

Test Report

Product: Saxophone wireless System

Trade Mark: DK

Model Number: MP-10pro

FCC ID: 2A7LD-MP-10PRO

Prepared for

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1 General Description

1.1 Description of EUT

Product name:	Saxophone wireless System
Model name:	MP-10pro
Series Model:	-
Operation frequency:	657.3 – 661.2 MHz
Modulation type:	FSK
Antenna type:	FPCB Antenna
Antenna gain:	-8dBi
Hardware version:	V1.0
Software version:	V1.0
Battery:	DC 3.7V, 3.33Wh
Power supply:	DC 3.7V by battery, USB 5V Charging
Adapter information:	-

1.2 Test Mode

Test Mode	Channel	Frequency (MHz)
1	Lowest	657.3
2	Middle	659.1
3	Highest	661.2

1.3 Operation Channel list

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	657.3	5	658.5	9	659.7	13	660.9
2	657.6	6	658.8	10	660.0	14	661.2
3	657.9	7	659.1	11	660.3		
4	658.2	8	659.4	12	660.6		

1.4 Test Setup

See photographs of the test setup in the report for the actual setup and connections between EUT and support equipment.

1.5 Ancillary Equipment

Equipment	Model	S/N	Manufacturer
Adapter	HW-100225C00	HC78E2N6A23645	Huawei

2 Summary of Test Result

No.	Standard Section	Test Item	Result	Remark
1	FCC Part15.203	Antenna Requirement	Pass	
2	FCC Part15.207	AC Power Line Conducted Emission	Pass	
3	FCC Part 15.236(g)	Spurious Emission	Pass	
4	FCC Part15.236(d)(2)	Maximum Radiated Power	Pass	
6	FCC Part 15.236(f)(2)	Emission Bandwidth	Pass	
7	FCC Part 15.236(f)(3)	Frequency Stability	Pass	
8	FCC Part 15.236(g)	Necessary Bandwidth	Pass	

3 Test Facilities and Accreditations

3.1 Test Laboratory

Test Site	Shenzhen HongBiao Certification& Testing Co., Ltd
Test Site Location	Room 102, 201, Building 2, Yuanwanggu RFID Industrial Park, Tongguan Road, Tianliao Community, Yutang Street, Guangming District, Shenzhen, China
Telephone:	(86-755) 2998 9321
Fax:	(86-755) 2998 5110
FCC Registration No.:	CN1341
A2LA Certificate No.:	6765.01

3.2 Environmental Conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15°C~35°C
Relative Humidity:	20%~75%
Air Pressure:	98kPa~101kPa

3.3 Measurement Uncertainty

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

Measurement Frequency Range	U, (dB)	Note
RF frequency	2×10^{-5}	
RF power, conducted	± 0.57 dB	
Conducted emission(150kHz~30MHz)	± 2.5 dB	
Radiated emission(9kHz~30MHz)	± 2.5 dB	
Radiated emission(30MHz~1GHz)	± 4.2 dB	
Radiated emission (above 1GHz)	± 4.7 dB	
Occupied bandwidth	± 4 %	
Temperature	± 1 degree	
Humidity	± 5 %	

3.4 Test Software

Software name	Manufacturer	Model	Version
EMI Measurement	Farad	EZ-EMC	V1.1.4.2
Conducted test system	MWRF-test	MTS 8310	V2.0.0

4 List of Test Equipment

Radiation emission							
Item	Equipment No.	Equipment name	Manufacturer	Model	Serial No.	Calibration date	Due date
1	HB-E001	Horn Antenna	Schwarzbeck	BBHA 9120D	02592	2022-04-02	2024-04-01
2	HB-E002	Biconical log-periodic composite antenna	Schwarzbeck	VULB 9168	01340	2022-04-06	2024-04-05
3	HB-E003	SHF-EHF Horn	Schwarzbeck	BBHA 91270	01193	2022-04-02	2024-04-01
4	HB-E004	Preamplifier	Noyetec	LAN-0910	NYCM1420101	2023-05-11	2024-05-10
5	HB-E005	Preamplifier	Noyetec	LAN-0118	NYCM1420102	2023-05-12	2024-05-11
6	HB-E006	Preamplifier	Noyetec	LAN-1840	NYCM1420103	2023-06-11	2024-06-10
7	HB-E007	EMI TEST RECEIVER	R&S	ESR7	102520	2023-05-12	2024-05-11
8	HB-E009	POSITINAL COTROLLE R	Noyetec	N/A	N/A	/	/
9	HB-E013	RF switch	Noyetec	NY-RF4	NY0CM1420204	/	/
10	HB-E066	Illuminance Tester	TASI	TA8121	N/A	2023-05-11	2024-05-10
11	HB-E075	Active loop antenna	Schwarzbeck	FMZB 1519B	1519B-245	2022-07-24	2024-07-23
Conduction emission							
Item	Equipment No.	Equipment name	Manufacturer	Model	Serial No.	Calibration date	Due date
1	HB-E014	4 Path V-LISN	Schwarzbeck	NNLK 8121	00770	2023-05-12	2024-05-11
2	HB-E015	Pulse Limiter	Schwarzbeck	VTSD 9561-F	00949	2023-05-12	2024-05-11
3	HB-E016	ZN23201	Noyetec	ZN23201	N/A	2023-05-11	2024-05-10
4	HB-E059	Attenuator	Xianghua	TS2-6-1	220215166	2023-05-12	2024-05-11
5	HB-E069	EMI TEST RECEIVER	R&S	ESCI	N/A	2023-05-12	2024-05-11
RF							
Item	Equipment No.	Equipment name	Manufacturer	Model	Serial No.	Calibration date	Due date
1	HB-E041	MXG AnaioG Signal Generator	Agilent	N5181A	MY47070421	2023-05-11	2024-05-10
2	HB-E042	WIDEBAND RADIO COMMUNICA	R&S	CMW500	132108	2023-05-11	2024-05-10

		TION TESTER					
3	HB-E043	MXG Anaioig Signal Generator	Agilent	N5182A	US46240335	2023-05-11	2024-05-10
4	HB-E044	Signal& spectrum Analyzer	R&S	FSV3044	101264	2023-05-11	2024-05-10
5	HB-E045	RF Control Box	Noyetec	NY100-R FCB	N/A	/	/
6	HB-E058	Thermometer Clock Humidity Monitor	N/A	HTC-1	N/A	/	/
7	HB-E077	PXA Signal Analyzer	Agilent	N9030A	N/A	2023-05-11	2024-05-10

Note: the calibration interval of the above test instruments is 12&24 months and the calibrations are traceable to international system unit (SI).

5 Test Item And Results

5.1 Antenna Requirement

5.1.1 Standard Requirement

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device

5.1.2 Test Result

The antenna is a FPCB antenna, which was permanently affixed to the device and un-replaced, complies with 15.203. In addition, the maximum antenna gain is -8dBi.

