

	    CERTIFICATE 2518.05 MS ISO/IEC 17025 TESTING SAMMNO. 0825																												
MOTOROLA PENANG ADV. COMM. LABORATORY Motorola Solutions Malaysia Sdn Bhd Plot 2A, Medan Bayan Lepas, Mukim 12 SWD, 11900 Bayan Lepas, Penang, Malaysia.	FCC / ISED TEST REPORT Report Revision : Rev.C																												
<table><tr><td>Date/s Tested</td><td>: 18-NOV-2019 - 29-NOV-2019</td></tr><tr><td>Report Issue Date</td><td>: 13-DEC-2019</td></tr><tr><td>Manufacturer/Location</td><td>: Motorola Solutions Malaysia SDN BHD Plot 2A, Medan Bayan Lepas, Mukim 12 SWD., 11900 Bayan Lepas, Penang, Malaysia</td></tr><tr><td>Requestor</td><td>: TEH TIAN HONG</td></tr><tr><td>Product Type</td><td>: Base Station</td></tr><tr><td>Model Number</td><td>: T7039A (T7039-VHF100W)</td></tr><tr><td>Frequency Band</td><td>: 136-174Mhz</td></tr><tr><td>Low / Max RF Output Power</td><td>: 2Watts /110Watts</td></tr><tr><td>Applicant Name</td><td>: Motorola Solutions Inc</td></tr><tr><td>Applicant Address</td><td>: 8000 West Sunrise Boulevard, Fort Lauderdale, Florida 33322</td></tr><tr><td>ISED Registrations</td><td>: MY0001</td></tr><tr><td>FCC Registrations</td><td>: 461337</td></tr><tr><td>Firmware Version</td><td>: 35.00.09</td></tr></table>  The equipment was tested accordance to the requirement listed below: <table><tr><td>(LMR) FCC 47 CFR Part 22/74/80/90 ISED RSS119/182</td><td>PASS</td></tr></table>		Date/s Tested	: 18-NOV-2019 - 29-NOV-2019	Report Issue Date	: 13-DEC-2019	Manufacturer/Location	: Motorola Solutions Malaysia SDN BHD Plot 2A, Medan Bayan Lepas, Mukim 12 SWD., 11900 Bayan Lepas, Penang, Malaysia	Requestor	: TEH TIAN HONG	Product Type	: Base Station	Model Number	: T7039A (T7039-VHF100W)	Frequency Band	: 136-174Mhz	Low / Max RF Output Power	: 2Watts /110Watts	Applicant Name	: Motorola Solutions Inc	Applicant Address	: 8000 West Sunrise Boulevard, Fort Lauderdale, Florida 33322	ISED Registrations	: MY0001	FCC Registrations	: 461337	Firmware Version	: 35.00.09	(LMR) FCC 47 CFR Part 22/74/80/90 ISED RSS119/182	PASS
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Prepared By:  AARON GOH TONG WEN Test Personnel	Approved Signatory: VINCENT FOONG CHUEN KIT Deputy Technical Manager																												

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Report Revision History

Revision History	Description	Date	Originator
Rev. A	Initial Report	3-DEC-2019	Aaron Goh
Rev. B	Updated power and spurious plots	25-FEB-2020	Vincent Foong
Rev. C	Fixed 9K80 designator, typo in TFB	27-FEB-2020	Vincent Foong

1.0 General Information

EUT Description:

Technologies	Land Mobile Radio (LMR)
Modulation Type	Analog, C4FM , Phase II,FSK,LSM

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

2.0 Summary of Test Results

FCC General Rules Part (47CFR)	ISED General Rules Part	Test Item	Result	Remark
2.1046,90.541(700MHz),22.565,74.461,74.534,80.215	RSS-119	RF Power Output	Pass	-
2.1055, 90.213, 22.355	RSS-119	Frequency Stability	Pass	-
2.1047,74.463,80.213	RSS-119	Audio Frequency Response	Pass	-
2.1047,74.463,80.213	RSS-119	Audio Low Pass Filter Response	Pass	-
2.1047,74.463,80.213	RSS-119	Modulation limiting	Pass	-
2.1049,90.210,22.359,74.462(c), 80.211(c),90.210,80.211(f),22.359(b)	RSS-119 RSS-182	Occupied Bandwidth	Pass	16K0F3E- 14.8269kHz 16K0F1D- 7.8632kHz 10K0F1D- 5.5237kHz 11K0F3E-9.8879kHz 8K10F1D-7.3527kHz 8K10F1E-7.3534kHz 8K10F1W-7.7724kHz 8K70D1E- 8.5845kHz 8K70D1D- 8.6263kHz 8K70D1W- 8.6023kHz 9K80D7E- 9.7843kHz 9K80D7D-9.7884kHz 9K80D7W-9.7378kHz
22.359(a),(b)	RSS-119	Band Edge Conducted Spurious Emission	Pass	-
90.214	RSS-119	Transient Frequency Behavior	Pass	-
-	-	Adjacent Channel Power	NA	-
Low end of the band,22,90,74D,74H,80	RSS-119	Conducted Spurious Emissions	Pass	No spur detected (noise floor)
Low end of the band,22,90,74D,74H,80	RSS-119	Radiated Spurious Emission	Pass	Highest Spur Level -37.26 dBm
-	-	GNSS (EIRP for 1559 – 1610MHz)	NA	-
-	-	Effective Radiated Power (ERP)	NA	-

NA → Not Applicable

3.0 Measurement Uncertainty

Measurement	Frequency	Expended Uncertainty (k=1.96) (±)
AC Power Line Conducted Spurious Emission	150KHz ~ 30MHz	3.43
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	5.01
	200MHz ~ 1000MHz	5.01
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.01
	18GHz ~ 25GHz	5.01

4.0 Equipment List

FCC Analog ATE#1: (SW version: 2.4.5 & FCC_Frequency Stability 1.0.3 rev.)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
Audio Analyzer	8903B	3729A17612	15-Nov-17	15-Nov-20
SIGNAL GENERATOR	2042	203002/747	22-Jan-19	22-Jan-20
MODULATION ANALYZER	8901B	3538A5696	4-Apr-19	4-Apr-20
DSA	36570A	MY42506790	4-Apr-19	4-Apr-20
POWER SENSOR	E9301B	MY41502652	31-Jul-19	31-Jul-20
POWER METER	E4416A	GB41293747	19-Nov-18	19-Nov-20
POWER SUPPLY	6623A	2916A01562	31-Mar-19	31-Mar-20
CHAMBER	SH-641	92009188	29-Mar-19	29-Mar-20
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
POWER SUPPLY	6032A	3232A08203	11-Apr-19	11-Apr-20
AC POWER SUPPLY	61604	616040003502	19-Dec-18	19-Dec-19
CHAMBER	HSK350/40	HS44-2	22-Apr-19	22-Apr-20

FCC Transient ATE #1: (SW version: FCC Transient ATE_R1.1.2)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
POWER SUPPLY	6031A	2430A00146	5-Apr-19	5-Apr-20
POWER SENSOR	E4412A	MY41498918	31-Jul-19	31-Jul-20
POWER METER	E4416A	GB41293866	26-Feb-19	26-Feb-21
ATTENUATORS/SWITCH DRIVER	11713A	2508A10141	CNR	CNR
STEP ATTENUATOR/11dB	8494G	MY42143870	17-May-19	17-May-20
STEP ATTENUATOR/110dB	8496G	MY42143622	17-May-19	17-May-20
OSCILLOSCOPE	MSO8104A	MY45002372	17-Jun-19	17-Jun-20
AUDIO ANALYZER	8903B	3011A08952	5-Jul-19	5-Jul-20
AUDIO ANALYZER	8903B	3729A17409	4-Jul-19	4-Jul-20
MODULATION ANALYZER	8901B	3226A04052	3-Apr-19	3-Apr-20
SIGNAL GENERATOR	8657B	3427U06025	5-Apr-19	5-Apr-20
SPECTRUM ANALYZER	E4440A	MY48250517	11-Sep-19	11-Sep-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 1.23.02)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
SWITCH CONTROL UNIT	3488A	2719A32735	CNR	CNR
PSA Series Spectrum Analyzer	E4445A	MY46181732	12-Mar-19	12-Mar-21
POWER SUPPLY	6032A	2723A02219	2-Jul-19	2-Jul-20
HIGH PASS FILTER SWITCH BOX	-	CS001	6-Jul-19	6-Jul-20
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

Radiated Emission: 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 (0-60V / 0-50A, 1000W)	6032A	MY41001736	25-May-19	25-May-20
SIGNAL GENERATOR	SMB 100A	181117	8-Nov-18	8-Nov-21
EMI TEST RECEIVER	ESW44	101750	24-Jul-19	24-Jul-20
EMI TEST RECEIVER	ESIB26	100017	19-Jul-19	19-Jul-20
5m Semi-anechoic Chamber	S800-HX	J2308	No Cal. Req'd	No Cal. Req'd
BILOG ANTENNA	CBL6112D	30991	5-Aug-19	5-Aug-20
BILOG ANTENNA	CBL6112B	2964	16-Feb-18	16-Feb-20
DATA LOGGER	SDL500	A.016800	19-Mar-19	18-Mar-20
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	21-Dec-18	21-Dec-19
18 - 40GHz PREAMPLIFIER	Miteq Hi Gain Sucoflex	001	No Cal. Req'd	No Cal. Req'd
PREAMPLIFIER	PAM-0118	269	24-May-19	24-May-22
LOOP ANTENNA	6502	00203479	10-Dec-18	10-Dec-19
Test Software	EMC_FCC_IC_Bluetooth_RE_Test			
Version	EMC FCC_RE v1.6.0			

CNR → Calibration Not Required

5.0 Test Condition

5.1 Transmitter Test Conditions

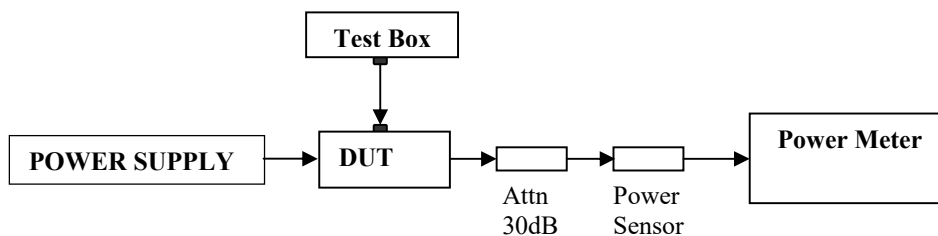
Test Item, (Channel Spacing)	Power (W)	Modulation	Test Frequency (MHz)	Tested By
RF Output Power	Low & Max	Analog	136.0125,138.0125, 152.03,152.09,152.81, 158.55,161.7,173.3875	AARON GOH
Frequency Stability	Max	Analog	158.55	AARON GOH
Audio Frequency Response (12.5kHz / 25kHz)	Max	Analog	152.09,158.55	AARON GOH
Audio Low Pass Filter Response (12.5kHz / 25kHz)	Max	Analog	152.09,158.55	AARON GOH
Modulation limiting (12.5kHz / 25kHz)	Max	Analog	152.09,158.55	AARON GOH
Occupied Bandwidth (12.5kHz / 25kHz)	Max	Analog, C4FM, LSM, HDQPSK, FSK	138.0125,152.09,158.55, 161.7,173.3875	AARON GOH
Band Edge Conducted Spurious Emissions (Part 22) (12.5kHz / 20kHz / 25kHz)	Max	Analog, C4FM	152.03,152.81	AARON GOH
Transient Frequency Behavior (UHF & VHF Band) (12.5kHz / 25kHz)	Max	Analog	158.55	AARON GOH
Adjacent Channel Power (700MHz Band) (12.5kHz)	Max	Analog	NA	NA
Conducted Spurious Emissions- (12.5kHz / 25kHz)	Low / Max	Analog, C4FM, LSM, HDQPSK, FSK	136.0125,138.0125, 152.09,158.55,161.7, 173.3875	AARON GOH
Radiated Spurious Emission (12.5kHz / 25kHz)	Low / Max	Analog, C4FM, LSM, HDQPSK, FSK	136.0125,138.0125, 152.09,158.55,161.7, 173.3875	Azil&Nazrin
GNSS (EIRP for 1559 - 1610MHz) (12.5kHz / 25kHz)	Max	Analog	NA	NA
Effective Radiated Power (ERP) (12.5kHz / 25kHz)	Max	Analog	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

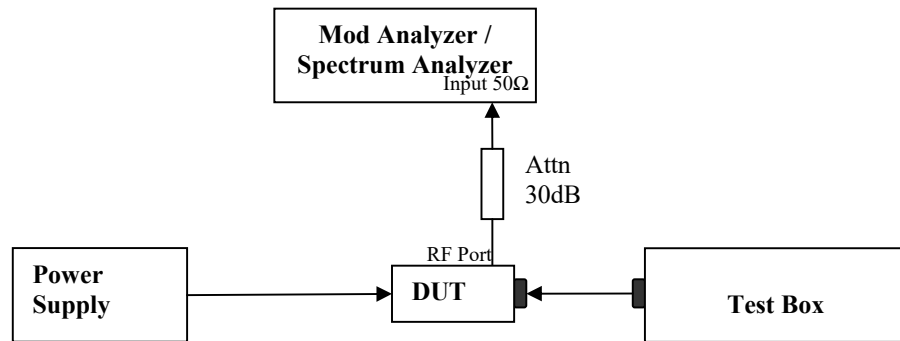
Temperature	25°C				Remarks
Voltage (V)	240V				
Frequency (MHz)	Low Power (W)	Current (A)	Max Power (W)	Current (A)	
136.0125	2.03	1.03	108	2.26	
138.0125	1.94	1.03	108	2.65	
152.03	1.96	1.05	107	2.83	
152.09	2.01	1.05	106	2.83	
152.81	1.99	1.04	107	2.83	
158.55	2.01	1.04	49.7	2.17	
161.7	1.92	1.03	97.2	2.25	
161.7	1.92	1.03	105	2.67	
173.3875	1.93	1.03	106	2.48	

Temperature	25°C				Remarks
Voltage (V)	120V				
Frequency (MHz)	Low Power (W)	Current (A)	Max Power (W)	Current (A)	
136.0125	1.92	1.96	107	4.58	
138.0125	1.96	1.96	107	4.62	
152.03	1.96	1.98	106	4.99	
152.09	2	1.98	106	5	
152.81	2.03	1.99	107	5.01	
158.55	1.96	1.98	47.9	3.58	
161.7	1.92	1.97	95.9	4.49	
161.7	1.92	1.97	106	4.68	
173.3875	1.96	1.94	106	4.25	

Temperature	25°C				Remarks
Voltage (V)	48V				
Frequency (MHz)	Low Power (W)	Current (A)	Max Power (W)	Current (A)	
136.0125	1.97	4.16	108	10.40	
138.0125	1.99	4.16	108	10.51	
152.03	2.02	4.23	107	11.43	
152.09	1.99	4.23	107	11.43	
152.81	1.98	4.23	107	11.40	
158.55	1.95	4.19	48.2	8.13	80, RSS 182 (Max 50W Fixed station)
161.7	1.97	4.19	95.7	10.03	74D (Max 100W), 74H (Max 1W)
161.7	1.97	4.19	107	10.64	90
173.3875	1.98	4.14	106	9.65	

6.2. Frequency Stability

6.2.1. Test Setup

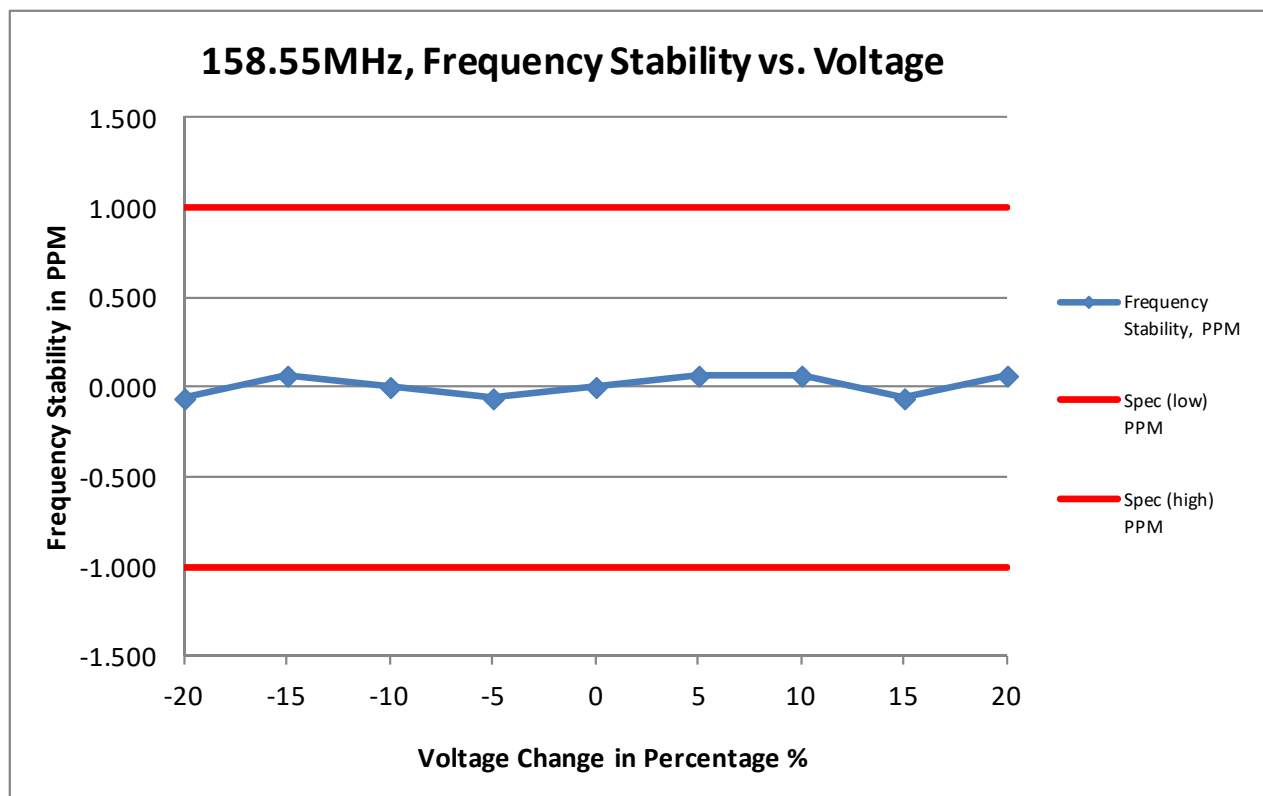


- 1) The DUT transmitter output port was connected to Modulation / Spectrum Analyzer.
- 2) Path loss for the measurement included.
- 3) Transmit the DUT and record the freq in MCF_{MHz} .
- 4) Test in 2 conditions:
 - Temperature: The frequency of the transmitter was measured from -30°C to 50°C.
 - Supply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

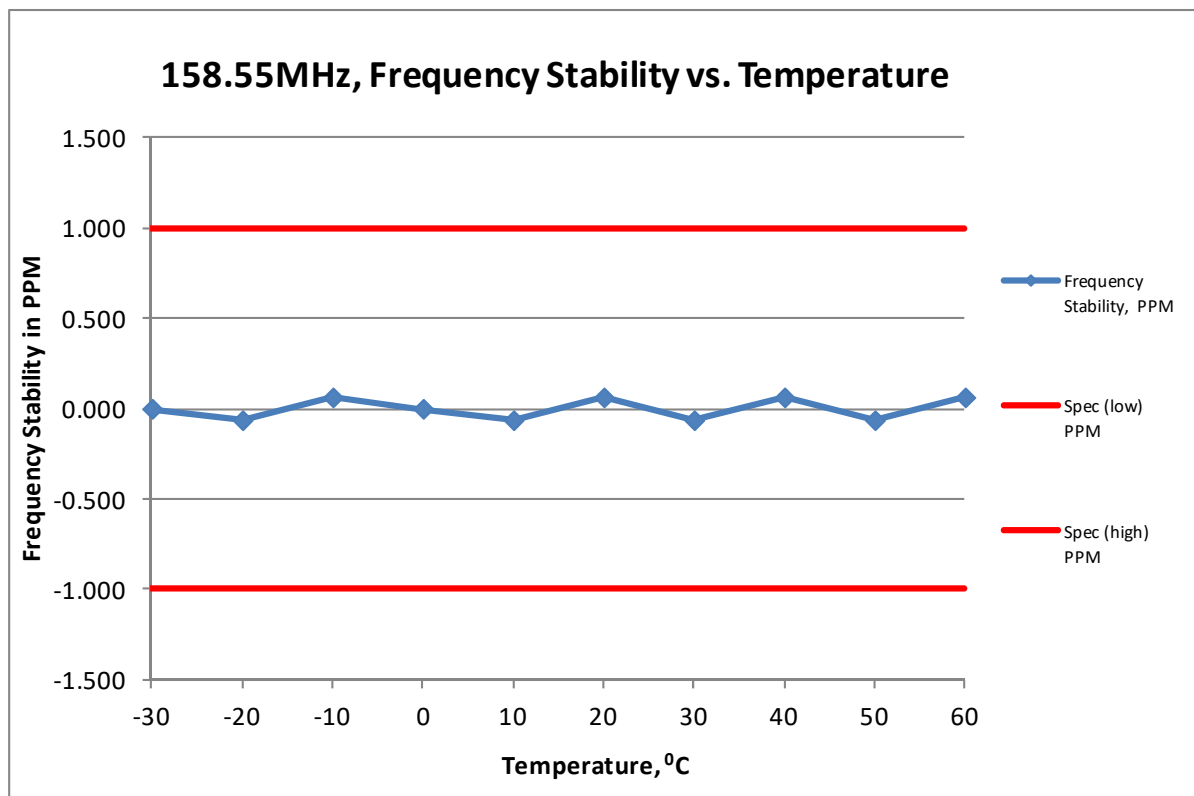
$$ppm\ error = \left(\frac{MCF_{MHz}}{ACF_{MHz}} - 1 \right) * 10^6$$

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

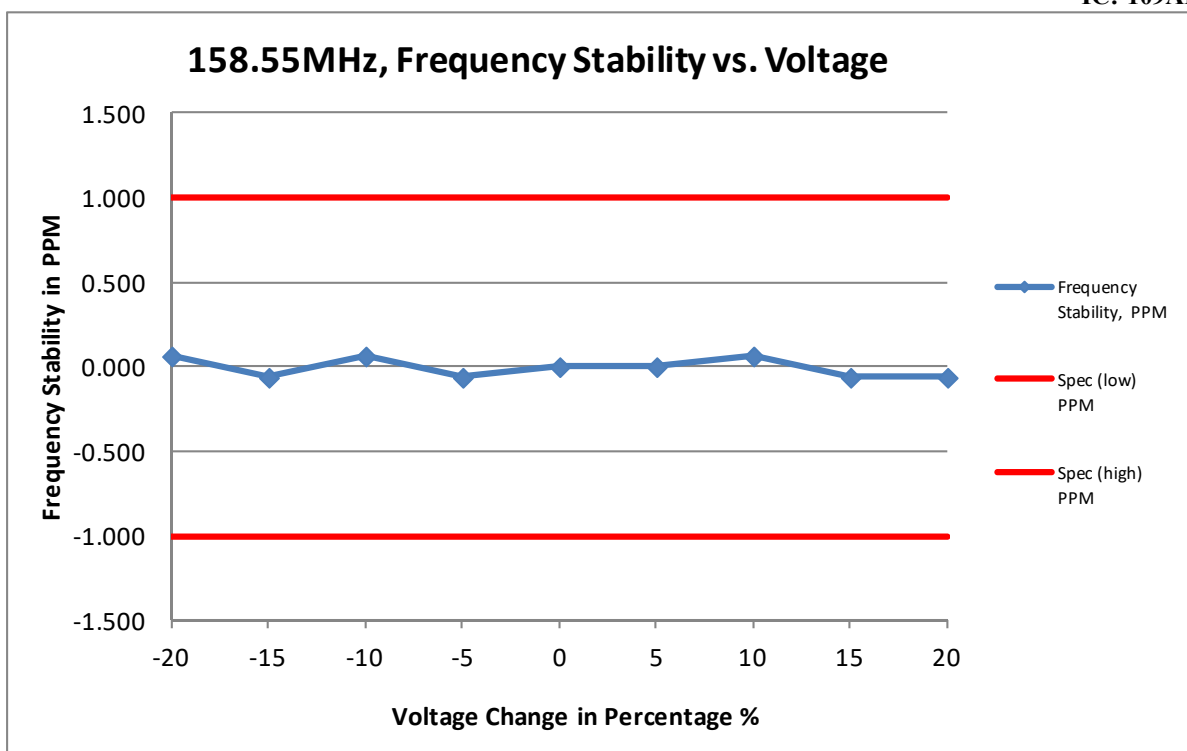
6.2.2. Test Result



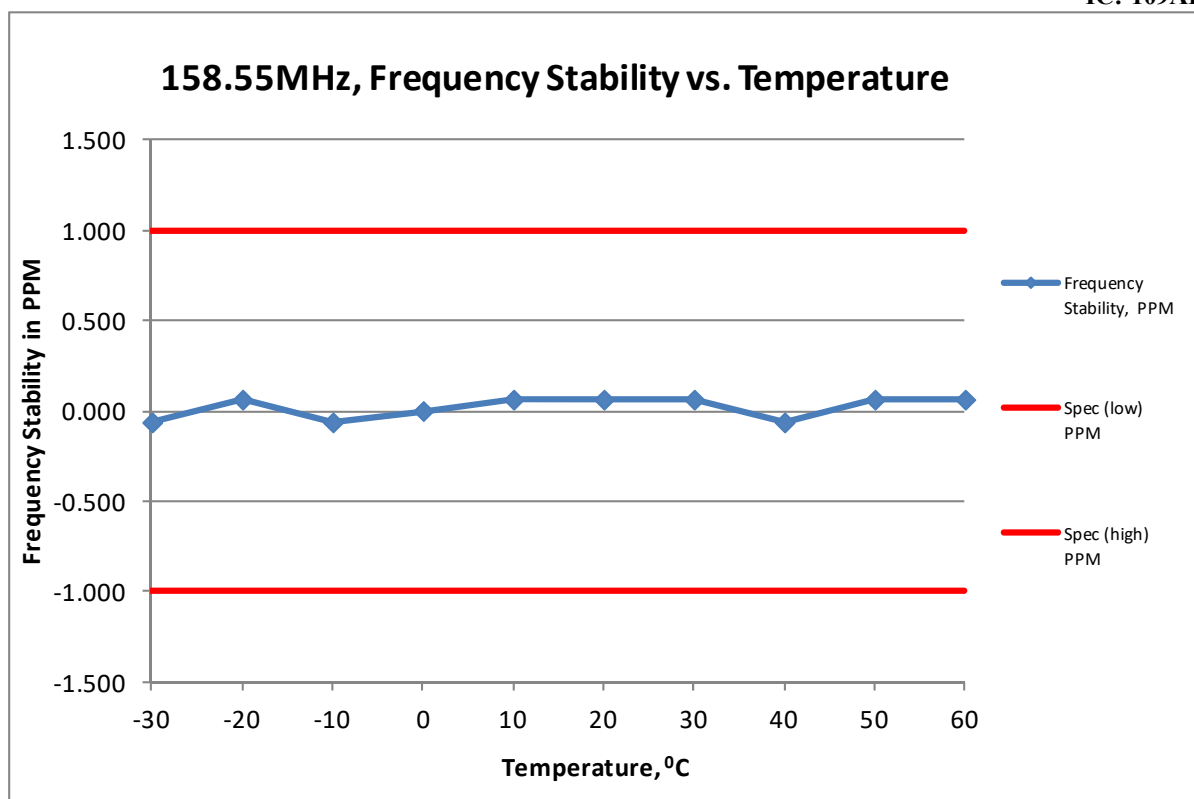
Frequency / Channel Spacing		158.55 MHz / 12.5 kHz			
Temperature, °C		25			
Voltage %	Voltage, V	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-20	192.000	158.549990	-0.063	-1.000	1.000
-15	204.000	158.550010	0.063	-1.000	1.000
-10	216.000	158.550000	0.000	-1.000	1.000
-5	228.000	158.549990	-0.063	-1.000	1.000
0	240.000	158.550000	0.000	-1.000	1.000
5	252.000	158.550010	0.063	-1.000	1.000
10	264.000	158.550010	0.063	-1.000	1.000
15	276.000	158.549990	-0.063	-1.000	1.000
20	288.000	158.550010	0.063	-1.000	1.000



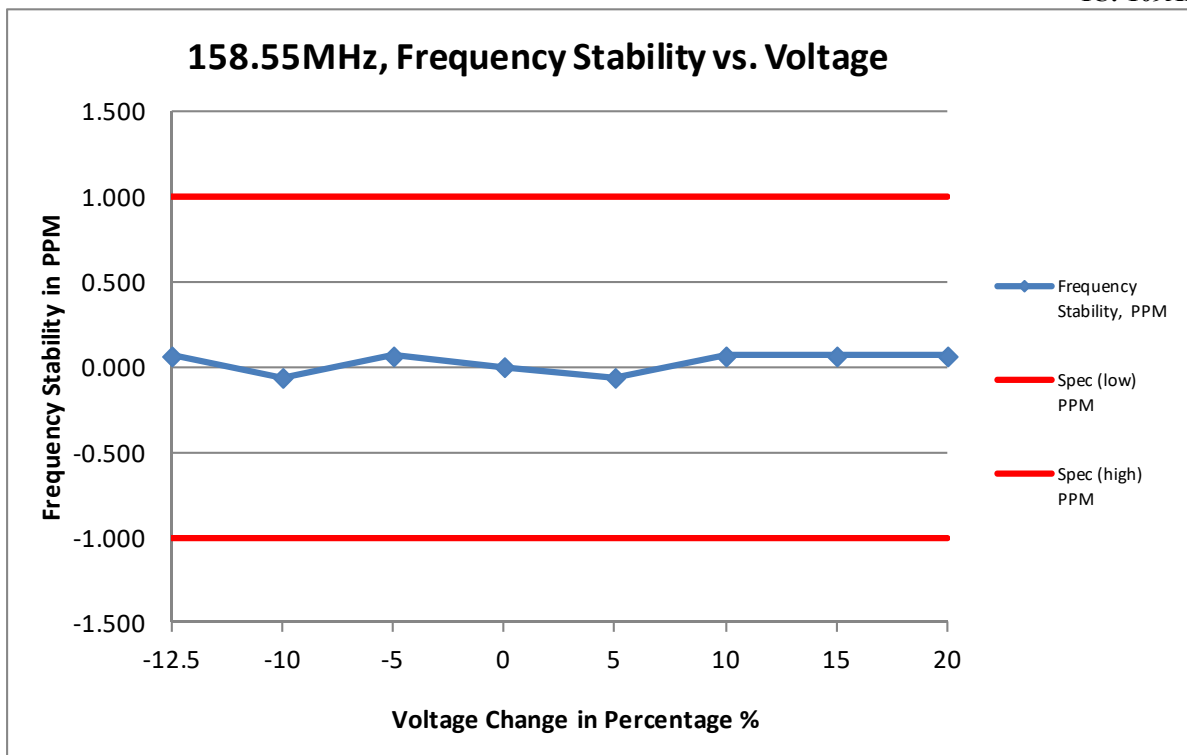
Frequency / Channel Spacing	158.55 MHz / 12.5 kHz			
Voltage, V	240.0			
Temperature, °C	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-30	158.550000	0.000	-1.000	1.000
-20	158.549990	-0.063	-1.000	1.000
-10	158.550010	0.063	-1.000	1.000
0	158.550000	0.000	-1.000	1.000
10	158.549990	-0.063	-1.000	1.000
20	158.550010	0.063	-1.000	1.000
30	158.549990	-0.063	-1.000	1.000
40	158.550010	0.063	-1.000	1.000
50	158.549900	-0.063	-1.000	1.000
60	158.550010	0.063	-1.000	1.000



