0F3E

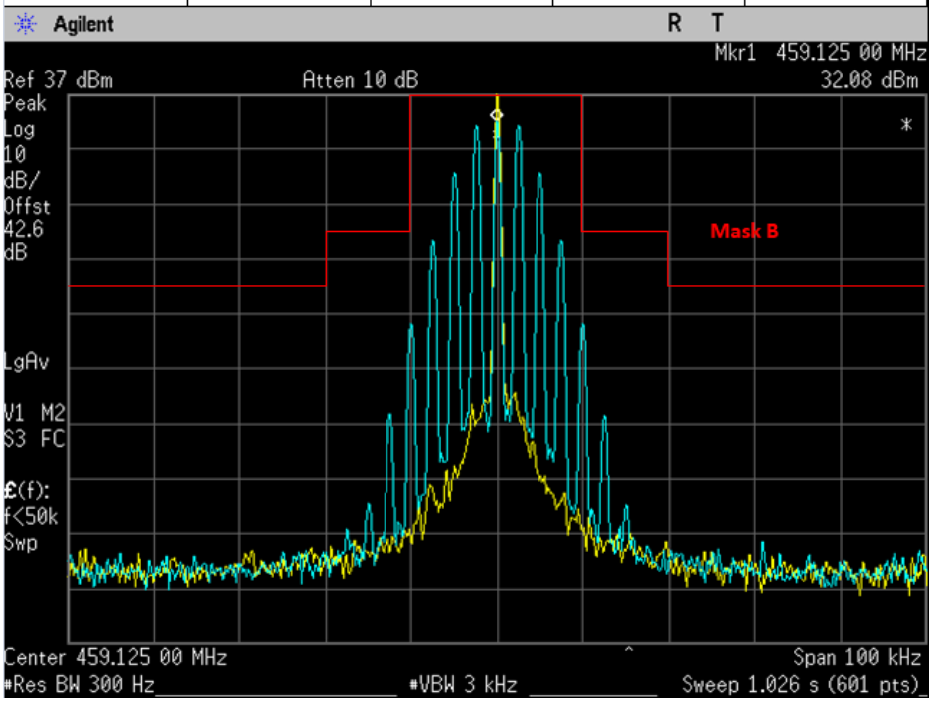


(NOT FOR FCC REVIEW)

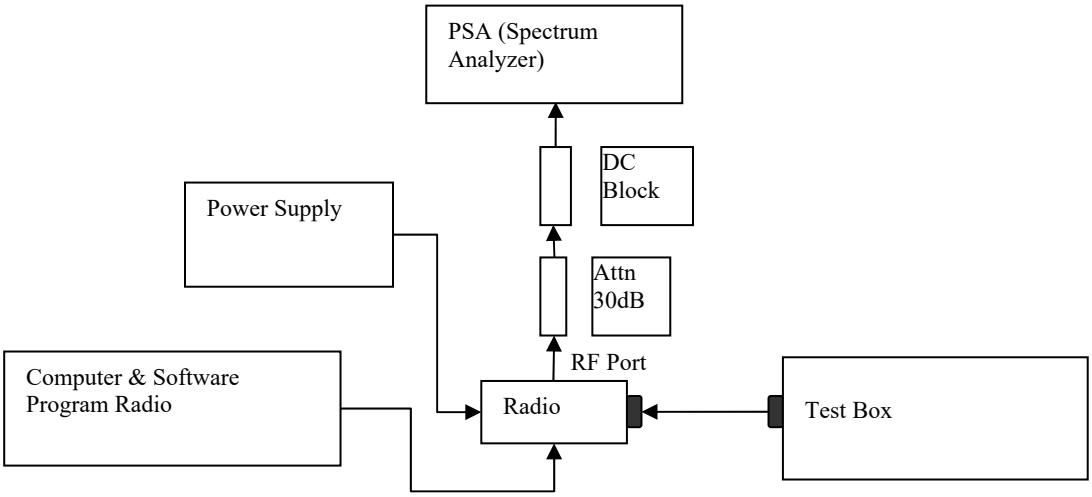
Modulation	Rules Part			
Analog Voice	22.359(b)			
Channel Frequency (MHz)	**Channel Spacing (kHz)**	**-26 dB Point (kHz)**	**99% OCB (kHz)**	**Emission Designator**
459.1250	25.0	15.5370	14.9388	16K0F3E



Modulation	Rules Part			
Analog Voice	22.359(b)			
Channel Frequency (MHz)	**Channel Spacing (kHz)**	**-26 dB Point (kHz)**	**99% OCB (kHz)**	**Emission Designator**
459.1250	20.0	15.3681	10.3563	16K0F3E



6.6.3. Test Setup (Digital)



1) Program and set radio to operate in desire test frequency and digital mode with modulation. (*4FSK, C4FM or other digital modulation form).
2) Path loss for the measurement included.
3) Select the Occupied Bandwidth measurement for 99% Emissions Bandwidth Measurement.
4) Key in the Fc and Resolution Bandwidth (1 ~ 5 % of emission designator).
5) Transmit the DUT and record the occupied Bandwidth frequency.
6) Preset the spectrum analyzer for modulation emission spectrum measurement.
7) Set the span and Resolution Bandwidth (according to FCC/ ISED standard).
8) Capture the screen shot as modulated signal.

*Note:

- For Digital Modulation, 12.5 kHz Data F1D & FXD would be the same. Therefore only measurements with F1D modulation shown below.
- For Digital Modulation, 12.5 kHz Data F1E & FXE would be the same. Therefore only measurements with F1E modulation shown below.