5.2 Conducted Emission

5.2.1 Limits

Limits – Class B		
Frequency (MHz)	Limit (dB μ V)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

Note:

- the tighter limit applies at the band edges.
- the limit of "*" marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

5.2.2 Test Procedures

a) EUT Operating Conditions

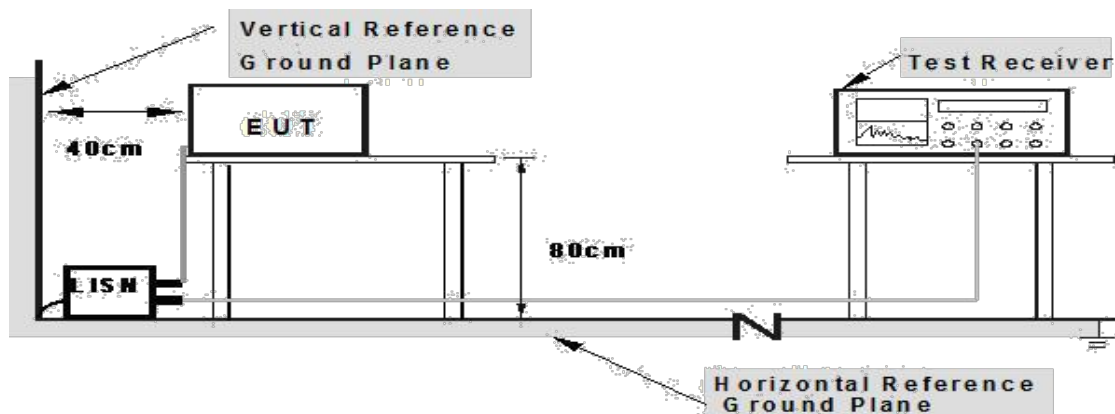
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

b) The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

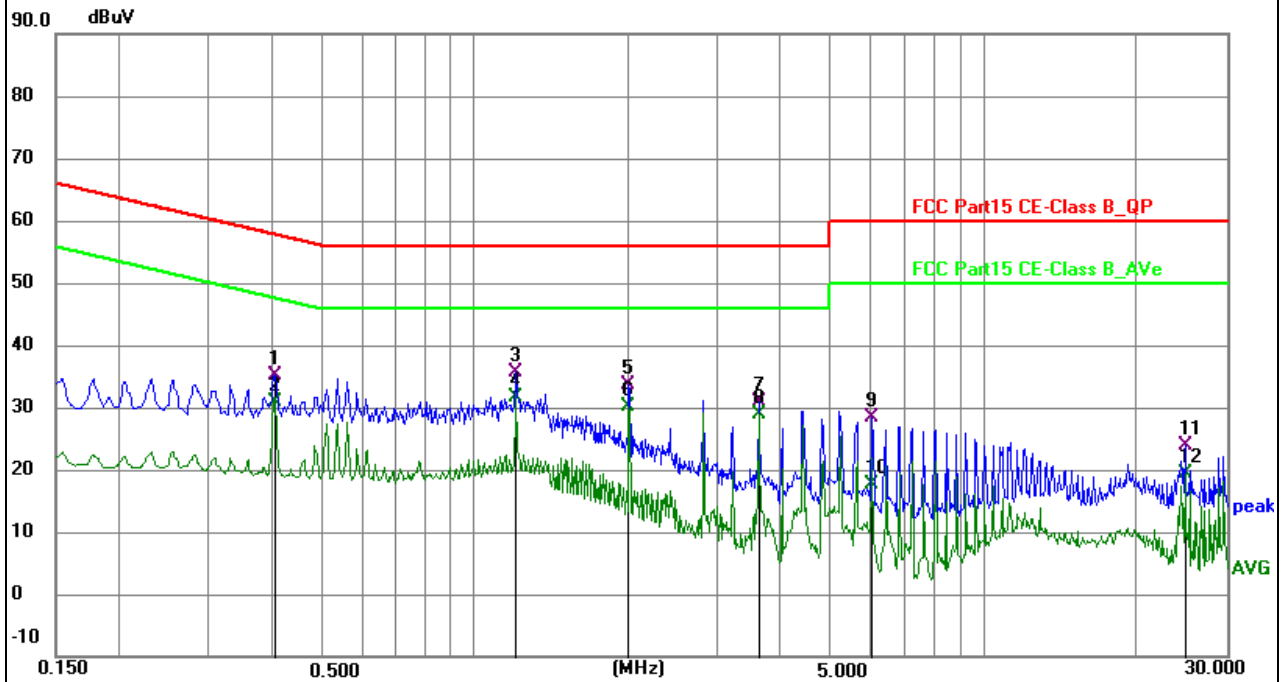
- The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN is at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item – photographs of the test setup.

