

	    <p>CERTIFICATE 2518.08</p> <p>MS ISO/IEC 17025 TESTING SAMM NO. 0825</p>
<p><b>MOTOROLA PENANG ADV. COMM. LABORATORY</b> Motorola Solutions Malaysia SDN BHD, Plot 2A, Medan Bayan Lepas, Mukim 12 S.W.D, 11900 Bayan Lepas, Penang, Malaysia.</p>	<p><b>FCC/ISED TEST REPORT</b> <b>Report Revision : Rev.C</b></p>
<p><b>Date/s Tested</b> : 30-NOV-2021 - 10-JAN-2022 <b>Report Issue Date</b> : 18-MAR-2022 <b>Manufacturer</b> : Motorola Solutions Malaysia SDN BHD <b>Manufacturer Address</b> : Plot 2A, Medan Bayan Lepas, Mukim 12 SWD, 11900 Bayan Lepas, Penang, Malaysia <b>Requestor</b> : HERI NIEVES <b>Product Type</b> : Mobile <b>Product Version (PMN)</b> : APX8500 <b>Model Number (HVIN)</b> : M37TSS9PW1AN <b>Frequency Band</b> : 136-174MHz <b>Max RF Output Power</b> : 60 Watts <b>Applicant Name</b> : Motorola Solutions Inc <b>Applicant Address</b> : 8000 West Sunrise Boulevard, Fort Lauderdale, Florida 33322 <b>ISED Registrations</b> : MY0001 <b>FCC Registrations</b> : 461337 <b>Firmware Version (FVIN)</b> : D26.50.06</p> <p><b>The equipment was tested accordance to the requirement listed below:</b></p> <p><b>(LMR)</b> <b>FCC 47 CFR Part 2/ 22 / 74 / 80 / 90</b> <b>PASS</b> <b>ISED RSS- Gen Issue 5 / 119 Issue 12 / 182 Issue 6</b></p>	
<p>This report shall not be reproduced without written approval from an officially designated representative of the Motorola Penang Adv. Comm. Laboratory. The results and statements contained in this report pertain only to the device(s) evaluated.</p>	
<p>Prepared By:</p>  <hr/> <p><b>Nuraini Binti Ismail</b> <b>Test Personnel</b></p>	<p>Approved Signatory:</p>  <hr/> <p><b>Soon Oi May</b> <b>Responsible Engineer</b></p>

# 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.....	17
6.4. Audio Low Pass Filter Response.....	18
6.4.1. Test Setup.....	18
6.4.2. Test Result.....	19
6.4.3. Test Limit.....	20
6.5. Modulation Limiting .....	21
6.5.1. Test Setup.....	21
6.5.2. Test Result.....	22
6.5.3. Test Limit.....	22
6.6. Occupied Bandwidth .....	23
6.6.1. Test Setup (Analog) .....	23
6.6.2. Test Result (Analog) .....	24
6.6.3. Test Setup (Digital).....	31
6.6.4. Test Result (Digital).....	32
6.6.5. Test Limit.....	43
6.7. Band Edge Conducted Spurious Emission (Part 22).....	44
6.7.1. Test Setup (Analog) .....	44
6.7.2. Test Result (Analog) .....	45
6.7.3. Test Setup (Digital).....	46
6.7.4. Test Result (Digital).....	47
6.7.1. Test Limit.....	48
6.8. Transient Frequency Behavior .....	49
6.8.1. Test Setup.....	49
6.8.2. Test Result.....	50
6.8.3. Test Limit.....	52

6.9. Adjacent Channel Power .....53

6.9.1. Test Setup (Analog) .....53

6.9.2. Test Result .....53

Not Applicable .....53

6.9.3. Test Setup (Digital) .....54

6.9.4. Test Result .....54

Not Applicable .....54

6.9.5. Test Limit .....55

6.10. Conducted Spurious Emission .....57

6.10.1. Test Setup .....57

6.10.2. Test Result (Analog) .....58

6.10.1. Test Result (Digital) .....66

6.10.2. Test Limit .....82

6.11. Radiated Spurious Emission .....83

6.11.1. Test Setup .....83

6.11.2. Test Result (Analog) .....84

6.11.3. Test Result (Digital) .....92

6.11.4. Test Limit .....108

6.12. Effective Radiated Power (ERP) .....109

6.12.1. Test Setup .....109

6.12.2. Test Result .....110

Not Applicable .....110

6.12.3. Test Limit .....110

6.13. GNSS (EIRP for 1559 - 1610MHz) .....111

6.13.1. Test Setup .....111

6.13.1. Test Result .....112

Not Applicable .....112

6.13.2. Test Limit .....112

**Report Revision History**

<b>Revision History</b>	<b>Description</b>	<b>Date</b>	<b>Originator</b>
Rev. A	Initial Report	31-Jan-2022	Nuraini
Rev. B	Remove rules part 24 from cover page	23-Mar-2022	Nuraini
Rev. C	Remove 8K10FXD, 8K10FXE in summary table	23-Mar-2022	Nuraini

## 1.0 General Information

### EUT Description:

<b>Technologies</b>	Land Mobile Radio (LMR)
<b>Modulation Type</b>	Analog, C4FM, Phase II

The EUT contains following accessory devices and data cable:

<b>Item</b>	<b>Brand</b>	<b>Model or P/N</b>
2.4/5 GHz Wi-Fi/BT and GNSS BT/WiFi Antenna BT/WiFi/GPS Antenna	MOTOROLA	AN000163A01
O7 Control Head (English)	MOTOROLA	PMHN4194C
Audio (PTT)	MOTOROLA	HMN4079G

### 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 C63.26-2015

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

### 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 General Rules Part (47CFR)	ISED General Rules Part	Test Item	Result	Remarks	Serial number tested
2.1046, 22.565, 74.461, 74.534, 80.215	RSS-Gen, RSS-119, RSS 182	RF Power Output	Pass		681TXT7208
2.1055, 90.213 22.355, 74.464, 74.561	-	Frequency Stability	Pass		681TXT7208
2.1047, 74.493, 80.213	RSS-Gen, RSS-119	Audio Frequency Response	Pass		681TXT7208
2.1047, 74.463, 80.213	RSS-Gen, RSS-119	Audio Low Pass Filter Response	Pass		681TXT7208
2.1047, 74.463, 80.213	RSS-Gen, RSS-119	Modulation limiting	Pass		681TXT7208
2.1049, 90.210, 22.359, 74.462, 74.535, 80.211(c), 80.211(f)	RSS-Gen, RSS-119, RSS 182	Occupied Bandwidth	Pass	16K0F3E- 15.0453kHz 11K0F3E- 9.9834kHz 20K0F1E-12.1378kHz 8K10F1D -7.9101kHz 8K10F1E - 8.0643kHz 8K10F1W - 8.0555kHz	681TXT7208
2.1051, 22.359 (a), (b)	RSS-119	Band Edge Conducted Spurious Emission	Pass		681TXT7208
90.214	-	Transient Frequency Behavior	Pass		681TXT7208
-	-	Adjacent Channel Power	NA		
2.1051, 22.359, 74.462(c), 80.211(c), 90.210	RSS-Gen, RSS-119, RSS 182	Conducted Spurious Emissions	Pass	Worst case emission- -29.17dBm	681TXT7208
2.1051, 22.359, 74.462(c), 80.211(c), 90.210	RSS-Gen, RSS-119, RSS 182	Radiated Spurious Emission	Pass	Worst case emission- -52.44dBm	681TXT7177, G0P0UX0X3C
-	-	GNSS (EIRP for 1559 – 1610MHz)	NA		
-	-	Effective Radiated Power (ERP)	NA		

NA → Not Applicable

### 3.0 Measurement Uncertainty

Measurement	Frequency	Expanded Uncertainty (k=1.96) (±)
AC Power Line Conducted Spurious Emission	150KHz ~ 30MHz	3.48 dB
Radiated Emissions up to 1 GHz dB $\mu$ V/m (Field Strength)	30MHz ~ 1000MHz	5.88 dB
Radiated Emissions above 1 GHz dB $\mu$ V/m (Field Strength)	1GHz ~ 18GHz	5.84 dB
	18GHz ~ 40GHz	6.02 dB
Radiated Emissions dBm (ERP/EiRP)	30MHz ~ 18GHz	4.03 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	08-Mar-21	08-Mar-22
SWITCH CONTROL SYSTEM	3499B	CN40150337	CNR	CNR
POWER SENSOR	E4412A	MY41502652	09-Sep-21	09-Sep-22
POWER SUPPLY	6032A	3232A08203	14-Jun-21	14-Jun-22
POWER METER	E4416A	GB41293240	14-Mar-21	14-Mar-22
SIGNAL GENERATOR	2042	203002/747	23-Feb-21	23-Feb-22
ANALYZER SIGNAL ( DYNAMIC )	35670A	MY42506847	17-Sep-21	17-Sep-22
MODULATION ANALYZER	8901B	3403A04974	06-Sep-21	06-Sep-22
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 SENSOR	E9301B	MY41495393	15-May-21	15-May-22
SIGNAL GENERATOR	8657A	3039A02769	11-Jun-21	11-Jun-22
AUDIO ANALYZER	8903B	3011A10318	01-Nov-21	01-Nov-22
POWER METER	E4418B	MY45104923	20-Feb-21	20-Feb-22
STEP ATTENUATOR	8494G	MY52300967	17-Jun-21	17-Jun-22
POWER SUPPLY	6033A	3004A04987	08-Jul-21	08-Jul-22
ANALYZER SPECTRUM	E4445A	MY46181732	29-Jun-21	29-Jun-22
ATTENUATOR/110DB	8496G	MY52300176	22-Aug-21	22-Aug-22
AUDIO ANALYZER	8903B	3413A14586	13-Sep-21	13-Sep-22
ANALYZER MODULATION	8901B	2619A00845	30-Sep-21	30-Sep-22
AUDIO ANALYZER	8903B	3011A12488	13-Sep-21	13-Sep-22
N to N RF Cable # 1	SF126/11N/11N	NA	NA	NA
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

**FCC 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	3221A02613	25-May-21	25-May-22
INTERFACE BOX - FILTER	CNR	CS001	06-Jul-21	06-Jul-22
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	06-Apr-21	06-Apr-23
DRG HORN FREQ.	SAS-571	719	13-Sep-21	13-Sep-22
POWER SUPPLY	N7976A	MY53410110	24-May-21	24-May-22
SIGNAL GENERATOR	SMB 100A	182511	4-Jun-21	4-Jun-24
EMI TEST RECEIVER	ESW44	101750	15-Jan-21	15-Jan-22
EMI TEST RECEIVER	ESIB26	827769/009	11-Mar-21	11-Mar-22
5m SEMI-ANECHOIC CHAMBER	S800-HX	J2308	No Cal. Req'd	No Cal. Req'd
BILOG ANTENNA	CBL6112D	55546	06-Jun-21	06-Jun-22
BILOG ANTENNA	CBL6112B	2964	4-May-21	4-May-22
HYGRO-THERMOMETER	SDL500	A.016800	18-May-21	18-May-22
SYSTEM CONTROLLER	SC104V	050806-1	No Cal. Req'd	No Cal. Req'd
TURNTABLE FLUSH MOUNT 2M	FM2011	NA	No Cal. Req'd	No Cal. Req'd
ANTENNA POSITIONING TOWER	TLT2	NA	No Cal. Req'd	No Cal. Req'd
BROAD-BAND HORN ANTENNA	BBHA9170	BBHA9170255	4-Feb-21	4-Feb-22
PREAMPLIFIER 18-40GHz	BBV9721	9721-007	No Cal. Req'd	No Cal. Req'd
PREAMPLIFIER	PAM-0118P	361	11-Sep-20	11-Sep-23
LOOP ANTENNA	6502	00203479	5-Feb-21	5-Feb-22
TEST SOFTWARE	EMC_FCC_IC_BLUETOOTH_RE_TEST			
VERSION	EMC_FCC_RE_v1.6.2			

## 5.0 Test Condition

### 5.1. Transmitter Test Conditions

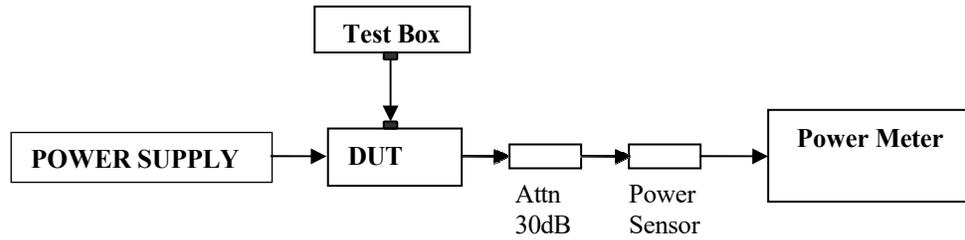
Test Item, (Channel Spacing)	Power (W)	Modulation	Test Frequency (MHz)	Tested By	Environmental conditions
RF Output Power	Low & Max	Analog	138.0125, 158.55, 161.7, 173.3875	Nuraini	23.4°C, 50%RH
Frequency Stability	Max	Analog	158.55	Nuraini	25.1°C, 54.3%RH, 60.3°C, 50%RH, -30.1°C, 51.2%RH
Audio Frequency Response (12.5kHz / 25kHz)	Max	Analog	158.55	Nuraini	23.4°C, 50%RH
Audio Low Pass Filter Response (12.5kHz / 25kHz)	Max	Analog	158.55	Nuraini	23.4°C, 50%RH
Modulation limiting (12.5kHz / 25kHz)	Max	Analog	158.55	Nuraini	23.4°C, 50%RH
Occupied Bandwidth (12.5kHz / 20kHz / 25kHz)	Max	Analog, C4FM, Phase II	138.0125, 158.55, 161.7, 173.3875	Nuraini	23.4°C, 50%RH
Band Edge Conducted Spurious Emissions (Part 22) (12.5kHz / 20kHz / 25kHz)	Max	Analog, C4FM, Phase II	157.77, 158.67	Nuraini	23.4°C, 50%RH
Transient Frequency Behavior (UHF & VHF Band) (12.5kHz / 25kHz)	Max	Analog, C4FM, Phase II	158.55	Nuraini	23.4°C, 50%RH
Adjacent Channel Power (700MHz Band) (12.5kHz / 25kHz)	Max	Analog, C4FM, Phase II	NA		
Conducted Spurious Emissions- (12.5kHz / 25kHz)	Low / Max	Analog, C4FM, Phase II	138.0125, 158.55, 161.7, 173.9875, 173.3875	Nuraini	23.4°C, 50%RH
Radiated Spurious Emission (12.5kHz / 25kHz)	Low / Max	Analog, C4FM, Phase II	138.0125, 158.55, 161.7, 173.3875	Qawiman&Nazrin	24.1°C, 69.8%RH
GNSS (EIRP for 1559 - 1610MHz) (12.5kHz / 25kHz)	Max	Analog	NA		
Effective Radiated Power (ERP) (12.5kHz / 25kHz)	Max	Analog	NA		

NA → Not Applicable

## 6.0 Transmitter Test Parameters

### 6.1 RF Output Power

#### 6.1.1 Test Setup



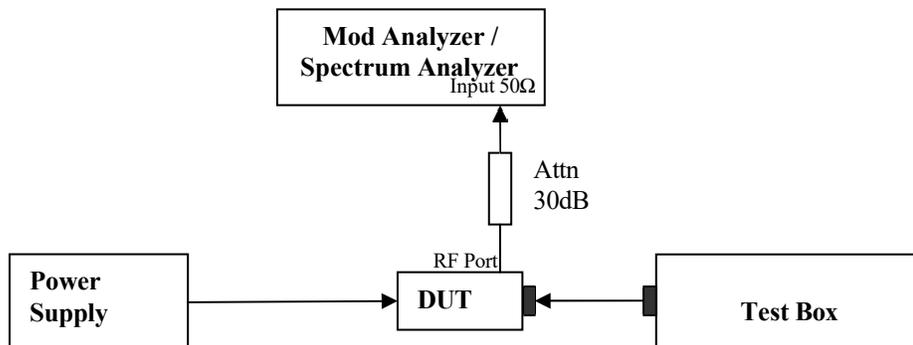
- 1) The DUT transmitter connected to Power Meter using the 30 dB attenuator and power sensor with above setup.
- 2) Path loss for the measurement included.
- 3) All the measurement was done at low, mid, high frequency for each band.
- 4) Record the power into the test report.

#### 6.1.2 Test Result

Temperature	25°C				Remark
Voltage (V)	13.6V				
Frequency (MHz)	Low Power (W)	Current (A)	Max Power (W)	Current (A)	
138.01250	1.01	2.55	59.50	11.06	Not for FCC review  Part 80
158.55000	1.03	2.23	59.20	9.3	
158.55000	1.03	2.23	50.00	9.01	
161.70000	1.03	2.43	59.00	10.25	
173.38750	1.03	2.44	59.20	10.28	

## 6.2. Frequency Stability

### 6.2.1. Test Setup

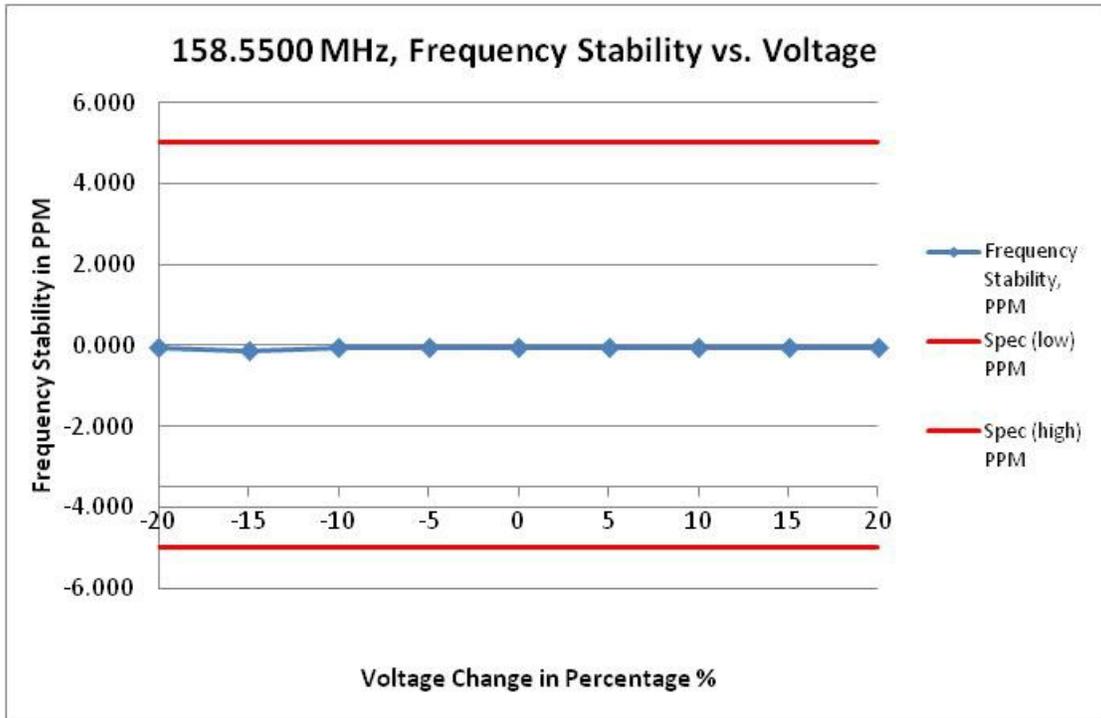


- 1) The DUT transmitter output port was connected to Modulation / Spectrum Analyzer.
- 2) Path loss for the measurement included.
- 3) Transmit the DUT and record the freq in  $MCF_{MHz}$ .
- 4) Test in 2 conditions:
  - Temperature: The frequency of the transmitter was measured from  $-30^{\circ}\text{C}$  to  $50^{\circ}\text{C}$ .
  - 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  $\pm x\%$  as specified by the manufacturer
- 5) Calculate the ppm frequency error by the following:

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

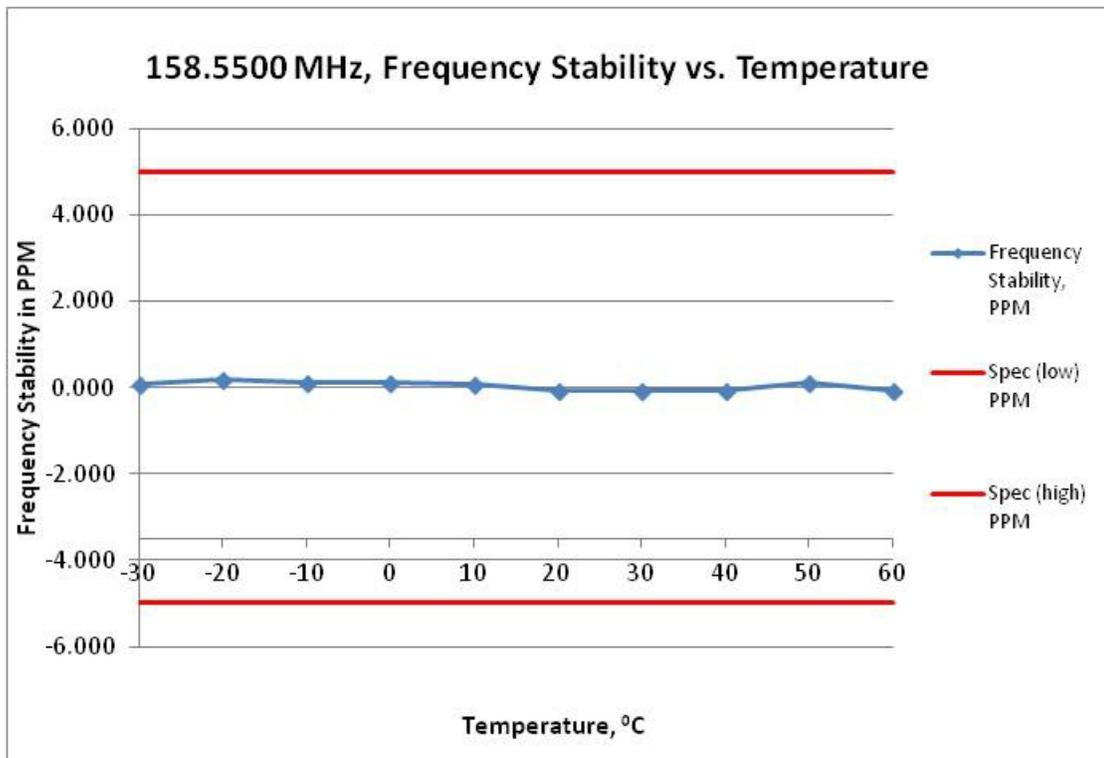
Where:  $MCF_{MHz}$  is the Measured Carrier Frequency in MHz  
 $ACF_{MHz}$  is the Assigned Carrier Frequency in MHz

**6.2.2. Test Result**



(i) Frequency Stability VS Voltage

Frequency / Channel Spacing		158.5500 MHz / 12.5 kHz			
Temperature, °C		25			
Voltage %	Voltage, V	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-20	9.000	158.549990	-0.063	-5.000	5.000
-15	11.560	158.549980	-0.126	-5.000	5.000
-10	12.240	158.549990	-0.063	-5.000	5.000
-5	12.920	158.549990	-0.063	-5.000	5.000
0	13.600	158.549990	-0.063	-5.000	5.000
5	14.280	158.549990	-0.063	-5.000	5.000
10	14.960	158.549990	-0.063	-5.000	5.000
15	15.640	158.549990	-0.063	-5.000	5.000
20	16.320	158.549990	-0.063	-5.000	5.000