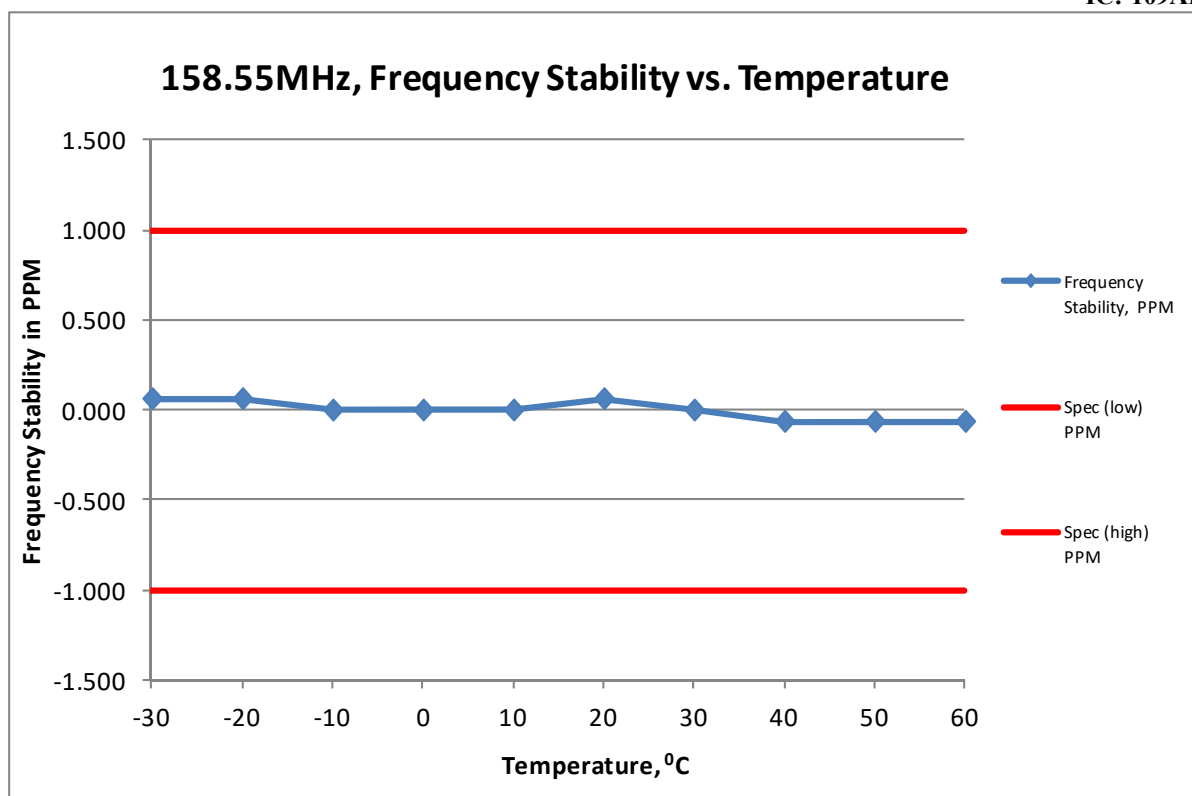
Frequency / Channel Spacing	158.55 MHz / 12.5 kHz				
Temperature, °C	25				
Voltage %	Voltage, V	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-20	96.000	158.550010	0.063	-1.000	1.000
-15	102.000	158.549990	-0.063	-1.000	1.000
-10	108.000	158.550010	0.063	-1.000	1.000
-5	114.000	158.549990	-0.063	-1.000	1.000
0	120.000	158.550000	0.000	-1.000	1.000
5	126.000	158.550000	0.000	-1.000	1.000
10	132.000	158.550010	0.063	-1.000	1.000
15	138.000	158.549990	-0.063	-1.000	1.000
20	144.000	158.549990	-0.063	-1.000	1.000



Frequency / Channel Spacing	158.55 MHz / 12.5 kHz			
Voltage, V	120.0			
Temperature, °C	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-30	158.549990	-0.063	-1.000	1.000
-20	155.550010	0.063	-1.000	1.000
-10	158.549990	-0.063	-1.000	1.000
0	158.550000	0.000	-1.000	1.000
10	158.550010	0.063	-1.000	1.000
20	158.550010	0.063	-1.000	1.000
30	158.550010	0.063	-1.000	1.000
40	158.549990	-0.063	-1.000	1.000
50	158.550010	0.063	-1.000	1.000
60	158.550010	0.063	-1.000	1.000



Frequency / Channel Spacing	158.55 MHz / 12.5 kHz				
Temperature, °C	25				
Voltage %	Voltage, V	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-12.5	42.000	158.550010	0.063	-1.000	1.000
-10	43.200	158.549990	-0.063	-1.000	1.000
-5	45.600	158.550010	0.063	-1.000	1.000
0	48.000	158.550000	0.000	-1.000	1.000
5	50.400	158.549990	-0.063	-1.000	1.000
10	52.800	158.550010	0.063	-1.000	1.000
15	55.200	158.550010	0.063	-1.000	1.000
20	57.600	158.550010	0.063	-1.000	1.000



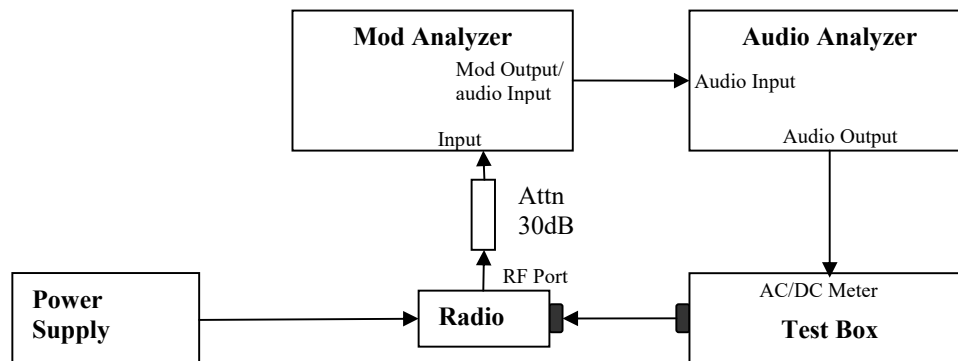
Frequency / Channel Spacing	158.55 MHz / 12.5 kHz			
Voltage, V	48.0			
Temperature, °C	Frequency, MHz	Frequency Stability, PPM	Spec (low) PPM	Spec (high) PPM
-30	158.550010	0.063	-1.000	1.000
-20	158.550010	0.063	-1.000	1.000
-10	158.550000	0.000	-1.000	1.000
0	158.550000	0.000	-1.000	1.000
10	158.550000	0.000	-1.000	1.000
20	158.550010	0.063	-1.000	1.000
30	158.550000	0.000	-1.000	1.000
40	158.549990	-0.063	-1.000	1.000
50	158.549990	-0.063	-1.000	1.000
60	158.549990	-0.063	-1.000	1.000

6.2.3. Test Limit

As per manufacturer declared spec +/- 1ppm

6.3. Audio Frequency Response

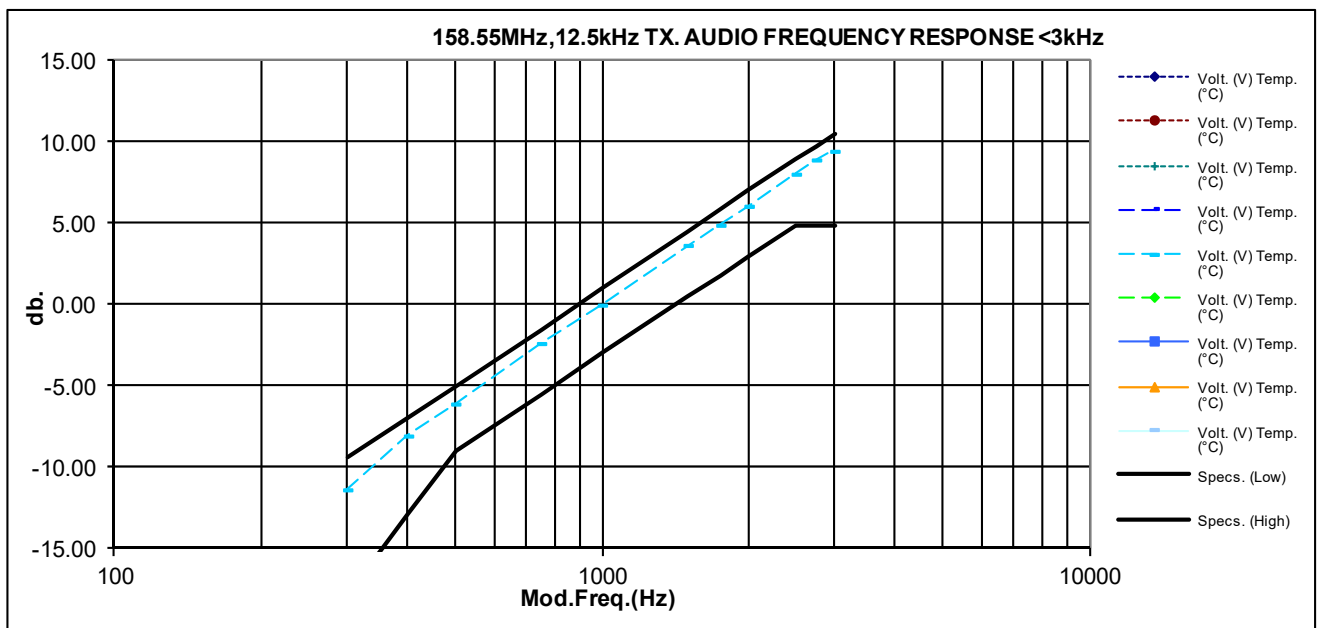
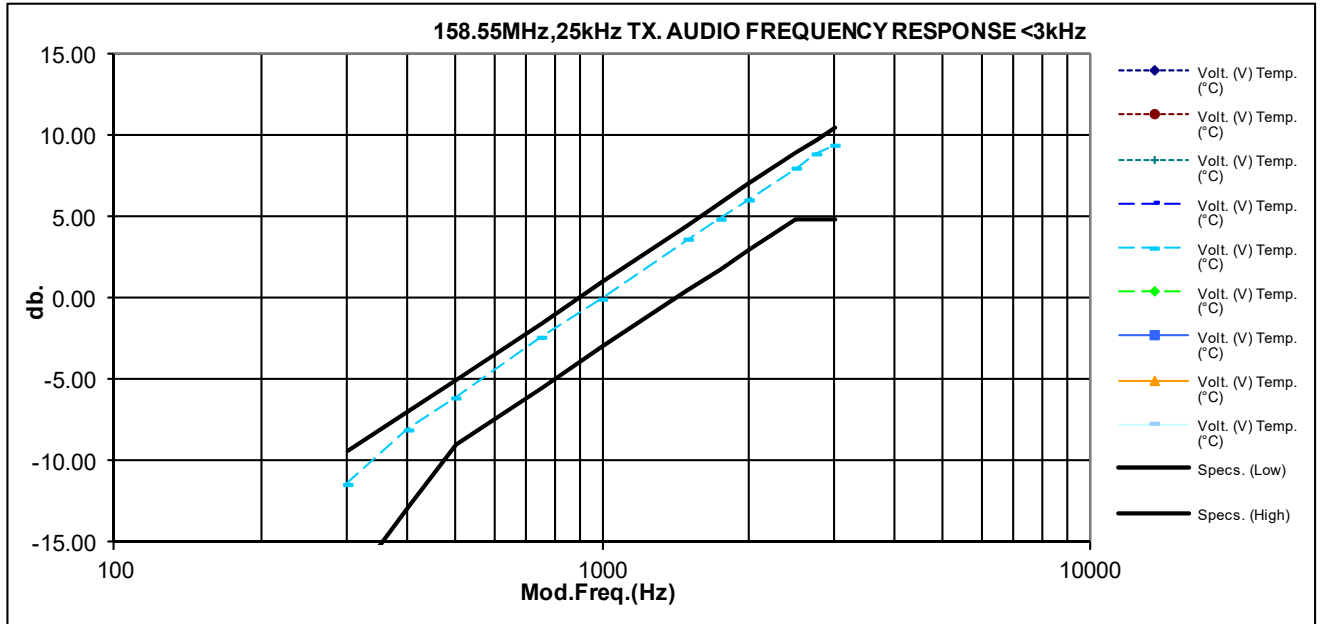
6.3.1. Test Setup



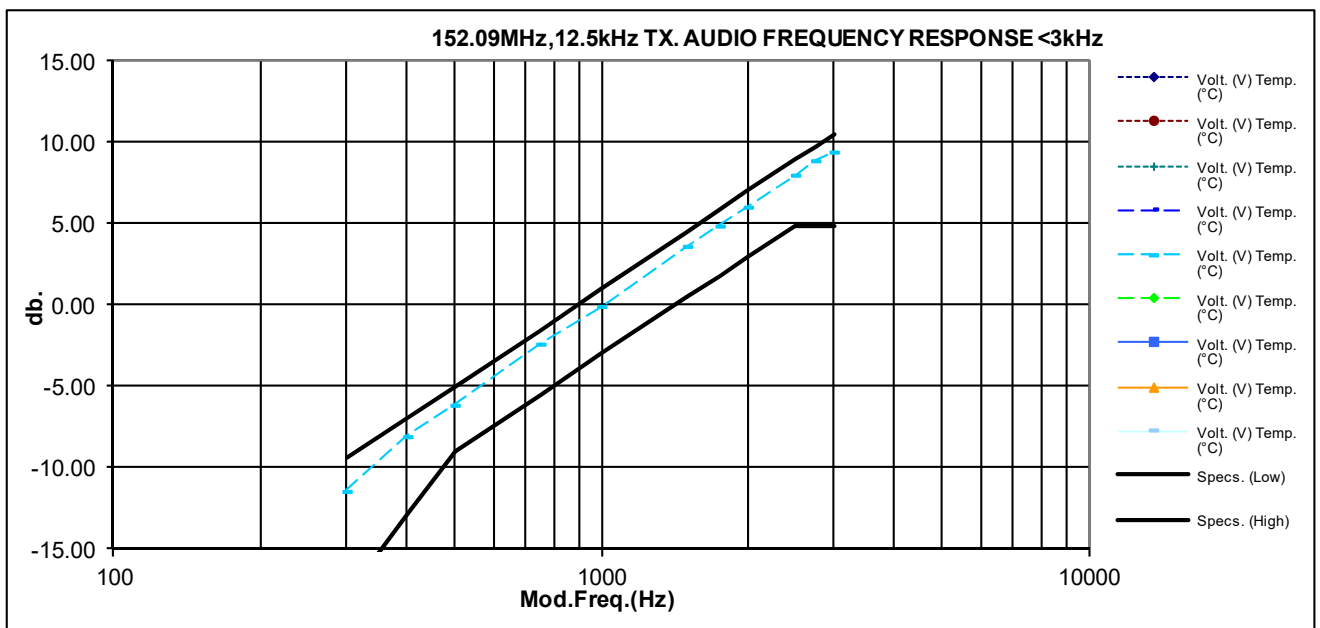
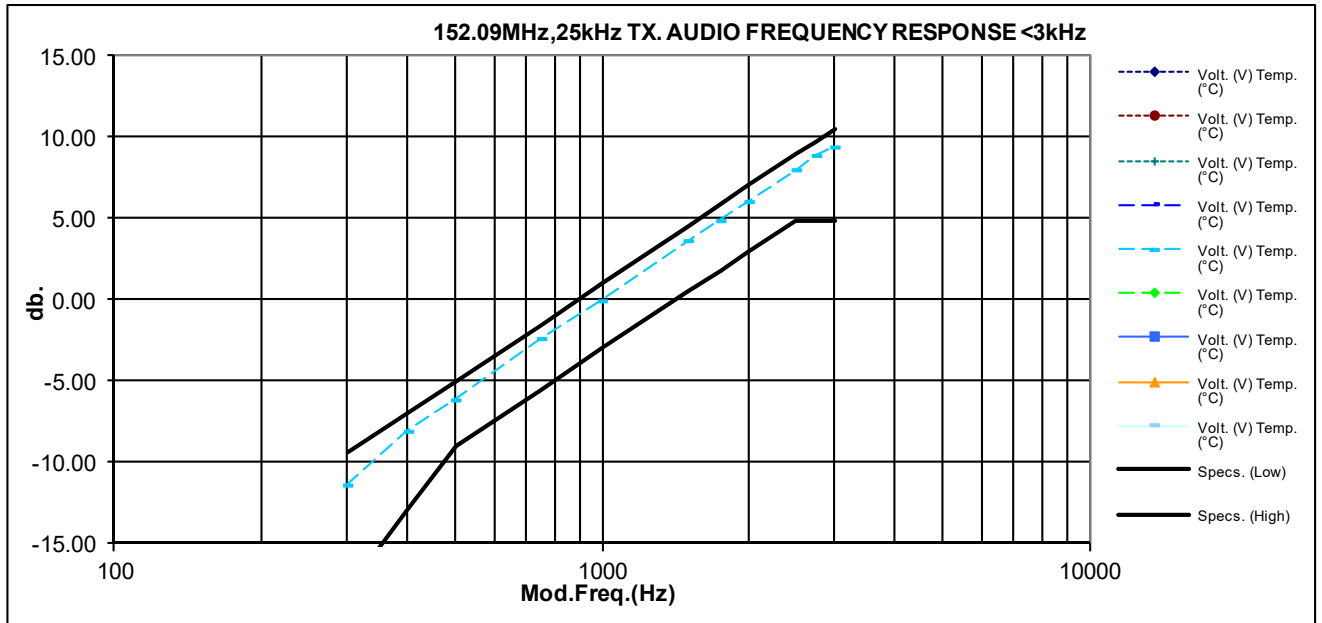
- 1) The DUT transmitter output port was connected to Modulation Analyzer.
- 2) Path loss for the measurement included.
- 3) Set the audio bandwidth filter to 15 kHz and 50 kHz.
- 4) Transmit the radio and set the audio analyzer to 1 kHz audio frequency and 20% of the Full rated system deviation.
- 5)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

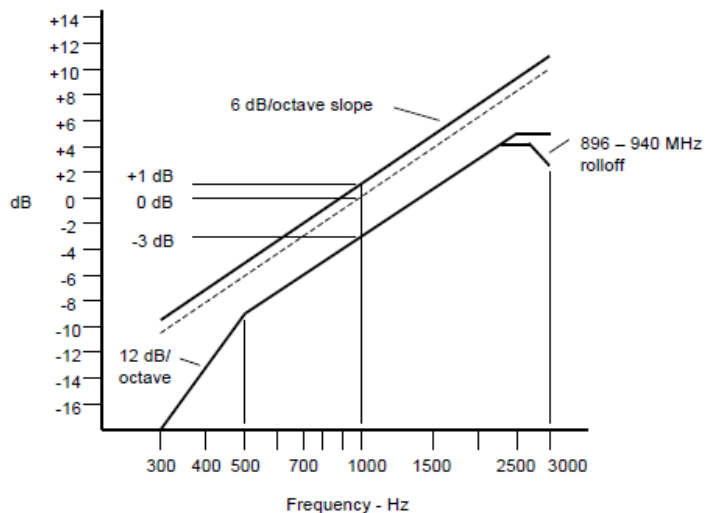
Not for FCC Review



Not for FCC Review



6.3.3. Test Limit

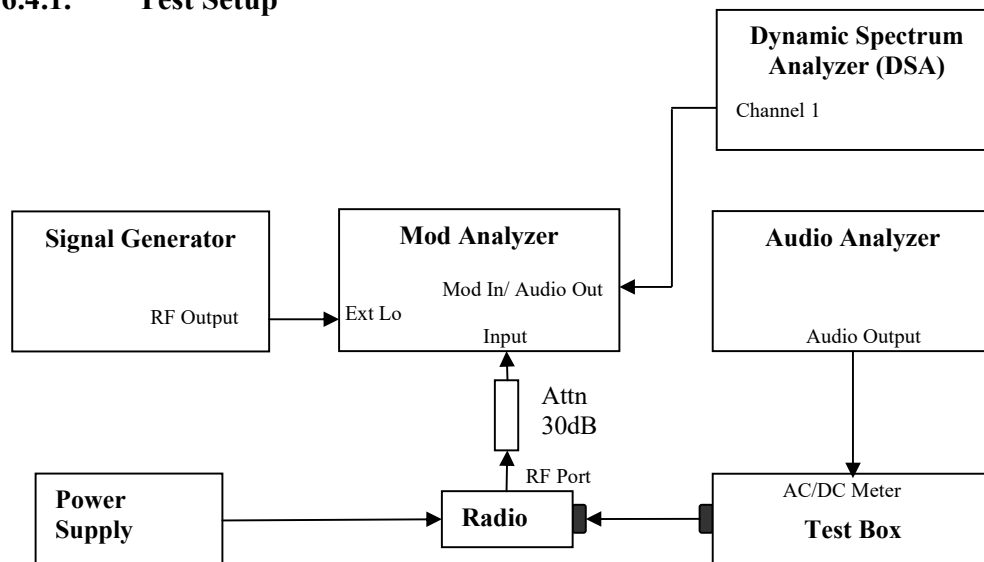


Note:

- 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

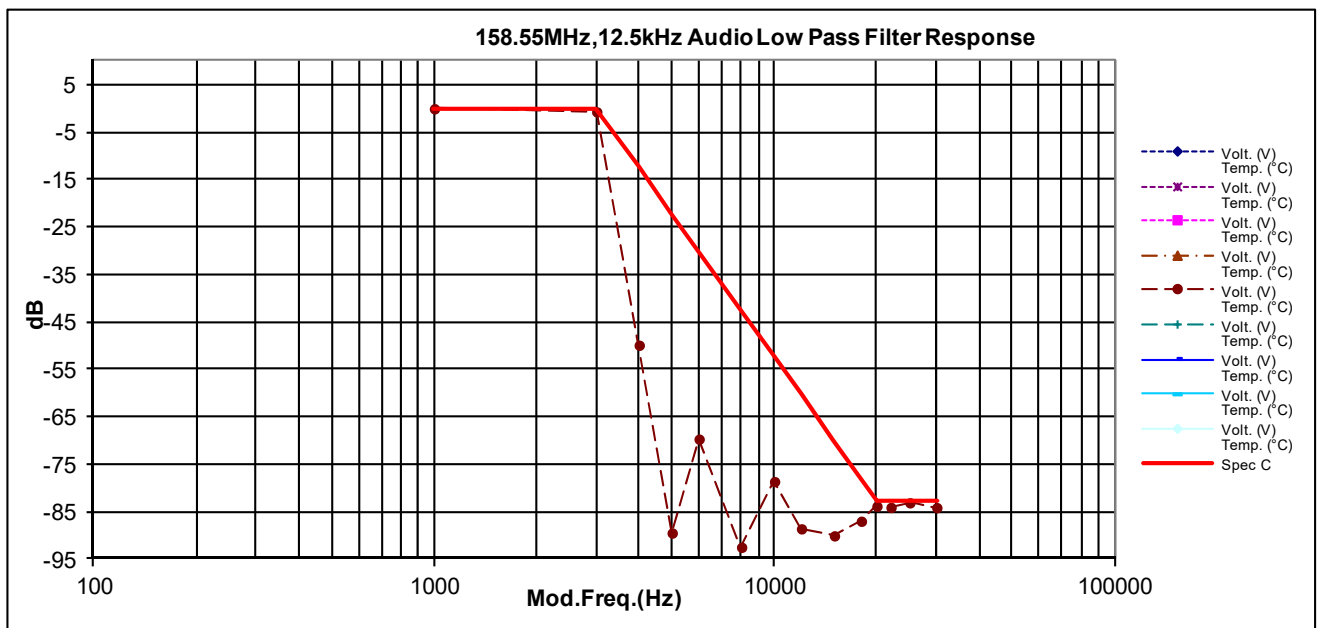
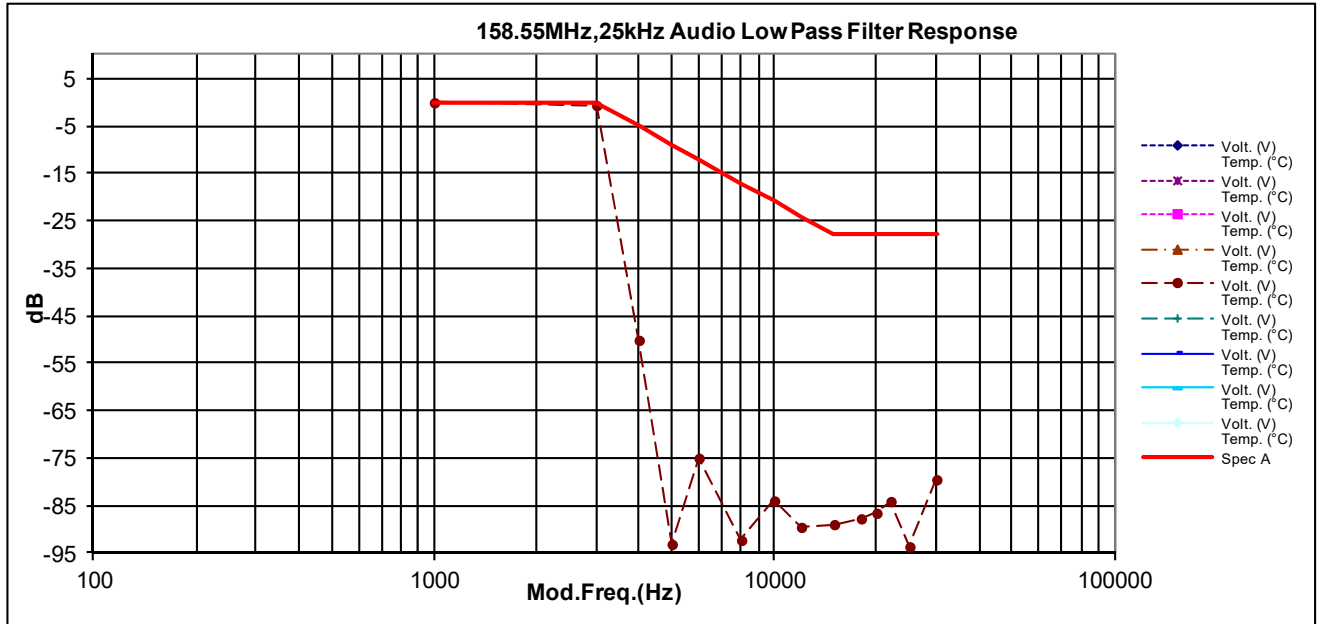
6.4.1. Test Setup



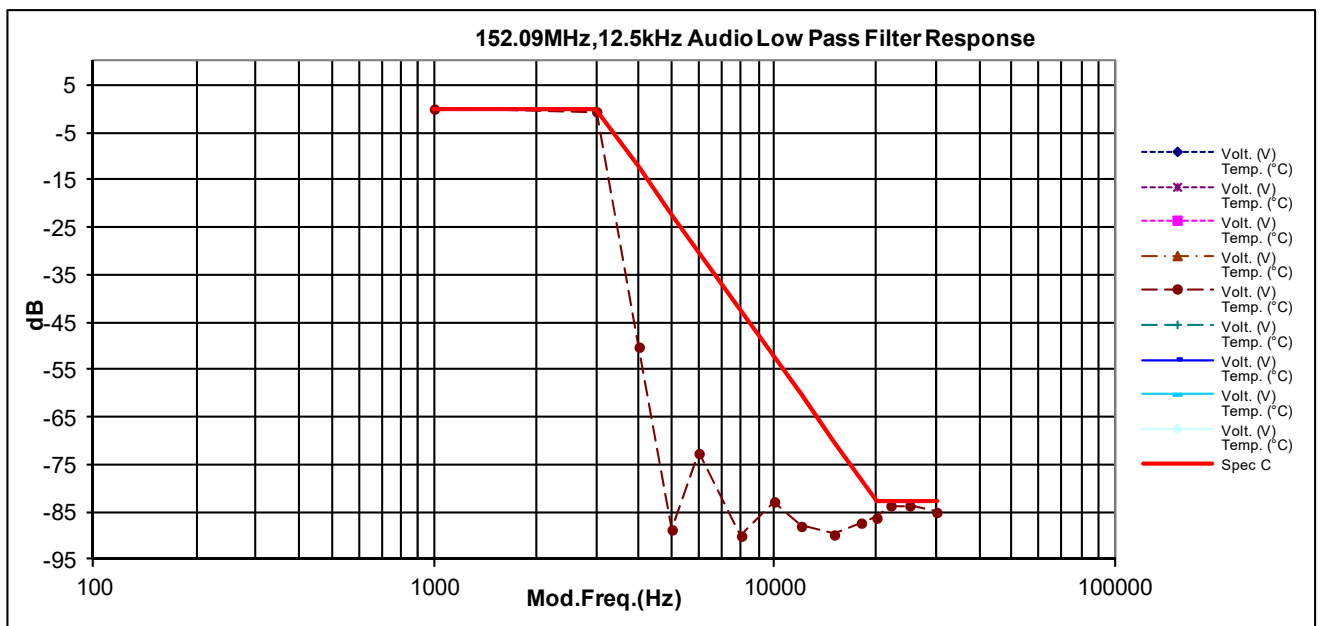
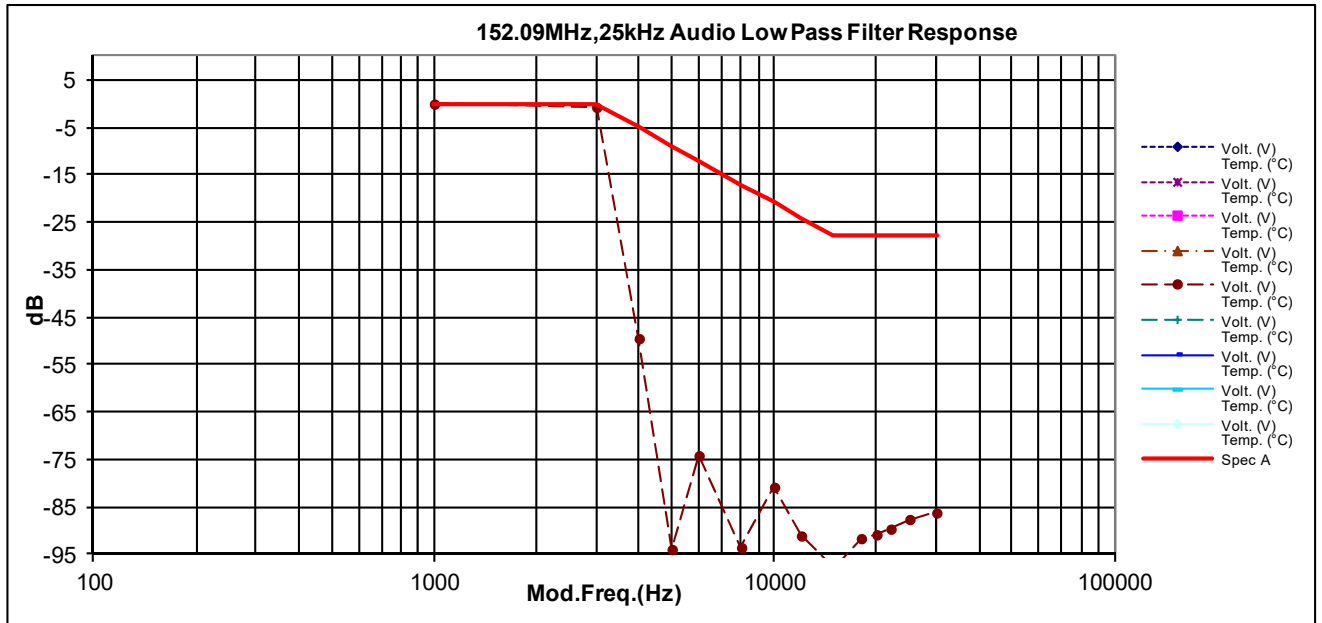
- 1) The DUT transmitter output port was connected to Modulation Analyzer.
- 2) Path loss for the measurement included.
- 3) Press 23.1SPCL on modulation analyzer to enable the external LO from Sigen.
- 4) Set the Sigen frequency to $F_c + 1.5$ MHz, RF output level to 0dBm without modulation.
- 5) Transmit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

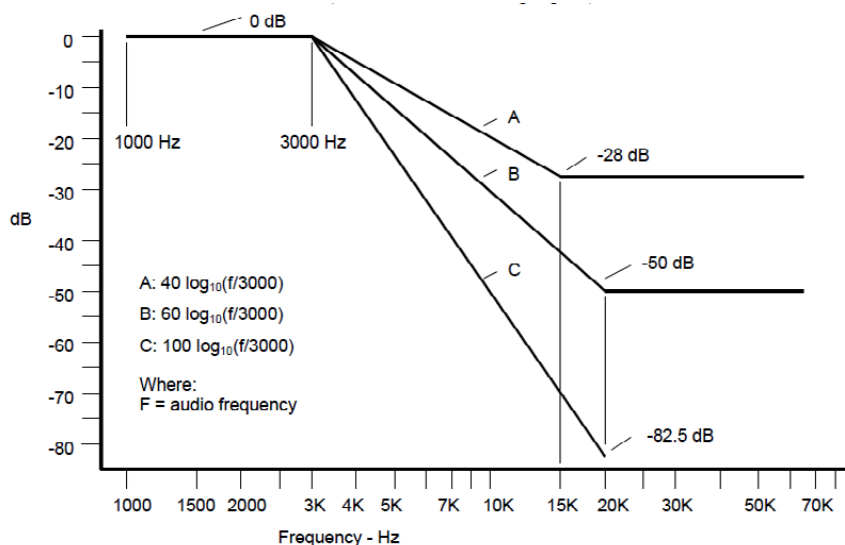
Not for FCC Review



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.