6.6.4. Test Result (Digital)

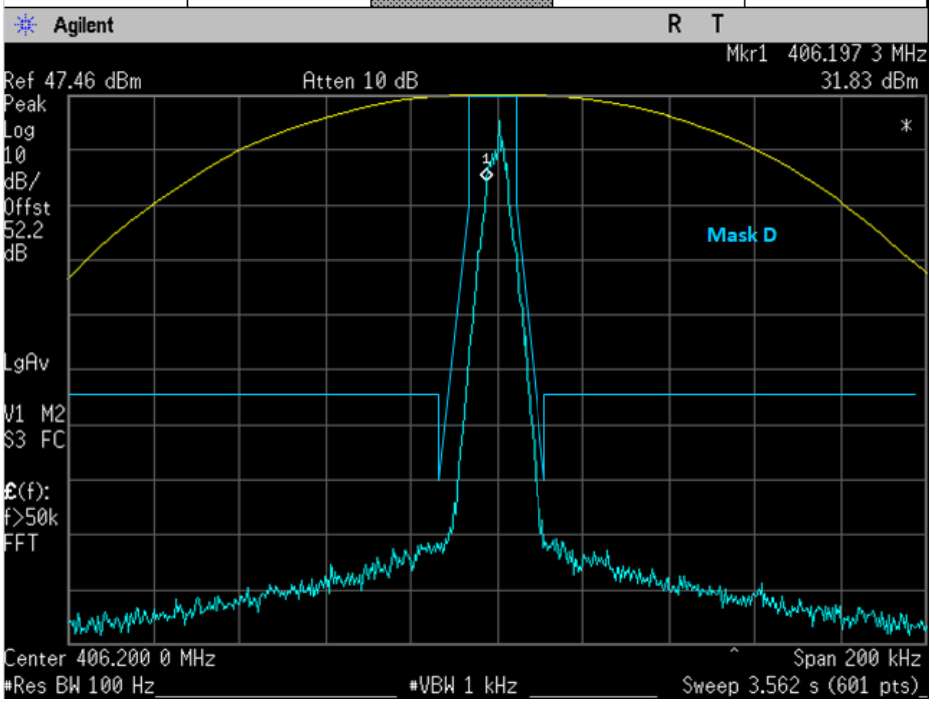
Digital (12.5 kHz Channelization, Digital Data/Voice/Data+Voice):
Emission Designator 8K10F1D/E/W

The 99% energy rule (title 47CFR 2.989) was used for digital mode and is more accurate than Carson's rule. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.60 kHz Measurements were performed in accordance with TIA/EIA TSB102.CAAB Section 2.2.5.2. The emission mask was obtained from 47CFR 90.210(d).

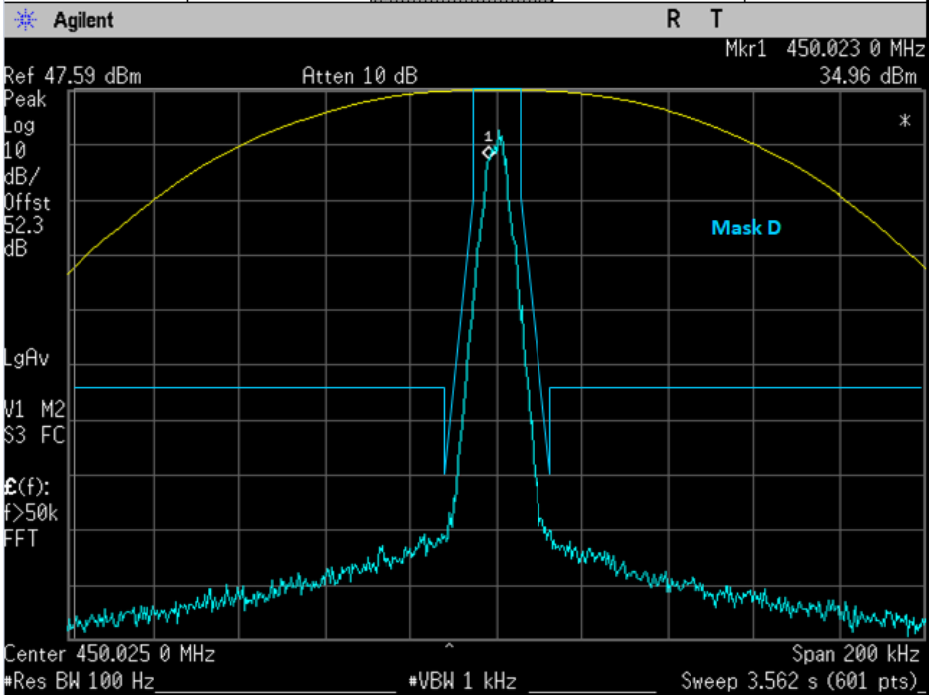
F1D/E/W portion of the designator indicates digital data/voice/data+voice respectively

Therefore, the entire designator for 12.5 kHz channelization digital data is 7K60F1D/E/W

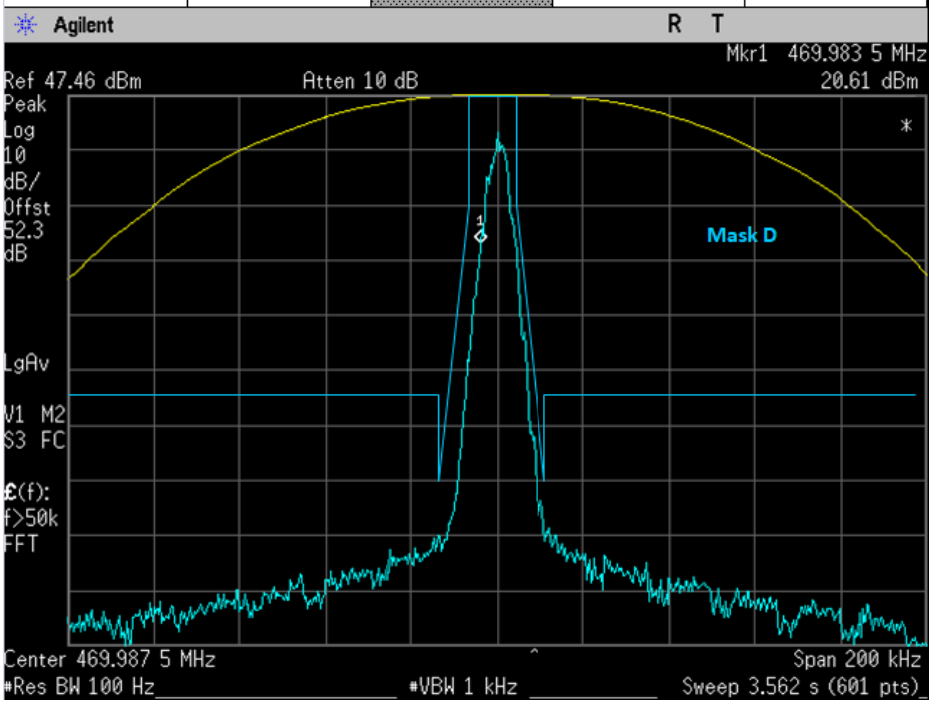
Modulation			Rules Part	
4FSK Data			90.210 / RSS 119	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
406.2000	12.5		7.4491	7K60F1D