(ii) Frequency Stability VS temperature

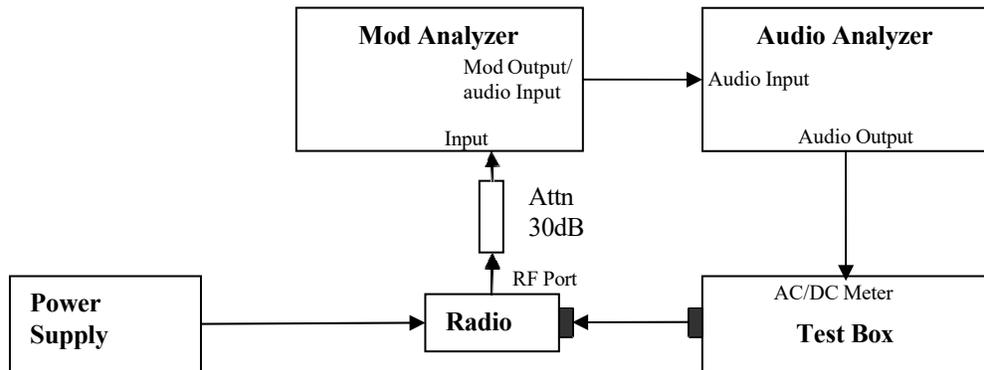
Frequency / Channel Spacing	158.5500 MHz / 12.5 kHz			
Voltage, V	13.6			
Temperature, °C	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-30	158.550010	0.063	-5.000	5.000
-20	158.550030	0.189	-5.000	5.000
-10	158.550020	0.126	-5.000	5.000
0	158.550020	0.126	-5.000	5.000
10	158.550010	0.063	-5.000	5.000
20	158.549990	-0.063	-5.000	5.000
30	158.549990	-0.063	-5.000	5.000
40	158.549990	-0.063	-5.000	5.000
50	158.550020	0.126	-5.000	5.000
60	158.549990	-0.063	-5.000	5.000

**6.2.3. Test Limit**

As per manufacturer declared spec +/- 5ppm

### 6.3. Audio Frequency Response

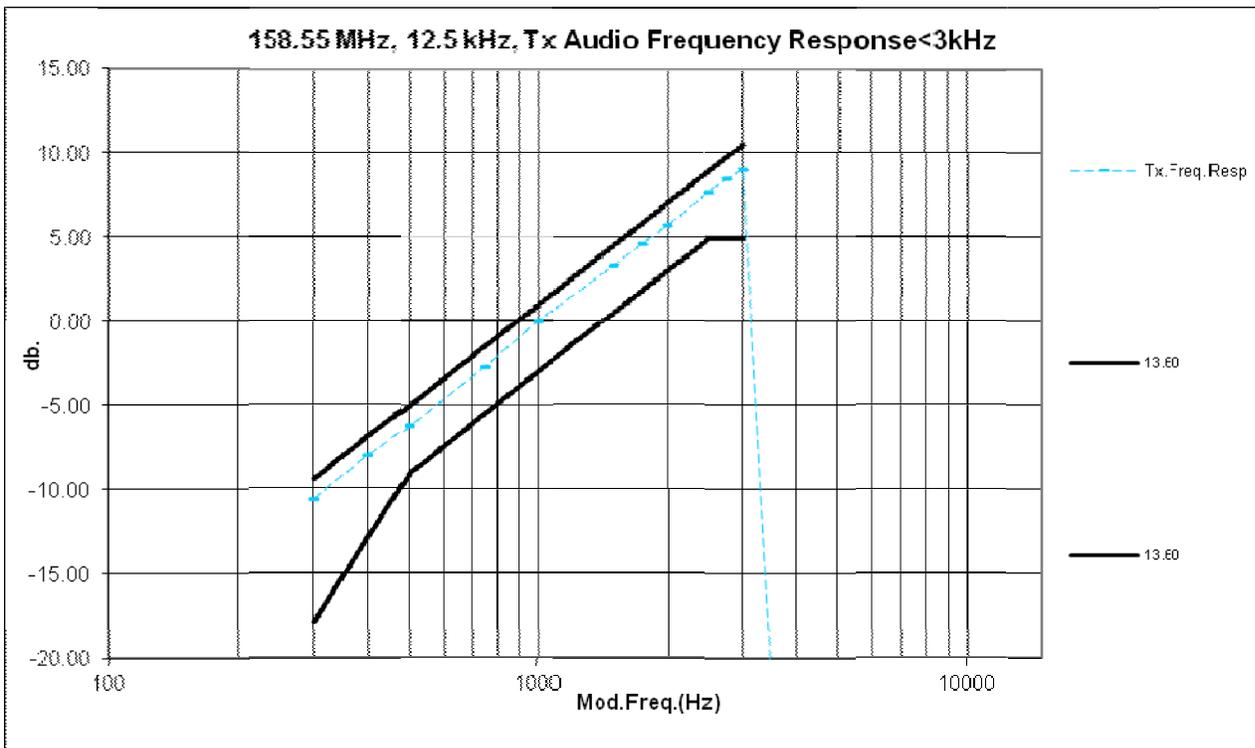
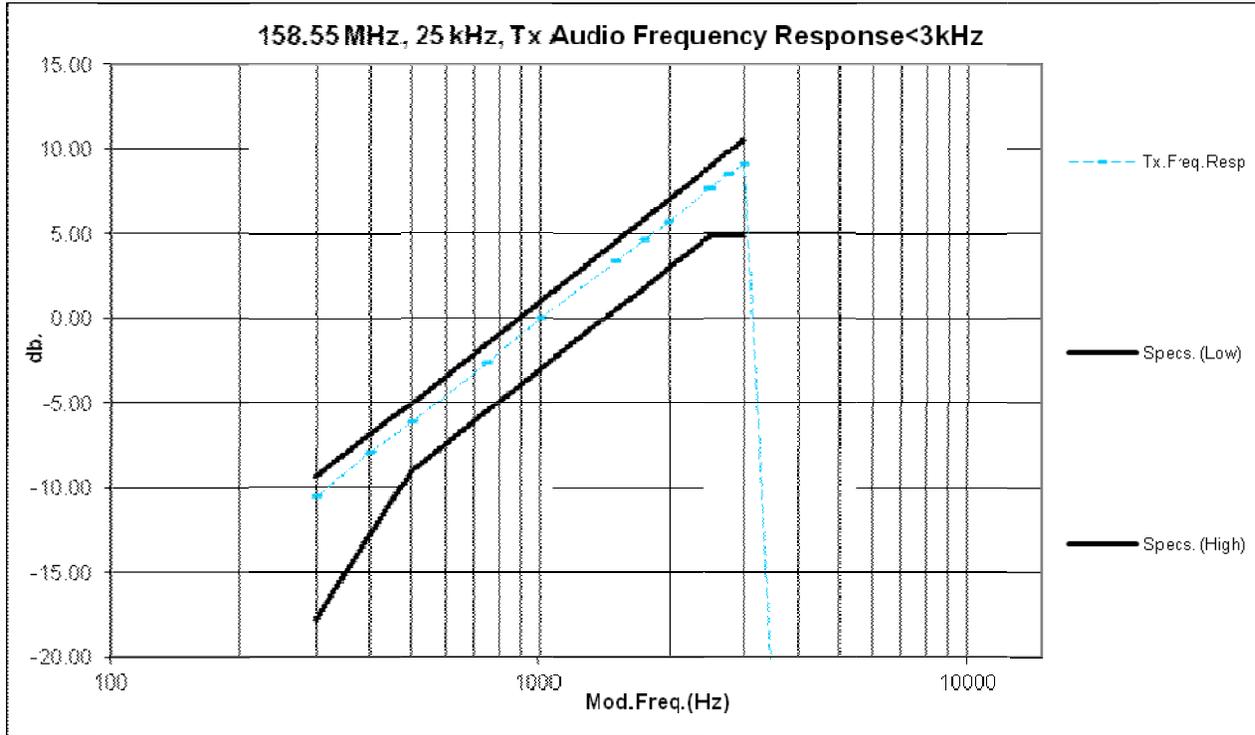
#### 6.3.1. Test Setup



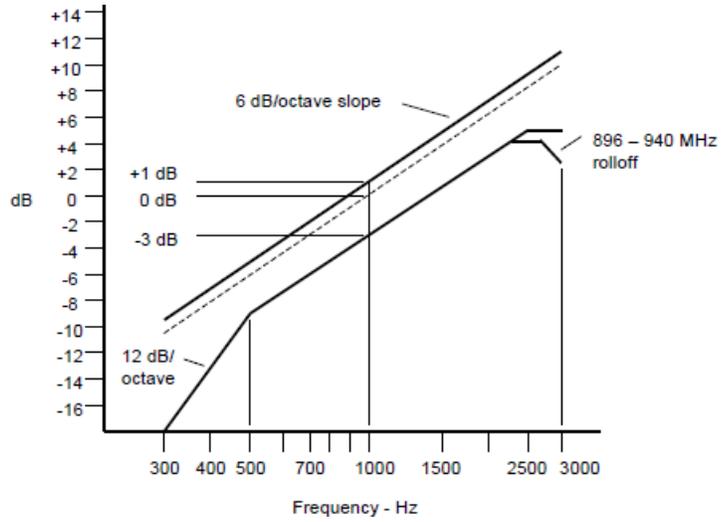
- 1) The DUT transmitter output port was connected to Modulation Analyzer.
- 2) Path loss for the measurement included.
- 3) Set the audio bandwidth filter to 15 kHz and 50 kHz.
- 4) Transmit the radio and set the audio analyzer to 1 kHz audio frequency and 20% of the Full rated system deviation.
- 5) 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



### 6.3.3. Test Limit

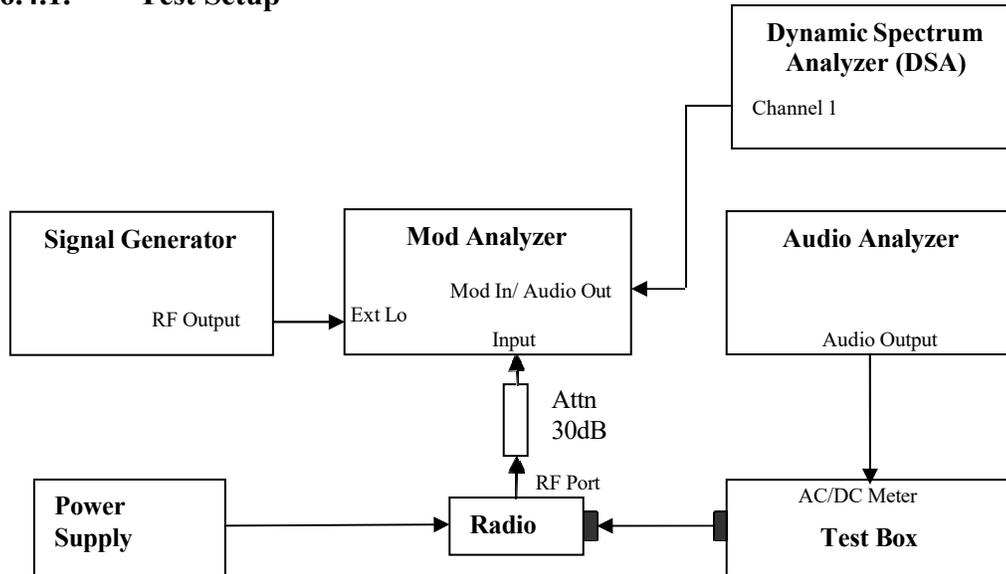


Note:

- o There are additional 6 dB per octave attenuation is allowed from 2.5KHz to 3KHz in equipment 25MHz to 869MHz radio.
- o 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

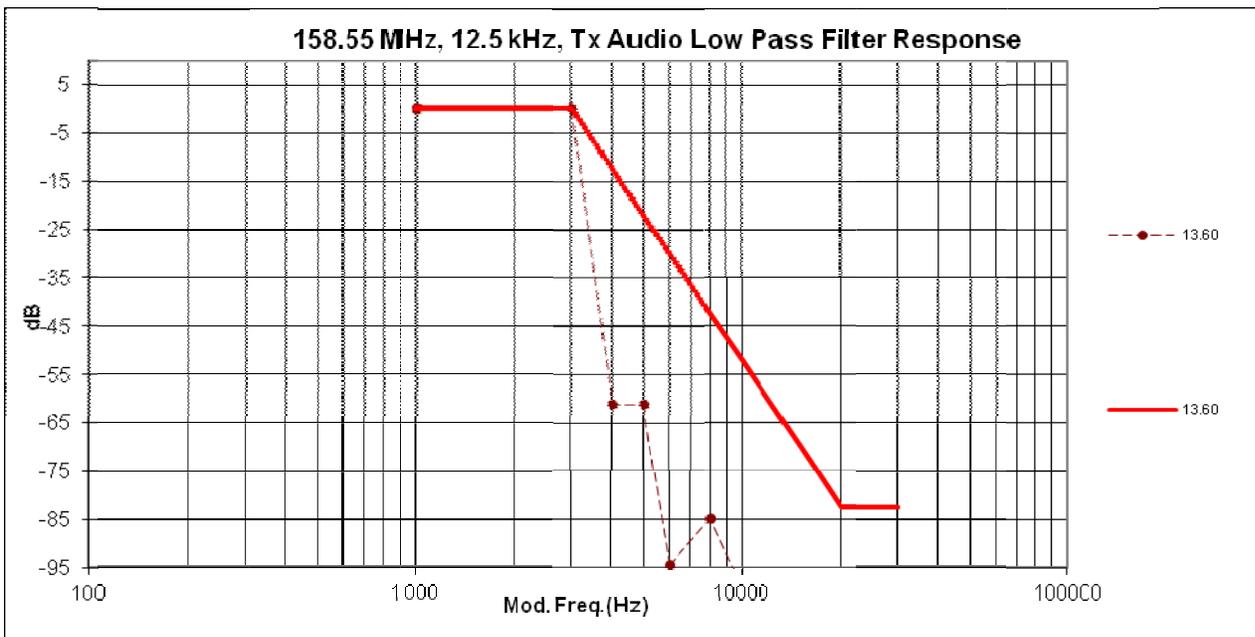
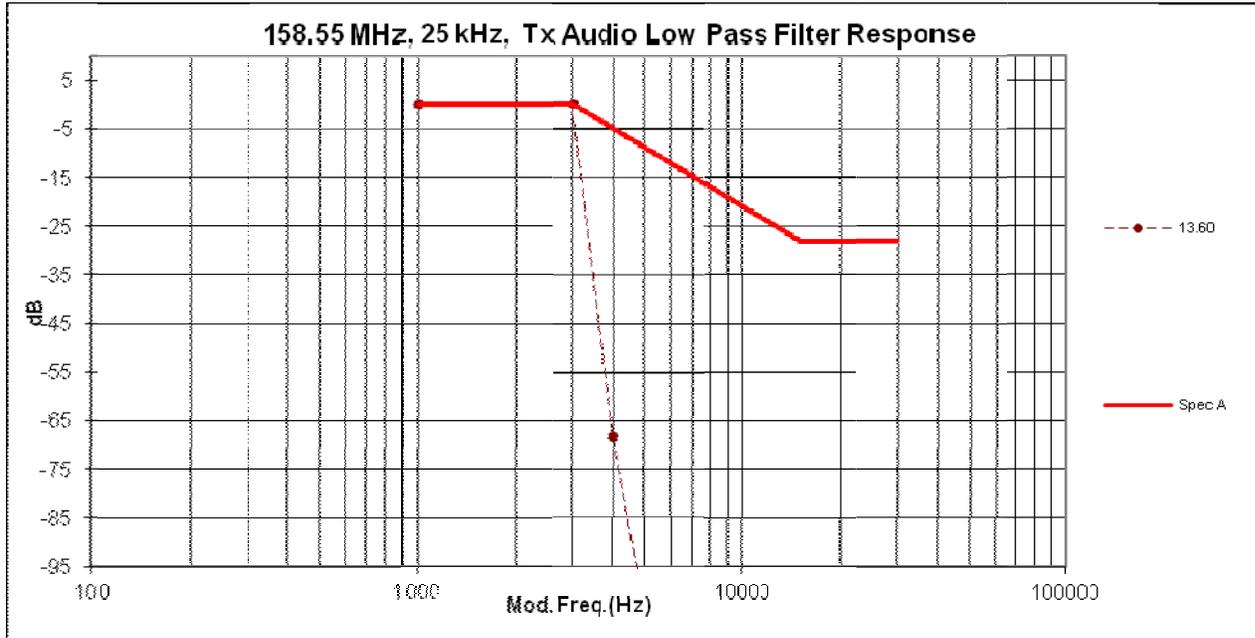
### 6.4.1. Test Setup



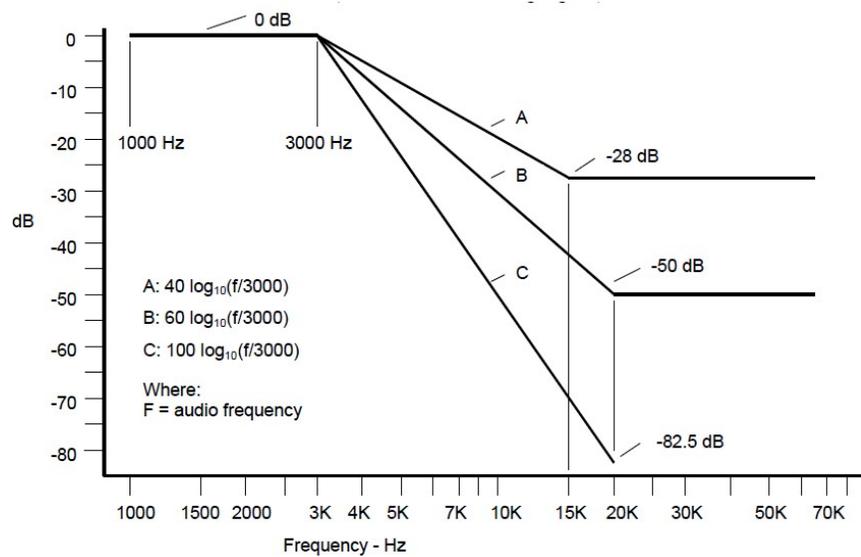
- 1) The DUT transmitter output port was connected to Modulation Analyzer.
- 2) Path loss for the measurement included.
- 3) Press 23.1SPCL on modulation analyzer to enable the external LO from Sigen.
- 4) Set the Sigen frequency to  $F_c + 1.5$  MHz, RF output level to 0dBm without modulation.
- 5) 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



### 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.

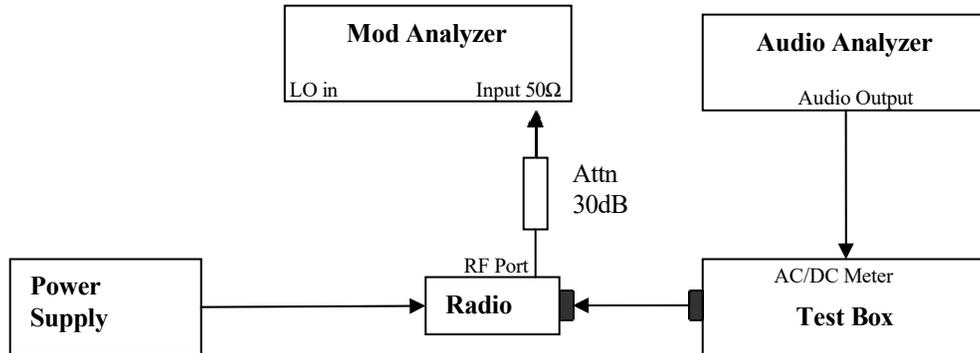
- c) For equipment operating on channels between 896 MHz through 901 MHz, between 935 MHz through 940 MHz, and 12.5 or 15 kHz spaced channels in the frequency range 138-174 MHz and 406-512 MHz.

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

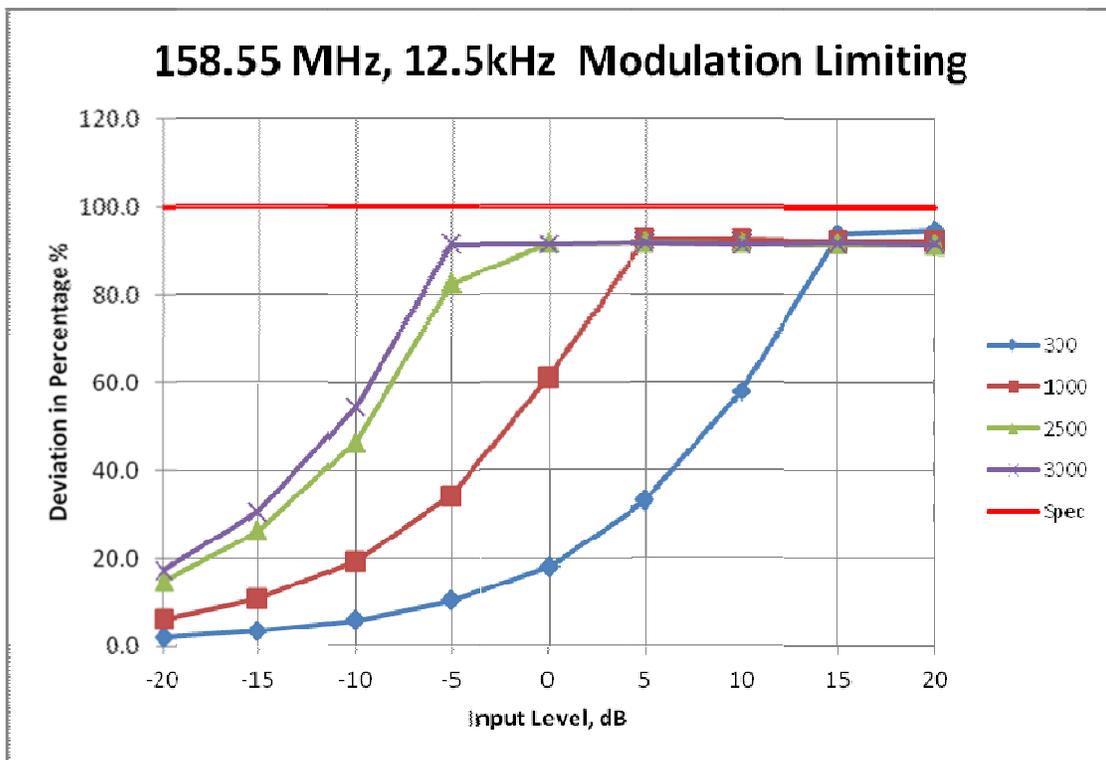
### 6.5.1. Test Setup



- 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

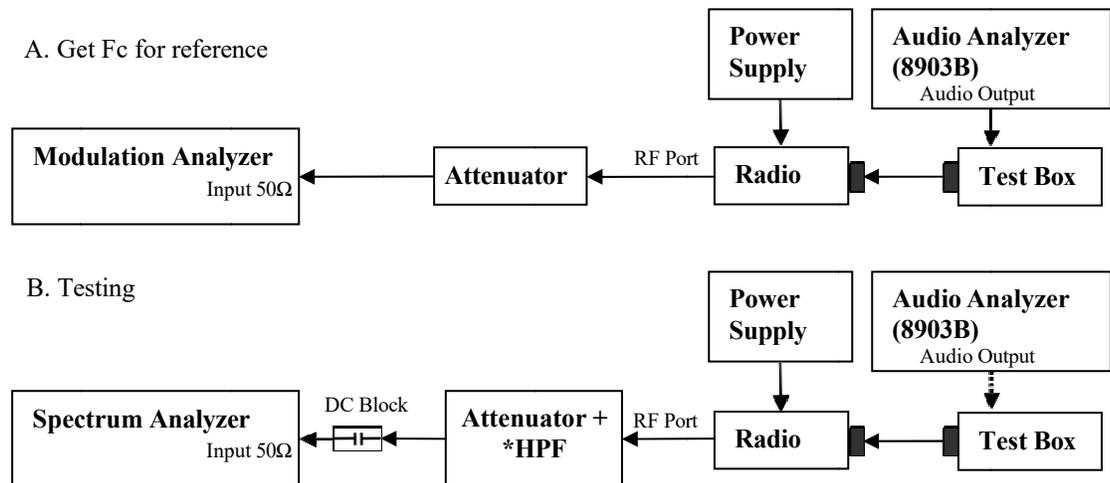


### 6.5.3. Test Limit

Modulation Limiting shall not exceed 100 percent.