5.2.3 Test Setup



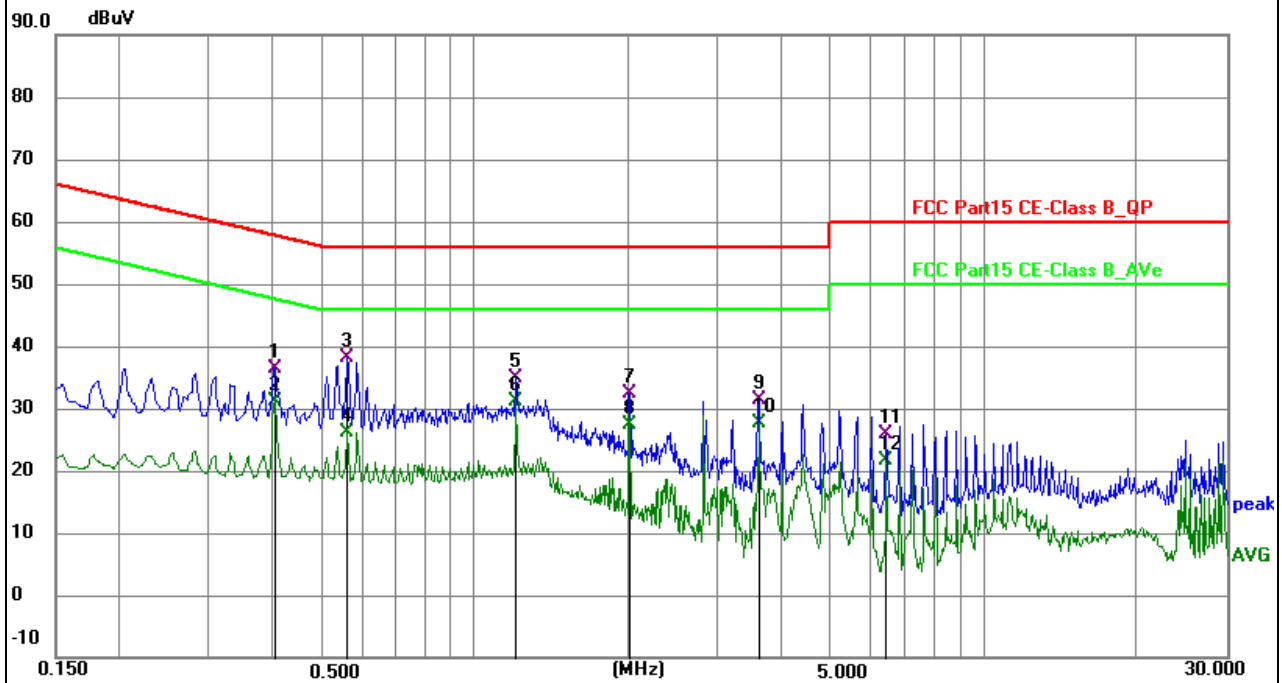
5.2.4 Test Result

EUT:	Saxophone wireless System	Model Name:	MP-10pro
Test Mode:	TM1	Phase:	L
Test Voltage:	AC 120V/60Hz		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.4020	25.22	9.94	35.16	57.81	-22.65	QP	P	
2	0.4020	21.01	9.94	30.95	47.81	-16.86	AVG	P	
3	1.2075	25.48	10.03	35.51	56.00	-20.49	QP	P	
4 *	1.2075	21.53	10.03	31.56	46.00	-14.44	AVG	P	
5	2.0085	23.60	10.06	33.66	56.00	-22.34	QP	P	
6	2.0085	20.10	10.06	30.16	46.00	-15.84	AVG	P	
7	3.6195	20.69	10.13	30.82	56.00	-25.18	QP	P	
8	3.6195	18.63	10.13	28.76	46.00	-17.24	AVG	P	
9	6.0225	18.18	10.25	28.43	60.00	-31.57	QP	P	
10	6.0225	7.50	10.25	17.75	50.00	-32.25	AVG	P	
11	24.9090	13.63	10.30	23.93	60.00	-36.07	QP	P	
12	24.9090	9.19	10.30	19.49	50.00	-30.51	AVG	P	

EUT:	Saxophone wireless System	Model Name:	MP-10pro
Test Mode:	TM1	Phase:	N
Test Voltage:	AC 120V/60Hz		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.4020	26.54	9.94	36.48	57.81	-21.33	QP	P	
2	0.4020	21.11	9.94	31.05	47.81	-16.76	AVG	P	
3	0.5595	28.44	9.80	38.24	56.00	-17.76	QP	P	
4	0.5595	16.36	9.80	26.16	46.00	-19.84	AVG	P	
5	1.2075	24.90	10.01	34.91	56.00	-21.09	QP	P	
6 *	1.2075	21.12	10.01	31.13	46.00	-14.87	AVG	P	
7	2.0130	22.24	10.05	32.29	56.00	-23.71	QP	P	
8	2.0130	17.43	10.05	27.48	46.00	-18.52	AVG	P	
9	3.6195	21.18	10.13	31.31	56.00	-24.69	QP	P	
10	3.6195	17.50	10.13	27.63	46.00	-18.37	AVG	P	
11	6.4320	15.74	10.24	25.98	60.00	-34.02	QP	P	
12	6.4320	11.28	10.24	21.52	50.00	-28.48	AVG	P	

5.3 Spurious Emission

5.3.1 Limits

FCC §15.236(g)

Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3 of ETSI EN 300422-1 V1.4.2 (2011-08). Emission outside of this band shall comply with the limits specified in section 8.4 of ETSI EN 300422-1 V1.4.2 (2011-08).

Limits for Spurious Emissions

State	Frequency		
	47 MHz to 74 MHz 87,5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other Frequencies below 1 000 MHz	Frequencies above 1 000 MHz
Operation	4 nW	250 nW	1 µW
Standby	2 nW	2 nW	20 nW

5.3.2 Test Procedures

On a test site, the sample shall be placed at the specified height on a non-conducting support. The transmitter shall be operated at the power as specified under clause 8.2, delivered to the antenna (see clause 5.1.1).

Radiation of any spurious components shall be detected by the test antenna and receiver, over the frequency range specified below, excluding the 250 % (out of band region) band of frequencies centred on the channel on which the transmitter is intended to operate.

The measuring receiver, as defined in table 4, shall be tuned over the frequency range 25 MHz to 4 GHz for equipment operating on frequencies below 1 GHz or in the frequency range of 25 MHz to 12,75 GHz for equipment operating on frequencies above 1 GHz.

At each frequency at which a component is detected, the sample shall be rotated to obtain maximum response and the effective radiated power of that component determined by a substitution measurement.

The measurement shall be repeated with the test antenna in the orthogonal polarization plane.

If the transmitter allows for standby operation, the tests shall be repeated with the transmitter in standby mode

Reference bandwidth for measuring receiver

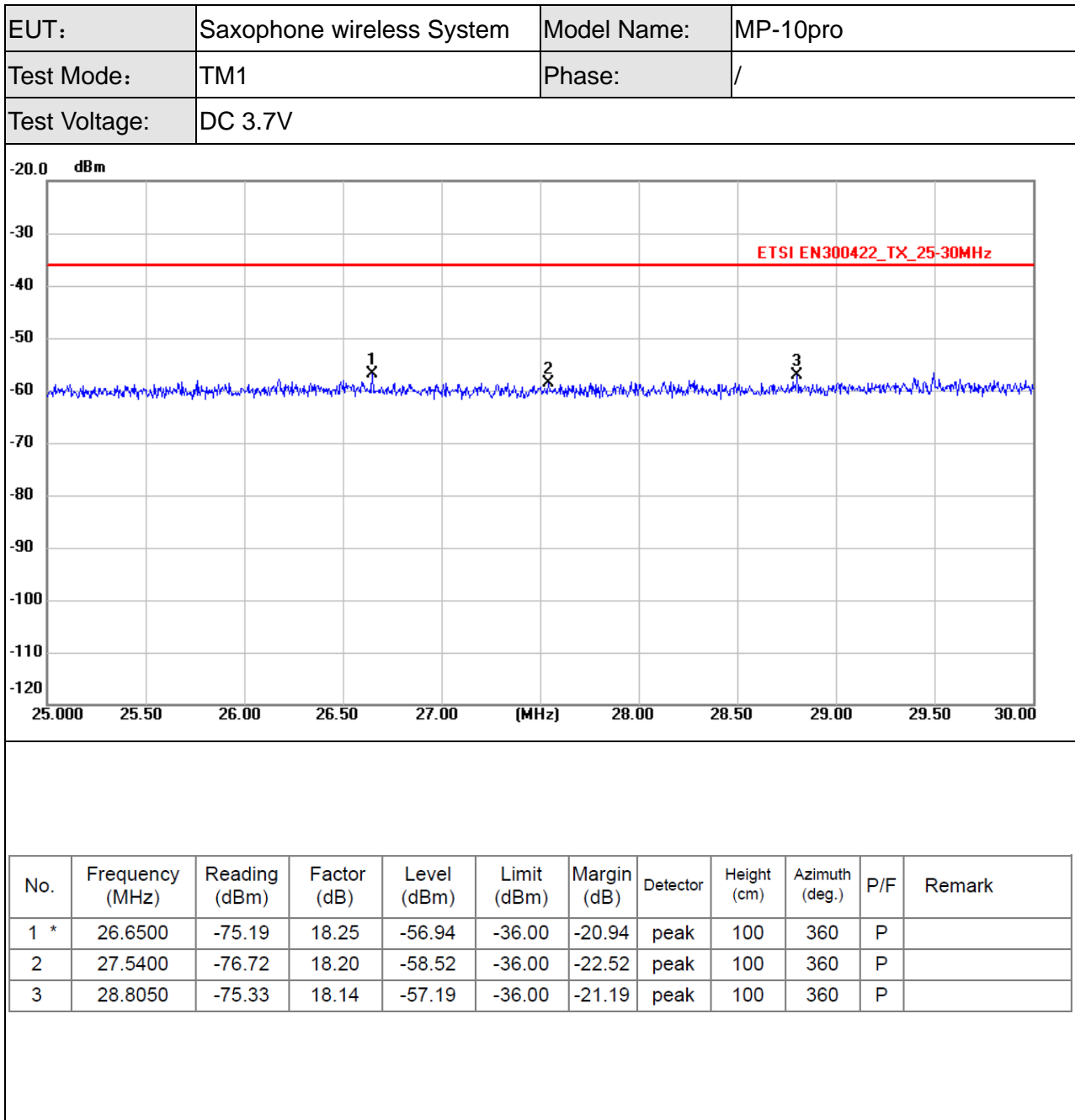
Frequency being measured	Measuring receiver bandwidth
25 MHz to 30 MHz	9 kHz to 10 kHz
30 MHz to 1 000 MHz	100 kHz to 120 kHz
> 1 000 MHz	1 MHz