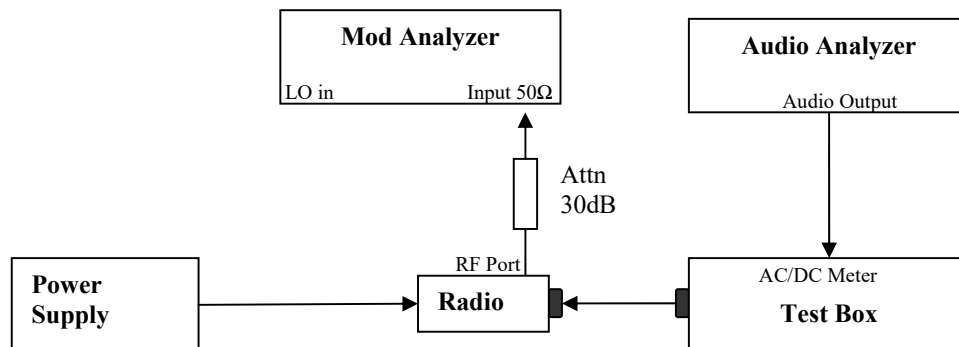
- c) For equipment operating on channels between 896 MHz through 901 MHz, between 935 MHz through 940 MHz, and 12.5 or 15 kHz spaced channels in the frequency range 138-174 MHz and 406-512 MHz.

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

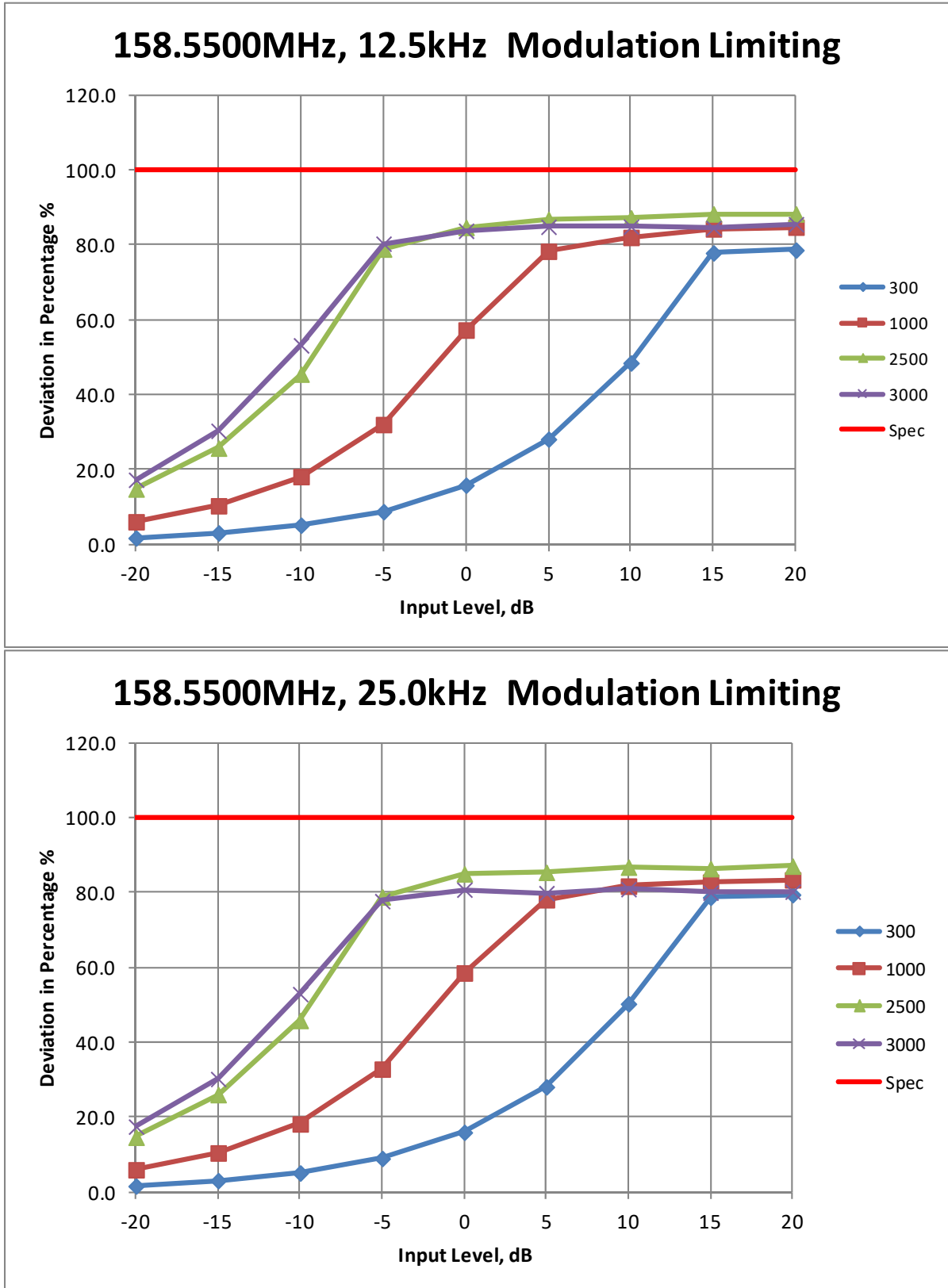
6.5.1. Test Setup



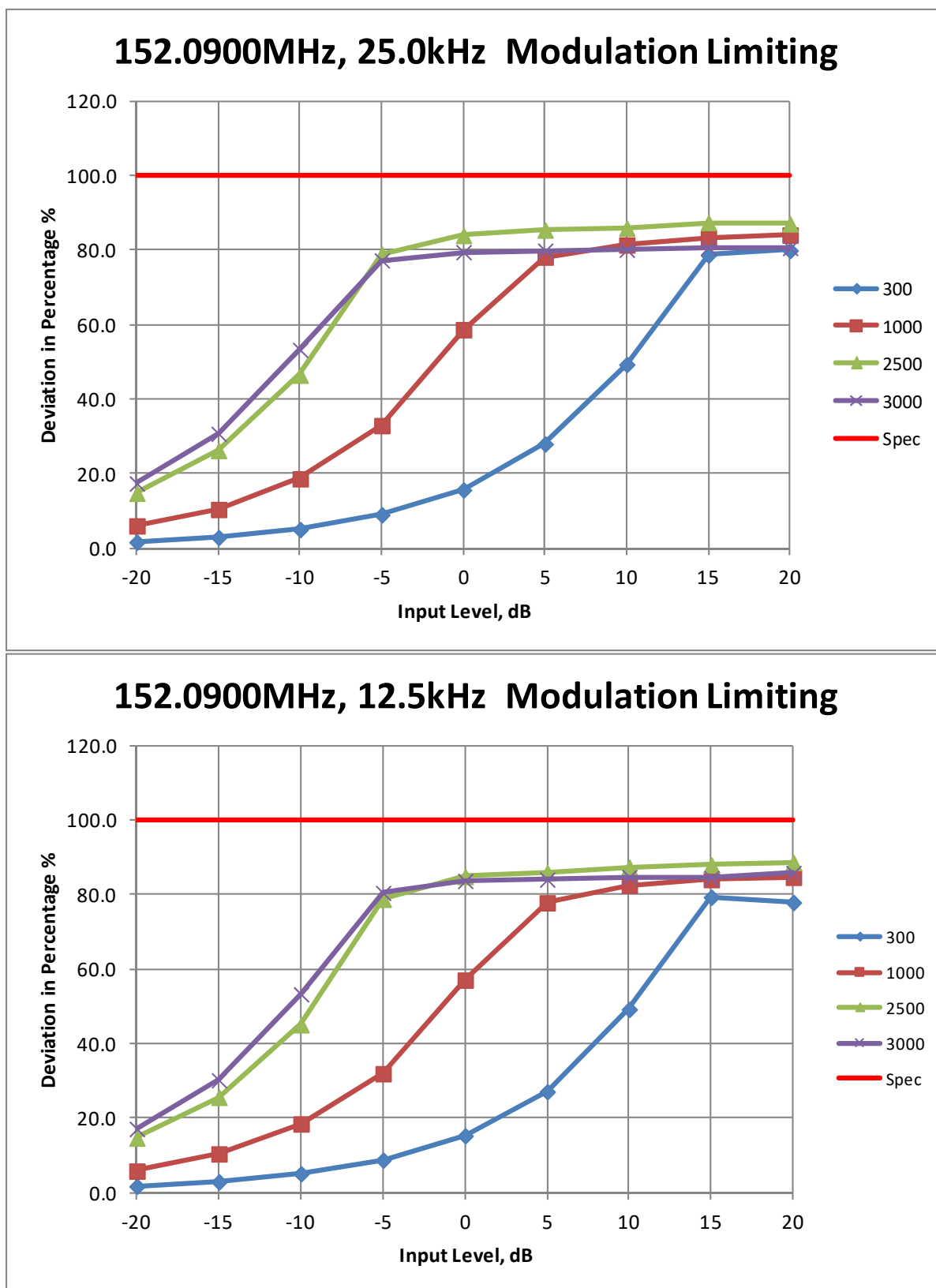
- 1) The DUT transmitter output port was connected to Modulation Analyzer.
- 2) Path loss for the measurement included.
- 3) Set the audio bandwidth filter to 15 kHz.
- 4) Transmit the radio and set the audio analyzer to 1 kHz audio frequency and 60% of the Full rated system deviation.
- 5) Record the 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



Not for FCC Review



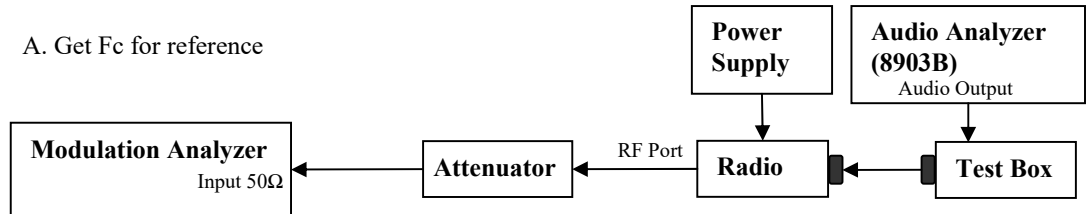
6.5.3. Test Limit

Modulation Limiting shall not exceed 100 percent.

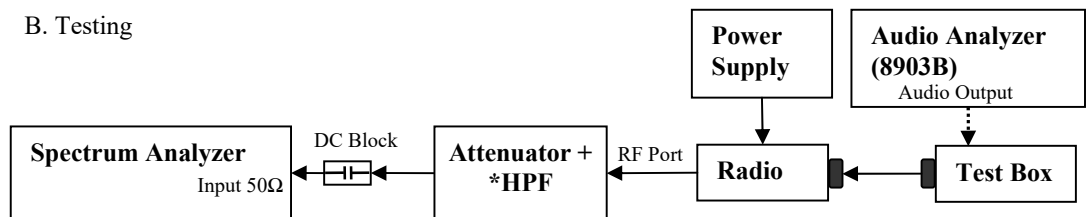
6.6. Occupied Bandwidth

6.6.1. Test Setup (Analog)

A. Get F_c for reference



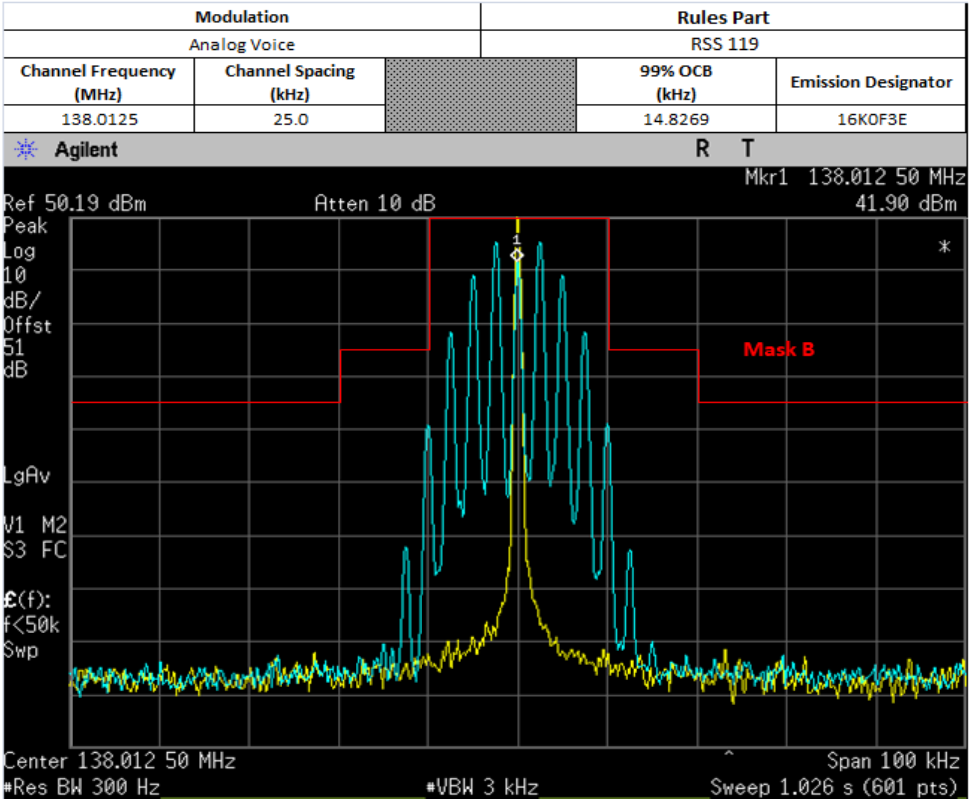
B. Testing



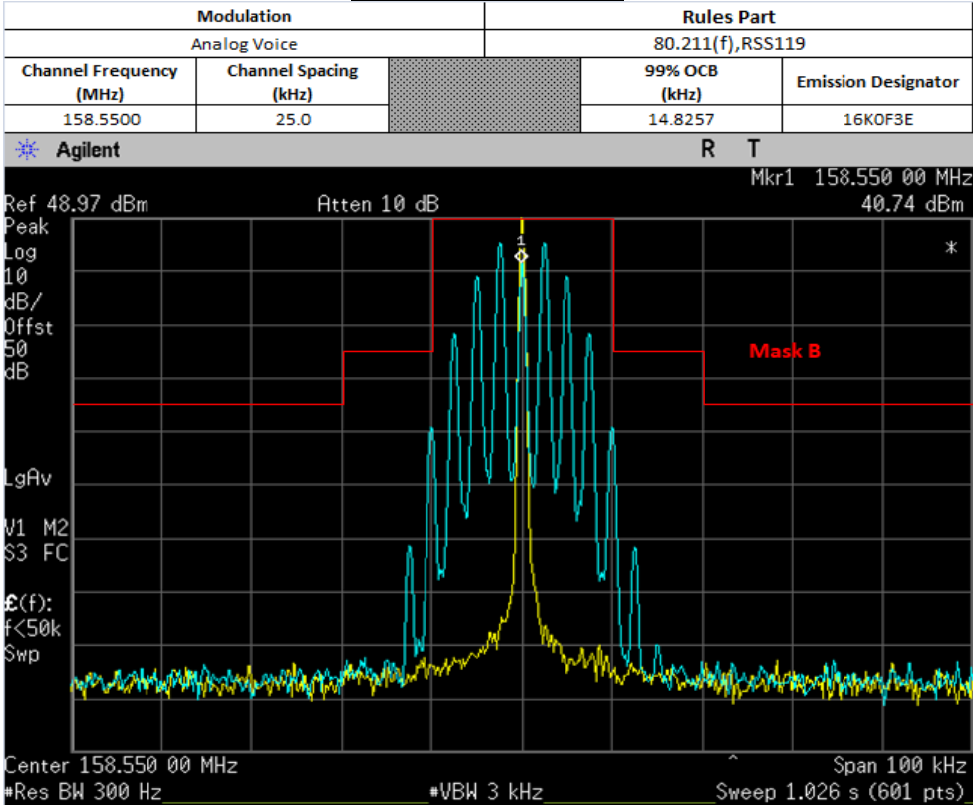
- 1) The DUT transmitter output port was connected to Modulation Analyzer.
- 2) Set the audio bandwidth filter to 15 kHz low pass filter and 50 kHz high pass filter.
- 3) Transmit the radio and set the audio analyzer to 2.5 kHz audio frequency and 50% of the rated deviation. Up the amplitude by 16 dB. 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 F_c 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.

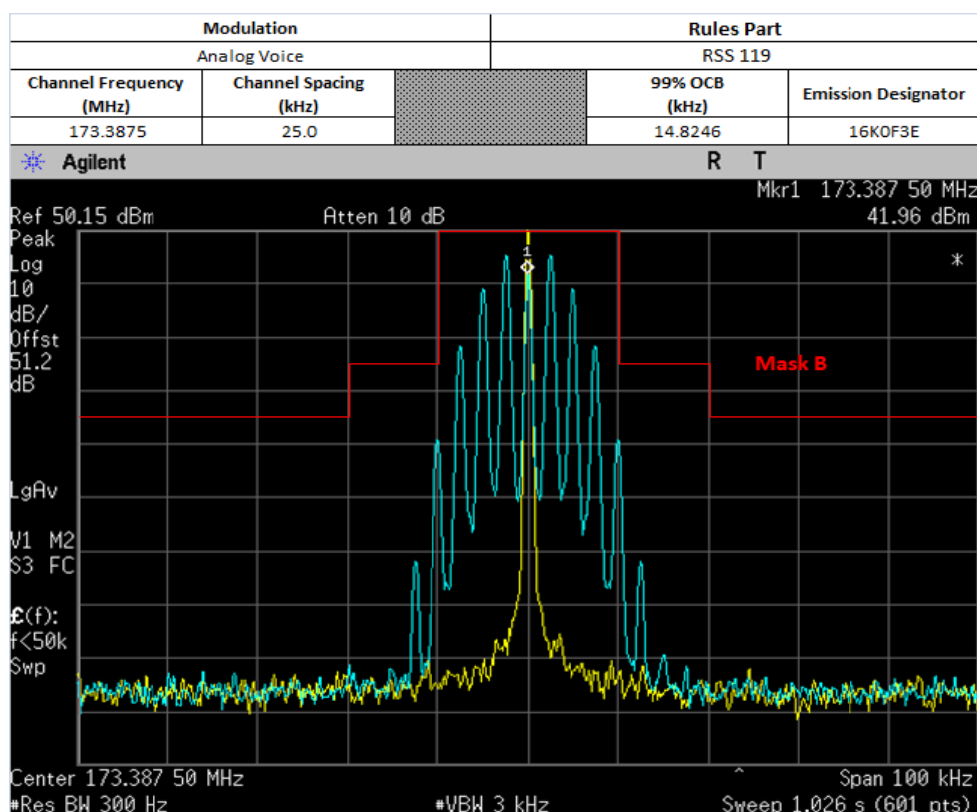
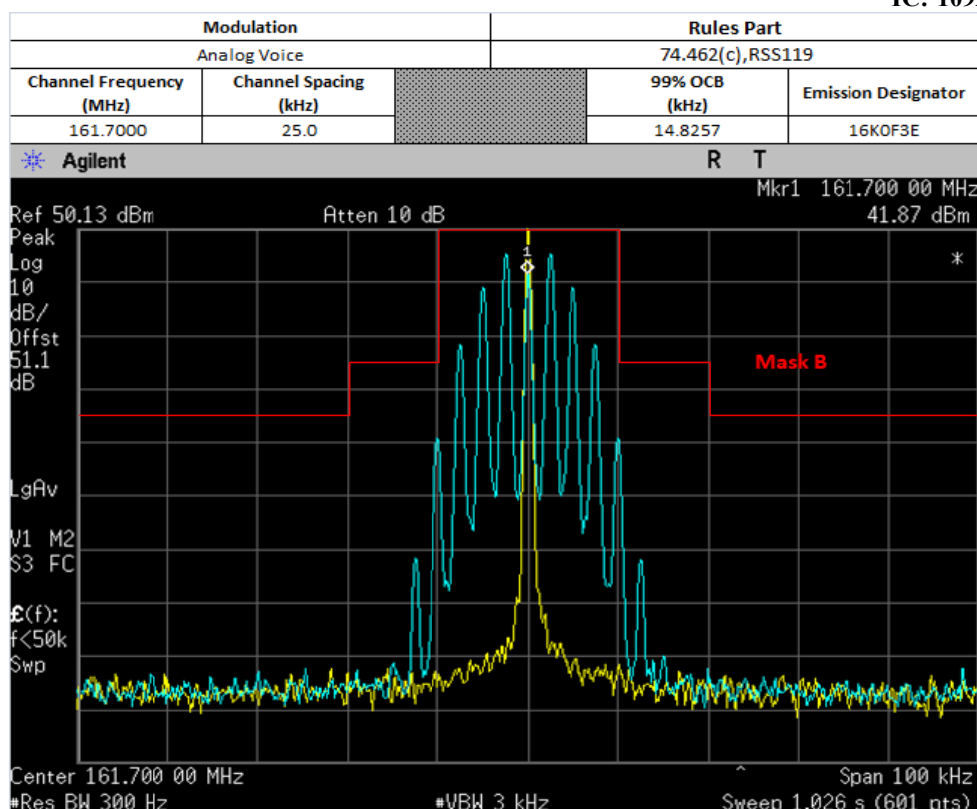
* Only HPF added for Mask 80.211 measurement with attenuator.