## 6.6. Occupied Bandwidth

### 6.6.1. Test Setup (Analog)



- 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.

\* 99% Bandwidth measurement is computed by the spectrum analyzer and is consistent with the C63.26 5.4.4 method.

## 6.6.2. Test Result (Analog)

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.

$BW = 2(M+D) = 2*(3 \text{ kHz} + 5 \text{ kHz}) = 16 \text{ kHz} = 16K0$   
F3E portion of the designator indicates voice.

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

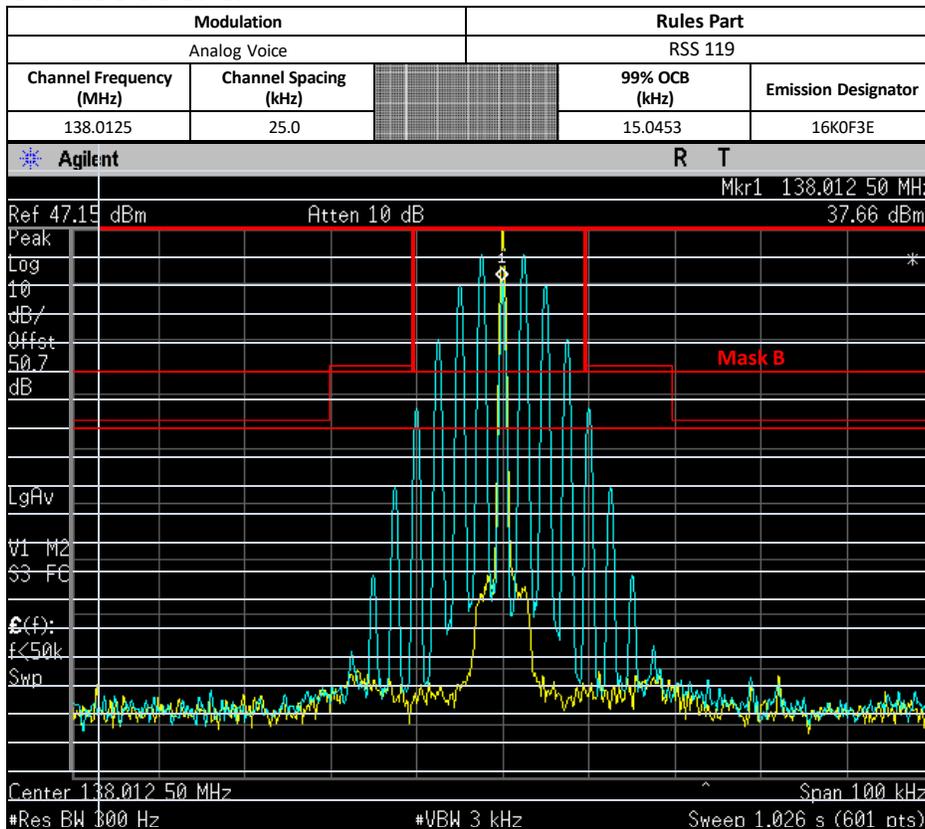
Standard Audio Modulation (12.5 kHz Channelization, Analog Voice):  
Emission Designator 11K0F3E

In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation.

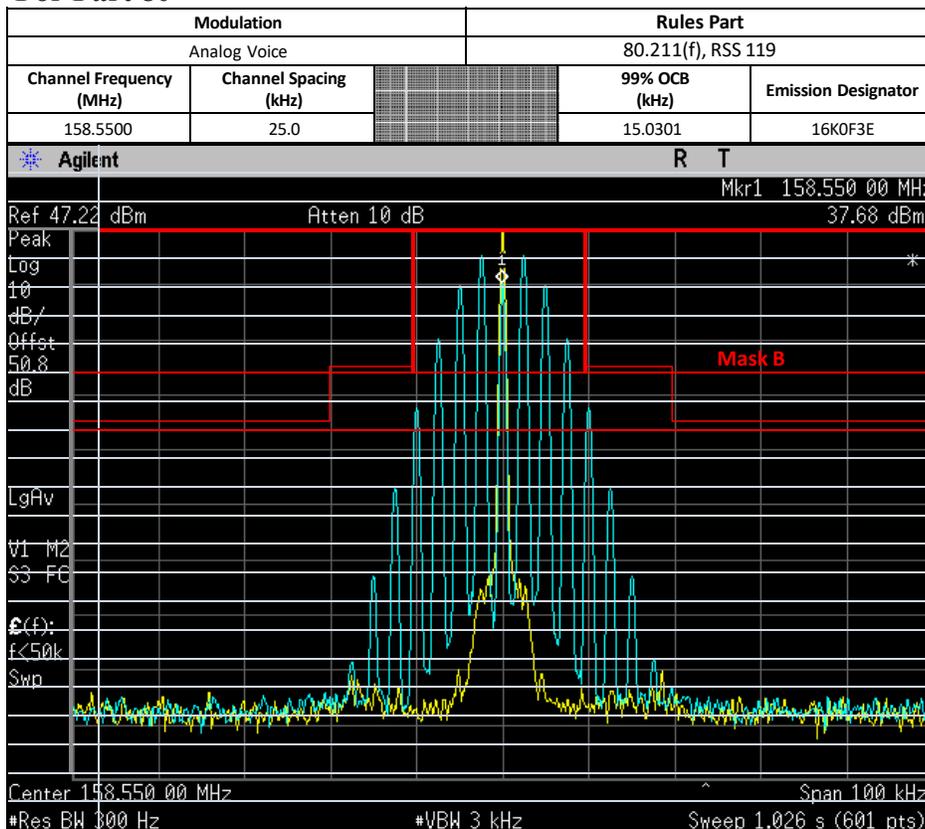
$BW = 2(M+D) = 2*(3.0 \text{ kHz} + 2.5 \text{ kHz}) = 11 \text{ kHz} = 11K0$   
F3E portion of the designator indicates voice.

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

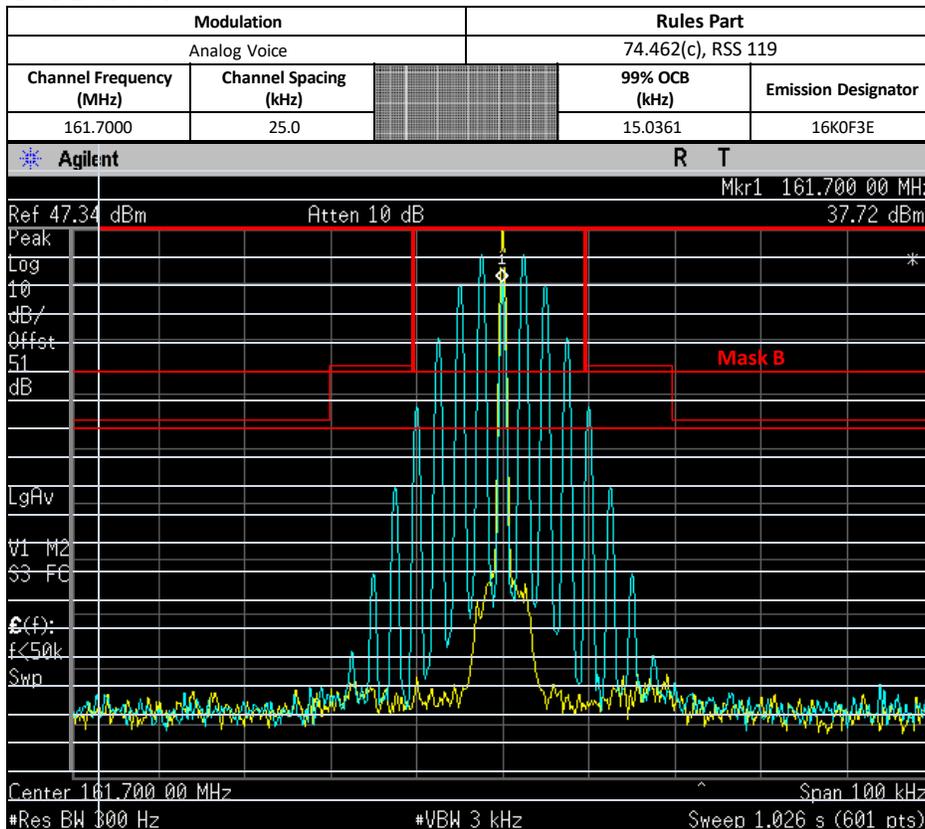
Not for FCC review



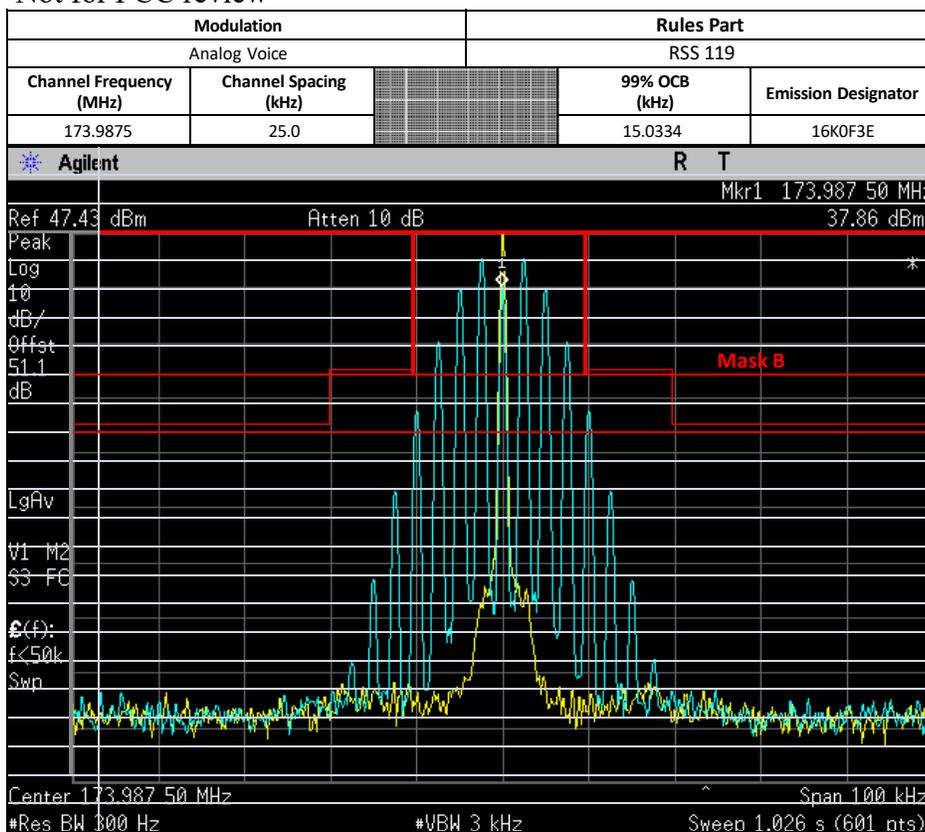
For Part 80



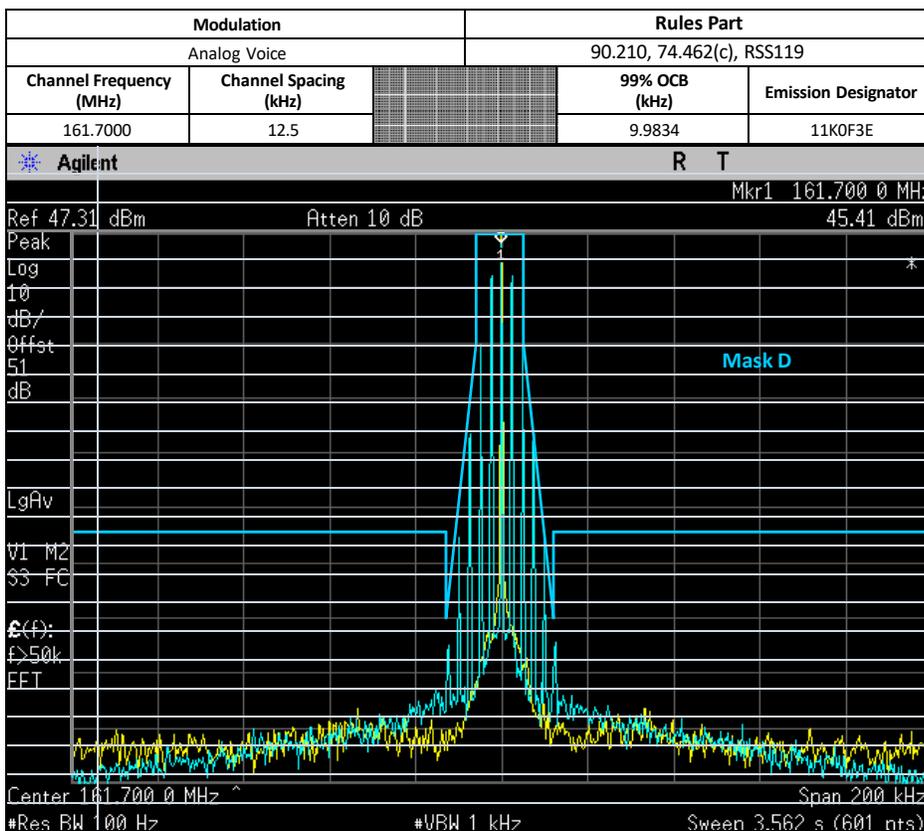
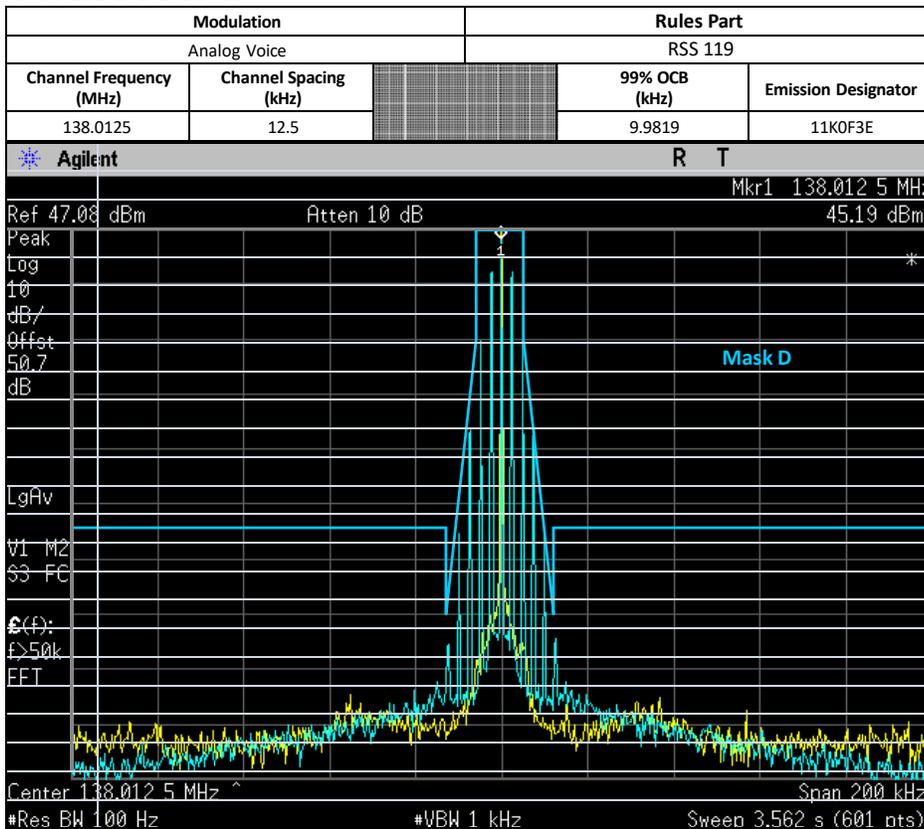
**For Part 74**

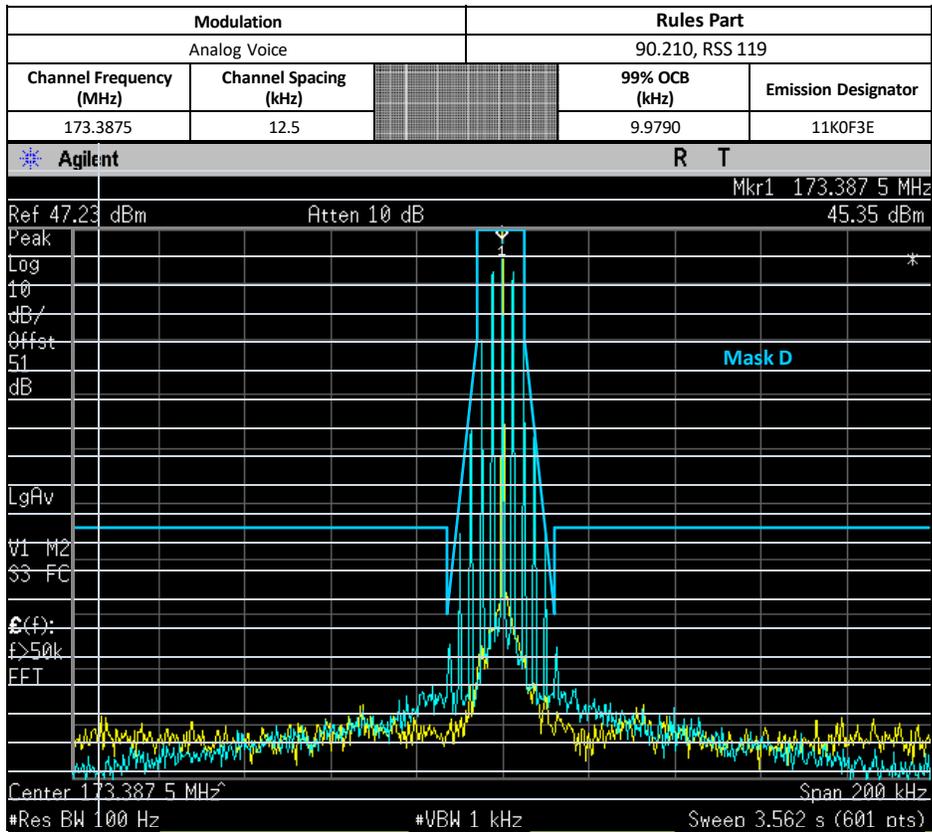


**Not for FCC review**

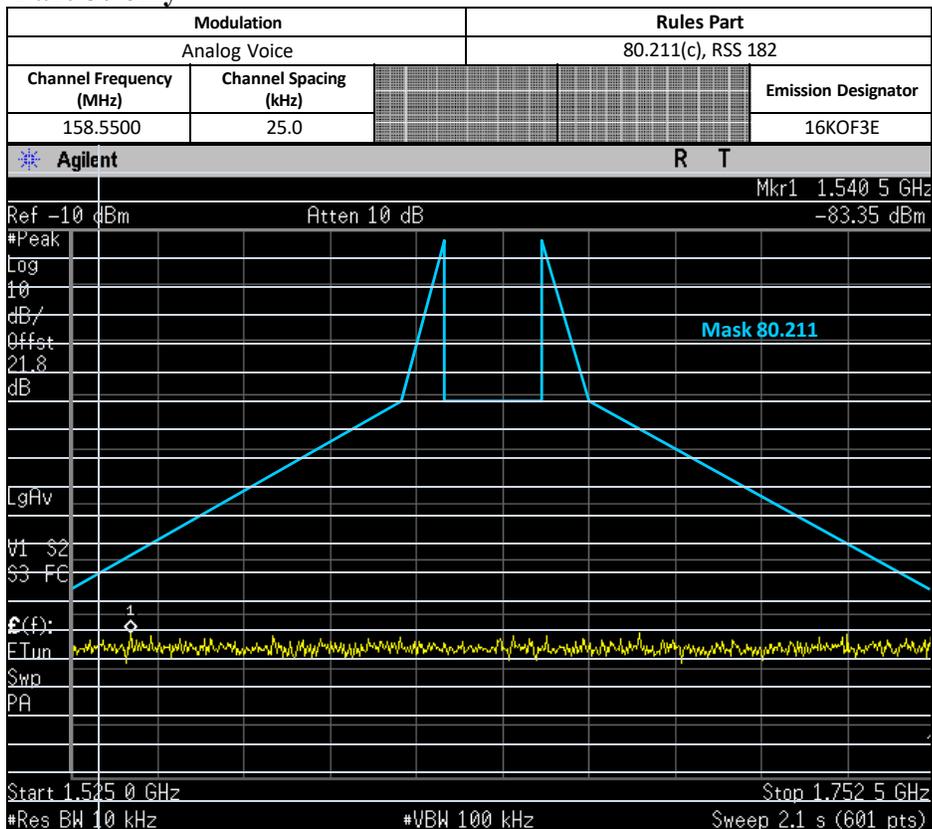


Not for FCC review

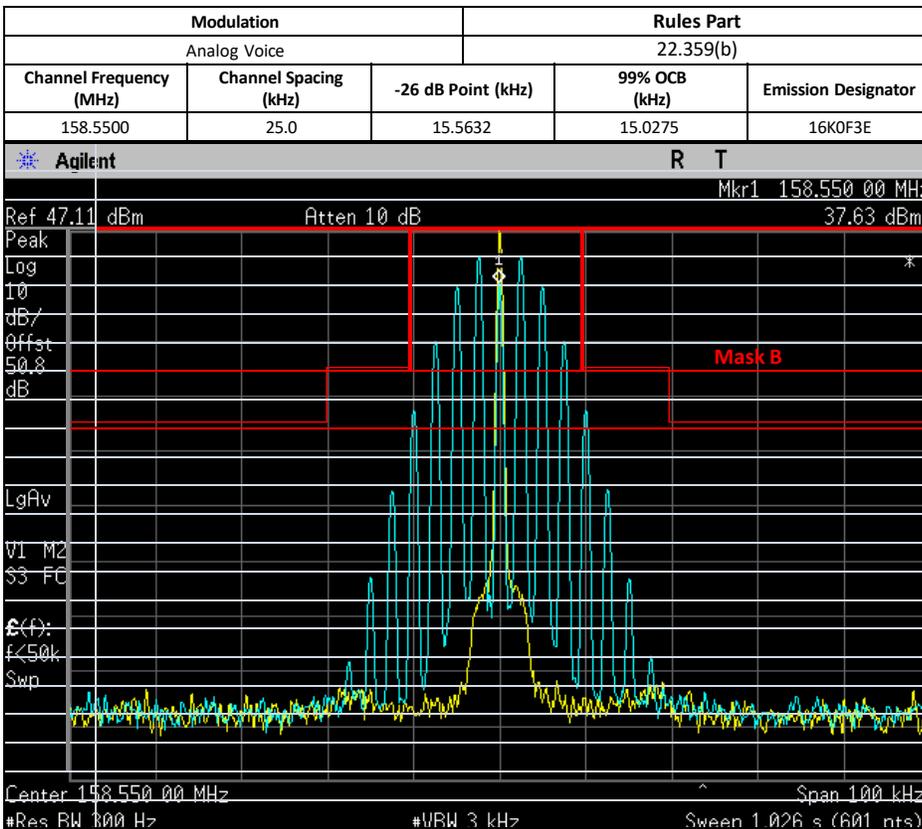
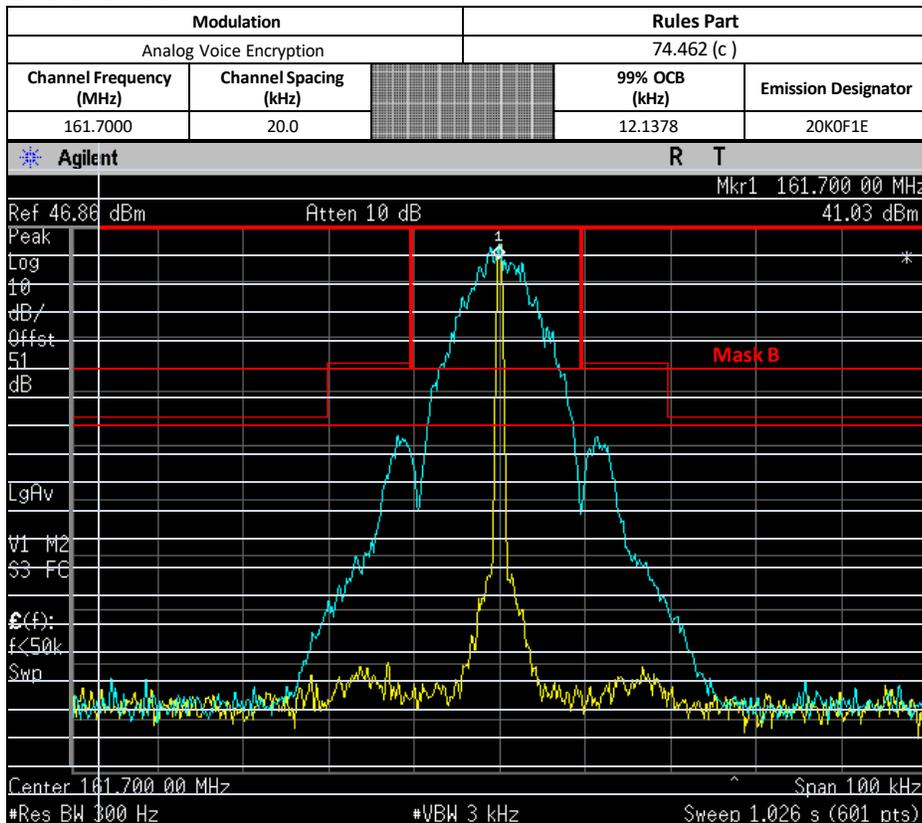