5.3.3 Test Result

Note 1: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

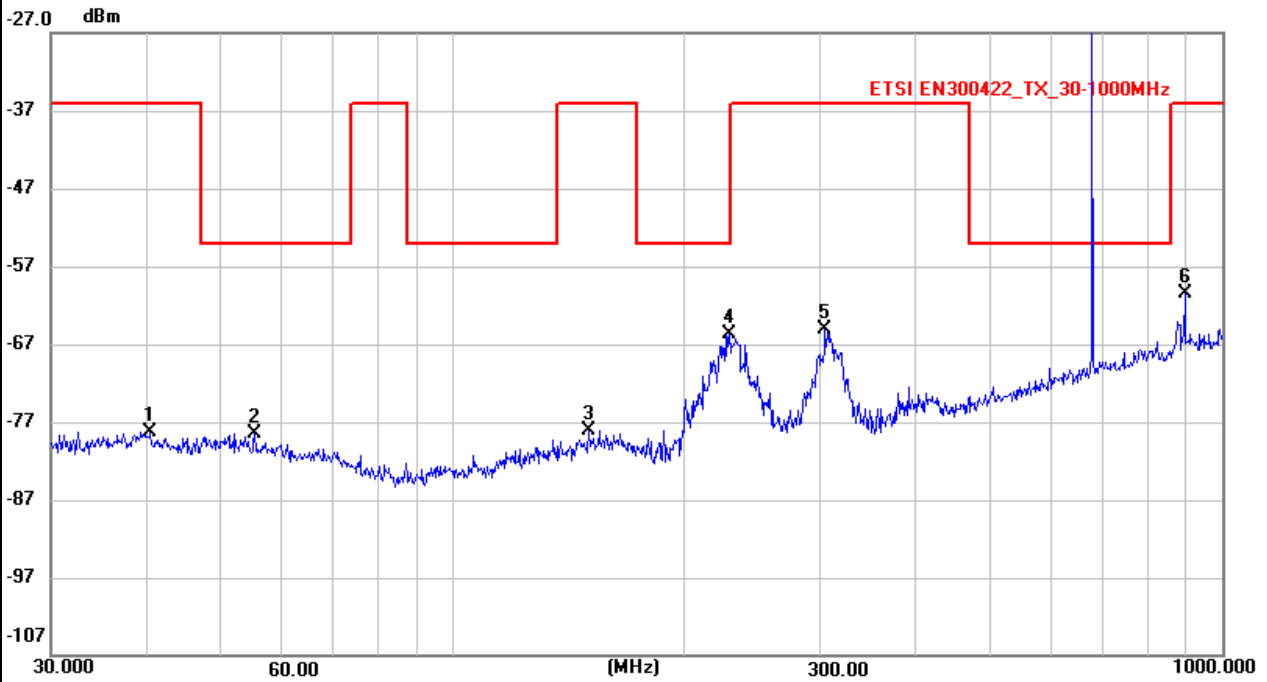
Note 2. All test modes are performed, but only the worst case is recorded in this report.

Frequency range (25MHz – 30MHz)



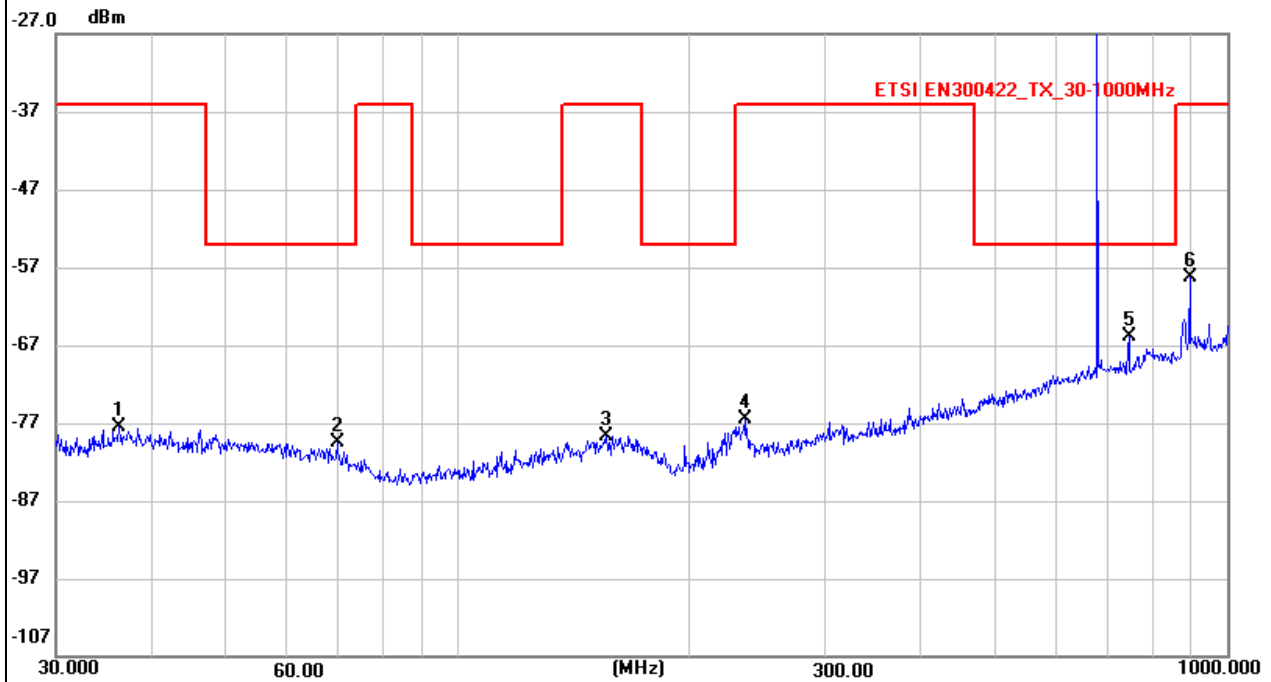
Frequency range (30MHz – 1GHz)