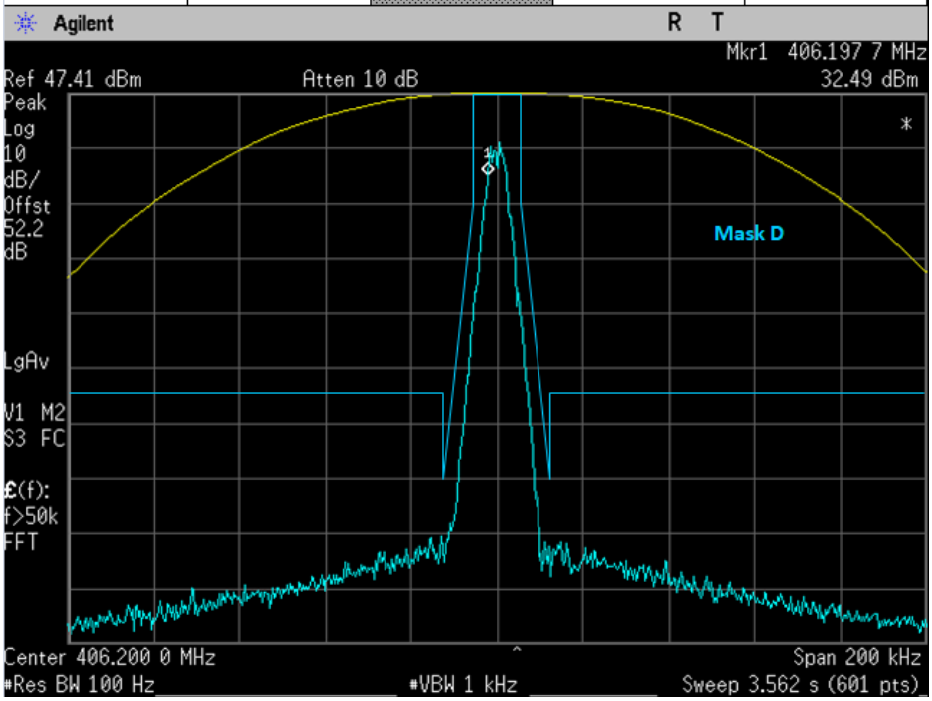
Modulation			Rules Part	
4FSK Data			90.210 / 74.462(c)	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
450.0250	12.5		7.4999	7K60F1D



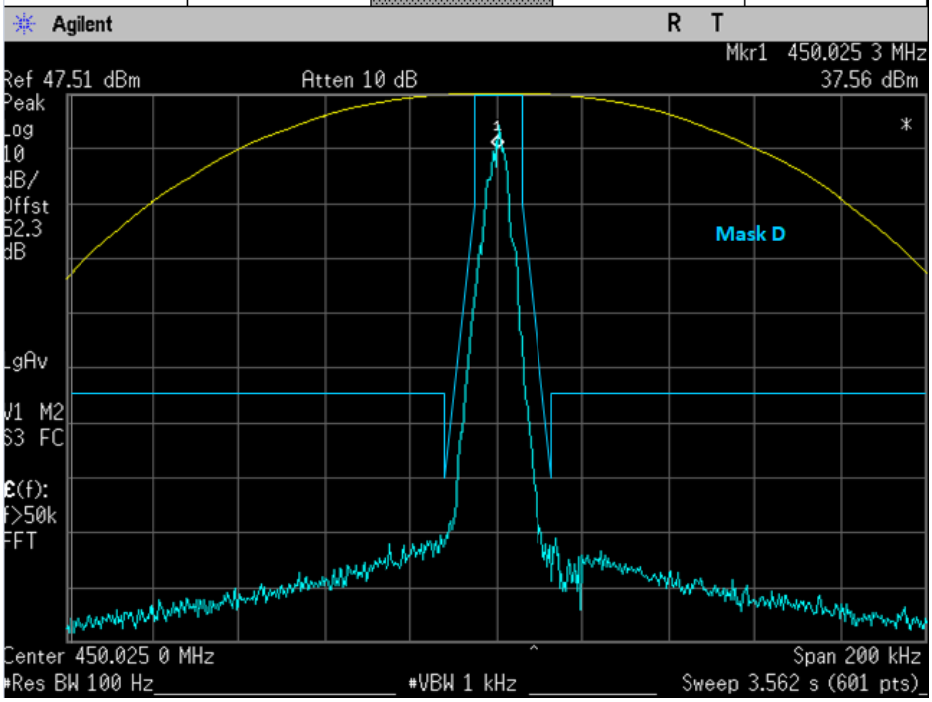
Modulation			Rules Part	
4FSK Data			90.210	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
469.9875	12.5		7.5681	7K60F1D