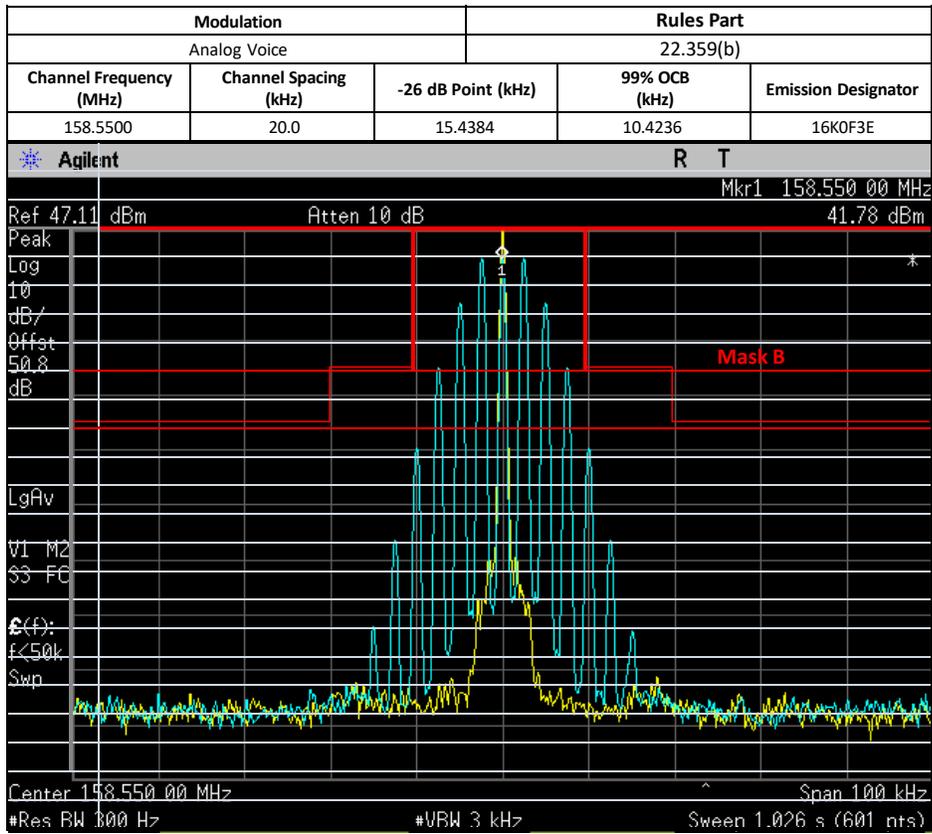


**Part 80 only**

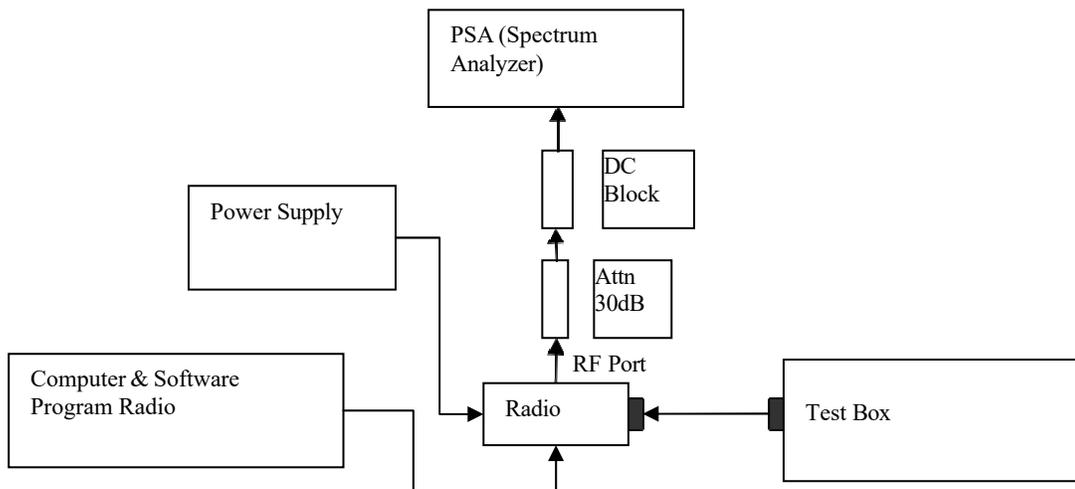


**For Part 74**





### 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.

\* 99% Bandwidth measurement is computed by the spectrum analyzer and is consistent with the C63.26 5.4.4 method.

\*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)**

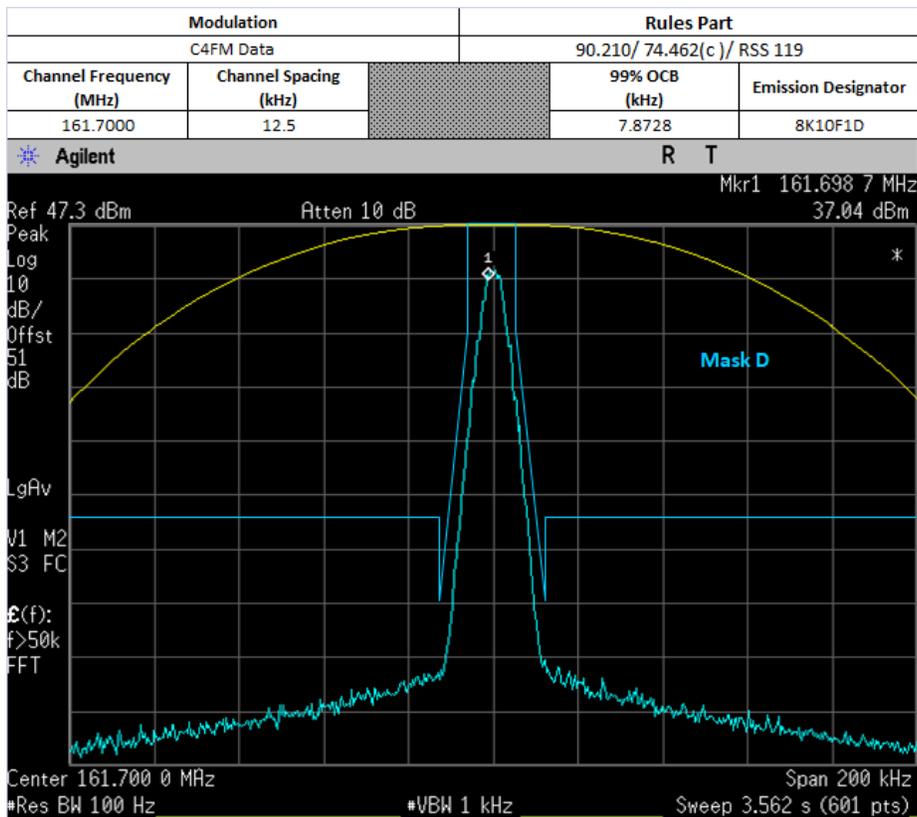
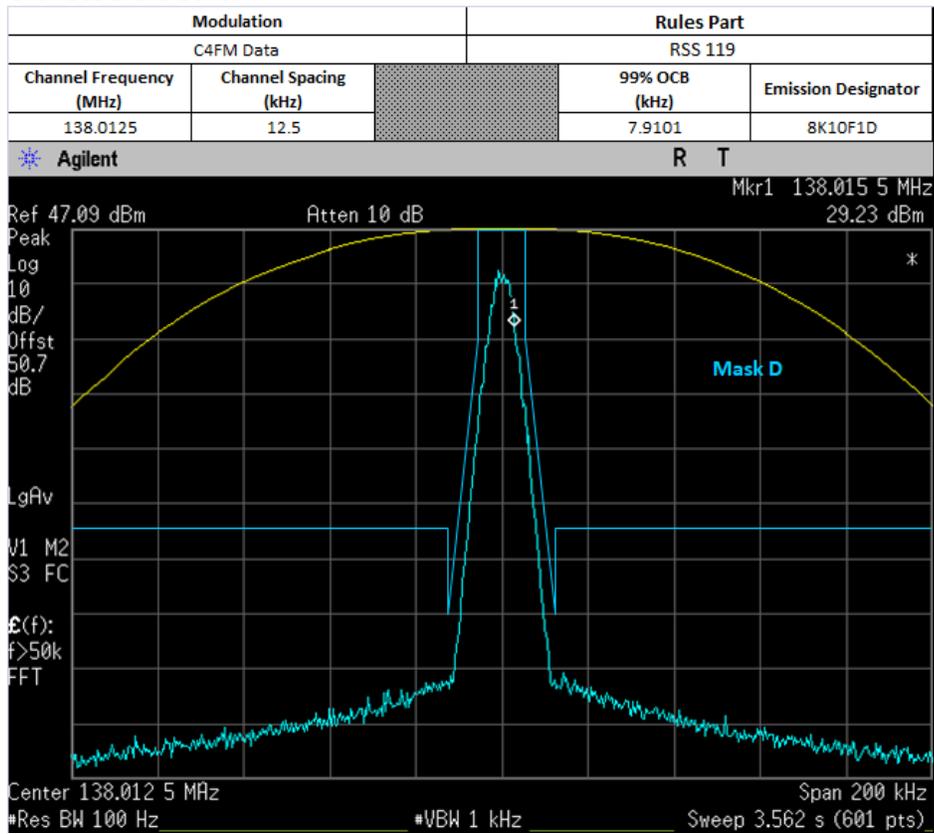
Digital (12.5 kHz Channelization, Digital Voice/Data/Phase II):  
Emission Designator 8K10F1E/D/W

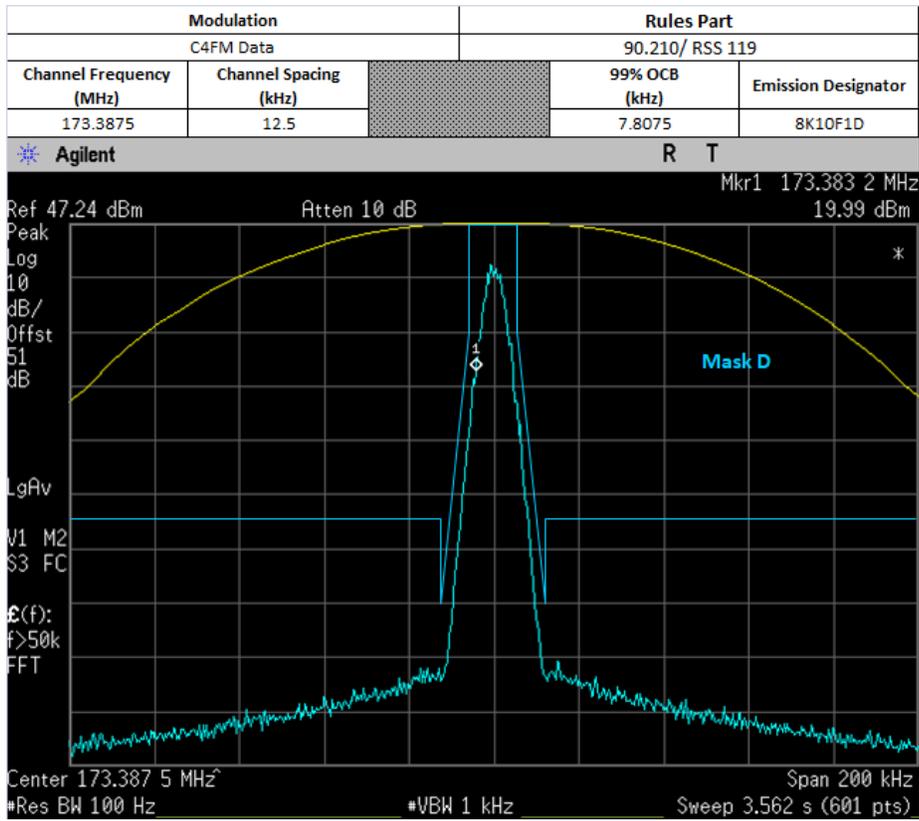
The 99% energy rule (title 47CFR 2.989) was used for digital mode and is more accurate than Carson's rule. It basically states that 99% of the modulation energy falls within X kHz, in this case, 8.10 kHz. Measurements were performed in accordance with TIA/EIA TSB102.CAAB Section 2.2.5.2. The emission mask was obtained from 47CFR 90.210(d).

F1E/D/W portion of the designator indicates digital voice/data/phase II.

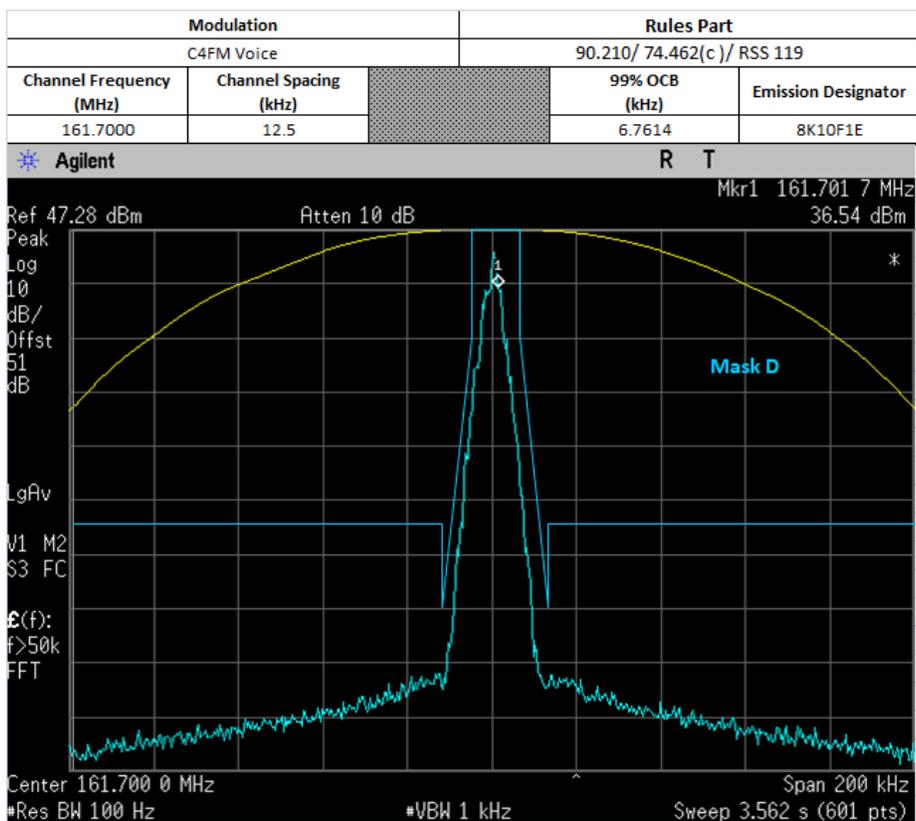
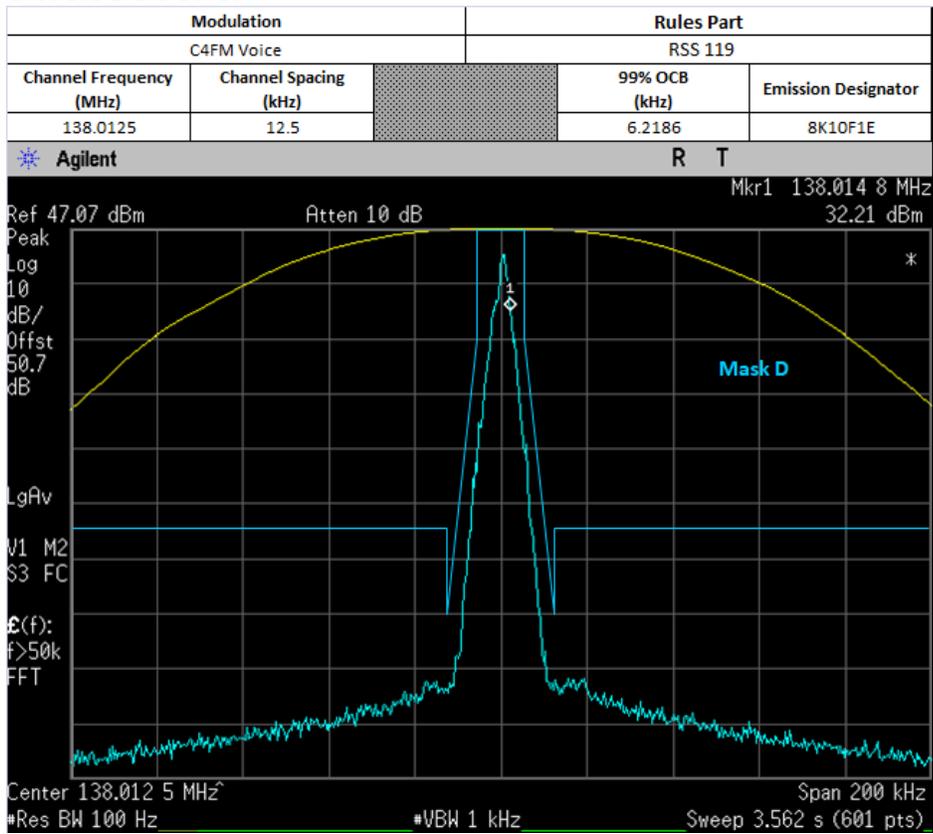
Therefore, the entire designator for 12.5 kHz channelization digital voice is 8K10F1E /D/W.