EUT:	Saxophone wireless System	Model Name:	MP-10pro
Test Mode:	TM1	Phase:	Horizontal
Test Voltage:	DC 3.7V		



No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	40.4172	-81.68	3.46	-78.22	-36.00	-42.22	peak	100	245	P	
2	55.2207	-80.78	2.34	-78.44	-54.00	-24.44	peak	100	62	P	
3	150.0108	-80.92	2.89	-78.03	-36.00	-42.03	peak	100	285	P	
4 *	228.4904	-66.68	0.91	-65.77	-54.00	-11.77	peak	100	315	P	
5	304.6099	-68.53	3.39	-65.14	-36.00	-29.14	peak	100	285	P	
6	893.8567	-75.85	15.44	-60.41	-36.00	-24.41	peak	100	359	P	

EUT:	Saxophone wireless System	Model Name:	MP-10pro
Test Mode:	TM1	Phase:	Vertical
Test Voltage:	DC 3.7V		



No.	Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	36.2541	-80.47	2.97	-77.50	-36.00	-41.50	peak	100	297	P	
2	69.6005	-80.22	0.80	-79.42	-54.00	-25.42	peak	100	338	P	
3	155.9101	-81.35	2.74	-78.61	-36.00	-42.61	peak	100	348	P	
4	235.8164	-77.92	1.41	-76.51	-36.00	-40.51	peak	100	193	P	
5 *	744.8661	-78.34	12.43	-65.91	-54.00	-11.91	peak	100	123	P	
6	893.8567	-73.72	15.44	-58.28	-36.00	-22.28	peak	100	287	P	

5.4 Maximum Radiated Power

5.4.1 Limit

FCC §15.236(d)

The maximum radiated power shall not exceed the following values.

- (1) In the bands allocated and assigned for broadcast television and in the 600 MHz service band:
50mW EIRP
- (2) In the 600 MHz guard band and the 600 MHz duplex gap: 20mW EIRP

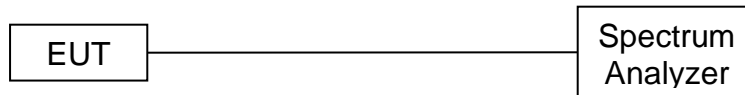
5.4.2 Test Procedure

The maximum peak output power was measured with a Spectrum Analyzer connected to the antenna terminal while EUT was operating in un-modulated situation.

Power was supplied to the battery input connector a power supply. The power supply was set to a normal operating voltage of the EUT.

The Spectrum Analyzer was connected at antenna terminal to measure RF power of the carrier.

5.4.3 Test Setup

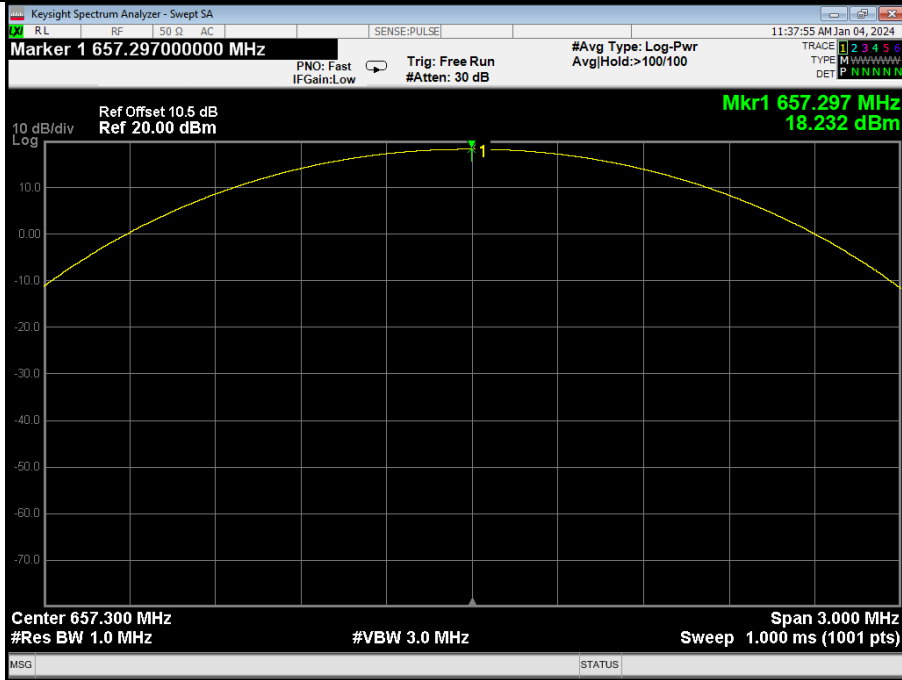


5.4.4 Test Results

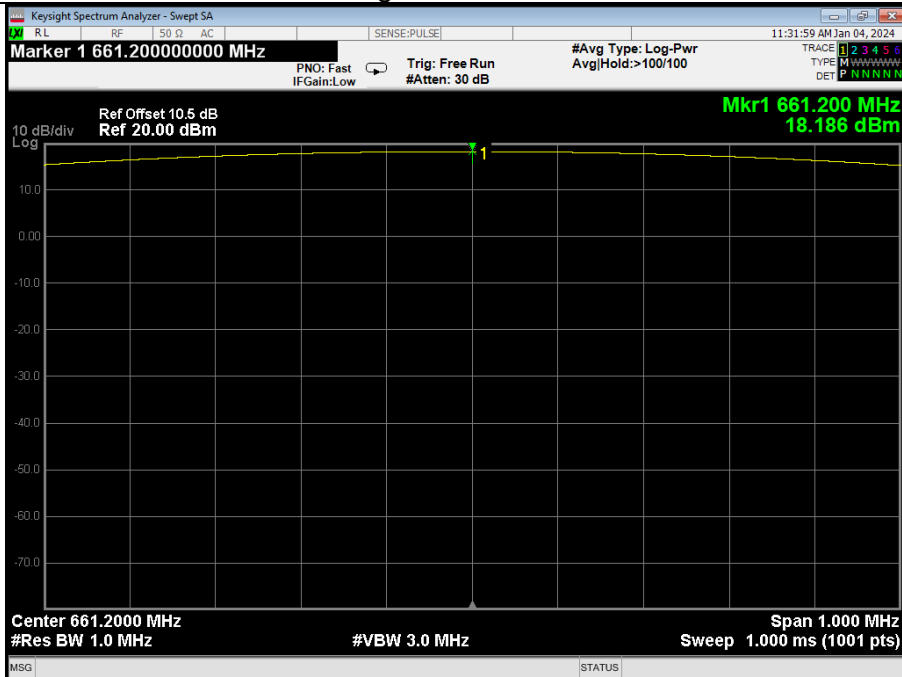
Frequency (MHz)	Conducted Output Power (dBm)	Gain (dBi)	EIRP (dBm)	Limit (dBm)	Result
657.3	18.232	-8	10.232	13	PASS
661.2	18.186	-8	10.186	13	PASS