6.6.2. Test Result (Analog)

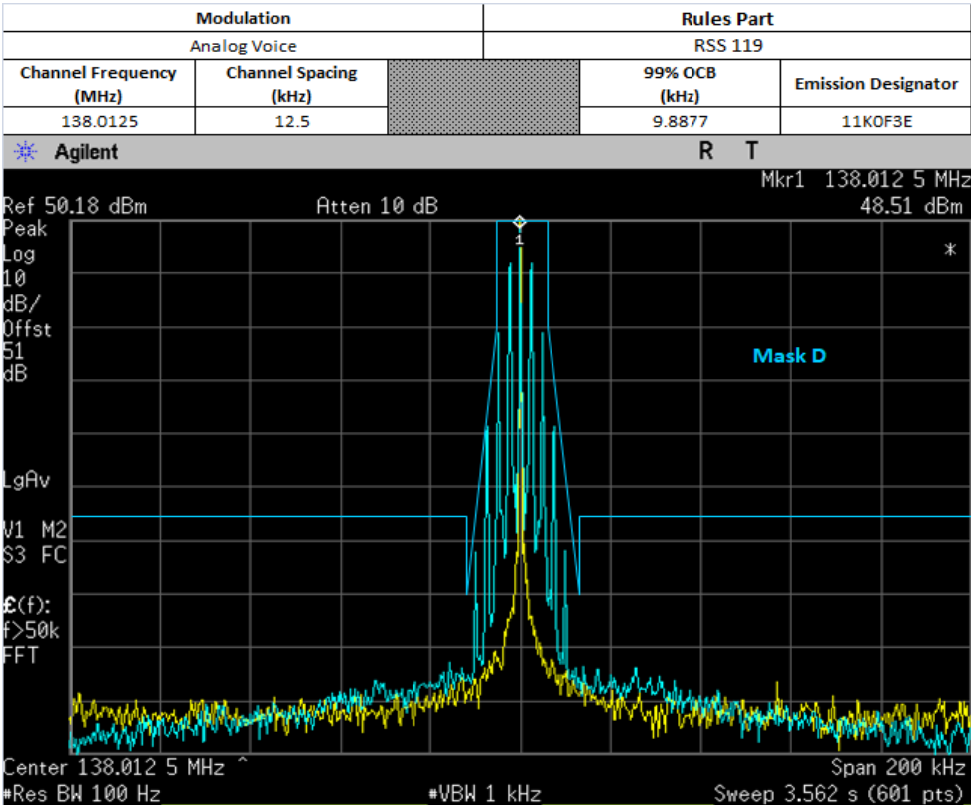


Not for FCC Review

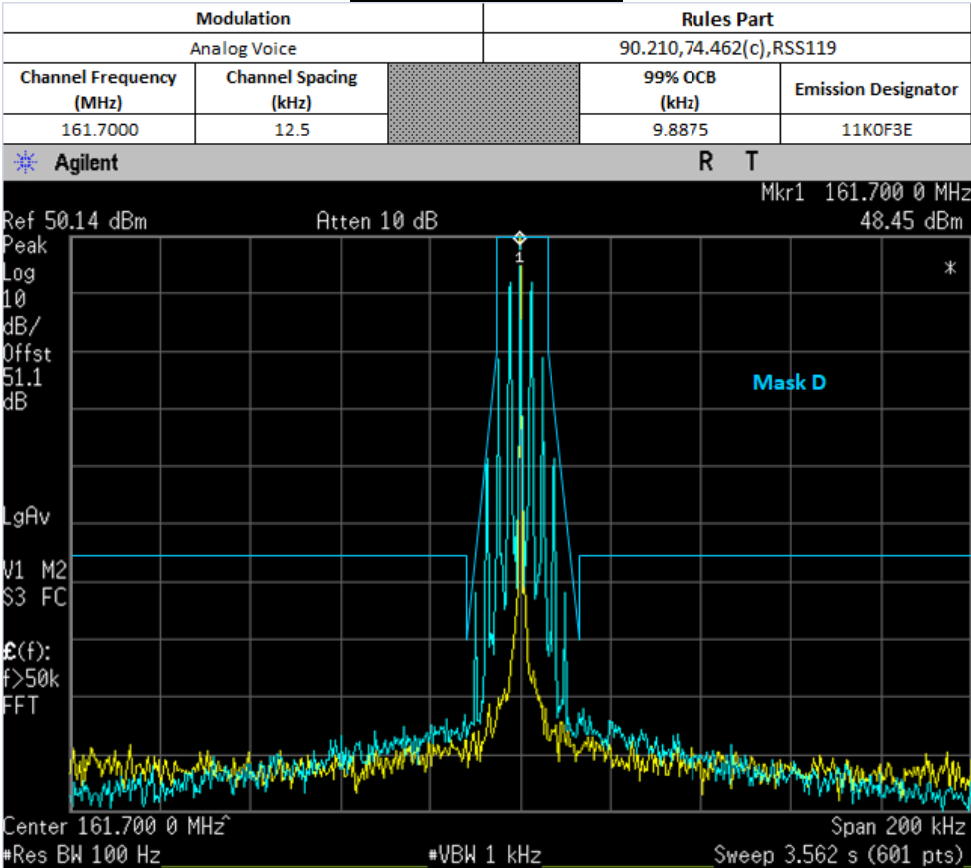


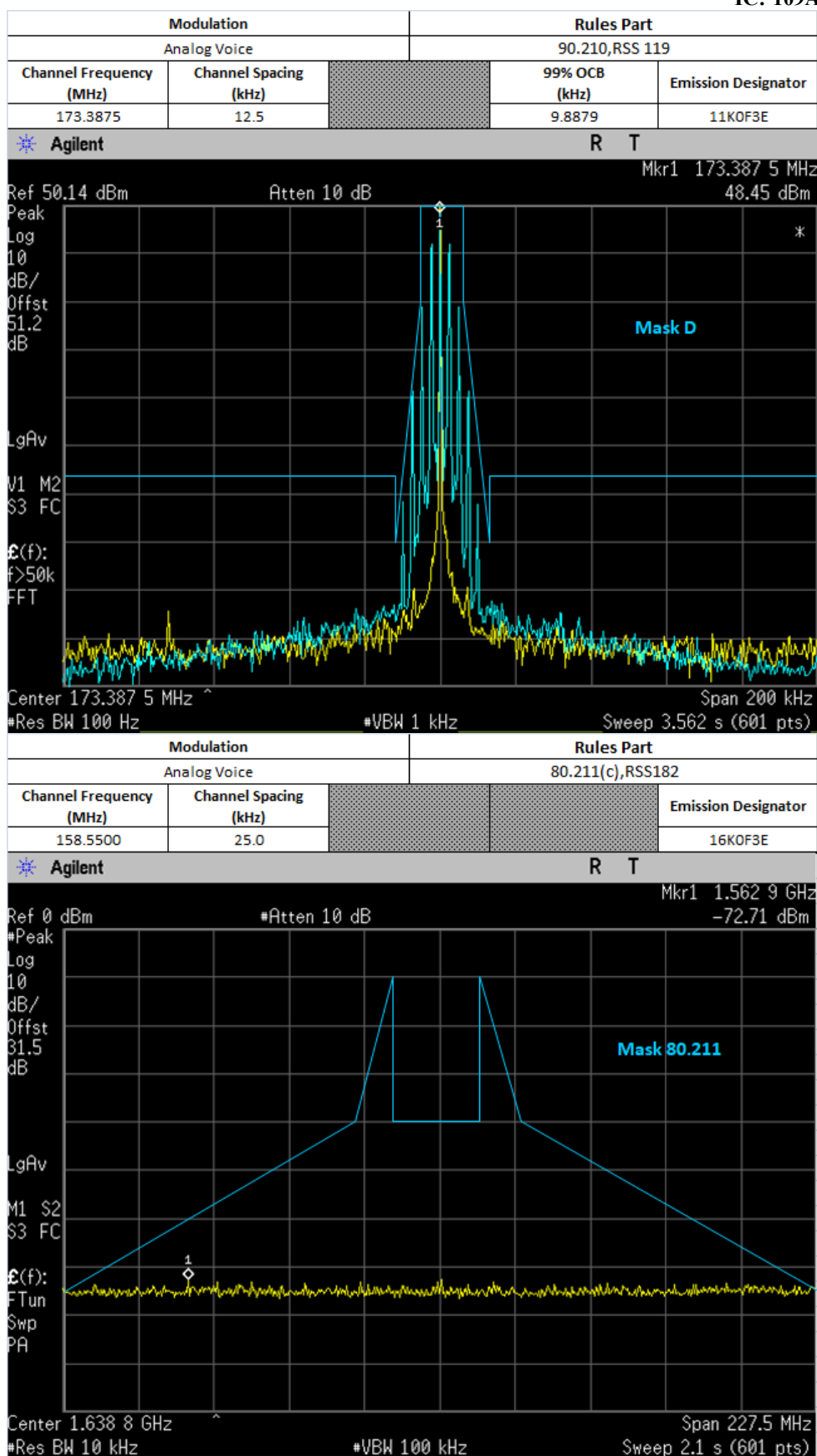


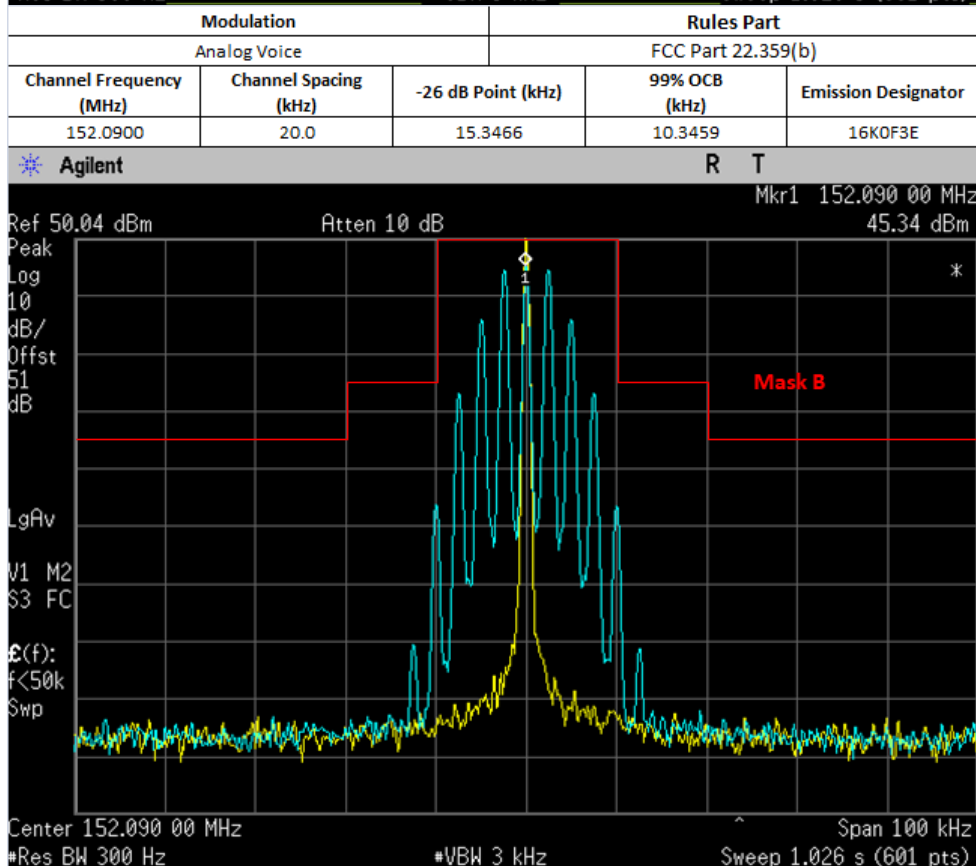
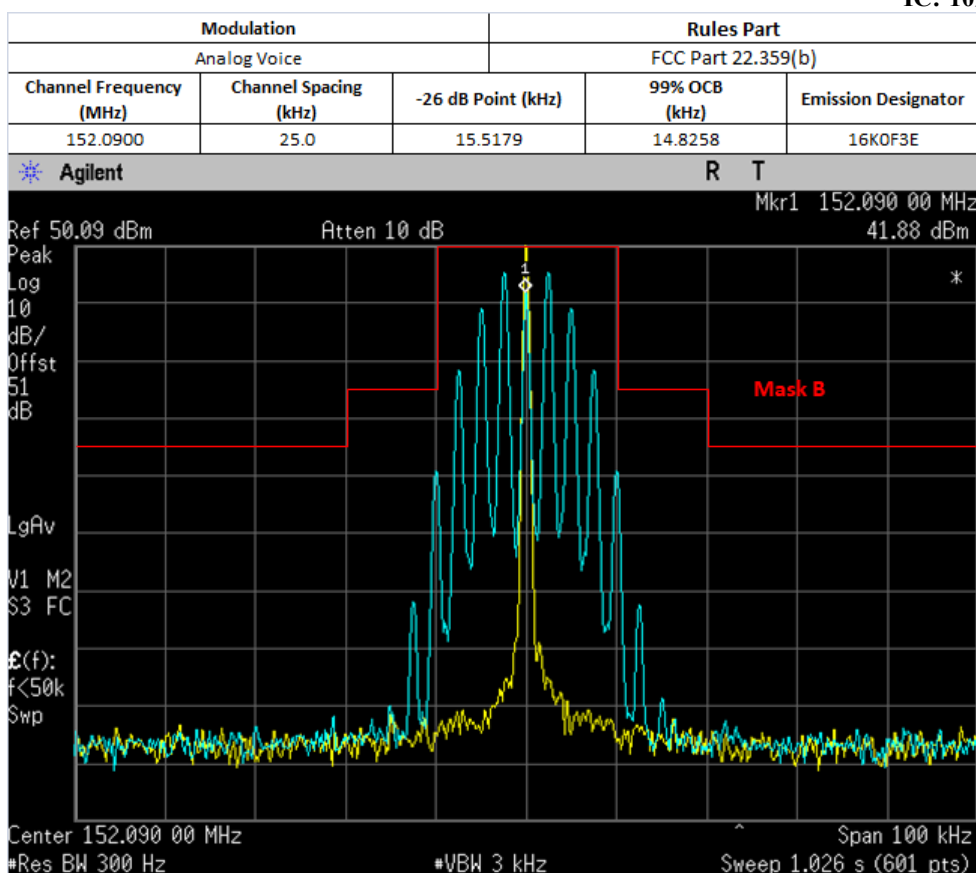
Not for FCC Review



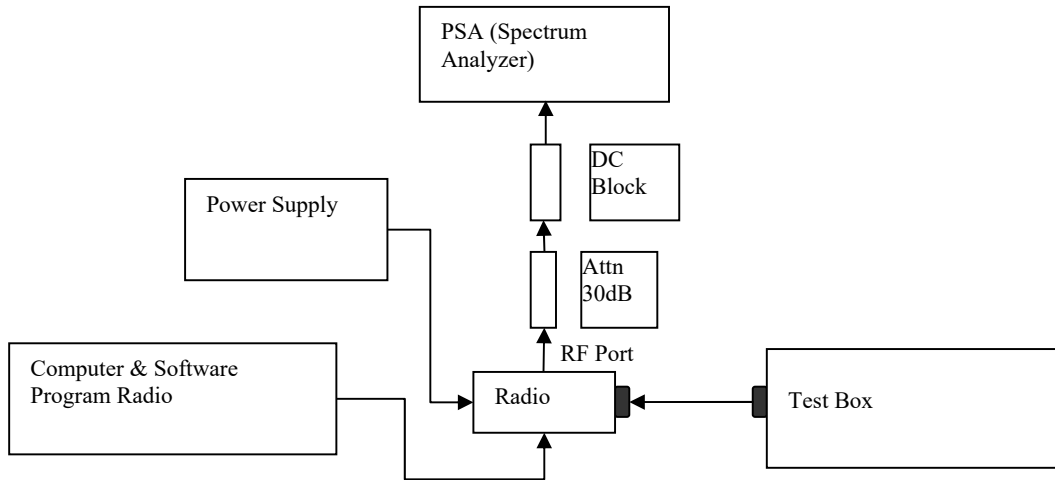
Not for FCC Review







6.6.3. Test Setup (Digital)

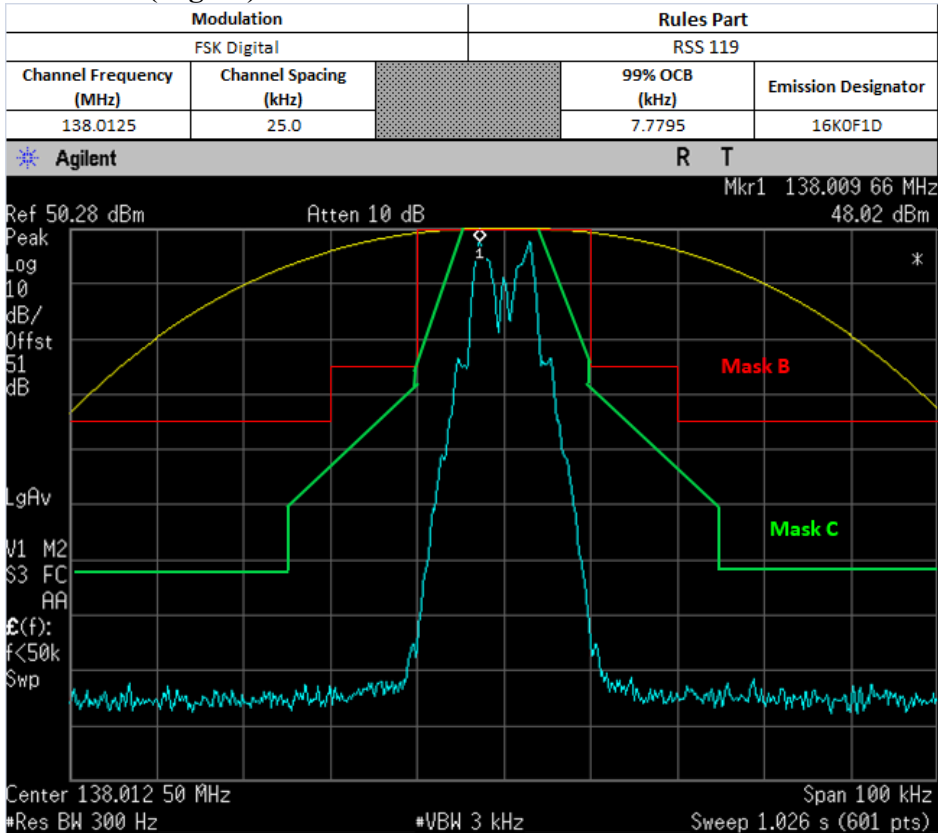


- 1) Program and set radio to operate in desire test frequency and digital mode with modulation. (*4FSK, C4FM or other digital modulation form).
- 2) Path loss for the measurement included.
- 3) Select the Occupied Bandwidth measurement for 99% Emissions Bandwidth Measurement.
- 4) Key in the Fc and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

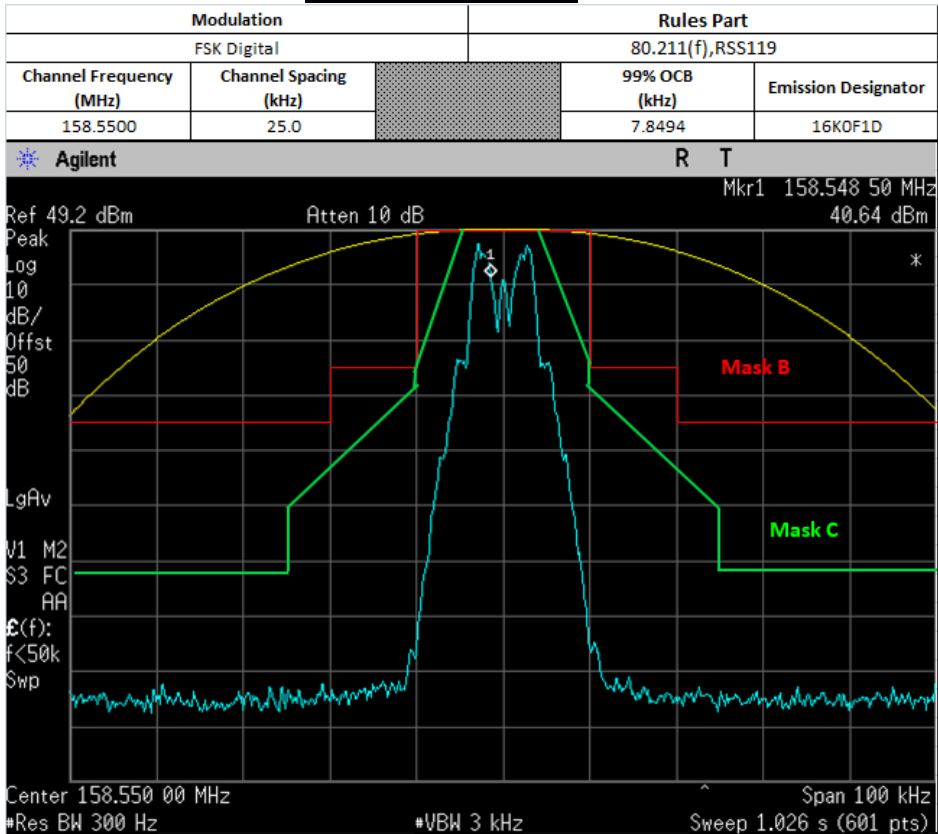
***Note:**

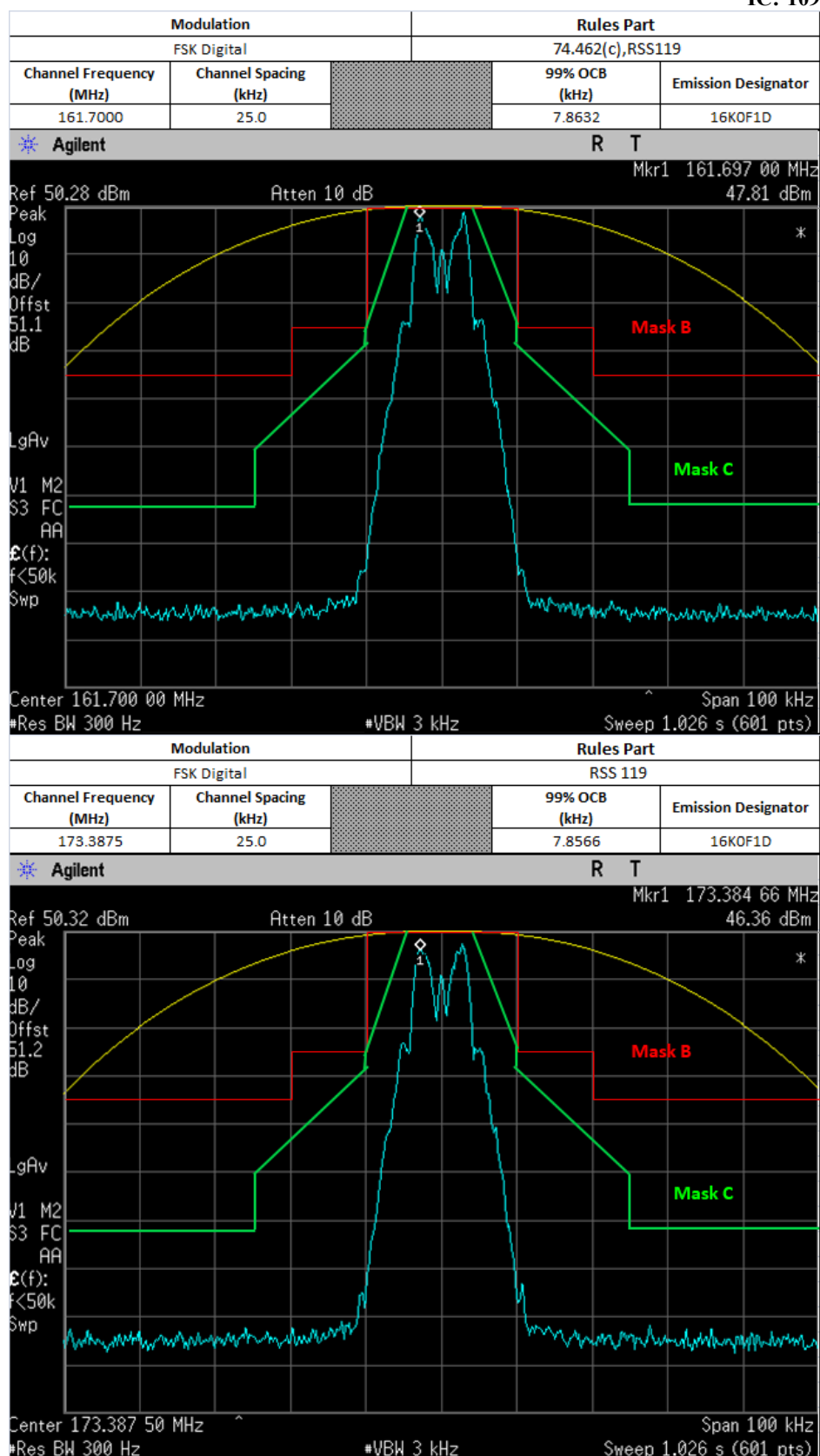
- For Digital Modulation, 12.5 kHz Data F1D & FXD would be the same. Therefore only measurements with F1D modulation shown below.
- For Digital Modulation, 12.5 kHz Data F1E & FXE would be the same. Therefore only measurements with F1E modulation shown below.