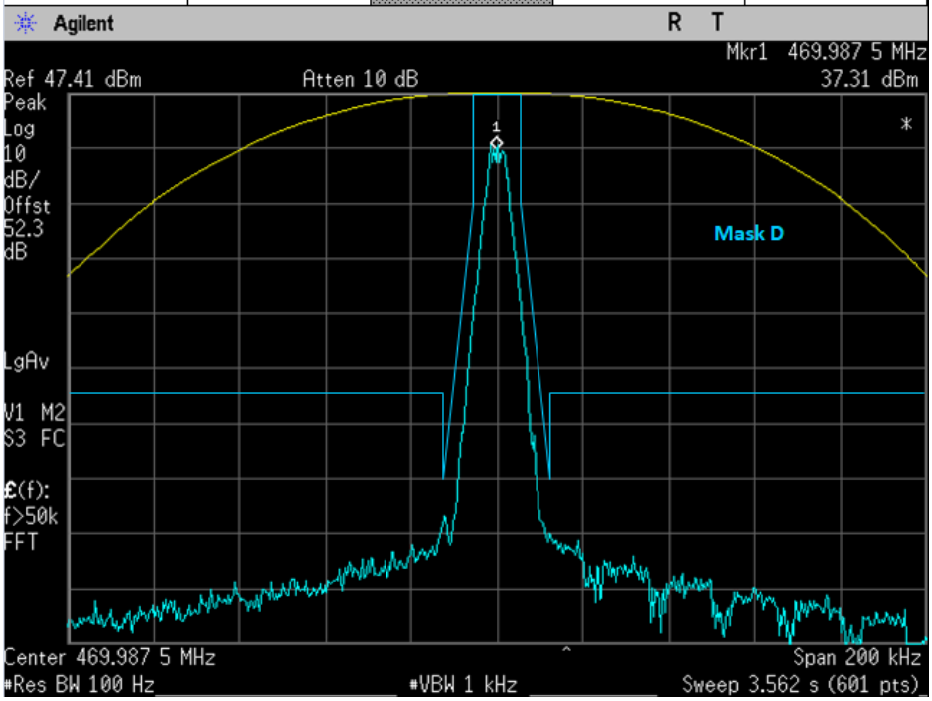
Modulation			Rules Part	
4FSK Voice			90.210 / RSS 119	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
406.2000	12.5		6.8228	7K60F1E



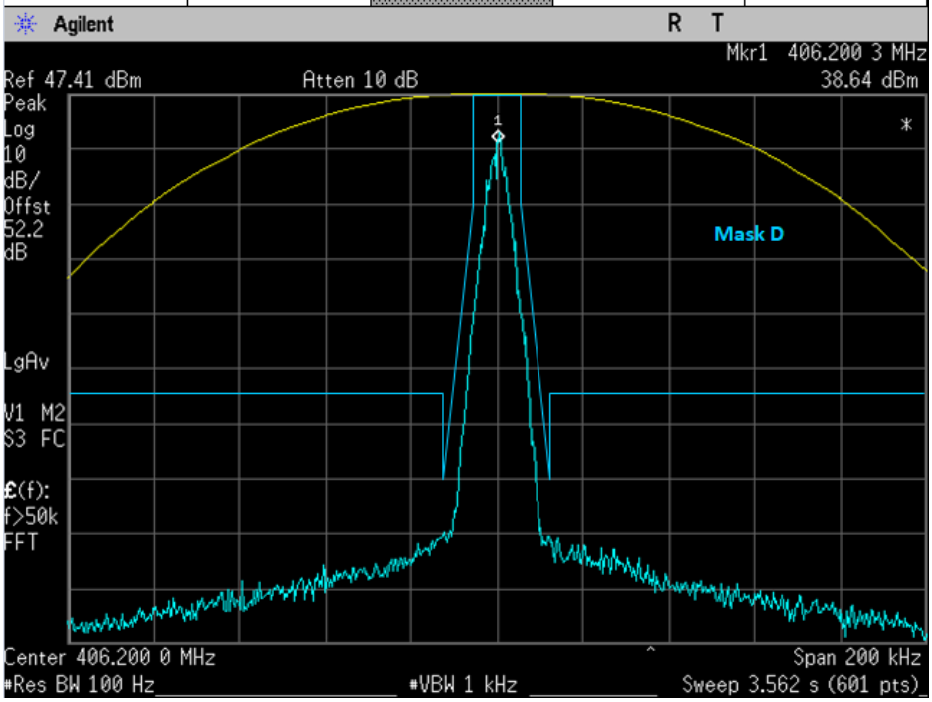
Modulation			Rules Part	
4FSK Voice			90.210 / 74.462(c)	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
450.0250	12.5		6.8032	7K60F1E



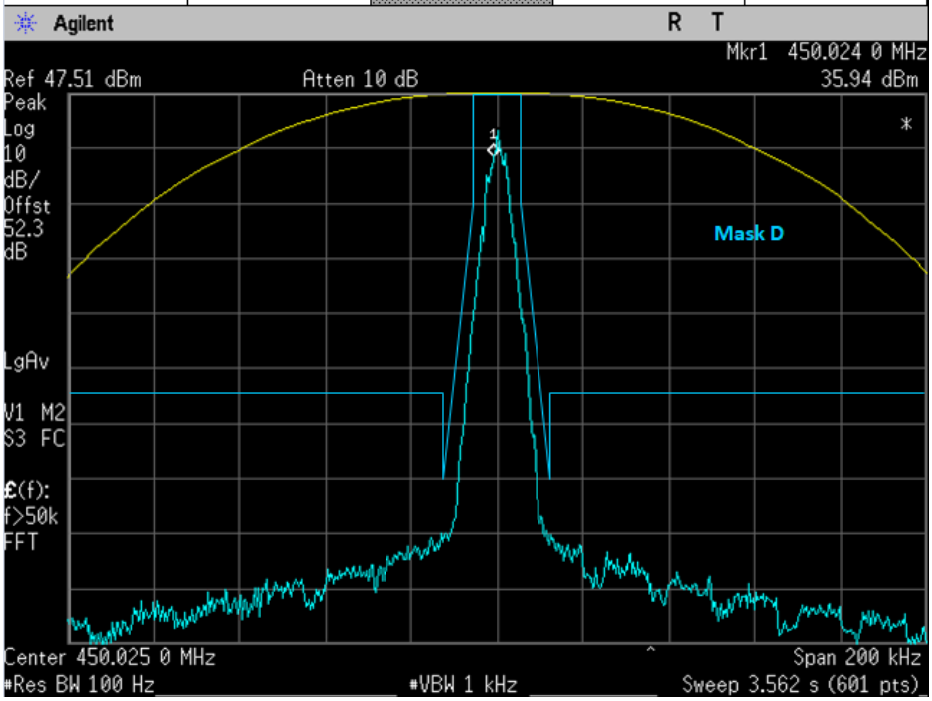
Modulation			Rules Part	
4FSK Voice			90.210	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
469.9875	12.5		7.0397	7K60F1E