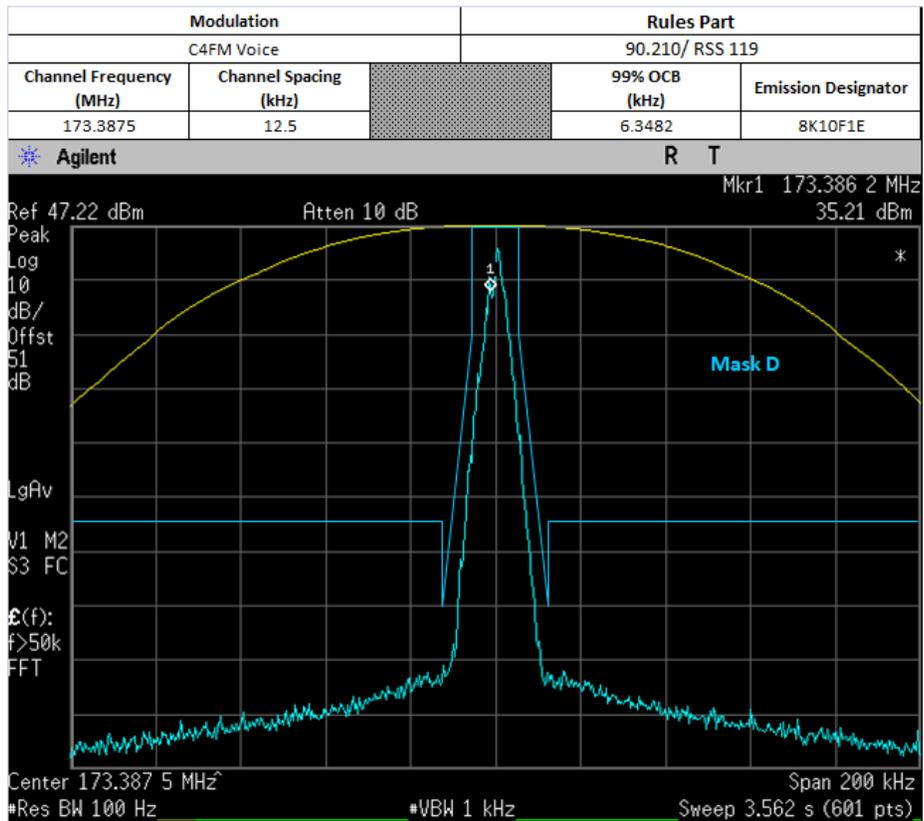
Not for FCC review



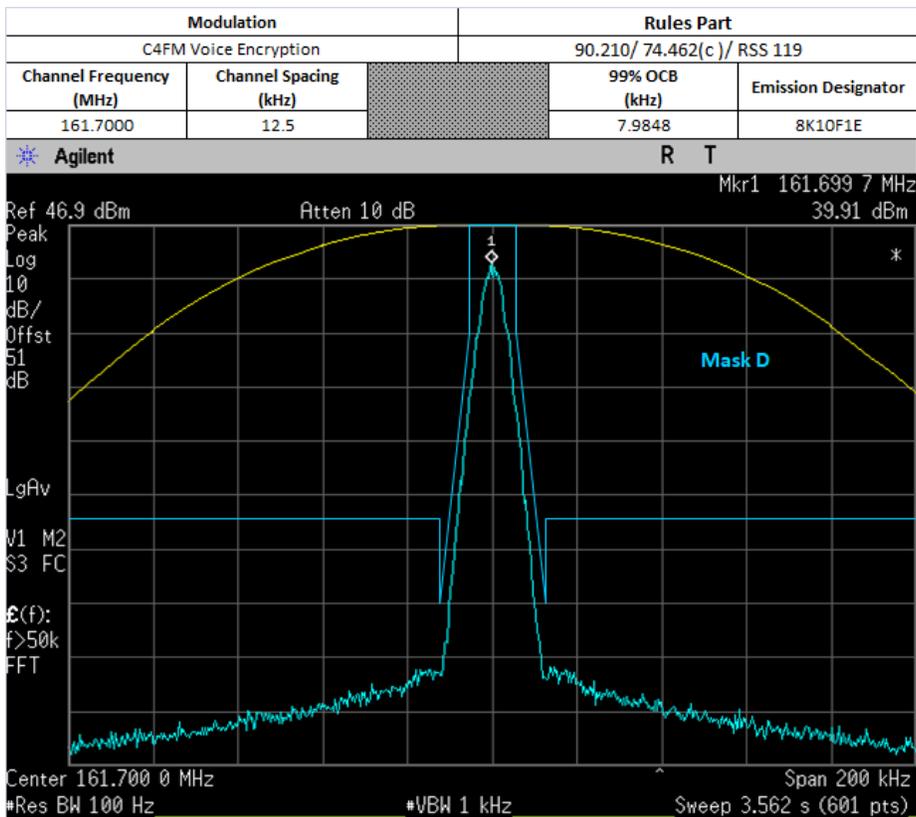
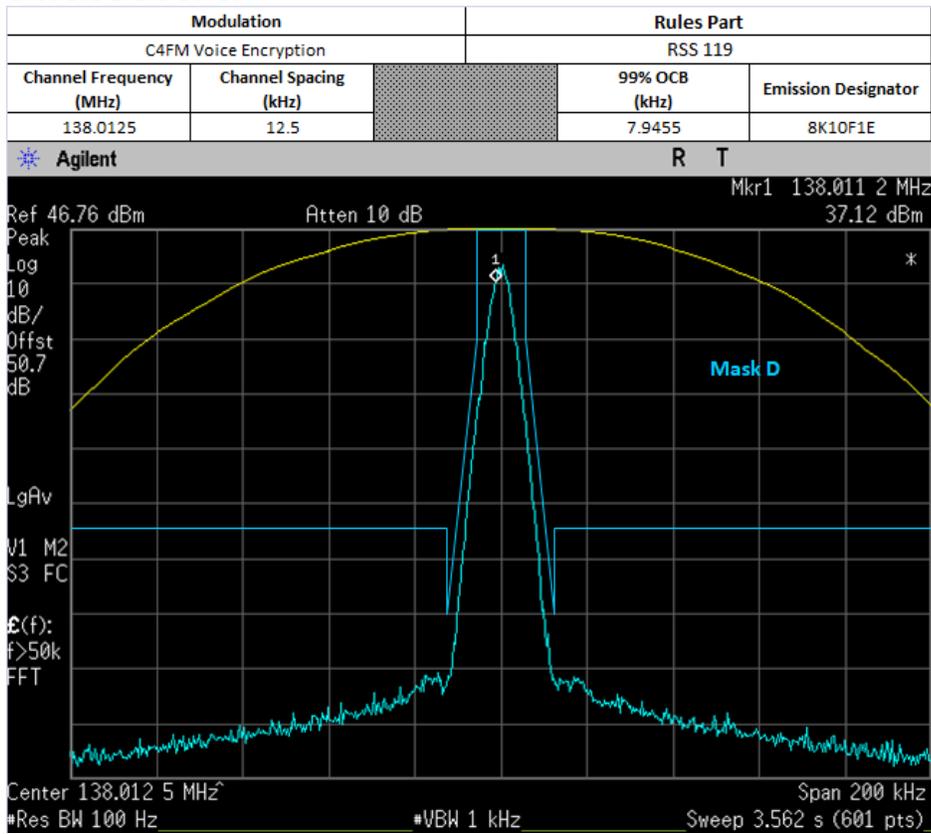


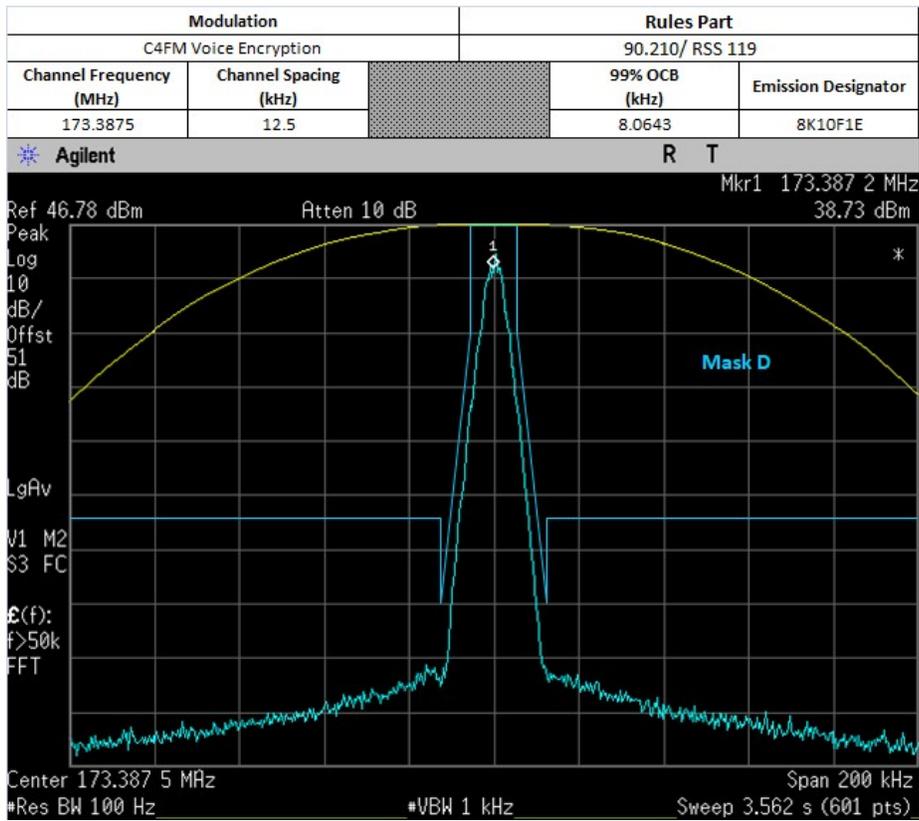
Not for FCC review



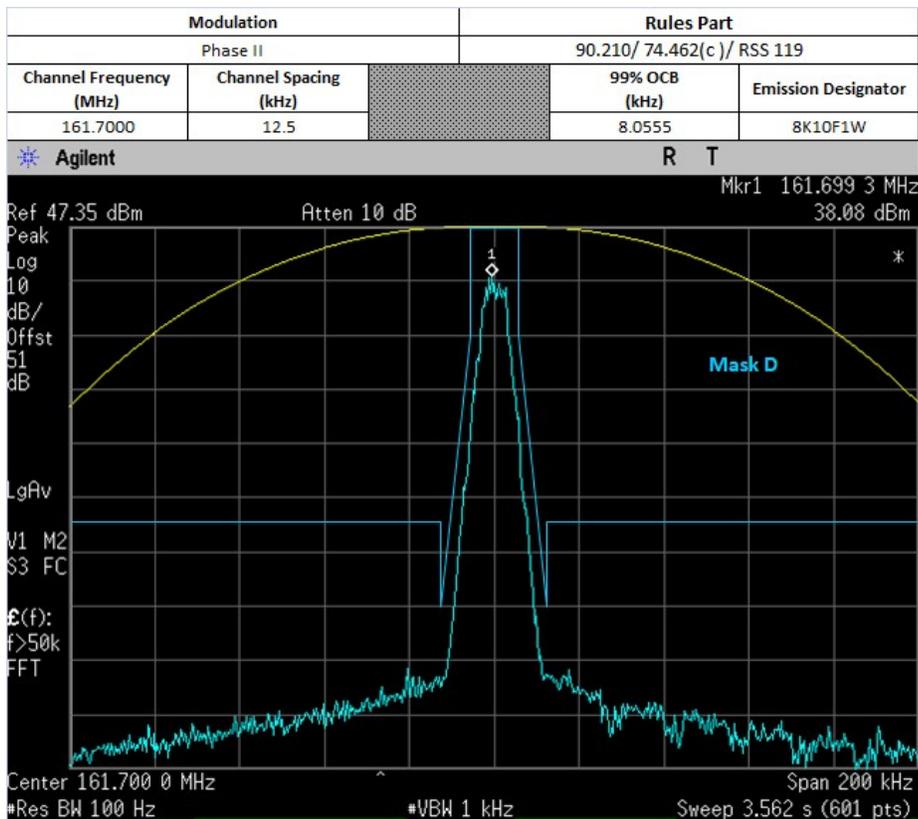
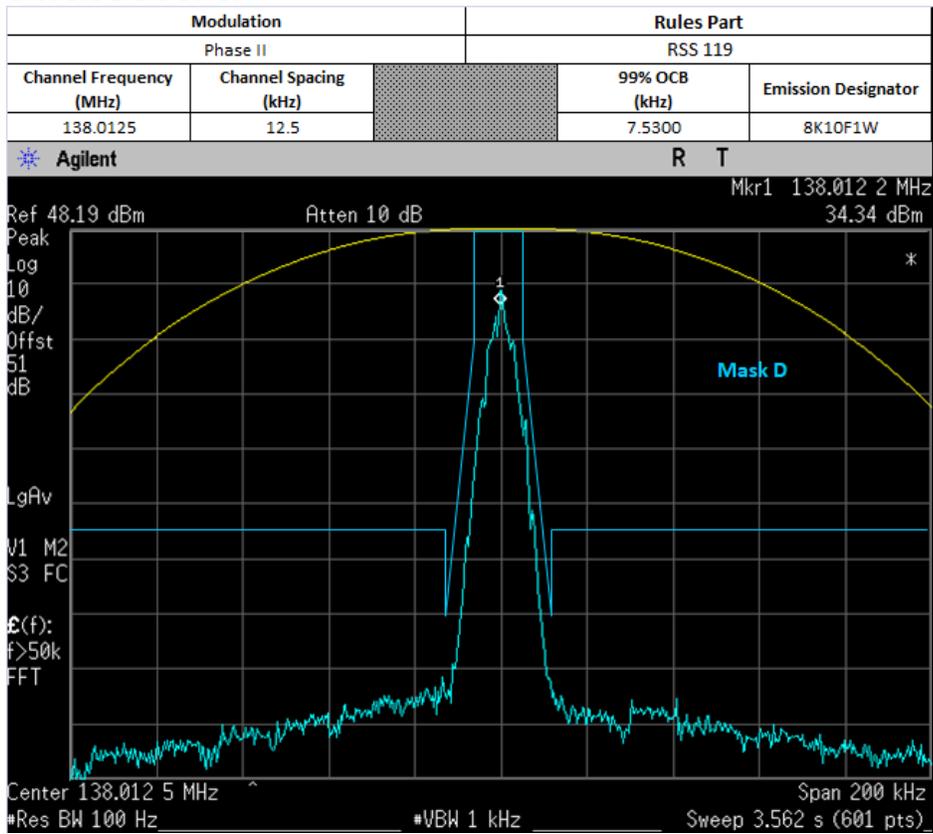


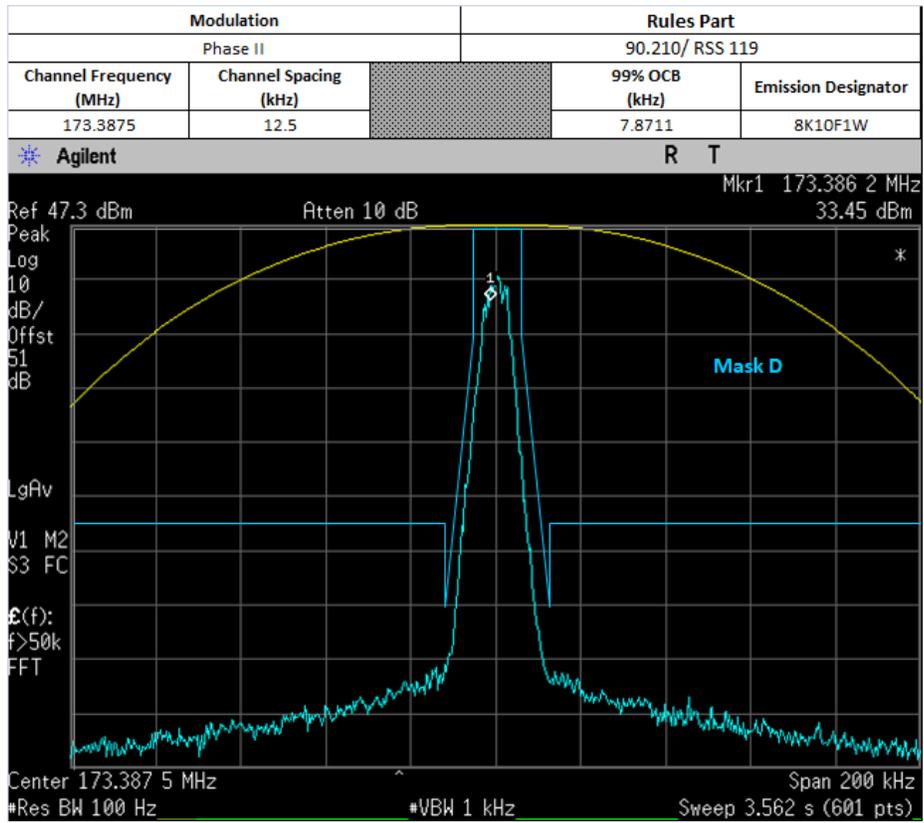
Not for FCC review

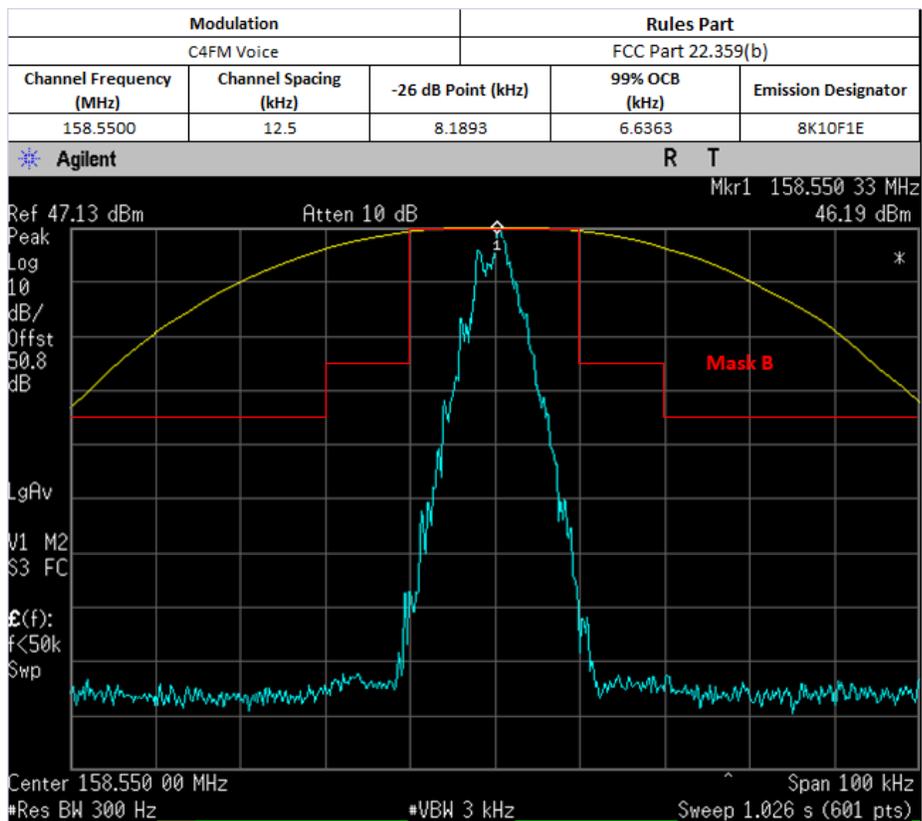
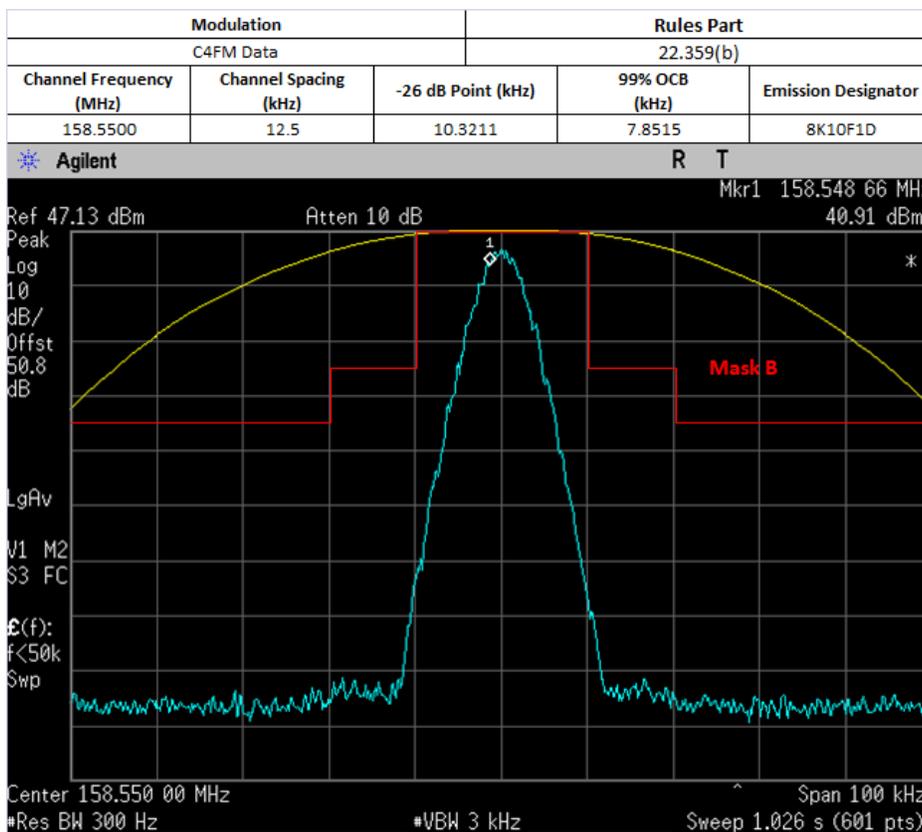


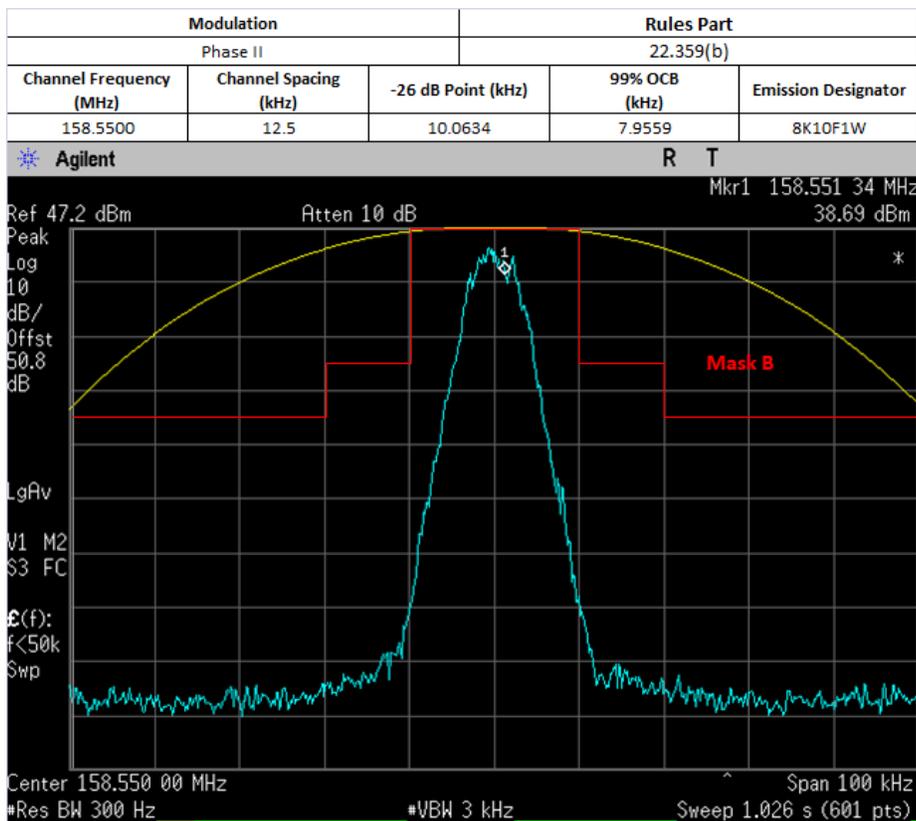
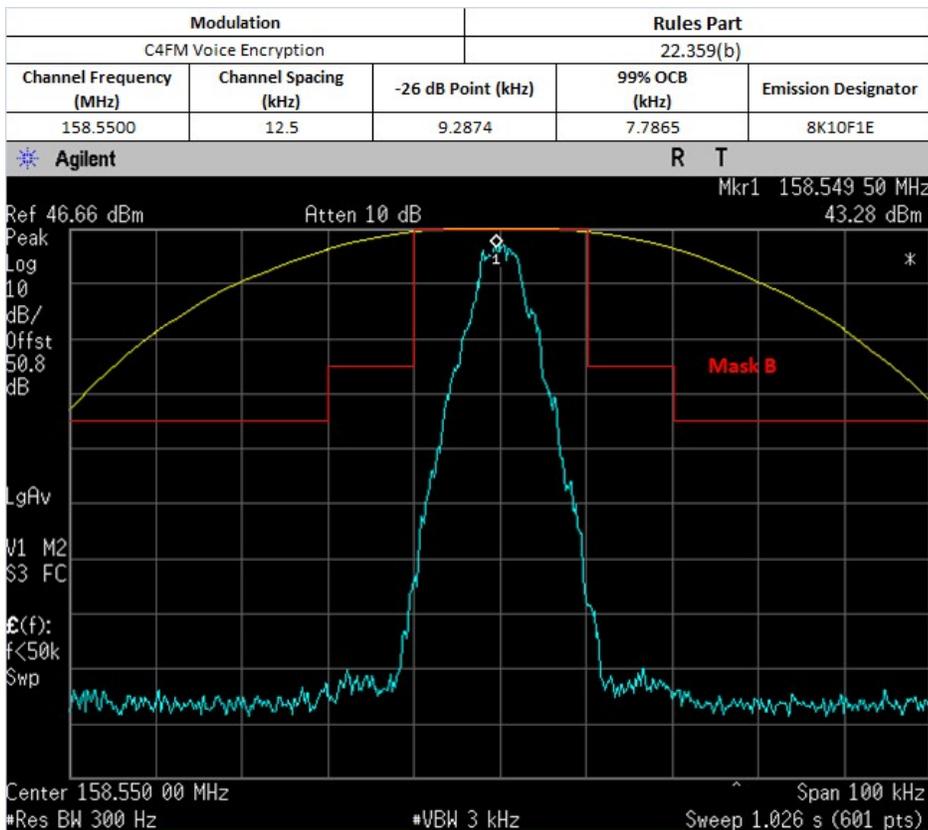