6.6.4. Test Result (Digital)

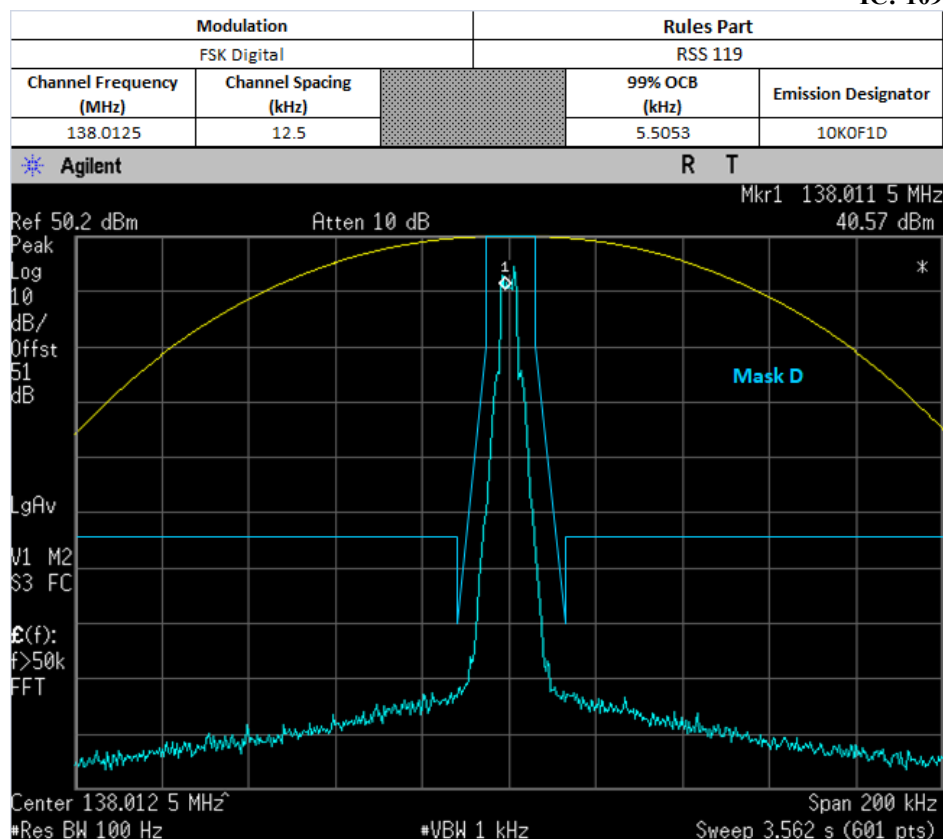


Not for FCC Review

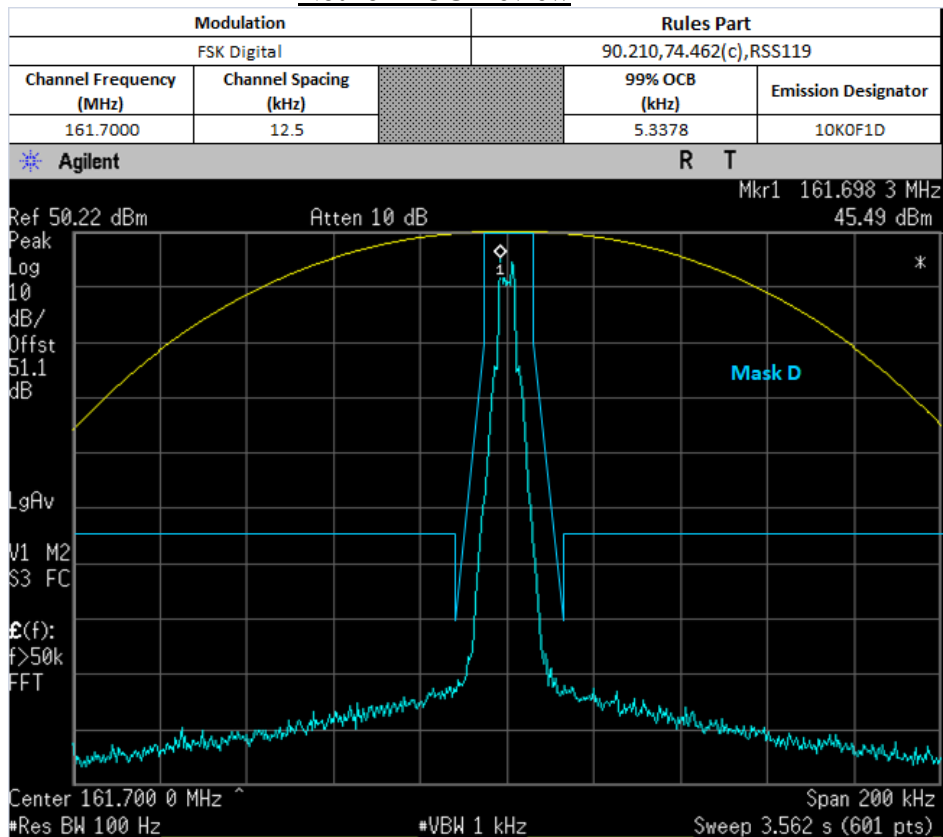


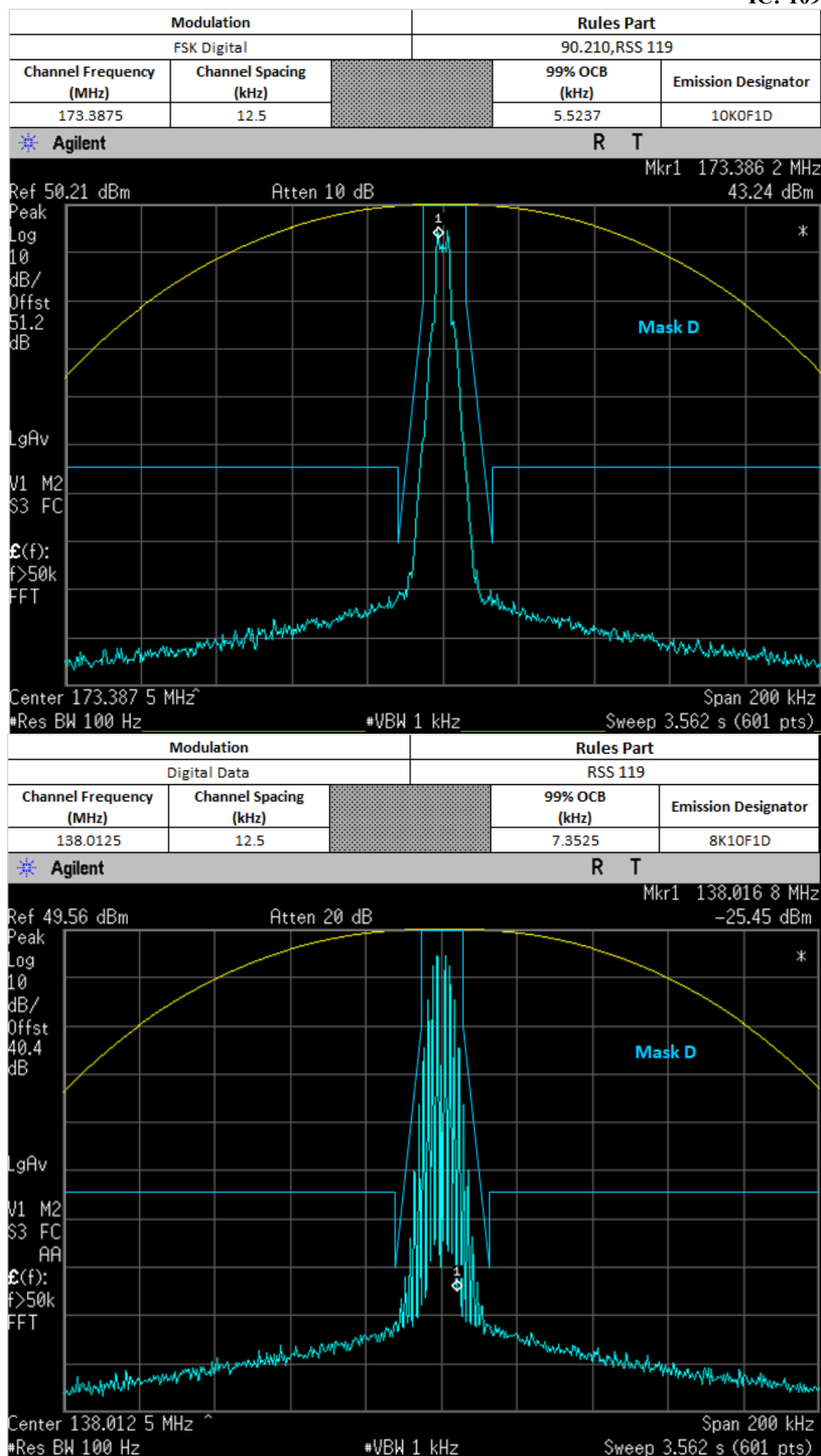


Not for FCC Review

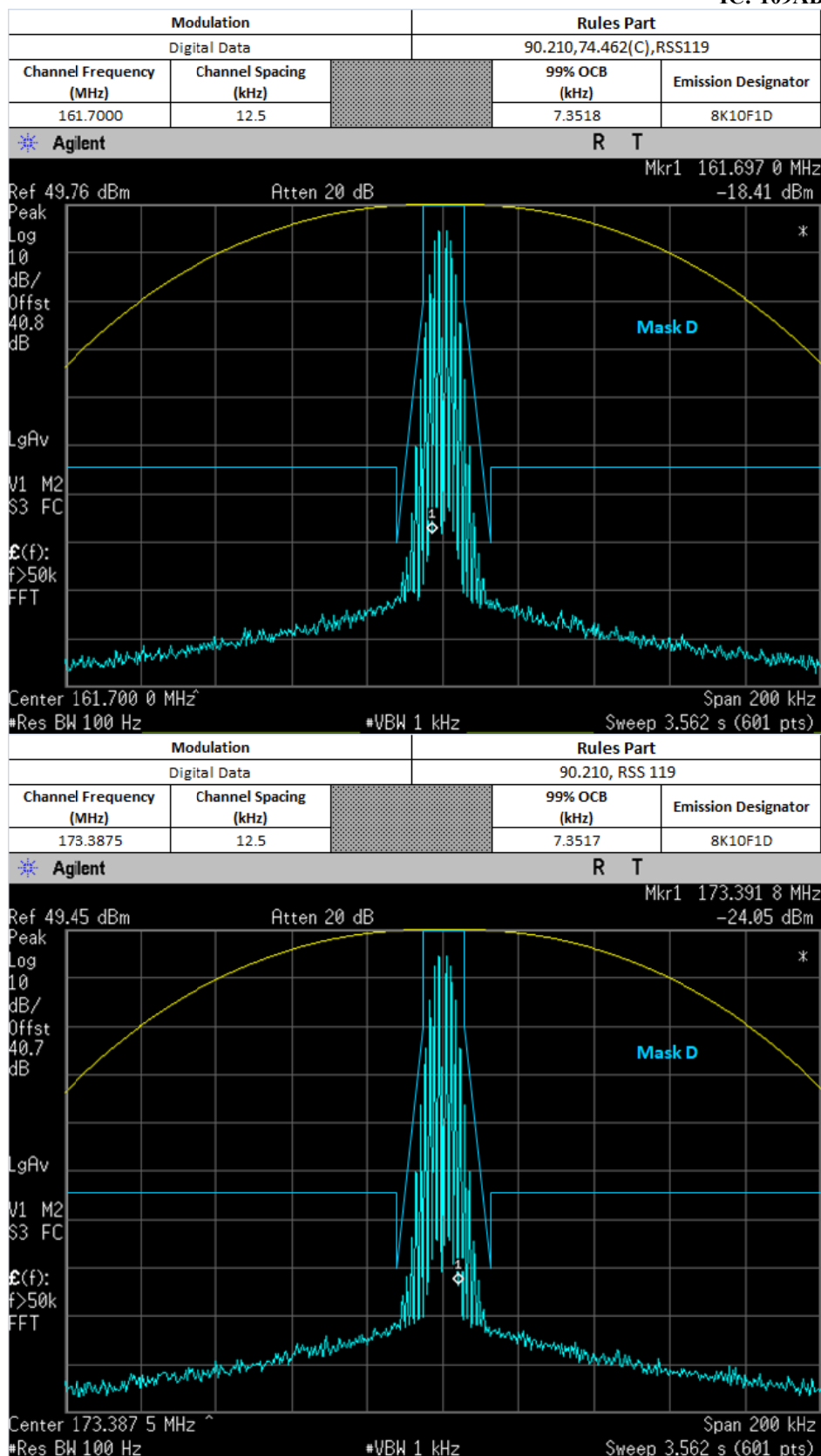


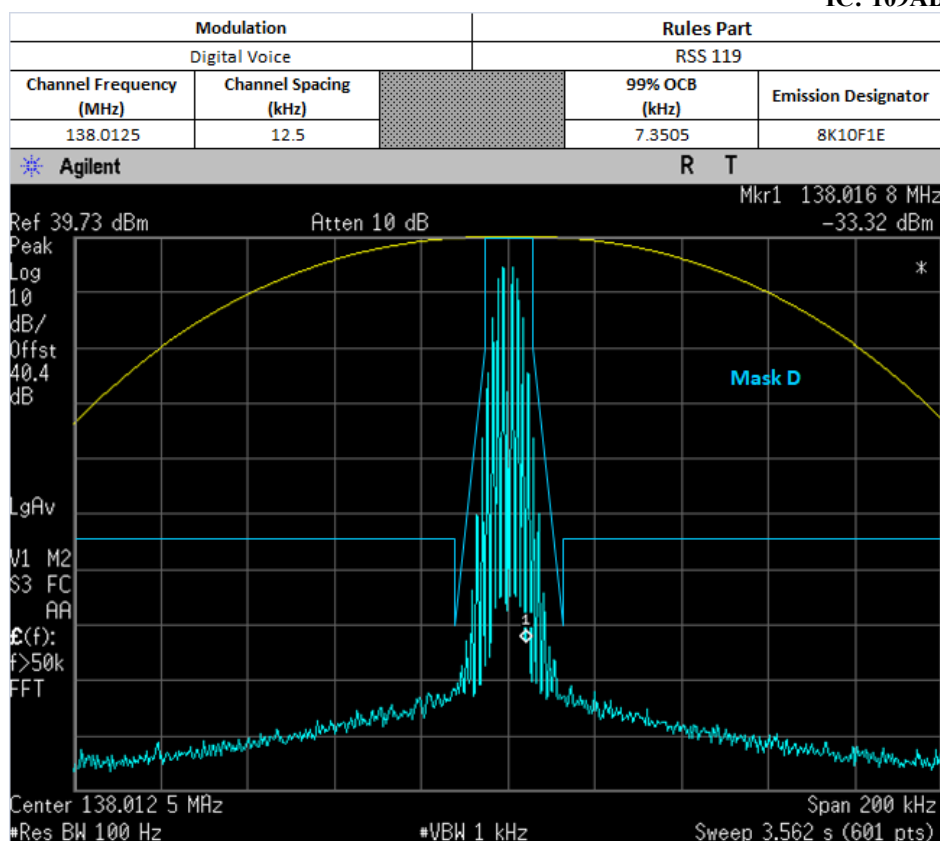
Not for FCC Review



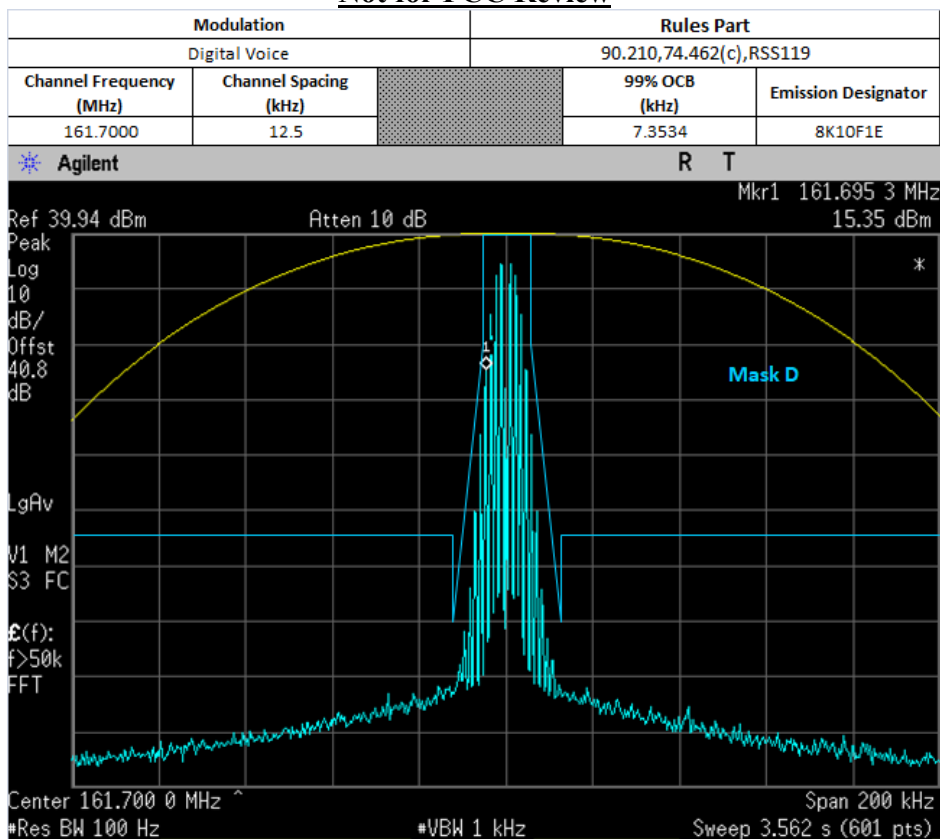


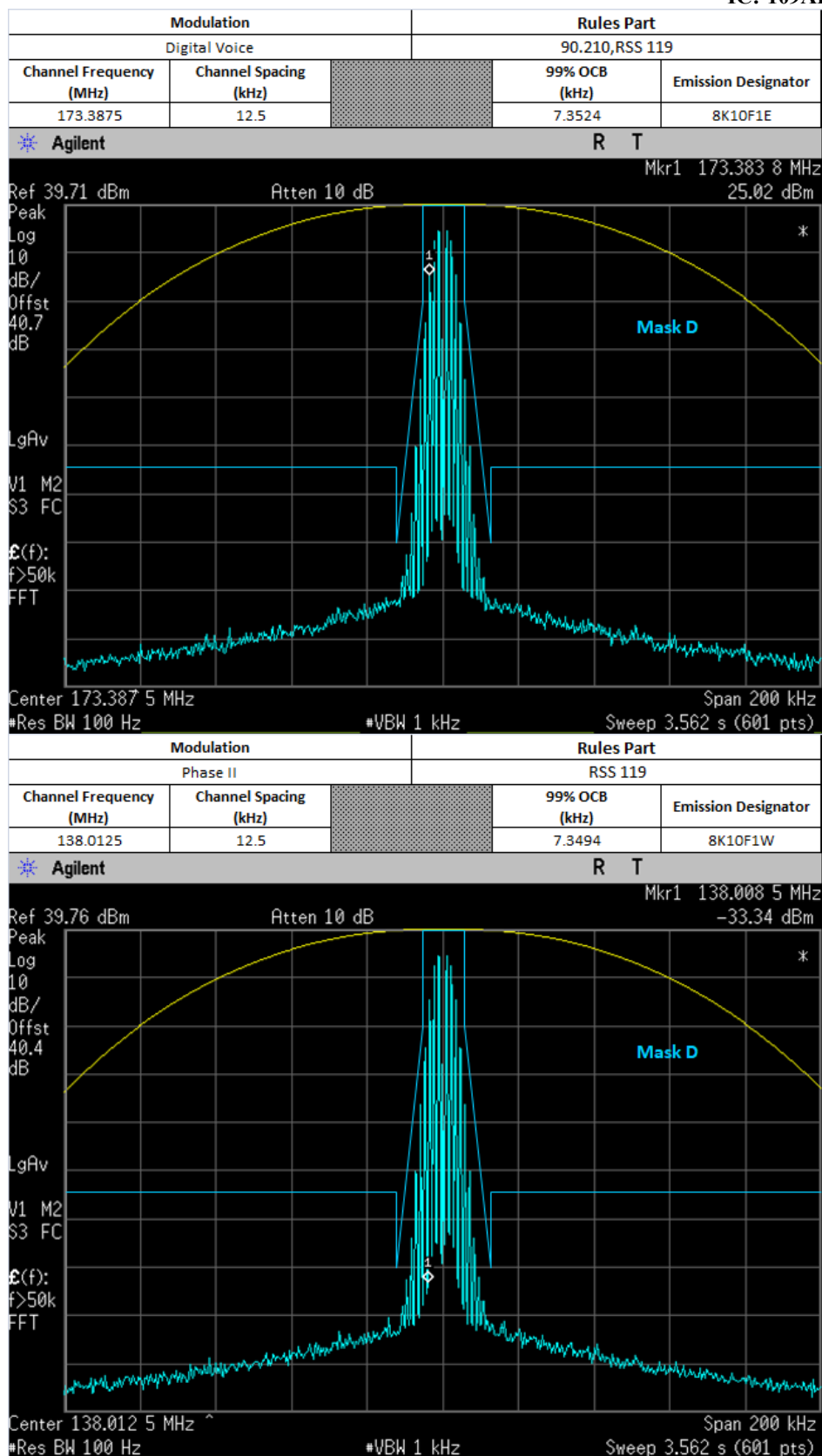
Not for FCC Review



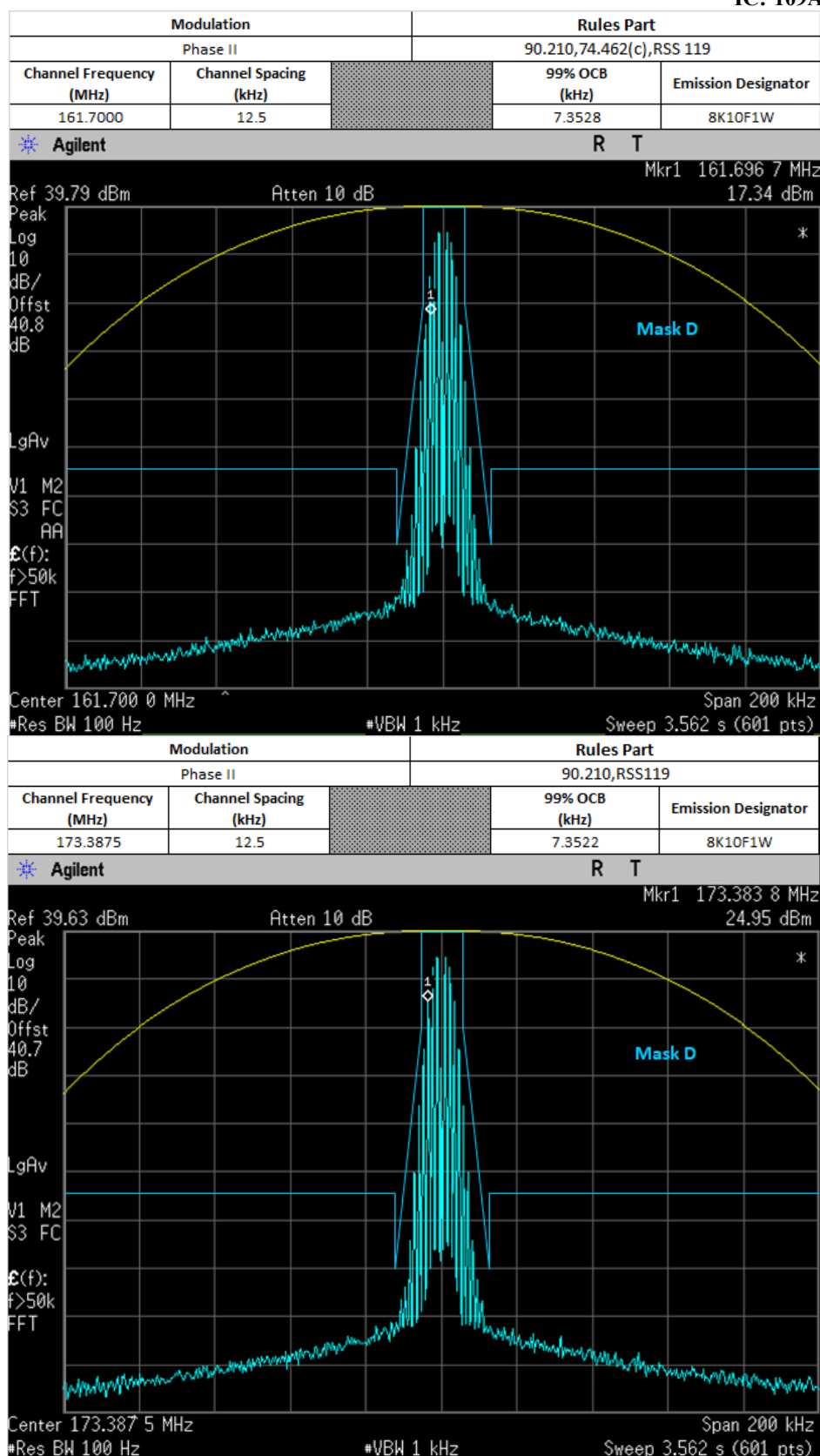


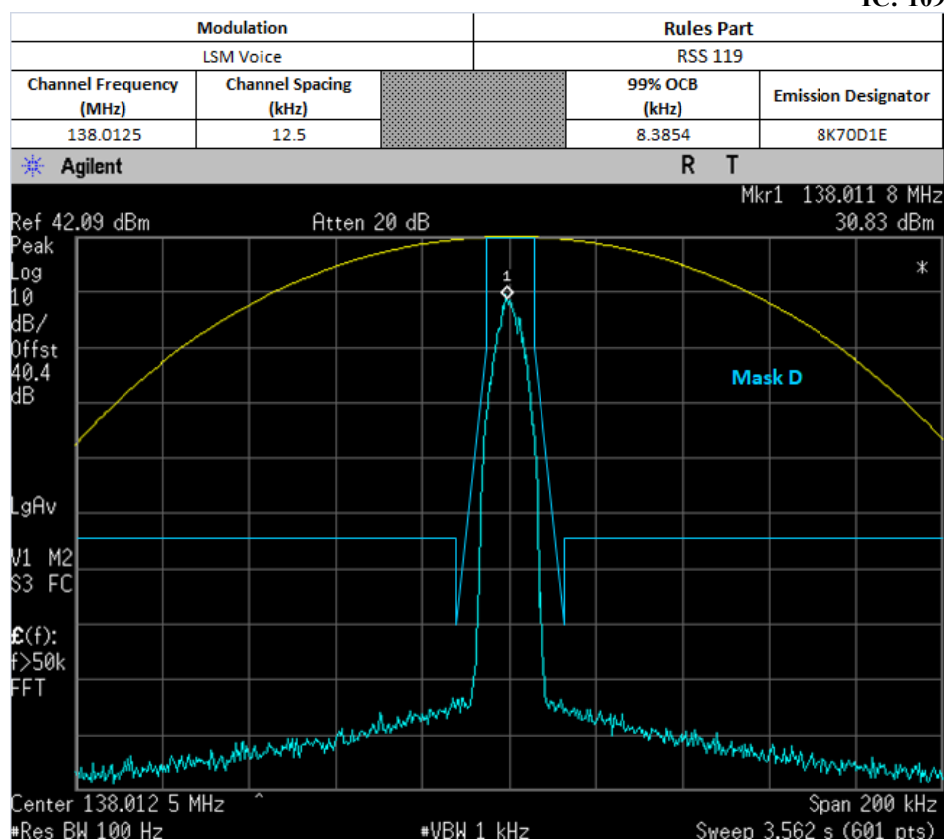
Not for FCC Review



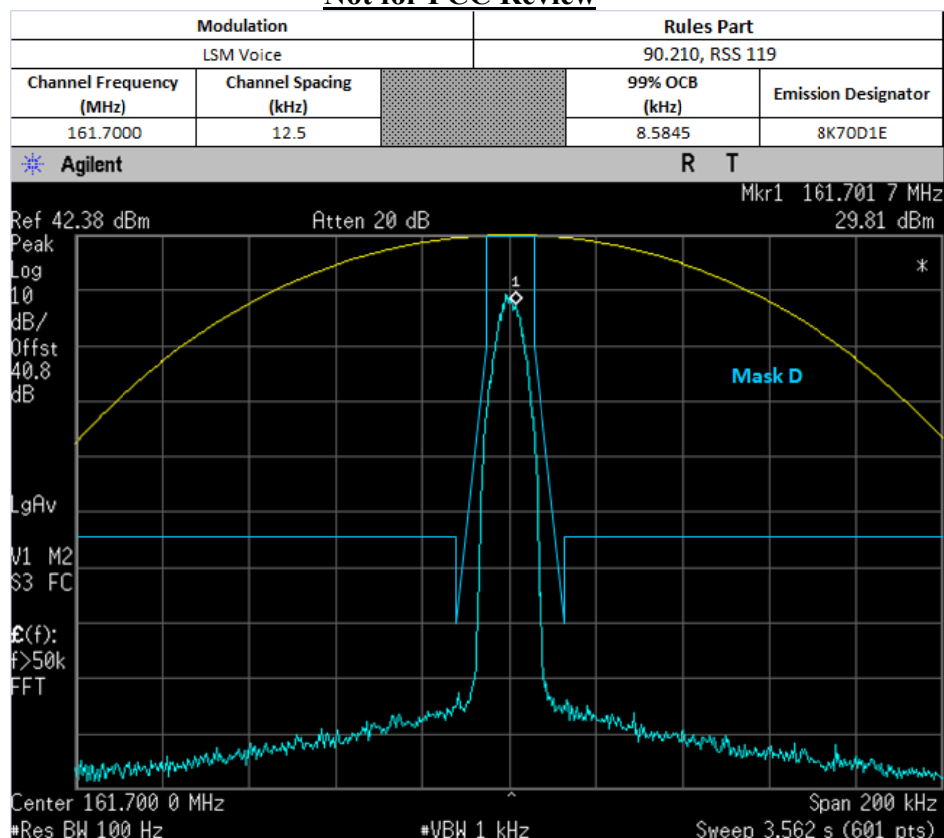


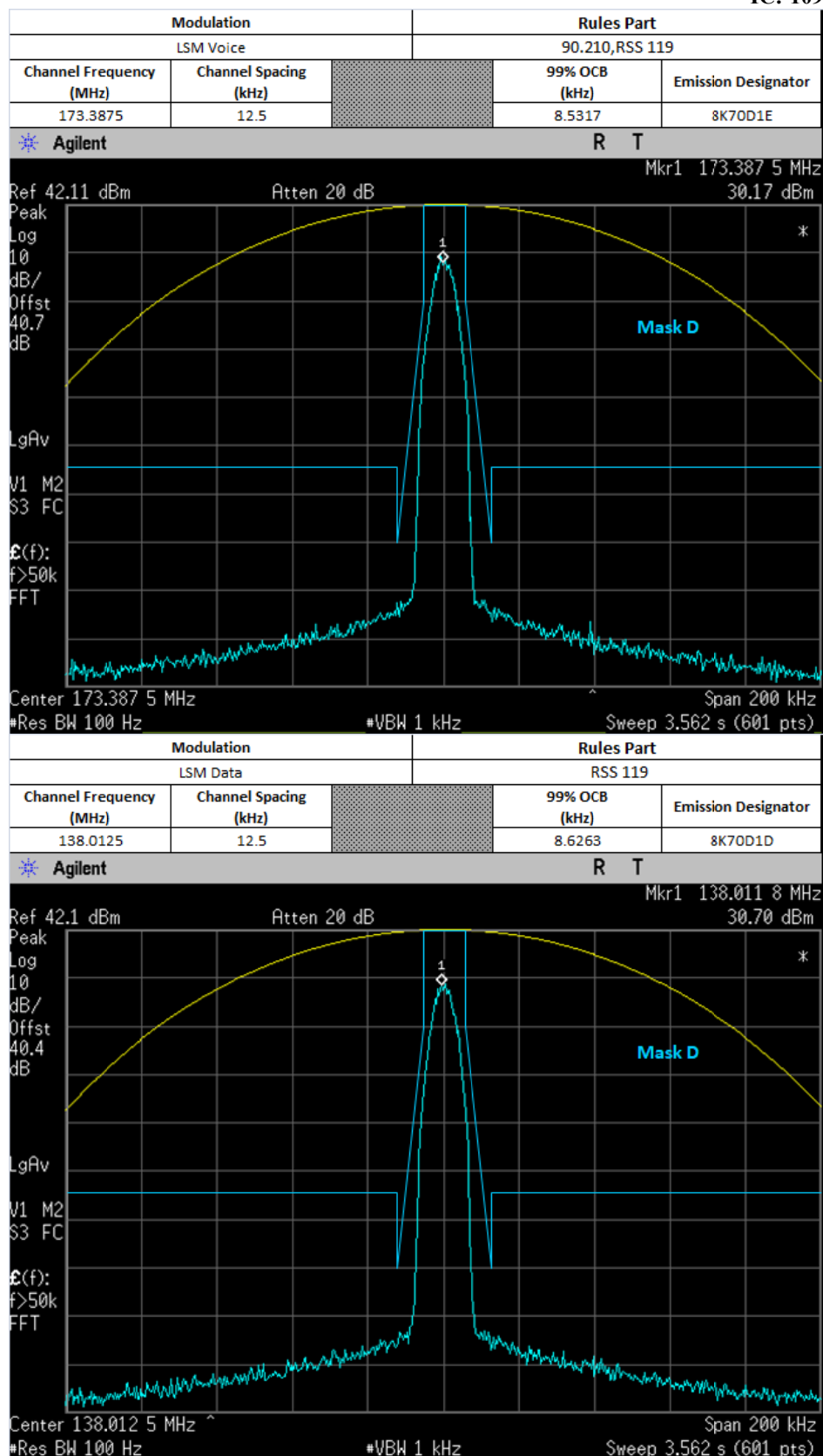
Not for FCC Review



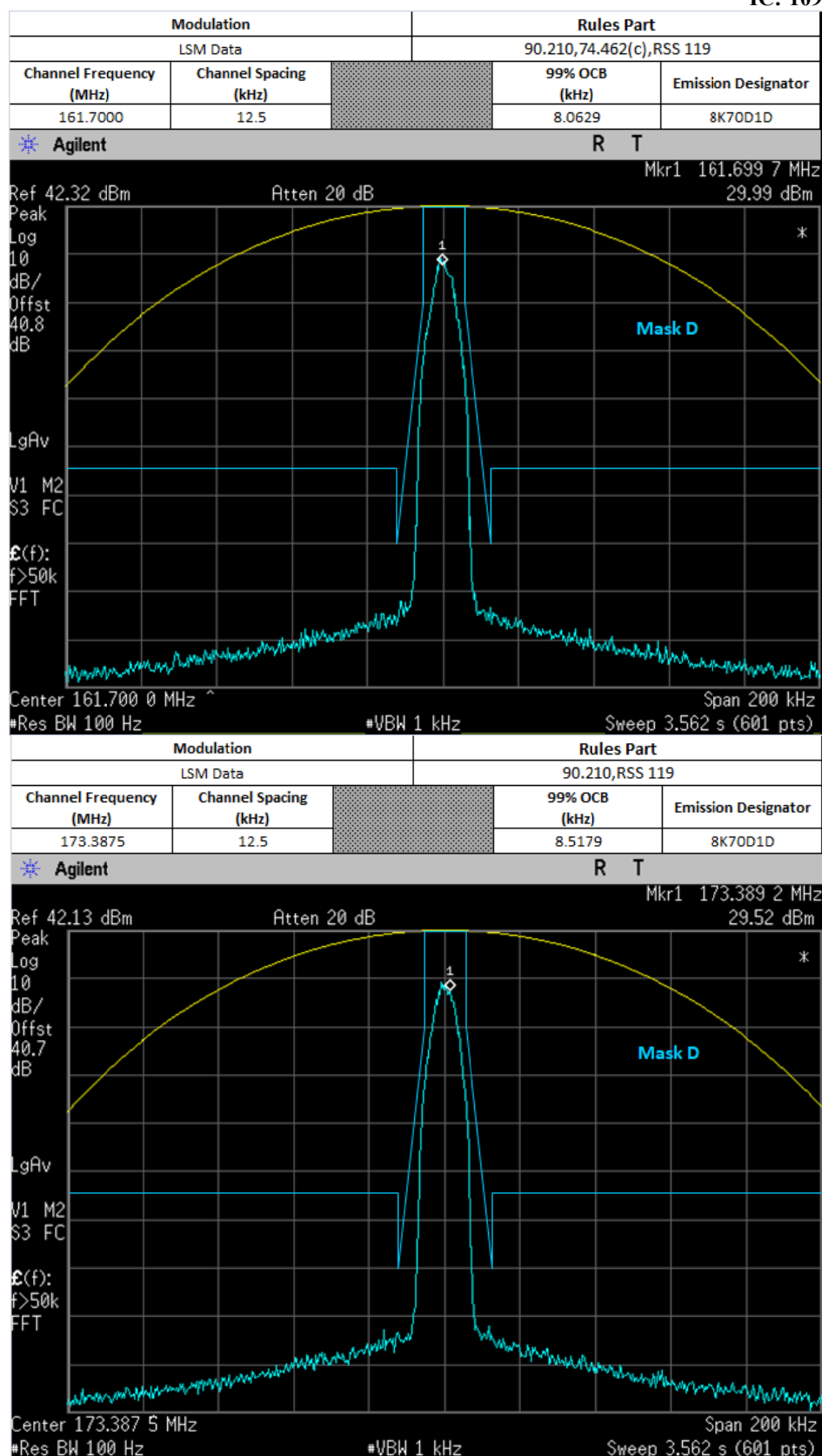