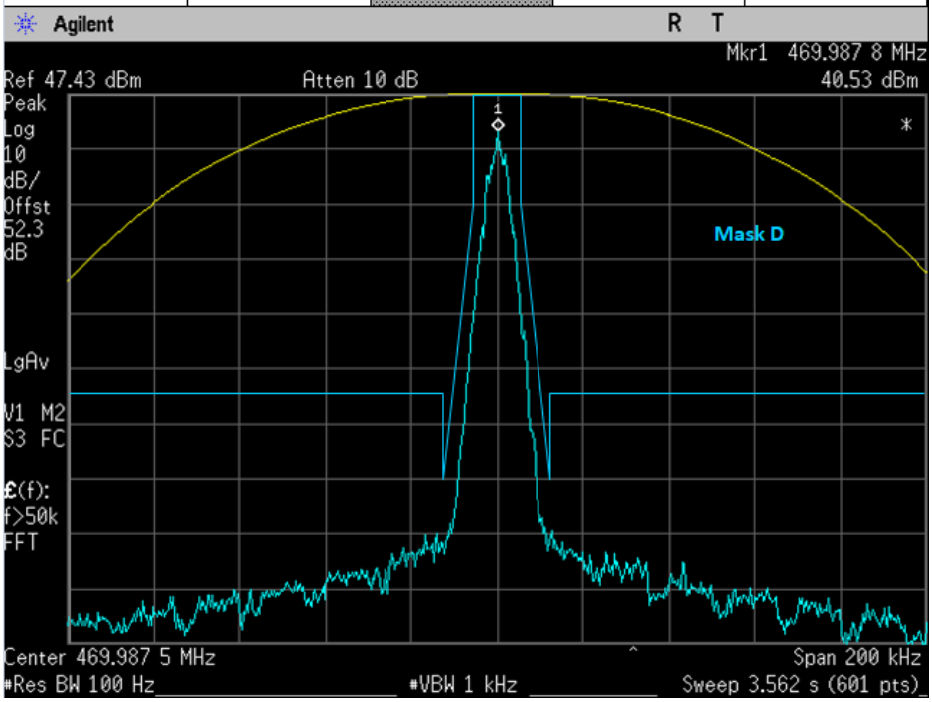
Modulation			Rules Part	
4FSK Data+Voice			90.210 / RSS 119	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
406.2000	12.5		7.3510	7K60F1W



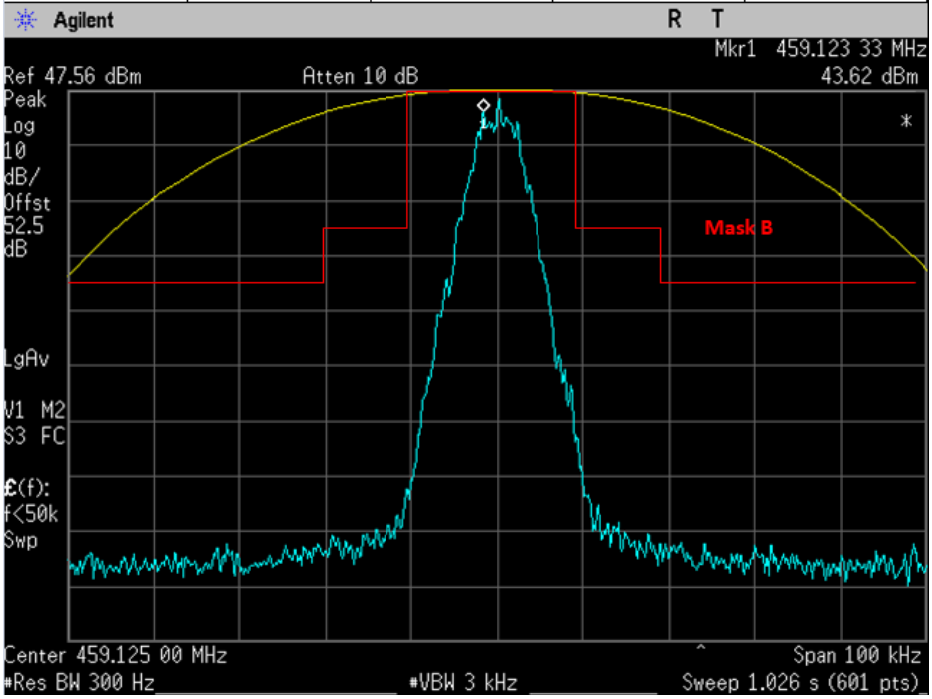
Modulation			Rules Part	
4FSK Data+Voice			90.210 / 74.462(c)	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
450.0250	12.5		7.1585	7K60F1W