Test plots

Lowest Channel



Highest Channel



5.5 Emission Bandwidth

5.5.1 Limit

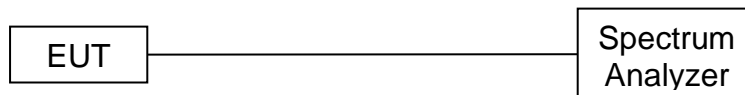
FCC §15.236(f)(2)

One or more adjacent 25kHz segments within the assignable frequencies may be combined to form a channel whose maximum bandwidth shall not exceed 200kHz. The operating bandwidth shall not exceed 200kHz.

5.5.2 Test Procedure

1. Use the following spectrum analyzer settings:
2. For 20 dB bandwidth
3. Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
4. RBW \geq 1% of the 20 dB bandwidth
5. VBW \geq RBW
6. Sweep = auto
7. Detector function = peak
8. Trace = max hold
9. The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth and 99% occupied bandwidth of the emission

5.5.3 Test Setup

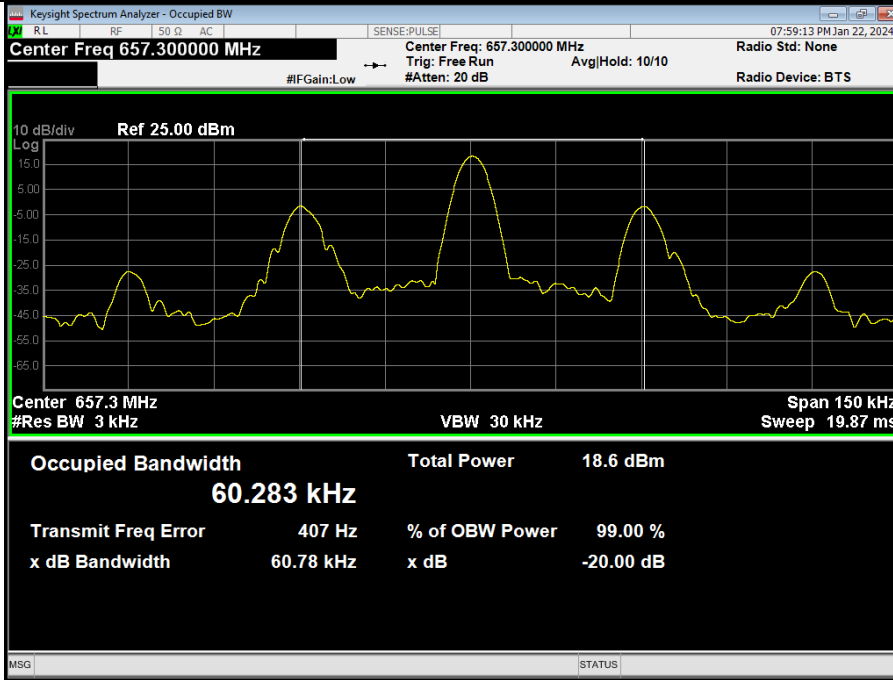


5.5.4 Test Results

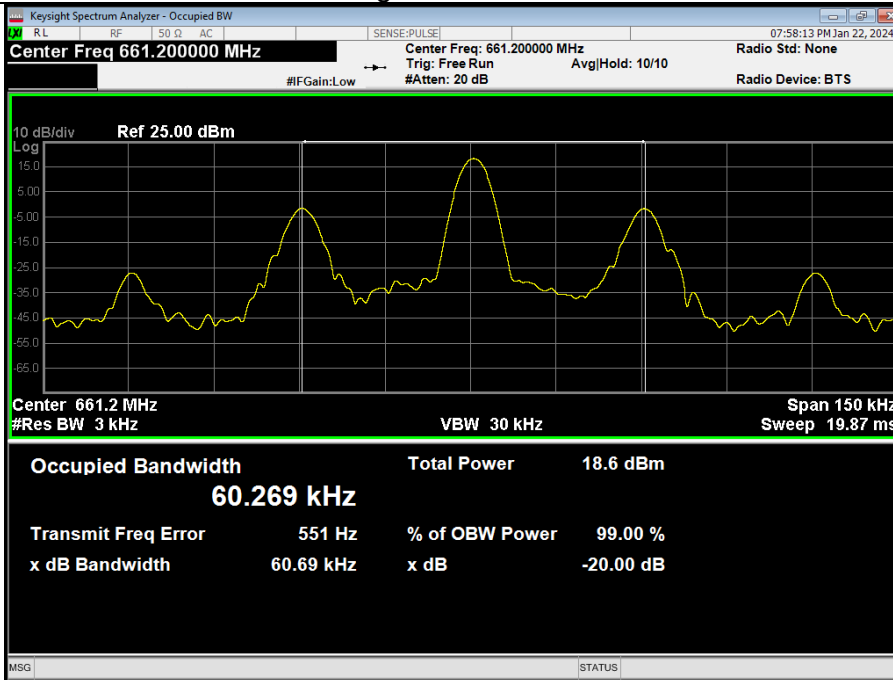
Frequency (MHz)	99% bandwidth (kHz)	20dB bandwidth (kHz)
657.3	60.283	60.78
661.2	60.269	60.69

Test plots

Lowest Channel



Highest Channel



5.6 Frequency Stability

5.6.1 Limit

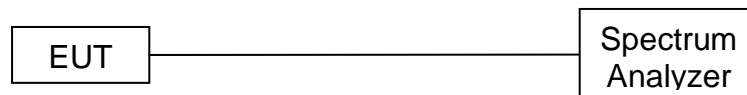
FCC §15.236(f)(3)

The frequency tolerance of the carrier signal shall be maintained within +/-0.005% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. Battery operated equipment shall be tested using a new battery.