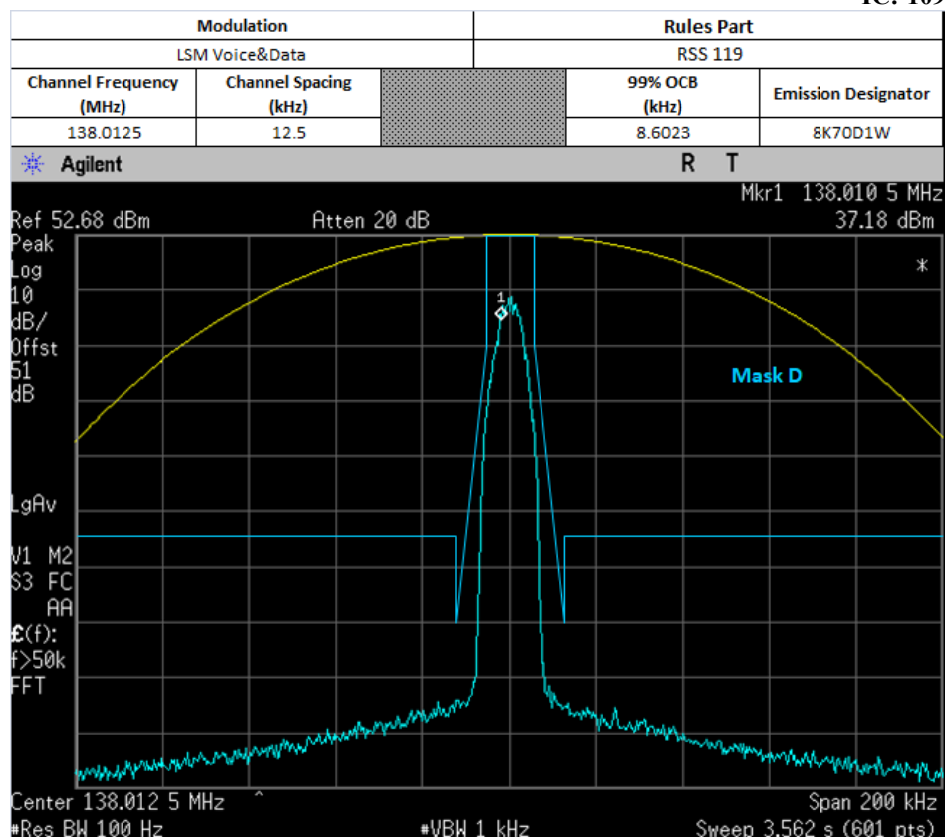
Not for FCC Review



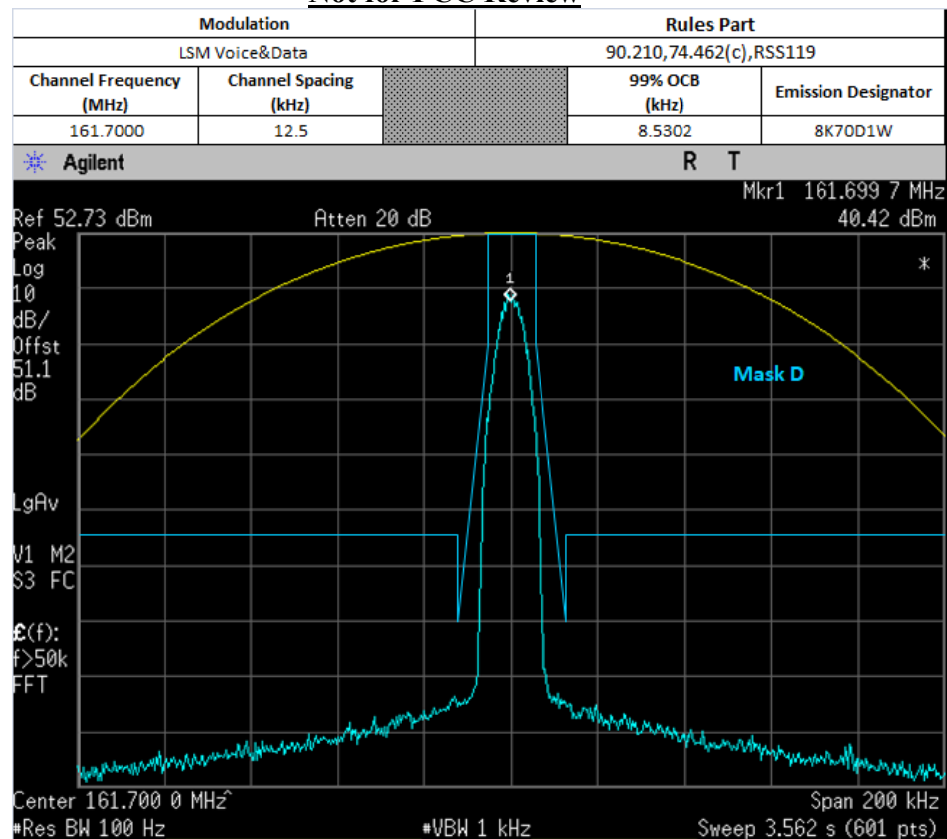


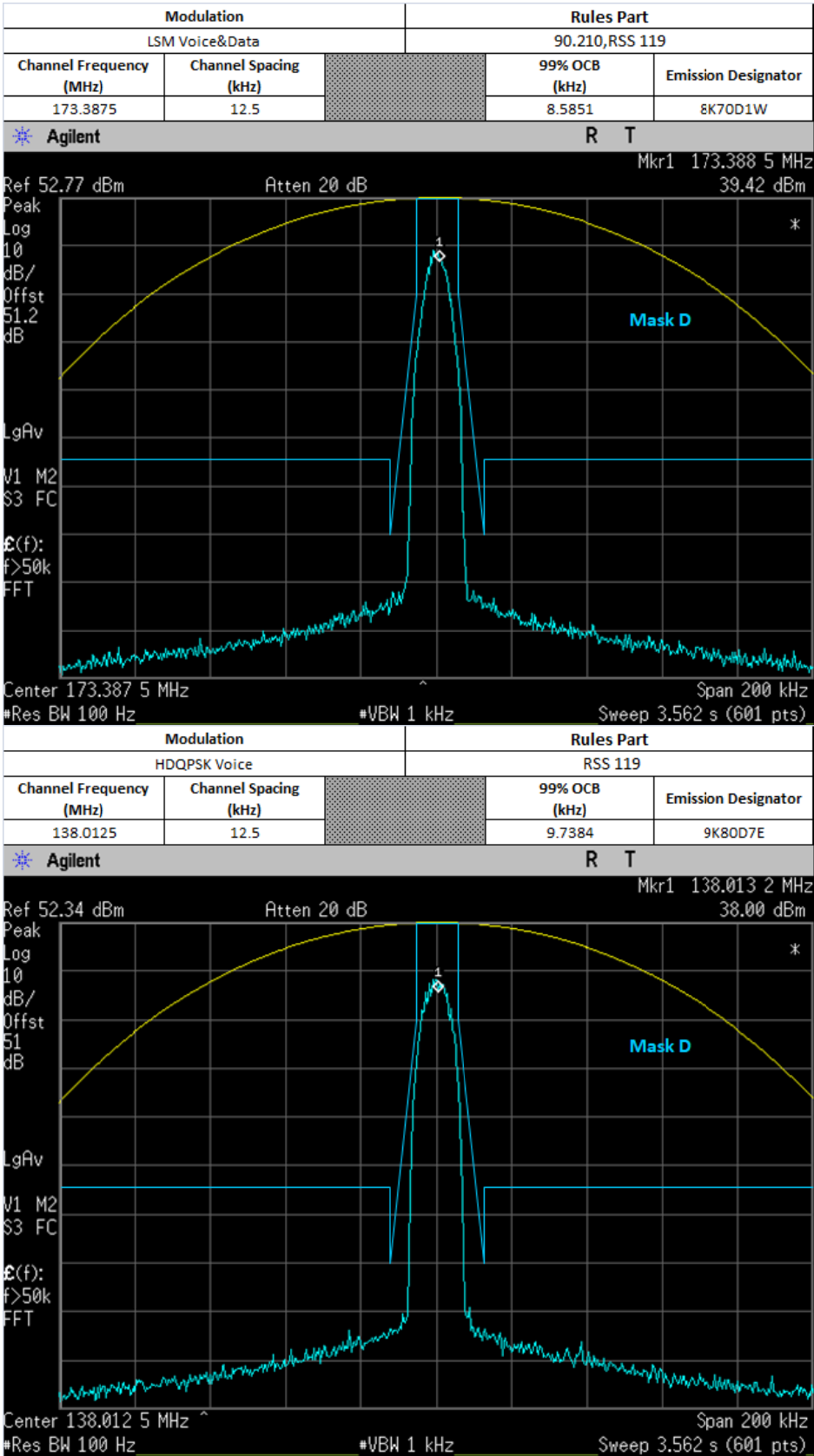
Not for FCC Review



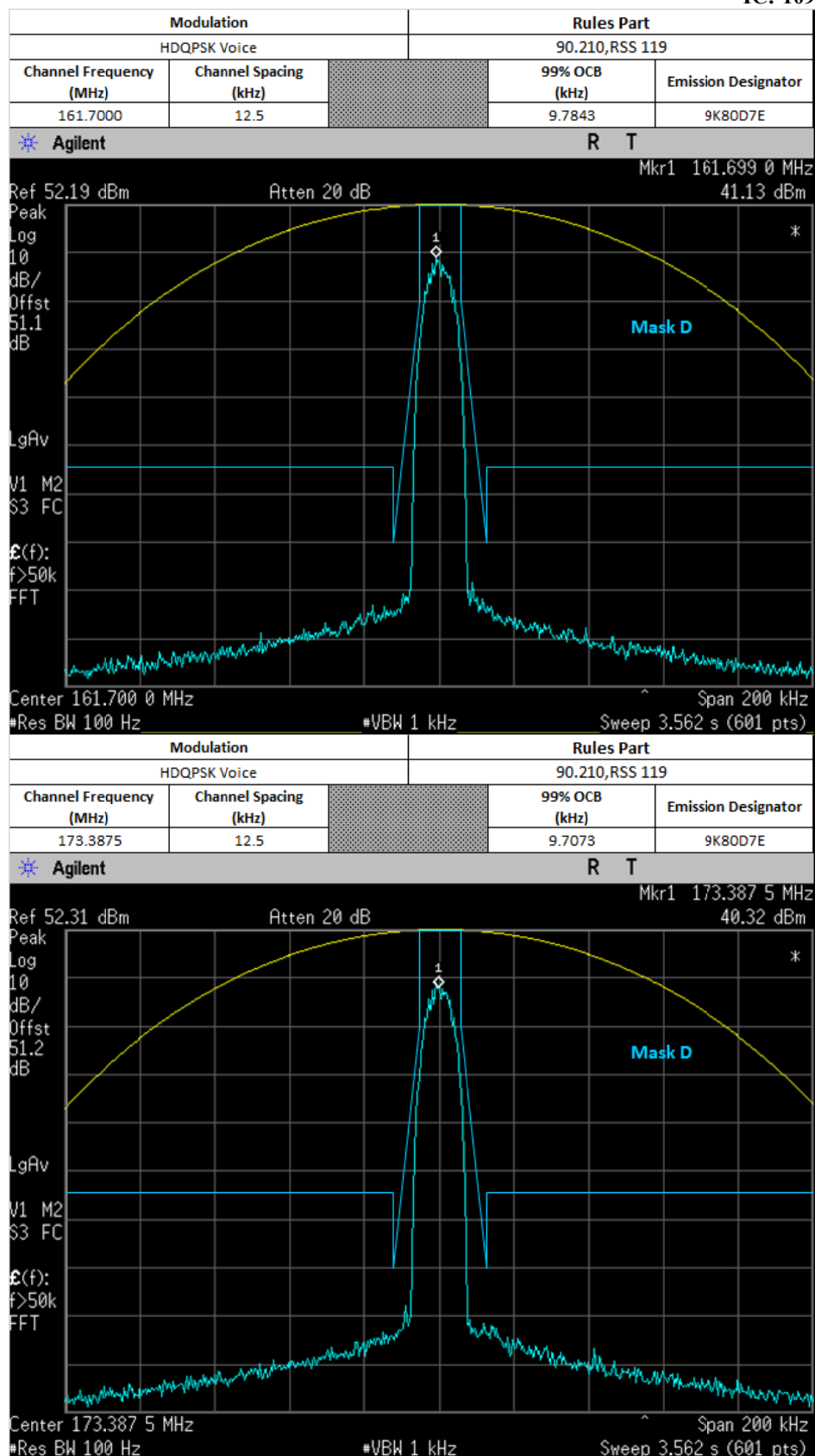


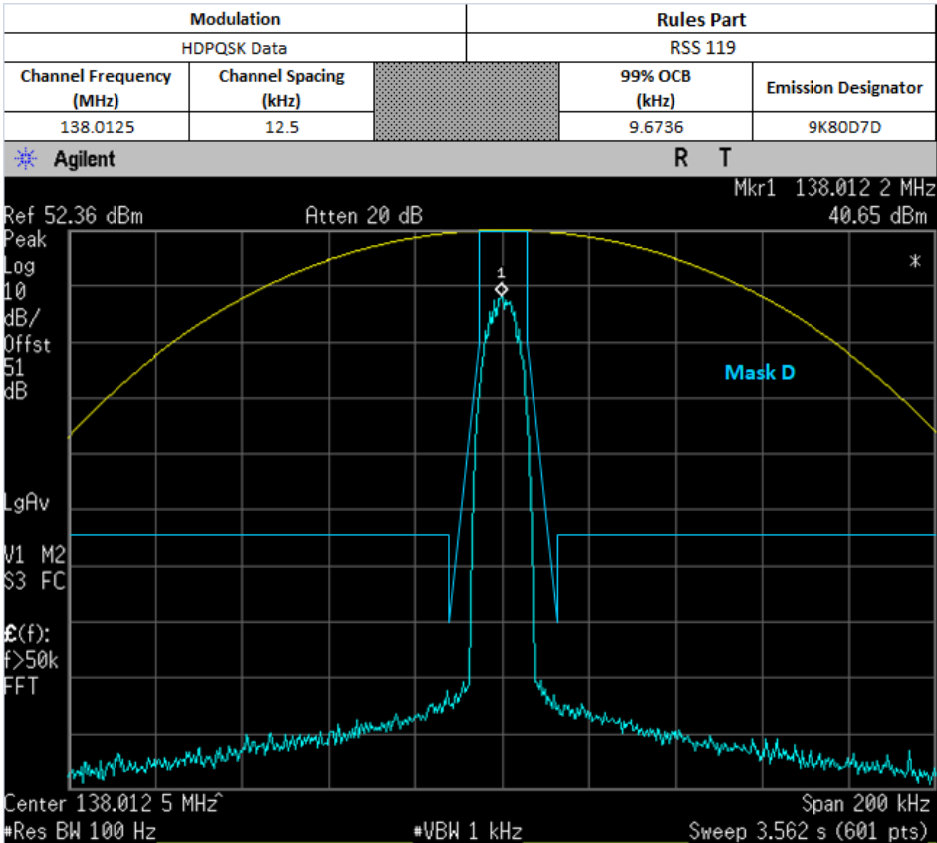
Not for FCC Review



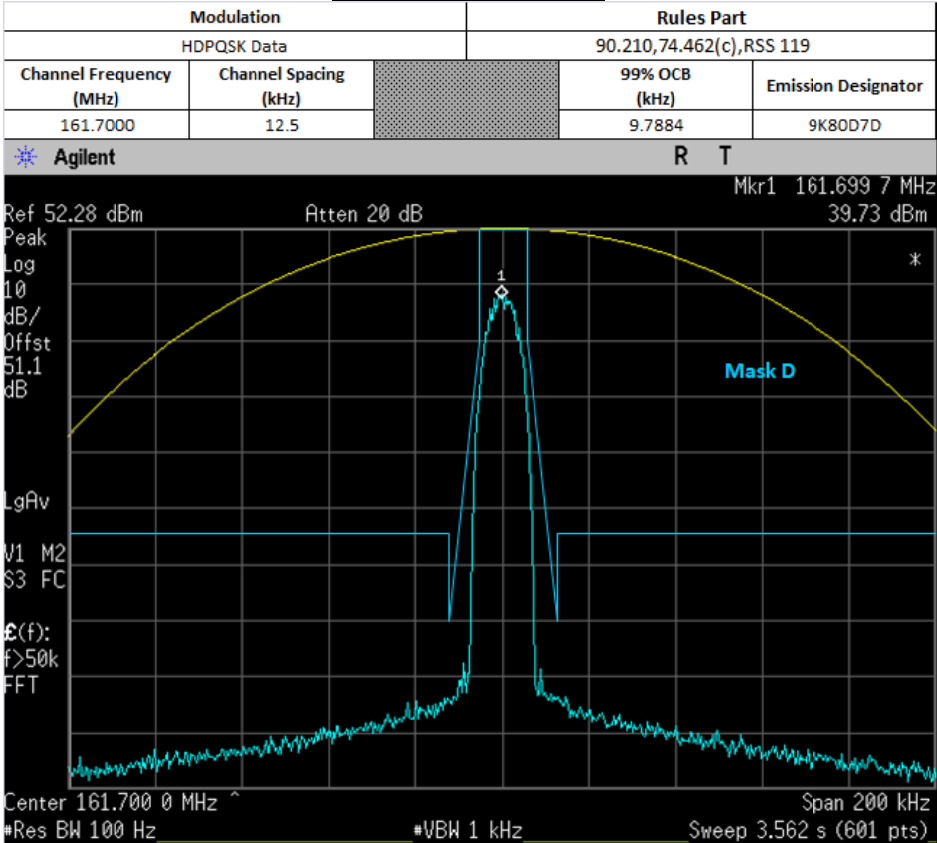


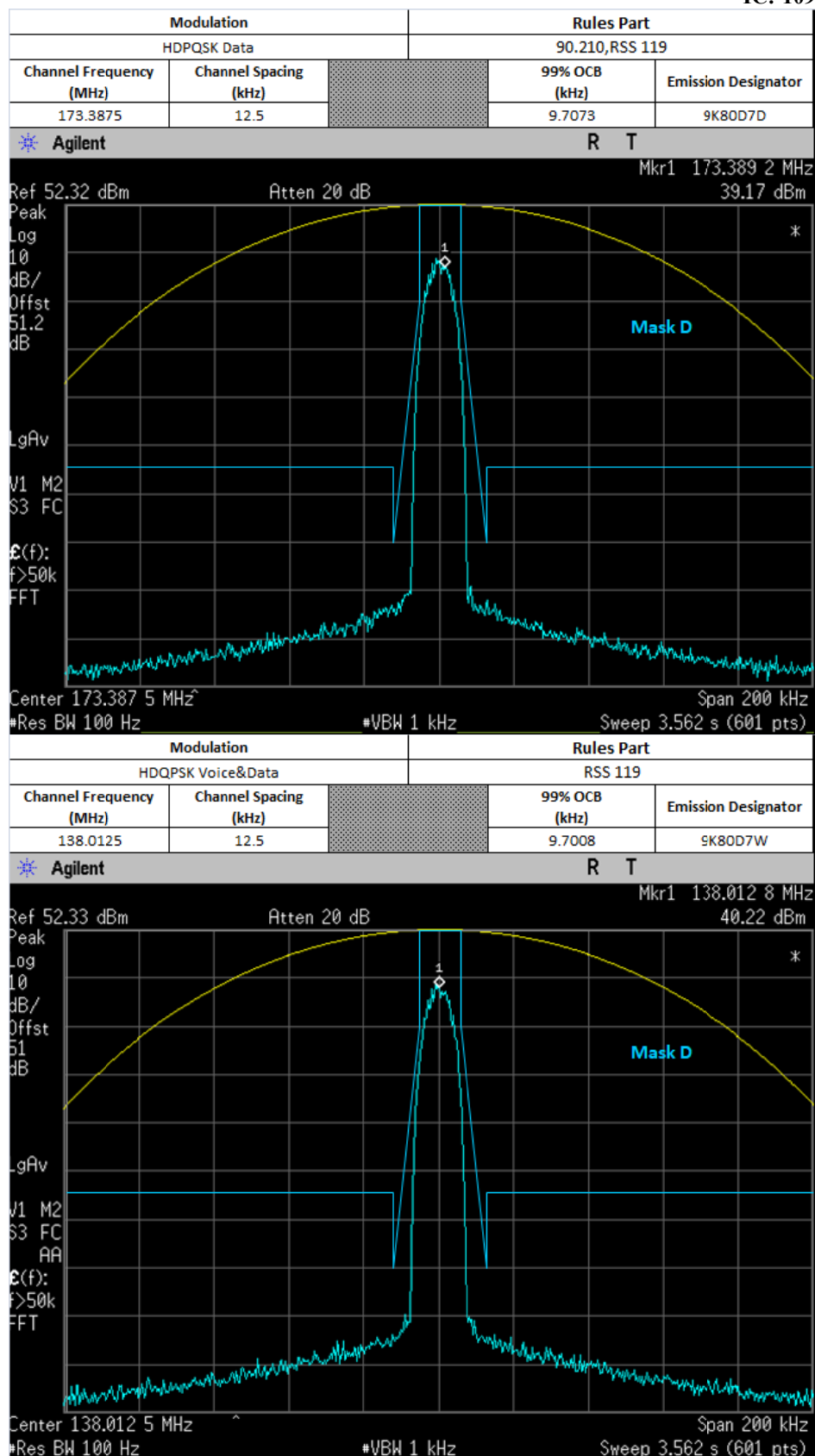
Not for FCC Review



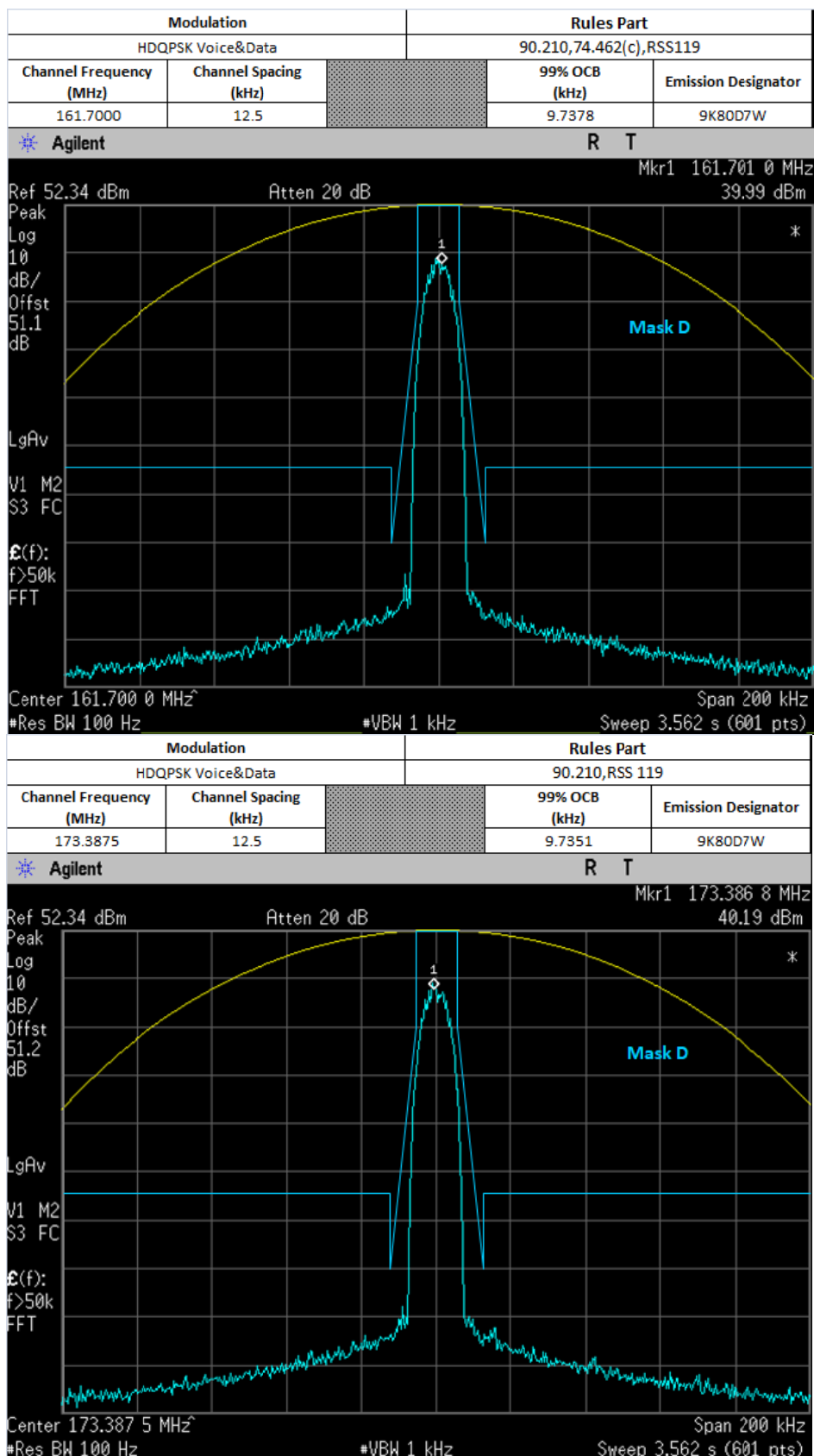


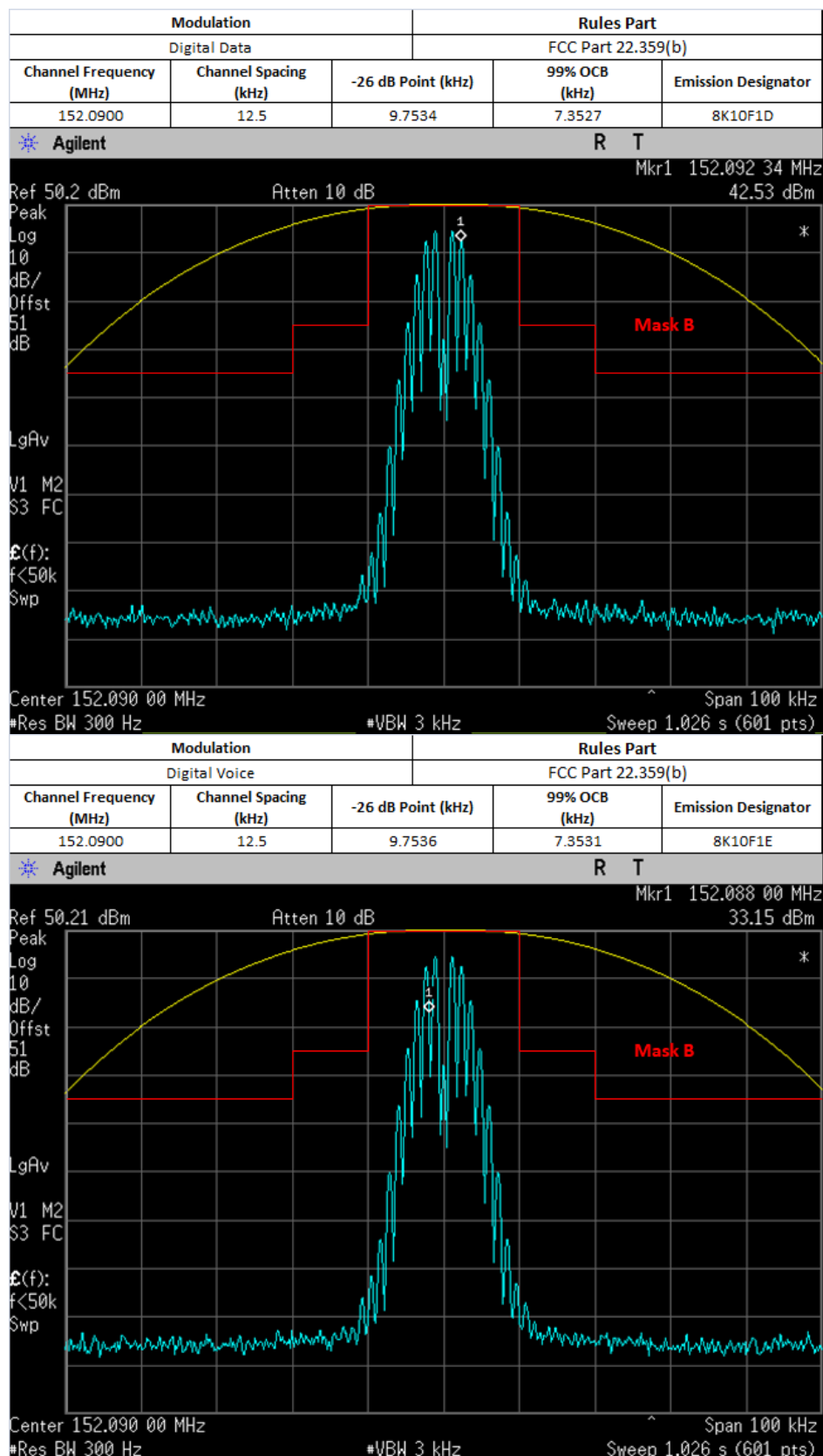
Not for FCC Review

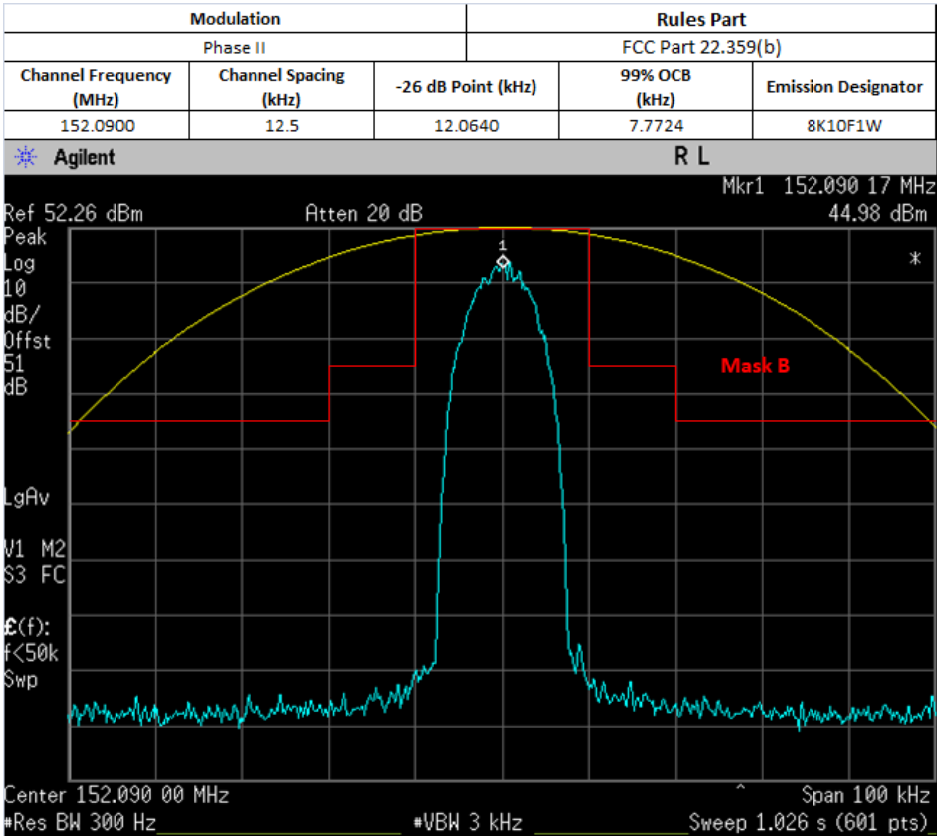




Not for FCC Review





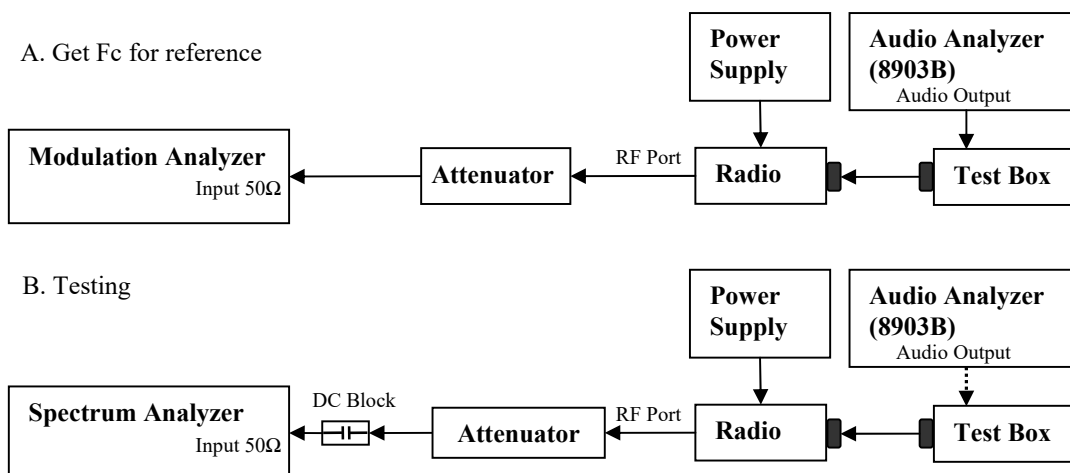


6.6.5. Test Limit

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)