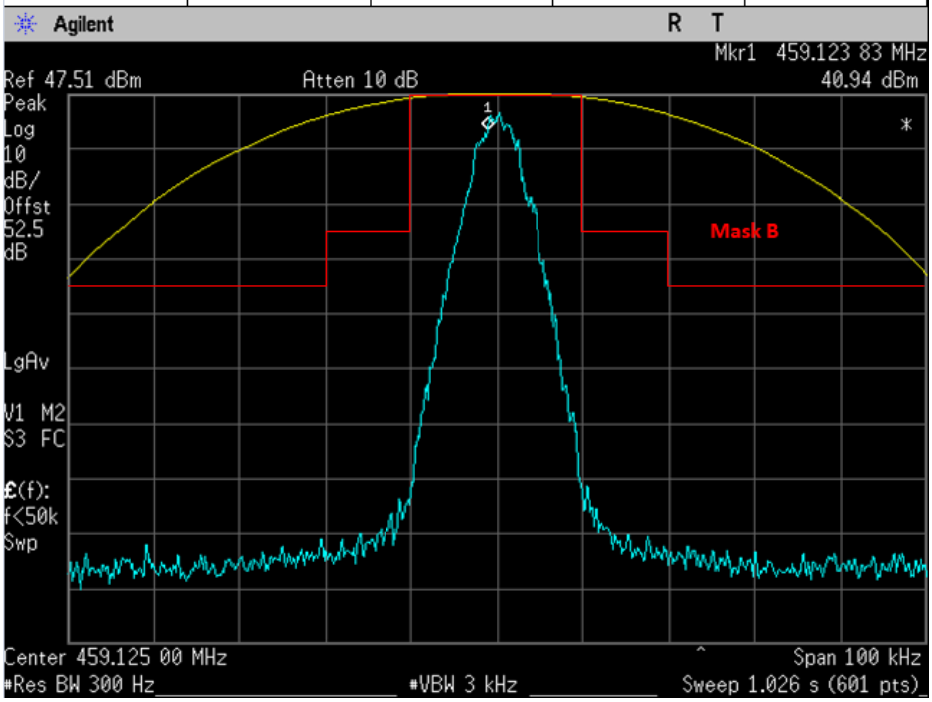
Modulation			Rules Part	
4FSK Data+Voice			90.210	
Channel Frequency (MHz)	**Channel Spacing (kHz)**		**99% OCB (kHz)**	**Emission Designator**
469.9875	12.5		7.3364	7K60F1W



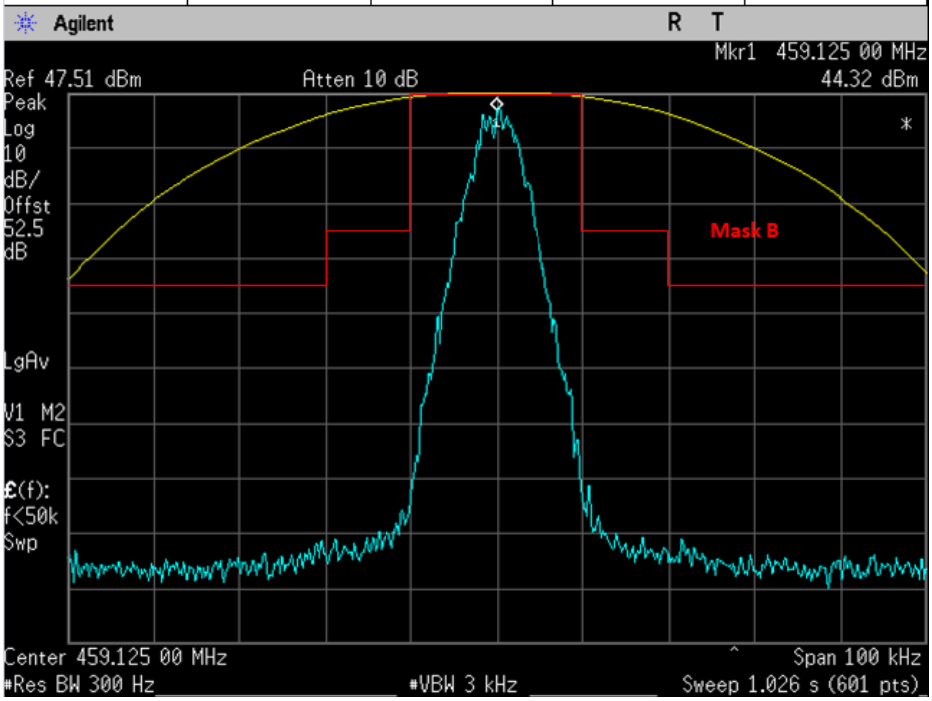
Modulation	Rules Part			
4FSK Data	22.359(b)			
Channel Frequency (MHz)	**Channel Spacing (kHz)**	**-26 dB Point (kHz)**	**99% OCB (kHz)**	**Emission Designator**
459.1250	12.5	9.1283	7.1114	7K60F1D



Modulation	Rules Part			
4FSK Voice	FCC Part 22.359(b)			
Channel Frequency (MHz)	**Channel Spacing (kHz)**	**-26 dB Point (kHz)**	**99% OCB (kHz)**	**Emission Designator**
459.1250	12.5	9.4849	7.1050	7K60F1E



Modulation		Rules Part		
4FSK Data+Voice		FCC Part 22.359(b)		
Channel Frequency (MHz)	**Channel Spacing (kHz)**	**-26 dB Point (kHz)**	**99% OCB (kHz)**	**Emission Designator**
459.1250	12.5	8.8169	7.1295	7K60F1W