Not for FCC review







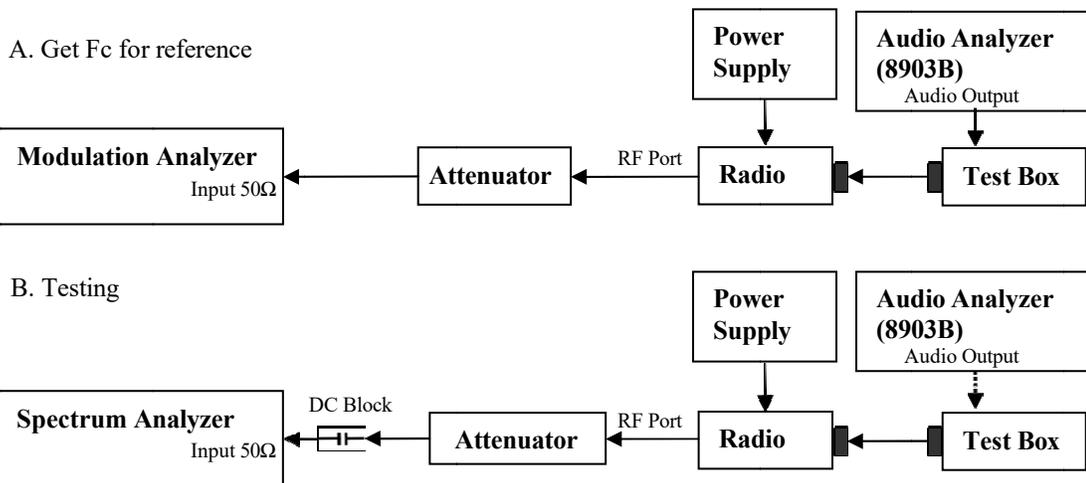


**6.6.5. Test Limit**

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)



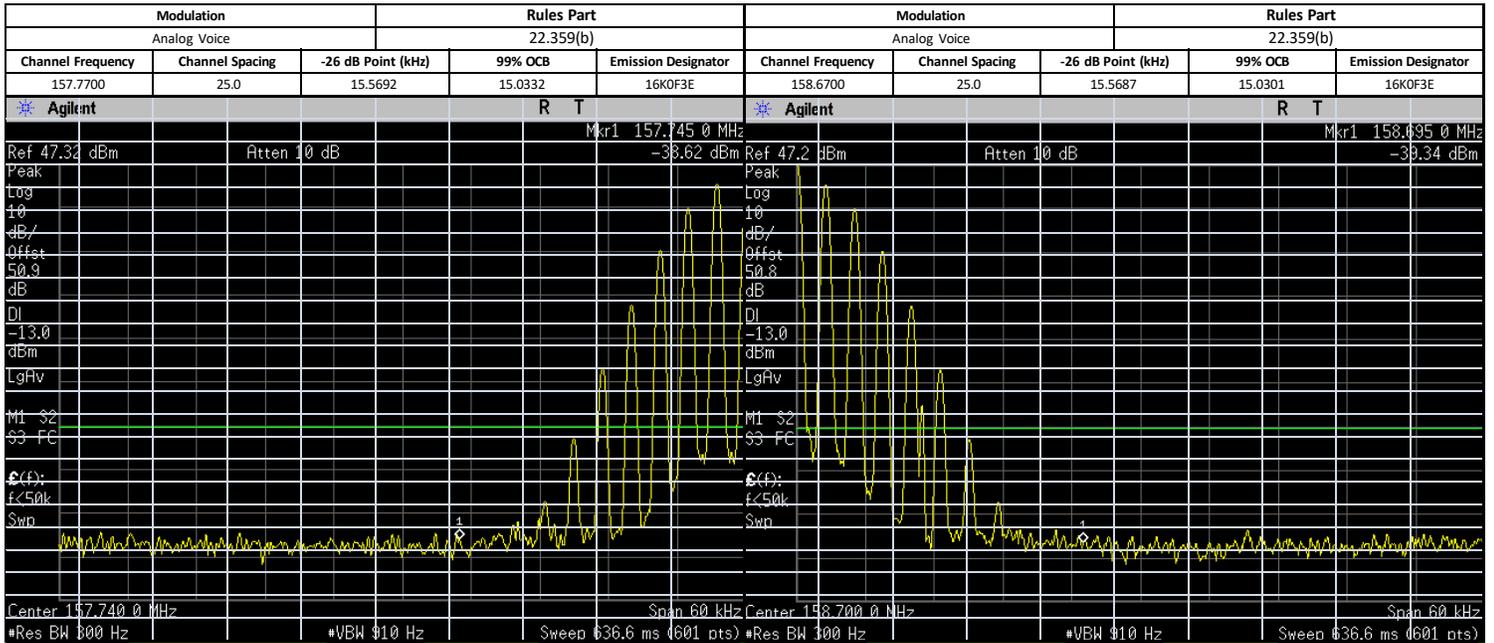
- 1) The DUT transmitter output port was connected to Modulation Analyzer.
- 2) Set the audio bandwidth filter to 15 kHz low pass filter and 50 kHz high pass filter.
- 3) Transmit the radio and set the audio analyzer to 2.5 kHz audio frequency and 50% of the rated deviation. Up the amplitude by 16 dB.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

\*Note:

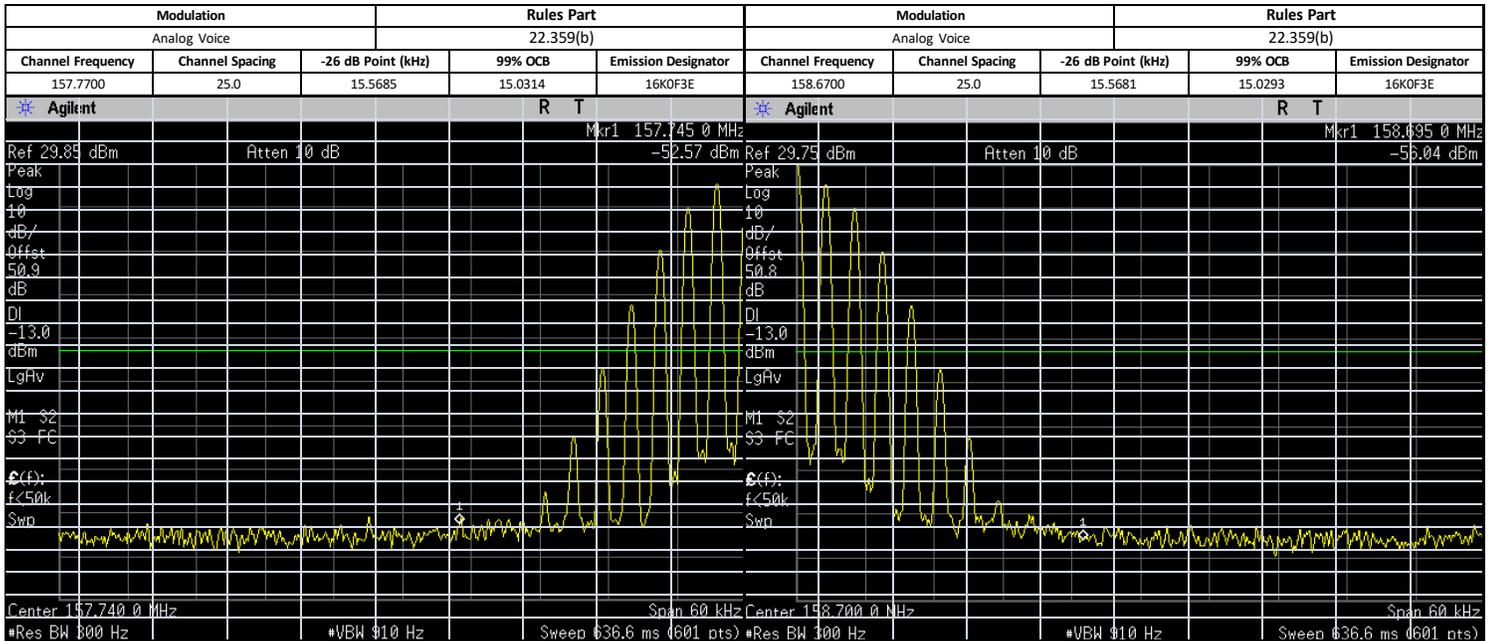
- For emission designator ending with F3E, 16K0F3E is the worst case and therefore only 16K0F3E will be shown.

### 6.7.2. Test Result (Analog)

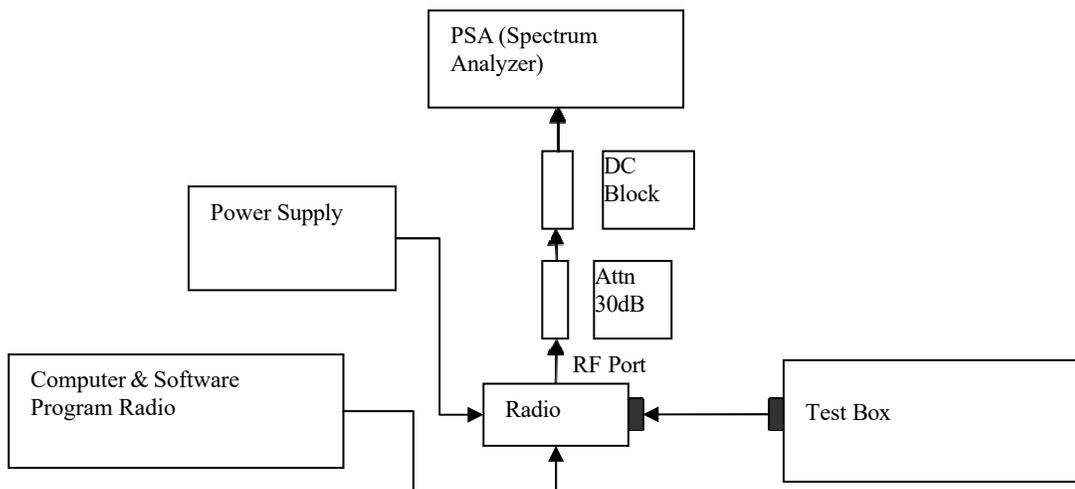
#### MAX POWER



#### LOW POWER



### 6.7.3. Test Setup (Digital)



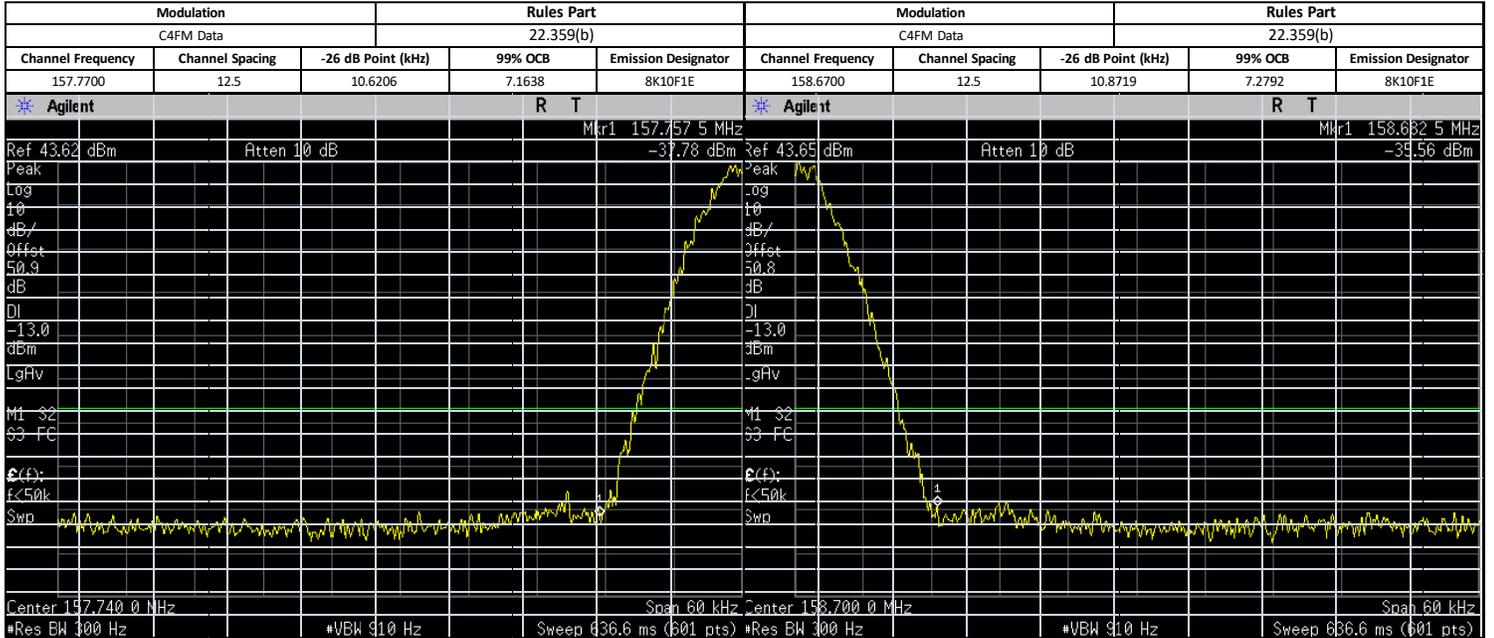
- 1) Program and set radio to operate in desire test frequency and digital mode with modulation. (\*4FSK, C4FM or other digital modulation form).
- 2) Path loss for the measurement included.
- 3) Select the Occupied Bandwidth measurement for 99% and 26dB Emissions Bandwidth Measurement.
- 4) Key in the 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:

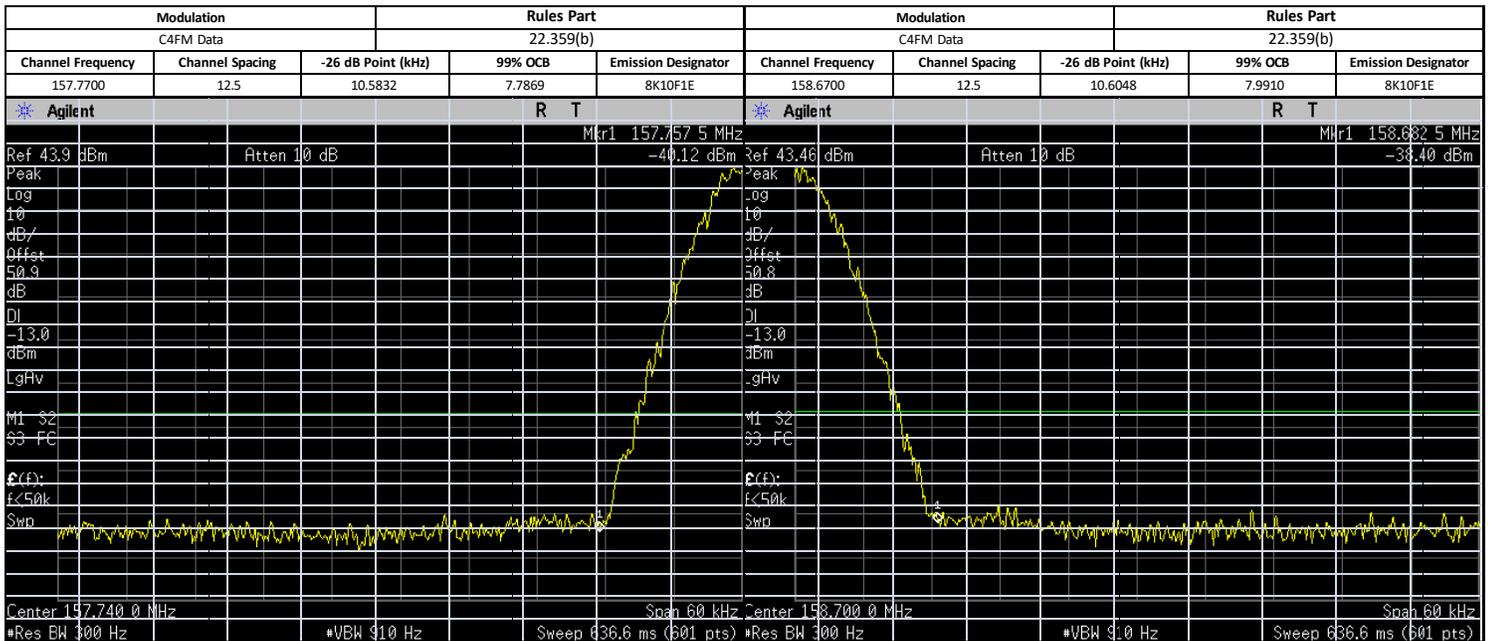
- For Digital Modulation, 12.5 kHz Data F1D & FXD would be the same. Therefore only measurements with F1D modulation shown below.
- For Digital Modulation, 12.5 kHz Data F1E & FXE would be the same. Therefore only measurements with F1E modulation shown below.