5.6.2 Test Procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set center frequency of spectrum analyzer = operating frequency.
3. Set the spectrum analyzer as RBW, VBW=10KHz, Span = 1MHz.
- 4 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided emission is repetitive in nature.
5. Repeat above procedures until all frequency measured was complete.
6. Setup the configuration of the ambient temperature from -20°C to 50°C, and a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

5.6.3 Test Setup



5.6.4 Test Results

Test conditions		Frequency Error		
		660 MHz	676.8 MHz	/
T(-20°C)	Vnom(3.7V)	0.4kHz	0.4kHz	/
T(-10°C)	Vnom(3.7V)	0.5kHz	0.5kHz	/
T(0°C)	Vnom(3.7V)	0.2kHz	0.2kHz	/
T(10°C)	Vnom(3.7V)	0.2kHz	0.2kHz	/
T(20°C)	Vnom(3.7V)	0.2kHz	0.2kHz	/
T(30°C)	Vnom(3.7V)	0.2kHz	0.2kHz	/
T(40°C)	Vnom(3.7V)	0.4kHz	0.4kHz	/
T(50°C)	Vnom(3.7V)	0.5kHz	0.5kHz	/
T(20°C)	Vmin(3.15V)	0.2kHz	0.2kHz	/
	Vmax(4.25V)	0.2kHz	0.2kHz	/
Max. frequency error (ppm)		0.76ppm	0.76ppm	/
Limit (ppm)		±50ppm		
End Point		DC 3.7V		

5.7 Necessary Bandwidth

5.7.1 Limit

FCC §15.236(g)

Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3 of ETSI EN 300422-1 V1.4.2 (2011-08). Emission outside of this band shall comply with the limits specified in section 8.4 of ETSI EN 300422-1 V1.4.2 (2011-08).

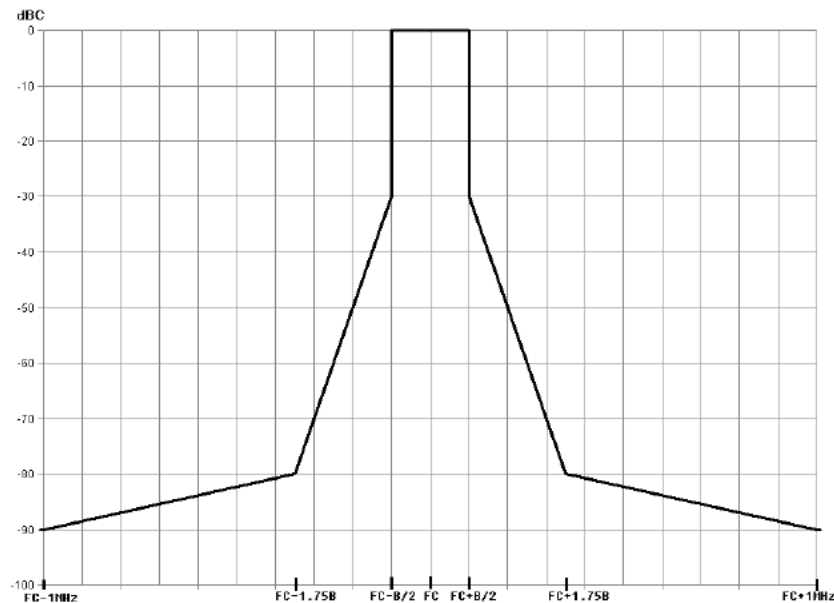


Figure 4: Spectrum mask for digital systems below 1 GHz

For the measurement uncertainty, see clause 10. The -90dBc point shall be ± 1 MHz from f_c measured with an average detector..

5.7.2 Test Procedure

The transmitter shall be modulated with the test signals defined in clause 7.1.2. In any case the mask shall not be exceeded.

- Step 1: Measure the "Carrier Power" with the spectrum analyzer setup:

- Center Frequency = f_c
- Span = Zero span
- Detector = RMS
- Trace Mode = Average
- RBW&VBW = $5 \times B$
- Sweep time ≥ 2 s

- Step 2: Measure the "Maximum Relative Level (dBc) at Specified Carrier Offsets" with the following

spectrum analyzer setup:

- Center Frequency = f_c
- Span $\geq 5 \times B$
- Detector = RMS
- Trace Mode = Peak Hold
- RBW&VBW = 1 kHz
- Sweep time ≥ 2 s

Limits: Mask shall not be exceeded.

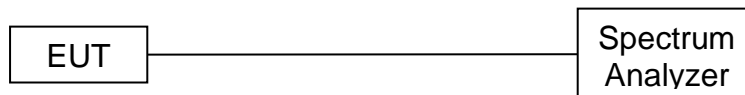
- Step 3: Measure the "transmitter wide band noise floor":

The measurement of transmitter broad band noise floor shall be carried out according to clause 8.3.1.1.

- Start Frequency = $f_c + 1,75B$ and $f_c - 1$ MHz below 1 GHz,
Start Frequency = $f_c + B$ and $f_c - 1$ MHz above 1 GHz.
- Stop Frequency = $f_c + 1$ MHz and $f_c - 1,75 B$ below 1 GHz,
Stop Frequency = $f_c + 1$ MHz and $f_c - B$ above 1 GHz.
- Detector = RMS
- Trace Mode = Average
- RBW&VBW = 1 kHz
- Sweep time ≥ 2 s

Limits: Mask shall not be exceeded.