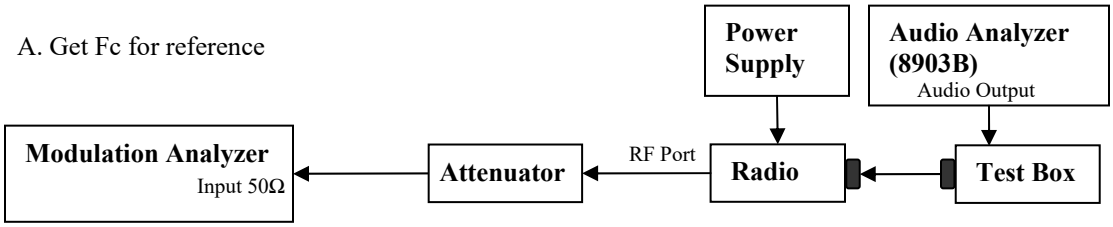
6.6.5. Test Limit

The 99% occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

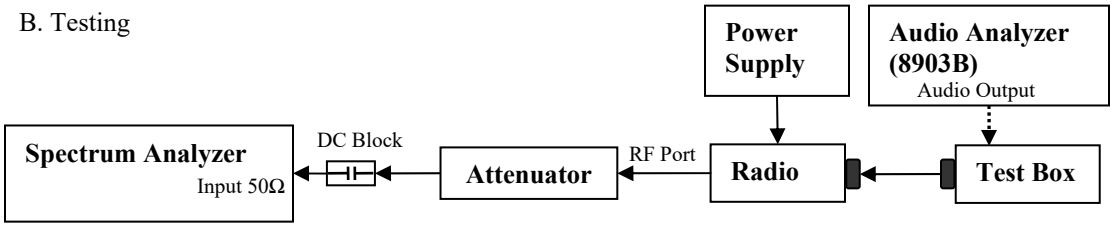
6.7. Band Edge Conducted Spurious Emission (Part 22)

6.7.1. Test Setup (Analog)

A. Get Fc for reference



B. Testing



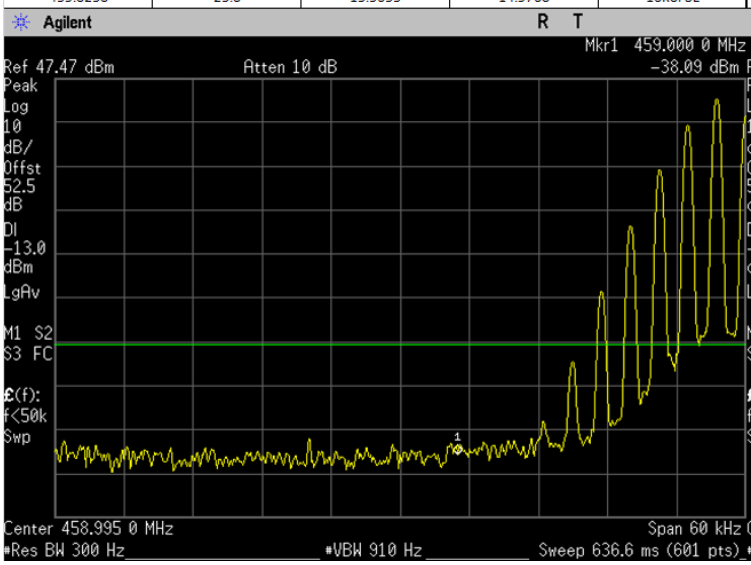
2) The DUT transmitter output port was connected to Modulation Analyzer.
3) Set the audio bandwidth filter to 15 kHz low pass filter and 50 kHz high pass filter.
4) Transmit the radio and set the audio analyzer to 2.5 kHz audio frequency and 50% of the rated deviation. Up the amplitude by 16 dB. Dekey the DUT.
5) Path loss for the measurement included.
6) Select the Occupied Bandwidth measurement for 99% and 26dB Emissions Bandwidth Measurement.
7) Key in the Fc and Resolution Bandwidth.
8) Transmit the DUT and record the occupied Bandwidth frequencies.
9) Preset the spectrum analyzer for band edge measurement.
10) The band edges of lowest and highest channels were measured.
11) Key in the Lowest and highest channel frequency, span is 60 kHz and Resolution Bandwidth is at least 1% of Emission Bandwidth.
12) Save the screen shot as modulated signal.
13) Remove the audio tone from audio analyzer to capture unmodulated signal.

*Note:
- For emission designator ending with F3E, 16K0F3E is the worst case and therefore only 16K0F3E will be shown.

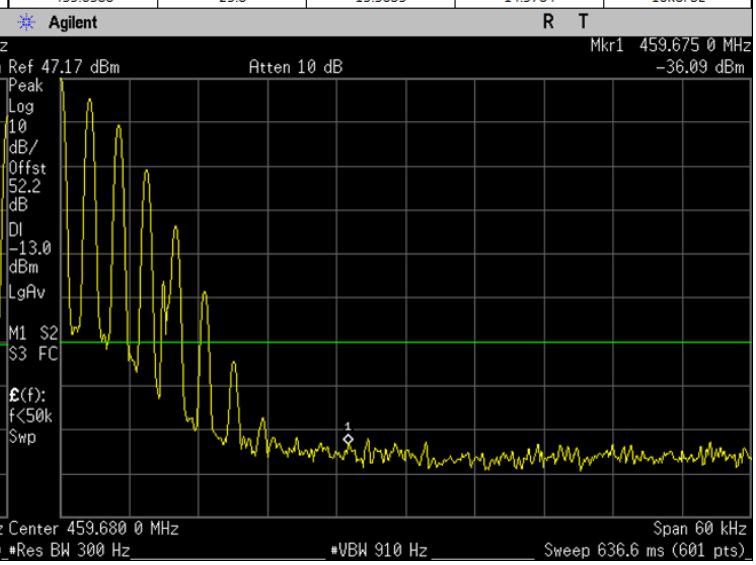
6.7.2. Test Result (Analog)

MAX POWER

Modulation	Rules Part			
Analog Voice	FCC Part 22.359(b)			
Channel Frequency	**Channel Spacing**	**-26 dB Point (kHz)**	**99% OCB**	**Emission Designator**
459.0250	25.0	15.5655	14.9760	16K0F3E