### 6.7.4. Test Result (Digital)

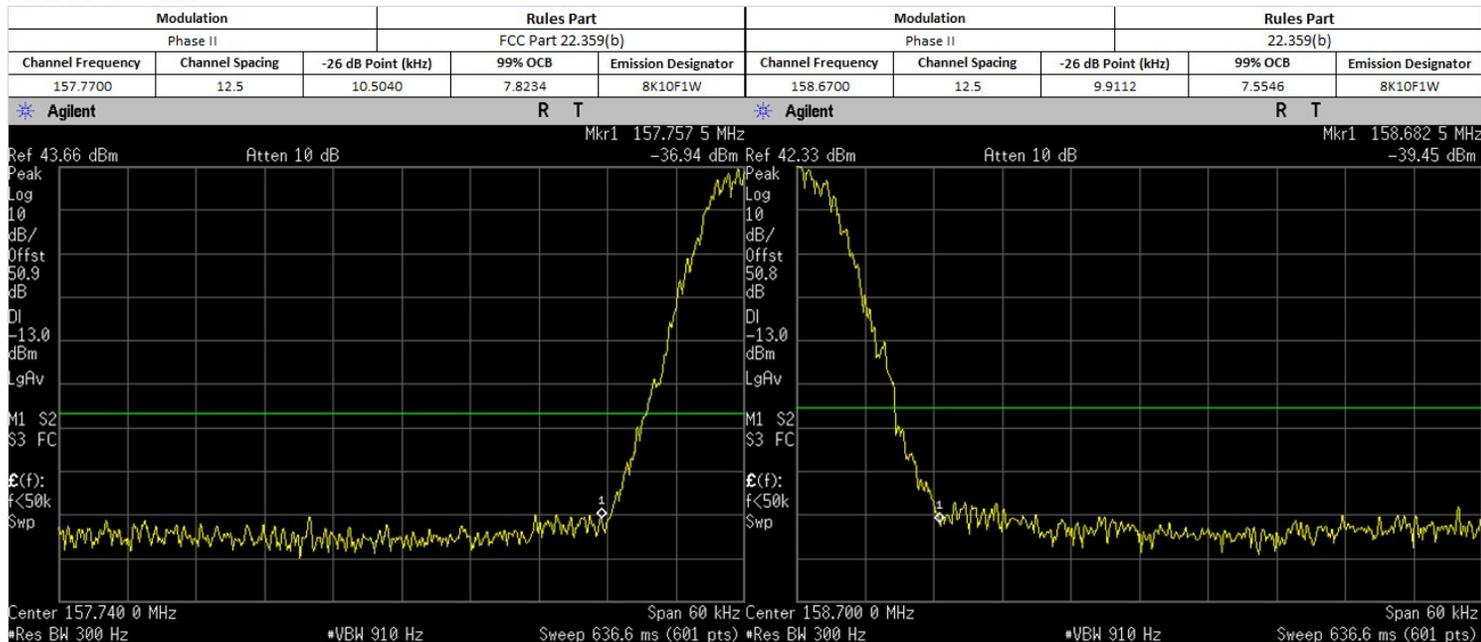
#### MAX POWER



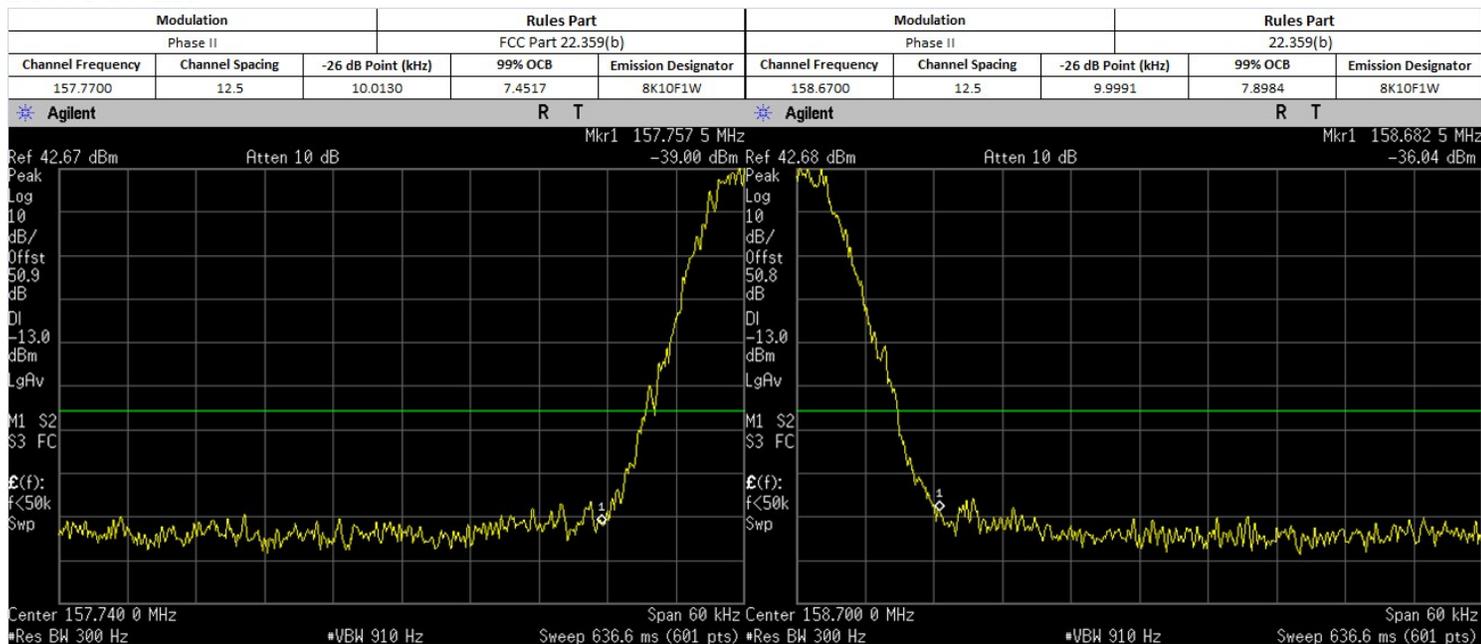
#### LOW POWER



### MAX POWER



### LOW POWER

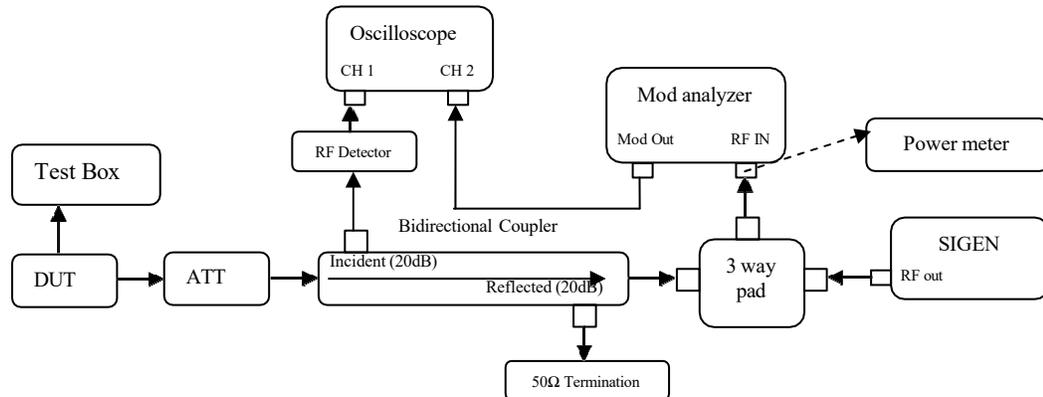


#### 6.7.1. Test Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

## 6.8. Transient Frequency Behavior

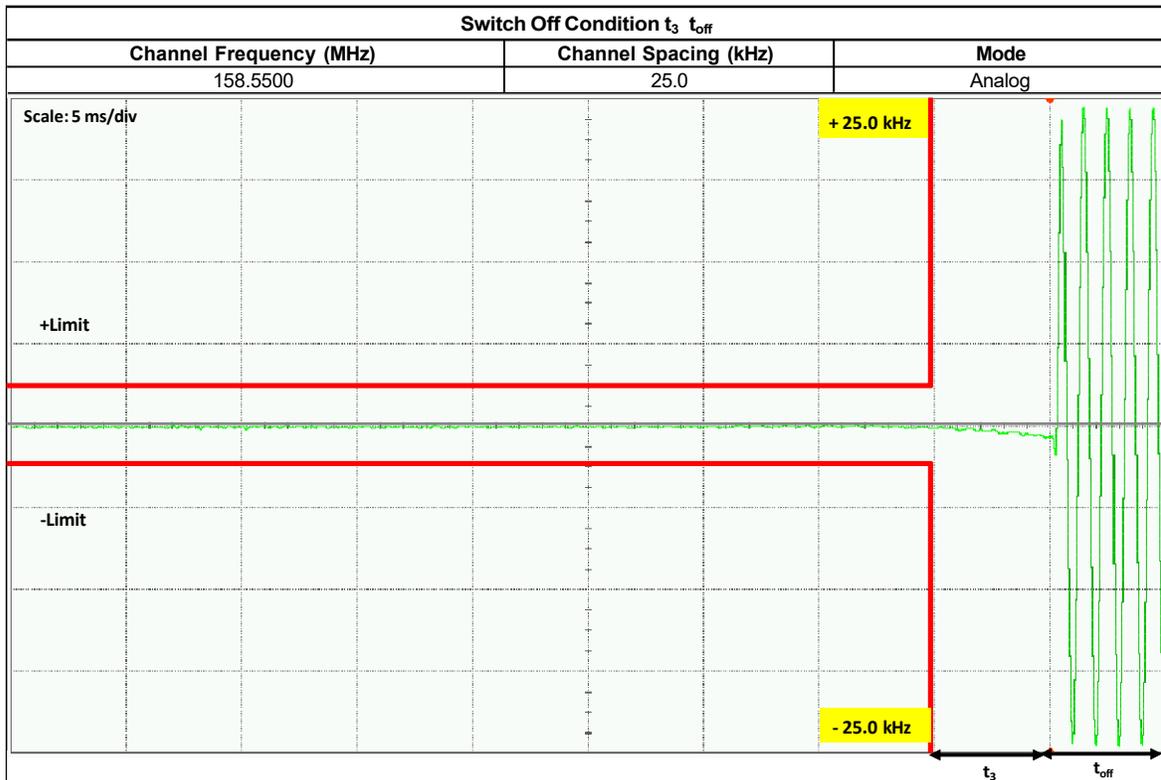
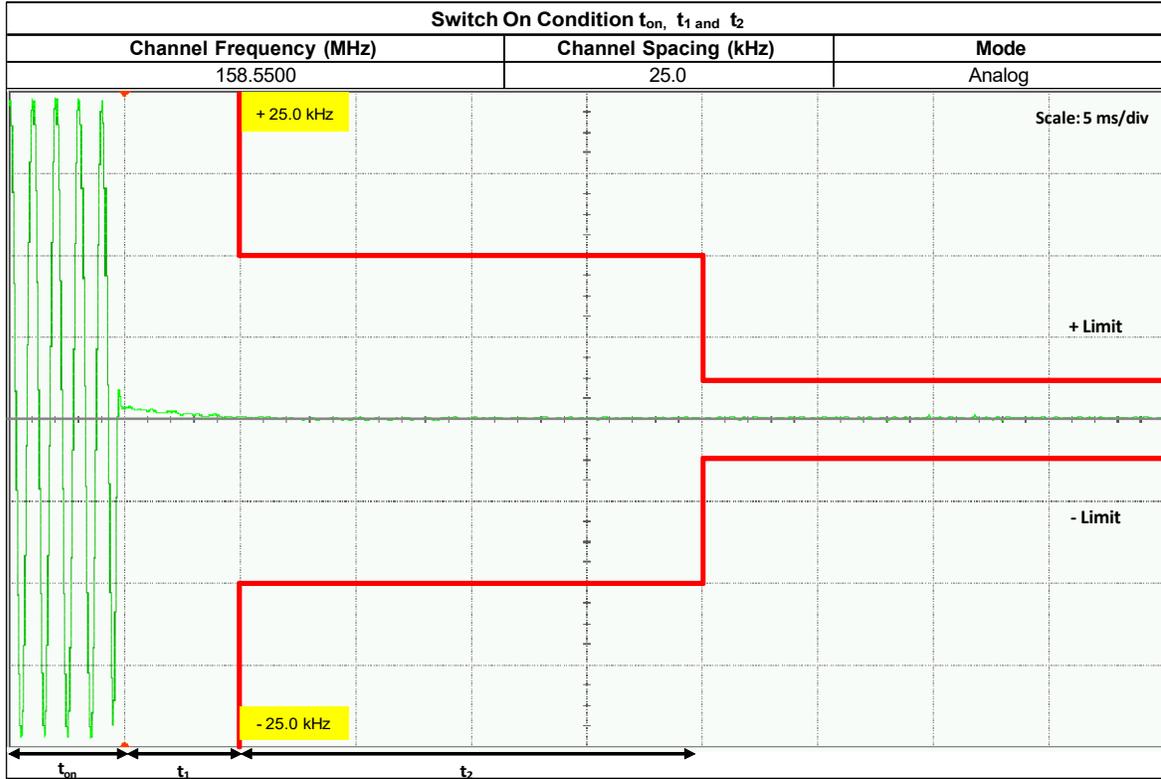
### 6.8.1. Test Setup

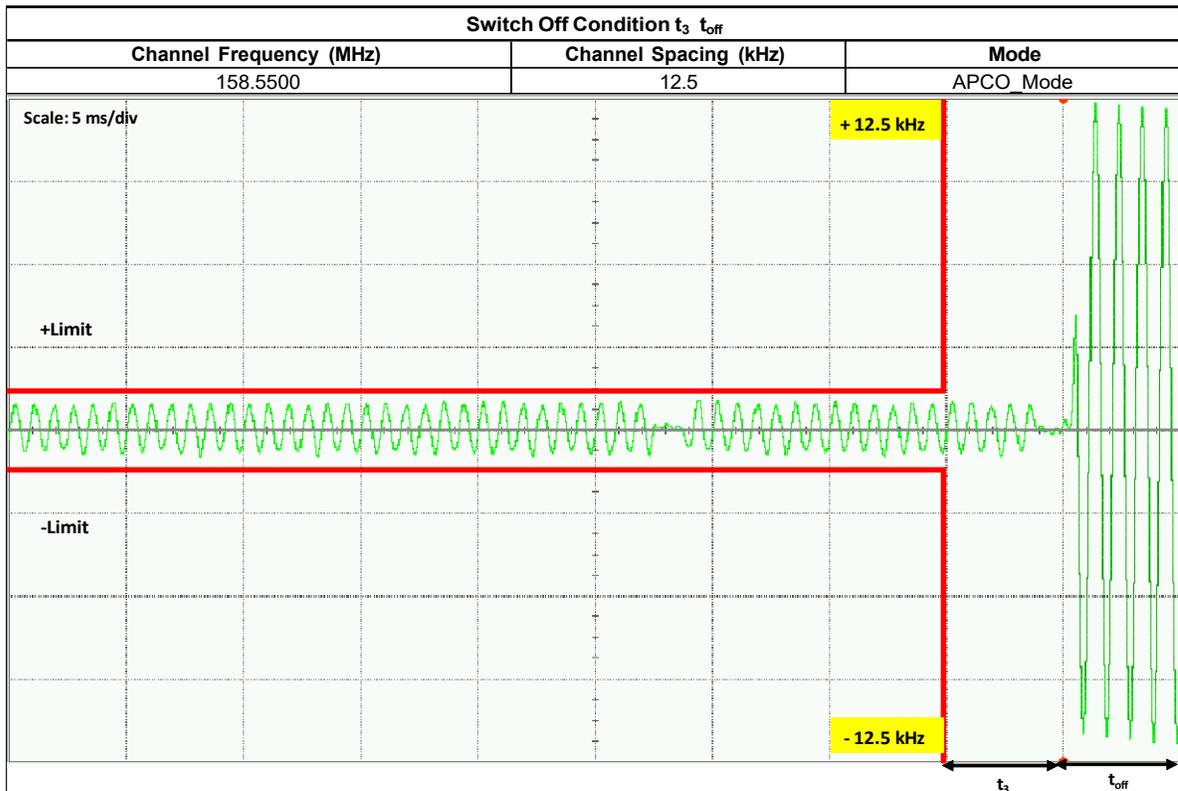
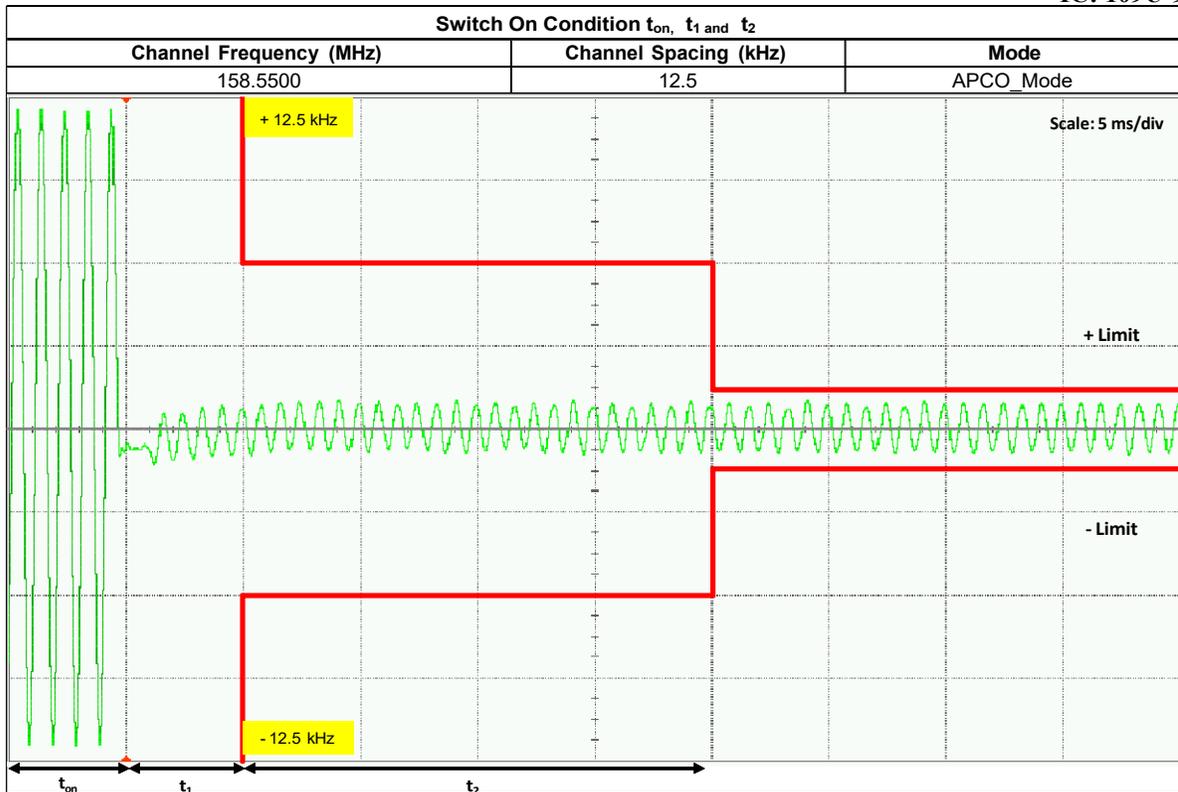


- 1) Connect the setup as figure above.
- 2) Path loss for the measurement included.
- 3) Set on Sigen with the assigned center frequency, internal 1 kHz FM tone.  
FM Deviation: Analog 25kHz Channel Spacing = 25 kHz  
Analog 12.5 kHz Channel Spacing = 12.5 kHz  
C4FM = 12.5 kHz
- 4) Turn on 50 kHz high pass filter and 15 kHz low pass filter on modulation analyzer.
- 5) Supply sufficient attenuation ATT to provide the output power of  $\leq -1$  dBm into power meter when DUT is keying up.
- 6) Note the power level on power meter and dekey the DUT.
- 7) Adjust the amplitude of the signal generator to the level power meter, maintained the amplitude throughout the rest of the measurement.
- 8) Connect the output to modulation analyzer.
- 9) Reduce 30dB attenuation and transmit the radio to get the trigger line.
- 10) Capture the screen shot for key-up (rising edge) and de-key (falling edge) mode.

### 6.8.2. Test Result

Not for FCC Review





### 6.8.3. Test Limit

Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time intervals <sup>1 2</sup>	Maximum frequency difference <sup>3</sup>	All equipment	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t <sub>1</sub> <sup>4</sup>	±25.0 kHz	5.0 ms	10.0 ms
t <sub>2</sub>	±12.5 kHz	20.0 ms	25.0 ms
t <sub>3</sub> <sup>4</sup>	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
t <sub>1</sub> <sup>4</sup>	±12.5 kHz	5.0 ms	10.0 ms
t <sub>2</sub>	±6.25 kHz	20.0 ms	25.0 ms
t <sub>3</sub> <sup>4</sup>	±12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
t <sub>1</sub> <sup>4</sup>	±6.25 kHz	5.0 ms	10.0 ms
t <sub>2</sub>	±3.125 kHz	20.0 ms	25.0 ms
t <sub>3</sub> <sup>4</sup>	±6.25 kHz	5.0 ms	10.0 ms

<sup>1</sup> t<sub>on</sub> is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

t<sub>1</sub> is the time period immediately following t<sub>on</sub>.

t<sub>2</sub> is the time period immediately following t<sub>1</sub>.

t<sub>3</sub> is the time period from the instant when the transmitter is turned off until t<sub>off</sub>.

t<sub>off</sub> is the instant when the 1 kHz test signal starts to rise.

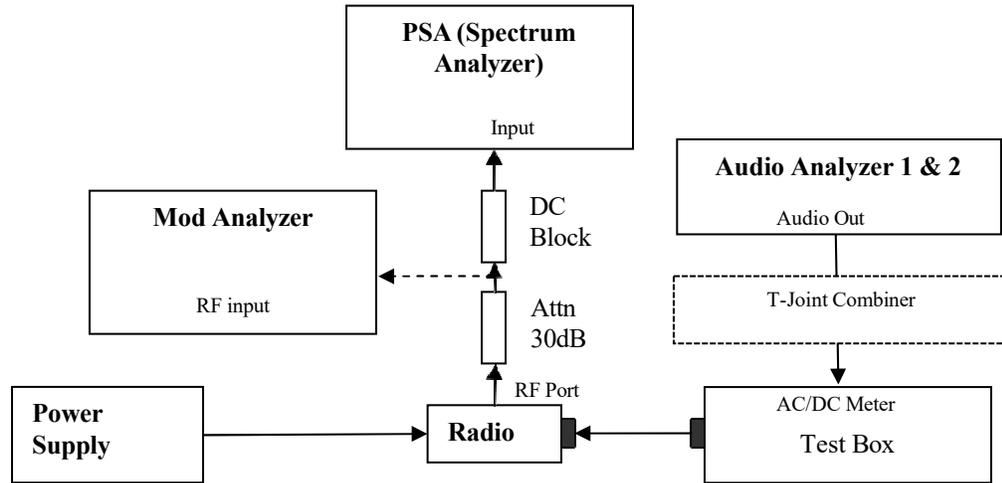
<sup>2</sup> During the time from the end of t<sub>2</sub> to the beginning of t<sub>3</sub>, the frequency difference must not exceed the limits specified in §90.213.

<sup>3</sup> Difference between the actual transmitter frequency and the assigned transmitter frequency.

<sup>4</sup> If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

## 6.9. Adjacent Channel Power

### 6.9.1. Test Setup (Analog)

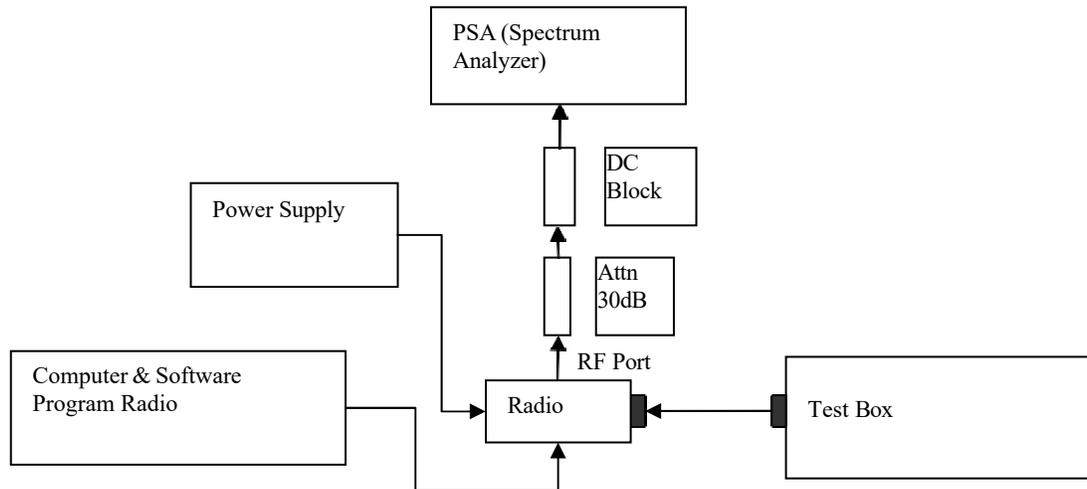


- 1) The DUT transmitter output port was connected to modulation analyzer.
- 2) Transmit the radio and turn on 1<sup>st</sup> audio analyzer with audio frequency 650Hz, 50% rated deviation, and record the amplitude value as AmpT1.
- 3) Turn off Audio analyzer 1 and turn on audio analyzer 2, set the audio frequency to 2.2 kHz and 50% deviation. Record the amplitude as AmpT2.
- 4) Turn both audio analyzers ON and up 10dB amplitude level.
- 5) Connect the output to PSA and set to assigned center frequency.
- 6) Set Span, Resolution Bandwidth and Video Bandwidth per rules part.
- 7) Transmit the radio and record the Adjacent Channel Power value in dBc.

### 6.9.2. Test Result

**Not Applicable**

### 6.9.3. 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) Prepare setup as per picture.
- 3) Turn on the ACP Measurement – Press Measure, ACP.
- 4) Set Span, Resolution Bandwidth and Video Bandwidth as per rules part.
- 5) Transmit the radio and record the Adjacent Channel Power value in dBc.

### 6.9.4. Test Result

**Not Applicable**

### 6.9.5. Test Limit

#### 12.5 kHz MOBILE TRANSMITTER ACP REQUIREMENTS

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP relative (dBc)
9.375	6.25	-40
15.625	6.25	-60
21.875	6.25	-60
37.50	25.00	-60
62.50	25.00	-65
87.50	25.00	-65
150.00	100	-65
250.00	100	-65
350.00	100	-65
>400 to 12 MHz	30 (s)	-75
12 MHz to paired receive band	30 (s)	-75
In the paired receive band	30 (s)	-100

#### 25 kHz MOBILE TRANSMITTER ACP REQUIREMENTS

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP relative (dBc)
15.625	6.25	-40
21.875	6.25	-60
37.50	25	-60
62.50	25	-65
87.50	25	-65
150.00	100	-65
250.00	100	-65
350.00	100	-65
>400 kHz to 12 MHz	30 (s)	-75
12 MHz to paired receive band	30 (s)	-75
In the paired receive band	30 (s)	-100

**12.5 kHz BASE TRANSMITTER ACP REQUIREMENTS**

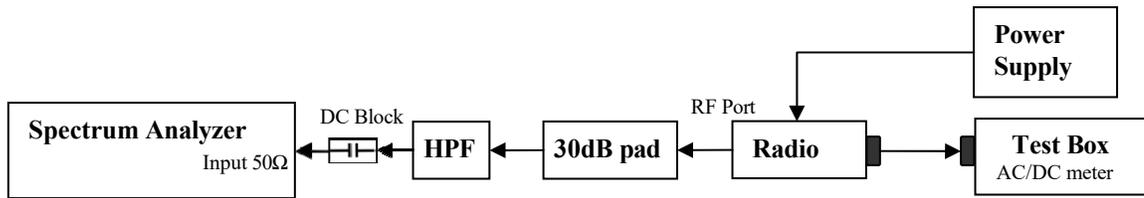
Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP (dBc)
9.375	6.25	-40
15.625	6.25	-60
21.875	6.25	-60
37.5	25	-60
62.5	25	-65
87.5	25	-65
150	100	-65
250	100	-65
350.00	100	-65
>400 kHz to 12 MHz	30 (s)	-80
12 MHz to paired receive band	30 (s)	-80
In the paired receive band	30 (s)	<sup>1</sup> -85

**25 kHz BASE TRANSMITTER ACP REQUIREMENTS**

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP (dBc)
15.625	6.25	-40
21.875	6.25	-60
37.5	25	-60
62.5	25	-65
87.5	25	-65
150	100	-65
250	100	-65
350	100.00	-65
>400 kHz to 12 MHz	30 (s)	-80
12 MHz to paired receive band	30 (s)	-80
In the paired receive band	30 (s)	<sup>1</sup> -85