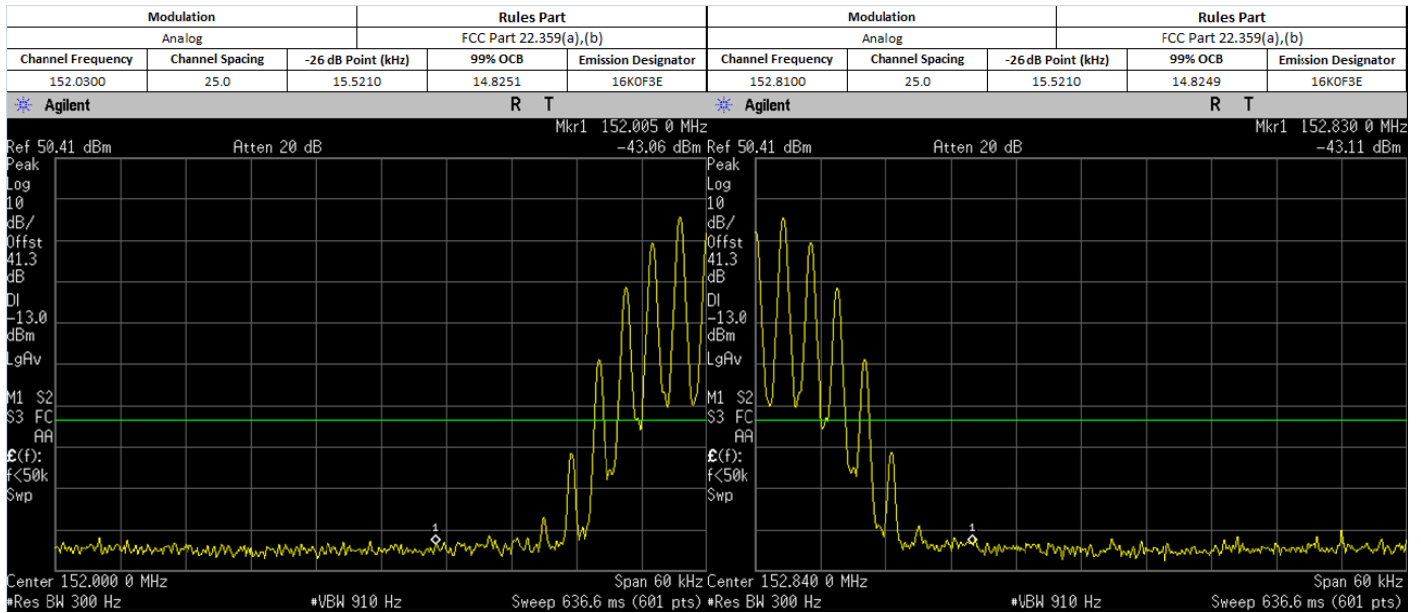
- 1) The DUT transmitter output port was connected to Modulation Analyzer.
- 2) Set the audio bandwidth filter to 15 kHz low pass filter and 50 kHz high pass filter.
- 3) Transmit the radio and set the audio analyzer to 2.5 kHz audio frequency and 50% of the rated deviation. Up the amplitude by 16 dB. 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:

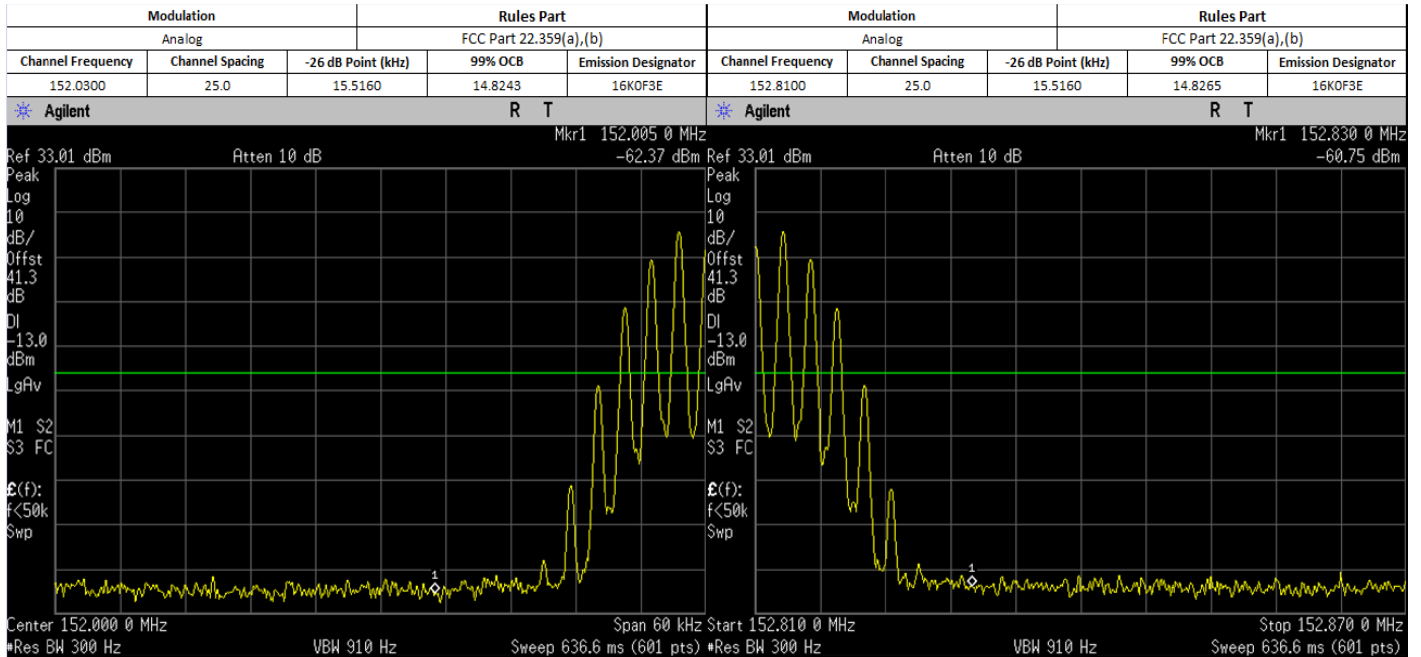
- For emission designator ending with F3E, 16K0F3E is the worst case and therefore only 16K0F3E will be shown.

6.7.2. Test Result (Analog)

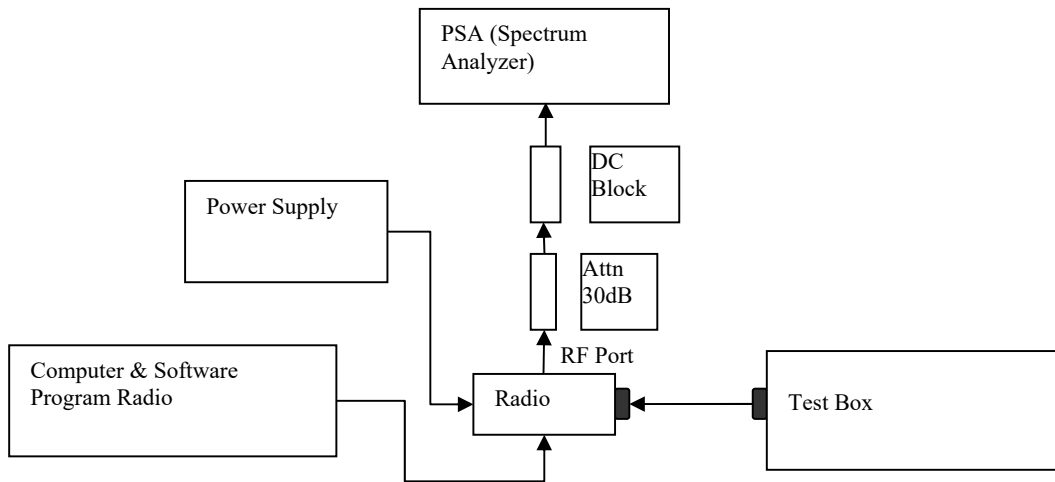
Max Power



Low Power



6.7.3. Test Setup (Digital)



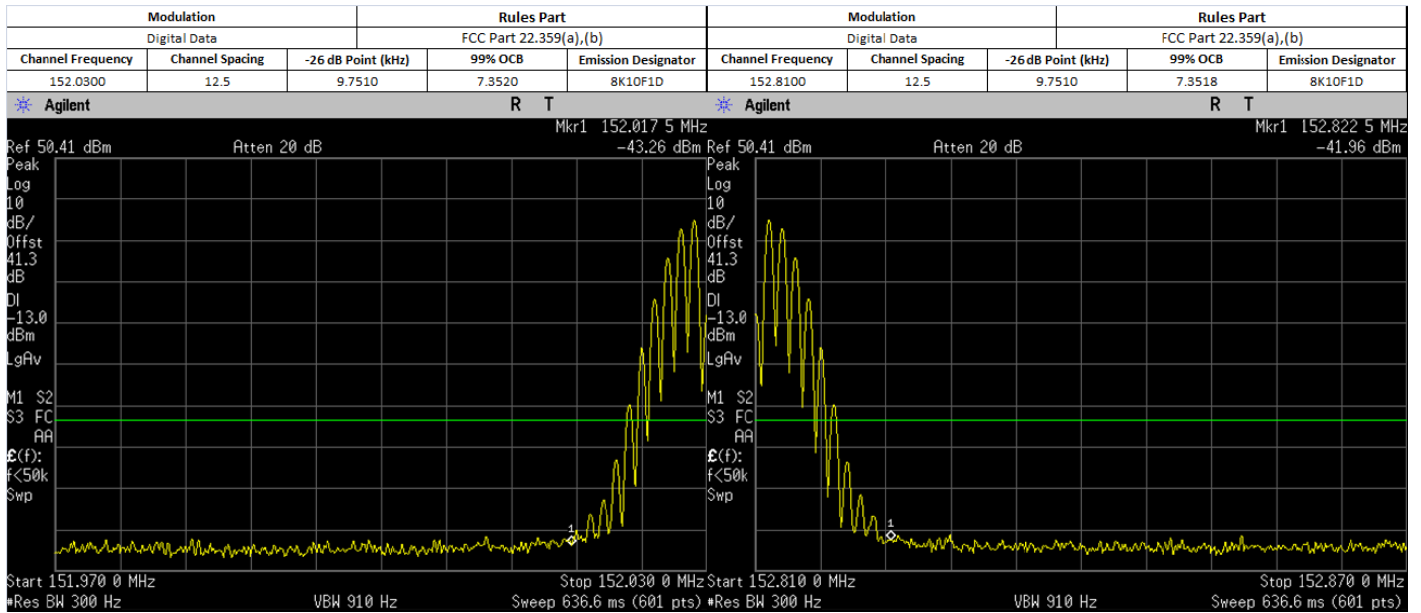
- 1) Program and set radio to operate in desire test frequency and digital mode with modulation. (*4FSK, C4FM or other digital modulation form).
- 2) Path loss for the measurement included.
- 3) Select the Occupied Bandwidth measurement for 99% and 26dB Emissions Bandwidth Measurement.
- 4) Key in the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

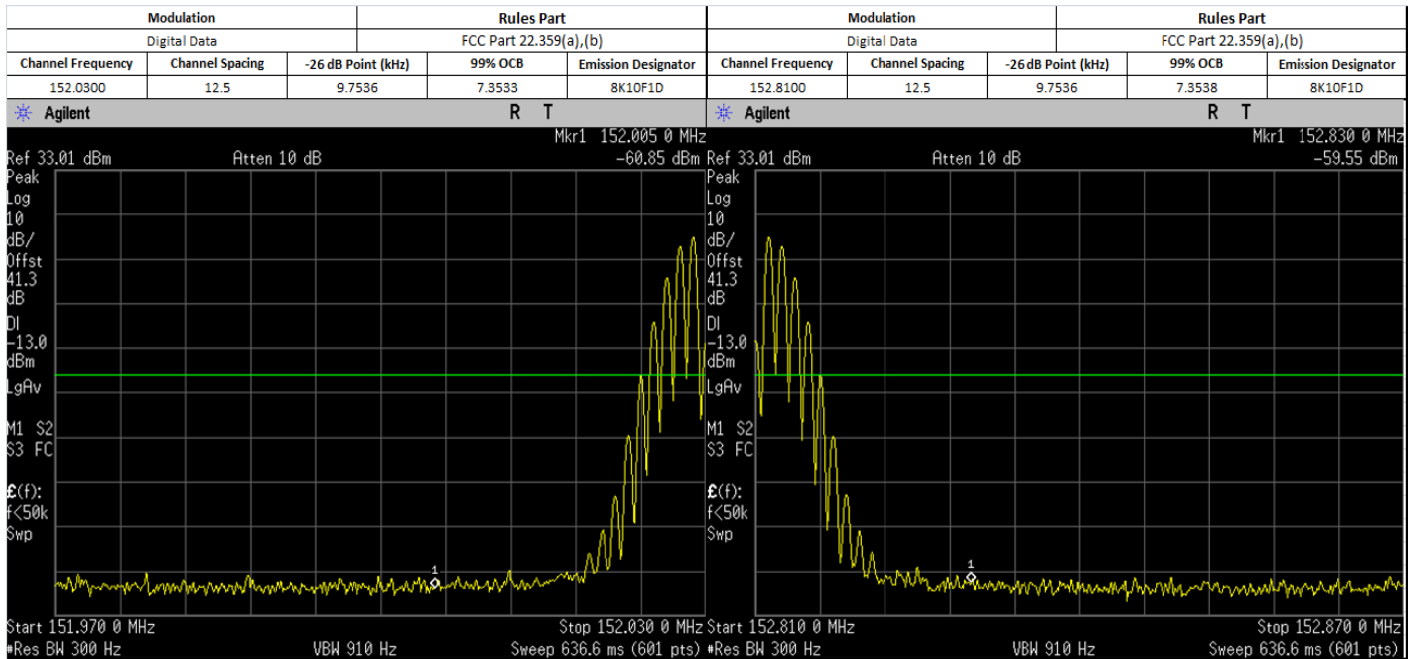
- All digital modulation modes utilize the same high deviation test pattern, and they are therefore identical. Hence, only one plot per digital modulation scheme is shown

6.7.4. Test Result (Digital)

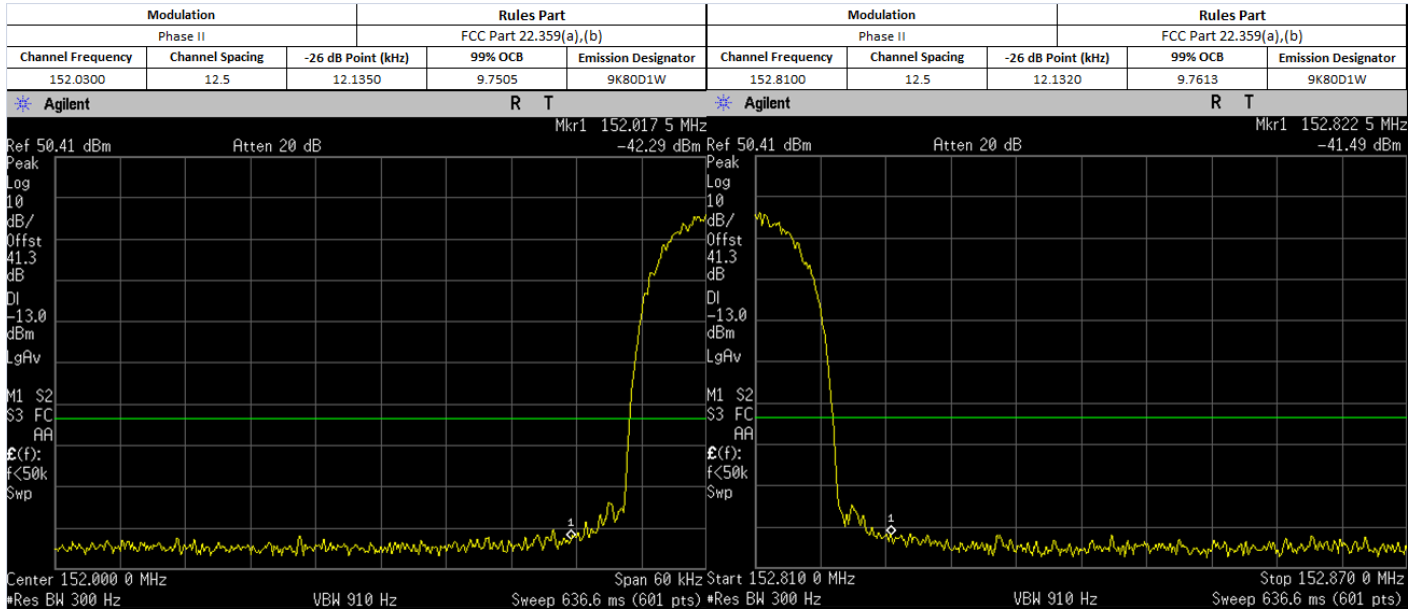
Max Power



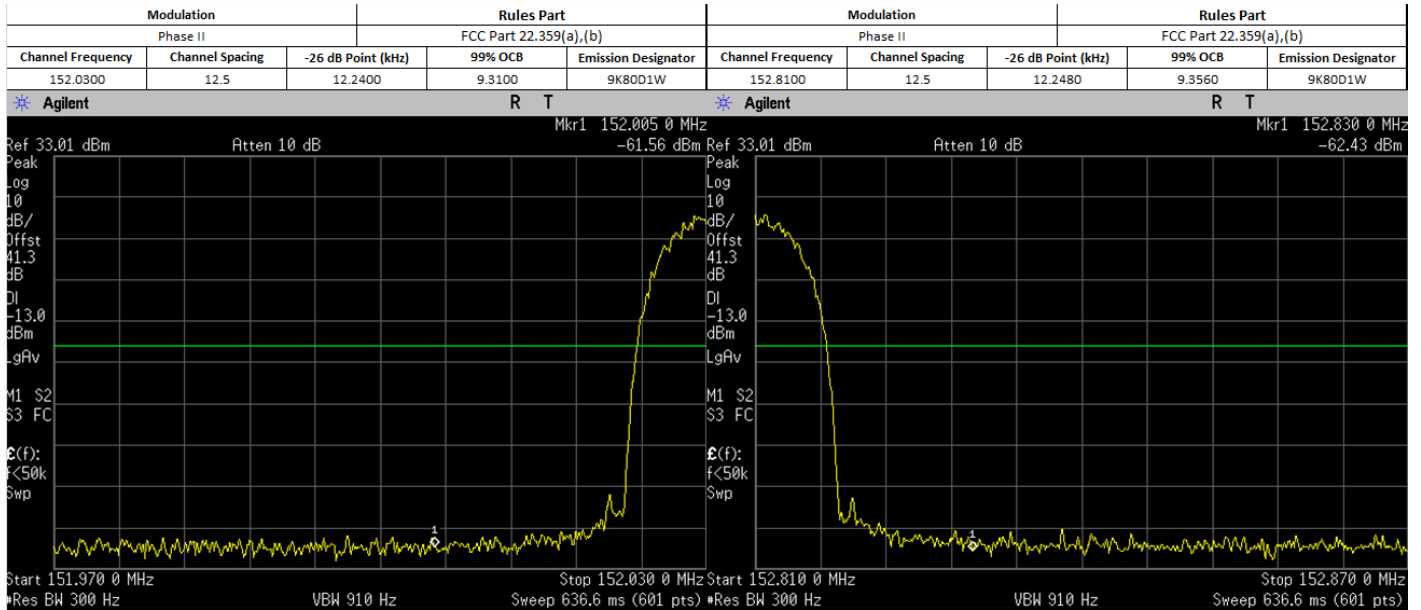
Low Power



Max Power



Low Power

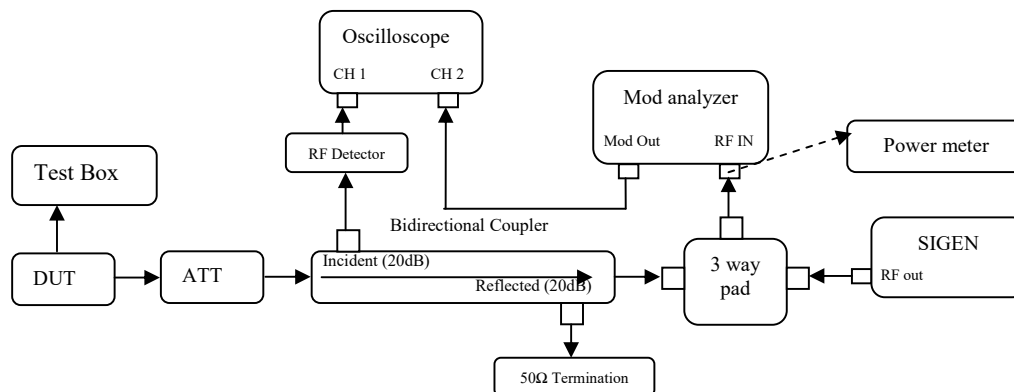


6.7.5. Test Limit

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.

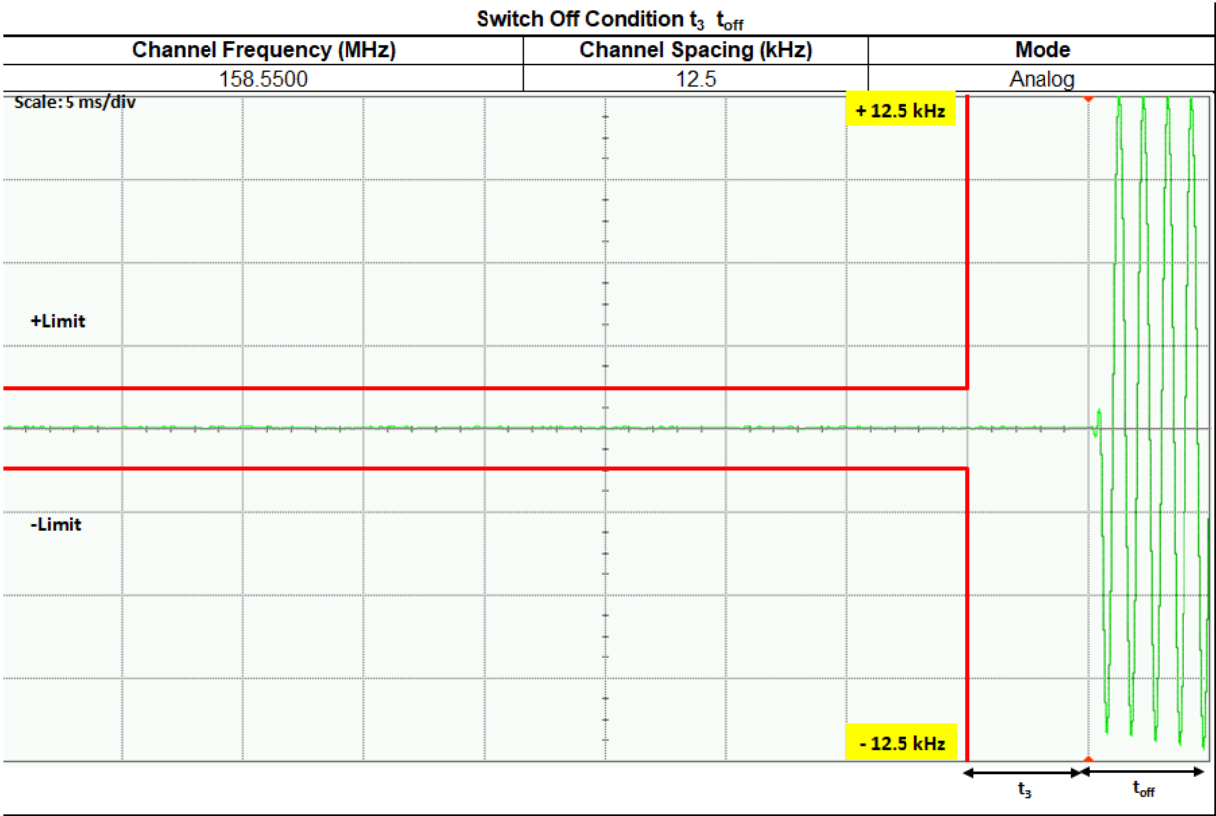
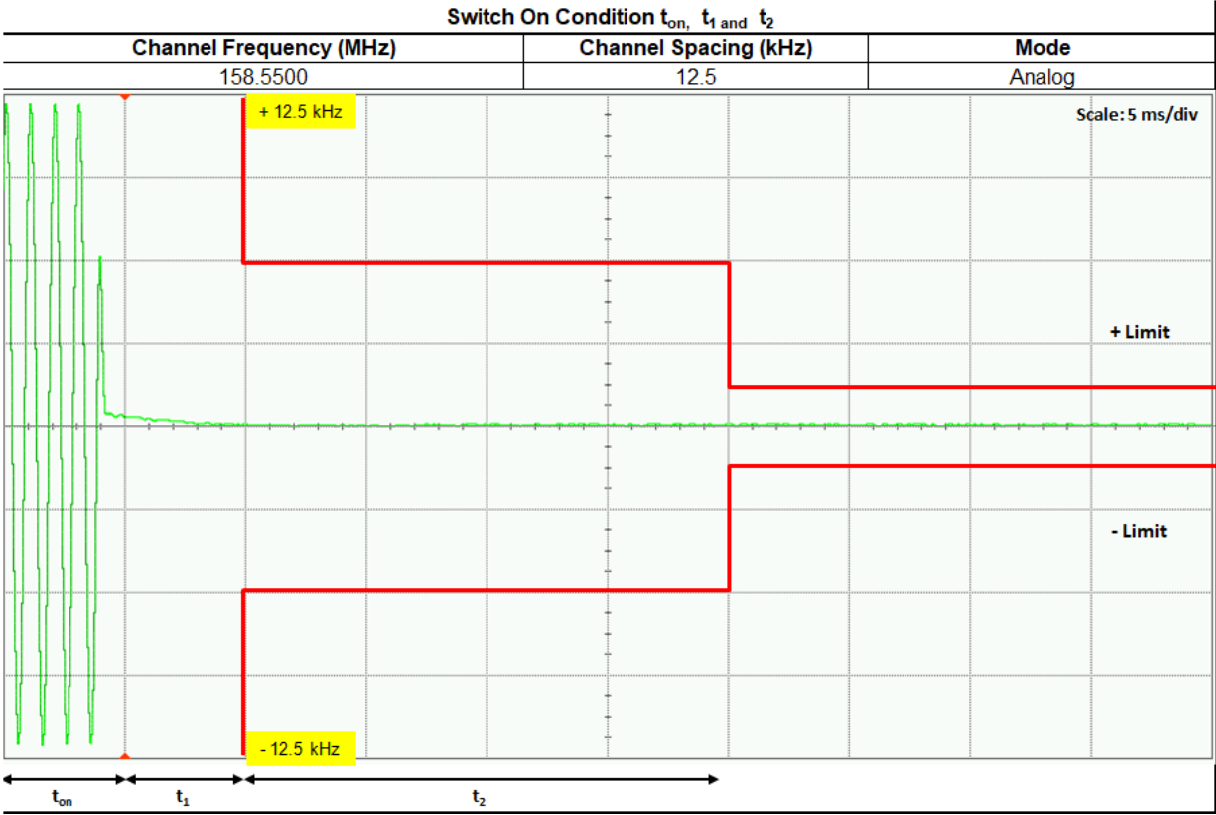
6.8. Transient Frequency Behavior

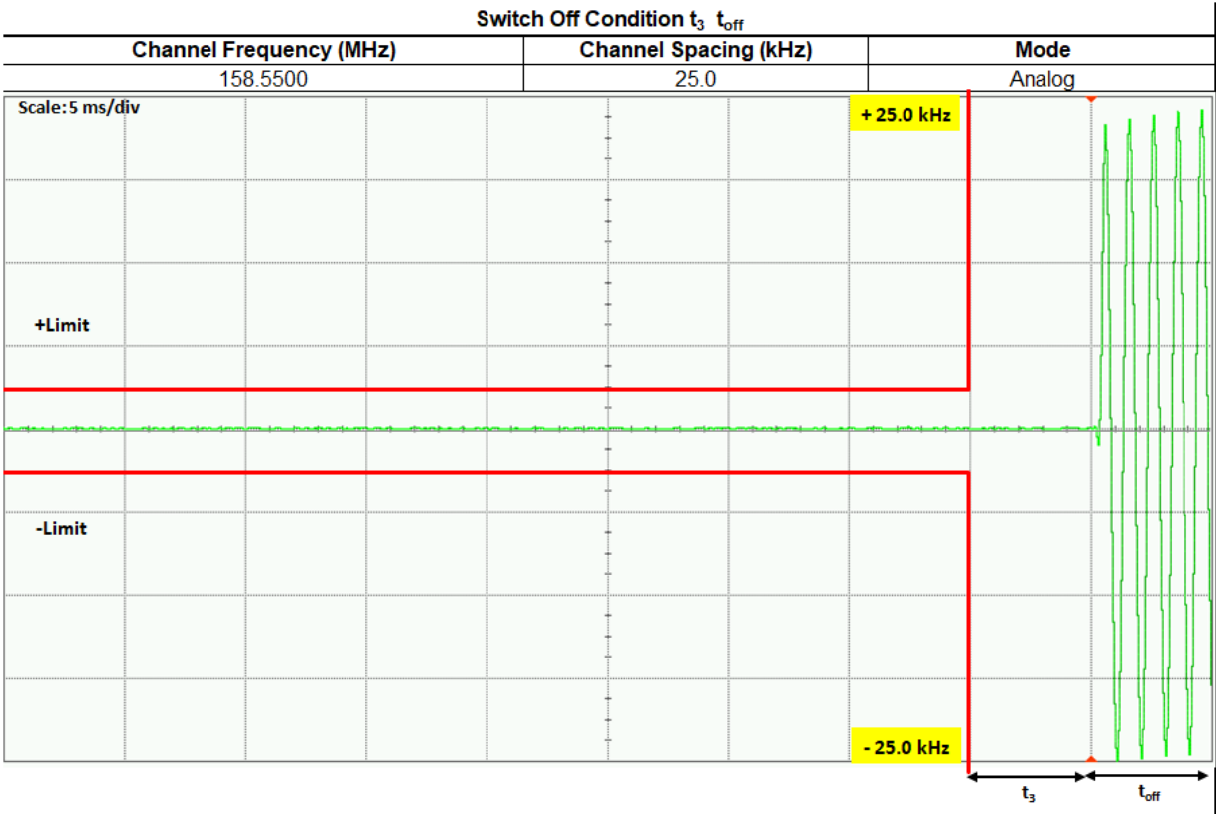
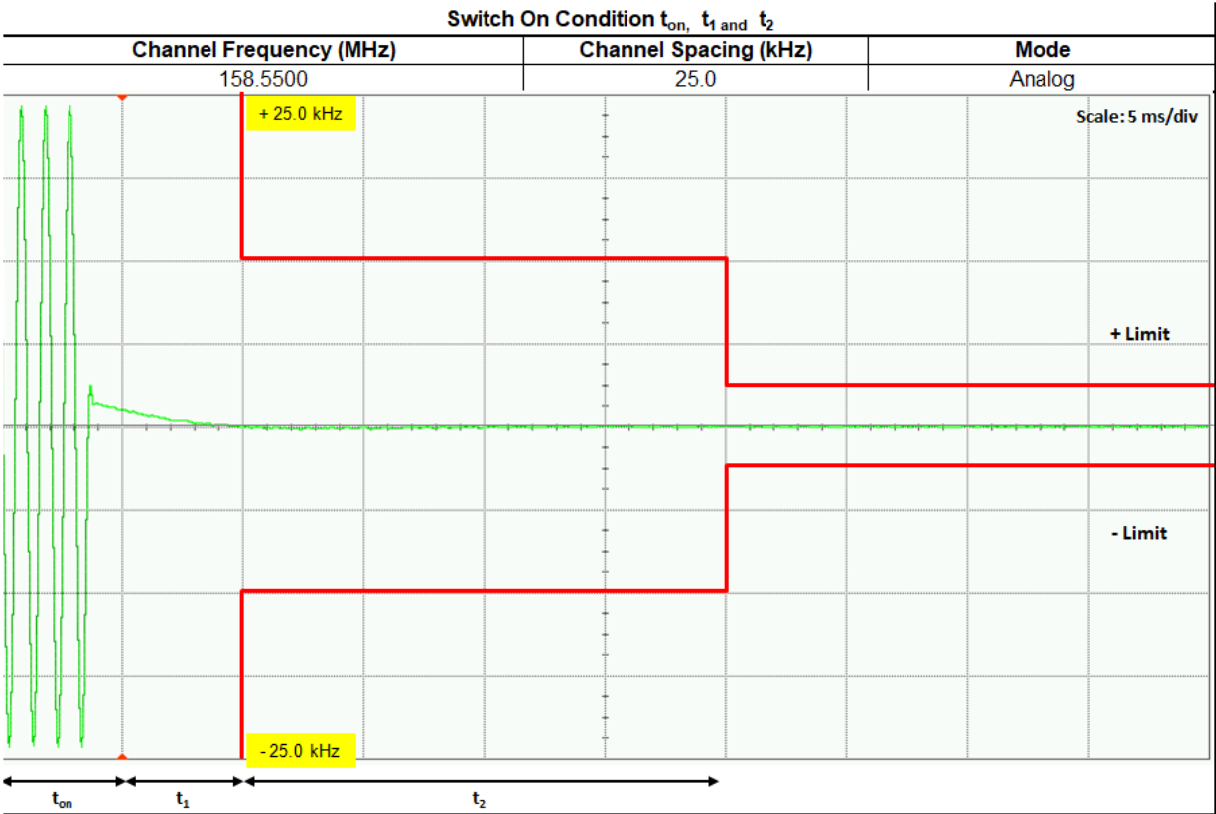
6.8.1. Test Setup