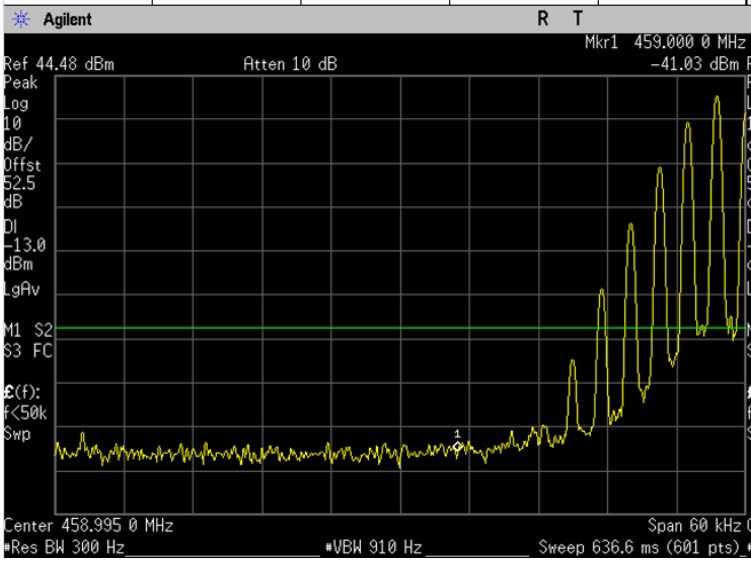


Modulation	Rules Part			
Analog Voice	FCC Part 22.359(b)			
Channel Frequency	**Channel Spacing**	**-26 dB Point (kHz)**	**99% OCB**	**Emission Designator**
459.6500	25.0	15.5635	14.9704	16K0F3E

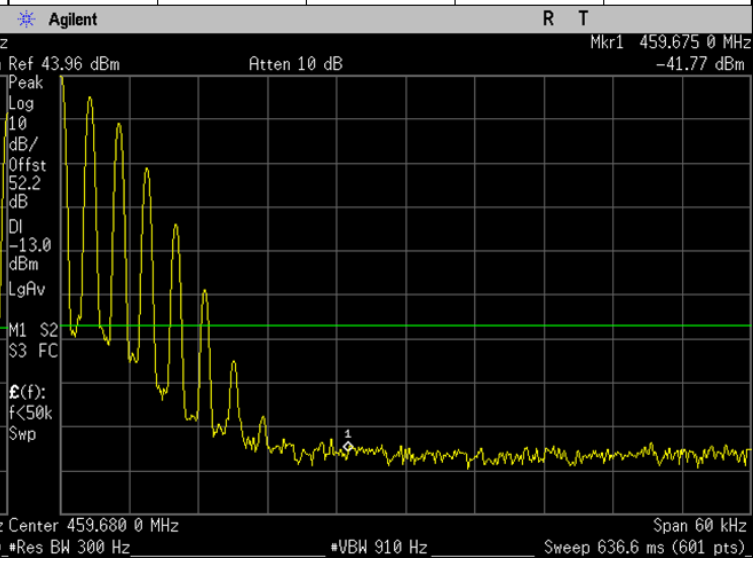


LOW POWER

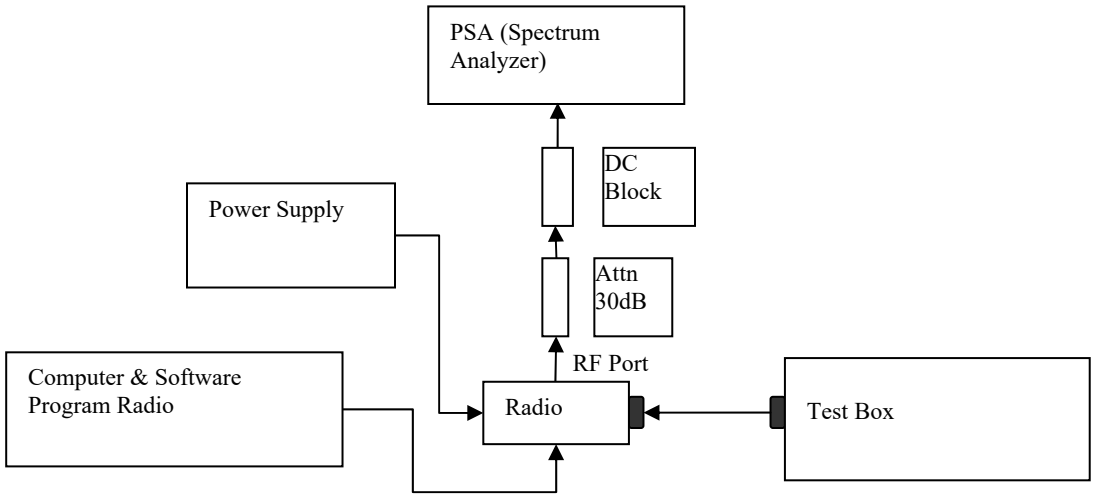
Modulation	Rules Part			
Analog Voice	FCC Part 22.359(b)			
Channel Frequency	**Channel Spacing**	**-26 dB Point (kHz)**	**99% OCB**	**Emission Designator**
459.0250	25.0	15.5582	14.9663	16K0F3E



Modulation	Rules Part			
Analog Voice	FCC Part 22.359(b)			
Channel Frequency	**Channel Spacing**	**-26 dB Point (kHz)**	**99% OCB**	**Emission Designator**
459.6500	25.0	15.5577	14.9625	16K0F3E



6.7.3. Test Setup (Digital)



1) Program and set radio to operate in desire test frequency and digital mode with modulation. (*4FSK, C4FM or other digital modulation form).
2) Path loss for the measurement included.
3) Select the Occupied Bandwidth measurement for 99% and 26dB Emissions Bandwidth Measurement.
4) Key in the Fc and Resolution Bandwidth.
5) Transmit radio record the occupied Bandwidth frequencies.
6) Preset the spectrum analyzer for band edge measurement.
7) Key in the lowest and highest channels frequency, span is 60 kHz and Resolution Bandwidth is at least 1% of Emission Bandwidth.
8) Save the screen shot.

*Note:

- For Digital Modulation, 12.5 kHz Data F1D & FXD would be the same. Therefore only measurements with F1D modulation shown below.
- For Digital Modulation, 12.5 kHz Data F1E & FXE would be the same. Therefore only measurements with F1E modulation shown below.