## 6.10. Conducted Spurious Emission

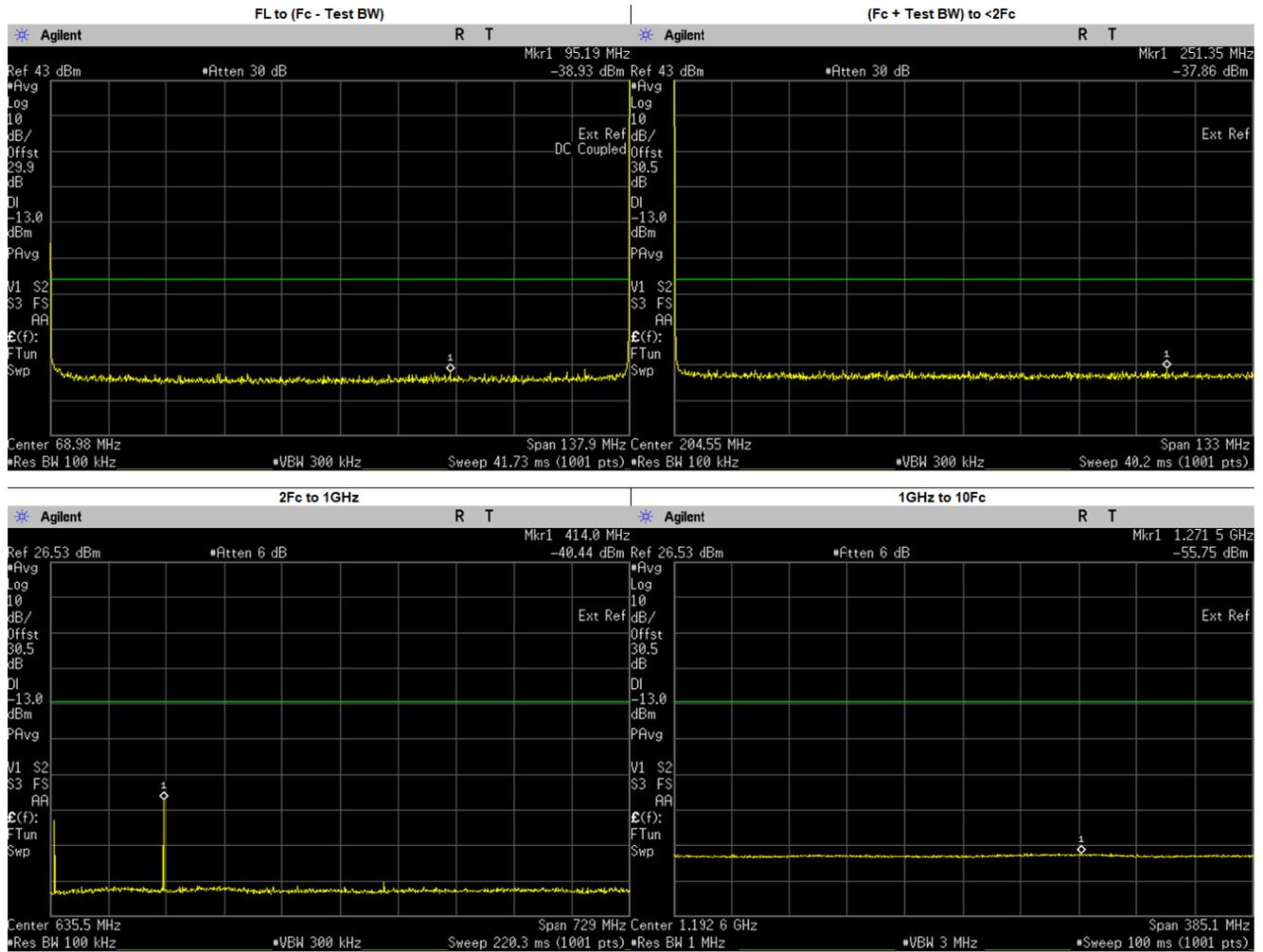
### 6.10.1. Test Setup



- 1) The DUT transmitter output port was connected to Spectrum Analyzer with above setup.
- 2) Program and set radio to operate in desire test frequency and mode. (Analog / digital modulation form).
- 3) Path loss for the measurement included.
- 4) Set the PSA Resolution Bandwidth as per rules part.
- 5) Set the Ref offset from the pathloss offset calibration file.
- 6) Adjust the center frequency of the spectrum analyzer for incremental coverage of the range from:
  - a. 9 KHz to  $F_c - \text{Test Bandwidth}$
  - b.  $F_c + \text{Test Bandwidth}$  to  $2F_c - 5\text{MHz}$ .
- 7) Key up the DUT, Peak Search the highest Spur and record the levels of spurious emissions
- 8) Dekey the DUT.
- 9) Turn On High Pass Filter path and Key up the DUT.
- 10) Adjust the PSA Freq for incremental coverage of range from  $2F_c$  to  $10F_c$
- 11) Key up the DUT and record the highest spur levels of spurious emissions.

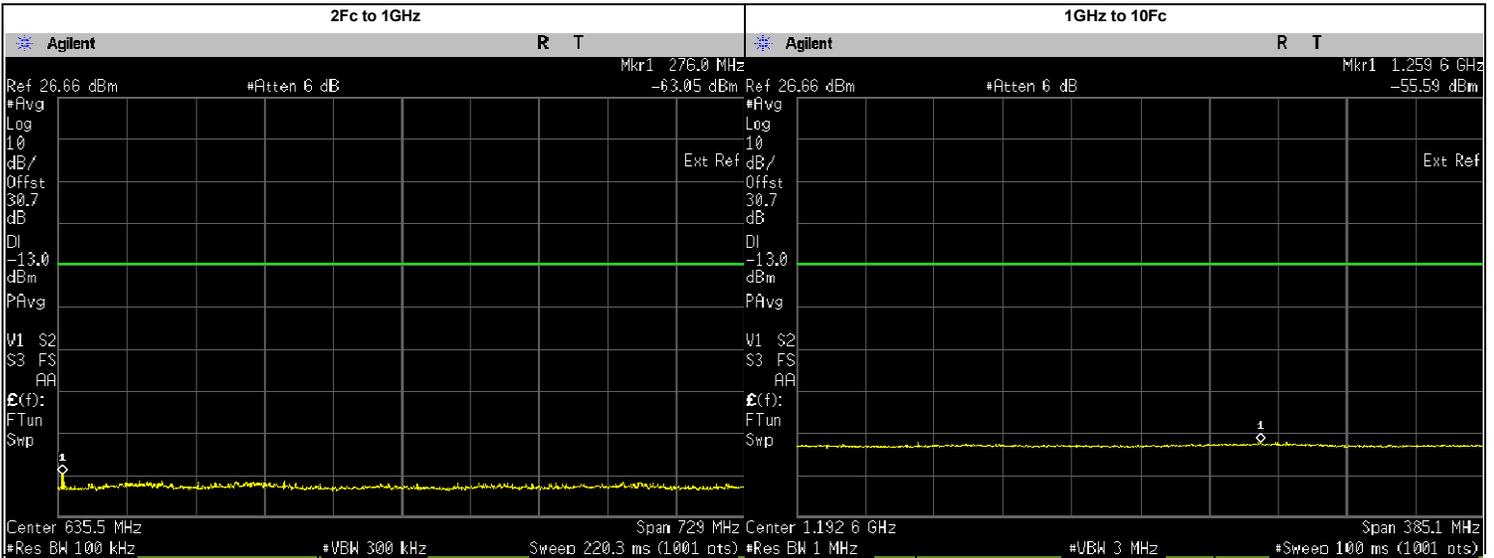
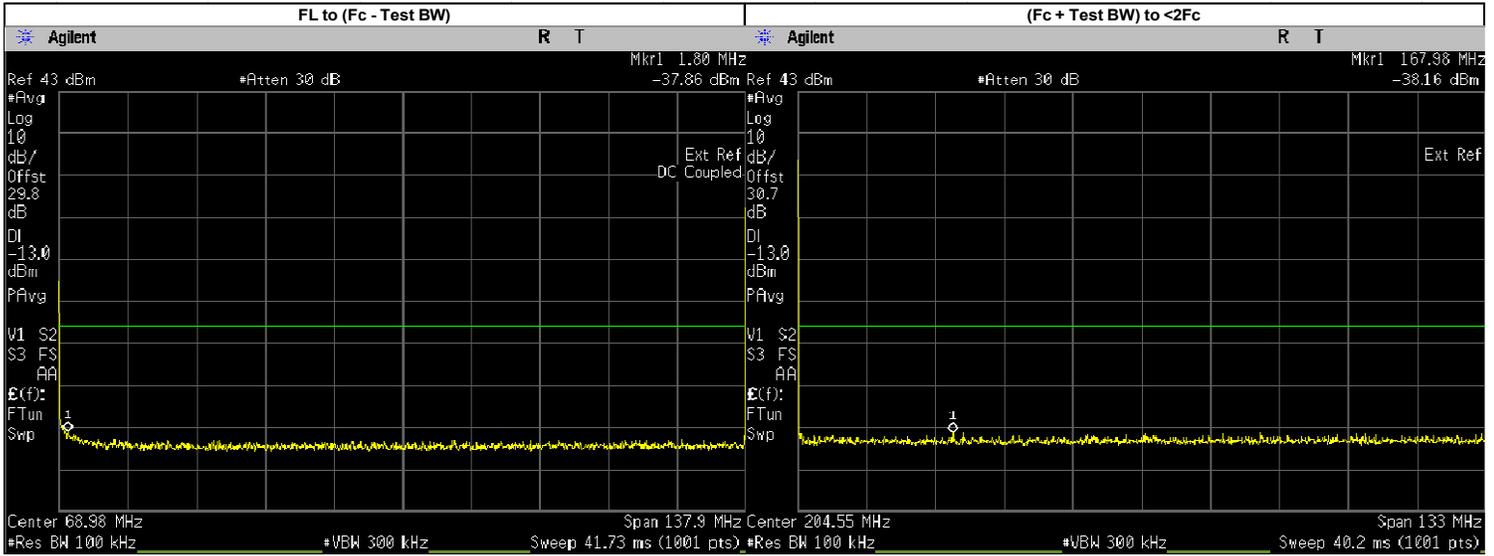
### 6.10.2. Test Result (Analog)

**Analog: 138.0125 MHz, 25 .kHz Channel Spacing, Max. Power**  
 Not for FCC review



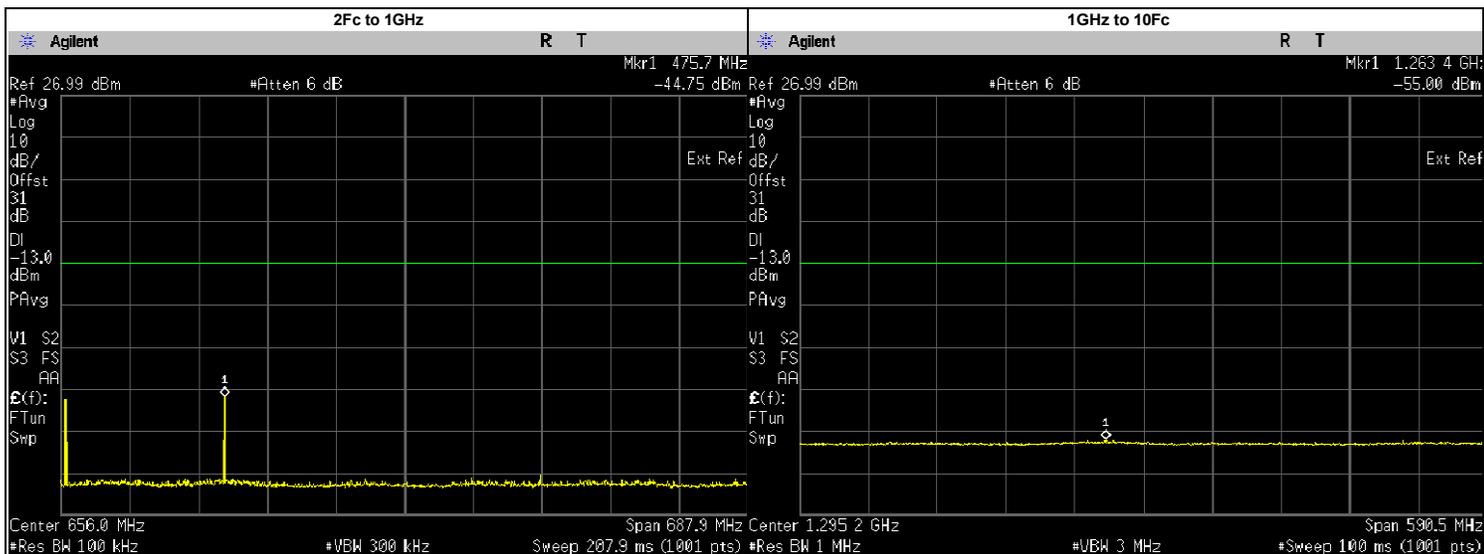
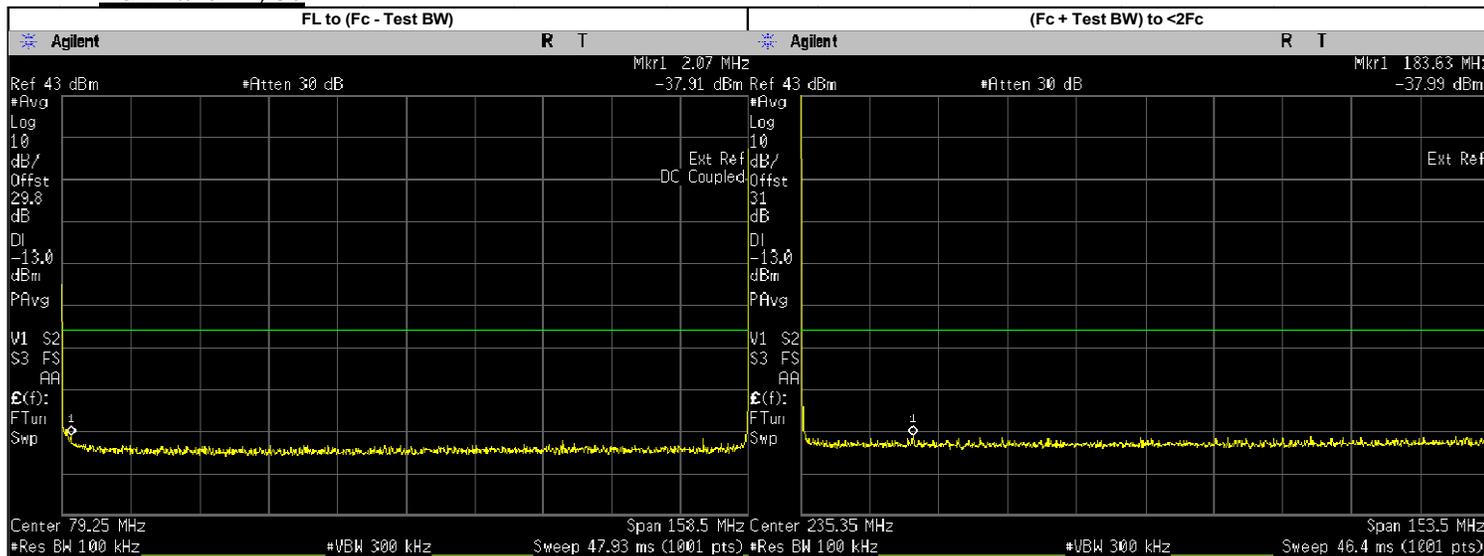
Frequency Range	Highest Spur Frequency (MHz)	Spurious Level (dBm)	Failing Limit (dBm)	Results
FL to (Fc - Test BW)	95.1900	-38.9300	-13.00	PASS
(Fc + Test BW) to <2Fc	251.3474	-37.8600	-13.00	PASS
2Fc to 1GHz	414.0000	-40.4400	-13.00	PASS
	276.0250	-49.2435	-13.00	PASS
	414.0375	-45.1642	-13.00	PASS
	552.0500	-65.4455	-13.00	PASS
	690.0625	-64.2164	-13.00	PASS
	828.0750	-66.3923	-13.00	PASS
1GHz to 10Fc	966.0875	-66.3281	-13.00	PASS
	1271.5130	-55.7500	-13.00	PASS
	1104.1000	-56.5289	-13.00	PASS
	1242.1120	-56.2861	-13.00	PASS
	1380.1250	-56.3631	-13.00	PASS

**Analog: 138.0125 MHz, 25 .kHz Channel Spacing, Low. Power**  
 Not for FCC review



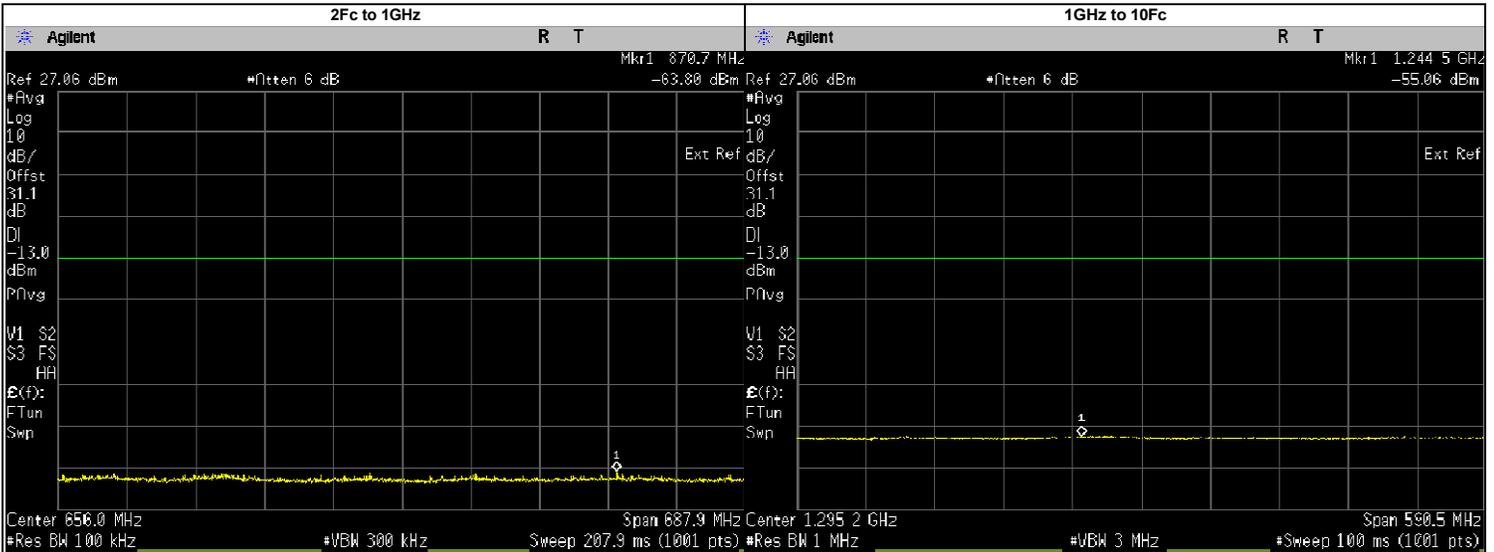
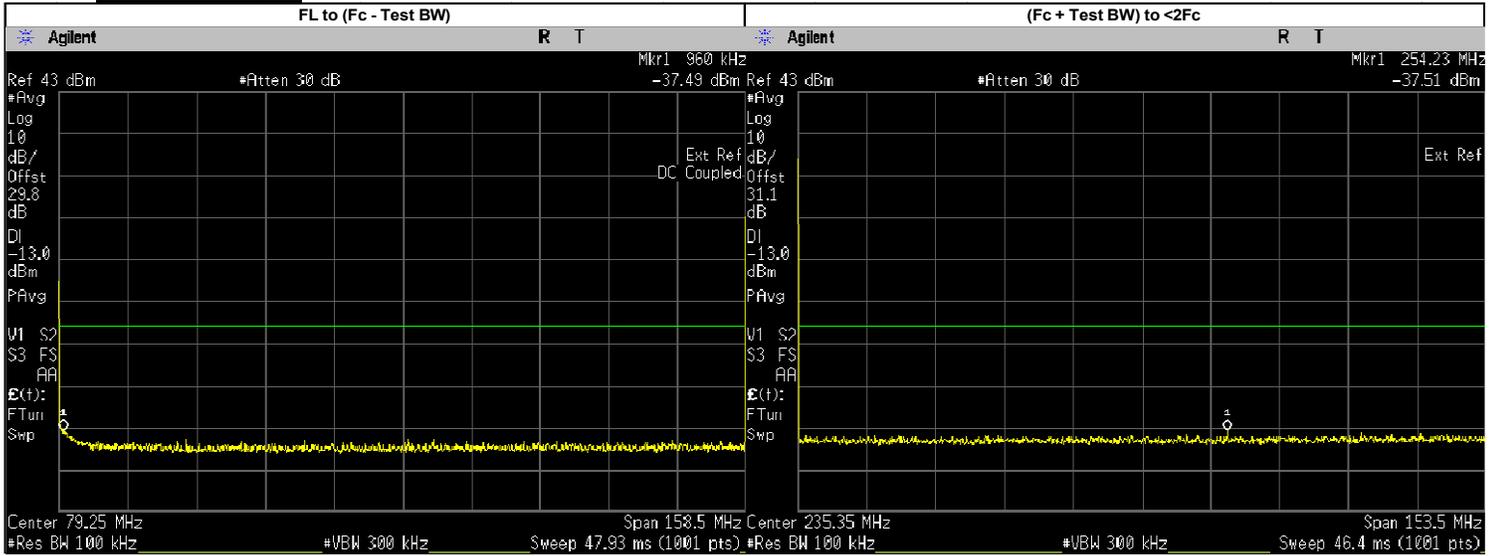
Frequency Range	Highest Spur Frequency (MHz)	Spurious Level (dBm)	Failing Limit (dBm)	Results
FL to (Fc - Test BW)	1.8000	-37.8610	-13.00	PASS
(Fc + Test BW) to <2Fc	167.9834	-38.1600	-13.00	PASS
2Fc to 1GHz	276.0000	-63.0500	-13.00	PASS
	276.0250	-63.5275	-13.00	PASS
	414.0375	-66.0914	-13.00	PASS
	552.0500	-66.4818	-13.00	PASS
	690.0625	-66.0736	-13.00	PASS
	828.0750	-65.7165	-13.00	PASS
	966.0875	-66.3116	-13.00	PASS
1GHz to 10Fc	1259.5740	-55.5900	-13.00	PASS
	1104.1000	-56.1028	-13.00	PASS
	1242.1120	-55.8750	-13.00	PASS
	1380.1250	-56.2728	-13.00	PASS

**Analog: 158.55 MHz, 25 .kHz Channel Spacing, Max. Power  
 For Part 22, 80**



Frequency Range	Highest Spur Frequency (MHz)	Spurious Level (dBm)	Failing Limit (dBm)	Results
FL to (Fc - Test BW)	2.0700	-37.9130	-13.00	PASS
(Fc + Test BW) to <2Fc	183.6252	-37.9900	-13.00	PASS
2Fc to 1GHz	475.7000	-44.7500	-13.00	PASS
	317.1000	-50.8377	-13.00	PASS
	475.6500	-49.8971	-13.00	PASS
	634.2000	-65.2042	-13.00	PASS
	792.7500	-64.0474	-13.00	PASS
	951.3000	-66.2235	-13.00	PASS
1GHz to 10Fc	1263.3630	-55.0000	-13.00	PASS
	1109.8500	-55.9351	-13.00	PASS
	1268.4000	-55.6866	-13.00	PASS
	1426.9500	-56.2501	-13.00	PASS
	1585.5000	-55.7821	-13.00	PASS

**Analog: 158.55 MHz, 25 .kHz Channel Spacing, Low. Power  
 For Part 22, 80**



Frequency Range	Highest Spur Frequency (MHz)	Spurious Level (dBm)	Failing Limit (dBm)	Results
FL to (Fc - Test BW)	0.9600	-37.4940	-13.00	PASS
(Fc + Test BW) to <2Fc	254.2326	-37.5100	-13.00	PASS
2Fc to 1GHz	870.6748	-63.8000	-13.00	PASS
	317.1000	-64.8342	-13.00	PASS
	475.6500	-64.6020	-13.00	PASS
	634.2000	-65.5727	-13.00	PASS
	792.7500	-65.6765	-13.00	PASS
	951.3000	-65.4743	-13.00	PASS
1GHz to 10Fc	1244.4670	-55.0600	-13.00	PASS
	1109.8500	-55.8334	-13.00	PASS
	1268.4000	-55.5732	-13.00	PASS
	1426.9500	-55.9020	-13.00	PASS
	1585.5000	-55.7898	-13.00	PASS