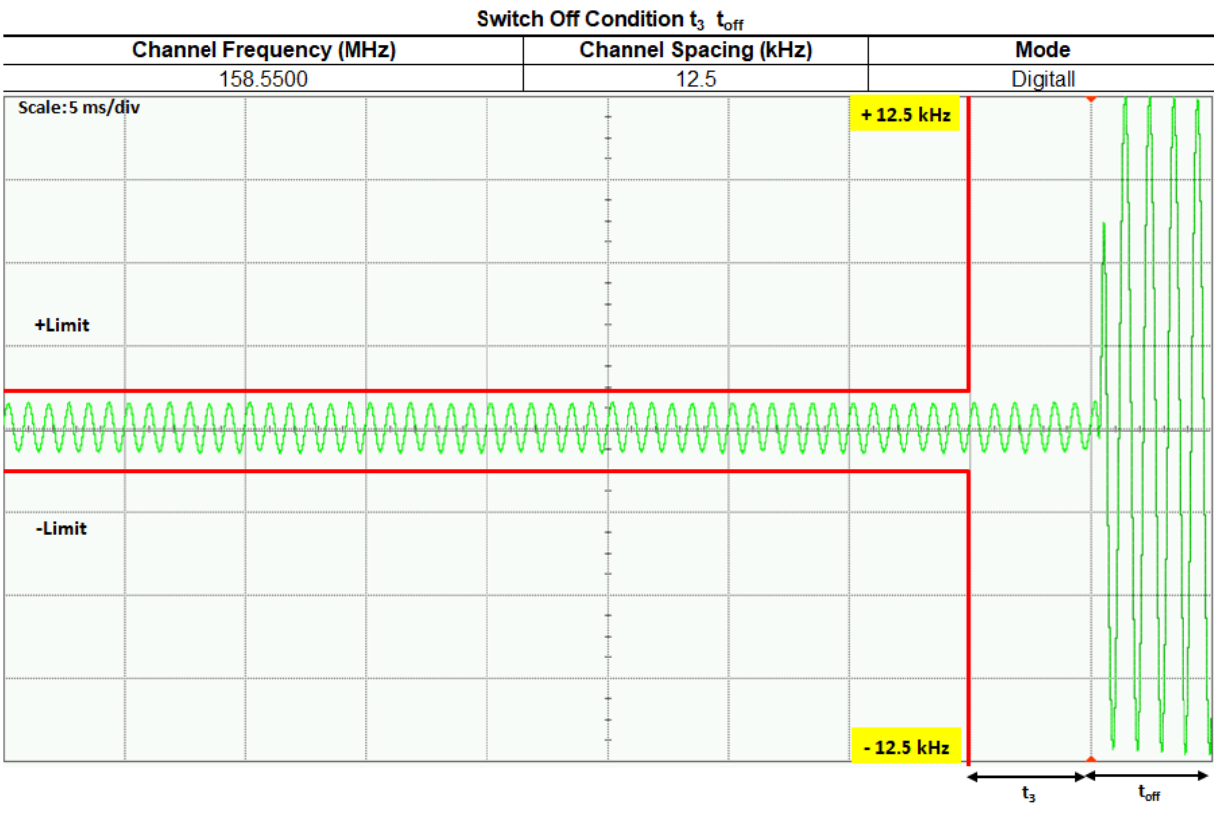
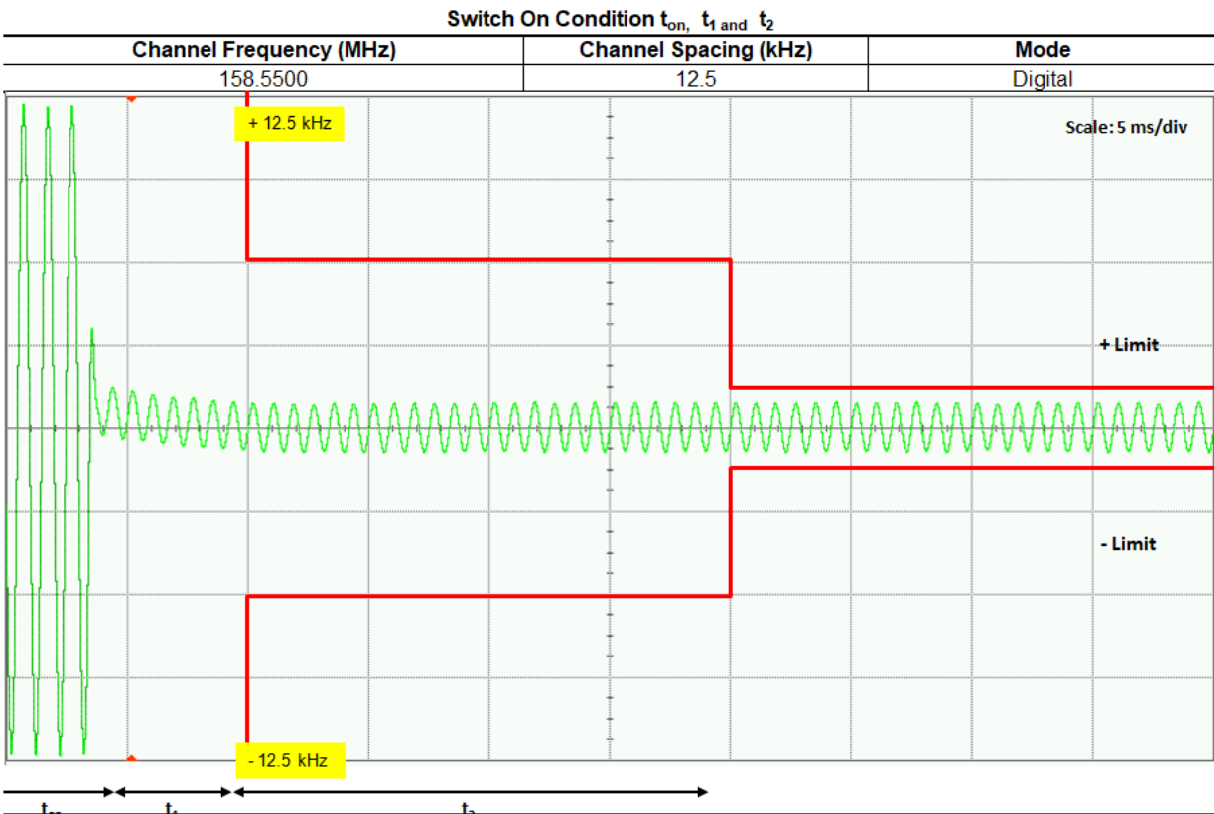


- 1) Connect the setup as figure above.
- 2) Path loss for the measurement included.
- 3) Set on Sigen with the assigned center frequency, internal 1 kHz FM tone.
FM Deviation: Analog 25kHz Channel Spacing = 25 kHz
Analog 12.5 kHz Channel Spacing = 12.5 kHz
C4FM = 12.5 kHz
- 4) Turn on 50 kHz high pass filter and 15 kHz low pass filter on modulation analyzer.
- 5) Supply sufficient attenuation ATT to provide the output power of $\leq -11\text{dBm}$ 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







6.8.3. Test Limit

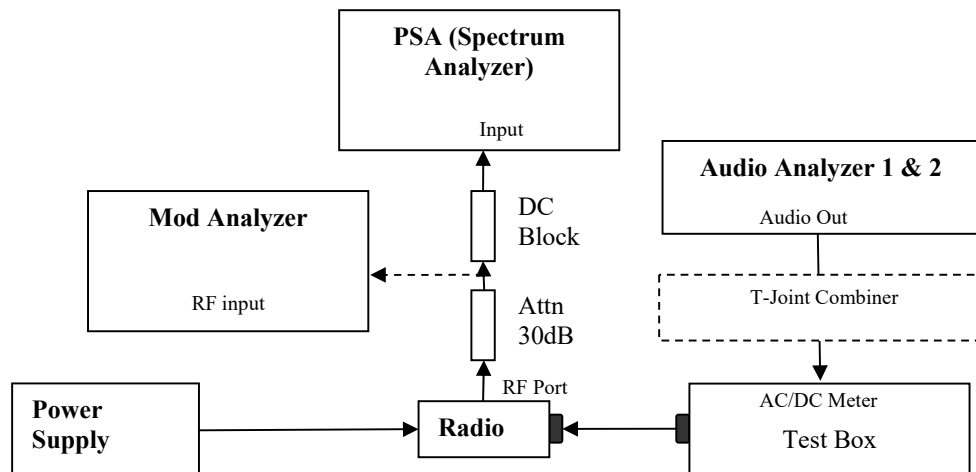
Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

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

- ¹ t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.
- t_1 is the time period immediately following t_{on} .
- t_2 is the time period immediately following t_1 .
- t_3 is the time period from the instant when the transmitter is turned off until t_{off} .
- t_{off} is the instant when the 1 kHz test signal starts to rise.
- ² During the time from the end of t_2 to the beginning of t_3 , the frequency difference must not exceed the limits specified in §90.213.
- ³ Difference between the actual transmitter frequency and the assigned transmitter frequency.
- ⁴ 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

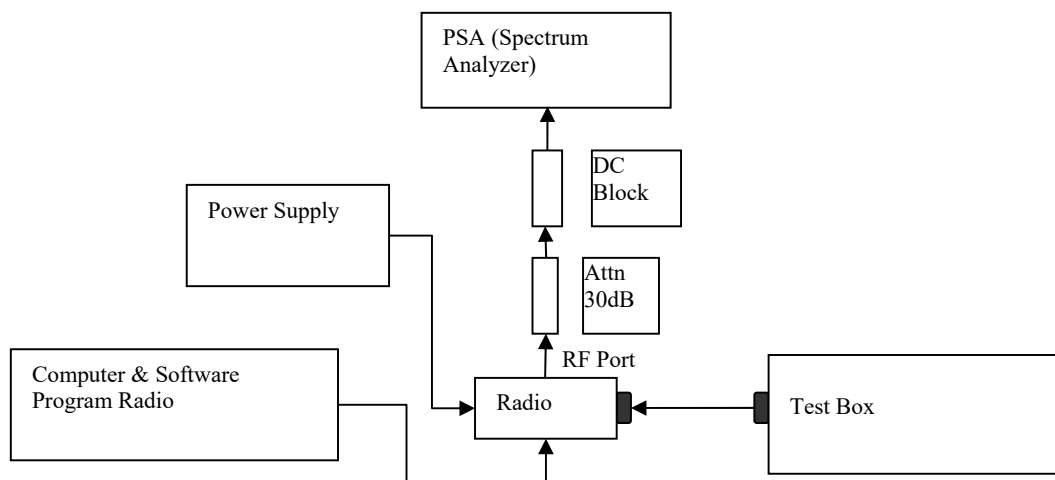
6.9.1. Test Setup (Analog)



- 1) The DUT transmitter output port was connected to modulation analyzer.
- 2) Transmit the radio and turn on 1st 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(Analog) NA → 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 (Digital)

NA → 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

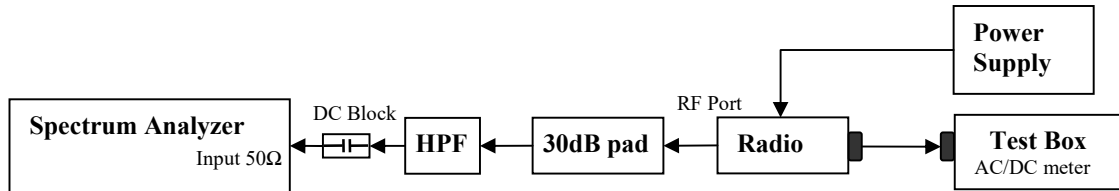
Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP (dBc)
9.375	6.25	-40
15.625	6.25	-60
21.875	6.25	-60
37.5	25	-60
62.5	25	-65
87.5	25	-65
150	100	-65
250	100	-65
350.00	100	-65
>400 kHz to 12 MHz	30 (s)	-80
12 MHz to paired receive band	30 (s)	-80
In the paired receive band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

6.10. Conducted Spurious Emission

6.10.1. Test Setup

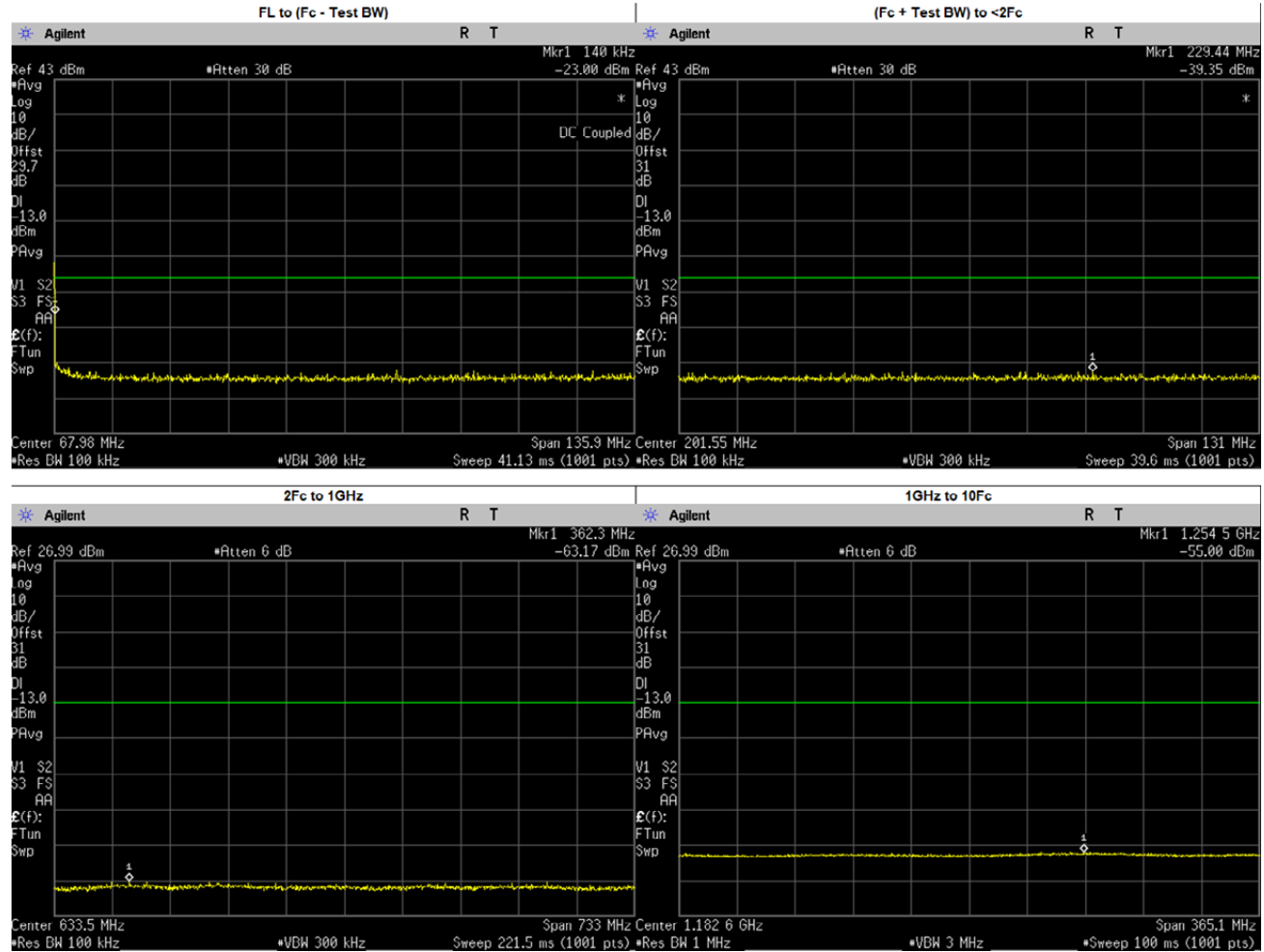


- 1) The DUT transmitter output port was connected to Spectrum Analyzer with above setup.
- 2) Program and set radio to operate in desire test frequency and mode. (Analog / digital modulation form).
- 3) Path loss for the measurement included.
- 4) Set the PSA Resolution Bandwidth as per rules part.
- 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.

***NOTE: Frequency points and modulations schemes in this section are worst case configurations**

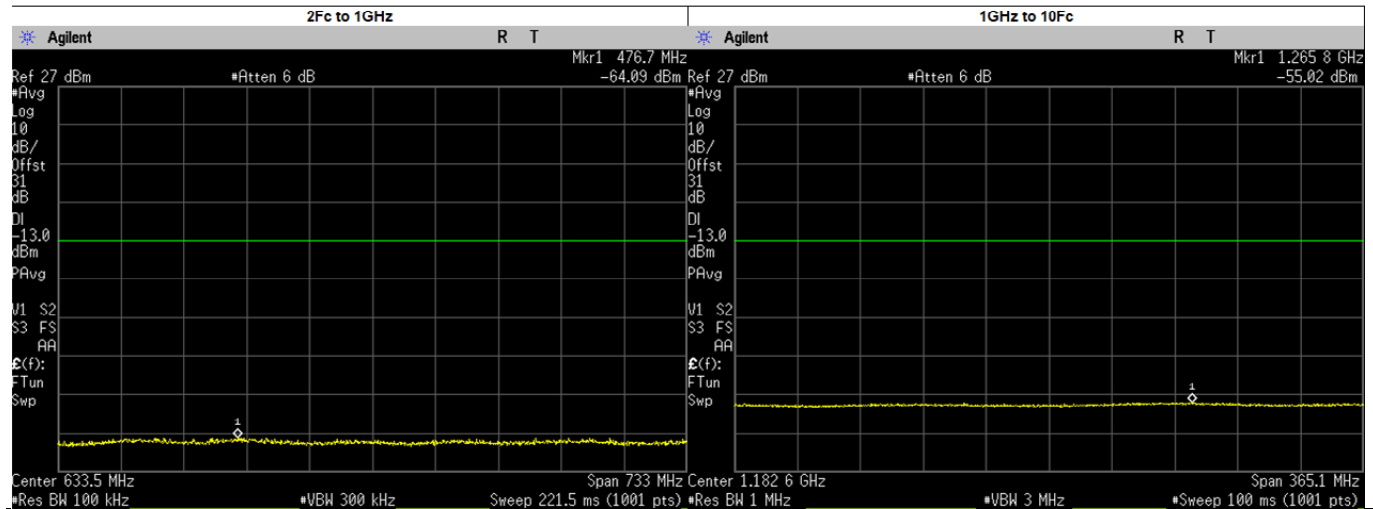
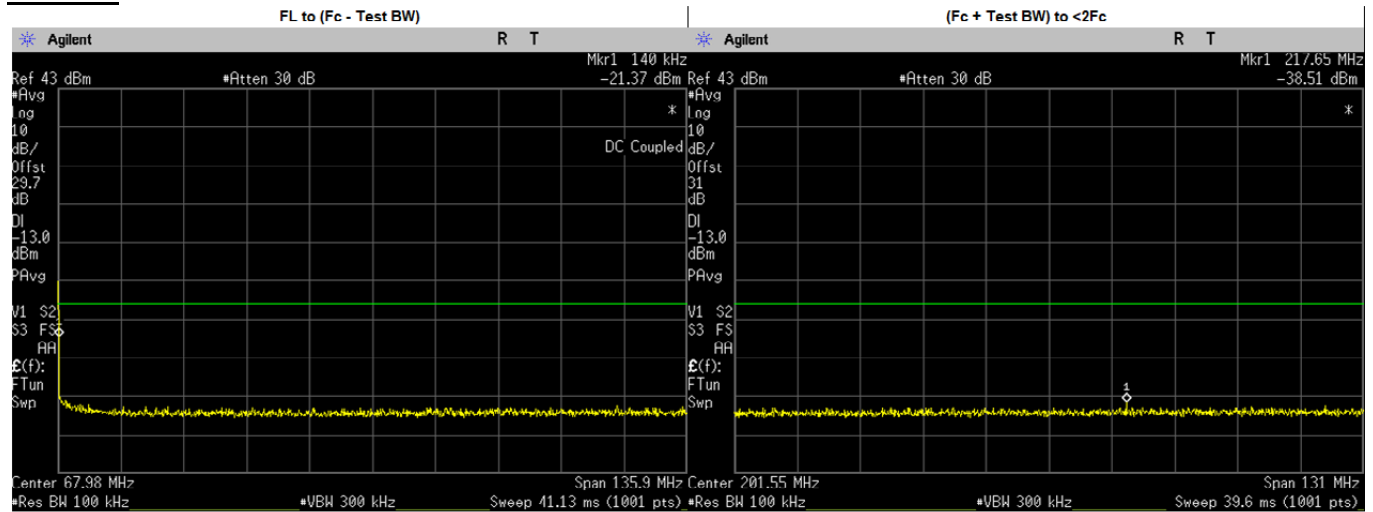
6.10.2. Test Result (Analog)

**Analog: 136.0125 MHz, 25.0kHz Channel Spacing, Max Power
RSS 119**



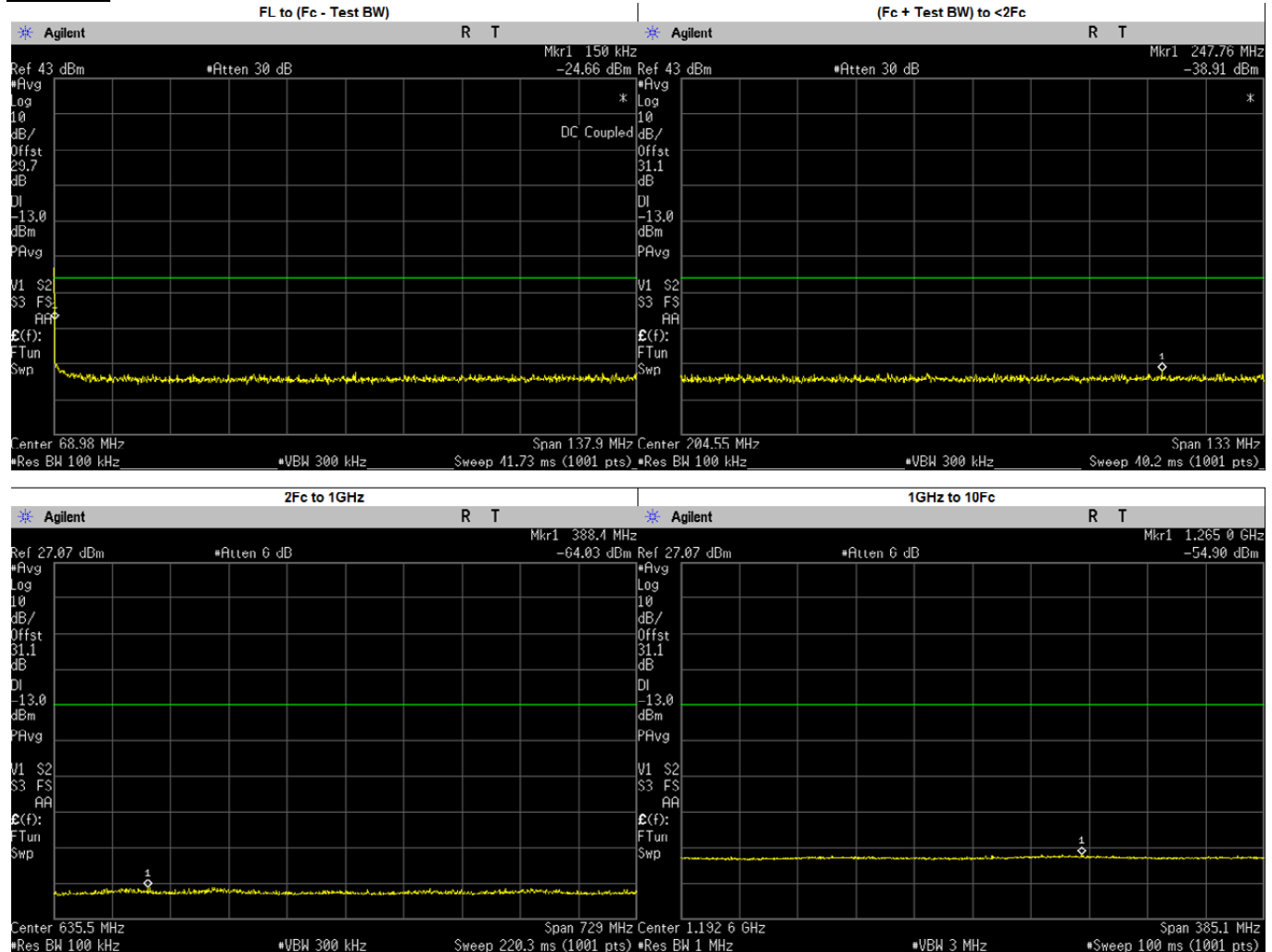
Frequency Range	Highest Spur Frequency (MHz)	Spurious Level (dBm)	Failing Limit (dBm)	Results
FL to (Fc - Test BW)	0.1449	-23.0000	-13.00	PASS
(Fc + Test BW) to <2Fc	229.4404	-39.3500	-13.00	PASS
2Fc to 1GHz	362.3118	-63.1700	-13.00	PASS
	272.0250	-65.6249	-13.00	PASS
	408.0375	-64.7725	-13.00	PASS
	544.0500	-64.7843	-13.00	PASS
	680.0625	-65.4268	-13.00	PASS
	816.0750	-64.4697	-13.00	PASS
	952.0875	-65.3595	-13.00	PASS
1GHz to 10Fc	1254.4920	-55.0000	-13.00	PASS
	1088.1000	-55.7857	-13.00	PASS
	1224.1120	-55.5998	-13.00	PASS
	1360.1250	-55.7353	-13.00	PASS

**Analog: 136.0125 MHz, 25.0kHz Channel Spacing, Low Power
RSS 119**



Frequency Range	Highest Spur Frequency (MHz)	Spurious Level (dBm)	Failing Limit (dBm)	Results
FL to (Fc - Test BW)	2.0482	-38.7000	-13	PASS
(Fc + Test BW) to <2Fc	217.6543	-38.5100	-13	PASS
2Fc to 1GHz	476.6558	-64.0900	-13	PASS
	272.0250	-66.1573	-13	PASS
	408.0375	-65.4238	-13	PASS
	544.0500	-65.8481	-13	PASS
	680.0625	-65.6128	-13	PASS
	816.0750	-65.8247	-13	PASS
	952.0875	-65.6794	-13	PASS
1GHz to 10Fc	1265.8110	-55.0200	-13	PASS
	1088.1000	-55.9617	-13	PASS
	1224.1120	-55.5745	-13	PASS
	1360.1250	-55.4755	-13	PASS

**Analog: 138.0125 MHz, 25.0kHz Channel Spacing, Max Power
RSS 119**



Frequency Range	Highest Spur Frequency (MHz)	Spurious Level (dBm)	Failing Limit (dBm)	Results
FL to (Fc - Test BW)	0.6987	-37.2400	-13.00	PASS
(Fc + Test BW) to <2Fc	247.7575	-38.9100	-13.00	PASS
2Fc to 1GHz	388.3900	-64.0300	-13.00	PASS
	276.0250	-65.8526	-13.00	PASS
	414.0375	-65.5287	-13.00	PASS
	552.0500	-65.5931	-13.00	PASS
	690.0625	-66.0731	-13.00	PASS
	828.0750	-64.8323	-13.00	PASS
	966.0875	-65.4650	-13.00	PASS
1GHz to 10Fc	1264.9660	-54.9000	-13.00	PASS
	1104.1000	-55.7096	-13.00	PASS
	1242.1120	-55.2915	-13.00	PASS
	1380.1250	-55.8438	-13.00	PASS