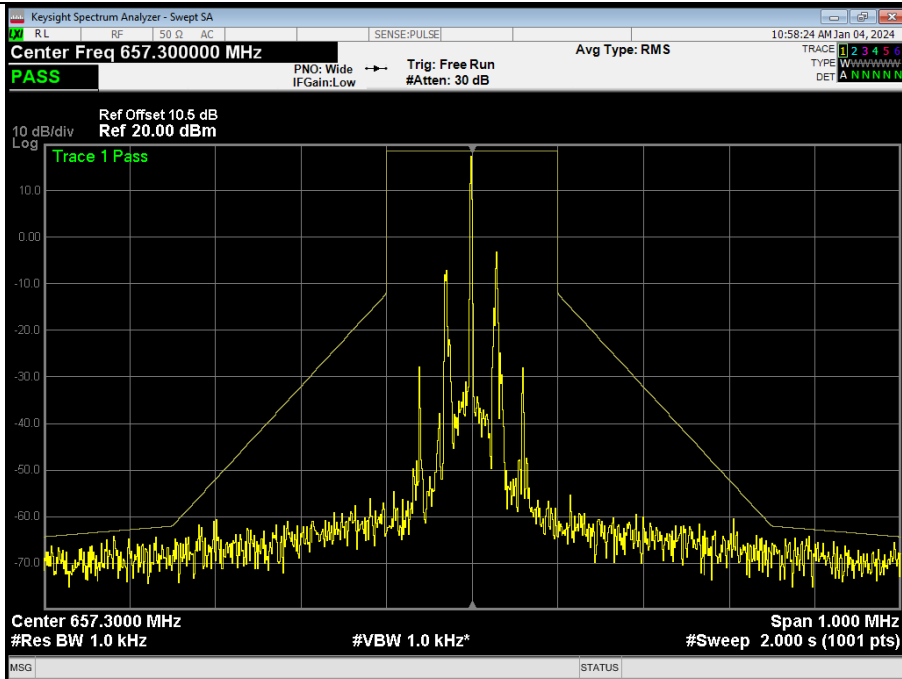
5.7.3 Test Setup



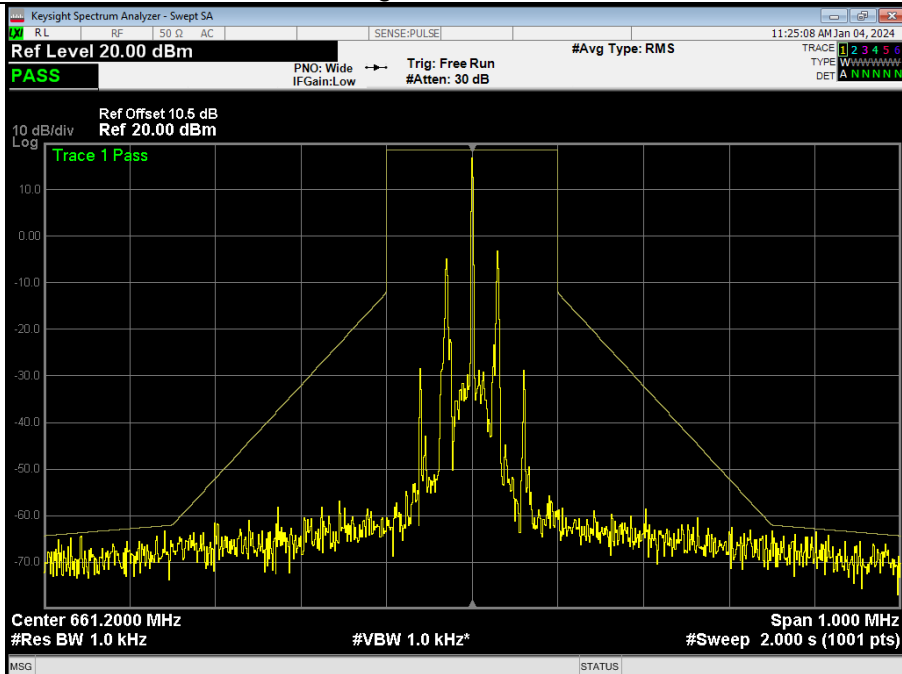
5.7.4 Test Results

Test plots

Lowest Channel

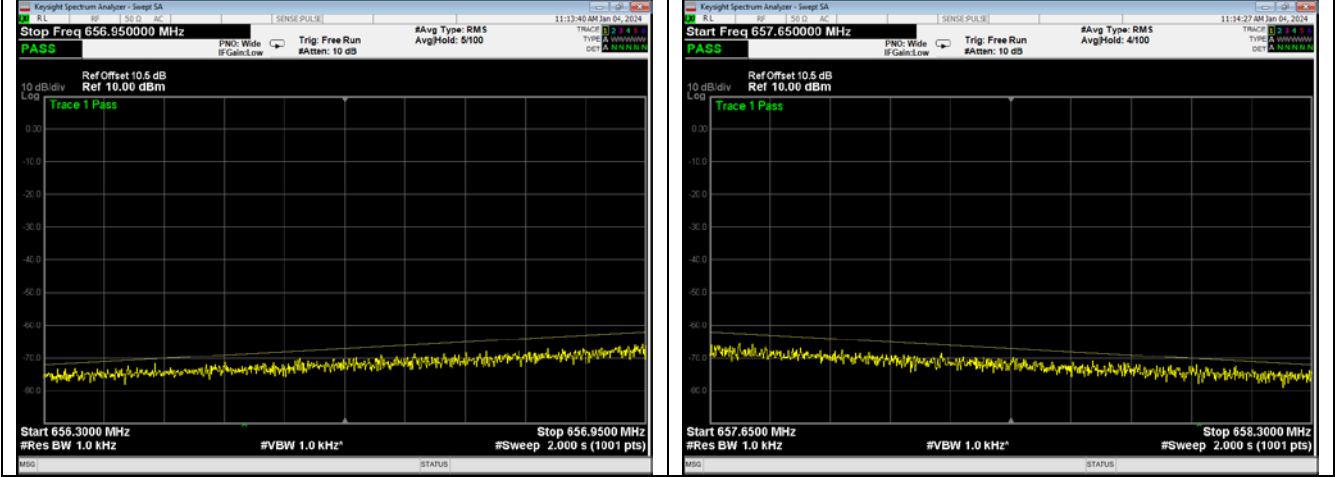


Highest Channel

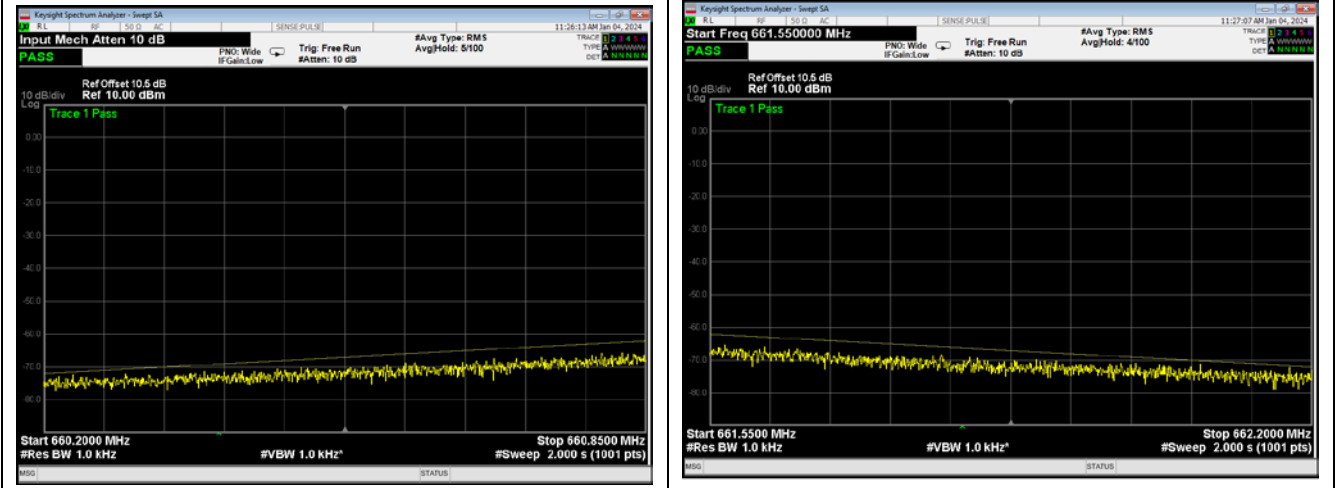


-90dBc point test result

Lowest Channel



Highest Channel



6 Photographs of the Test Setup

Reference to the appendix Test Setup Photos for details.

7 Photographs of the EUT

Reference to the appendix External Photos and Internal Photos for details.

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